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# **POPULAR MECHANICS**

**FEB. 1964  
35 CENTS**

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**FOUR-BARREL SPORTS GUN • PIANO BUYERS' GUIDE**



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- Wings remove
- Parts interchange
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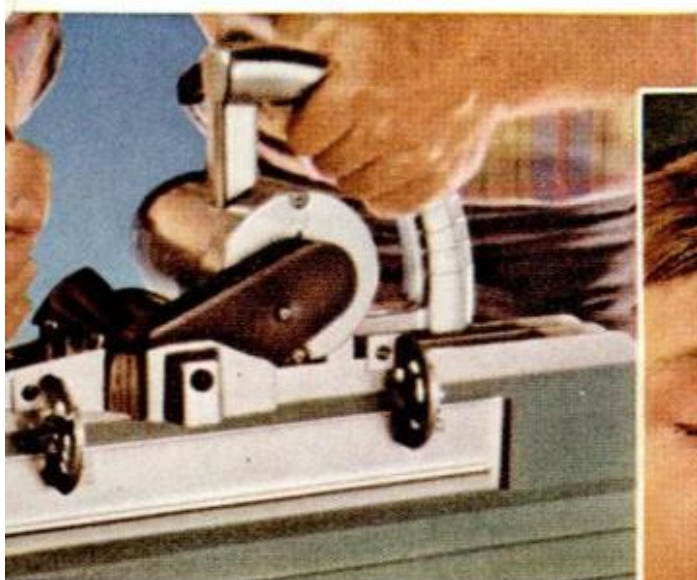


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## SOUPED UP ½ HP "ALL SAW"

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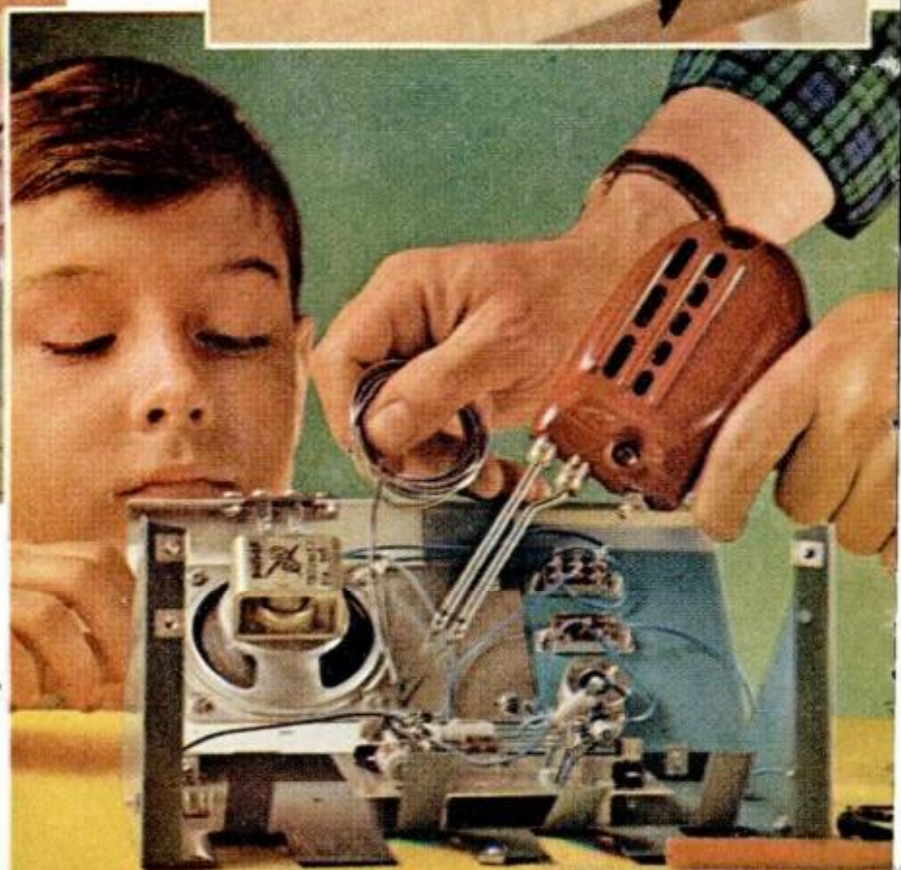


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beautiful  
eat for edging;  
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# WEN

# POWER TOOL



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W. P. MARSHALL, PRESIDENT

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NL=Night Letter  
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1201

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**LLD001 PD CHICAGO ILL AUG 26  
TO MODERN MINDED CRAFTSMEN**

**A TREMENDOUS VALUE...ACTUALLY 2 TOOLS FOR 1/2 THE PRICE OF ONE...NEW WEN SANDER/POLISHER...7-INCH DISC...SOUPED UP 1/2 HP MOTOR...2 SPEEDS...INDUSTRIALLY RATED**

**MODEL 940**

**FOR ONLY  
\$44<sup>95</sup>**

including oversize  
lambswool bonnet  
and 2 sanding discs



Now you get the right speed and the right power at the right price—all in one professional quality tool. Compare—you'll find it's the best value on your dealer's shelf.

**IT'S A SANDER AT 3400 RPM**

Ideal for heavy removal on metal, wood, plastics. Removes paint quickly and feathers edges beautifully.

**IT'S A POLISHER AT 1800 RPM**

Electronically reduced speed for efficient polishing of floors, cars, furniture—you name it.

**SHOP AND COMPARE**

You'll find nothing on the market to equal the value of this new tool!





# YOUR MONEY

## FROM SPACE AGE RESEARCH COMES THE FIRST REALLY NEW SOLDERING DEVELOPMENT IN 20 YEARS



### New Model 75 SOLDERING PISTOL with ATR\*

gives you the long reach and clear view of a soldering "pencil"—yet delivers the heat of a 100 watt device . . . just twice its 50 watt rating. This tremendous *efficiency* comes from the first commercial use of a new metal developed for use in "red hot" missile motors. With the Pistol's comfortable grip and tapered tip, you'll solder faster and more accurately than ever. Instant heat . . . quick to cool. **\$4.95**

### \*NEW ATR REGULATES TEMPERATURE FOR HIGHEST EFFICIENCY

Automatic Thermal Regulation gives this tool the greatest efficiency of any soldering device ever. The Pistol draws only enough current to maintain *maximum* heat in the tip. A surge of 50 watts brings tip to working temperature *in seconds* . . . then only 30 watts are needed under normal soldering conditions. When the tip is placed against an unusually large cold mass, ATR again triggers more watts until the mass is properly heated . . . then regulates back to its amazing 30 watt efficiency. No double triggers or tricky switches with ATR—exclusively in the new WEN Model 75 Soldering Pistol.

Wen has a thing about making the best tools for your money. Take for example the Electric Belt Sander. It sells for under \$50. Yet it's the only sander, unless you go into the three figures, that's dustfree. No vacuum bag either.

The  $\frac{3}{8}$ -inch power drill has a manually operated two speed shift and sells for \$29.95. Other tool manufacturers have equivalent drills with an automatic two speed shift for two and three times that amount. The Wen manual gear shift takes you less than 30 seconds to change. Hardly an inconvenience—particularly when you think of the money saved.

The Wen Electric Plane demonstrates our success in bringing you new, exciting products for less. The plane is a fully integrated *professional* power tool that sells for under \$50. Others cost \$125 and up.

All Wen tools are lean on tricky parts, heavy on power. The Zipp Saw and the All Saw are examples of power tools produced through fresh thinking in mechanical design and engineering—that's why they outsell all other sabre saws.

### ROTARY ELECTRIC SHAVER

A precision product of unusual quality. Larger contoured shaving surface adds speed to traditional rotary comfort. Hollow-ground self-sharpening cutters shear whiskers cleanly without pinching. Brush and commutator motor adds years of effective life. **\$19.95**



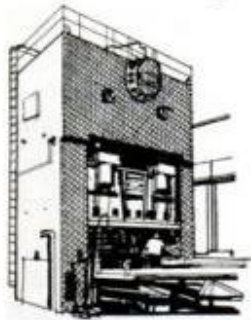
## BUY WEN TOOLS AT FINE STORES ACROSS THE COUNTRY

# WEN

PRODUCTS, INC.  
5810 Northwest Highway  
Chicago 31, Illinois



# How to build your own totally new Rambler American '64



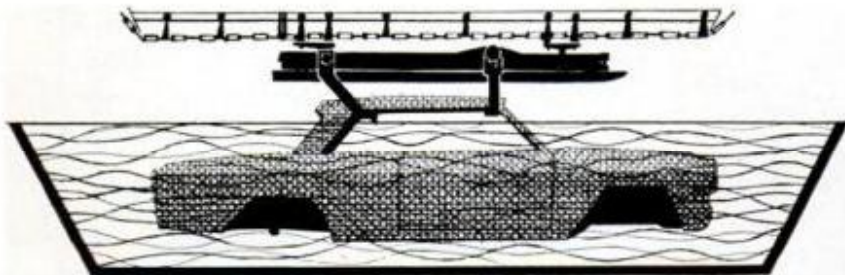
Use an 800-ton capacity press to stamp out massive one-piece unisides. (This Advanced Unit Construction defies strains that cause squeaks and rattles.)



Get curved-glass side windows like you'll find in no other car in its class. (They let doors curve right up into the roof for easier entrance and easier exit.)



Devise an exclusive new kind of front-end suspension with many parts lubricated for life. (Get an amazingly smoother, quieter ride as a bonus.)



String up a conveyor system to deep-dip car bodies—right to the roofline—in a monster tank containing 12,000 gallons of rustproofing primer paint. (Most other car makers settle for spray-on rustproofing.)



Add Double-Safety Brakes for doubled security. (With separate braking systems, front and rear, you can stop when other cars can't.)



New American 440-H hardtop

Dress all these advances beneath the head-turning beauty of the all-new Rambler American for '64. It finds room for 6 adults—is still America's lowest-priced\* car! **FREE! '64 CAR X-RAY BOOK!** 32 illustrated pages—side-by-side comparisons of leading '64 cars—can save you hundreds of dollars. Get one at your Rambler dealer.

\*Price comparison based on manufacturers' suggested retail prices.

## Insist on more in '64—go Rambler

Rambler American • Rambler Classic 6 or V-8 • Rambler Ambassador V-8

Watch the Danny Kaye Show on CBS-TV, Wednesday Evenings





**This Super Hi-Miler tread design gives you  
an extra 130 square inches of rubber  
...and thousands of extra truck tire miles!**

**Yes, outwears! Yes, any other!**

With every turn of the wheel, the Super Hi-Miler truck tire puts almost 130 extra square inches of rubber against the road. And more rubber means longer wear.

This Super Hi-Miler tread is made up of solid continuous ribs. No little segments here with excess space between. It's a wider tread.

And it's made with Tufsyn, toughest rubber Goodyear ever used in a tire. Tufsyn rubber means more mileage.

**Runs up to 25° cooler, too!**

The Super Hi-Miler tread is actually made of two kinds of rubber. Outside, an abrasion-resistant tread; inside,

a softer, more resilient rubber that absorbs flexing and creates less heat-building friction.

This, plus a new specially grooved shoulder design, keeps Super Hi-Miler running up to 25° cooler, mile after pounding mile.

You get extra traction, more recaps, even a lower-pitched sound at high speeds.

Mileage-stretching features like these make sense for your fleet. Buy and specify Super Hi-Miler at your Goodyear Dealer's or Goodyear Service Store. Goodyear, Truck Tires, Akron, Ohio 44316.

**Another reason why more truck manufacturers, more fleet owners choose Super Hi-Miler.**

**GOOD YEAR**



This One



71QH-6R1-2RKZ

Hi-Miler, Tufsyn—T.M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

FEBRUARY 1964

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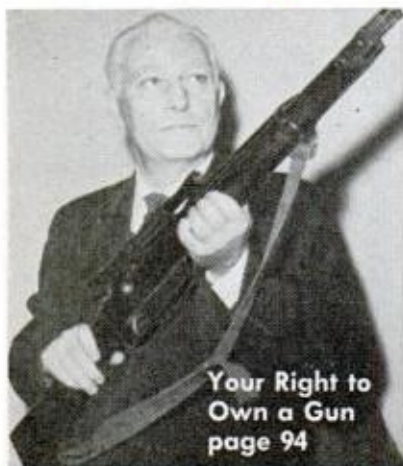


# POPULAR MECHANICS®

FEBRUARY 1964  
VOL. 121 NO. 2

INTERNATIONAL EDITIONS • AUSTRALIAN • SPANISH • CARIBBEAN • FRENCH • DUTCH

## Features of Special Interest



Your Right to Own a Gun  
page 94

Owners Report on Their 1964 Chevelles . . . . .	87
Right to Own a Gun: Will New Laws Restrict It? . . . . .	94
The New Plane You Can Buy Complete for \$2500 . . . . .	100
Emergency Road Service Chart . . . . .	105
Hopped-Up Sailboats: How They Work . . . . .	108
Backyard Bulldozer . . . . .	114
A Dwarf to Guide Apollo . . . . .	116
Four-Barrel Sports Gun . . . . .	122
Buying a Piano You Can Keep on Enjoying . . . . .	124
Inside 1964's Biggest Show: The World's Fair . . . . .	137
Color TV in Pieces . . . . .	194
Cam-Dwell Meter for Auto Tuneup . . . . .	196

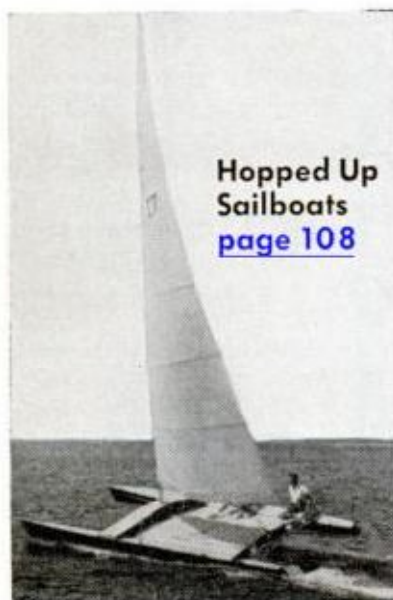
## For the Shop Craftsman

New 8-in-1  
Power Tool  
page 184



Prefinished Hostess Party Cart . . . . .	146
Stereo Microscope . . . . .	151
Southern Comfort for the Chilly Angler . . . . .	155
Lay Ceramic Tile Like an Expert . . . . .	156
Lamps with a Flair . . . . .	161
Professional Portrait Photo Secrets . . . . .	166
Sprucing Up Your Tired Chairs . . . . .	171
Arc Welding Basics (Part II) . . . . .	178
Servicing Power Brakes Safely . . . . .	184
PM Tests the Multi-Matic Power Tool . . . . .	186
Electronic Drill Press Drive . . . . .	188

## Regular Departments



Hopped Up  
Sailboats  
page 108

Over the Editor's Desk . . . . .	8
News from the Services . . . . .	14
Items from All Outdoors . . . . .	16
Science Worldwide . . . . .	20
Sidelights on Aviation . . . . .	26
Inventors' Corner . . . . .	32
New on the Market . . . . .	36
Shopping for Tools . . . . .	38
Spotlight on Valiant's New V8 . . . . .	42
Detroit Listening Post . . . . .	54
Worth Writing For . . . . .	60
New for Your Home . . . . .	130
Solving Home Problems . . . . .	164
Auto Clinic . . . . .	183
Clinic for Homeowners . . . . .	206
New in Electronics . . . . .	240



**NEXT MONTH: PM** reports on changes in this year's boats and new boating accessories; hydro-karters' antics on their powered shingles; PM's roomy water sled. You'll also find owners' likes and dislikes about their Falcons and Pontiacs—and what it's like to be the target of a jet plane

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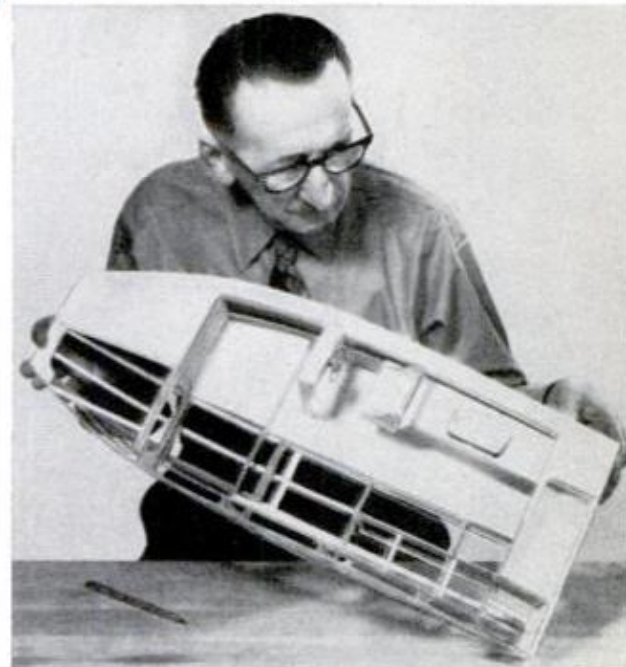
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# BACKSTAGE at PM . . .

There may be snow on the ground here and there, but boaters—like the green-thumb crowd with their seed catalogs—are indulging in fireside dreaming about the joys of warm weather. And you can bet that a lot of them are hoping that this is the year they'll be able to get a new boat.

If you're one whose heart is set on a new family outboard, don't make any decisions until next month. We've got a dandy coming along for you—called the PM Sports Sled.

The boat has already been built twice, once in full size by its designer, Bill Jack-



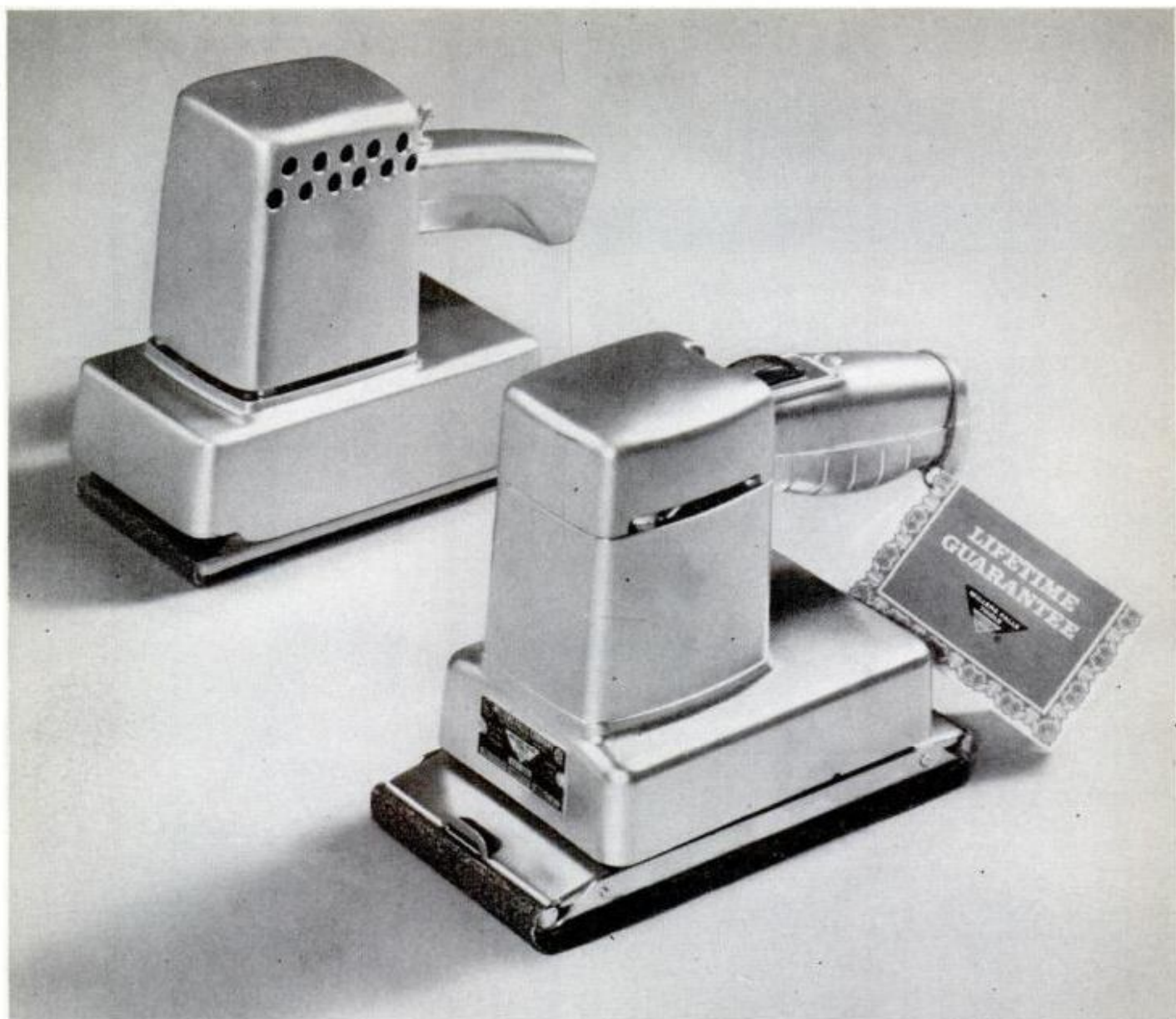
son, and once in 1½-inch scale by PM staff artist George Blow (above).

George, incidentally, has been building scale models of PM boats for years as an aid in detailing those construction drawings that have helped make PM boats famous among home-workshop boat builders.

He made the Sports Sled of heavy illustration board, cutting and placing every piece shown in the plan. That way, he says, he's sure that he knows that everything is where it's supposed to be.

It's only natural that *Little LeMans on Ice* (page 132) should be reported by Dick Dempewolff. Dick has been to Antarctica twice on trips for PM, so he takes to cold weather like a penguin. (He adds, though, that when it comes to driving those sports cars on ice, he does it slowly.)





## Tough decision? Not when that tag says **LIFETIME GUARANTEE**

That tiny tag is big news. Please look for it when you buy tools. It's our way of saying you get the most for your money. In fact, *extra value . . .* because you get Millers Falls *Lifetime Guarantee*: "If any tool carrying the Millers Falls Lifetime Guarantee fails for any reason except abuse or normal wear, we'll repair or replace it free." So, if you believe that tools should be a careful investment, you can depend on the ones backed by the tag that says *Lifetime Guarantee*.



**MORE THAN 2000 HAND AND POWER TOOLS FOR HOME AND INDUSTRY**



# Use Rotunda car care products to keep your car showroom bright



**All cars get older . . . but given proper care, can keep that showroom shine year after year. Rotunda car care products will keep your car sparkling bright, top to bottom, inside and out. See your Ford Dealer.**

**Liquid Car Wash:** Just a small amount of this powerful cleaner in a pail of water gets you ready to clean your car fast! Makes mud and dirt literally "float" off painted surfaces.

**Tar and Road Oil Remover:** Quickly and easily removes tar, asphalt, undercoating, old wax or any gummy material from painted surfaces. Excellent also for use as a prepaint cleaner.

**Chrome Cleaner:** A little bit on a cloth brings back high lustre to bright metal surfaces on your car. Works easily, is particularly valuable for metal surfaces exposed to water.

**Triple Clean:** Ready-to-use cleaner gives fast

results on leather and vinyl trim, whitewalls, convertible tops. Has brush on top of self-generating foam dispenser for easy application.

**Custom Auto Wax:** Here's a paste wax that returns shine and color to faded finishes. Special new formula does away with back-breaking rubbing.

**Wax-Treated Dust Cloth:** Removes dust and dry mud: cleaning, dusting and polishing in one motion. Will last for months under daily use.

**Upholstery Spot Remover:** Keep your car's interior spotless with this cleaner. It's perfect for leather, vinyl and other plastics, imitation leather and fabrics.

**MORE FOR YOUR DRIVING PLEASURE FROM YOUR FORD DEALER!**





# Over the Editor's Desk

## Sub Rescuer

Upon our return from an extended cruise, I saw your article *Sub Rescues—Four Miles Deep* (page 69, August PM). It was of particular interest to us on board *Florikan* since you used a *Florikan* photo.

Submarine rescue is our business, and we take pride in our work even though



modern technology may be advancing beyond our ability to respond effectively in some rescue situations.

Your article was very informative as we are also looking forward to the development of any and all modern sub-rescue equipment which will enhance our capabilities and increase the margin of safety for our deep-diving submarines.

I am enclosing a recent photo of *Florikan* to substantiate our contention that we stand ready to do our part.

U.S.S. *Florikan* C. H. SMITTER  
Fleet Post Office Lt. Comdr., USN  
San Francisco, Calif. Commanding Officer

## Patio Boat Shed

Since my husband is too modest to write you about his accomplishment, I'd like to do it. He built *Swish* (page 152, March 1958 PM).

First he had to build a roofed patio to have a place to work. Next he drew your



plans to scale and made his own patterns. There were many delays for various reasons—like a broken collarbone and a 116-day steel strike. Except for having the boat seats cut out, he did every bit himself, even to fiberglassing and painting.

After four years, you can well imagine it was a proud moment when we put the boat in the water.  
South Gate, Calif. MRS. DAVID LANGFORD

## Commandos Approve

As you stated in *The Gun That Broke the Red-Tape Barrier* (page 108, Sept. PM) the AR-15 is the rifle used by the Air Commandos. Up to this time, your article is the best and most complete that I've seen on this fine weapon.

1st Air Commando

Wing

EUGENE D. ROSSELL  
Howard AFB, Canal Zone 1st Lt., USAF

## Two-Wheeler for Two

Thanks for your article on building a tandem bike (*Bicycle Built for Two*, page 176, April PM). I am continually asked if mine is a factory-built job. I have to



agree that it looks pretty snazzy.

For less than \$20 I added new chrome fenders and a spray paint job. It was welded by a local shop for \$6. Note that my tandem has chain guards.

Winchester, Ind.

L. R. FERGUSON

## Quick Starter

I think *How Owners Rate Their Volkswagens Now* (page 77, Sept. PM) missed a very important point—namely, the VW's ability to start promptly even in very cold weather.

My '59 Volks stayed outside four years, and not once did it fail to start at the flip of a key. Now that I have traded for the '63 model, I view the onset of winter with misgivings since VW has gone to the automatic choke.

Dartmouth, N.S.

E. H. ANTHONY

VWs used to have a reputation of not

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





# How Long Since YOU'VE Had a Real Raise?



"I am now Traffic Supervisor with John-Manville. I owe this advancement to your course."—J. E. Sanders, Natchez, Miss.



"Am controller of a concern with millions of assets and sales. Thanks to LaSalle."—Walter Ziecke, Bridgeman, Mich.



"My salary has more than doubled since enrollment with LaSalle and is still growing."—William T. Black, Canoga Park, Cal.



"Salary is double what I earned when I enrolled, thanks to the opportunity you offered."—Robert Hughes, CPA, Costa Mesa, Cal.



Mrs. Kleptine McGill, Brooklyn: "Cannot tell you how much LaSalle has done for me. Business education is being put to good use."



"I appreciate the training received from your accounting course. My salary has doubled."—Robert Dinkel, Russel, Kansas.



"My selection for my position was based primarily on the fact that I held LaSalle's L.L.B. Degree."—W. F. Hornbeck, Cheyenne, Wyo.



"8 months after I started I got a job in Accounting. I now earn 3 1/2 times my former pay."—Robert Fisher, Holbrook, Ariz.

## La Salle students report big increases in pay during the first year of training

A man may work for years at his job, and still be worth only a clerk's pay. Without special training, those hoped-for raises come in dribbles.

You can command a much bigger salary than you are now earning—with prestige and privileges to go with it—by getting out of the ranks of the untrained. You can become an expert in the kind of work you like—and employers will seek you out. For in today's vastly expanded business activity, there are more key jobs than there are trained men to fill them.

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Name..... Age.....  
 Address..... County.....  
 City & Zone..... State.....  
 Occupation..... Working Hours..... A.M..... P.M.



**IT'S  
POINTLESS!**

**So Throw Away  
the Major Cause  
of Ignition Troubles!**



**The New Holly Electronic System  
for Most U. S. Cars and Trucks  
Obsoletes All Other Ignition Systems . . .**

At last, the ignition system has gone modern . . . caught up with the other engine improvements.

**REASON:** Holley's new Transistorized Pulse Ignition (*TPI*) electronic system does away with mechanical contacts in the distributor—the principal cause of ignition troubles.

**RESULTS:** Improved engine performance . . . greater economy . . . faster cold weather starting . . . practically no maintenance.

**INSTALLATION:** Holley's *TPI* system consists of just four major parts and can be installed in about the same time as an engine tune-up.

**HOW *TPI* WORKS:** A magnetic pulse generator replaces the points and triggers the system. There are no moving parts—no wear!

**COST:** More, naturally, but you get a system that eliminates most ignition troubles. *After all, what good is transistorized ignition if points are still used?*

***TPI* KITS:** Available *now* to convert most U. S. cars and trucks!



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"Quality Parts for Auto Makers and Owners"

TP/K-2

**Over the Editor's Desk**

*(Continued from page 8)*

starting when the temperature dropped to around 9 degrees F. However, they've been improved, and we've heard few complaints about their cold-weather starting abilities in recent years.

**Fans of the 38**

The PM-38 (page 140, Aug. 1962 PM) was the first boat I have ever attempted to build. It was well worth the effort. I have



had many compliments on the boat.

The building material cost me \$38, but the building time was considerably more than the author's 38 hours.

Neoga, Ill.

WAYNE E. CLARK

I started deviating from the PM-38 plans after the hull was constructed and the deck was to be applied. I used cedar for the deck and also added two small seats and an aft compartment for battery and gas tank.

The windshield is a rear glass from a Studebaker which I framed with wood. I added a Dodge visor plus wing glasses and rear door windows from an Oldsmobile.



The top from a convertible was added, and I put on a railing made of conduit to make it safer for a child.

Heidelberg, Ky.

DONNELLY COLE

The simplicity of the PM-38 plans and *(Please turn to page 12)*

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## Over the Editor's Desk

(Continued from page 10)

the well-described construction steps make it very easy for an amateur to build. The results are amazing.

I like boats, and I fish quite a bit—and



I've planned for the past few years to purchase a boat. However, I'm extremely glad that I built my own as it is the nearest to my idea of how a boat should look and perform.

The total cost to me to build this beautiful boat was \$43.85.  
Birmingham, Ala. J. T. NORMAN, SR.

### Wax Eloquent on Guns

I was paging through some back issues of *PM* and enjoyed *Armchair Target Shooting* (page 142, Nov. 1962 *PM*). This was the first complete article I've seen on wax bullets, even in gun and sporting magazines.

I hope you are planning to have more gun articles in the future. I enjoy the fine magazine you put out and appreciate its range of content.  
Grand Forks, N.D. KEN CURFMAN

### Breezy Melody

Please publish plans for an aeolian harp in a future issue.

As you probably know, it's a stringed instrument that's placed in a gentle breeze to produce music.

I'd be very much interested in building one, but have been unable to get any helpful information.

Toronto, Ont. M. HUDYMA

One of our editors remembers his dad making a harp for him when he was a very small boy—but he can't recall the construction details. How about it: Does anyone have a homemade aeolian harp on hand that we could borrow—and return after we have worked up the project for use in the magazine?

*The Editor*



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## Sidelights from the SERVICES

By William R. Kreh

**Man-made lightning.** The Air Force has developed a portable machine that's capable of producing 10 million volts of lightning that will help engineers find out what happens to the delicate machinery of a ballistic missile when it's hit by a natural lightning bolt. The machine, called the most realistic portable lightning simulator in the world, has an output of more than 300,000 amperes, compared with the up-to-500,000 amps generated by Mother Nature's fireworks. It will produce bolts as long as 50 feet.

**Golden silence.** You can't accuse Air Force scientists of wasting anything. They've even found a way to make use of the silent periods between spoken words in a sentence on a communications channel. The speech signals are converted to digital form, then other data is inserted into the silent gaps for transmission at the same time. The signals are then reconverted to speech at the receiving end.

**Penguin detour.** A decrease in the Antarctic's penguin population has led the Navy to order a cut in flights around known penguin rookeries. Pilots have been told not to fly below 2000 feet or within 300 yards of rookeries, except where absolutely necessary. At one rookery, the drop in the Adelle penguin population has been so severe that it is feared the rookery will be extinct in 10 years. Experts say that plane noises frighten the birds when they are nesting.

**Extra mileage.** The Air Force is getting some unforeseen use out of several hundred old vehicle tires. Workers building the North American Air Defense Command's new combat operations center inside a Colorado mountain, are using the old tires to protect the support columns against bumps by heavy equipment and rock blasting.

**A-blast spotter.** The Coast Guard's long range (Loran) navigation equipment is reported to be capable of spotting high-altitude atomic bomb blasts and hence may become a detection instrument for enforcement of the test ban treaty. A nuclear burst pumps electrons into the so-called D-layer of electrical charge above the atmosphere—the layer from which the

Loran radio waves are reflected back to earth. After studying the effect of the 1962 U.S. blasts on reflected Loran waves, scientists report that those effects were a dead giveaway of high atomic blasts.

**Still another rifle** is in the military news. The Stoner 63 is arousing interest among Army and Marine Corps weapons men. It is a single "rifle" that can be used as a carbine, light and medium machine gun, assault rifle or a fixed machine gun for vehicles and possibly aircraft. Designer is James Stoner who is credited with designing the lightweight AR-15 rifle which the Army is buying for guerrilla warfare.

Using only a cartridge for a tool, the Stoner 63 can be converted to a (1) Clip-fed assault rifle, (2) Clip-fed carbine with folding stock, (3) Clip-fed light machine gun using a bipod barrel rest, (4) Belt-fed light machine gun using a bipod barrel rest, (5) Belt-fed medium machine gun using a tripod stand, and (6) Belt-fed fixed machine gun for vehicles or aircraft.

As an assault rifle, the Stoner 63 weighs 7.9 pounds; as a light machine gun—with stock and bipod—about 12 pounds, and about 10½ pounds as a fixed machine gun. Its caliber is .223 (5.64-mm), the same as the AR-15.

**Sea-launched ballistic** missiles are being studied by the Air Force. The idea is to mount missiles in launchers on submerged platforms which could be manned by a small crew and kept hidden in inland waterways or close-to-shore ocean spots. The missiles would be used in the 1968-74 period, planners believe.

**Whirlybird defrosters** are being used in Alaska. When weather conditions cause frost crystals to form on the Alaska Communications System telephone lines, the Air Force sends its helicopters out to jar them loose. The frost covering, which sometimes measures as much as eight inches in diameter, causes poor communications and threatens to break the wires. Low-flying helicopters, however, jar the ice loose with air vibrations.

**"Radio pills"**—tiny transmitters so small that they can be swallowed—have been developed by the Air Force to shed light on a new biological frontier—the inside of living animals and man. The pill is a plastic capsule about half an inch in diameter and an inch-and-a-half long. Inside the capsule there is a coil, a ferrite disk for pressure sensing, a transistor, condensers and a tiny battery for power. Life of the transmitter varies from eight hours to three weeks.





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long. Over winding hilly back-roads. Against precise time schedules over a route the drivers know nothing about beforehand. (That's where Mrs. O'Leary's skillful "advice" comes in.)

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## Items from All Outdoors

Off-center bore in a rifle eliminates vibrations of the barrel after firing, and gives greater accuracy. Designed by gunsmith Bill Atkinson of Prescott, Ariz., the new rifle has the bore .110 inch off-center at the muzzle and centered at the breech. We telephoned Bill to inquire about the exact reasons for this. "With full length center bore the rifle can whip in any direction," he said. "I believe the off-set bore will cause uniform whip in one direction, allowing the shooter to make compensations automatically." The unique idea is still in the test stage, but it has already performed well in one test match.

It was just a matter of time before our PM readers began finding new uses for the



snap-top openers on beer cans, and the first comes from Howard Roberson of Dayton, Ohio. He has fashioned the opener into a metal fishing lure by simply straightening it out, using a punch to make small holes in each end, then opening the eye of a hook

slightly to attach it to the lure. The flanges are twisted to give a variety of actions.

Steady encroachment of wilderness areas and the dwindling supply of wild life has resulted in higher prices for zoo specimens, prompting Dr. Fairfield Osborne, president of the Bronx (NY) Zoological Society, to request a considerable increase in his budget. It also inspired a PM bard:

Prices are up, the Bronx Zoo claims,  
For stoats and sloats and orangutans.

Antelopes are very high,  
The price is awful on wapiti.

Five times more for an elephant shrew,  
Three-toed sloth or kangaroo.

Costs, they say, have hit the sky,  
For lemurs, chimps, rhinoceri.

Giraffes way up, says the zoo,  
The white-tailed gnu, the gemsbok, too.

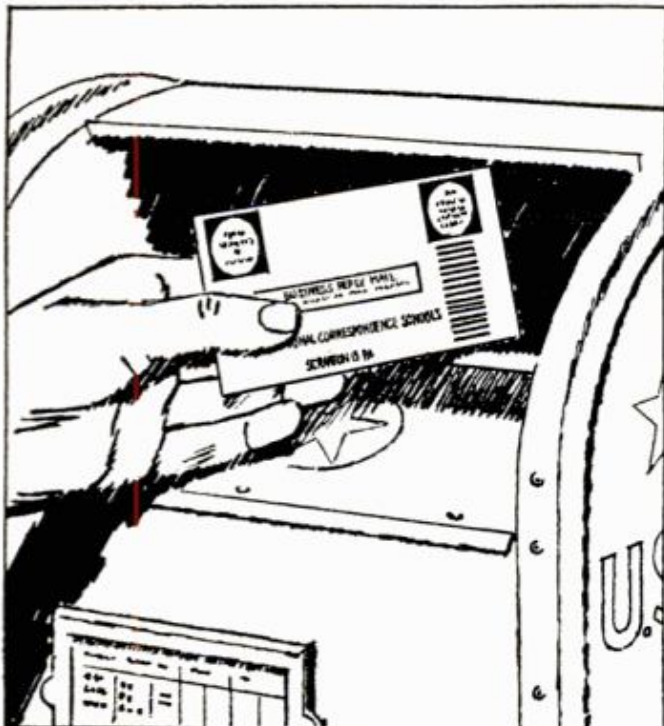
STUART JAMES

Outdoors Editor

POPULAR MECHANICS

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**New thumbs** to replace those lost in accidents are now being supplied in a startling new operation. Plastic surgeons literally move the little finger across the palm to take the lost thumb's place.

Dr. James G. Sullivan, a surgeon of Toledo, Ohio, says that in such operations the detached finger is connected to the muscles which operate the thumb; the finger's original blood vessels and nerves are left intact. Patients learn to use it as a thumb in about nine months to a year. "If you hit it with a hammer," says Dr. Sullivan, "it feels like a little finger."

**Jangled nerves** due to noisy pile drivers may soon be a thing of the past in Britain. A firm there has come up with an automatic pile driver which makes so little noise it can scarcely be heard above traffic din. It's done with eight hydraulic jacks which work without vibration or impact in the soil.

**Light rays** may some day be used to make brick buildings stand without mortar. A University of Cincinnati physicist has suggested that a laser beam could be used to fuse bricks together to form a single solid wall.

**Heartbeats** of whales are probably responsible for a mysterious subsonic throbbing noise first heard about 10 years ago in the Atlantic and Pacific oceans. Scientists at Bell Telephone Laboratories, who are using hydrophones to solve the problem, believe the sounds are made by blue whales. These monsters have a heart weighing more than half a ton which pumps eight tons of blood and develops about 10 horsepower.

**Facial deformities** can now be remedied with a new liquid plastic that is injected under the skin and molded to a desired shape before it hardens. Known as Silastic, the new substance was tried out on countless laboratory animals before it was applied to humans. Dr. Herbert Conway of New York told *PM*.

Dr. Conway said the procedure had been performed on hundreds of human patients. "It's being used to treat deficiencies in facial features such as the chin and nose and also to augment the female breast," he said. The substance is injected with a hypodermic needle and hardens in about 10 minutes. It is readily accepted by body tissues and will not "drift."

Silastic was described in a paper presented to the American College of Surgeons by three investigators from Baylor University College of Medicine.

**The New Jersey coast** is sinking at the rate of 50 inches every thousand years, according to Yale University scientists, who conducted studies and measurements of the coast near Brigantine City in south Jersey. They say the New England coast is subsiding at about the same rate.

**Floating sculpture** suspended with electromagnets in midair has hit the contemporary art field. A Venezuelan student at Boston University is using the force of repellent magnetic fields to suspend his metal works of art over their bases.

**Making false teeth** with explosives is a new technique being tried out in Ireland. Denture plates, made of very thin stainless steel, are literally blown into shape by explosives which push them into a mold of the patient's mouth. Porcelain teeth are then attached to the perfect-fitting and less-bulky dental plates.

**A volcano** which suddenly appeared out of the sea off the coast of Iceland is creating a new island. Now some 100 yards high and 1000 yards in diameter, it is still too hot for landings to be made. The eruption started last November 14.

**Sleeping pills** and alcohol definitely don't mix. An Air Force biochemist reports that experiments on rats prove that the combination of alcohol and barbiturates, both depressants, can be fatal. The drugs were found to interfere with an enzyme which controls the first step in the body's disposal of alcohol.

**Dinosaur footprints**, nearly 100 of them, are being cut from a quarry in England for installation on the lawn of London's South Kensington Natural History Museum. The biped footprints, perhaps 140 million years old, are the only dinosaur prints so far discovered in Britain. The tracks were made on what was originally a mudflat on the shore of a lagoon; shortly afterwards, the sun baked the mud dry.

(Please turn to page 22)



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Wonderful for experiments, miniature waterfalls, fountains, Christmas gardens, HO gage railroad backdrops, hobbyists, labs, schools. Pumps continuous flow of water etc. Tiny (2 5/8" x 1 3/4") electric motor and pump ideal for hobbyists, labs, schools. Pumps continuous flow of water at rate of one pint per minute at a 12" head. With 2 D Batteries in series will pump to 24" high. Works in either direction. Stock No. 50,345-H ..... \$2.25 Postpaid

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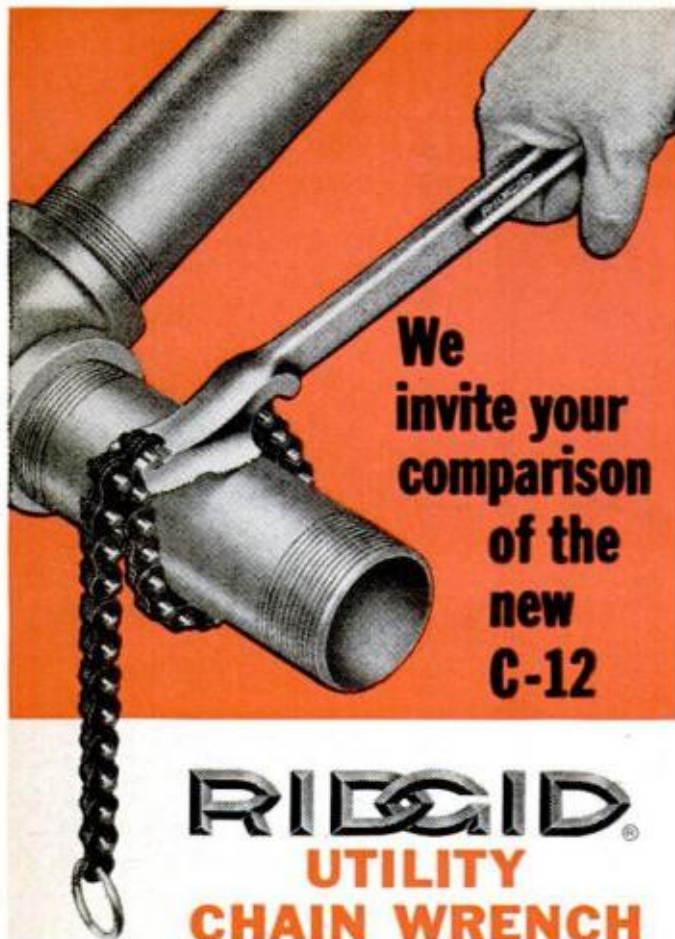
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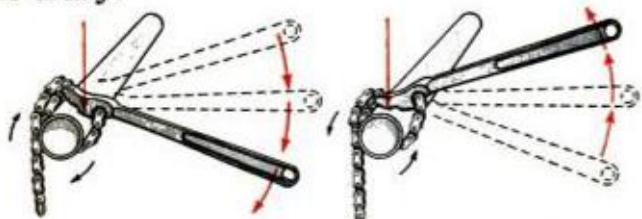
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Rear jaw for downward pressure      Front jaw for upward pressure

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## Science Worldwide

(Continued from page 20)

Later deposits covered the prints and preserved them.

They don't build them like that anymore. A 4000-year-old house, virtually intact although made of perishable materials, has been excavated from a site on the coast of Peru. The semi-subterranean house was found in an excellent state of preservation, with beams, thatch covering and binding about as they were 40 centuries ago. The ancient structure will be set up in the University of La Molina museum in Lima.

Multiple fetuses can be more easily detected with a telemetering device perfected by a gynecologist at Yale. Electrodes from the transistorized apparatus pick up fetal heartbeats as early as the 14th week of pregnancy, give parents ample warning of the advent of twins, triplets or worse. Impulses from the electrodes can be picked up by any short-wave receiver within a radius of 300 feet.

Climates of 75,000 years ago may soon be analyzed in a deep hole at the South Pole. Aim is to drill through snow and ice to a mile in depth for ice samples laid down during prehistoric times. Already cores have been brought up from depths of 500 yards to yield snow that fell as long ago as the year 1558.

Biggest "eye" in the world, the 18½-acre radar telescope dish at Arecibo, Puerto Rico, will be focused on Venus this spring in an attempt to draw a geological-like map of the surface of the cloud-covered planet. The telescope, which has a 1000-foot-diameter antenna, is 40,000 times more powerful than the 'scope which bounced the first recognizable radar signal off Venus.

Leukemia may face a powerful new antagonist in a drug developed in Australia which is undergoing tests at the National Institutes of Health. The drug is made with a substance from a rare north Australian plant.

War will be declared on germs during assembly of the unmanned spacecraft the U.S. hopes to rocket to Mars, perhaps in 1966. Even minor ills such as dandruff, athlete's foot or a cold will disqualify a worker from helping with the craft. But strangely enough, men assembling the robot explorer will be barred from tak-

(Please turn to page 24)

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**NO OTHER CAREER OFFERS YOU  
A BRIGHTER FUTURE**

Consider this fact. In the short time it takes you to read this page 1,100 accidents will take place. Over 440,000 will occur before this day ends. *These accidents must be investigated.* The law demands it. Yet in 4 out of 5 cities, towns and rural communities, no one has been trained for this vital work.

**KEEP PRESENT JOB  
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Step into this fast-moving Accident Investigation field. *Already* hundreds of men we have trained are making big money. Joe Miller earned \$14,768 his first year. A. J. Allen earned over \$2,000 in ten weeks. Robert Meier says "I'm now earning \$7.50 to \$15.00 an hour in my own business... Universal's course is wonderful."

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**Science Worldwide**

(Continued from page 22)

ing baths within a few hours before they report to work. That's because the Mayo Clinic found that dissemination of organisms from the human body is five times greater just after one takes a shower than it is a few hours later.

**Special Science Report**

A recent statistical study issued by the American Cancer Society provides new indications that men who smoke show a far higher death rate than nonsmokers. Most frequent causes of death among the 422,094 men over 40 who participated in the 34-month study were cancer and coronary diseases.

Some offbeat aspects of the report on death rates, however, were more intriguing than the perennial smoking-cancer controversy. Here are some statistics on age-standardized death rates per 100,000 man years, comparing nonsmokers with men who smoke a pack or more a day. (Age standardized death rates are adjusted to account for difference in age groups.):

Group	Death rate per 100,000 man years	
	Nonsmokers	Smokers
Height of subject:		
Under 66 inches	1065	1782
72-73 inches	687	1481
Over 74 inches	735	1672
Religion:		
Protestant	790	1578
Catholic	858	1607
Jewish	1095	1522
Fried Foods:		
None	1208	2573
Eat 3-4 times week	642	1714
Tranquilizers:		
Use	1308	2286
Do not use	755	1501
Marital status:		
Married	796	1560
Single	1074	2467
Divorced	1420	2675
Sleep:		
Under five hours	2029	3936
Seven hours	626	1426
Over 10 hours	1898	2694
Exercise:		
None	834	1416
Moderate	486	1065
Heavy	474	998

*John P. McNeel*  
Science Editor

POPULAR MECHANICS





# You Schedule the Orders while Your Servicemen Bring You \$18 an hour gross profit

Yes, that is your hourly gross profit from the work of only three servicemen . . . at "national-price-guide" rates. And this is much easier to do than you think. We show you how . . . step by step. Duraclean dealers find it is easy to gross \$6 per hour on EACH serviceman plus \$9 per hour on any service they themselves render. Your income is limited only by the number of servicemen you employ. The 24 page illustrated booklet we'll mail you (with no obligation) explains how most of your gross profit becomes a clear net profit to you.

## Start while Continuing Present Job We furnish all the equipment...and help finance you

If you've wanted to be YOUR OWN BOSS . . . to become financially independent . . . have a fast growing income . . . and own a Nationally Advertised business, NOW YOU CAN! This business is easy to learn . . . easy to start . . . easy to service . . . and no experience is needed. We show you everything and furnish all equipment. At the start you can stay on your present

job, do servicing evening or weekends, or you can line up jobs for your servicemen to do while your customer list grows . . . then switch to full time. One small job a day brings a good starting income . . . and you operate from your home phone.

If you are reliable, honest, and willing to work to become financially independent, mail the coupon for complete facts.

### It's Easier than You Think to Start Your Own Business

When you receive our illustrated booklet, you will see the way we show you step by step how to quickly get customers . . . how to steadily build more customers from their recommendations.

All six services are rendered "on location" in homes, offices, hotels, theatres, churches, clubs, motels and institutions. These superior, safer and convenient methods spread Duraclean dealerships throughout the world.

National Magazine advertising explains

the superior merits of your services, builds your customer confidence and brings job leads to you.

You have pre-tested newspaper and yellow-page ads, commercials, and a full mailing program.

Furnishings stores, insurance adjustors and decorators refer jobs to our dealers. The year 'round services are in constant demand. Investigate TODAY . . . before someone else takes your location.

### Start Small, Grow Big . . . in this Booming Business

Many men have said to us, "I can't afford to give up my job till I know I have a sure thing . . . a sound business that will provide both security and a better living for my family."

That made sense to us so we worked out such a plan. You can start small and grow big just as we did. A third of a century ago Duraclean was an idea . . . but it caught fire and spread rapidly to a worldwide service. It spread because it was based upon (1) superior processes and (2) proven customer-getting methods. You don't experiment. You use tested, proven methods. You have our backing and "know how."

Our first service, the care of carpets and upholstery, exemplifies these superiorities. It not only cleans; it enlivens the fibers . . . revives dull colors. Pile rises with new life. Furnishings are used again in a few hours.

There's no machine scrubbing. No soaking. Duraclean cleans by absorption. Mild aerated foam lightly applied, lifts out dirt, grease and many unsightly spots like magic.

Government figures show \$750 million yearly potential just in rug and furniture cleaning. You have five other services . . . fully explained in the free booklet.

A few hundred dollars establishes YOUR OWN business. A day's profit more than takes care of the monthly payments we finance for you.

We furnish electric equipment and enough materials to return your TOTAL investment. It is surprisingly easy to learn this business. You can decide from the information we will send you whether to apply for a dealership. So, with no obligation whatever, mail the coupon TODAY.

### Own a Nationally Advertised Business

Your Services Are Endorsed by *McCall's Magazine, American Research & Testing Laboratories and by leading Carpet Mills & Furniture Makers*

### What Dealers Say:

**Langdon Lawson:** National advertising is tops, creates leads. In September, working alone, jobs totaled \$1,475.

**Charles Randal:** Business keeps growing. Made as much as \$120 in one day.

**D. Kern:** Duraclean's proven-best process and the continuous help from headquarters gave me a big jump on all competition.

**George Byers:** For University, my total billing was \$2,416. Total expenses \$814.

**Gerald Weihrauch:** Three persons called me—saw Duraclean advertised in magazines.

**Edward Hoy:** A smoke damage insurance claim bill was \$186. All work was done by me in exactly 8 hours and 2 minutes.

**W. C. Smith:** Earned \$650 one week. Volume keeps getting bigger. Service man for dealer C. Weed:

Furniture was filthy black. When through, I was amazed how clean.

**John E. Frost:** First 2 months I grossed \$1,000 part-time.

**Loren Farris:** I'm proud to be independent at 30. I wish I had known about Duraclean earlier.

**Earl Davis:** Our sales increased \$17,660 this year.

**Ed. Kramsky:** In 2 years, now have two assistants, a nice home and real security for my family.

### Resale Service

If, because of illness, moving or for any reason a dealer wants to sell, we maintain a service to locate buyers and to help him sell.

Dealerships resell at up to 10 times the dealer's cost. R.D.K., after 5 months, sold for \$2,000 above his cost. L.L., after 30 months, got \$7,116 more than he had paid. The value of your dealership and franchise grows monthly.

### FREE BOOKLET tells how to Start Your Own Business

With no obligation, we'll mail you a letter and 24 page booklet explaining this business . . . how and why your income grows . . . how we help finance you.

Then decide if this opportunity fulfills your dream of independence and a much bigger income.

Your location could be taken tomorrow . . . so mail coupon today.

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It may put you in business

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With no obligation, mail letter with 24 page illustrated booklet explaining how I can increase my income and family security with a Duraclean Dealership.

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**NEW SYLVANIA KIT**  
contains 3 photoconductors, AC/DC relay, resistor, mounting bracket, how-to-build-it booklet.

Sidelights on

AVIATION

The price tag of \$2500 placed on the remarkable new aircraft reported on in the story beginning on page 100 reminds us of a recent conversation we had with Steve Wittman, veteran racing pilot and aircraft designer. Steve, who is now airport manager at Oshkosh, Wis., used to design, build and fly his own racing planes.

Speaking of the cost of flying these days, Wittman says that even those who build their own airplanes feel the cost pinch. About half of those who do, build them because they can't afford to buy them; the other half builds them because they enjoy building.

Wittman claims that anyone who says he can build an airplane for less than \$3000 is either a great scrounger or a great story teller. Scrounging—finding good used parts at low, low prices, or finding good, cheap material from which to make your own parts—this is the great art in building your own airplane.

The engine, of course, is invariably the most expensive item. A good new engine, he says, might cost the light-plane builder as much as \$1700. But if he's a good scrounger he might find a used one for as little as \$100. This disparity in price exists right down the line, for wheels and brakes, landing gear, tubing, skin, spars, instruments and all the other miscellaneous parts that make up a sports plane.

All of which makes the \$2500 tag on the new BD-1 a remarkable breakthrough in a production aircraft.

The BD-1, if it catches on, might start the snowball rolling in several directions. The cost has certainly been one factor in the slow growth of private aviation. The young pilots just aren't coming along.

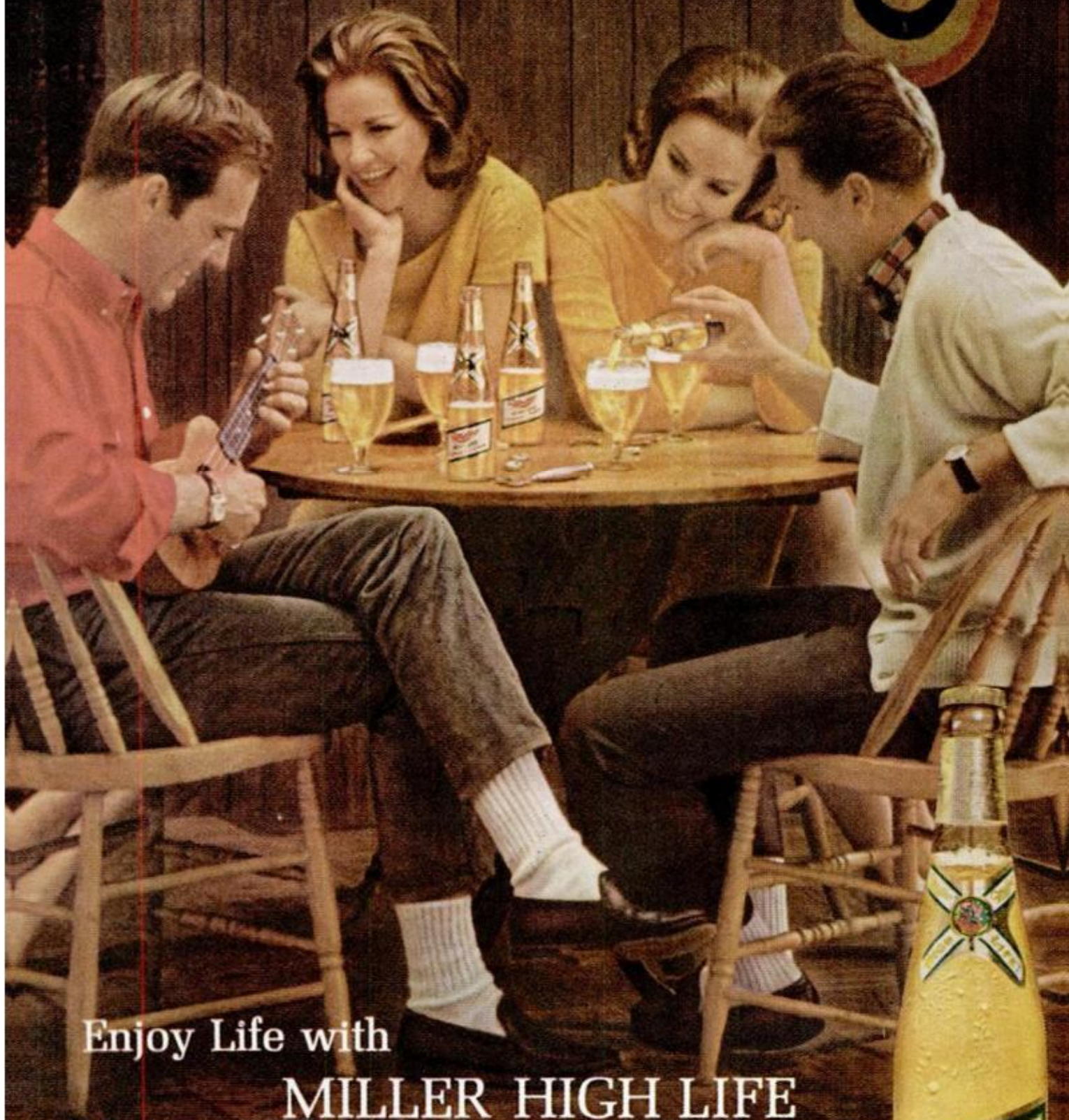
The military, meanwhile, is trying to do its share. In the face of the Space Age, the Air Force is increasing its quota for pilot trainees up to 2700 per year. It is currently turning out 1500 new pilots each year.

On another front, Piper Aircraft is offering a free, 12-page illustrated booklet, *Add an Airpark*, in a concerted effort to encourage the building of airstrips in every community in the nation. Write them at Lock Haven, Pa.

Kevin V. Brown  
Aviation Editor



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**Big load space, flat floor.** Cargo area is 7½ feet long—with an extra 4 feet of length along the right side of the engine compartment. Interior height is 54¼". You get 211 cubic feet of capacity in all.

**Easy to load or unload.** Those big rear and side doors are over 4 feet in both width and height to make it easy to load big bulky items. Side doors are extra-cost; rear doors are standard.





# ALL-NEW CHEVY-VAN

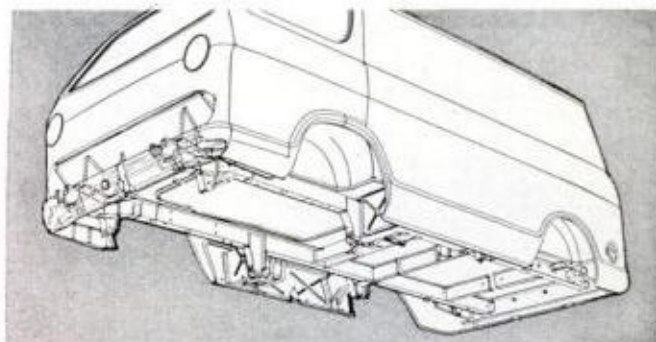
## JOINS THE FLEET!

**New low-cost van from Chevrolet—and what a lot of truck for the money! It can save you dollars in all sorts of ways. On first cost, on operating costs, and by its ruggedness that means longer life with less upkeep. Meet the newest and best of the lowest cost vans!**

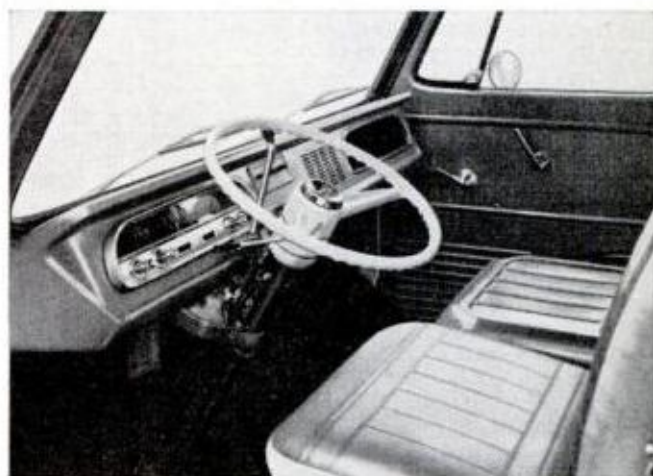
The first cost of the Chevy-Van, you'll find, is right. And the build is right to keep costs low through years of steady use. All doors, for instance, are double-walled; all critical underbody areas are specially treated to resist corrosion. There is the sturdiness of integral body-frame construction.

And the new Chevy-Van will take a lot of cargo, too. You can get almost a ton of whatever you haul into that big strong body. The floor is flat; doors are high and wide to save you work. And for saving on daily running costs, two tight-fisted engines are available—the standard 153 Four and the extra-cost 194 Six.

As we said, a *lot* of truck for the money! —all-new Chevy-Van at your dealer's now. . . . Chevrolet Division of General Motors, Detroit, Michigan.

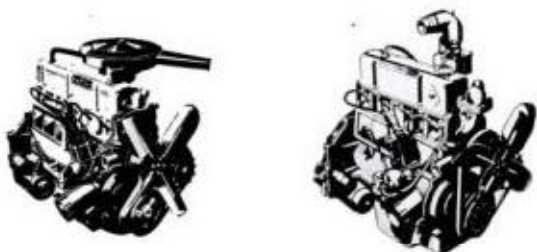


**Underneath.** Tough integral body-frame design. Rocker panels and wheel housings galvanized against corrosion. Underbody coated with special primers—box-section members sprayed with aluminum preservative—to last longer.



**In the driver compartment.** Big wide one-piece windshield. Foam-cushioned driver seat (flip-swing passenger seat, optional at extra cost). Armrest, dome lamp, electric windshield wipers, heavy rubber floor mat, insulated engine cover.

**In the engine compartment.** The most powerful engines in this truck class! Standard is the High Torque 153 Four with 4-cylinder economy and more power than some sixes. The High Torque 194 Six, with 120 hp, is optional at extra cost.



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**By Harry Lorayne**

Let me explain! I don't care how poorly organized your mental powers are today — how difficult it is for you to concentrate . . . how bad your memory may be . . . how much a prisoner you are of crippling mental habits . . . how long it takes you each morning to get your mind going with adding-machine speed and certainty!

**I BELIEVE THAT YOUR MIND IS WORKING TODAY AT ONLY 5% TO 10% OF ITS TRUE POWER — SIMPLY BECAUSE YOU DON'T KNOW THE RIGHT WAY TO FEED IT DIRECTIONS!**

Simply because you don't know the right way to feed your mind problems — so clearly and logically that those problems half-solve themselves before you even touch them!

Simply because you don't know the right way to feed your mind facts, figures and names and faces — so they burn themselves into that mind in such picture-form that you remember them forever!

Simply because you don't know the right way to feed your mind a FULL CHARGE OF ENTHUSIASM — so that it revs up instantly every morning . . . so that it operates at full power, not for just a few brief minutes each day. **BUT FOR AS MUCH AS 8 TO 10 FULL HOURS AT A STRETCH!**

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Yes! Problem-solving is a trick! Concentration is a trick! Memory is a trick! Habit-breaking is a trick! And, above all, generating the will power that means success IS A TRICK! Mind power can be made to order — you don't have to be born with it! The secret of a fast-acting, full-power, THINKING MACHINE MIND is as simple as tying your shoelace! And I'm willing to prove it to you without your risking a penny! Here's how!

## **The Very First Hour After You Pick Up This Book, You Will Perform A Feat Of Mind Power That Will Astound Your Friends!**

All I ask from you is this. Let me send you — at my risk — one of the most fascinating books you have ever read. When this book arrives, set aside a few moments each day from the following weekend. Glance through just one chapter. And get ready for one of the most thrilling weekends of accomplishment in your entire life!

What you are going to do in that very first hour you receive the book, is this. Turn to page 144. Read three short pages — no more! And then, put down the book. Review in your own mind the one simple secret I've shown you — how to feed facts into your mind so that they stay there — permanently — as long as you wish!

Then put this simple trick to work for you — that very same hour!

Call in your family or friends. Ask them to make a list of any TWELVE facts, names or objects they wish, as fast as they wish. Have them write down the list so they won't forget it! But, as they give you each fact, YOU are going to perform a simple mental trick on that fact, that will burn it into your mind, IN PERFECT ORDER, as long as you wish!

And then — INSTANTLY AND AUTOMATICALLY — you are going to repeat that list, backwards and forwards, in perfect order, exactly as if you were reading that list in your friend's hand! And you are going to have one of the most exciting moments of your life, as you watch the expression on those people's faces as you reel off those facts as though they were flashing on a screen on the inside of your memory!

Thrilling? Yes! But also one of the most profitable secrets you will ever learn. For that list of twelve facts can just as easily be an appointment schedule — with each appointment flashing automatically into your mind at just the right time and place that you need it! Or a shopping list — or the outline of a speech — or a sales presentation — or the highlights of an important article — or a list of things that have to be done in perfect order!

Any one of them — they flash into your mind automatically, as though you pressed a button! And this astonishing mental gift — which will serve you every day for the rest of your life — is yours from the very first hour that you pick up this book!

And yet it's only the beginning!

## **Which Areas Of Your Mind Do You Want To Strengthen In A Single Weekend? Concentration, Will-Power, Self-Confidence, Habit-Breaking!**

Yes! From this moment on, in less than one thrilling hour a day, you begin testing the wonder-working techniques of Automatic Organization on every untrained corner of your mind! You begin breaking through mental barriers — mental limitations that have been blocking you for years!

You begin tapping the buried pow-

ers of your own mind . . . powers that you have glimpsed before in brief flashes . . . now brought to the surface — organized with simple formulas to double their potency — and placed forever at your beck and call, ready to go to work for you at the blink of an eyelash!

For example —

**DO YOU WANT TO DEVELOP "STEEL-SHUTTER CONCENTRATION" — OVERNIGHT?**

Then turn to page 85 . . . master one simple exercise . . . and thrill to your ability to absorb huge amounts of information — easily and swiftly — even in a room filled with half a dozen howling children!

**DO YOU WANT TO DEVELOP "X-RAY EYES" — POWERS OF OBSERVATION THAT AMAZE YOUR FRIENDS?**

Then turn to page 136 . . . play three fascinating games . . . and then startle your friends, time and time again, by your ability to spot revealing details — put together hidden pieces of evidence — that they never even dreamed were there at all!

**DO YOU WANT TO SEE HOW EASY IT IS TO REPLACE BAD HABITS WITH HABITS YOU CAN BE PROUD OF?**

Then get ready for the revelation of your life on page 103 . . . that replaces agony with fun . . . that actually lets your bad habits break themselves without your hardly touching your will power.

**YES! AND DO YOU WANT TO GENERATE ENTHUSIASM . . . FRIENDLINESS . . . PERSONALITY AT AN INSTANT COMMAND?**

Then read every word starting on page 165! Learn how to overcome shyness and fear, automatically . . . make anyone like you . . . dissolve opposition with as little as a single word . . . earn both trust and respect from everyone you meet — and keep them — for good!

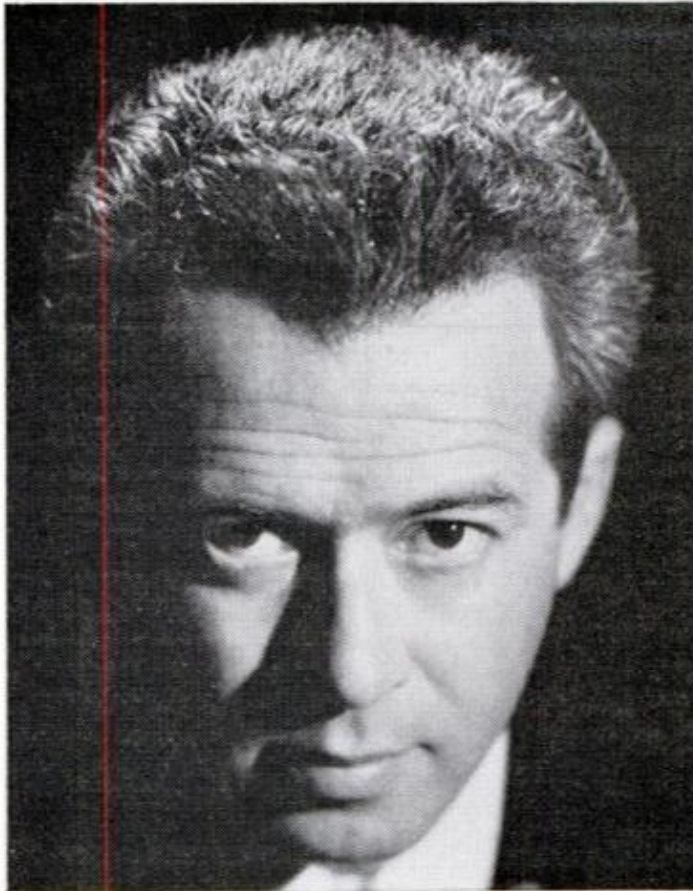
## **Read It For Ten Days— Entirely At Our Risk!**

And this still is just the beginning! What Harry Lorayne has described to you on this page is just a small sampling of the information packed into his amazing new book, SECRETS OF MIND POWER — now available only through this article!

Here at last is a practical, fascinating, easy-to-read book on improving the powers of your mind that really works! Its author, Harry Lorayne, has been called by experts "the man with the most phenomenal memory in the



# WIZARD IN ONE EVENING!



## MEET HARRY LORAYNE

"The human being with the most phenomenal memory in the world." Harry Lorayne has lectured in front of thousands of Americans! Rotarians, Elks, Masons, Chamber of Commerce groups have all called on this amazing man to prove the business and social power of a Thinking-Machine Mind! Lorayne's mind is so well organized that he can remember the names, faces, addresses and occupations of over 700 different people in a single evening—after meeting each one of them only once!

Mr. Lorayne's first book "HOW TO DEVELOP A SUPER-POWER MEMORY" has already shown over 250,000 men and women, all over America, how they can achieve startling improvements in their memory, overnight, with just a few minutes work. But this fabulous Push-Button Memory Technique is only one small part of this great new work! Now Harry Lorayne gives you secrets that powerfully strengthen EVERY AREA of your mind — Concentration, Will-Power, Problem-Solving, Idea-Creating, Rapid-Learning, Clear-Thinking, Worry-Control, and dozens more! Secrets that work overnight! Secrets that can change your entire life in a single week — OR EVERY CENT OF YOUR MONEY BACK!

Read the thrilling details on this page! Try this great work — ENTIRELY AT OUR RISK!

world!" He has already shown over 250,000 men and women, all over America, how they can achieve startling improvements in their memories overnight, with just a few minutes work!

But this fabulous Push-Button Memory Technique is only one small part of Harry Lorayne's great new book! Here — in addition to Memory — are complete "Push-Button Sections" on Observation, Concentration, Enthusiasm, Will-Power, Idea-Creating, Rapid-Learning, Time-Saving, Clear-Thinking, Personality, Friend-Making, Public-Speaking, Worry-Control, Conquest of Fear, and many more!

Yes! Here are dozens of simple techniques that enable you to overcome crippling emotions, and keep your thoughts headed straight for each goal! Showing you how to think clearly and effectively in any situation — make decisions without agonizing delays — learn vital facts and figures at a glance — work at full mental power, all day long, for weeks and even months on end!

Here are tested, and proven "Thought-Stimulators" that streamline your mind — develop your creative imagination — increase your daily output — help you make time for everything you have to do!

Here are "Confidence-Generators,"

that let you laugh off worries and fears — make your own good luck — keep other people from taking advantage of you — turn bad breaks into opportunities — yes, even sharpen your sense of humor and improve your ability to speak well, whether in private conversation or before a crowd of hundreds!

### It Must Work For You— Or You Don't Pay a Penny!

The price of this fascinating, one-volume Mind-Power Encyclopedia is

\$4.98 — far less than similar books that do not do its job as well!

But even more important is its unconditional guarantee! We realize that this book is of no value to you unless it does everything we have promised you! Therefore, we allow you to read it at our risk for ten full days.

If at the end of that time you are not delighted in every way, then simply return the book for every cent of your purchase price back! There are no conditions! You are the only judge! Send in the No-Risk Coupon below — TODAY!

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119 Fifth Ave., New York, N. Y. 10003

Gentlemen: Yes, I want to try a copy of Harry Lorayne's amazing new book SECRETS OF MIND POWER, entirely at your risk. I am enclosing the low introductory price of only \$4.98 complete. I will use this book for a full ten days at your risk. If I am not completely delighted . . . if this book doesn't do everything you say, I will simply return it for every cent of my money back.

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# INVENTORS' CORNER

By Joseph H. Kraus

Mr. Kraus has been helping inventors solve their problems since 1919. Readers may send queries on ideas, inventions and patents to him, care of *Popular Mechanics*. Questions of general interest will be answered in this column. Please include all information necessary to understand the proposed idea or invention, plus your return address.

**Sound box** for transistor radios: Robert E. Doerfest of Dayton, Ohio, wants to know if it has possibilities and is worthy of a patent application.

Even though your invention improves the sound of your transistor radio, it destroys the only virtue these small sets have: compactness. The set would also sound better if the hand is cupped over the speaker, or if the set is held in front of a wooden salad bowl. Also, there is no scientific reason why your box would be superior to any other box. Suggest you get a better transistor and forget the box.

**Brake failure signal:** Theodore C. Kowalski of Dallas, Tex., sent his idea to several companies which claim to help inventors. All asked for money and he wants to know what he should do.

Any organization expected to perform a service must charge for it. Staff must be paid, overhead must be covered. Your signal idea is neither new nor good. It requires the use of your own make of brake bands and involves electrical contacts which are even more likely to fail. Redesign your signal to fit the brake bands of established manufacturers, produce a non-failing signal—and you still will have to sell the idea to the auto manufacturers. Success might be possible only through an attachment. This could be developed if you really work on it.

**Inventory control system** for industry, submitted by A.M.R. of Phoenix, Ariz. A patent search reveals prior art but nothing combining components of his system. Another similar combination is available under a "Patent Pending" assignment. How can he discover if his system is infringing? Is there a law about marking a product "Patent Pending?"

Except in rare instances, more than five years is a long time for a patent to be

pending. A search should uncover the patent in question. If you know the name of the inventor or corporation, you might be able to locate the patent, which must actually be pending before it can be so marked. If you infringe, you can be sued for all profits, plus damages and costs. Get yourself a patent attorney; he may feel a patent is potentially possible.

**Rear window wiper:** Dr. Jacques A. Jodoin of Lynn, Mass., asks if such a wiper could be mounted in a suction cup.

They once were, as accessory equipment. I had them on a Pontiac and an Oldsmobile. A suction cup will hold for a while, but pranksters can remove them easily. Incidentally, a splash guard suspended from the rear bumper will eliminate much of your trouble.

**Pencil sharpener** patented by O. E. Hammond of Oregon, Ill., sharpens a pencil to a needle point without breaking the lead. Is there a demand for such a device?

It depends on the cost, life expectancy and operation of your invention. There are 24 pencil sharpener manufacturers in the U.S., plus foreign imports. Many sharpeners do what you claim yours will do. Either yours must perform as well at a lower cost, operate faster, or it must do a better job at the same price.

**Typewriter signal** invented by Jacques MacCaughan of Richmond, Quebec, indicates when typist is near end of paper. Is there a demand for this device?

Not too much and then only if it can be easily attached to any typewriter. About 20 have been patented. You don't need a technician. Any good modelmaker or even watchmakers probably could produce a pilot model.

**Brick veneer** patented by Joseph Piccarillo of Brooklyn, N.Y., can be interlocked to concrete blocks. Patent rights are available on cash or royalty basis.

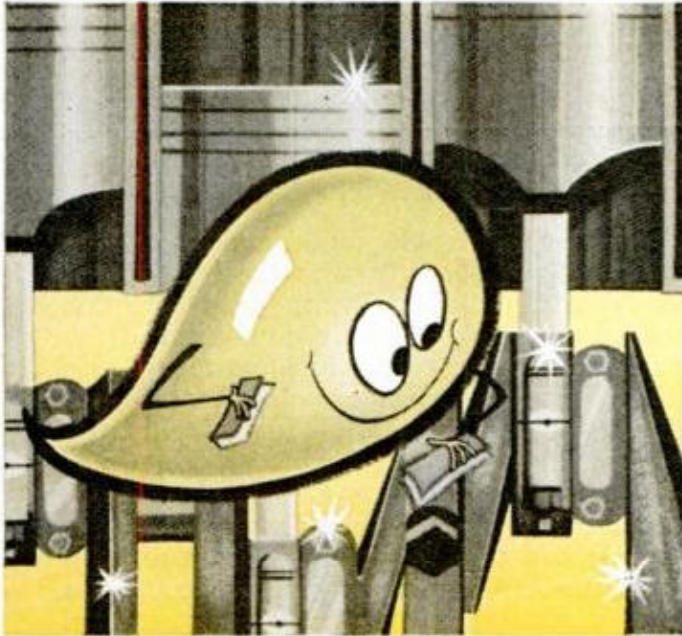
This is not a substitute for the brick veneer facings which are attached to metal ties. These latter may be applied to any structure, even a wooden frame or stucco house. Your invention requires specially molded concrete blocks, specially fashioned bricks for interlocking, and expert laying of the concrete blocks. Doubtless your structure would be firm and strong, also more expensive and troublesome.

**Sabre saw attachment** developed for special jobs by D. L. Langdon of Houston, Tex. What should he do? Is it worth a hoot?

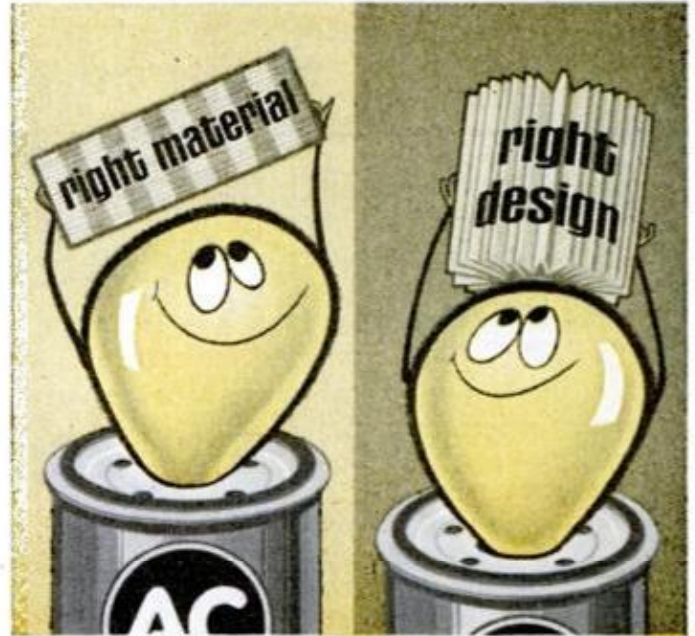
(Please turn to page 34)



# AC filters add extra miles to your engine



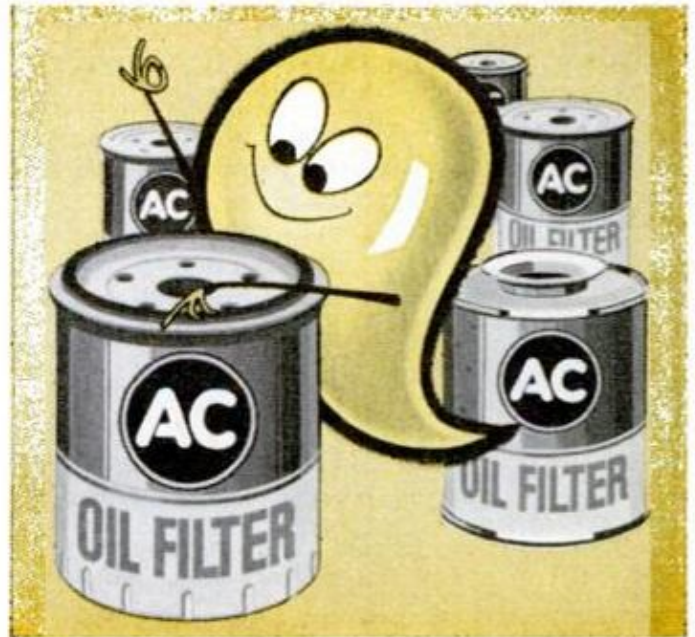
In order to keep your engine clean, the protective engine oil must be kept clean. That's why you need an AC Oil Filter.



AC Oil Filters remove dirt particles too small to see. They do this while retaining the helpful additives in the oil.



AC Oil Filters are better because they combine the right material with the right design to give thorough filtering action.



There's an AC Oil Filter designed to keep your oil cleaner, give you extra miles of trouble-free driving. Ask for an AC Oil Filter with your next oil change.



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**INVENTORS' CORNER**

(Continued from page 32)

I recommend a patent search, then an application for a patent if the report is favorable and you can manufacture the item. Manufacture is simple and inexpensive. Your product might make the sabre saw more than twice as useful. And if the product were made available in many shapes and sizes, usefulness multiplies a hundredfold.

**NEW PATENTS**

**Radioactive waste** could be sealed inside artificial rocks by a method described in patent 3,110,557. Silicon added to the waste would react with metal oxides to trap the waste material inside an insoluble silicate rock. Inventor was Marshall L. Spector of the M. W. Kellogg Company, Jersey City, N.J.

**Pampered pets** can now have their own drying bag to get wrung out in after a bath. Made of an absorbent material, the bag is similar to women's hair dryers. Patent 3,108,568 went to Robert E. and Jean L. Whitney of Minneapolis.

**Police cars** could sneak up on speeders if they were equipped with a retractable dome light described in patent 3,107,865. The light, invented by John V. Hostetter of Beltsville, Md., is set into the car's roof.

**Water evaporation** in dry lands may be retarded by a new chemical film that is only one molecule thick. Made of a polyhydroxymethylated compound, it can be applied to water surfaces either as a powder or in a solvent. Patent 3,112,167 went to Allen F. Millikan of Crystal Lake, Ill., and Walter E. Kramer of Niles, Ill.

**Shivering hunters** waiting on a deer stand can now warm themselves with a human body heater which burns propane gas in a disposable tank. Carried in a coat pocket near the heart, it sends heat throughout the body via blood circulation. The heater earned patent 3,110,301 for Lester J. Bricker of Waynesboro, Pa.

**Poor soil** could be improved by injecting it with synthetic or plastic foam containing soil nutrients. It forms a rigid underground structure which retains water and fertilizer and permits a humus layer to ferment on the surface. Patent 3,110,129 went to Heinz Baumann of Frankenthal, West Germany.



# \$1050 GROSS IN SINGLE MONTH IN MY OWN BUSINESS

F. E. DORAN reports

Some make more, some less...

**START YOUR OWN BUSINESS NOW!** • Here's YOUR chance to start a money-making, year 'round business of your own and make the success you've dreamed about.

G. R. Adcock took in \$102 in one day. O. W. Hare landed a \$750 hotel job. J. S. Corbit grossed \$279.50 his first month. Homes, hotels, offices, clubs, offer you big profit possibilities. Auto upholstery also.

**NO SHOP NECESSARY** • You clean upholstered furniture with efficient PORTABLE ELECTRIC DETERGER on customer's premises. No hauling, no high rents; you operate from your home. Supplies cost little; what you take in is mostly profit.

**Ours is NOT a Lease Arrangement** • You are free to operate in an independent manner. You sign no contract. You own the detergent outright and are always your own boss...and every dollar you take in is yours to keep...you pay no fees, or dues, or royalties to anyone. And you take no risk. Your detergent is fully guaranteed and enough supplies come with it to return far more than your investment. Many earn the cost of the detergent in a week or two.

**It costs nothing to get the details...write TODAY!**



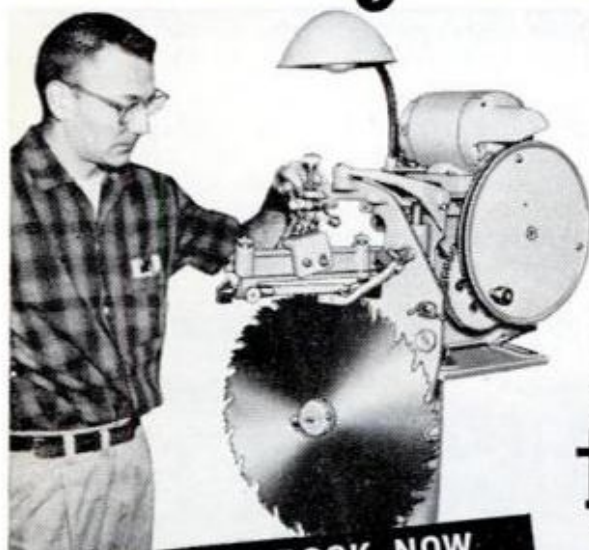
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Without obligation rush your FREE booklet about how I can start my own permanent, profitable electric Upholstery Cleaning business.

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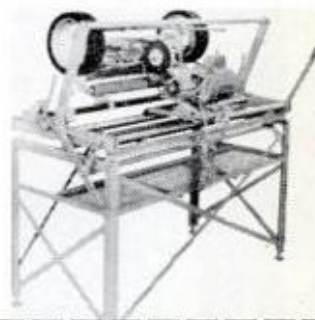
## For Sparetime or Full Time Income, There's Good Money In Sharpening



Here's a proven practical way to earn extra dollars in spare time - to develop a money-making repair business of your own. Investment is small. There's no overhead, no stock of goods to carry. No experience needed, no canvassing. You do it with the famous Foley Saw Filer that automatically sharpens all kinds of saws - and the Modern Lawn Mower Sharpener that precision sharpens all types of mowers.

### EARN \$3 to \$6 An Hour Sparetime

Hundreds of people like yourself are making cash like this - \$20 to \$30 a week - right now in spare time. "My spare time saw filing business has made me \$952 these first ten months" - says R. T. Chapman. Many have built a complete sharpening service with such year-around profits. You can too, simply by following the sure, easy Foley Plan.



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This valuable book shows you how to start, how to get business from home owners, factories, carpenters, etc., and how to make profits fast. Mail coupon today. No salesman will call.

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#200 Saw Filer information.  Modern Lawn Mower Sharpener information.  Money Making Facts booklet.

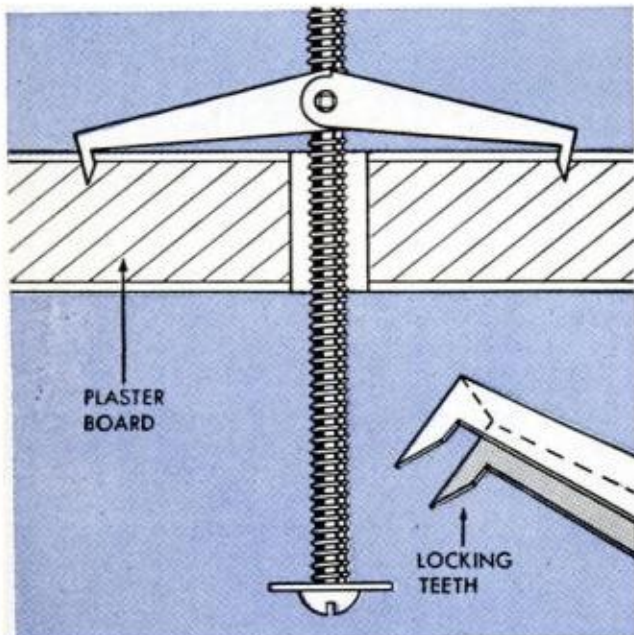
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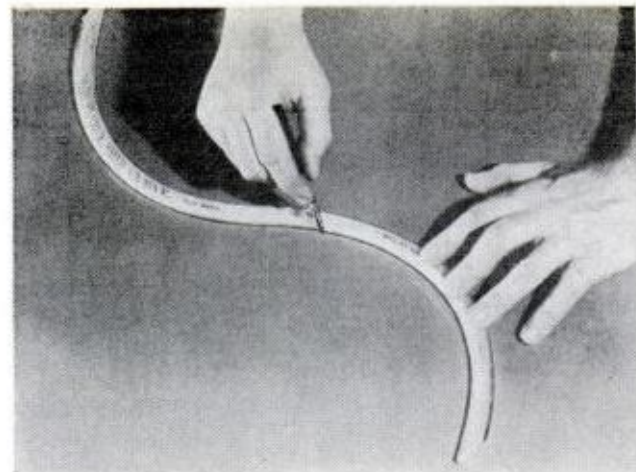


# New on the Market

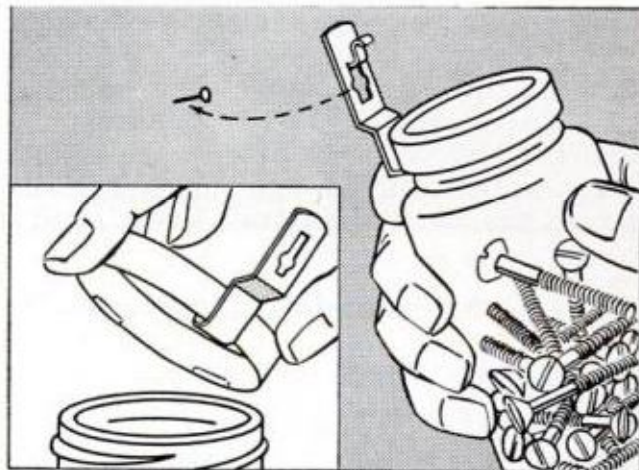


**WHEN YOU UNSCREW** one of these new toggle bolts, the wings remain at the hole, permitting you to reinsert the bolt later on. This is accomplished by a pair of teeth on each wing that dig into the back of the wall. Priced same as standard toggle bolts. Jordan Ind., Inc., N.W. 75 St., Miami 47, Fla.

**AUTOMATIC DOOR CLOSER** was designed specifically for sliding screen doors. Manufacturer says it is hardly noticeable when installed, and permits door to open smoothly. Made of anodized aluminum, and priced at \$12.95, postpaid, from McGraw Manufacturing & Dist. Co., 1489 So. Broadway, Denver, Colo.

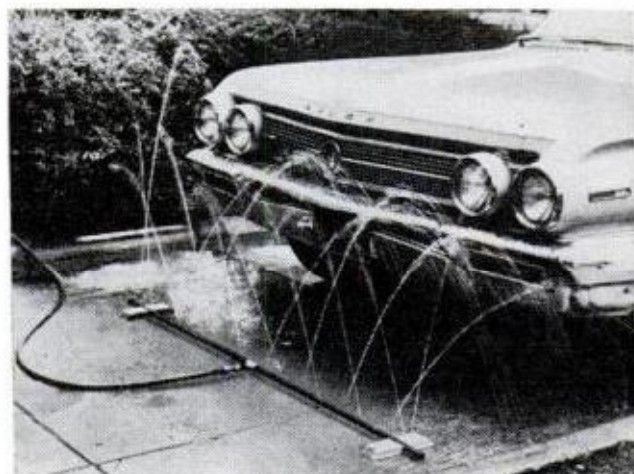


**ADJUSTABLE SHIP CURVE** holds whatever curve you shape it to, giving more versatility than rigid drafting devices. Made of clear plastic strips, with edges for inking or pencil drawing. In 18-in. (\$2.25) and 24-in. (\$2.85) lengths. From Hoyle Engineering Company, 25408 West Highway 66, Barstow Calif.



**WITH THE GLEN CLIP** you can fasten almost any jar or can to your workshop wall, to hold small parts, paints, etc. Jar lids can be left on, or removed. Aerosol cans are stored upside-down. Will even hold a gallon paint can. Cost 98¢ for 12. Cassell Craft Co., 67 Vine Hill Road, West Hartford, Conn.

**IF THEY SALT THE ROADS** in your area, the Nifti-Wash will come in handy. Set it up in your driveway, and you can wash the bottom of your car by merely driving over it. Connects to an ordinary garden hose, and is adjustable for car width. Retail price is \$4.95, from Nifti-Wash, 16 Iradell Road, Ithaca, N.Y.





More proof that Ford-built means better built!

# NASCAR AWARD FOR ENGINEERING EXCELLENCE GIVEN TO FORD MOTOR COMPANY FOR "THE SKILL AND IMAGINATION TO BUILD THE BEST"

"The skill and imagination to build the best"—these were the key words spoken by Mr. William France as he presented the annual NASCAR Award for Engineering Excellence to Ford Motor Company. Mr. France, president of the National Association for Stock Car Auto Racing, continued, "Ford reflects these qualities in the highest degree. It has taken the lead in presenting America's 'Engineering Image' to the world."

**Skill** is a vital part of Ford Motor Company's continuing engineering program to give you cars with maximum performance, reliability, durability, comfort and safety. The achievement of these objectives is reflected in the most successful record in open competition known in modern times!

**Imagination** combined with technical competence is the key to building America's most reliable automobiles. This sustained and successful effort in every area—engineering, manufacturing and testing—makes every Ford-built car a better value.

Among other things, it means the spirit and stamina of thrifty Sixes and America's most precisely cast V-8 engines. It means the ruggedness and convenience of America's only three-speed, all synchro-mesh transmission. It means bodies and frames so solidly constructed that your car rides smoothly and quietly on the roughest roads. It means advanced styling—gleaming five-coat body finishes and smart, long-lived interiors. It means the extra protection, pioneered by Ford Motor Company, against rust and corrosion so that our cars will last longer and hold their value better.

Take a revelation ride. See for yourself that Ford-built means better built.

## A PARTIAL LIST OF OTHER PERFORMANCE ACHIEVEMENTS\*

Daytona International "500" ..... Ford Galaxies sweep 1st through 5th place!  
Indianapolis "500" ..... Ford-powered Lotus car places 2nd . . . only 34 seconds out of 1st!

Pikes Peak Championship Trophy  
presented by the U.S. Auto Club ..... Mercury Marauder streaks to new record!

Pure Oil Durability Award for  
100,000-mile Comet Durability Run ..... Comet Calientes break more than 100 records!

U.S. Auto Club Index  
of Performance Award ..... Ford Galaxie wins highest number of points in USAC races!

Golden State "400", Riverside, Calif. .... Won by Mercury Marauder!

Firecracker "400", Daytona Beach, Fla. .... Ford Galaxies win 1-2-3!

Trans-Canada Rally ..... Falcons win Manufacturers Team Award!

\*Won in open competition by modified cars.



FALCON • FAIRLANE • FORD • THUNDERBIRD  
COMET • MERCURY • LINCOLN CONTINENTAL





## Shopping for Tools

**A TIME-SAVING FEATURE** of this new propane torch is its double nozzle. To switch from pencil flame to utility nozzle, all you do is turn two valves. An additional advantage claimed for the Dual-Flame Torch is the ability to supply extra heat when needed, by using both nozzles simultaneously. The torch, which sells for \$7.95 retail, is made by the BernzOmatic Corporation, 740 Driving Park Ave., Rochester 13, N.Y.

**A SHOT OF FREON GAS** from the Jet Plumber unclogs stopped drains, pipes, toilets, etc., according to the manufacturer. You load the tool with an aerosol cartridge, insert its nozzle in the drain and operate the plunger. Retail for \$29.95, from Universal Jet, 3333 Rosecrans Street, San Diego, Calif.

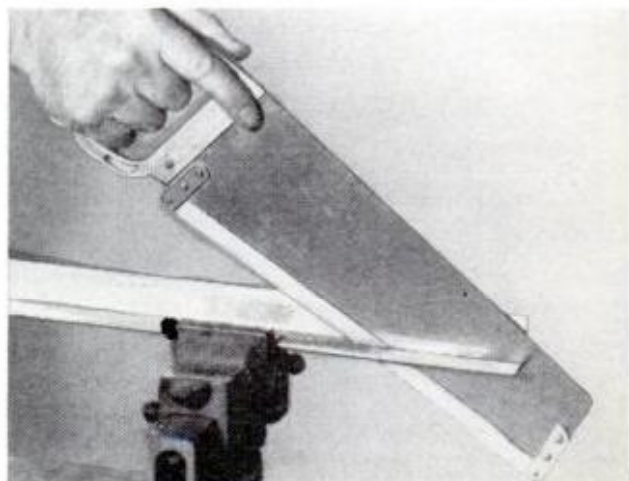
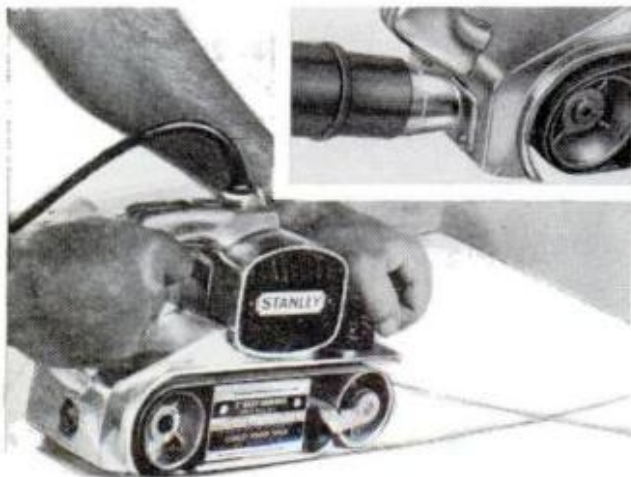
**R-E-H SPRAY GUN** applies paint by the electrostatic process. Since this process wraps the spray around the work with static electricity, the manufacturer claims the gun has saved 30 to 70 percent in paint over conventional air spray. Ransburg Electro-Coating, 3939 W. 56 St., Indianapolis, Ind.

**A CONTROL DIAL** on the handle of this ½-in. electric drill gives you any desired speed from 150 to 500 r.p.m. The low speeds adapt the tool to drilling masonry, while high speeds are good for drilling wood, aluminum, etc. Lists for \$99.95. From Thor Power Tool Co., 175 North State Street, Aurora, Ill.



**CONNECT A VACUUM CLEANER**—either domestic or commercial—to this belt sander, and you catch the dust before it flies into the room. Another feature reported by the manufacturer is the ability to sand flush to any vertical surface without re-positioning the belt. Two models available—the H493 (3x21 in.) and the H494 (4x24 in.). Cost \$69.95 and \$99.50. From The Stanley Works, 195 Lake St., New Britain, Conn.

**NEW HACKSAW DESIGN**, Eclipse No. 55, eliminates the frame used on conventional hacksaws. This feature makes it possible to cut sheet materials, large diameter pipes and other objects that require a deep cut. Also, PM editors found that the flat back of the saw tends to aid in guiding the blade on a straight cut. Available from the Janus Company, 277 Clay Avenue, Roselle Park, N.J. Retail price is \$3.80 each.







**Has shop in basement — gets  
"more and more work all along"**

"I HAD PRACTICALLY NO knowledge of any kind of repair work. One day I saw the ad of NRI in a magazine and thought it would be a good way to make money in my spare time. Now I am busy almost all my spare time and my day off—and have more and more repair work coming in all along. I have my shop in the basement of my home."

—JOHN D. PETTIS,  
172 N. Fulton, Bradley, Illinois

# IF YOU'VE BEEN WANTING TO START "A LITTLE BUSINESS OF YOUR OWN" IN YOUR BASEMENT OR GARAGE

## CHECK the advantages of NRI training in Servicing Electrical Appliances

- STEADY DEMAND** for your services. Over 400 million appliances in U.S. — 6 million sold last year alone — mean shortage of trained appliance service men.
- NO ELABORATE EQUIPMENT NEEDED** — just simple hand tools, and Appliance Tester which we provide at no extra charge.
- START SMALL — GROW BIG.** You can start out in your own basement or garage, in spare time. Gradually expand until you open your own shop.
- NO NEED TO RISK YOUR SAVINGS.** Many businesses require a sizable investment. But here you can build up a following of customers *first*, then open a full-time shop if you wish to.
- EARN \$3 TO \$5 PER HOUR.** Fixing appliances is a high-paying skill because the demand for trained men is so great.
- ENJOY SEMI-RETIREMENT ON A GOOD INCOME.** When you're ready to retire, you can devote a few hours a day to this work. Live and work anywhere you please.
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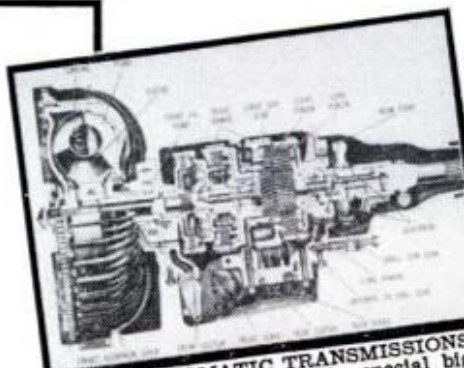


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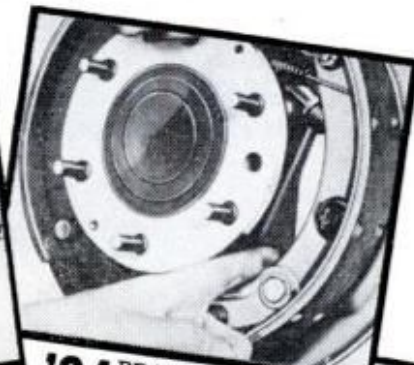
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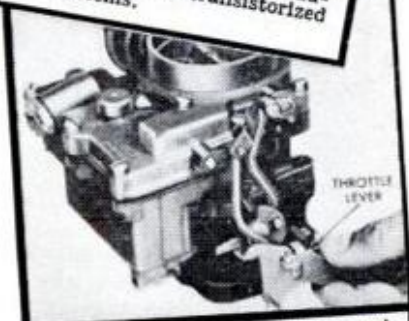


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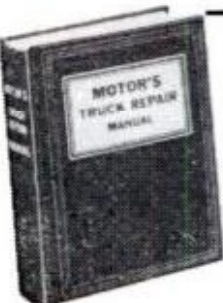
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# Valiant's New V8

*Now, a brand new, weight-saving new V8 that adds vigor to Valiant (and Dart's) versatility*

By Jim Whipple

**A**LL IN ALL, it was a fair-sized stampede. The year was 1962 and word was getting back to Detroit that substantial segments of the buying public were in the mood for more power under the hoods of the compacts. To most divisional managers, this meant V8 engines.

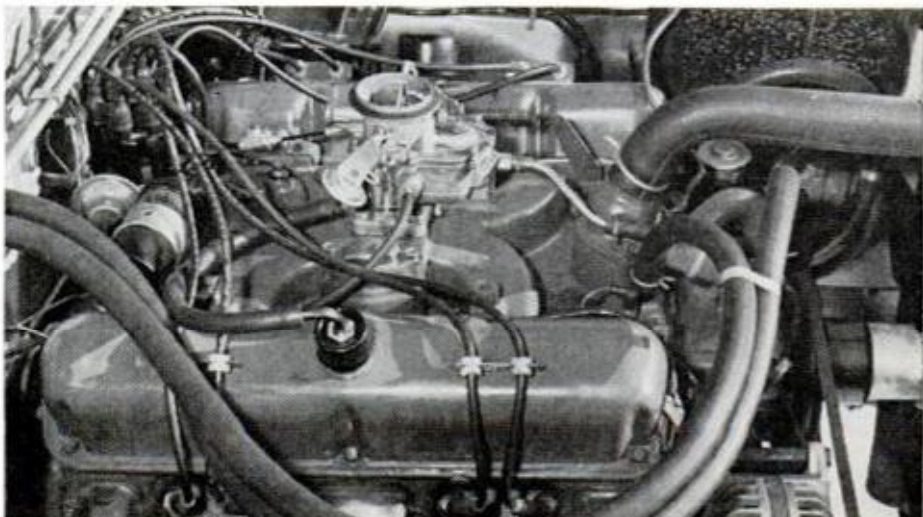
Rambler and Chevy II grabbed off V8s from their big brother cars and stuffed them into the shorter, lighter wheel-based compacts. Ford was luckier. A lightweight V8 they had just tooled up for Fairlanes and Meteors was small enough to fit nicely between the fenders of Falcons and Comets and light enough not to introduce handling problems in the lighter cars.

But, Chrysler Corporation didn't stampede, perhaps because their Valiants and Darts optioned a larger, 145 h.p. six-cylinder engine—the most powerful Six offered for any compacts. The fairly warm performance and cool fuel savings of this Six seemed to satisfy a lot of customers at the time.

Chrysler officials also felt that they had no V8 for either Valiant or Dart. The smallest V8 in the corporation's stable was Plymouth's 318-cubic-incher which was heavy for a

[\(Please turn to page 44\)](#)

**VALIANT'S ENGINE** compartment holds the new 273-cubic-inch V8. Left bank exhaust manifold is swept up to clear steering box. However, all spark plugs and like parts are easy to reach





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## Spotlight on Valiant's New V8

(Continued from page 42)

compact and would have needed considerable modification to fit in Valiant or Dart.

So, Chrysler started designing a new V8 tailored to the needs of their current compacts, Dart and Valiant.

The new engine, which became available as an option in January, has 273 cubic inches displacement, with a bore of 3.62 inches and stroke of 3.31. Horsepower is rated at 180 at 4200 r.p.m. while torque is 260 ft. lbs. at 1600 r.p.m. It has a compression ratio of 8.8 to 1 and operates on regular fuel.

To find out what this new V8 would do for (or to) Valiant, *PM* borrowed one of the very first production cars, a Signet two-door hardtop with Chrysler Corporation's new four-speed floor stick synchromesh transmission, power steering and power brakes.

In traffic the car is docile, quiet and smooth as syrup, but when you snick it into third gear you can follow the big power wagons—the Impalas, Galaxies and Bonnevilles—right through the holes in the traffic pattern like a ball carrier following his blockers. Some of these boys were a bit surprised to find a Valiant sticking with them on a fast passing maneuver.

On the open road the car is again smooth and reasonably quiet. You can choose your cruising speed to suit conditions. The car floats effortlessly at 50 m.p.h., yet, with only a small increase in noise (most of it from the wind), you can set cruising speed at 80.

At 90, the car signals its basic lightness—just 2895 pounds—by beginning to float.

Firmer shock absorbers might tie it down.

At 100 m.p.h. we ran off the dial of the electric speedometer with the engine still eager, like the county fair strong man, to tear more phone books in half.

Here are some specific performance times with the new V8. Acceleration corrected for both speedometer error and distance was 10.2 seconds to a true 60 m.p.h. (63 on the car's speedometer) using First and Second gears only. Best time from 40-60 m.p.h. (in fourth gear) was 8.2 seconds, while 50-70, also in fourth, was 9.3 seconds. We then ran the 40-60 in third gear in a sizzling 5.6 seconds.

Time for the standing quarter mile was 17.4 seconds using all the gears.

Similar times recorded for a 145 horsepower, six-cylinder Valiant *PM* tested recently (*PM*, January 1964 p. 104) were 17.05 seconds for 0-60 m.p.h., 7.8 for 40-60, and 11.7 for 50-70 with a 20.6 second quarter mile. In fairness to the Six, though, it should be noted that it had an automatic transmission while our new V8 sported a four-speed stick shift.

The extra weight of the V8 engine is only 140 pounds, and it doesn't seem to penalize handling. The change in weight distribution toward the front is a matter of 1.5 percent of total car weight. You can feel the difference in a smoother, more solid ride, but there was also a slight tendency for the front end to dip when you snapped the car into a sharp curve. Either an anti-roll bar or stiffer shock absorbers should cure this nicely.

For an extra \$106, Valiant buyers get a happy combination of big car performance and the still valid advantages of compactness and economy. ★★★

**TEST SETUP** on Valiant V8 included electric speedometer and pulse odometer. Performance is smooth and engine is quiet well up into the 90s. The new V8 has an 8.8 to 1 compression ratio, two-barrel carb, runs on regular fuel





# NOW! RUN YOUR CAR WITHOUT SPARK PLUGS

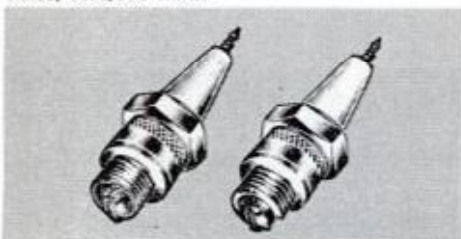
Get Up to 31 More Horsepower, 8 More Miles Per Gallon—  
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Your car runs because gasoline is fed into the cylinders where a spark causes it to fire. This action causes the gas to explode—this explosion pushes down the piston. Now here is the important 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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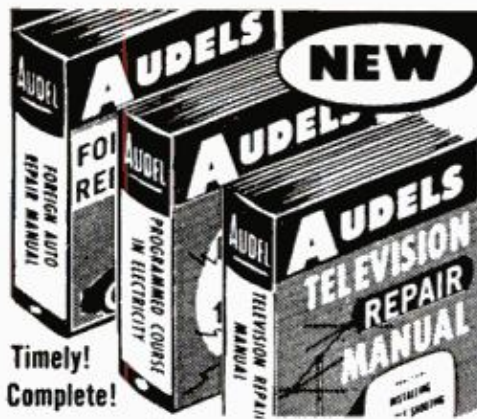
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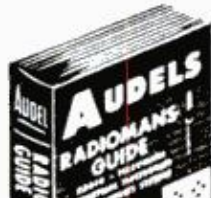
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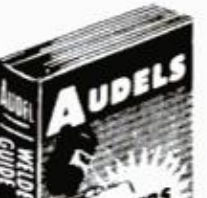
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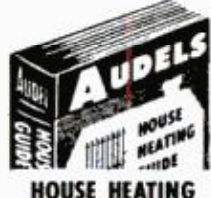
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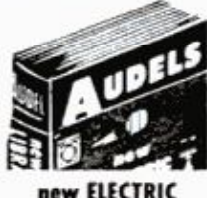
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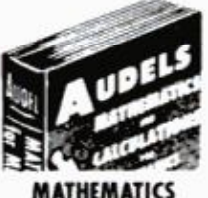
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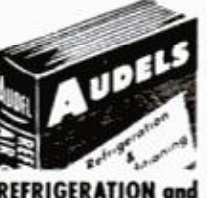
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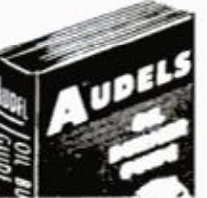
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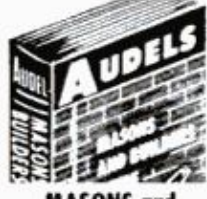
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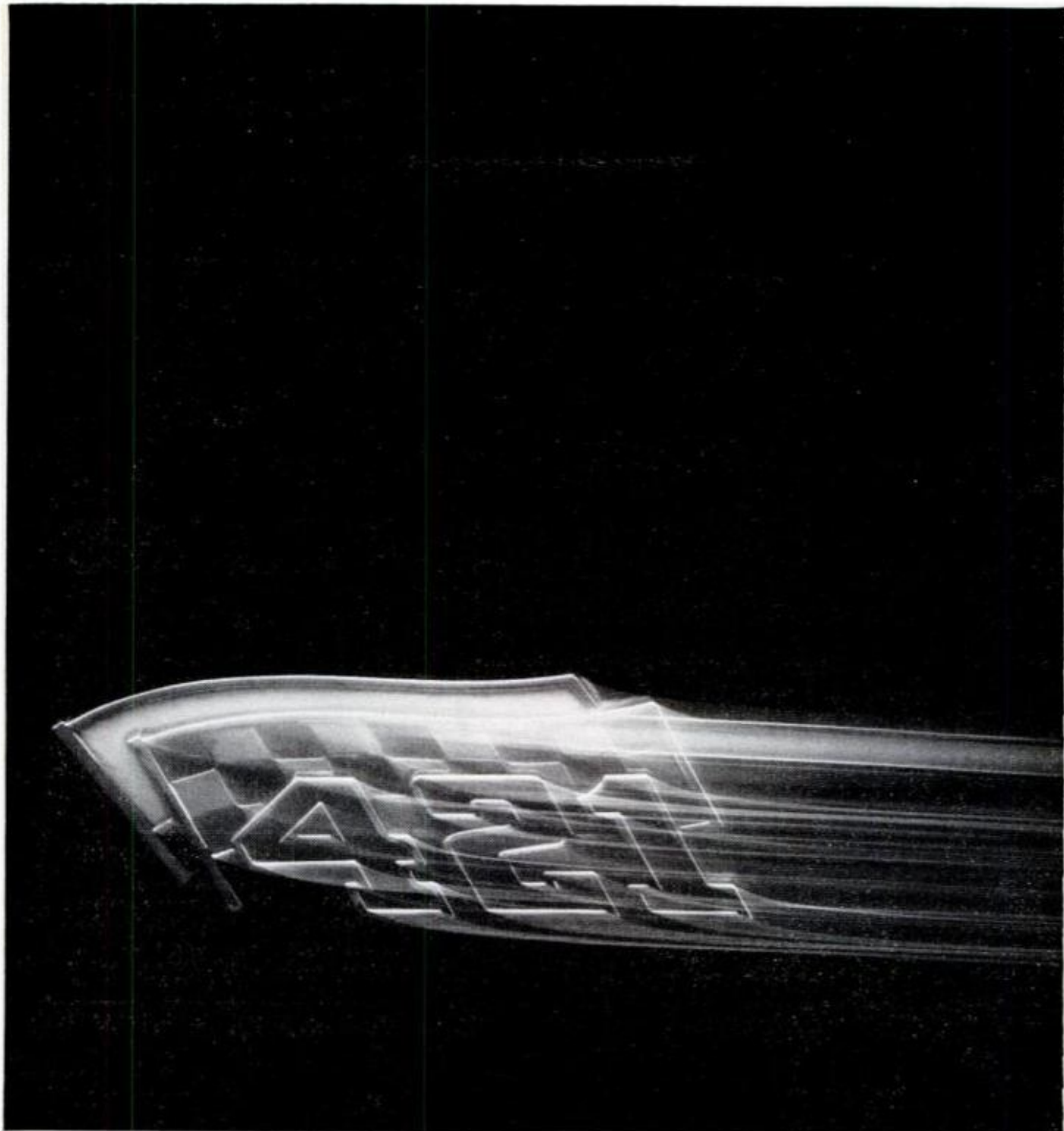
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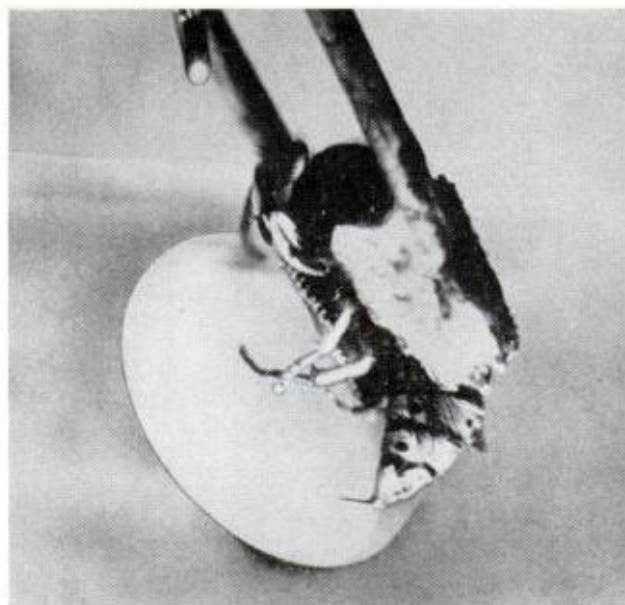
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## Milking Bees for Poison

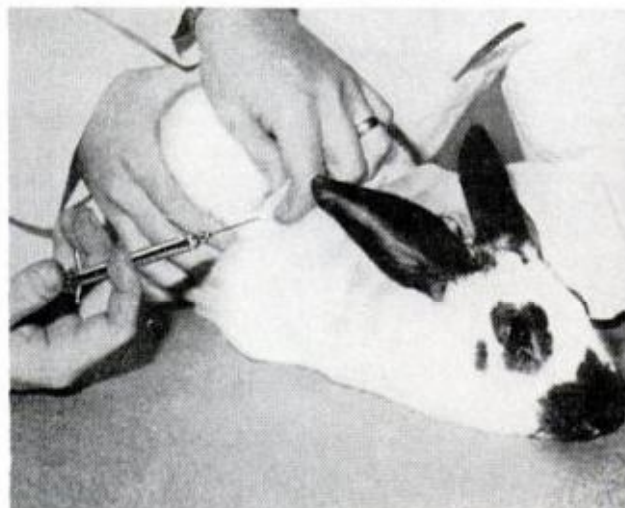


Scientists are now playing milkmaid to such stinging insects as bees, wasps and hornets. A research team at Montana State College, in need of quantities of insect venom for research into what causes humans to be allergic to bee stings, has developed a simple apparatus for "milking" insects of their poisonous brew.

Insects are anesthetized with carbon dioxide and lightly bound with a strip of aluminum foil into a half-cylinder of fine mesh brass which is wire-mounted over a microscope well-slide. As it revives, the insect is given a brief high-voltage shock which causes the stinging muscles to contract and eject venom (top photo).

Where previous methods killed the insects, this apparatus permits them to be "milked" over and over again. It has no ill effects other than making the insects hungry and thirsty. Two or three insects can be treated every minute.

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## **What innovations are in the works for your next car? How do the builders decide? An insider speaks out**

Probe and question as he will, an independent auto editor will never get the complete story of what is behind the design of a car.

He can test and inspect the product and give his readers the performance results. But what went on in the mind of the designer, the engineer, the company president and his ever-present right hand man, the cost accountant, which explains the changes made in the car this year and the changes which will be made next year.

To bring you this viewpoint, *PM* this month is letting a guest columnist—an industry insider—do the talking. He shall remain nameless in deference to his employer, but here's how the thinking behind 1964's automotive changes looks to him:

Styling rather than technical change got the heavy emphasis this year, although there are numbers of worthwhile mechanical improvements including new engines and transmissions.

One cost-conscious product planner sums up the industry's reasoning behind all this with brief clarity. "No automaker can afford to make extensive mechanical innovations that the public won't pay for—even though such a change might provide great improvement."

For example Chrysler's new four-speed manual transmission would never have left the drawing board unless management was sure that the demand would be great enough for this extra-cost item to absorb the millions involved in tooling up for it.

When people aren't willing to tack on an extra, red ink flows like water in the accounting departments. An example of such an item was air suspension, a great engineering achievement offered at about \$150 extra a few years ago.

The noticeable improvement in ride quality was negligible, however, so car buyers preferred to spend their money on more dramatic innovations like automatic transmissions, more powerful engines and air conditioning.

Another factor contributing to Detroit's cautious attitude toward technological breakthroughs is the increasing length of warranty periods on major items. General

Motors, Ford and American Motors offer 24-month, 24,000-mile warranties on key mechanical components, while Chrysler has gone to five years and 50,000 miles for their vehicles.

Automakers realize that they must pay for repair or replacement of any new mechanical features which don't "prove-out" completely. So, they hold off.

It would appear on the surface that General Motors is spending money as if it were going out of style this year. Besides four completely redesigned intermediate-sized cars (Chevelle, Tempest, Olds F-85 and Buick Special), there are a new V8 and a V6 for the B-O-P cars, plus a new six for Tempest and two new automatic transmissions for the B-O-P models, as well as for Oldsmobile, Buick and Cadillac.

But, at a closer look, what seems to be a multi-million dollar spending spree is actually a massive economy move. The all new Chevelle and B-O-P intermediate cars share many more parts than did the three B-O-P compacts of 1961-63.

Frames, bodies, suspensions, brakes and rear axles are identical for all four cars. Both V8 and V6 engine plus automatic transmissions for the Special and F-85 are almost completely identical. Tempest's automatic is much the same as F-85's and Special's, with the exception of the "switch the pitch" feature in the torque converters of the two higher-priced cars. Tempest's six-cylinder engine is made from the same tooling as the pair of sixes used in Chevrolet, Chevelle and Chevy II.

Previously, Tempest had its own transmission, its own four-cylinder engine and unique flexible shaft drive line. The first series F-85 and Special used different automatic transmissions as well as different cylinder heads, carburetors and intake manifolds on a 225-cubic-inch aluminum V8.

That aluminum V8 is another example of an attempt at technical advance that did not pay off in profit for the manufacturer. The aluminum cylinder blocks afforded a weight saving but the extra cost of the metal over cast iron, coupled with a high rate of scrapage due to casting problems,

*(Please turn to page 56)*



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## Detroit Listening Post

(Continued from page 54)

made for a more expensive engine that did nothing more for the buyer. The iron cylinder liners which were necessary in those aluminum blocks cost about 80 cents each.

The new 300 and 330 cubic-inch precision cast iron V8 engines, on the other hand, use many identical parts and accessories, so the change means a big saving.

The new V8s will really pay their way because they can be used on the full-sized Buick LeSabre and Oldsmobile Jetstar 88. So, in effect, one basic engine-transmission combination powers four different car lines.

Another example of clever cost cutting in planning products is American Motors' use of identical doors and side body frames for both the American and Rambler Classic-Ambassador series cars.

In spite of the re-emphasis on power and performance in the 1964 crop of V8 engines, including the all-out racing program at Ford and similar activity at Mercury Division, moves to larger engines in the near future are not likely.

The current 400-plus-cubic-inch V8s provide all the power that performance-minded car buyers can handle on the streets. Specially tuned versions are breaking records at the drag strips and race tracks from coast to coast. These super-tuned engines are turning out over 400 horsepower right now. To go significantly higher, Detroit would have to either move to larger, brand new engines, necessitating new casting facilities, as well as new crankshafts, connecting rods, etc.

If sizeable power boosts were to come from existing 426-cubic-inch engines it would have to be via the better breathing route, which means high performance overhead camshafts. And if a new 500 horsepower class of engines were to come into being, other areas in the drive train from clutches to rear axle gearing would be necessary to handle the power. Some margin of reliability and chassis components would have to be re-engineered to make the cars safe and controllable.

Since General Motors—currently making one out of every two cars sold—has made no move to involve any of its divisions in performance competition, chances are that an entirely new class of super engines is not in the offing.

The final proof is that wherever today's super-performance engines are offered as options to tamer "average" versions, the hot engines are purchased by not more than five percent of all buyers. (Corvette is the sole exception.) It is clear that Detroit is not going to spend hundreds of

millions for a new series of "monster" V8s, or exotic overhead camshaft powerplants, as production engines to satisfy five percent of the buyers. Anyone who thinks otherwise does not have the slightest grasp of the economic realities of today's auto market.

But if the foregoing examples of "standpatism" in development of new engines and other engineering innovations gives you the idea that Detroit's drawing boards are bare and that engineering laboratories are cobwebbed, that impression is incorrect. What can you look for, then?

The engineering chiefs of the major automakers would be the first to admit—off the record of course—that there is room for improvement in their current products. Here are a few things that Detroit's design chiefs are thinking about:

Brakes are adequate for average driving conditions, but in super-powered high performance cars which may be driven hard (as in police usage) today's drum brakes are close to their performance limit.

Body design may well be in for considerable improvement. Tunnels and transmission humps need to be whittled away. Doors can be designed to give greater ease of entry and exit. There's a great deal of room for improvement in driver vision, and the business of fitting the seat and controls more correctly to a wider range of driver sizes and shapes. The recent development of the tilting adjustment for steering wheels is a typical step in that direction.

Headroom, legroom and kneeroom are still marginal in 75 percent of all cars now sold. The challenge to make the car a more efficient passenger package, easier and safer to drive, may well be taken up.

Development of suspension systems offering greater comfort is another area getting attention from research teams.

However, no improvement in any of these major areas will see a production line until it is so well engineered that it can be put into production at no more cost than the current bodies, chassis and components.

The life cycle of any current car is tied to the life of the tools that produce it. Only when those tools wear out and *must be replaced* does it become economically sound to make a major change.

Body panels and trim parts, grilles, fenders are sometimes an exception.

What GM is doing in its standardization of bodies, chassis engines and transmission across divisional lines, can only spell accelerated design progress. The tooling will pay for itself in higher volume and be ready for greater changes just that much sooner. ★ ★ ★



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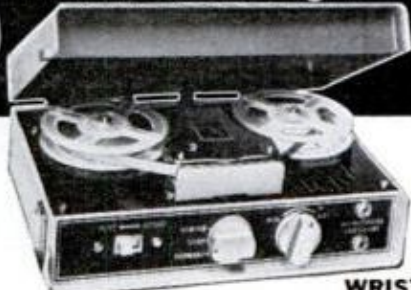
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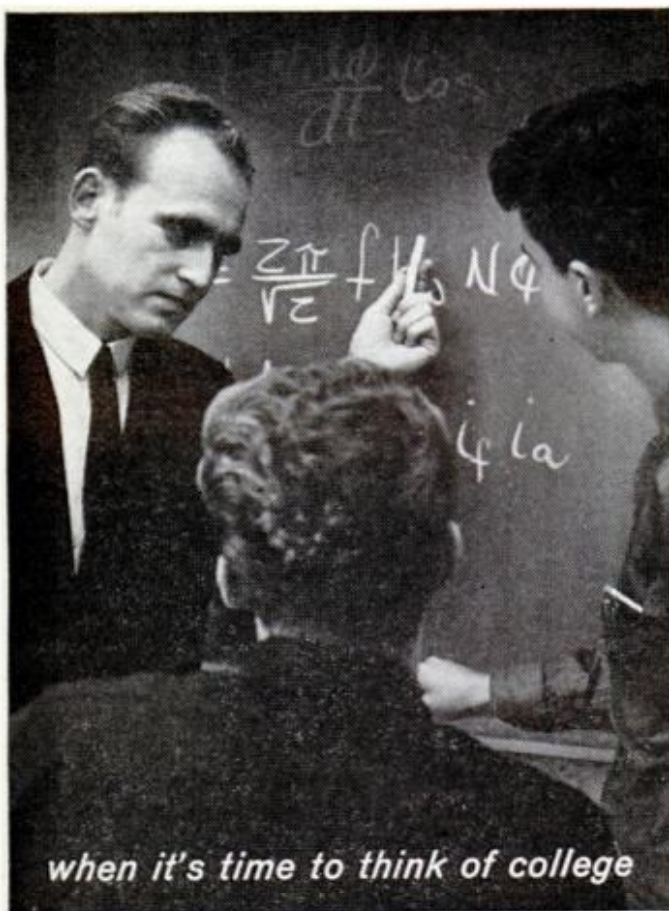
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## PM Tests New Color Films

A new color film—the fastest yet available to amateurs—makes it easy to shoot excellent slides indoors by available natural light. Called Anscochrome 200, it's one of four new Ansco slide films. The others are Nos. 50, 100 and T100.

In testing the No. 200, we took a roll of candid shots inside a restaurant, using available window light and the existing fluorescents—no flash. The speed of this film (ASA 200) permitted settings of 1/30 second at f:5.6, which were adequate for reasonable steadiness and good depth of field. Results were very pleasing—evenly lit slides with good shadow detail, fine grain and generally natural colors. Other test shots were made in a living room using only the daylight from two windows. Colors were again highly pleasing. We'd call this an outstanding film.

Examining our first test shots of the Anscochrome 50 (ASA 50), which replaces the old regular Anscochrome (ASA 32), we immediately saw this is not merely the old film with a beefed-up ASA. Grain appeared much finer—hardly noticeable, in fact—and colors were natural and bright in the shade, pleasantly muted in sunlight. Skin tones were good and shadow detail excellent. A very good film for general outdoor snapshooting.

Results with the Anscochrome 100 (ASA 100) were similar to those with the No. 50. It's a big improvement over the Super Anscochrome (also ASA 100) which it replaces, and is a good choice for shooting outdoors on a cloudy day.

The T100 also performed well. Balanced for 3200K photofloods at an ASA of 100, this film should let you take candid shots at a wedding or a party, using two bounced photofloods. Your settings would be around 1/60 at f:2 in an average room.

All four films are available in 35-mm, but only the No. 50 comes in 127, 120 and 620 sizes as well. Prices range from \$1.35 to \$5.20, depending on which size you buy, how many exposures and whether or not processing is included.—Art Maher

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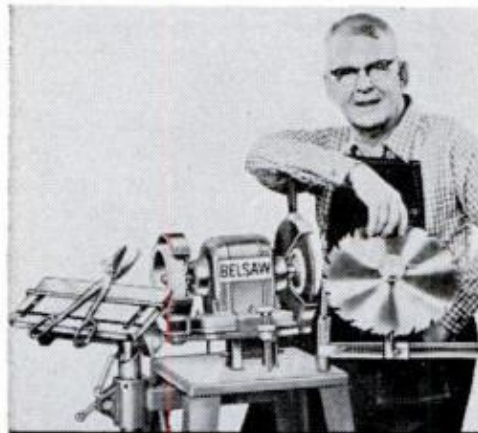


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(Continued on page 64)

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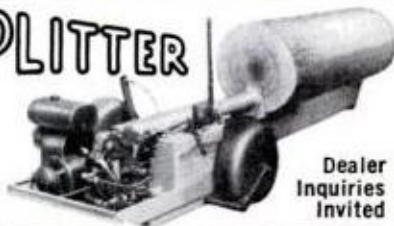
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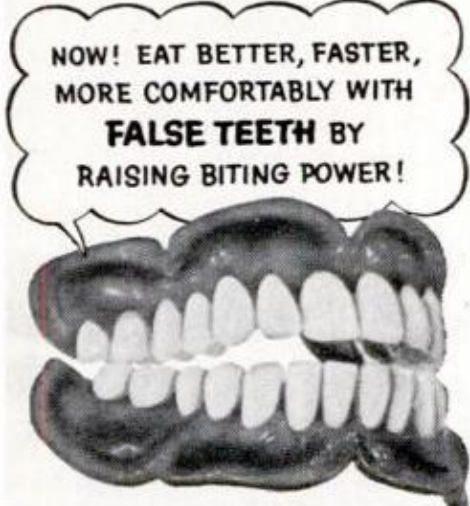
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Carpet care should go on year round, but it is no secret that certain types of rug fibers and rug cleaners make the job easier. "The Inside Story of Rug and Carpet Care" discusses which fibers take the most wear, and also examines the cleaning abilities of sweepers, vacuum cleaners and rug shampoos. The booklet is free from Bissell, Inc., Home Service Institute, Grand Rapids, Michigan.

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**Tape recording** is discussed in full in the new book, "Magnetic Recording for the Hobbyist," by Art Zuckerman. Photos and drawings augment the text on party recording, sound effects and taping broadcasts for clear sound with a minimum of fuss. This 128-page book is available for \$2.50 from publisher Howard W. Sams and Co., Indianapolis, Ind.

**New math**—does it baffle you? If your children speak of "structural patterns" or "inverse operations," a good pamphlet of explanation is "Modern Math and Your Child," available for 20 cents from the U.S. Government Printing Office, Div. of Public Documents, Washington, D. C. The objectives of modern math methods, sample problems and programs in operation are covered. Of special interest is a chapter on how parents can help their children study at home.

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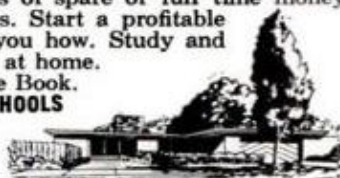
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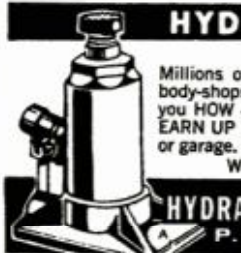
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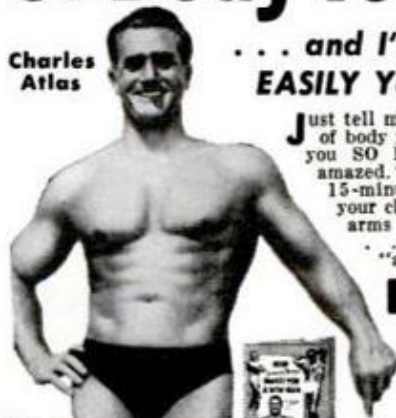
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**NEW ORLEANS.** Remails 25¢. \$3.00 monthly. Services unlimited. Williams, P.O. Box 6161, New Orleans, Louisiana 70114.

**CONFIDENTIAL Remails** 25¢. monthly \$3.00. Allen's, Box 9127, Phoenix, Ariz. 85020.

**HAWAII Secret address** \$3.00 monthly. Postcards. Coe, Box 984, Kailua, Hawaii.

**REMAILS** 25¢ single. \$3.00 monthly. Details free. Box 4327, Tampa 7, Florida.

**NEW YORK CITY.** Confidential address. Remails 25¢. \$3.00 monthly. Hayes, P.O. Box 3, N.Y. 10064 N.Y.

**ALABAMA.** Florida, preference. 25¢. \$3.00 monthly. Dixieland Forwarding, Samson 176, Alabama.

**LOS ANGELES, Hollywood.** San Fernando Valley—25¢ single; \$3.00 monthly. Confidential, 10437P Lanark, Sun Valley 3, California.

**LATENCY Address,** \$3.00 month. West, M-226 Spruce Dr., Wilmington, North Carolina 28403.

## WANTED—MISCELLANEOUS

**PENNIES.** Paying \$10.00 each! 25¢ brings information. Dressel's, Goldendale, Washington.

**QUICKSILVER.** Platinum, silver, gold. Ores analyzed. Wholesale Terminal, Norwood, Mass.

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**RUPTURED.** Relief and comfort. No understraps, elastic or steel. Write Hand-Lock Products, Preston 4, Ontario.

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**BIBLE Questions answered.** Stamped envelope. Bylon, 17167 Bentler, Detroit, Michigan 48219.

**INVESTIGATORS.** Free brochure, latest subminiature electronic listening devices. Ace Electronics, 11500-P NW 7th Ave., Miami 50, Florida.

**LOANS** By mail, \$100-\$600. Anywhere. Confidential. Write Union Finance, Dept. PM, 323 E. Camelback, Phoenix, Arizona.

**FREE!** Accurate handwriting analysis. Adults only. Roger Booth, Custer Park 1, Illinois.

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**BORROW \$100 To \$1000** by mail. Quick, easy, private. No-co-signers. Repay in 24 small monthly payments. For the amount you want write today to Dial Finance Co., 410 Kilpatrick Bldg., Dept. 2-214, Omaha 2, Nebraska.

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## FOR SALE—MISCELLANEOUS

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**HEARING Aid batteries** wholesale. Free list. Habs, Box 51, York, Penna.

**LEG IRONS, \$7.95; Handcuffs, \$7.95.** Leather restraints. Fetters. Collector's specialties. Catalog 50¢. Thomas Ferrick, Box 12M, Newburyport, Mass.

## MISCELLANEOUS

**"STAMMER—Stutter—No More."** (Dr. Young.) Write: Gaucho, Box 9309-S7, Chicago 90.

**TOBACCO** For cigarettes, pipe, chewing. Write. Fred Stoker, B164, Dresden, Tennessee.

**HOW To wipe out all debts.** Clear credit. Free details. Counselor, Box 331, Harlingen 19, Texas.

**RECEIVE Gifts, samples, magazines, catalogs, opportunities, 10¢.** Directory, Adkins, Texas 78101.

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**LOANS** By mail, \$100-\$600. Anywhere. Confidential. Write Union Finance, Dept. PM, 323 E. Camelback, Phoenix, Arizona.

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**FREE Wholesale catalog!** 100,000 products. Tremendous discounts! Taylor Distributors, Newton 2, New Jersey.

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**BOOKS** On antiques and their prices. Free circular! P. Warman Publishers, Uniontown, Penna.

**COMICS 3"x4"** sizes illustrated with comic characters. Unique. 20 assorted \$1.00. Thornton, Box 7762, Chicago 80, Illinois.

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**FREE—132-page** wholesale catalog illustrating latest styles, national brands of building materials, kitchen, bathroom, electrical equipment, doors, windows, light fixtures, fireplaces, tools, etc. at lowest prices. Write Dept. PM, Morgan-Wightman, Box 1, St. Louis, Mo. 63166.

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**ZIP-CLIPS** Instant hammer-in steel channels hold shelves, drawer dividers, partitions up to 3/4" thickness. 24—\$1.12. Zach, 1175 N. Vermont, Hollywood, Calif. 90029.

**500 NEW Gold address labels.** They are different. \$2.00. J. I. Godwin, P.O. Box 108, Rome, N.Y.

**FREE Details.** Train your dog to be obedient. Stephenson, Box 67, Shiremans-town, Pa. 17091.

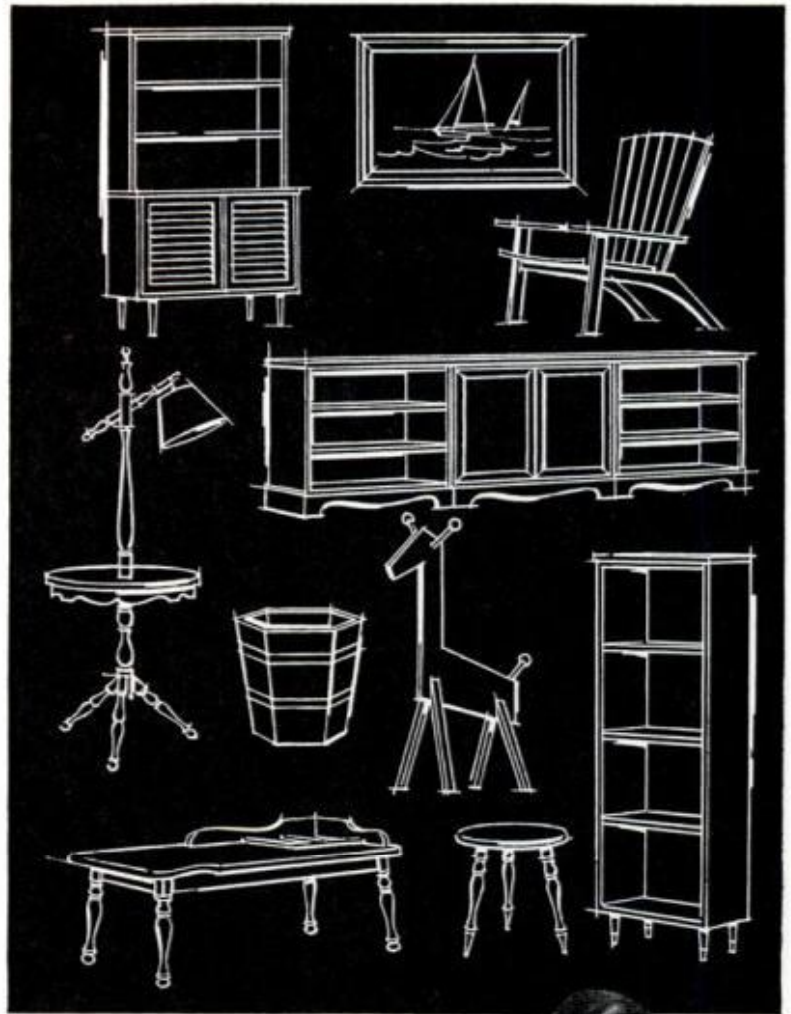
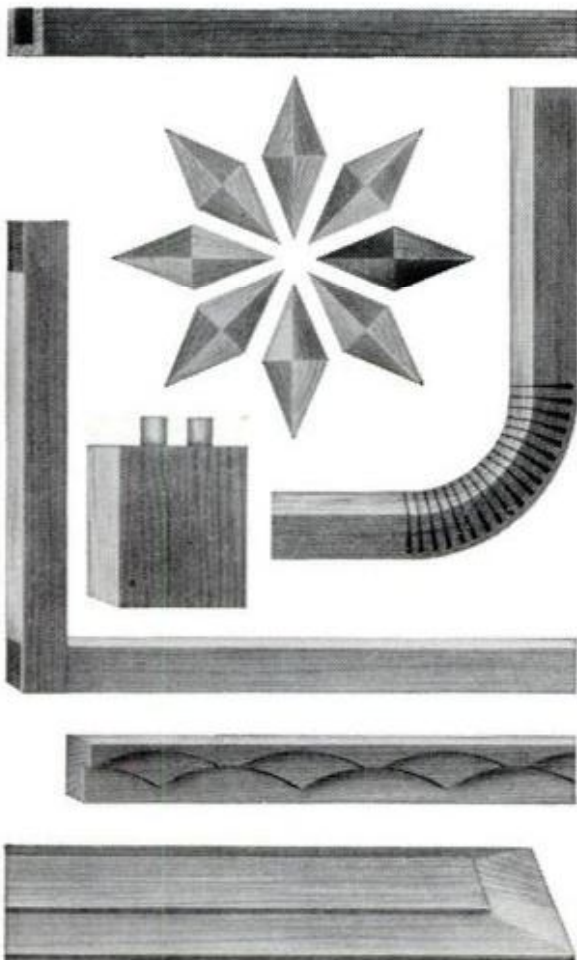
**BIRTH Certificates, marriage certificates, diplomas—blank form—\$1.00.** Sample 10¢. Standard Forms, Box 7228-M, Washington 4, D.C.

**AFRICAN Carvings, 25 varieties \$20.** Chandrakant, Box 5175, Nairobi, Kenya.

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You hear a lot of echoes about **Fairlane** wagons:  
 they handle and park with compact ease.

*(Handle and park with compact ease.)*

Carry almost as much as the big ones.

*(Carry almost as much as the big ones.)*

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*(Offer you a "289" V-8 option.)*

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 WINNER OF MOTOR TREND'S  
 CAR OF THE YEAR AWARD



## How Owners Rate Their New



## CHEVELLES

*Early units, in Chevelle's first year out, draw handling praise and some workmanship beefs*



**OWNERS' PRAISE FOR CHEVELLE'S HANDLING** was borne out by PM's test driver on gravel surface

*Marginal and boldface comments by Jim Whipple,  
PM's Automotive Editor*

**Could be the pendulum of public taste has stopped swinging between the unparkable big Chevies of 1959-60 and the cramped Corvair of '61** →

**If the next '55-'56 Chevy doesn't fit this hymn of praise to Chevelle we'll eat it, wheels and all. We → seem to have come full cycle with Chevelle. But will we stop here?**

**T**O MANY OWNERS, Chevelle seems like an old friend returning after a long absence. An Iowa sawmill operator puts it this way:

"This was just the size and style of car I had been waiting for. The full-sized cars were too big; the compacts too small. So, I kept my old car—a '54 Chevrolet."

A number of owners weren't quite sure whether Chevelle was a compact or not when they first saw it. Says an Indiana salesman:

"We saw a Chevelle on the road and were quite impressed with its beauty. Upon closer examination, we were happy to find that it wasn't a true compact."

A Colorado realtor had another way of putting it: "Wheelbase, over-all length, smaller windshield, manual top are all a return to sanity. So is absence of chrome and fins. Clean design is important; the public should get what it wants, not be told what it wants!"



## OWNERS LIKE

Easy handling .....	..(52.3%)
New styling .....	..(41.7%)
Comfortable size .....	..(30.8%)

## and They Dislike

Poor workmanship .....	..(12.6%)
Scant headroom .....	..(9.6%)
Water leaks .....	..(8.6%)



**THE STATION WAGON'S REAR OPENING** takes loads to 28½ inches high. The tailgate is less than 20½ inches from the ground. About 10 percent of the owners surveyed chose station wagon

*He's a bit exuberant, but a V8 Chevelle in luxury trim is pretty smooth and satisfactory transportation—big but not bulky, soft riding but not sloppy →*

*He's dead on target. We saw this problem on Corvair and Chevy II. The factory is involved in a mad rush to assemble and ship out 20-30,000 brand new cars—unfamiliar to the men on the line—in a few short weeks between old model shutdown and → introduction date*



An Illinois clergyman who traded a full-size Chevy for his new Chevelle expresses his approval as follows: "The Chevelle is the most sensible domestic car produced in many a year. It has grace, beauty and over-all ruggedness."

Another slant on Chevelle comes from a Texas salesman who says: "As a Chevelle owner for about six weeks (1800 miles), I have enjoyed my Chevelle like my daughter enjoys her toys on Christmas morning. I have never driven another make of automobile in the same weight class that can compare with Chevelle."

Not every owner had a Christmas morning feeling toward his new Chevelle, however. For approximately 30 percent of those reporting, the joys of new car ownership were marred by the old problems of quality control. A supervisor from Indiana says: "This is the best-engineered auto in its price field, but the sloppiest job of assembly I have ever seen. This is my 24th Chevrolet."

An industrial designer from Pennsylvania adds, "I haven't had the car long enough to make an honest judgment except to comment on the fact that quality control at the factory is quite ineffectual."

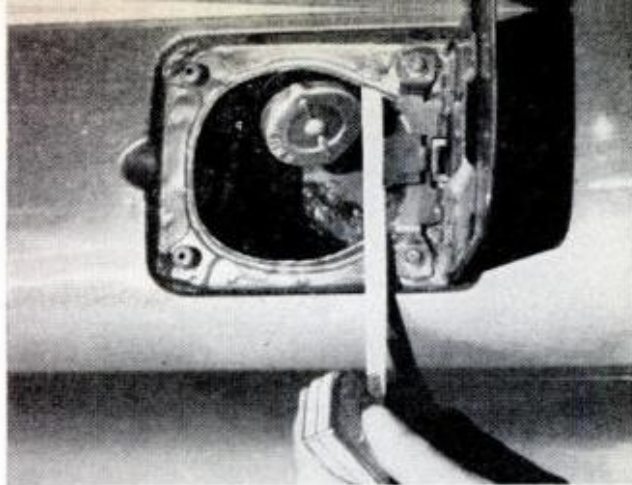
And a Massachusetts electronic technician, reacted this way: "Workmanship is very bad—a lot of little things overlooked. I will never again buy a new car that was built before introduction date. It was put together in a hurry."

To put the Chevelle in proper perspective, however, a total





**GENEROUS LEGROOM** drew praise from some owners although others felt the dash on their Chevelle crowded them, coming too close to the front seat



**FUEL FILL PIPE ON PM's test wagon** was recessed so spilled gasoline, instead of running down the outside of the body, drained to ground inside fender



**RAKISH C-PILLAR ANGLE** and curved door reduce entry-exit area. Some cases of poor door fit, with rattles and squeaks, sparked complaints by owners

of only 12 percent of all owners specifically complained about poor workmanship as such, though there were additional complaints about some mechanical shortcomings.

Complaints notwithstanding, some 64.9 percent of the owners gave the car a rate of Excellent, 29.1 rated it good and 4.0 and 2.0 percent rated it Fair and Poor respectively.

To back up owners reports on fuel consumption, PM ran its usual set of metered fuel mileage runs.

Steady-speed fuel consumption was tested running both with and against the wind and averaging results in PM's Chevelle wagon. Here are the results.

- At 30 m.p.h., 22.50 m.p.g.
- At 40 m.p.h., 23.65 m.p.g.
- At 50 m.p.h., 20.75 m.p.g.
- At 60 m.p.h., 19.34 m.p.g.
- At 70 m.p.h., 16.98 m.p.g.

Tests were run on a Chevelle Malibu station wagon with 155 horsepower six-cylinder engine and automatic transmission. Over-all mileage for the 500-plus miles came to precisely 18.0 miles per gallon.

Owners found significant items to praise. Here, in the order of their popularity, are numbers one through five:

"Handles easier and with more comfort at any speed than any car I have ever driven."—Florida traveling salesman.

"Easy to handle on the road. Handles well on snow and in slippery driving."—Maine office worker.

**The key percentage on which we base a prediction that Chevelle will succeed, is that**  
 ← **86.7% of owners reporting said they'd buy another Chevelle**

**With a barely broken-in 3300-pound station wagon and automatic transmission, this mileage is acceptable**



Probably his wife if he's got a V8 Chevelle, and she's trying to parallel park it on dry pavement →

Next year's annual "restyling" may bring forth a sprinkling of more chrome, although GM seems to be resisting this bad habit better than some →

He's right; that's no accidental resemblance! →

And for this reason we feel that it will "steal" sales from both of the other cars. It could become sales leader of the Chevrolet line →

We'll agree, although with a 300-400 pounds in rear seat or trunk Chevelle's ride comes close to "big car comfort" →

"I like its driving ease; who needs power steering?"—Washington teamster.

"A little bit light and fishtail on bad roads, but on smooth roads, my Chevelle drives and corners very well."—Montana student.

"It has remarkable maneuverability without power steering. Handles quite well in snow."—New Hampshire mechanical engineer.

"Exterior styling is what I like most."—Indiana service operator.

"Car is sharp looking and attractive in appearance, although short on chrome."—Missouri teacher.

"Its fine features are the sleek, trim sides of the car and the trim, narrow back window. Body style is really sharp."—Indiana bricklayer.

"I like the basic body style of the car as it reminds me of a sawed-off Grand Prix Pontiac."—Tennessee shipping clerk.

"I like its sensible size."—Indiana construction foreman.

"It's small enough to be compact but large enough to have plenty of passenger room and luggage space."—Missouri telephone worker.

"Size most influenced my decision to buy Chevelle. It's bigger than Chevy II and smaller than the big Chevrolet."—New Hampshire machinist.

"It rides well over rough roads—I'm a rural mail carrier on a ninety-mile route over rough terrain with about 270 stops per day."—Missouri rural mail carrier.

"I like the riding comfort; it's fair—not as good on cruising as '62 Bel Air, but comfortable enough."—Washington boiler operator.

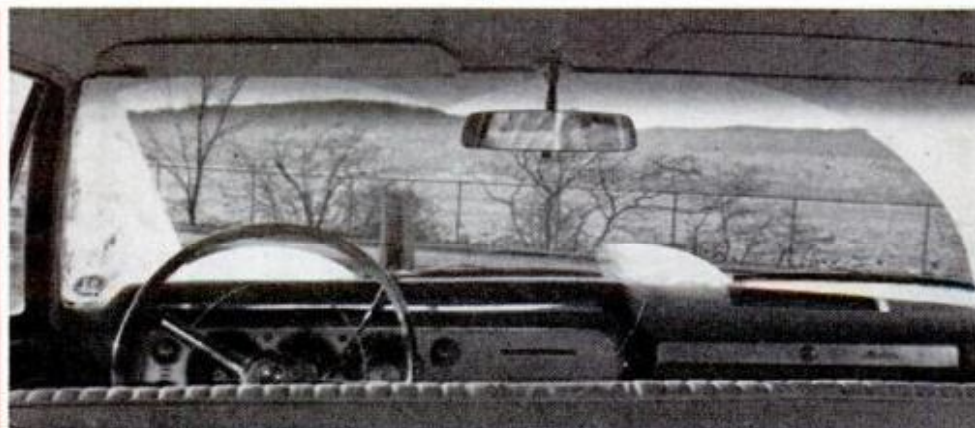
"I drive 40-50,000 miles per year and comfort is a must. This

### WHAT MILEAGE DO CHEVELLE OWNERS GET?



ALTHOUGH THE BULK of city-driving fuel consumption was at 15-16 m.p.g.—and touring not much better—few Chevelle owners felt fuel economy was worth complaining about. Over 60 percent bought V8s

DASHBOARD and instrument panel led list of interior styling "pluses." Wiper spread is good but could profit from adjustment toward left of glass





car has it. Better all around than the '62 Olds I traded in."

—Arizona insurance agent.

"It rides like velvet."—Massachusetts retiree.

"Less weight to carry around with more power to spare."—North Dakota farmer.

"It has excellent pickup."—Maine phone company executive.

"I like the pickup it has, and the power it has for a small six-cylinder motor."—Idaho miller.

"It's got enough power (V8) for the average driver."—Texas electrical worker.

"My 155-hp. Six will get up and move when called on."—Idaho retiree.

*Not everything is a bowl of cherries for Chevelle, however. Owners also had complaints. Here, listed in order of their frequency, are the first five:*

"There were several minor faults because of poor final inspection—rough spot in exterior paint, loose door molding, one quart too much oil, etc."—Tennessee park ranger.

"Body was assembled by a bunch of blind babies. Doors do not match openings, chrome moldings keep falling off, paint is chipping off, trunk won't stay closed, etc."—Iowa credit manager.

"Poorly constructed, windows don't roll properly, rattles all over."—Texas retiree.

"Windows do not fit and the car generally lacks craftsmanship. Chrome was loose."—Texas aircraft mechanic.

"Not enough headroom. Not enough legroom for passengers."—Illinois heavy equipment operator.

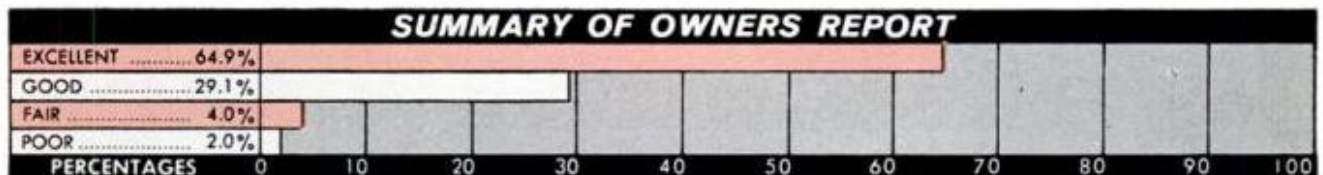
"Headroom is somewhat cramped. After owning a Corvair, though, this car is excellent."—Indiana mail carrier.

(Please turn to page 238)

He's hit the mark here.  
← The 195-hp. V8 is merely adequate on the big Chevy. It zooms the Chevelle

← Early Chevelle buyers like these reporting to PM favored V8 engine 60 to 40 percent, but later buyers may swing percentage in favor of the Six

He's right. Chevelle designers set seats at about right elevation, but pulled roof liner down for stylish effect. They could well replace loose cloth roof lining with tight fitting polyfoam for an extra inch of hat clearance



<b>Fuel economy</b>	
About as expected	52.1%
Better than expected	23.1
Not as good	24.8
<b>Best-liked features</b>	
Handling ease	52.3
Styling	41.7
Size	30.8
Riding comfort	26.5
Power, performance	25.5
Roominess	17.2
Economy	12.9
Ease of parking	12.9
Vision	9.9
Balance and weight	4.6
Interior styling	4.3
<b>Most frequent complaints</b>	
Poor workmanship	12.6
Inadequate headroom	9.6
Water leaks (1/3 in trunk)	8.6
Badly fitting doors	7.3
Inferior paint job	7.0
Wind noise	7.0
<b>Mechanical trouble, if any</b>	
No trouble	70.9
Carburetor trouble	3.0
Manual transmission trouble	2.3
Clutch trouble	2.3
Directional signals	2.0
<b>Consider another full-size car?</b>	
Yes, did consider	50.3
No, didn't consider	49.7

<b>Other full-size make considered</b>	
Chevrolet	55.3%
Ford	23.0
Pontiac	7.9
Rambler	4.6
<b>Consider buying a compact?</b>	
Yes, did consider	52.0
No, didn't consider	48.0
<b>Compact make considered</b>	
Chevy II	26.1
Corvair	18.5
Pontiac Tempest	7.9
Ford Falcon	7.9
<b>Best-liked exterior style features</b>	
Clean, sleek, smooth lines	9.9
Curved-glass windows	9.3
Side view	7.0
Front end	6.2
Rear end	5.9
Grille	4.3
<b>Least-liked exterior style features</b>	
Rear (half said 'too high')	13.2
Tail lights	3.6
Low front end	3.0
Curved windows	2.6
<b>Best-liked interior style features</b>	
Dash, instrument panel	26.8
Upholstery	12.9
Comfortable seats	8.6
Bucket seats	7.9
Console-mounted stick	5.0
Gauges instead of lights	3.3

<b>Least-liked exterior style features</b>	
Dashboard	7.0%
Finish on dashboard	5.6
Lack of rear seat room	3.3
Speedometer location	3.0
Unlighted gear selector, ash tray	2.3
<b>Is Chevelle family's only car?</b>	
Yes, it is	60.3
No, it is not	39.7
<b>Make of other car</b>	
Chevrolet	19.5
Other General Motors make	32.1
Ford	4.6
Other Ford Motors make	6.6
Plymouth	3.3
<b>Chevelle decision based on</b>	
Style	47.4
Size	46.0
Price, trade-in	34.8
Economy	14.2
Handling ease	12.3
<b>How is dealer service?</b>	
Excellent	61.7
Average	32.9
Poor	5.4
<b>Would you buy from him again?</b>	
Yes, would buy again	74.5
No, would not	7.3
Undetermined	18.2
<b>Would you buy another Chevelle?</b>	
Yes, would buy	86.7
No, would not buy	5.0





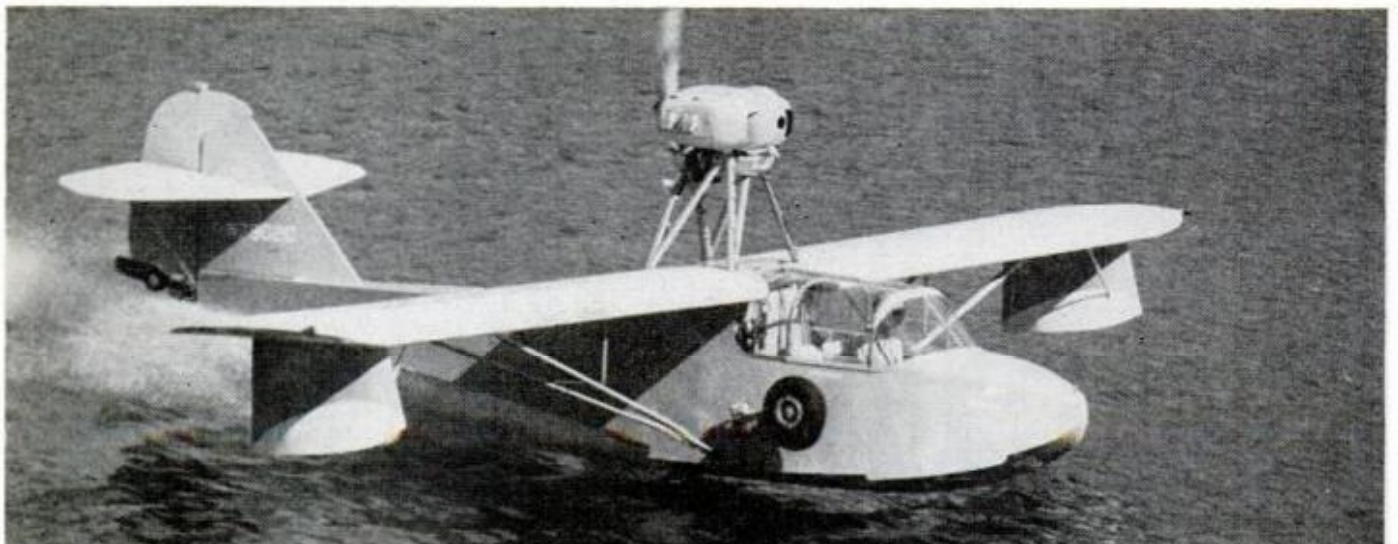
## She Shall Have Light Wherever She Goes

Adaptable to almost any situation, a limber lamp makes its own stand or clamp. Called the Bendalux, it has a long, flexible "tail" that can be shaped.

Twisted into a circle (top left), it makes its own desk stand. Wound around the

head (center), it's a roving light. Twisted into a clamp (right), it can be attached to the back of a chair. It can also hang from a wall or ceiling.

The manufacturer is Brigstowe Products, Kingswood, Bristol, England.







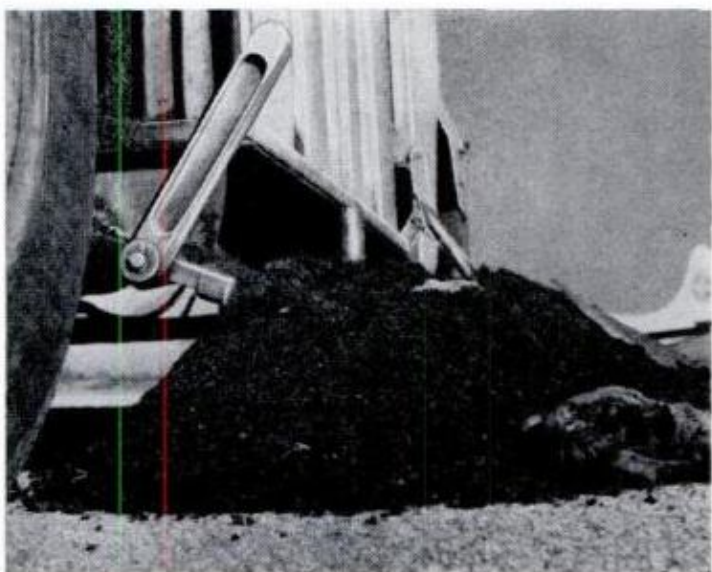
### Turboprop Executive Plane

Featuring propjet engines and a pressurized cabin, the new Beechcraft *King Air* will be the first American turboprop aimed exclusively at the business market. Carrying six to eight passengers, it cruises 270 m.p.h. over a 1400-mile range.



### Nuclear Hockey, Anyone?

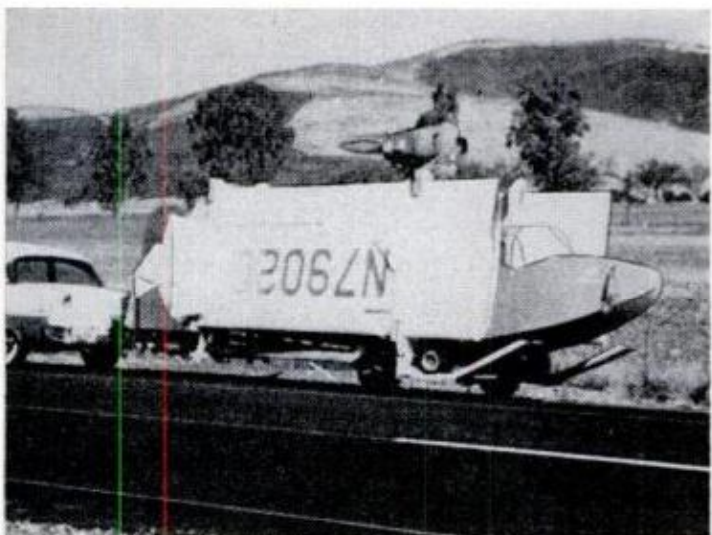
Looking like a hockey puck and a button, two pellets of nuclear fuel are displayed by a Westinghouse engineer. The uranium dioxide pellets can now be produced in thicknesses from one inch to .015 inch—the widths of these samples.



### \$35,000 Vacuum Cleaner

Perhaps the world's largest—and most expensive—vacuum cleaner sucks the dirt off runways at the John F. Kennedy International Airport (formerly Idlewild) in New York. Because the engines of jet aircraft take in 2000 cubic feet of air per second—and a lot of debris along with it—the runways must be kept spotless.

The \$35,000 machine has a V8 engine to power the suction equipment, plus the conventional rotating brush to stir the dirt up. In one day it has swept the runways of as much as 213 pounds of rubbish like that pictured just to the left.



### Homemade Amphibian

A home-built two-place amphibian can be disassembled by two people in 30 minutes for towing to and from an airport.

The craft, powered by an 85-hp. engine, cruises at 80 m.p.h. It has a range of 300 miles on 20 gallons of gas.

The amphibian uses wing panels and modified tail controls from Aeronca trainers. The hull is made of mahogany plywood and covered with fiberglass.

The aircraft, Volmer Sportsman, was built by J. W. Chappell of Vancouver, B.C. from plans supplied by Volmer Aircraft Co., 104 Providencia Ave., Burbank, Calif.



# YOUR RIGHT TO

## *Will It Be Challenged by New Restrictions in the*

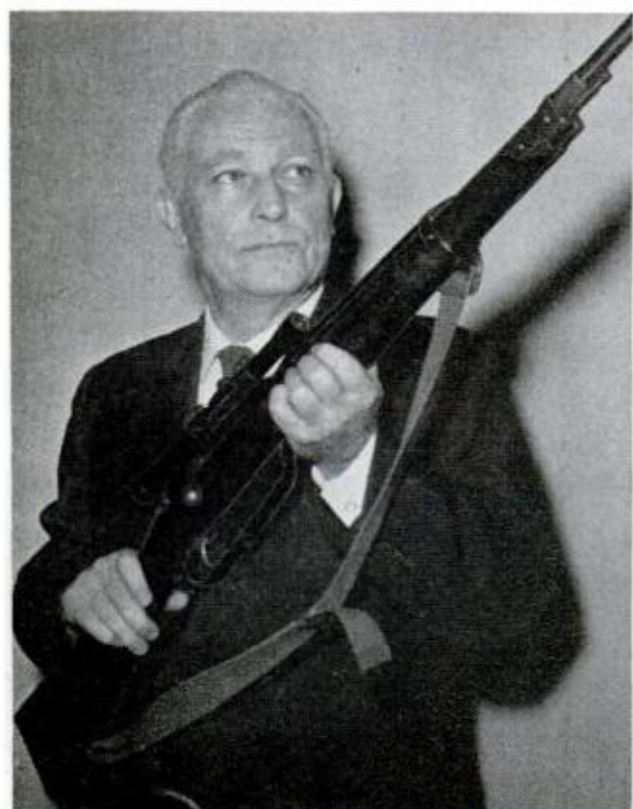


STARNES with 20-ga. shotgun used by bird hunters

*Yes, says Richard Starnes, well-known columnist and sportsman*

**I**T IS NONSENSE to say that the Dodd bill—or any law—would have prevented the assassination of President Kennedy. The United States already has a plethora of confusing and often contradictory gun laws on the books, and all of them have proved uniformly ineffective in keeping firearms out of the hands of criminals. There is no reason to believe Senator Dodd's proposed legislation will be any more successful.

But what it will do is plain. It will make it infinitely more difficult and burdensome for the law-abiding citizen to own sporting firearms. Criminals, who by definition disregard the law, will experience little inconvenience as a result of enactment of



DODD holds type of rifle which murdered Kennedy

*No, says Senator Thomas J. Dodd, author of impending firearms control legislation*

**A** FIREARM has one objective—to put a bullet through a target, an animal or a human being. I believe that the special nature of this product calls for special regulation.

During 1963, approximately one million dangerous weapons were ordered through the mails and delivered by mail order firms. Thousands of the weapons were used for criminal purposes. One of them was used to murder the President of the United States.

For more than two years, as Chairman of a Subcommittee, I have been conducting investigations into this problem and negotiating with the various groups principally concerned, seeking a legislative



# OWN A GUN

## *Wake of President Kennedy's Murder?*

the bill. It is Orwellian lunacy to contend that a man bent upon murdering the President would have been dissuaded by any provision contained in the Dodd law.

Even if the law had previously existed, Lee Harvey Oswald, the alleged assassin of President Kennedy, would probably have qualified under all its provisions to purchase his mail-order rifle.

As with many gun laws, the Dodd bill seems deceptively innocuous. Sober analysis shows, however, that like most gun laws it is wide open to abuses, not the smallest of which is the sharp likelihood that it will be subject to whimsical and arbitrary interpretation at the hands of local police authorities.

Time after time we have seen how the immensely powerful bureaucracy of government erects huge, oppressive and unduly restrictive superstructures upon high-minded and innocently-intended laws. New York's Sullivan Law is a prime

example of this. There is, of course, every historical cause to believe the Dodd bill would quickly undergo the same inexorable metamorphosis.

The tools for doing this, indeed, were deftly inserted in Senator Dodd's proposed bill while the country was still reeling with hysteria over the President's murder. As useless and potentially harmful as the bill was in its original form, an amendment offered by Senator Dodd five days after the President's death made it immeasurably worse.

The avowed purpose of the original Dodd bill was to make sure that criminals, crazies and kids could not purchase mail-order hand guns—perhaps a praiseworthy goal. But after the death of President Kennedy, Senator Dodd told the Senate he had decided his bill should include all firearms regardless of size, shape or description.

"I have amended my bill," he an-

solution. The product of this joint effort is now before the Congress in the form of Senate Bill S. 1975.

It prohibits the shipment in interstate commerce of guns to persons under eighteen years of age.

It bars mail order weapons to those who have been convicted of a felony.

It tightens up licensing requirements for manufacturers and sellers of guns in a manner designed to discourage fly-by-night mail order houses and others who operate on the fringes of law.

It requires one seeking to buy a gun through the mails to state, in an affidavit, his name, address, age, whether he has a criminal record and whether the purchase would be contrary to local or state law.

This affidavit is then sent to the mail-order firm along with the application to buy a gun. The mail-order firm then must mail a copy of the affidavit to the local police chief by registered mail, and the

firm cannot ship the gun to the customer until it has received a return receipt for the registered letter sent to the police.

Some contend that my legislation would deter men from developing the proficiency in firearms which is necessary to the national defense in time of war. In the first place, S. 1975 involves no real obstacle to any law-abiding citizen who wishes to purchase a weapon; no more of an obstacle than that required to operate a bicycle and far less than that required to operate an automobile.

Some have gone to the ridiculous extreme of weeping nostalgic tears over the memory of Daniel Boone and the pioneers, and declaring solemnly that a great American tradition will be destroyed by my bill.

This is absolute nonsense.

I cannot repeat too often that my bill does nothing to prohibit the responsible citizen from obtaining the weapon of his choice.



## **Richard Starnes**

*. . . "It is Orwellian lunacy to contend that the man intent on murder will be dissuaded by the Dodd law."*

nounced, "to require that not only must a person provide an affidavit attesting to his age, name, address, and criminal record, if he has one, and his compliance with state gun laws, *but in addition, the affidavit must be authenticated by the highest local law enforcement authority in his community.*"

Anyone who is not hopelessly naive in the ways of government can anticipate the effect of that amendment. Neither Senator Dodd nor any lawgiver alive knows what "authenticate" as used in the amendment will be held to mean. In some jurisdictions it may mean no more than a *pro-forma* rubber stamp affixed to an order blank by a bored station house clerk, in which case it is pointless. But in many places it will unquestionably be used to justify unwarranted use of police power, and the consequent erosion of a little bit more of our personal freedom. I hazard, at a guess, that most police or sheriff's departments would have implemented the authentication pro-

vision of the law about as follows:

"Before we can authenticate your name and age, we will have to see a birth certificate (which itself may have to be authenticated). Next, before we can authenticate that you have provided your correct address, we will have to send a policeman to your neighborhood to conduct an investigation, which will mean asking your nosy neighbors if you really live where you say you do. And, of course, before we can authenticate your claim that you do not have a criminal record, we will have to fingerprint you and then search our files of known criminals, and ask the FBI to do likewise."

This is a blueprint for costly and time-consuming red tape, to be sure, but it also proposes a colossal indignity against law-abiding American sportsmen. Inevitably, Senator Dodd's bill—as amended—was attacked on the ground that it would be used as a vehicle for the proliferation of police power, just as old Tim Sullivan's

## **Senator Dodd**

*. . . "Where the purchase of a dangerous weapon is concerned, it is not an undue burden on any citizen to fill out a brief affidavit . . ."*

Daniel Boone could have easily purchased a mail order weapon under the provisions of my bill.

But we are not living in the days of the pioneers. We are not required to protect our homes from Redcoats or Indians or wild beasts.

Some people are so out of touch with reality, so unwilling to be slightly inconvenienced, or so financially involved in the gun traffic as to hold that no regulation whatever should be imposed upon this commerce in deadly weapons. But any reasonable, objective person, looking at this problem from the viewpoint of public safety, will agree that some form of control must be achieved. The type of control is a question that is open to legitimate controversy by people of good sense and good will.

Weapons available via mail order to juveniles, dope addicts, mentally de-

ranged persons and criminals range in size and destructive power all the way from small caliber pistols to field artillery pieces. This is no rhetorical exaggeration, as my records prove.

In Fairfax County, Virginia, a 14-year-old boy was recently killed with a mail order weapon by a teenage friend who was mentally disturbed. When the head of the California firm which shipped this weapon, a convicted ex-pornographer, was confronted with this fact, he said, "They had the money. I sold them the gun. I didn't break any law, did I?"

In Sussex County, New Jersey, three youths in Nazi uniforms set up an anti-tank gun, purchased through the mails, and were in the process of demolishing a building with 22 millimeter, armor-piercing shells when they were seized by the police. Also seized was a veritable arsenal of mail order weapons.



wrong-headed monument has been. The law, it was charged, would be resolutely ignored by hoodlums, who would continue to steal most of the guns used in crimes, just as they do now. It would penalize (and ultimately discourage) the honest citizen who enjoys plinking at targets, or hunting, or shooting skeet.

As soon as the true nature of the revised bill was understood, a notable howl arose from sportsmen—and once again Senator Dodd switched signals. He dropped the requirement that local lawmen "authenticate" orders for guns-by-mail, and substituted a curious clause that may even be worse.

As the somewhat dog-eared bill stands now, mail-order gun purchasers must include an affidavit as to name, age, criminal record and mental condition with their order. The seller must forward a copy of the affidavit to the cops in the would-be buyer's area, and is forbidden to fill the order until the local police re-

turn a registered receipt attesting that they have received the affidavit.

The new provision removes none of the objections to the bill. It remains an invitation to abuses by arbitrary or whimsical police departments. It is likely that many departments would refuse to acknowledge receipt of the affidavit until it was satisfied that the information it contained was accurate which again would require a thorough investigation. Other departments would file and forget the affidavits, in which case they would be useless and could mask gun purchases by lunatics, subversives or children. And, of course, there would be police who would simply refuse to accept delivery of the affidavit—thus effectively blocking the sale.

Whether Senator Dodd admits it or not, the effect of his bill is to take a long first step toward the day when it will be virtually impossible for Americans to keep sporting firearms. I am sure the good Sen-

***"Senator Dodd's amendment will unquestionably be used to justify unwarranted use of police power and consequent erosion of more of our personal freedom."***

The extent to which the criminal element participates in this mail order traffic can be easily demonstrated by police records in a typical metropolitan area.

The Senate Subcommittee to Investigate Juvenile Delinquency, in collaboration with local police, conducted an intensive survey of mail order gun recipients in the District of Columbia. This is what they found:

Twenty-five percent of all recipients of mail order guns had criminal records. In the precinct with the highest percentage of crime, 80 percent had criminal records. And these figures are not unusual. Chiefs of Police from all over the country have told us that what we found in Washington is typical of their own communities.

The following state regulations are in effect concerning concealable weapons.

Seven states require a permit for the purchase of a weapon; eight states require a waiting period between the pur-

chase and the delivery of a weapon so that police may check the identity of the recipient.

The 17 million citizens of the State of New York must obtain a license for the purchase of a weapon.

The two million citizens of South Carolina may not purchase a weapon under any circumstances.

And this is only part of the story. Almost every community has local ordinances governing the sale of weapons.

We are now a highly complex nation of 188 million people. Many of these people are mentally disturbed, many are drug addicts, many are children who have no concept of the responsible use of weapons. And some are criminals who seek weapons only to rob, assault and murder their fellow citizens.

The question before us as a nation, then, is whether this interstate mail order traffic in murderous weapons should con-

***"The ridiculous extreme of weeping nostalgic tears over the memory of Daniel Boone . . . is absolute nonsense."***



**Richard Starnes** . . . *"The hunter without access to urban markets or the resources to meet over-the-counter prices will be hurt by what will become prohibition of mail-order gun sales."*

ator will deny this, just as he will undoubtedly deny that his law in its earlier form would have required honest men to submit to police fingerprinting as if they were common criminals. But having studied his proposed law, I am persuaded both assertions are true nevertheless.

Old Tim Sullivan's law is a classic case history of what happens when ill-considered gun legislation is adopted. I spent a decade in New York City, and for a number of those years I endured the petty bureaucracy, harassment and inconvenience that goes with being licensed to keep a handgun in that city. I have sweated out red tape mills in the most backward nations of the Middle East and Southeast Asia, but the enforcers of New York's Sullivan Law have them all beat hollow. The annual relicensing ritual is enough to dishearten all but the most doughty, and even that isn't the end of it. At any time

during the year the cops are likely to summon you to bring your guns in to be "checked," an aimless procedure that can waste a whole morning. Ultimately, of course, I sold off my handguns and surrendered my license, which is what the police had in mind all along. Their admitted purpose is to wipe out private ownership of handguns, and they have very nearly done it. Among New York's teeming millions, fewer than 17,000 have pistol licenses.

In spite of old Tim's pious assertion that his law would deprive only hoodlums of handguns, exactly the reverse has been true. New York's flourishing underworld is as well-armed as any on earth, and all the misguided zeal of the police in administering the Sullivan Law has been unable to disarm it. In an attempt to make the Sullivan Law work, there have been some notable miscarriages of justice. One con-

**Senator Dodd** . . . *"My bill does nothing to prevent the responsible citizen from obtaining the weapon of his choice."*

tinue completely uncontrolled, or whether reasonable controls should be instituted.

Some maintain that the Second Amendment to the Constitution prevents any regulation by Congress of the citizen's right to purchase weapons.

Let's look at the clause itself. It reads as follows:

"A well regulated Militia, being necessary to the security of a free State, the right of the people to keep and bear Arms, shall not be infringed."

The United States Supreme Court in *U.S. vs. Miller* 307 US 174 (1939) stated that the purpose of the Amendment was to insure the continuation and render possible the effectiveness of a Militia.

Since there is no relationship between the mere regulation of mail order purchases covered in my bill and the maintenance of a Militia, my law would not be in violation of the Second Amendment. So says the United States Department of

Justice.

S. 1975 is not an infringement on the right to keep and bear arms. It merely prescribes minimal controls over the purchase of firearms shipped in interstate commerce.

Since there are many misconceptions abroad about this legislation I would like to spell out what the bill *does not* do.

It *does not* involve a violation of our constitutional rights.

It *does not* pose a threat to the sportsman who knows how to handle a gun properly.

It *does not* adversely affect those legitimately entitled to bear arms or the responsible companies which make and sell them.

It *does not* outlaw the mail order gun business. It will merely require the proper identification of purchasers.

It *does not* require the licensing or registration of weapons. That is a local matter.

It *does not* place in the hands of police



cerns a Brooklyn cab driver who found a revolver in the back seat of his hack. Dutifully he turned the weapon over to the cops, and dutifully the cops arrested him on charges of violating the Sullivan Law. He spent 16 days in jail before a magistrate succumbed to the howls of public indignation and turned him loose.

In charity we must assume that Senator Dodd, like Tim Sullivan, is not being disingenuous but is merely a victim of the sort of loose thinking that is an occupational disease in his profession. "I am certain," he told the Senate, "that the responsible, law-abiding sportsmen and gun owners in the United States will be willing to tolerate what I feel is only a slight inconvenience at worst. Certainly my bill will be a step forward to get some measure of control over the intolerable situation that prevails today with respect to the sale of firearms.

"What more do we need than the death

of a beloved President to arouse us to place some regulation on this traffic in guns used for crime?"

There is sufficient fallacious reasoning in the foregoing two paragraphs to keep a freshman logic class in fodder for a semester. The small inconvenience he brushes aside is, as we have seen, likely to be much more than that when—and if—his proposal becomes law. And, whatever else it does, the law will have little or no effect on the "traffic in guns used for crime." The odds are that no gun owning sportsman who knows what is really in Senator Dodd's law is going to be willing to tolerate it for any longer than it takes to write a letter demanding that his Congressman vote it down.

Putting aside the serious questions as to the merit of the bill as it now stands, it is still bad law simply because it discriminates against one class of gun buyers and

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

***"Realities of the world we live in dictate that freedom is given only to those who have the will and the means to defend it."***

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authorities any discretion as to who should and who should not obtain weapons. The police can do one thing and one thing only—and that is to receive and maintain a file of the affidavits of gun purchasers sent them by mail order gun firms.

There are other questions raised about the bill which arise, not from ignorance of its provisions, but from concern over its effects.

It is contended, for instance, that this bill would place an undue burden on law-abiding citizens, who will comply, but will have no deterrent effect on criminals, who will evade.

I contend that where the purchase of a dangerous weapon is concerned, it is not an undue burden on any citizen to fill out the affidavit which is required.

The person who feels he is unduly burdened by the provisions of this bill can always purchase his weapon over the counter at the local gun store. There is a

good chance, however, that he will run into stricter controls at the local gun store than those in my bill.

As far as criminals are concerned, this bill will close off one more avenue to lethal weapons. If they violate the law, they open themselves to investigation by the FBI and to prosecution by the Federal Government. This is a strong deterrent factor for any criminal, and it will be of valuable assistance to police in putting more criminals where they ought to be: behind bars.

My faith in the responsible approach of sportsmen and marksmen is so great that I cannot believe they would object to such mild regulation. For it is the people who use guns legitimately who are the first to insist on the responsible, safe use of weapons. They know their destructive power; they know the tragedies that can be caused by accidents; they know the danger of a

[\(Please turn to page 236\)](#)

***"We are not required to protect our homes from Redcoats or Indians or wild beasts."***



# New Plane Breaks Price Barrier

*At \$2500, it costs less than many compact cars, has features that are found in no other aircraft*

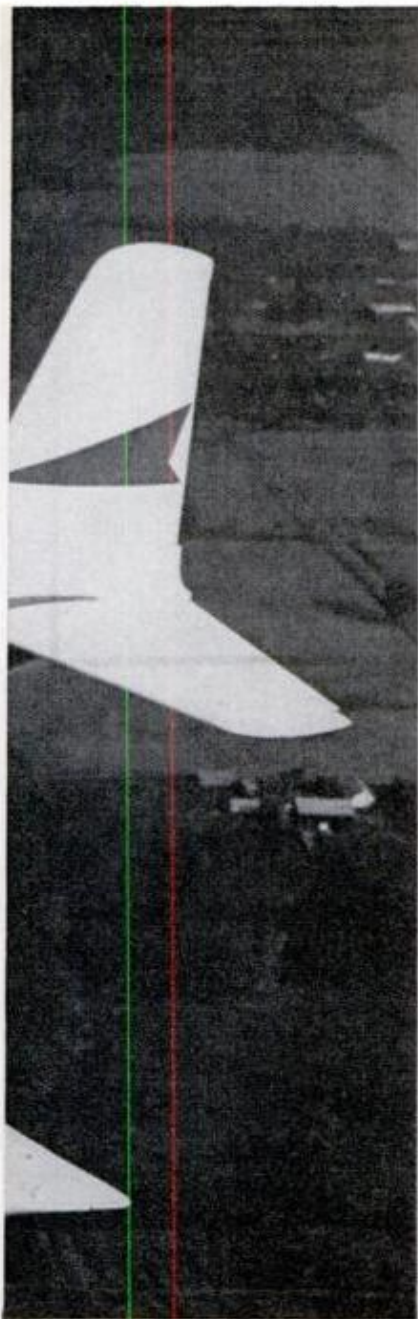


By Kevin V. Brown

**NEW BD-1, sporty 145-m.p.h. runabout, is stressed for aerobatics, has interchangeable parts, removable wings**







**I**F ANY ONE FACTOR has retarded the long-predicted boom in private aviation, it's probably the cost. A young man with the sky in his eyes is often shaken to learn that he must put up at least \$750 before he's even qualified to fly, then several thousand more if he wants to own a plane.

In the latest list of new aircraft, the lowest-priced plane—the Piper Colt—retails at \$5495. There are several in the \$6000 to \$9000 bracket, then the price jumps to five figures. Some single-engine planes are selling at more than \$30,000 and, if you want a twin, you have to go even higher than that.

Now comes a small new voice from the Midwest that announces loud and clear, and without any qualification, that it is going to build and sell airplanes for \$2500. Some of the "low-priced" automobiles cost more than that.

If the claim is overly optimistic, it's the kind of optimism that is refreshing in an industry noted for its respect for the status quo. If the claim is true, it's a fantastic breakthrough.

But there's more to the claim:

—The plane will be completely aerobatic, stressed to nine Gs up or down (outside loops, anyone?);

—Its wings are removable, so the plane can be towed home and stored in the garage;

—It's all-metal, including parts made of the new lightweight, high-strength honeycomb material formerly found only in jets;

—It uses bonded (glued) construction, eliminating rivets, increasing strength and reducing drag;

—It cruises anywhere from 112 m.p.h. to 145 m.p.h., using 65-hp. to 108-hp. engines, roughly a third to two-thirds more speed than horsepower (most standard light planes get less speed than their horsepower, 115 m.p.h. from a 160-hp. engine, for instance);

—It has interchangeable parts, reducing construction costs and making replacements easier.

If all *these* claims are true, and the price still stands, then

**UNIQUE AIRPLANE** has only 385 parts, and only 175 of them are different

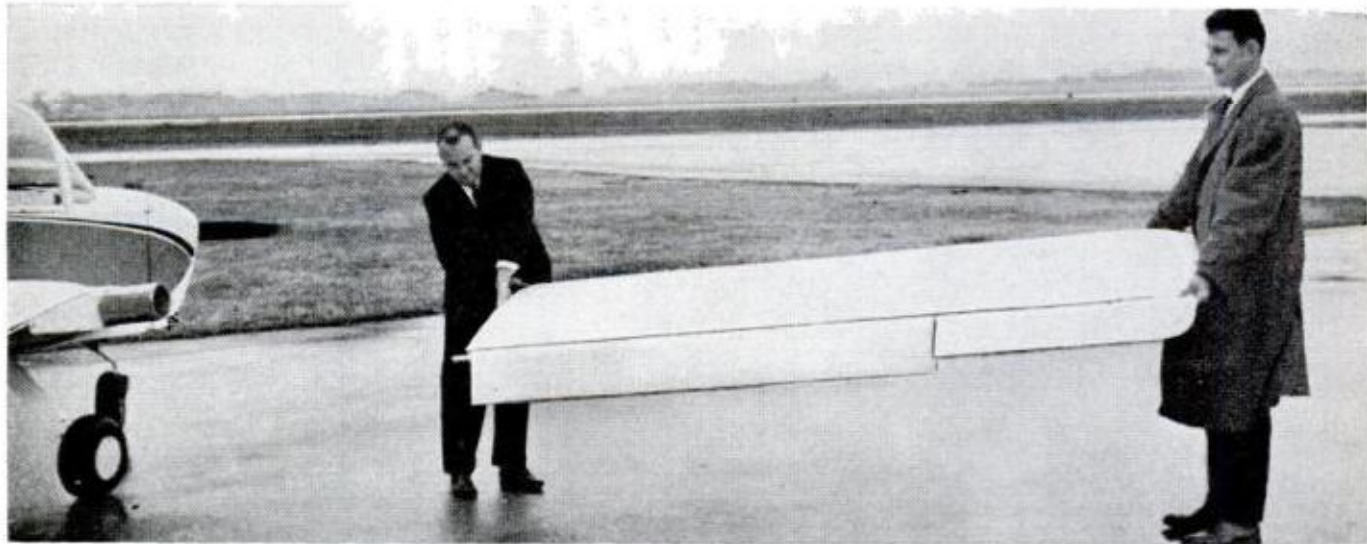




**PERFORMANCES & SPECIFICATIONS (estimated)**

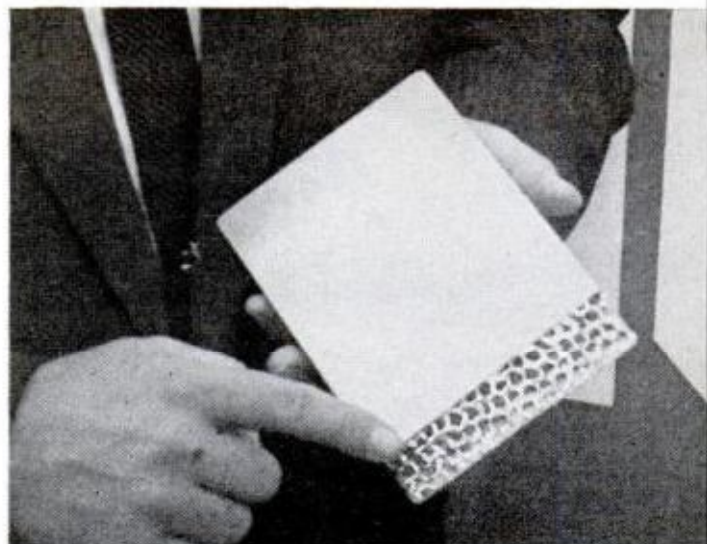
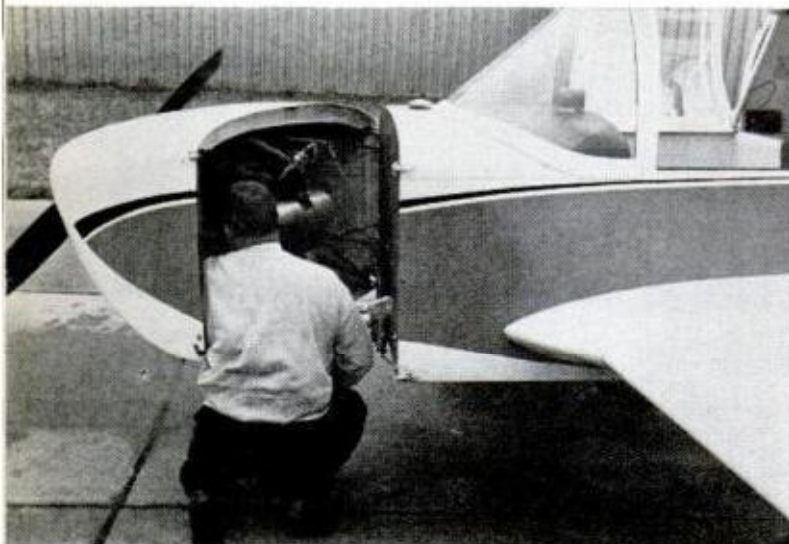
	65 hp	90 hp	108 hp	
Speed:	Max. Sea Level .....	120 mph.	145 mph.	155 mph.
	Max. Recommended Cruise 65% .....	112 mph.	135 mph.	145 mph.
	Stall: Flaps Up .....	61 mph.	61 mph.	61 mph.
	Flaps Down .....	54 mph.	54 mph.	54 mph.
Range: Max. Recommended Cruise 65% .....	600 miles	600 miles	600 miles	
Rate of Climb at Sea Level: .....	750 fpm.	900 fpm.	1150 fpm.	
Service Ceiling: .....	12000 ft.	15000 ft.	18000 ft.	
Take off: Ground run .....	700 ft.	700 ft.	600 ft.	
Landing: Landing roll .....	400 ft.	400 ft.	400 ft.	
Gross Weight: .....	1272 lbs.	1327 lbs.	1350 lbs.	
Empty Weight: .....	730 lbs.	785 lbs.	812 lbs.	
Baggage: .....	40 lbs.	40 lbs.	40 lbs.	
Fuel Capacity: (Total Gallon) .....	25	25	25	
Oil Capacity: (Total Quart) .....	4	4	6	
Wing Span: .....	23.5 ft.	23.5 ft.	23.5 ft.	
Wing Area: .....	94 sq. ft.	94 sq. ft.	94 sq. ft.	
Wing Loading: (Lbs. per sq. ft.) .....	13.5	14.1	14.3	
Power Loading: (Lbs./hp) .....	19.6	15.2	12.5	
Length: .....	18.5 ft.	18.5 ft.	18.5 ft.	
Width: (Wing removed) .....	7.6 ft.	7.6 ft.	7.6 ft.	
Height: .....	6.3 ft.	6.3 ft.	6.3 ft.	
<b>CABIN DIMENSIONS:</b>				
Width .....	41 in.	41 in.	41 in.	
Length .....	53 in.	53 in.	53 in.	
Height .....	41 in.	41 in.	41 in.	

**REMOVABLE WING** comes off in less than two minutes. In production model, simple rack will be built into fuselage to carry wings while towing. BD-1 has tricycle landing gear and can be towed along highway without trailer



**ENGINE SWINGOUT** is another innovation. All fuel and electric lines are on right side so left side can be swung open for minor maintenance on engine

**HONEYCOMB METAL** has highest strength-to-weight ratio, was formerly used exclusively on jets. It's built like beehive, spreading its strength evenly





the whole project borders on the incredible. To find out how close to the borderline it came, *Popular Mechanics* visited Springfield, Ohio, where Bede Aircraft built its first prototype. We talked with James Bede, who organized the whole thing, got the story from him and his associates, examined the plane, then flew it.

The verdict: With some qualification, it's all true. Of all the others, Bede is most positive about the price. "There isn't any question we can do it."

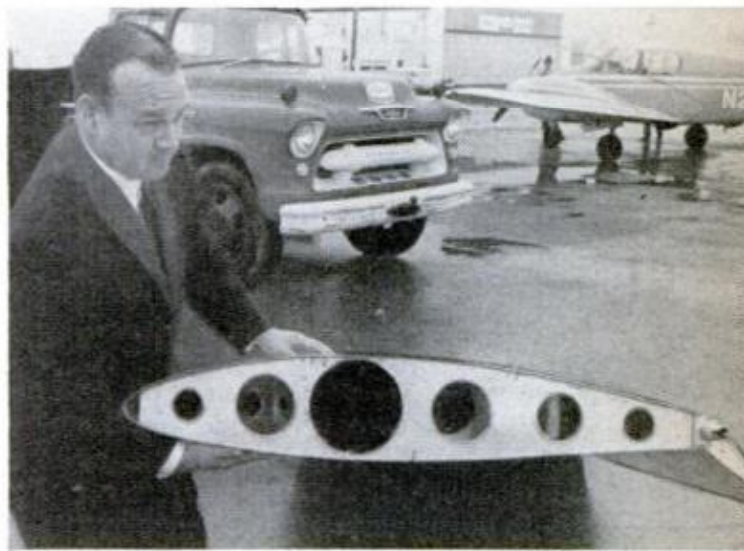
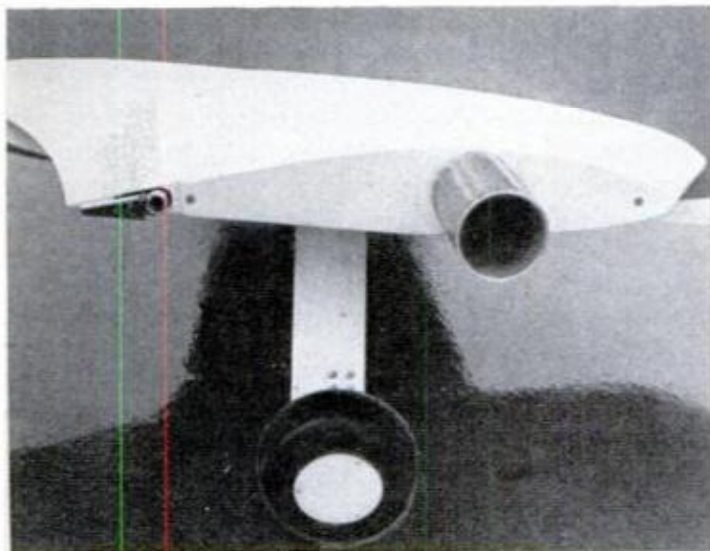
Jim Bede (it's pronounced like the letters "BD", so the plane became the BD-1) came by his creative instincts naturally. His father, now a major shareholder in the fledgling firm, holds patents on paint-spraying equipment. Young Jim has been

flying since he was 14 and began fooling around with model airplanes in high school. In fact, three of his high-school chums—and fellow model builders—are with him today in the company, two of them having studied aeronautical engineering with him at Wichita University. After graduation in 1957, they went their separate ways, then in 1960 got together and, with the fourth man, built their first plane. It was not the BD-1.

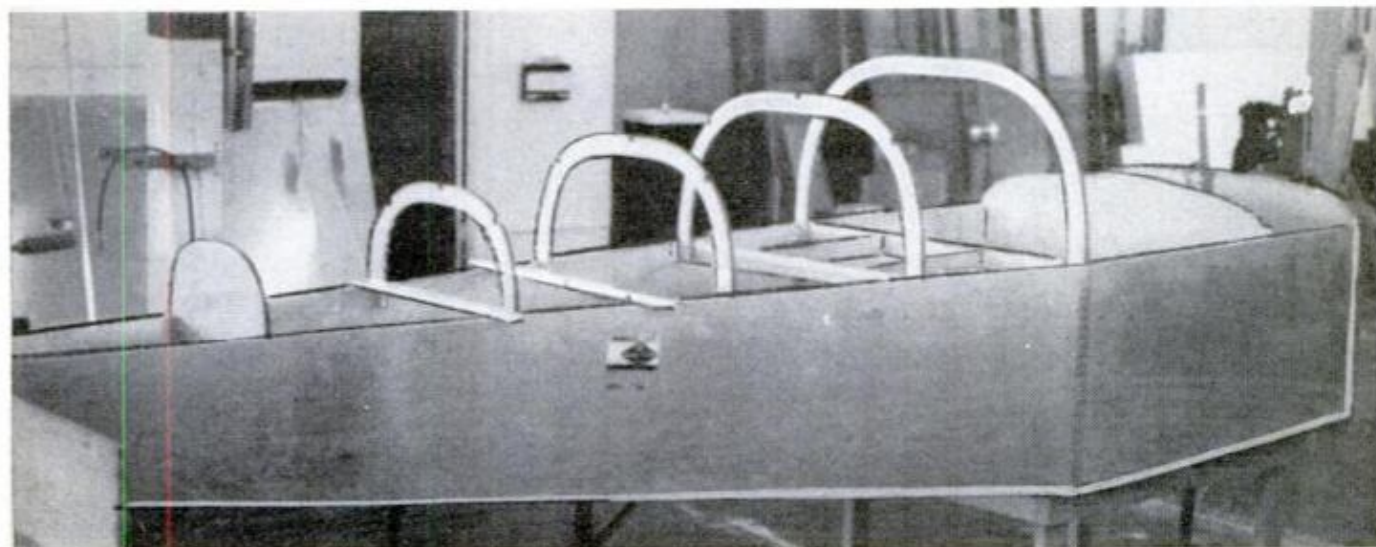
Their first effort was an executive STOL with some rare innovations. It had two engines buried in the fuselage driving one pusher propeller which was enclosed in a shroud. Along with boundary-layer control in the wings, the radical design gave the plane (the prototype was at Spring-

**CENTER SPAR** runs under cockpit and juts beyond wing fairing. Wing spar fits over center spar, and lip on wing fits over fairing. Note flap control

**WING SPAR** is large hole. Other holes are part of wing brace. The 6½-inch extruded-steel spar runs length of wing panel, gives it superior rigidity



**BD-1 FUSELAGE** is 50 percent honeycomb material, and all of it is shown here. Note bulkheads. All were cut from same slab, each one smaller than last one. Two sides were cut from same slab, identical and interchangeable







**INTERCHANGEABLE PARTS** are most unique feature of BD-1. Note symmetry of tail assembly; fins, tips and control surfaces can be used in any position



**BD BRAIN TRUST:** Jim Bede (left) and three high-school buddies, Don Keck, Larry Schneider and Dick Jiminez. Their ideas may shake up aircraft industry

field) a stalling speed of 42 m.p.h. and a remarkable cruising speed of 300 m.p.h.

Meanwhile, back at the drawing boards, they had been fooling around with designs for a small sports plane, using the honeycomb metal proved out in the STOL. When it began to shape up, they decided to push it ahead of the larger plane and Bede is frank to admit why.

"The market is bigger and, for a brand-new company, we figured we could get more publicity from it."

In a brand-new company, everybody does a little bit of everything (even the office girls were sanding down parts on the prototype before it flew) so it's hard to break down the duties. However, our impression is that Bede gets most of the ideas; Richard Jiminez and Lawrence Schneider, his two Wichita chums and qualified design engineers, translate his ideas into blueprints; and Donald Keck, their old high-school buddy and a meticulous do-it-yourself type, translates the paperwork into hardware. It's an ideal arrangement.

We asked Bede, when this fearsome foursome first sat down to discuss the plane, what was the sequence? How do you design a \$2500 airplane?

"We had several things we wanted to incorporate in the design—the honeycomb metal, the bonded construction, glass-fiber landing gear, a removable wing, extruded-steel wing spar and interchangeable parts—but when you put things down on paper, you have to start somewhere.

"We wanted a two-place plane. That set the size of the cockpit and, indirectly, the

size of the fuselage. We wanted a tricycle landing gear. That affected weight distribution. We wanted a low-wing airplane, because it's cheaper to build, better for acrobatics, and looks better. (Don't kid yourself. Airplane owners are as impressed by chrome plate and styling as automobile owners.) And we wanted a small airplane, the smaller the better, because we could use lighter materials and the plane would have good low-speed qualities.

"At each stage of the design, we tried to keep it as simple as possible so we could keep the cost down and, more important, keep the price down. After we had nearly completed the design, we started backing up to see how many of the parts we could make interchangeable."

Here is probably the most amazing part. "When we finished we had a plane with only 385 parts, and only 175 of them were different. Some of the other light planes (he named two) have from 1600 to 4000 different parts."

This remarkable reduction in number of parts—and consequent reduction in labor—is the principal reason for the price breakthrough.

Item by item, these are some of the BD-1 features:

**All-metal**—It's 95 percent true. The nose cowlings, wing fairings and wing tips, landing gear, tail tip and tail-assembly tips are all glass-fiber, but the rest of the plane, especially the structural parts, are mostly aluminum. One major exception is the steel tube used as the wing spar.

**Honeycomb parts**—Proven on jets, this

[\(Please turn to page 228\)](#)



# Your Emergency Road Service Chart

By Morton J. Schultz



ROAD BREAKDOWNS can happen to anyone. Pushing or towing the vehicle offers no problem in a car with standard shift; just put it in neutral. But with automatics, damage can occur if you don't know the correct procedure.

If the push or tow is short (up to five miles) there's no need to get a wrecker or disconnect the propeller shaft—the safest methods. But extended distances call for

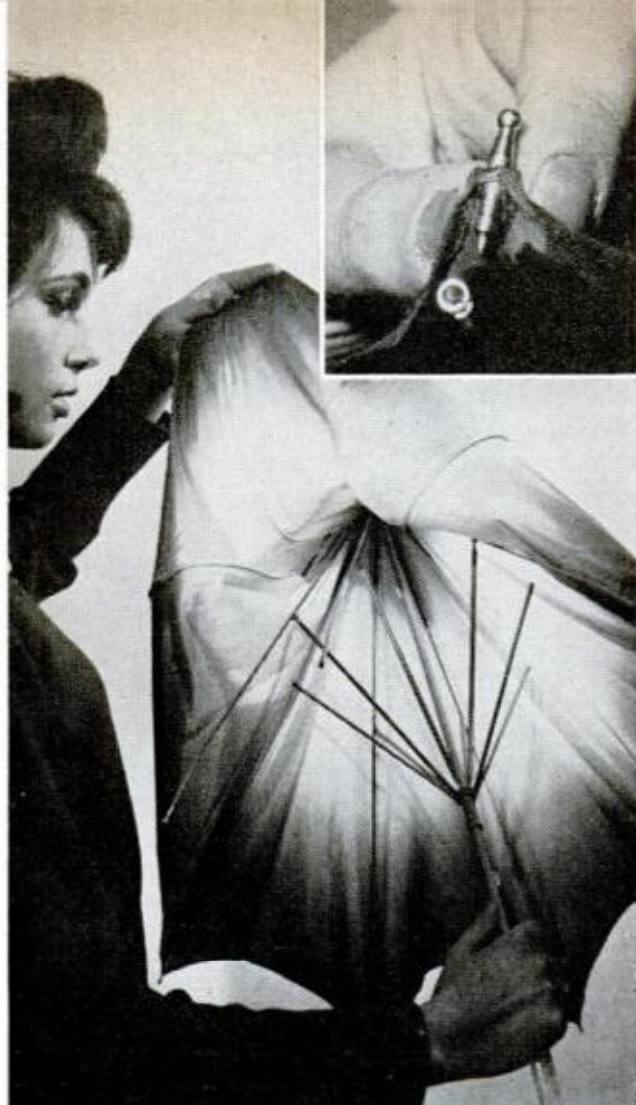
special techniques. On this page, *Popular Mechanics* presents a chart for your glove compartment, outlining correct push and tow methods for American cars with automatic transmission (models 1959-'64). If your model is not listed, the procedure for the corporate manufacturer applies. For example, Chrysler rules hold for Dodge. Corvairs need different handling than Chevrolets, so they're listed separately.

## PUSH AND TOW SPECIFICATIONS CHART

CAR & YEAR	PUSH-TO-START			PUSHING & TOWING		
	Begin Push In—	Until Reaching This Minimum Speed—	Then Shift to—	Shift Lever Position	Maximum Push-Tow Speed	Maximum Distance (4 Wheels on Ground)
Buick (1959-63)	Neutral	15 m.p.h.	Low	Neutral	25 m.p.h.	*Short
Buick (1964)	Cannot be started by pushing			Neutral	25 m.p.h.	*Short
Buick Special & Skylark (1959-64)	Cannot be started by pushing			Neutral	25 m.p.h.	*Short
Cadillac (1959-64)	Cannot be started by pushing			Neutral	30 m.p.h.	50 miles
Chevrolet (1959-64)	Neutral	25-30 m.p.h.	Low or Grade Retard (Turbo-glide)	Neutral	30 m.p.h.	*Short
Chevrolet Corvair (1960)	Neutral	25-30 m.p.h.	Low	Neutral	30 m.p.h.	*Short
Chevrolet Corvair (1961-64)	Neutral	25-30 m.p.h.	Low	Neutral	50 m.p.h.	*Short
Chrysler Corporation-produced cars (1959-64)	Neutral (Powerflite) Low or First (Torqueflite)	25 m.p.h. 25 m.p.h.	Low No Shift	Neutral	35 m.p.h.	100 miles
Comet (1960-63)	Neutral	25 m.p.h.	Low	Neutral	30 m.p.h.	15 miles
Comet (1964)	Cannot be started by pushing			Neutral	30 m.p.h.	15 miles
Edsel (1959-60)	Neutral	30 m.p.h.	Low	Neutral	40 m.p.h.	12 miles
Ford (1959-64)	Neutral (Fordomatic 3-speed) Neutral (Fordomatic 2-speed & Cruise-O-Matic)	30 m.p.h. 25 m.p.h.	Low Low	Neutral Neutral	40 m.p.h. 30 m.p.h.	12 miles 15 miles
Lincoln (1959-64)	Neutral	25 m.p.h.	Low	Neutral	40 m.p.h.	12 miles
Mercury (1959-64)	Neutral	25 m.p.h.	Low	Neutral	40 m.p.h.	12 miles
Mercury Meteor (1961-64)	Neutral	25 m.p.h.	Low	Neutral	30 m.p.h.	15 miles
Oldsmobile (1959-64)	Cannot be started by pushing			Not recommended with four wheels on ground. Lift rear wheels off ground to tow or disconnect propeller shaft to push.		
Oldsmobile F-85 (1961-64)	Cannot be started by pushing			Neutral	30 m.p.h.	*Short
Pontiac (1959-64)	Cannot be started by pushing			Neutral	30 m.p.h.	50 miles
Pontiac Tempest (1961-64)	Neutral	20-25 m.p.h.	Low	Neutral	30 m.p.h.	50 miles
Rambler (1959-64)	Neutral	30 m.p.h.	D-1	Neutral	40 m.p.h.	*Short
Studebaker (1959-64)	Neutral	20-30 m.p.h.	Low or 1st (Floor shift)	Neutral	30 m.p.h.	15 miles

\*Maker specifies no distance; for safety, don't exceed 5 miles





### ◀ Chameleon Umbrella

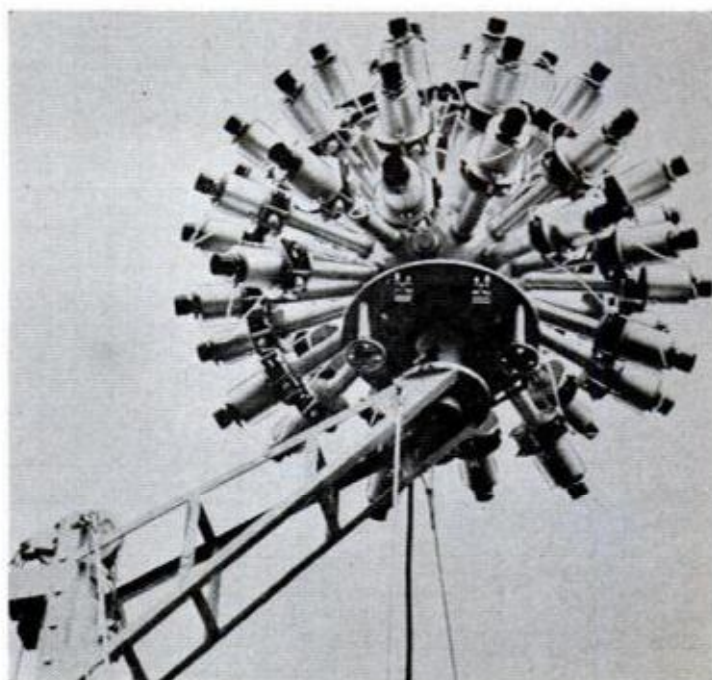
Covers of the "quick-change" umbrella can always match a lady's outfit. Each different cover slips on over the ferrule and stems (inset) of the frame. Price is \$3.25; maker is A. & L. Lister, Ltd., of England.

### Buttons Replace Dials

Telephone "dialing" by pushbutton has started in two Pennsylvania towns and will be made available to other areas in the future by the Bell System. The caller simply pushes the buttons in sequence. The advantage is speedier calling.

### Optical Pincushion

Fifty-six lenses of a Swiss panoramic movie camera record everything visible for a full hemisphere. A 39-foot-high dome, divided into 56 hexagons, is used for viewing the camera's images. It will be shown at the Swiss National Exhibition.







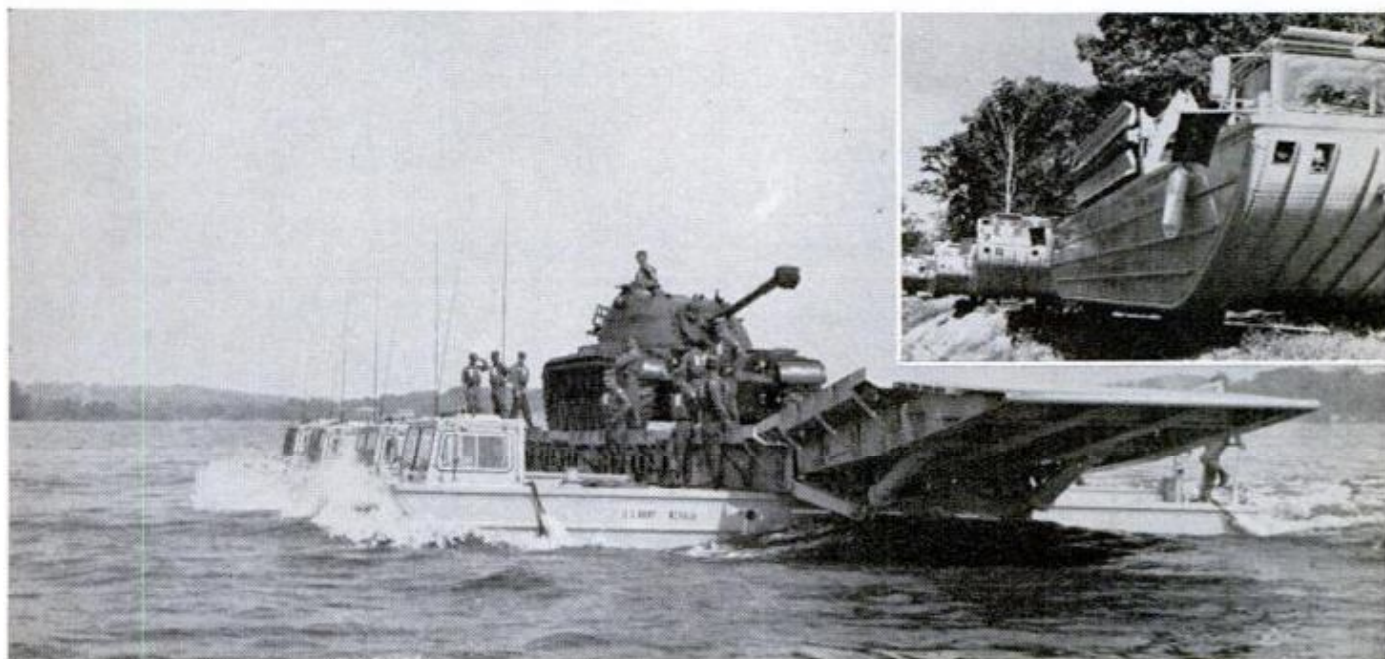
### Ceiling's Always Zero, but the Pilot Doesn't Mind

For this eight-year-old, the best substitute for flying is taxiing her own plane. The nine-foot biplane, built by a Lumberton, N.C., flyer for his daughter, has a two-hp. engine that provides power for ground maneuvers. The nonflying craft is made of wood strips covered with doped-and-painted bed sheeting.

### Army Now Speeds Its Bridges Overland

Self-propelled bridge units in use by the Army can travel overland at 35 m.p.h. (inset) and then move directly into water to act as ferries or bridges. Bridge decks are carried lengthwise on the 16-ton vehicles as they travel on land. When they

enter water, the bridge decks rotate 90 degrees to form the bridge or ferry. In the photo below, a 47-ton tank is being taken across a river. The mobile floating assault bridge-ferry was developed by the Army at Fort Belvoir, Va.







**MONITOR**, an experimental design built in 1957 by Baker Mfg. Co. for the Navy, ran on ladder-type foils. Her movable rear foil was used for steering

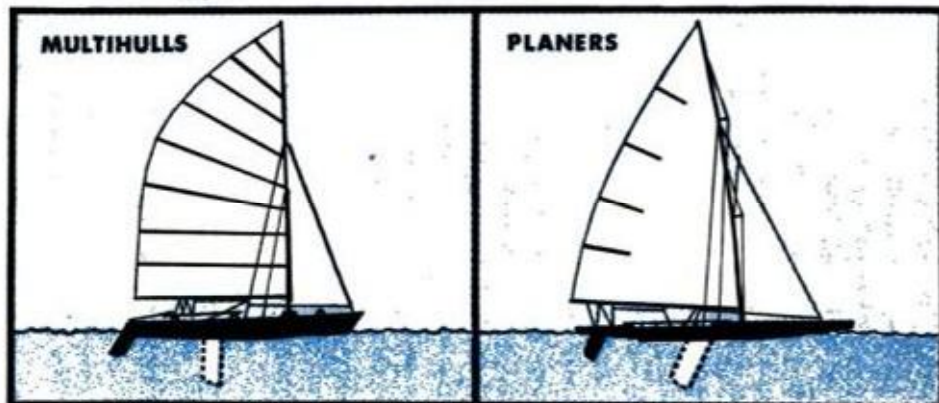
# The "How" of

*Speed takes on a new shape in modern sailboat racing as hot cats claw their way to the top of the competition heap*

**By Frank Rohr Jr.**



**SEALION**, a 25-ft. featherweight, weighs only 632 lbs. Her slim fibreglassed hulls are planked with strips of polyurethane foam







**BEVERLY**, over-all winner of the 1963 OAK Regatta, lost to *Sealion* later in the year but is still rated as one of the fastest racing sailboats in the world



**MALIBU OUTRIGGER**, an up-to-date version of the old Polynesian sailing craft, features two hulls of different sizes with mast stepped in larger one

# Those Hopped-Up Sailboats

**W**ATER SKI behind a sailboat? Sounds ridiculous, doesn't it?

But it's possible with any of today's larger high-speed catamarans. True, only a real ski buff would get much of a kick out of this stunt, but the fact that it can be done points up the tremendous speed and power of the modern sailing catamaran.

Today's cats are the kings of sailboat racing, and their position of supremacy can hardly be challenged by even the most die-hard single-hull fan after last year's One-of-a-Kind Regatta. Held in Miami, this "World Series of Sailing" turned out to be a big bowl of cream for the cats.

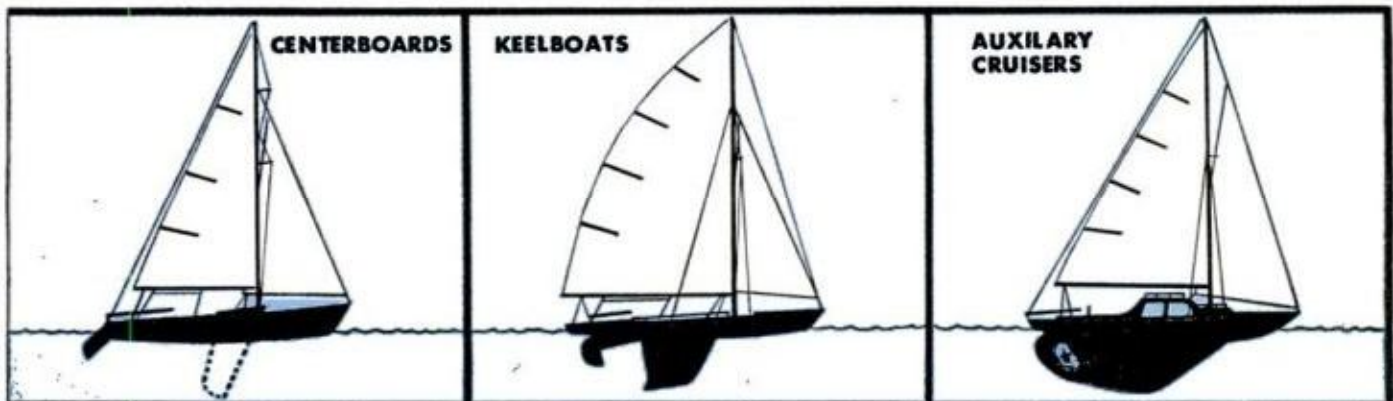
At speeds approaching 30 knots, a 25-ft.

cat named *Beverly* easily skimmed away from the closest monohulls to win the title of "World's Fastest Sailboat."

The OAK Regatta is held at irregular intervals—just how often depending on progress in sailboat design—and brings together both custom and development class daysailers with representatives of a wide variety of one-design classes. (Technically, a one-design class is made up of a number of small racing sailboats built to the same basic set of specifications, thus making it possible to hold class races without handicapping.)

Designed by MacLear & Harris, *Beverly* became the first boat in the history of the

**DIFFERENT TYPES** of sailboats shown below illustrate the changes in hull design over the years. Auxiliaries and keelboats, traditionally larger than the rest, achieve stability through fixed ballast instead of live ballast







**24-FT. TRIMARAN** has stabilizing foils on the outrigger hulls, tops 20 knots with 275-sq.-ft. of sail. It's owned by Dick Newick of the U.S. Virgin Islands



**LINKED BY THREE** transverse aluminum tubes, *Beverly's* twin 25-ft. fiberglass hulls are mounted far enough apart to give the boat a whopping 12-ft. 6-in. beam

meet to win both elapsed victories in every heat as well as the perpetual Small Boat Open Championship for best over-all corrected time. Her stop-watch rate of 28.3 m.p.h. was fast even for a cat, and she actually lapped the swiftest monohulls on the weather leg.

Just to show that *Beverly's* victory wasn't a fluke, cats also took the next 10 places over-all. The 12th spot—first place among the monohulls—went to a scow, the M-20.

Considering their spectacular record in recent years, it seems almost unbelievable that only a decade ago the majority of sailing enthusiasts were ridiculing catamarans as "funny looking" curiosities. At that time, anyone suggesting that cats would ever offer serious competition to the swift Inland Lake Scows would have been laughed off the dock.

The catamaran type, of course, had been

familiar since the first Polynesian outriggers. Indeed modern versions of the outrigger design competed against *Beverly* in Miami. But until 1959, small catamarans had two big drawbacks—they performed poorly in light weather and had difficulty going to windward.

Up to that time, cats had been built with knifelike asymmetrical hulls almost flat on the outboard side and sharply curved on the inboard side. They had deep sections and sharp V bottoms.

The 1959 OAK Regatta marked the debut of a radically different cat design. *Tiger*cat, a 17-ft. twin-hulled speed demon designed by Bob Harris and Bill Cox, sported relatively light shallow hulls which were exactly symmetrical. And this turned out to be the magic combination, for *Tiger*cat went on to become the first multihull to win the One-of-a-Kind Regatta.

Actually, progress toward *Tiger*cat's

### Wings for the Cats?

In preparing this article, *Popular Mechanics* discovered that MacLear & Harris had already done some preliminary research on the shape of sailboats to come. We asked them for some rough sketches on the most promising approach, and these were translated into the artist's conception of a foil-equipped *Beverly* that you see on the opposite page.

Neither Frank MacLear nor Bob Harris envision this craft as maintaining a foil-riding attitude around a complete course. Instead, the foils would be cranked down by means of a worm gear once the boat reaches 15 or 20 knots when running, thus producing a healthy boost in speed. If conditions were right, they might conceivably be used for windward work.



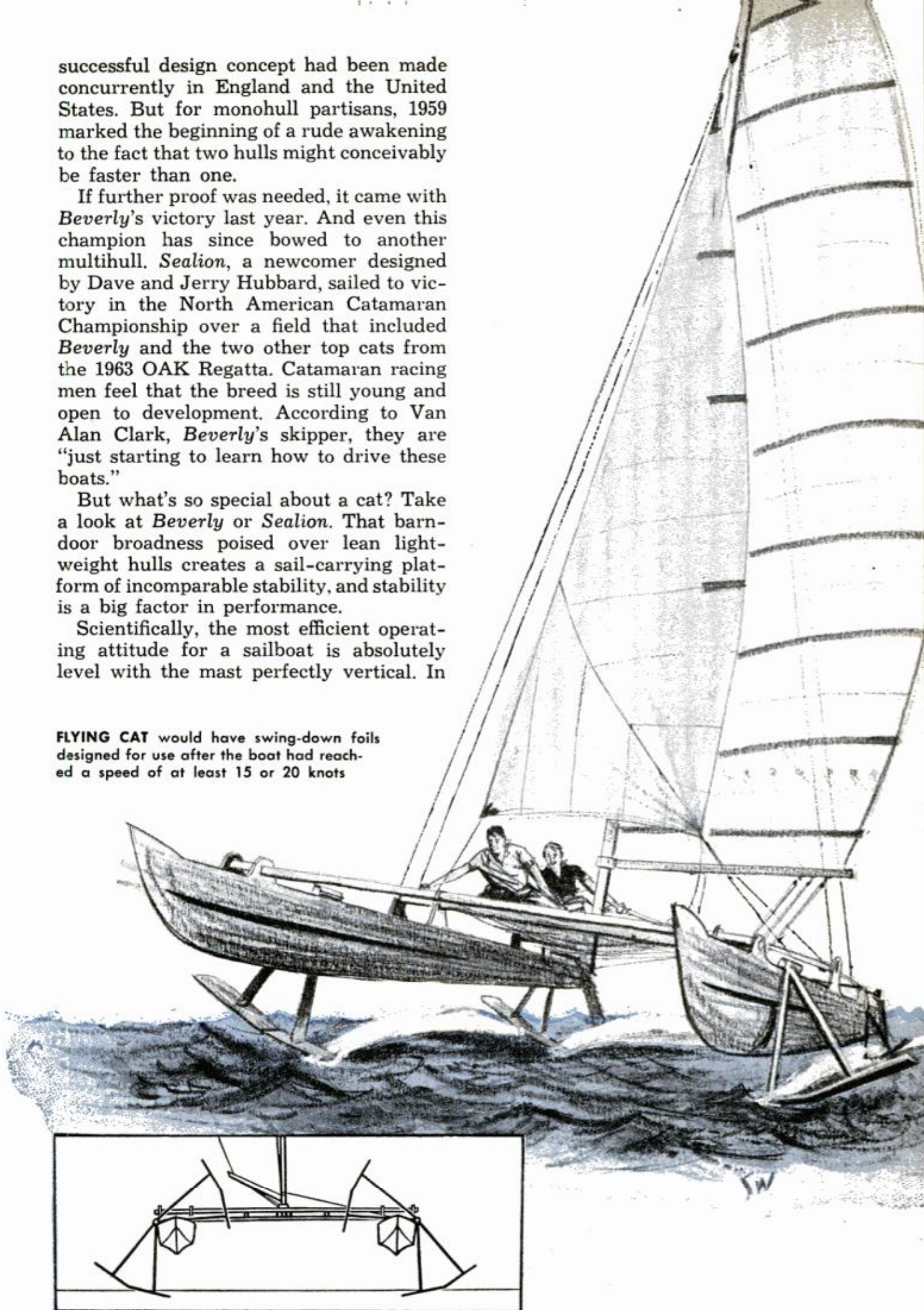
successful design concept had been made concurrently in England and the United States. But for monohull partisans, 1959 marked the beginning of a rude awakening to the fact that two hulls might conceivably be faster than one.

If further proof was needed, it came with *Beverly's* victory last year. And even this champion has since bowed to another multihull. *Sealion*, a newcomer designed by Dave and Jerry Hubbard, sailed to victory in the North American Catamaran Championship over a field that included *Beverly* and the two other top cats from the 1963 OAK Regatta. Catamaran racing men feel that the breed is still young and open to development. According to Van Alan Clark, *Beverly's* skipper, they are "just starting to learn how to drive these boats."

But what's so special about a cat? Take a look at *Beverly* or *Sealion*. That barn-door broadness poised over lean lightweight hulls creates a sail-carrying platform of incomparable stability, and stability is a big factor in performance.

Scientifically, the most efficient operating attitude for a sailboat is absolutely level with the mast perfectly vertical. In

**FLYING CAT** would have swing-down foils designed for use after the boat had reached a speed of at least 15 or 20 knots



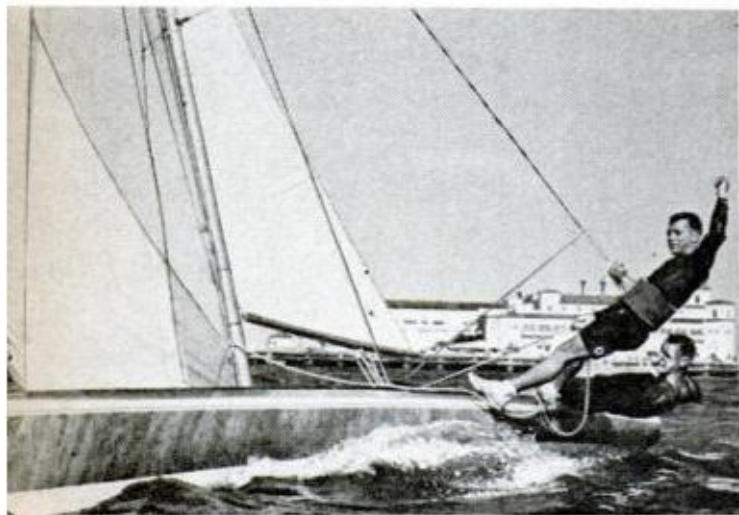




**HIKING STRAPS** secured both fore and aft on port and starboard sides enable the crew to throw their weight out to windward without danger of dunking



**HIKING BOARD**, still used in the International Decked Sailing Canoe class, has generally been replaced by trapeze. Note the "hiking stick" tiller extension



**TRAPEZE** slung from upper part of mast makes it possible for crew to stand on gunnel with weight outboard. It's almost a stock item on the hot monohulls

this position the sails can make the most complete use of the wind and achieve the greatest drive.

The catamaran under way is basically a stable needle with a tremendous sail carrying ability. *Beverly*, for instance, has a ridiculously low angle of heel—only five degrees. Most monohulls, on the other hand, will heel as much as 35 deg., losing both efficiency and drive in the process.

Incidentally, if you'd like to know whether a \$5000 catamaran can beat a \$500,000 America's Cup 12-meter, the answer is yes, probably eight out of 10 times.

In a way, the 1963 One-of-a-Kind Regatta resembled a pageant of progress in racing sailboat design.

Partly because the meet had grown so large and partly because the hottest monohulls (scows and trapeze planing boats) and cats had already shown signs of an

embarrassing superiority to conventional centerboarders and keel boats in match racing, the race committee divided the 83-boat fleet into five groups of relatively similar designs: 1) multihulls; 2) trapeze planing boats and scows; 3) conventional centerboarders; 4) racing keel boats; and 5) cruising auxiliaries up to 30 ft. in length. Handicaps were determined by a formula of length, sail area and keel.

Actually, these five divisions parallel historical developments in design. Back in the days of the big J and M boats, only press of sail could enhance speed. These beautiful monsters knifed *through* the water, and hull speed could be forecast as a function of effective waterline length. This still holds true for today's conventional displacement sailing craft.

However, in their continual search for

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



## Indoor Ski Resort

There's indoor skiing all winter long for Japanese skiers living around Tokyo.

The indoor resort, Sayama Ski Slopes, was built on a natural hillside and is covered with a metal roof.

Crushed ice is fed by conveyor belts to blowers that spread the artificial snow evenly over the hill. It takes about 200 tons of the snow to equal a mountain slope that is safe for skiing.

Capacity of the slope is 1000 persons. There are enough skis, poles and boots on hand to rent to those 1000 skiers.

There's even a ski lift that'll take tired sportsmen to the top of the slope for eight cents.

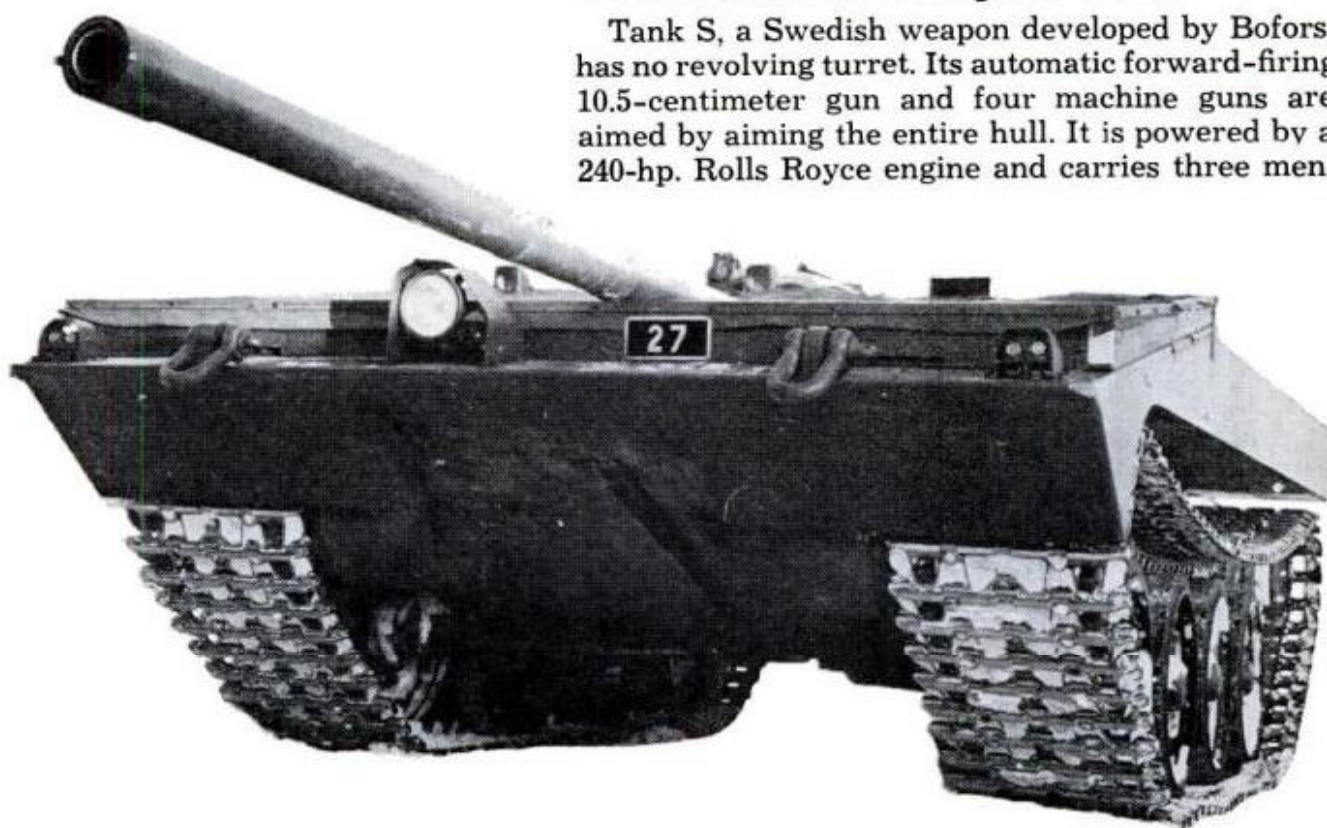
The indoor slide is located 25 miles from Tokyo at the end of an electric rail line.

Average temperatures there during the skiing season are 40 to 50 degrees.



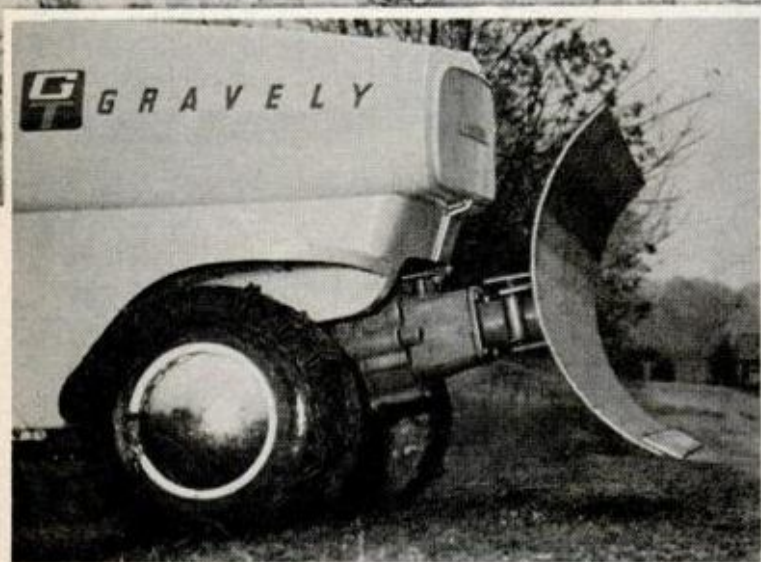
## Tank Aims Like a Fighter Plane

Tank S, a Swedish weapon developed by Bofors, has no revolving turret. Its automatic forward-firing 10.5-centimeter gun and four machine guns are aimed by aiming the entire hull. It is powered by a 240-hp. Rolls Royce engine and carries three men.





# Backyard Bulldozer



**WITH AID OF CHAINS, DUAL WHEELS,** husky little riding tractor keeps moving, even through heavy mud. If it sinks too deep, operator can rock loose by working the forward-reverse lever back and forth

**TO GET OVER ROUGH SPOTS,** or travel on roads, operator can raise attachment with a hydraulic lift similar to that on a bulldozer. This is possible because attachment and engine both pivot on the front axle



**LOW CENTER OF GRAVITY** lets operator mow right along on a precarious slope. It's been tested successfully on grades of up to 60 percent. Note also that all engine parts are enclosed—good safety feature



*New estate-sized lawn mower packs a 12-hp. wallop that lets it tackle many tough jobs*

**P**OWERFUL ENOUGH to be used as a bulldozer for light grading—as well as for plowing snow—Gravely's new riding tractor, the Westchester, has other unusual features:

It has front-wheel drive, its body is made of weatherproof fiberglass and it can be shifted instantly from forward to reverse without clutching.

With a 12-hp., one-cylinder engine, the Westchester is the most powerful garden tractor we know of. And its relatively low operating speed of 3000 r.p.m. gives more torque, or usable force, than, say, an engine of 10 hp. and 3800 r.p.m. Also, says the manufacturer, the low operating speed should mean less wear, fewer repair bills.

When I saw the new tractor in action, it seemed to have an unusual degree of control and maneuverability. For example, the operator was able to trim grass within inches of a tree, and mow smoothly along a steep slope that would have toppled many other machines. Such feats are made possible, says the company, by a combination of factors.

For one thing, a low center of gravity gives stability. Then, most of the machine's attachments mount on the front. Besides letting the operator see exactly what he's doing, this adds the attachment's weight to that of the engine, which bears on the front drive wheels. Result is excellent traction. To maintain this traction, a differential permits either drive wheel to keep turning if the opposite wheel bogs down or slips.

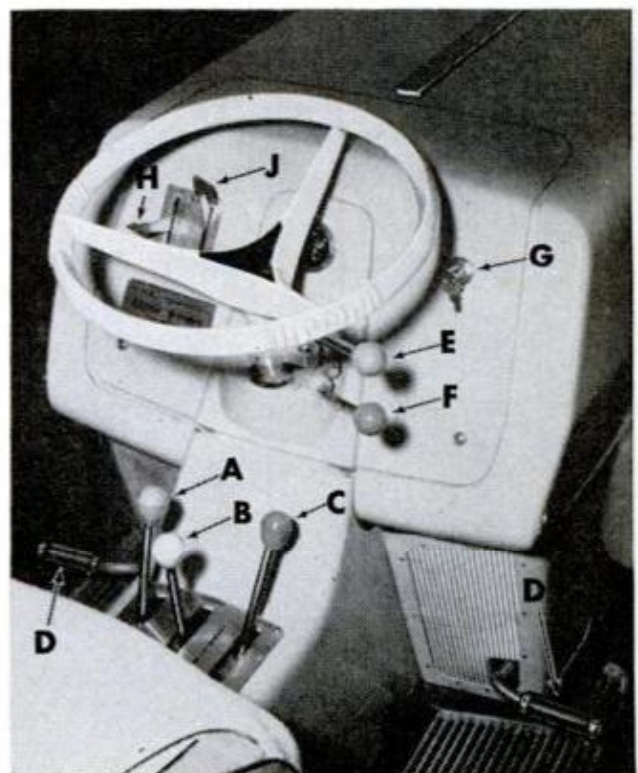
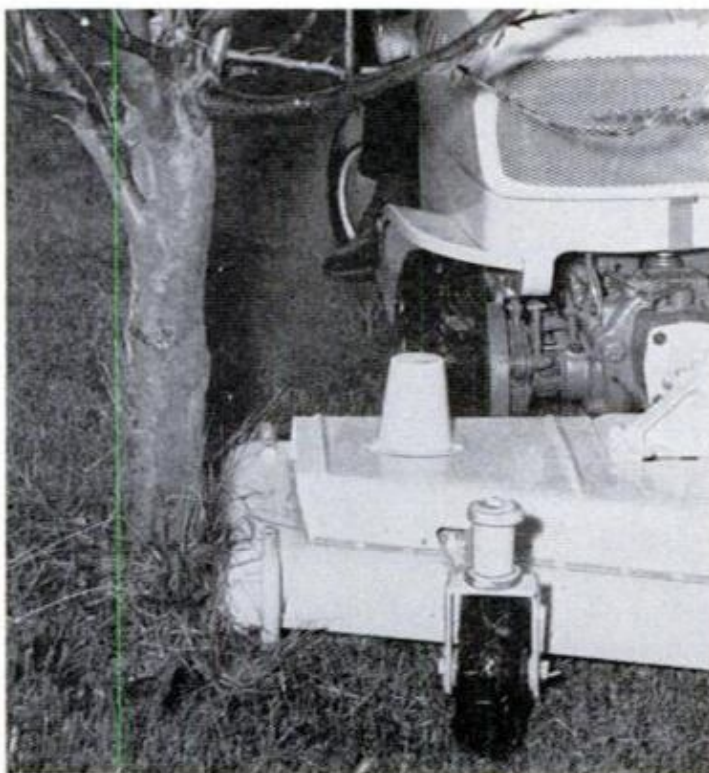
But to me, the most impressive control feature is a choice of four forward and reverse gears, giving maximum speeds of 1.55 to 4.25 m.p.h. You can change gear without declutching, and by merely flipping a lever, you go instantaneously from forward to reverse, or vice versa.

Gravely will offer nine attachments for the Westchester—two rotary mowers, a reel mower, a cedar spreader, a snow plow-dozer blade, a lawn roller, a 20-gallon sprayer, a utility scoop (for clearing trash or snow) and a snow blower.

What about prices? About \$875—with the attachments extra.—*Art Maher*

**CUTTING IT CLOSE:** With mower attached to front, and engine in low range-low gear, operator can inch up to flower beds, poles or trees. This eliminates a lot of the trimming that is normally required

**LAYOUT OF CONTROLS:** A, speed range selector; B, forward-reverse; C, gearshift; D, individual side brakes; E, attachment lift; F, attachment clutch lever; G, key-type ignition switch; H, throttle; J, choke







# Dwarf

*For spacemen, this little robot genius will be servant, pilot, guide, astronomer and mathematician, rolled into one. Without it, there might not be a trip to the moon*

**By Volta Torrey**



# to Guide Apollo

WHEN THREE ASTRONAUTS embark from Florida for the moon, a dwarf standing at the navigator's feet will steer their ship. The human navigator will be lying in a couch, as will the ship's commander on his left and the engineer on his right. The dwarf will be upright at the helm while rocket engines shoot the ship through the sky.

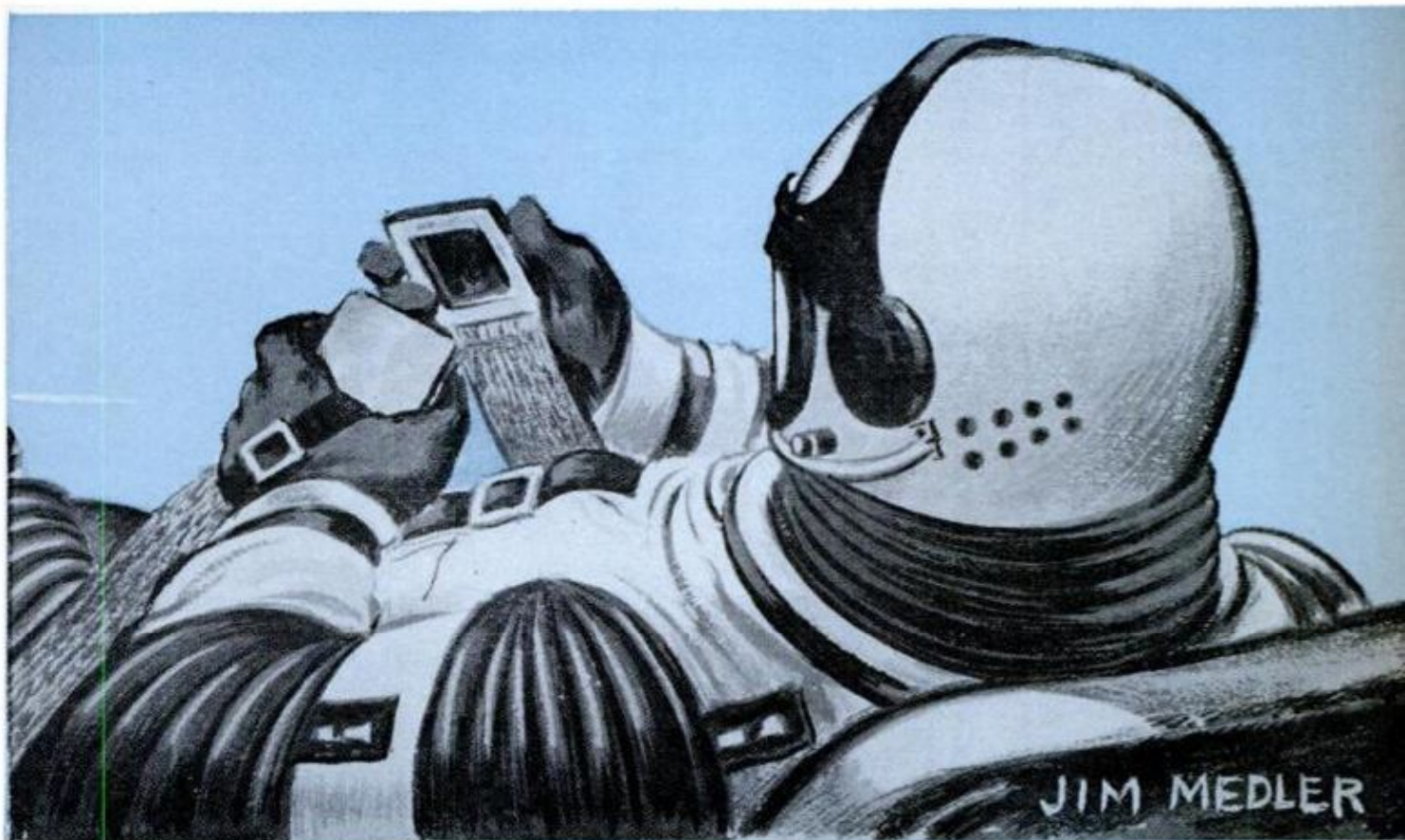
Suppose you were the navigator (no one has been chosen for the job yet). When you rose from your couch, the dwarf would tell you where you were headed and how fast you were going. While you floated around and peeked out of your tiny cabin, it would be your mathematician. Whenever your ship needed another powerful thrust—which you might have to go back to bed to endure—the dwarf would take charge again.

This new kind of pilot, only four feet

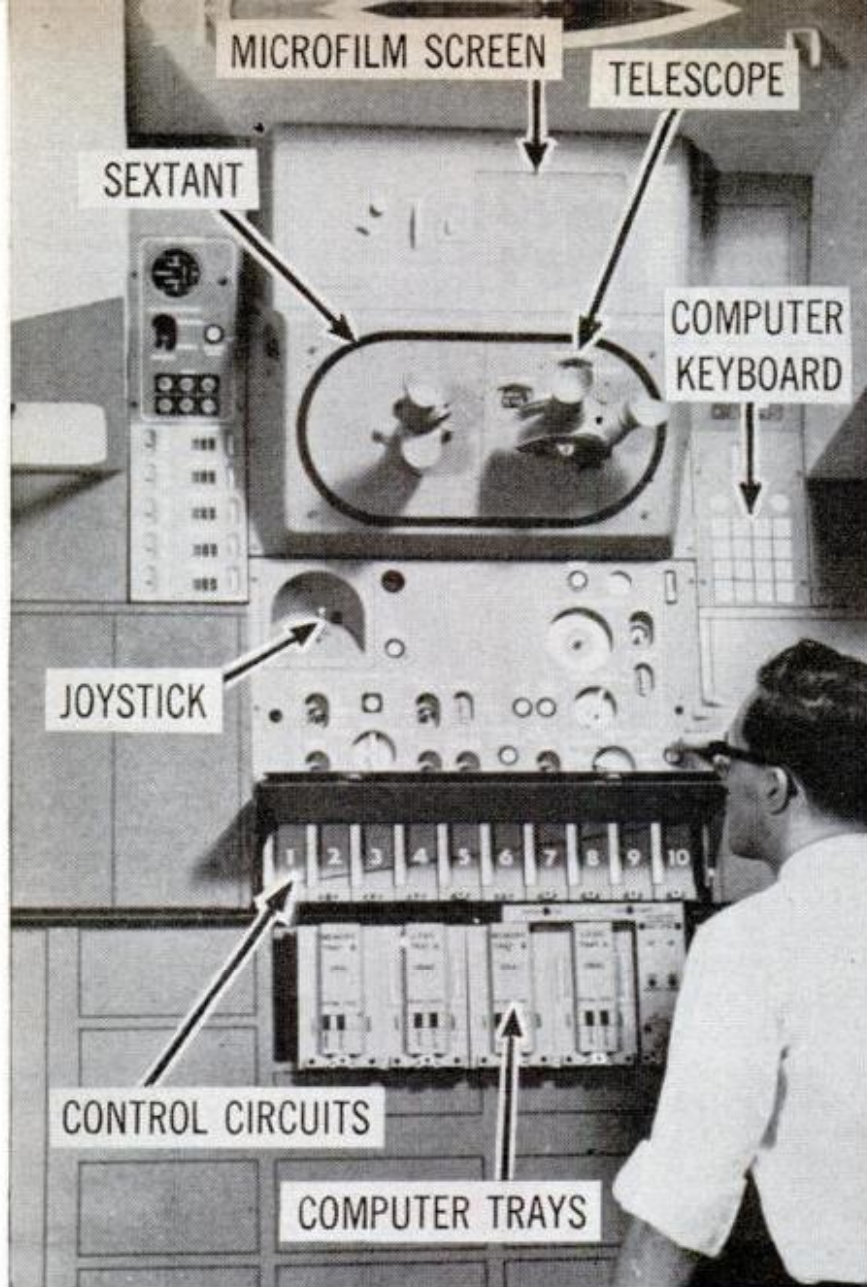
high and at no point more than three feet wide, was designed at the Massachusetts Institute of Technology and is being prepared now to go aboard the Apollo moon craft. For the astronauts, the builders say it will be "an intelligent servant with high-level capabilities."

They refer to it, as they might to a person, by its initials: G&N, for guidance and navigation. It is a descendant of systems now in use on missiles and subs; compared to its forefathers it is a midget.

Columbus would have welcomed G&N aboard the *Santa Maria*. When he sailed the ocean blue in 1492, he kept two reckonings, one for himself and an optimistic one for his crew. Even so, his men rebelled when they saw the compass at variance. A meteor nearby, the weeds of the Sargasso Sea, low clouds and birds, but no land, roused superstitions. Apollo's G&N



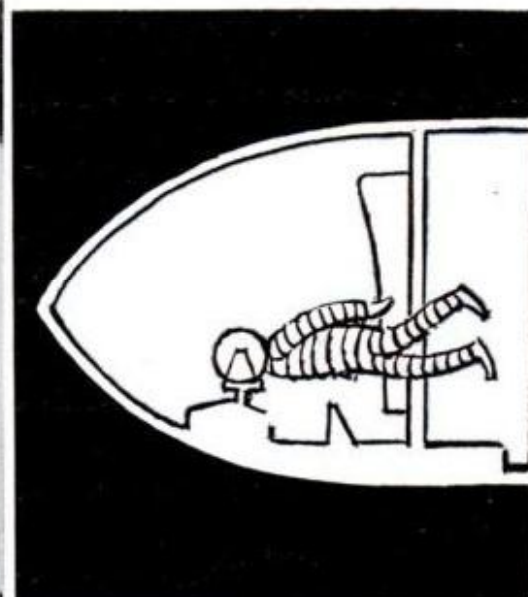




**MOCKUP OF G&N** (guidance and navigation), the awesomely talented dwarf which will guide Apollo space craft to the moon and back. Developed at M.I.T., it has two measuring systems and an electronic brain



**DURING BLASTOFF**, the navigator lies prone on a couch, with the dwarf standing erect at his feet



**ONCE IN ORBIT**, the navigator can move around cabin and peer at the sky through a telescope

will be capable of many reckonings, and if the astronauts see things that puzzle them it will be able to reassure them.

Once under way, Columbus was free from kibitzers in Europe, but the men going to the moon will have no such privacy. The boys in the backroom on earth will be watching and advising these explorers; if the experts send fresh instructions to Apollo, the dwarf will put them into effect. But it will not be dependent on monitoring or coaching by anyone on earth.

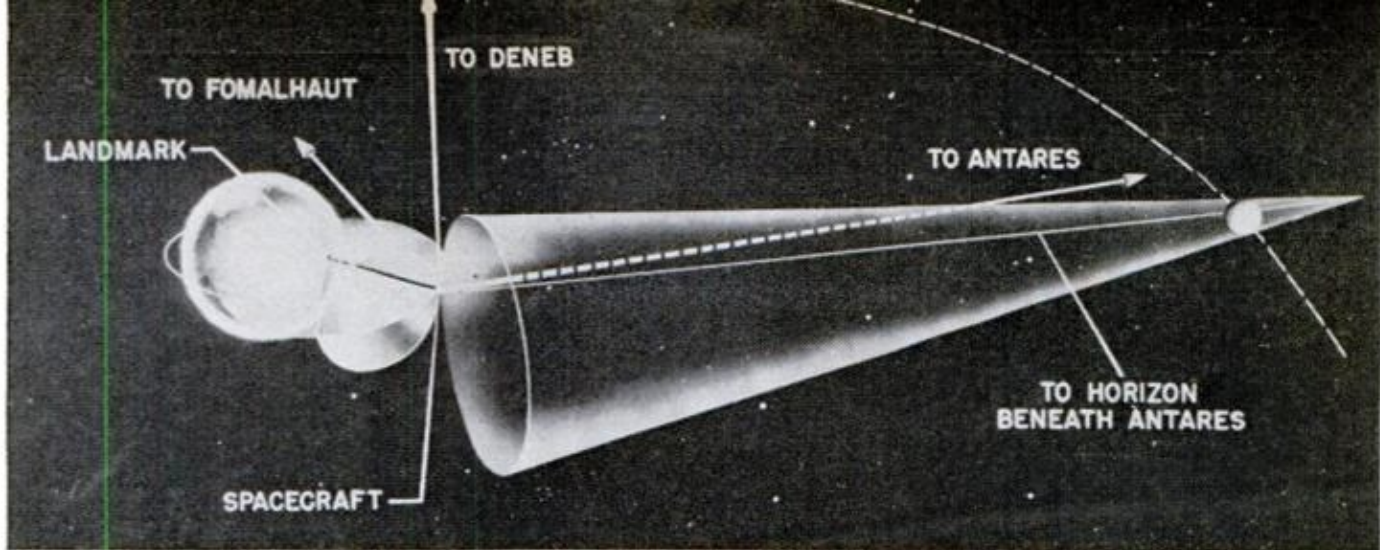
G&N will have an atlas, an almanac and an operating manual on microfilm. Whenever the navigator wishes, it will display a frame from this library on a screen.

The dwarf is really just a compact combination of things that men use every day. It has three principal parts: two measur-

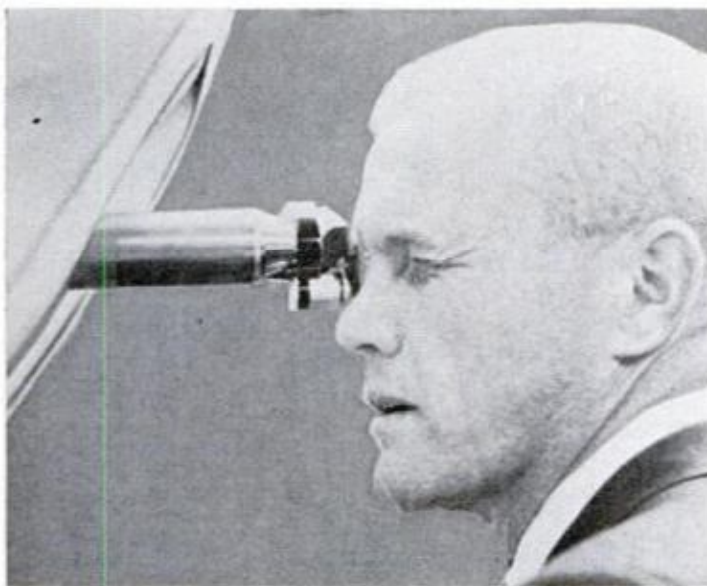
ing systems and an electronic brain. Hundreds of men have worked more than a million hours to improve these three components, however, and the M.I.T. Instrumentation Laboratory has found new ways to use them to control a ship far out in the vacuum of space.

Keeping a vehicle on an imaginary line is easier in a near vacuum than in rough air or water. But to go from one port to another in space, you must keep all three of the solar system's dimensions in mind. A navigator on a fairly flat ocean need only note his progress in two dimensions, but the men heading for the moon will have to watch their course in three dimensions. Like seamen, they will use "landmarks" but much of the time these will be far away.

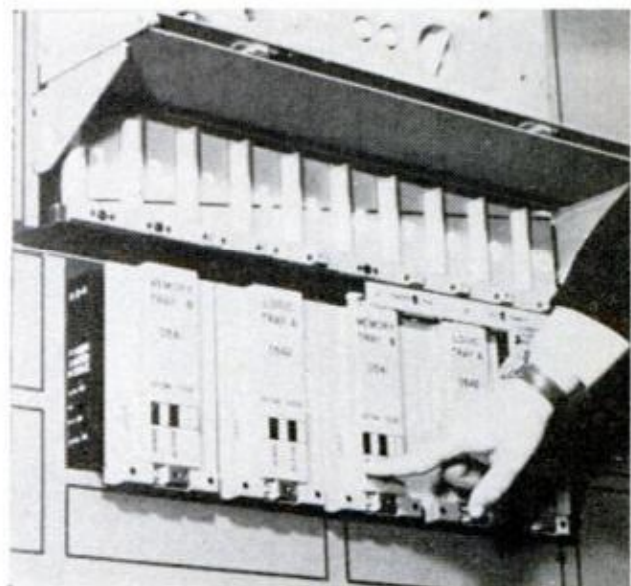




**TAKING A FIX** of your position in space involves sightings on two or more stars, plus a landmark on the earth or the moon. Fixes are taken by computers; spaceships move too fast for human computations to be accurate



**ASTRONAUT** John Glenn takes a visual celestial sighting through the Apollo space sextant. The spacemen will take some 40 fixes on the way to the moon



**TWO SETS OF TRAYS** beneath instrument panel hold the computer and the miniaturized circuits that operate G&N. Spare modules are carried for each tray

G&N's three measuring systems are:

- **An optical device**, including a sextant, which the men on the spaceship will use to determine angles. They will not have to work out their position from those measurements, however, because this will be done for them by other highly sophisticated G&N components.

- **An inertial device**, responding to properties of matter, will act as if it, too, had an eye fixed on a star which will enable it to hold a three-axis frame of reference.

Three little gyroscopes will keep an inner part of this inertial apparatus stable. Three even smaller pendulum accelerometers will measure the magnitude and direction of the shoves that the rocket engines give the ship. Those three speedometers will send electrical pulses to the

computer: the pulses will tell the computer where the ship is and how fast it is going in each of three directions.

- **The computer** will be especially designed to handle moon flight data from either a man or a mechanism. It will have two parts, exactly alike, each of which can serve both the optical and the inertial measuring systems; each consists of interchangeable parts. This computer will have capabilities comparable to the giant "brains" used in earthbound laboratories and factories. But it will weigh less than 60 pounds and take up less than a cubic foot of space.

Once aloft, as Apollo's human navigator rises from his couch, he will face a panel in front of the inertial measuring system

[\(Please turn to page 220\)](#)

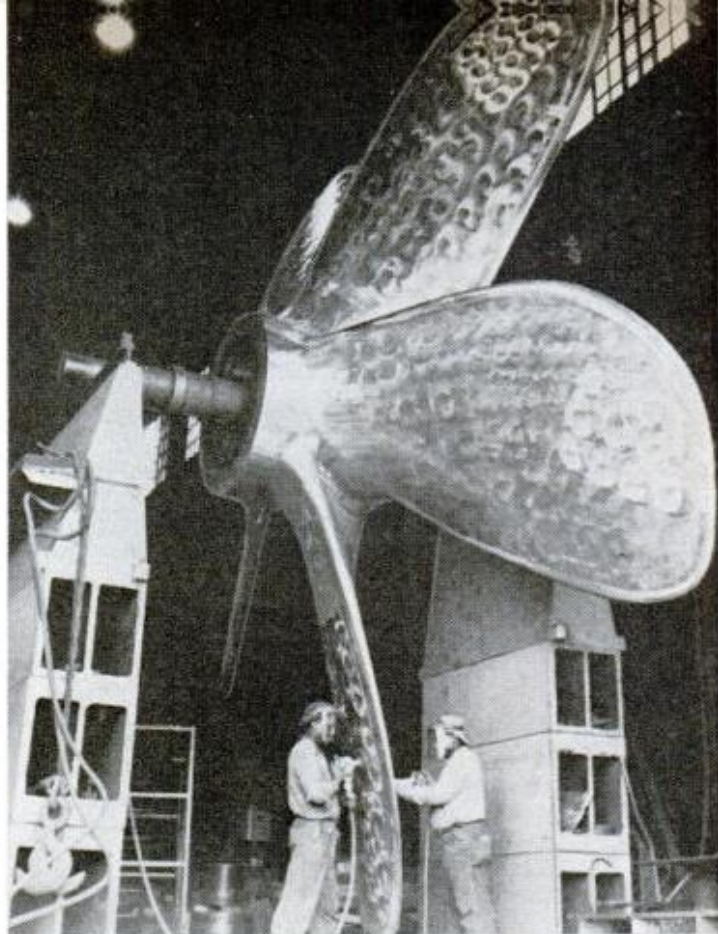




## Sails—Even Sawed in Two

You can go sailing, rowing or motorboating in the Squall. And what's more, you can't sink—even if the craft is sawed in two (top photo). Made of two fiberglass hulls bonded together with polyurethane foamed plastic, it will stay afloat even though completely awash; pull a plug in the bottom and the water drains out, whether the boat is empty or loaded.

Ideal for young sailors, the 115-pound, nine-foot craft comes completely equipped, including sails, for about \$500 (less as a rowboat) from the Chestnut Hill Boat Co., Stoughton, Mass.



## Giant Prop

A 41-ton propeller was recently shipped to Japan from Philadelphia for one of the biggest cargo ships afloat, the 114,356-ton *Universe Apollo*. The blade was made of a nickel-aluminum-bronze alloy by the Baldwin-Lima-Hamilton Corporation.

## North-Country Carrier

A light, cross-country truck designed for use in rough terrain and frigid climates has been developed by Volvo for the Swedish and Norwegian armies. The L 3314 has four-wheel drive, a top speed of 60 m.p.h. and it weighs 3310 pounds.







### First American Three-Engine Airliner Since the 1930s

A big new passenger jet designed for short runways will soon bring jet service to cities off the main air routes. The tri-jet Boeing 727, first American three-engine airliner since the old Ford Trimotor, can operate from 5000-foot runways even with

a full payload. Carrying 92 passengers, the 600-m.p.h. plane is powered by three tail-mounted Pratt & Whitney turbofan jets. Eastern and United Air Lines, first carriers to take delivery of the 727, have ordered 40 each of the one-class airliners.

### Speedy Rover

Drivers who like speed in small packages can hit 90 m.p.h. in less than 40 seconds in a new Rover sports car from Britain. With a top speed of more than 100 m.p.h., it has disk brakes, a four-speed all-synchromesh gearbox; under \$3600.



### Tiny Thermometer

Temperatures up to 1000 degrees C. can be measured with a 1/8-inch-long screw thermometer (arrow, left) developed by Royal Dutch Shell. The Templug, inserted in a hole (arrow, right), is used to measure heat levels in piston heads and the like.





*A budget weapon, the Topper 158 changes from rifle to shotgun in 10 seconds*



**BOTH RIFLE BARRELS** of the combination gun are drilled and tapped for scope mounting. The .22 Jet magnum with a 6X scope is an effective varmint rifle

**WHEN THE BARREL** is slipped into receiver and snapped into the breech lock, and fore-end snapped on, the gun is ready to fire. Barrels are replaced in a matter of a few seconds

**SPECIFICATIONS**  
**H&R Topper Model 158**

**Action:** Single shot, take down, side lever opening with automatic ejection

**Caliber/gauge:** .30-30, .22 Remington Jet, 20 ga., .410

**Over-all length:** 37½ inches

**Weight:** .30-30 rifle, 5 lbs. 12 oz.; .22 Jet rifle, 6 lbs.; 20 ga. shotgun, 5 lbs.; .410 shotgun, 5 lbs. 7 oz.

**Sights:** Lyman No. 16 folding adjustable rear sight. Ramp front sight. Front bead on shotguns.

**Rifling:** .30-30 rifle, 4 grooves; .22 Jet rifle, 6 grooves; both right twist

**Price:** \$35.75 in either rifle caliber. Extra rifle barrel in either caliber, \$16.75. Shotgun barrels in either caliber, \$12.





# Four-in-One Gun

**I**NTERCHANGEABLE RIFLE and shotgun barrels on a stock frame—something that disappeared from the scene in the early 1930s—have returned in the Harrington & Richardson Topper Model 158.

A single shot, center-fire weapon, the Topper features sturdiness, economy, light weight and simplicity of design. The frame is the standard Topper that appeared in 1958 as a single-barrel shotgun. Barrels in the new model are .30-.30 and .22 Remington Jet rifles; 20 ga. and .410 shotguns.

Barrels are changed by removing the fore-end, depressing the side lever lying alongside the hammer, and removing the barrel. A second barrel is snapped into place, the fore-end snapped on—the total operation taking only about 10 seconds.

The four barrels, hammer and lever are blued, and the receiver is finished in case-hardened colors. Stock and fore-end are finished walnut, and the stock is equipped with a recoil pad.

Complete with four barrels it retails for \$76.50, but it is also sold as a rifle in either caliber for \$35.75, with extra rifle barrel at \$16.75 and each shotgun barrel at \$12.

Its great appeal should be as a low-cost utility weapon for the casual varmint shooter and trap shooter, and as an "intro-

ductory" weapon for a teen-ager. The single-shot feature is a drawback for big-game hunting and bird shooting where a fast second shot is often vitally important.

The proof of a gun is in the shooting, and we fired the Topper at various intervals over a two-month period. With certain limitations, its performance was excellent.

Mounting a 6X Weaver scope on the .22 Jet Magnum (both rifle barrels are drilled and tapped to accommodate the Weaver #60 base), PM staffer, Bob Berger, fired four six-shot groups at 50 yards, kneeling. The best (shown below) is comparable to the accuracy of a small-bore magnum of twice the cost. The .30-30, fired with open adjustable sights, did not group as well, due to sharp recoil.

Both shotguns held a good tight pattern at 30 yards. We fired 100 shells through each barrel at hand-thrown clay targets. The light 20-gauge had considerable recoil that took getting used to before the targets were broken with consistency. The .410, on the other hand, was steady as a rock. We broke 20 targets in a row with the .410, and then proceeded to bust ice cubes thrown into the air—a difficult target.

As a well-made, dependable combination gun, the Topper 158 does its job well.

**SHOOTING** at a hand-thrown clay target, the .410 shotgun powders it while it is still on the rise

**SIX-SHOT GROUP** fired from 50 yards in kneeling position proves effectiveness of the .22 Jet magnum





# Buy a Piano You'll Keep on Enjoying

*Don't be a "tire kicker." Look inside for moth-eaten felts, excessive rust and damaged hammers*

By Jay J. Earl

**P**IANOS, like automobiles, depreciate sharply after the original purchase, so secondhand instruments can mean sizeable savings to the savvy consumer who knows what to look for "under the hood."

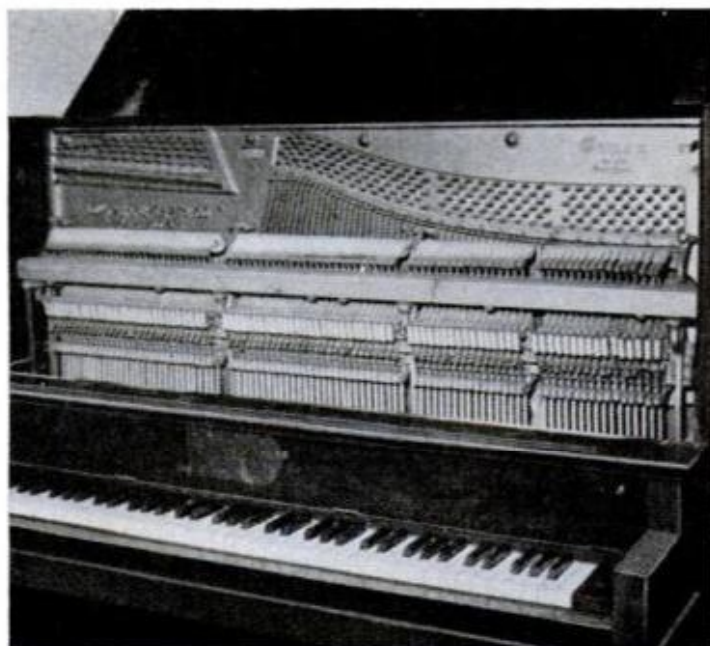
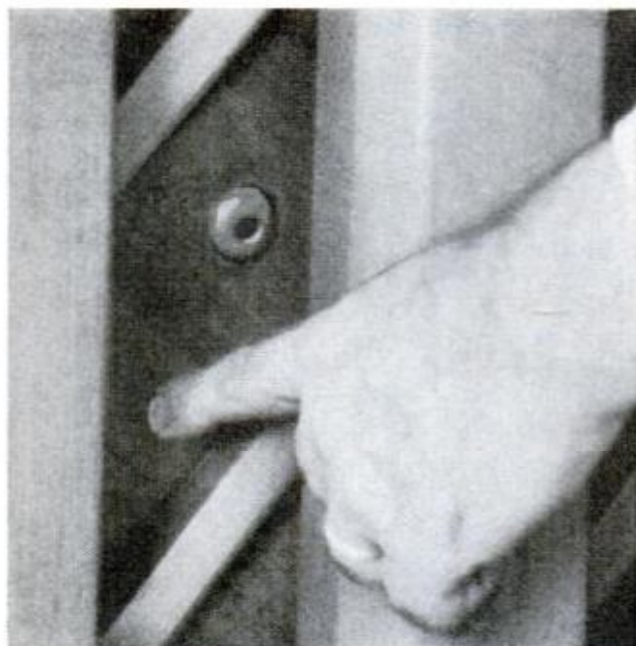
There is a vast price range in used pianos, from the \$20 practice piano for children's lessons to the \$500 spinet which will also do justice to a Bach fugue.

Price alone does not mean you are getting a bargain. The \$20 upright, for instance, may need a complete tuning, which can run as high as \$50, and will have to be moved (another \$50), raising the price to \$120. On the other hand, a piano priced at \$120 might have internal disorders that would make it totally worthless. But there are bargains in used pianos,

**PIANO KEYS** are tested for stability by grasping the "lip" of the key in the fingers and moving it sideways. If it touches the adjoining key, felt bushings have deteriorated and some will then have to be replaced

**BETWEEN** the upright posts at the back of the piano is the soundboard. If there are cracks in the grain of the wood, it will necessitate expensive repairs

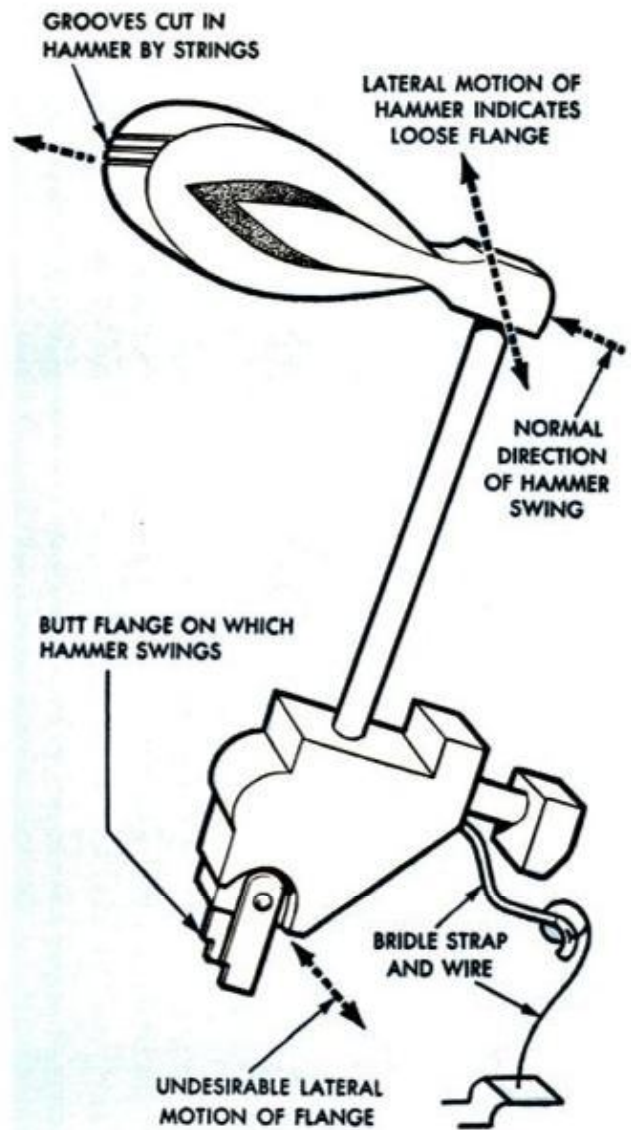
**WHEN THE FRONT** of the piano is removed, the "action" is exposed for examination. This is the system of levers which produces the instrument's sound





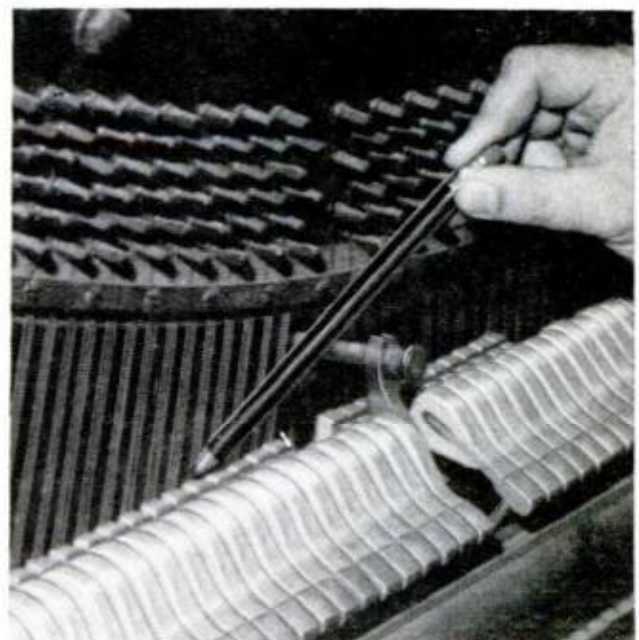
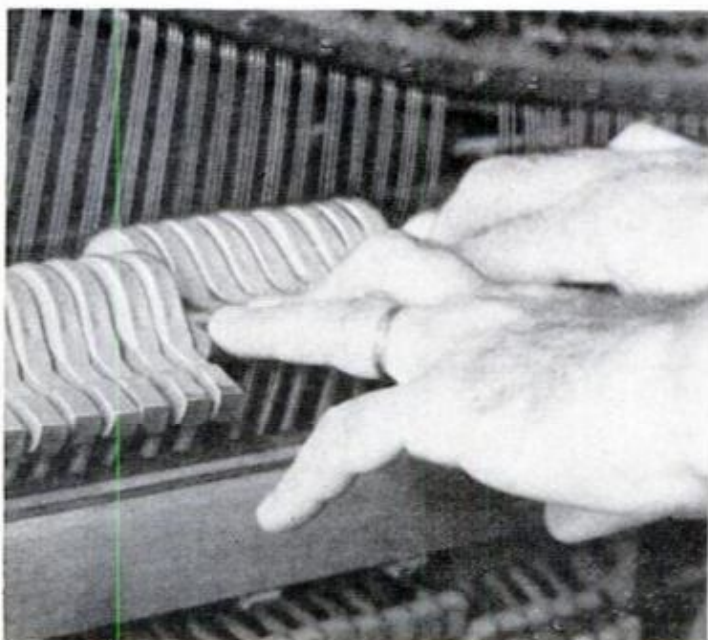


**TESTING HAMMERS** for "lateral motion" which will cause poor action and a distorted tone, move hammers forward and work them gently from side to side

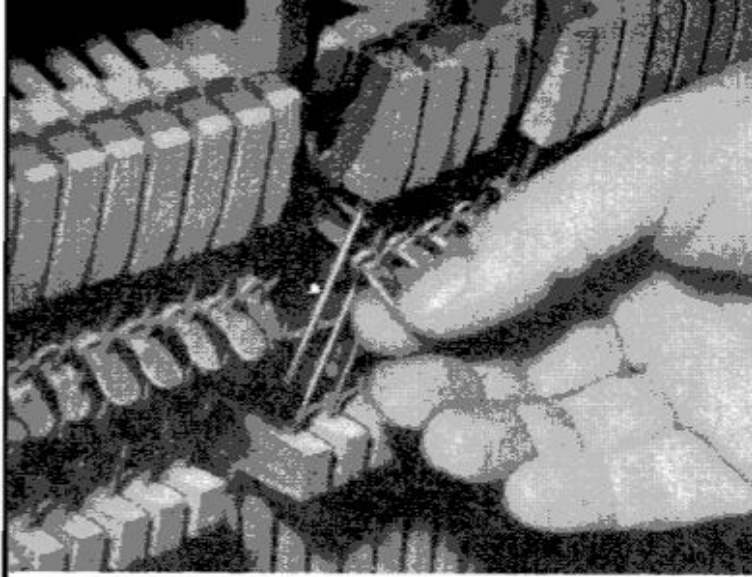


**TO PRODUCE** a clear, resonant sound, the hammer must be in good condition. Danger points are where it connects to stem and at the flange in the base

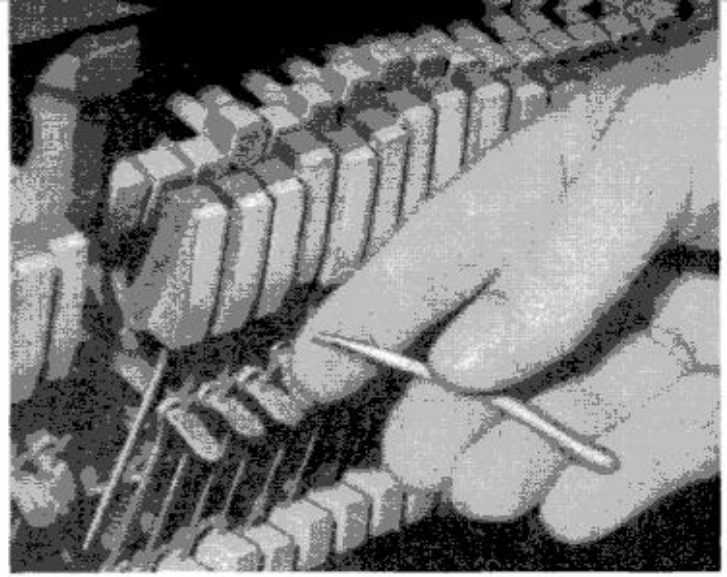
**DAMPERS** are small felt-tipped blocks of wood pressing against strings. If many are missing, it ruins the sound, and they are expensive to replace







**BROKEN BRIDLE TAPES**, fabric tapes attached to the base of the hammer and a vertical wire, mean a sluggish return of the hammer after hitting a note



**TEST BRIDLE TAPES** by simply giving them a firm pull. If they are rotted they will give easily. Replacement of a full set is an inexpensive repair

and you don't have to be a piano tuner to recognize the good from the bad when making a selection.

Surface characteristics have little to do with the condition of the instrument. Loose veneers can be easily reglued, and discolored woods can be painted. Begin your examination with the soundboard.

This is the back of the piano, the wood panel between the heavy support posts. It is easily recognized by its diagonal crossgrain. Held rigid by "ribs" glued to it, the soundboard carries vibrations from the strings, amplifying them by means of its own vibrations, created by its "crown" or bend under tension. Look closely for cracks along the grain or evidence of the board pulling away from the ribs. If you find either condition, forget the piano. Soundboard repairs are expensive.

While it is true, in certain cases—notably grand pianos—that minute cracks may not cause immediate trouble, it is probable they will expand, causing trouble.

If you have doubts about the soundboard's condition, go to the keyboard and thump a few vigorous chords opposite the crack. If there is a buzzing undertone, the condition is bad.

Satisfied with the soundboard, move on to the keyboard. Ignore any discoloring of the keys. Tuners clean keys by sanding and polishing them.

Grasp the slight overhang of a key between your fingers and move it sideways, backwards and forward. There should be a little give, but if it touches the key next to it, it means that the felt bushings are badly worn or eaten by moths. Keys that slant below the line of the keyboard have

broken supports. A few keys in either condition can be repaired, but a dozen or more might indicate that someone has been hitting the piano hard enough to cause serious internal damage.

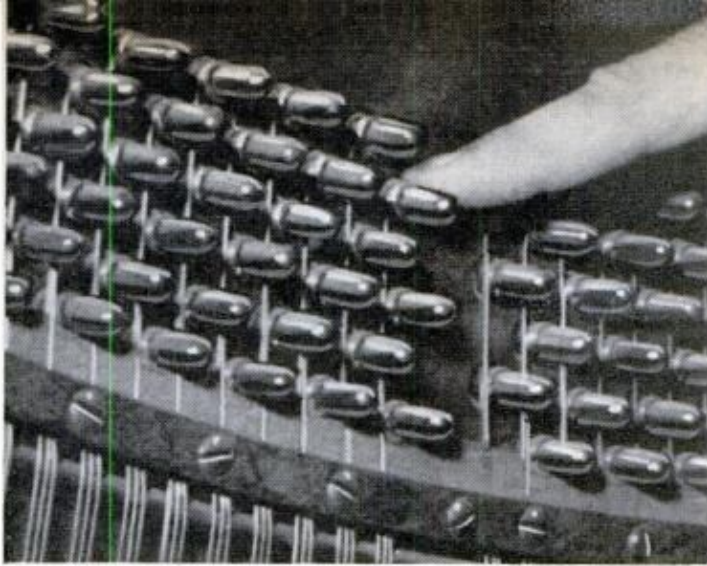
Tone is created by the quality of materials used in the construction of the piano. It cannot be changed by tuning, which merely modifies the basic tone, restoring notes to their proper relation to each other.

The base section, however, should be checked for a tonal condition, rather than quality. The heavy base strings are wound with copper wire, and if these windings have become clogged with dirt, the strings produce a dull "thunk" instead of a vibrant throb. To remedy this condition means restringing the bass section, which will cost as high as \$75.

Removing the front panel of the instrument exposes the "action," the system of levers which control the sound production.

Felts, compressed wool matrices, are used throughout the action to eliminate unwanted sounds of metal and wood. One set is a cushion for the hammers. Press down a key and hold it until the sound dies away. Listen carefully as you let it fall back. If there is the click of the hammer's wooden stem hitting the wood of the piano frame, the felt is gone, disintegrated through age or eaten by moths or mice. Repeat the test for a number of keys. A few can be easily replaced, but if many of them are bad, in all probability the felts throughout the instrument will be worn, producing a sound like a machine gun when it is played. A complete refelting is a major repair.





**TUNING PINS**, around which are wound the strings, are vitally important. If they are loose or rusted, or wood around them cracked, avoid the piano

The hammers are the rounded felt implements that strike the strings when the keys are pressed. With the tips of the fingers, move several of them forward and then try to move them sideways. There should be no lateral movement. At the base of the hammer's stem, it is attached to a flange by a metal pin bushed with felt. If this hole has become enlarged through wear, the hammer will wobble, ruining its performance. The hammer head should be firmly attached to the stem. Check this by *very gently* trying to turn a few of the heads. If they are loose it will produce a poor sound.

On the face of the hammer, where it hits the strings, there should be grooves worn into the felt. If there are no grooves the piano has not been played, or the hammers were resurfaced.

Unlike a used car, a piano that has not been played often may be a bad one. A well-played piano has been kept "alive" by vibrating its strings and soundboard.

A moderate degree of indentation in the hammer face is acceptable, but if the strings bury themselves in deep grooves, a resurfacing will be necessary—a moderately priced repair.

Resurfaced hammers, usually whiter in color and a bit fuzzy, are an advantage and not a cover-up. They improve the tone.

At the base of each hammer there is a short fabric tape attached to an upright wire. These are called bridle tapes, and in 90 percent of old pianos they are missing or rotting away. Pull on one of the tapes. If it crumbles, a new set will have to be installed, which will cost about \$15. Without these tapes the hammer return is slug-

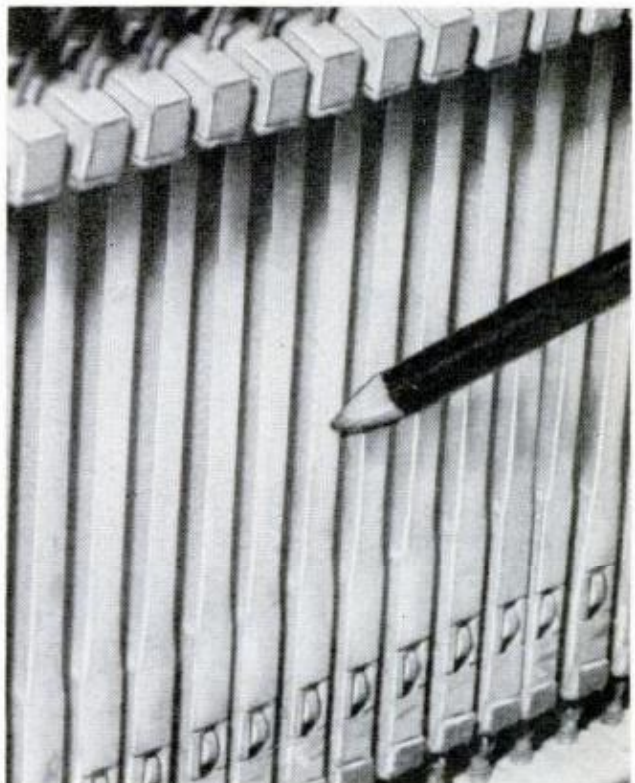
gish, and the second blow may not produce a sound. If you find a fresh set installed it means that the piano has been kept in good repair, always a good sign.

Looking inside the piano, you will notice small felt-faced blocks of wood pressing against the strings. These are the dampers, which regulate the vibrations of the strings, and they are operated by the right foot pedal in the front of the case. When the pedal is pressed the entire damper line should lift away from the strings. With the pedal depressed, play a few notes. When the pedal is released the sound should cease. See if any dampers are missing. A few can be replaced inexpensively, but a dozen or more can be expensive. The last two octaves of the treble section (the high notes) are not equipped with dampers.

The tuning pins, the most critical part of the piano, must be checked by a professional tuner. These are the studlike steel projections around which the strings are wound. You cannot test them completely, but if they are loose or badly rusted, or if the wood around them is split, it would be wise not to buy.

The last thing to check is the foot pedals. Squeaks can be removed with powdered graphite. A slanting pedal is just a \$10 repair. ★★★

**CRACKS** in the "abstract," the mechanism that drives the hammers forward, indicate extremely hard use, but these repairs are relatively inexpensive

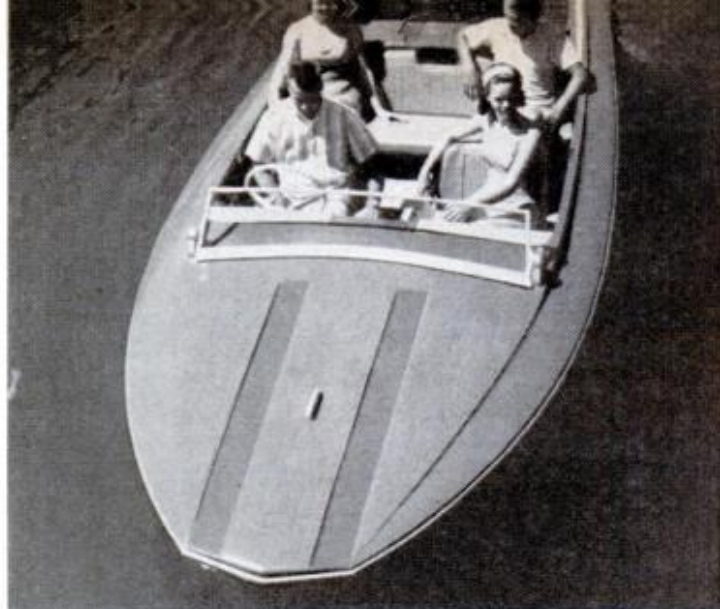




## Plush Package for Skiers

Packing up 160 horses into 16 feet of luxury, the new "Super G" is a skier's dream come true.

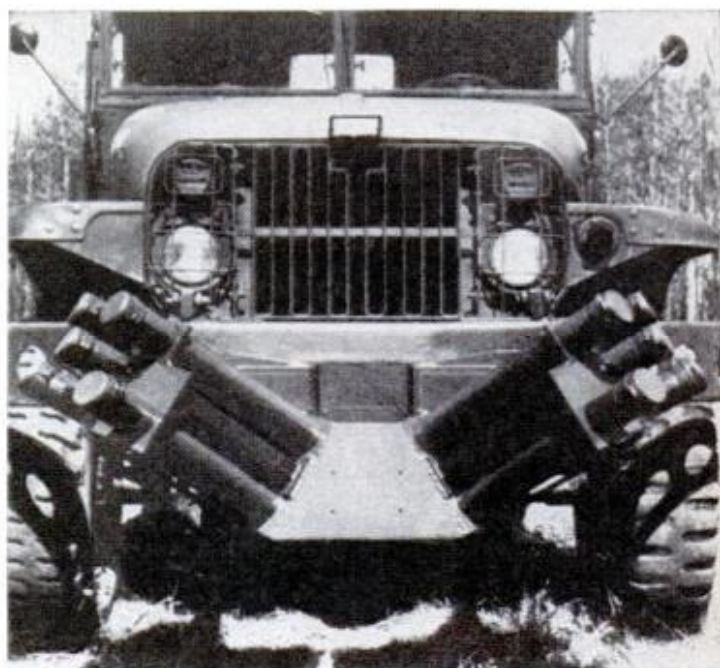
This hot new skimmer will take either outboard or stern-drive propulsion, and as you can see from the photo on the opposite page, it's the nearest thing to a pure planing hull you're likely to find in today's market. A pair of fins mounted in the center of the planing platform provides a perfect pivotal point for sharp turns. Featuring padded dash and adjustable windshield, it's made by Glasspar Co., 191 Newport Ave., Santa Ana, Calif.



## Truck Tosses Grenades

As they jounce cross-country through enemy terrain, Army cargo trucks can now lob white phosphorus grenades in all directions—like a farmer sowing seed on a ploughed field—to discourage hidden enemy snipers.

During recent field tests (right) of the truck-mounted grenade-tossing system, a typical cargo carrier demonstrated how effective its new defense can be. Its popping fireworks spouted from a total of four clusters of five launching tubes in each of the four corners of the truck. Each tube is capable of firing a "nest" of three grenades which separate in flight, permitting individual grenades to scatter. The result is a formidable umbrella of cover.



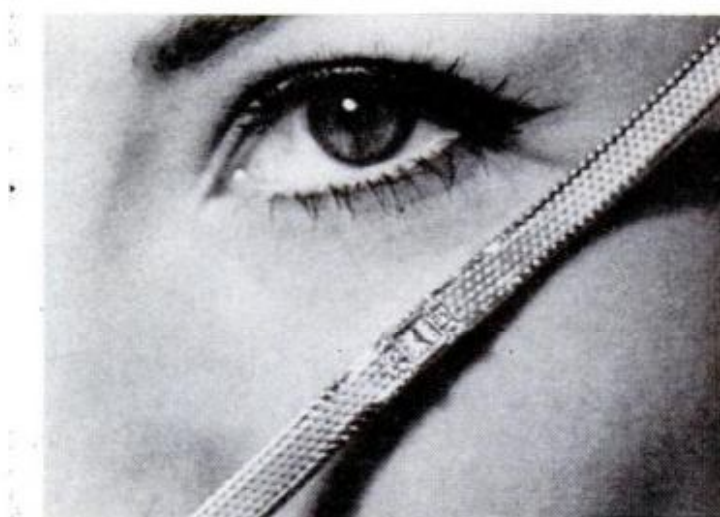
## Walkie-Talkie for Squad Tactics

An infantryman tucks it in his helmet, holds the cigarette-pack-size transmitter in his hand, and the upshot is constant communication with his squad leader and platoon leader. Trick is the Army's new compact two-way radio, good to 500 yards.

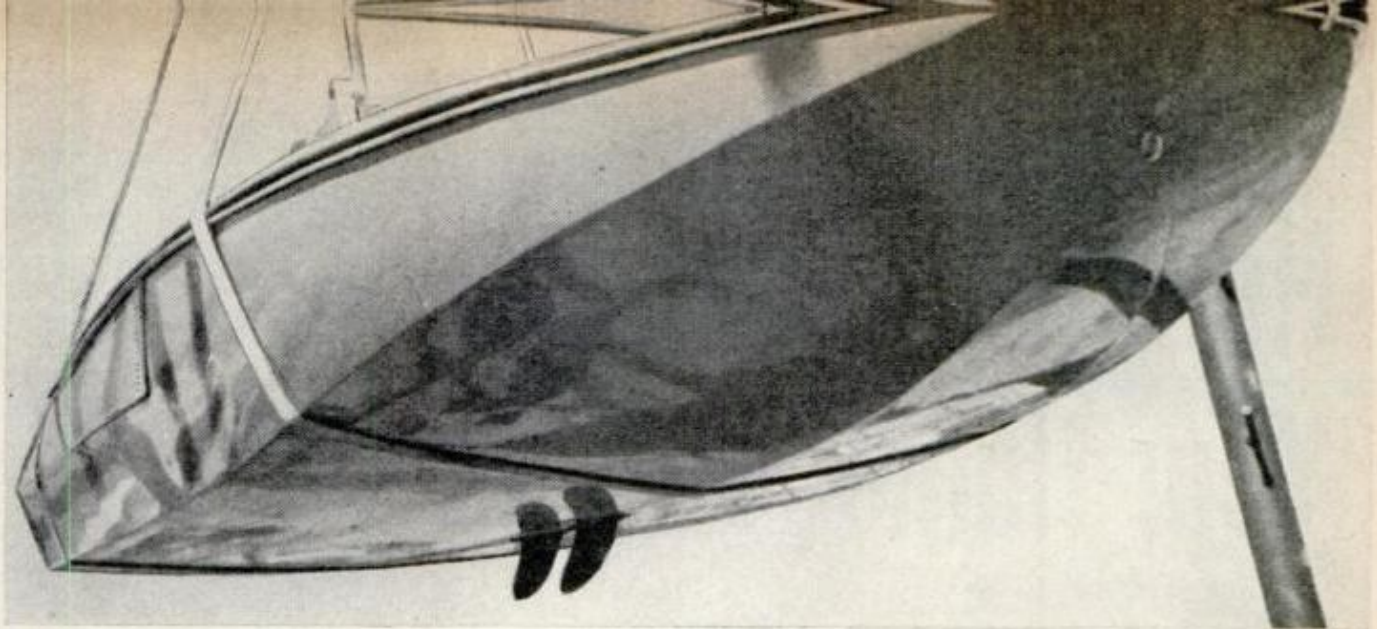


## Match-Head-Size Watch

Billed as the "smallest watch in the world," a bit of jewelry showed up at Britain's Earl's Court Fair. The "works" comprise 74 parts including mainspring wire  $\frac{1}{5}$ th the diameter of a hair. Photo below shows size compared to an eye pupil.

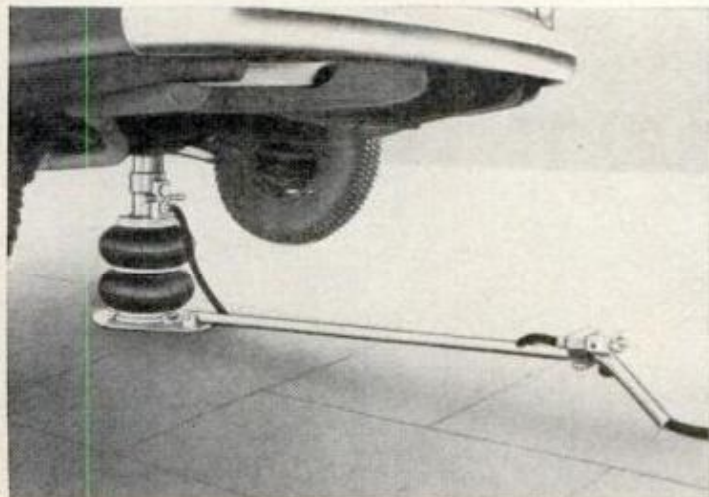






### Air Lift for Cars

It's like filling a tire when you lift a car with this pneumatic jack. Any air supply source does the job; a relief valve blows when limit is reached. Beissbarth, 8000 Munich 54 (Bavaria), 98 Hanauerstr.; West Germany, supplies the gadget.



### Yard "Cat" Crawls on Tracks

Instead of wheels, dual tracks propel a new combination mower, snow-blower and dozer. Track brakes steer it and a six-hp. engine grinds it over lumpy terrain. Low center of gravity for hills. Lennox Industries, 1701 E. Euclid, Des Moines 5, Iowa.





# New for Your Home

**DRAIN CLEANER** creates unclogging force in drain line. To operate, place rubber nozzle over drain, insert cartridge of non-toxic liquid in tube, press handle. Unit with two sizes of nozzles costs \$6.98; Seymour Tool & Engineering, 1466 Merchandise Mart, Chicago, Ill.



**FOLDING HIGH CHAIR** of tube steel is equipped with safety belt, adjustable foot-rest. Upholstered in vinyl, its over-all height is 37 in. Baby's weight locks chair securely in position. Price: \$18.95. Comfortlines, 1737 W. Diversey Pkwy., Chicago, Ill.

**LOG-CUTTING TOOL** of steel fits curved surface of composition log, scores log at desired spot so it breaks off. Lever action applies great pressure to log with little effort. \$5.95 in black; \$6.95 in brass; J.M.C. Enterprises, 1151 N. W. 46th St., Seattle, Wash.



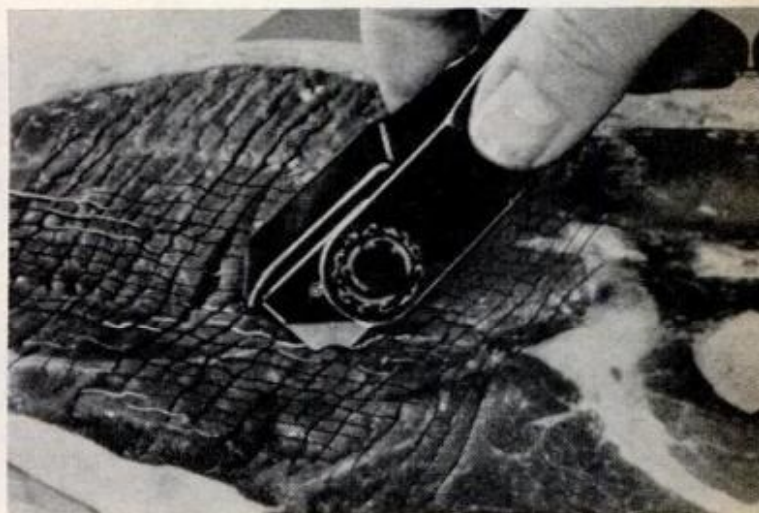
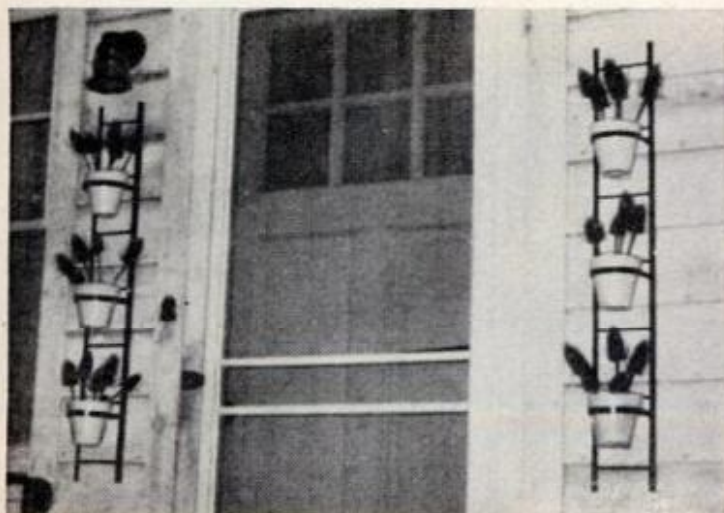




**BAR BUFFET CART** with extension panels cools to 35°F. or heats to 160°F. Cooling is by a thermoelectric heat pump that transports energy by electrons, not a refrigerant; the reverse flow of electricity heats. Walnut finished, the unit (roughly 28 by 20 by 20 in.) rolls on casters, operates by pushbutton, houses adjustable shelves, ice trays and bucket. By Sears, Roebuck, Chicago, Ill. Price: \$495

**FLOWER POT LADDER** can be used on any indoor or outdoor wall. In black or oyster white, ladders are 40 in. high and 5½ in. wide; plastic pots hold real or artificial flowers. \$5.39 each, with clips and wall fasteners. Selinsgrove Products, Spruce St., Selinsgrove, Pa.

**MEAT TENDERIZER** contains five razor-sharp blades which cut tough meat fibers (at 3 selectable depths) and yet hold in juices. Simply draw blades across surface of frozen meat to save cooking time. Cost: \$2.98; Tender Cutter, 1611 Broadway, Box 35, San Antonio, Tex.





# LITTLE LE MANS



**MADNESS** won't promise a win, but it helps in Naomi's "Dark Deepfreeze" race on ice, featuring headlights going away backwards and speeds of 70

**COMPACTS** often do as well as more exotic sports cars on the ice. The trick lies in the skill of the man behind the wheel, who knows how to use the extra traction provided by a little snow to stop a slide, as shown here



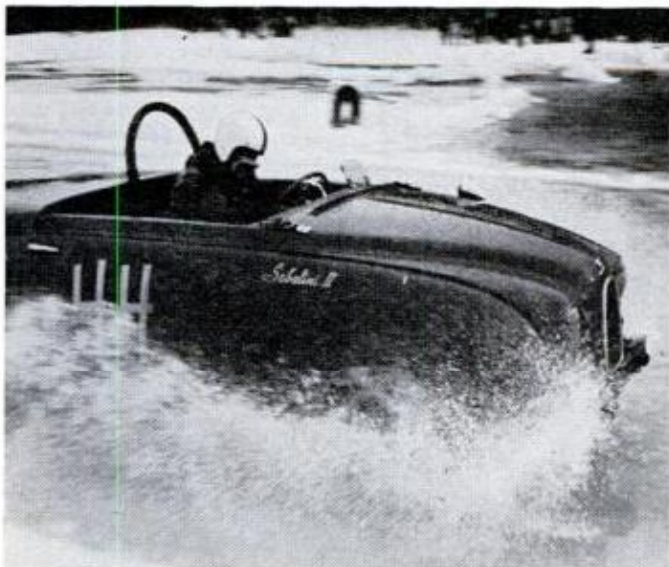


*Road racers take to the slick at 115 m.p.h. without chains or snow tires, in a slithering melee that even features night runs*

**By Richard F. Dempewolff**



**FREEZING SHOWER** bathes car and driver as it ploughs through a lake on a lake. In one race, cars collected 200 pounds of ice from spray



**W**ITH A ROAR of open exhausts and whining engines, a motley assortment of sports cars, family sedans and "specials" creeps off the starting mark at a solid one mile per hour.

Practically nothing moves but the drive wheels, and they're about to fly apart.

But within a minute or two, the slithering pack is strung along the straight. The leaders, streaking out at 75 to 100 m.p.h., slide into "S" turns and around bends sideways (and sometimes backwards).

Experts carom off snowbanks to save precious seconds on curves. Some make it. Others slide into long spins. Looping gracefully around and around each other, they go waltzing across the panorama. Most will recover to re-join the race. But a few will be busy "shoveling out" for an hour or two.

It's all in a day's fun for enthusiasts of one of the "hairiest" sports ever devised—automobile racing on ice.

Thrill-seeking nuts have been dropping "Detroit iron" through melt holes in frozen northern lakes from Maine to Minnesota since the turn of the century. But credit for putting the madness on a reasonably safe, organized basis generally goes to an energetic 32-year-old Easterner with a crew cut, named Franklin "Skip" Miller.

According to Miller, a private pilot and sports car enthusiast, the whole thing started by accident about ten years ago. In winter, when he landed his plane on Naomi Lake—a two-mile-long former ice pond at his family's stronghold in Pocono Pines, Pennsylvania—the prop wash would blow snow from large areas of glare ice. "I used to take my car out and skid around on it for fun," he says. "Then some neighbors wanted to try it. We began competing for biggest spin-outs, and in due course wound up racing."

In no time, they were scraping away snow to form a two-and-a-half-mile circuit with two sweeping hairpins, a pair of



"S" turns and two narrow squeezes, or "chicanes." By 1958 it had become an annual affair run by Miller and his attractive wife, Lorna (who also manages a pair of lively young sons). Under the sponsorship of their Ice Racing Enterprises, Inc., major seasonal events are featured: Sprint Races, a four-hour Grand Prix, a Little LeMans, and a Dark Deepfreeze—"for night racing fans who don't like to see where they've been when they're sliding backwards," explains one champ.

From January deep into March, bad weather permitting, entries pour in for weekend events (at \$10 a head and no cash prizes) from a dozen states including Ohio, Vermont and Virginia. A nice winter Saturday or Sunday may find a hundred contestants on Naomi's ice. Up to 3000 spectators line the lake shore, munching cold hot dogs flavored with mitten wool and stamping to keep warm.

All kinds of people are devotees. One regular fan is an undertaker from Endicott, N. Y., who drives down nearly every week in a hearse. Pits, in the center of the circuit, swarm with convalescent cars waving friendly fenders, and do-it yourself mechanics wearing ice skates.

#### A Saab You Wouldn't Know

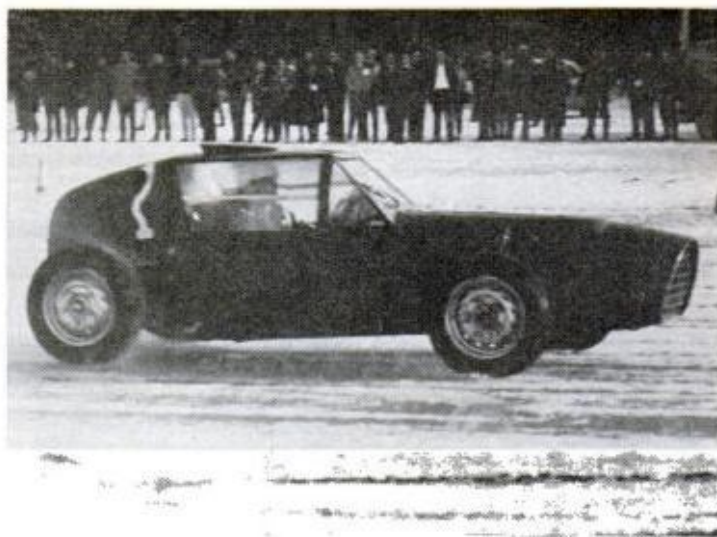
You're likely to find almost any kind of car, from production models to Allison B. Stout's "A. S. Special," on the lake. Stout, a retired engineer, designed the car especially for ice racing. He used the running gear of a Swedish Saab, modifying it to produce a long, low single seater resembling the front end of a wingless jet fighter plane. The three-cylinder engine boasts three carburetors.

Special features include a pair of forked drag brakes that reach down from the rear end to claw the ice and keep the front end up front on the corners. When he uses this device, Stout races by himself. It works too well, so it has been outlawed. But even without it, Al Stout has swept the field enough times to become known as the "Ice King." He holds the track record of 115 m.p.h.

Average lap speeds for the circuit run up to 70 m.p.h., which means that anybody who hopes to be anybody must push at least 75 to 90 on the straights.

Only a raging blizzard or torrential downpour is enough to "call" an ice race. Even at 20 below zero, hardy contestants

[\(Please turn to page 214\)](#)



**SPECIAL ICE CAR** built by retired engineer Al Stout boasts Saab running gear, one-seat cockpit, three carburetors and holds the ice track record of 115

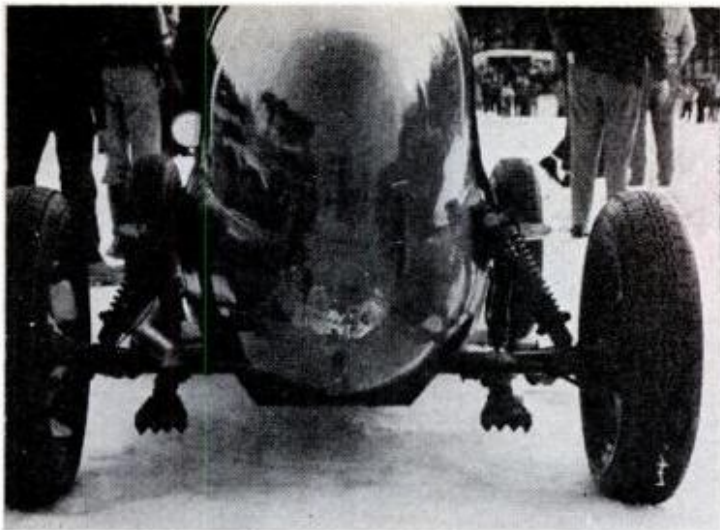
**SLUSH** and water on the track create freezing spray that coat windshields, so drivers usually wear masks and drive with their heads out the side



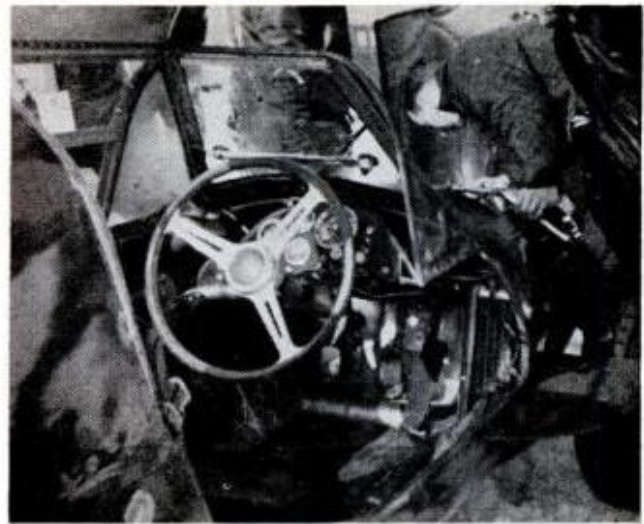
**SNOW DIVES** result when drivers "overcook" it on the corners and shoot over the snow embankments at trackside. It's the end of the race for this one





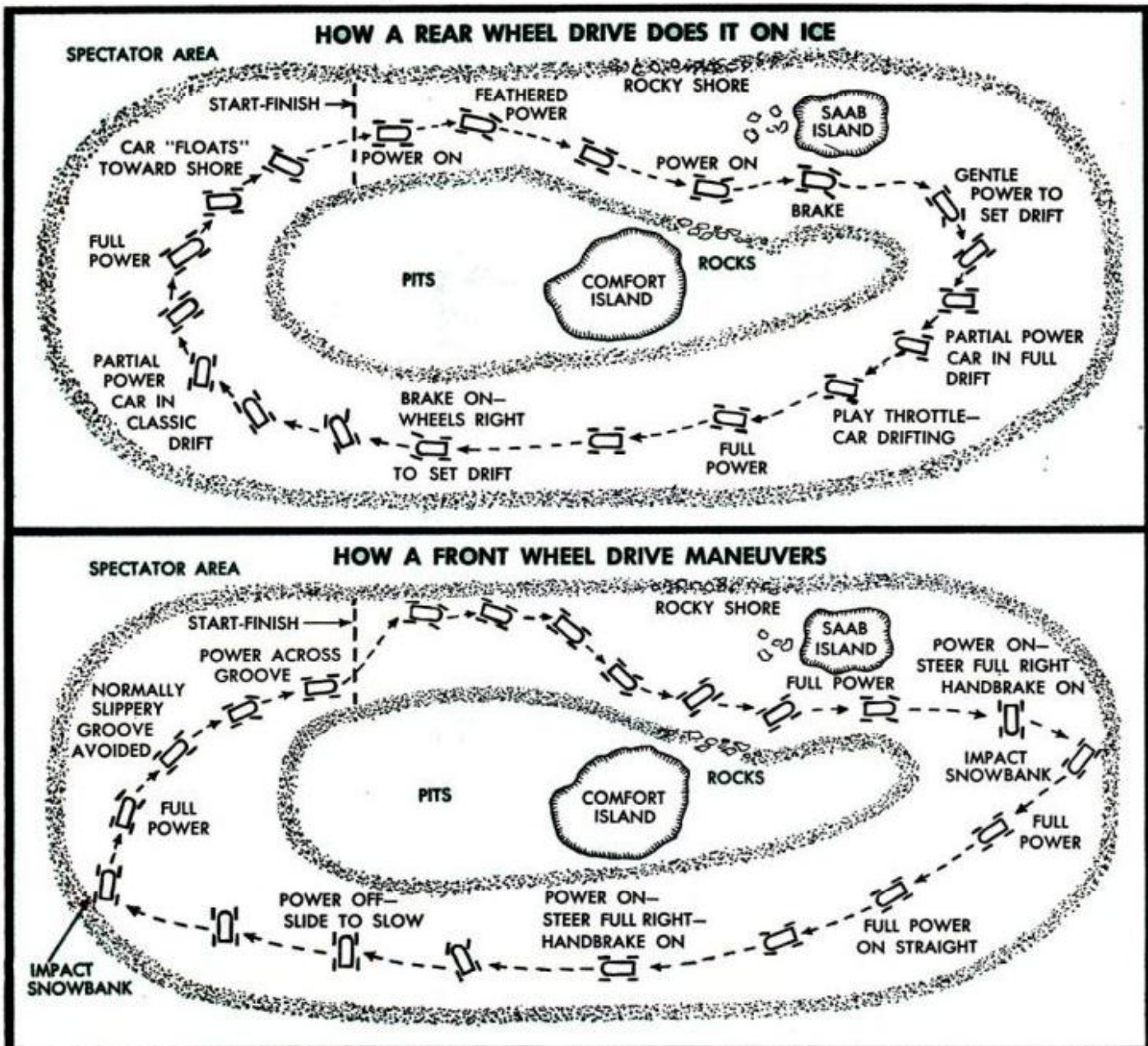


**FORKED BRAKES** on A.S. Special reach down from rear end to grab the ice, and keep the front end up front on corners. Its use in races is outlawed



**THERE'S NO ROOM** for anything but business in the A.S. Special's single-seat cockpit. The "pilot" sits practically on the deck, with legs out front

**COURSE** at Naomi Lake is ploughed over a two-and-a-half mile circuit. The hairpins are a quarter mile wide (for sliding); straights measure 50 feet



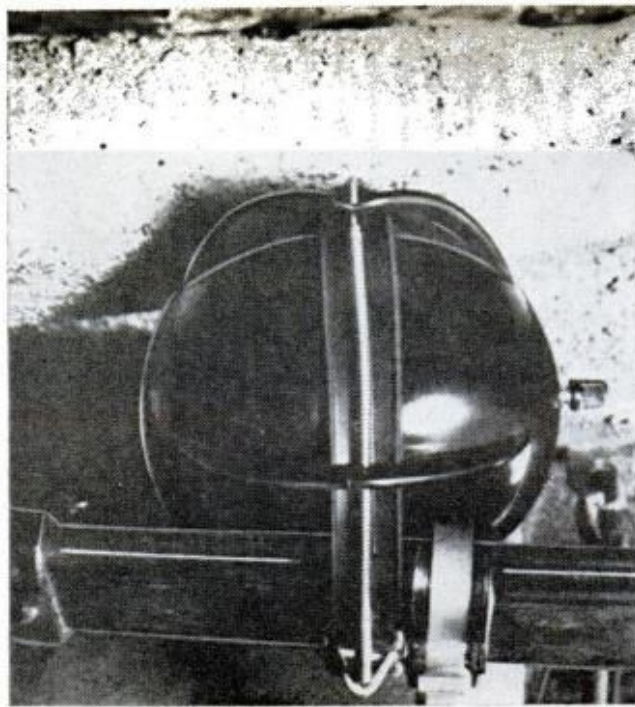




### Now Hear This, Baby

To detect faulty hearing in newborn babies so that treatment can be started early in life, an Australian teacher has developed a deafness detector.

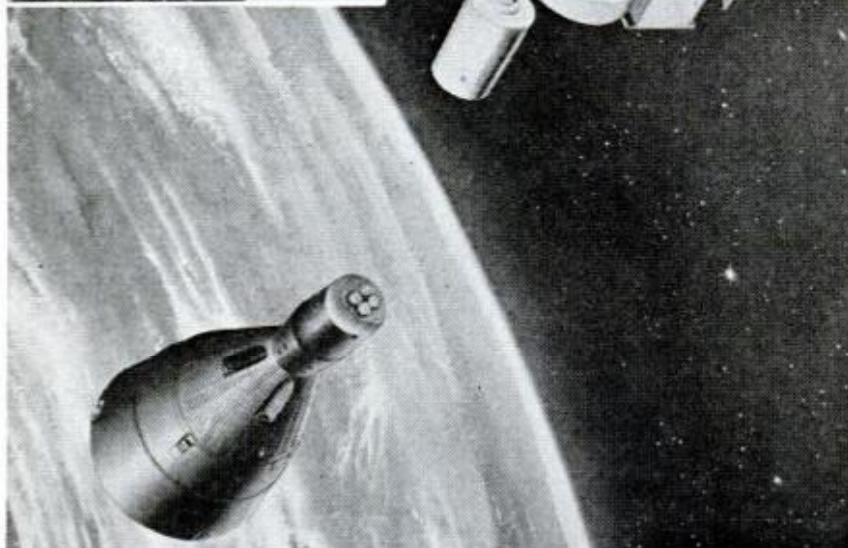
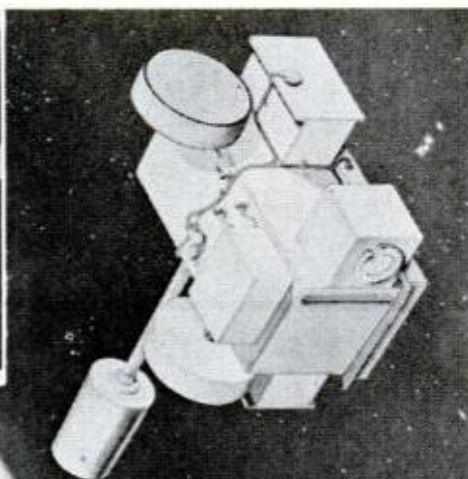
The unit is held close to a sleeping baby's ear. It emits signals over the entire hearing range. The hearing baby responds by twitching or moving. Lack of response in a series of tests indicates deafness.



### Air Springs for Springs

Air springs that fit between the frame of a car and its rear leaf springs can be inflated or deflated to give occupants of the car a firm or soft ride.

The air springs, which are made of a resilient plastic, may be installed with hand tools. With brackets and air pump, they're \$10.50 a pair from J. C. Whitney & Co., 1917 Archer Ave., Chicago 16, Ill.

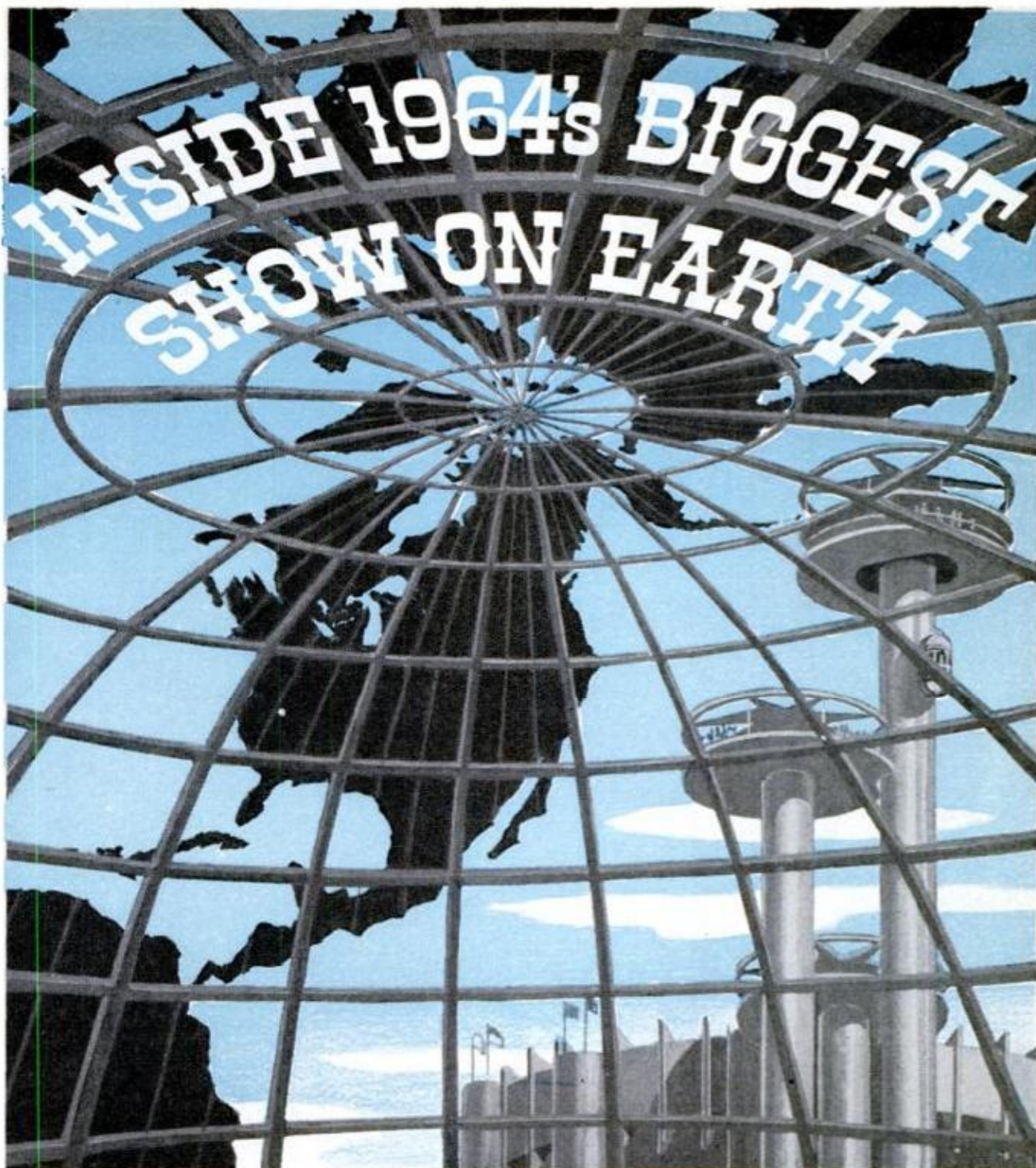


### Practice Session

Crewmen of the two-man Gemini spacecraft will practice space rendezvous techniques by carrying aloft a piggyback satellite that they'll eject from their craft and then rejoin. The drawing at left shows the Gemini capsule (lower left) and the satellite ("rendezvous evaluation pod").

Inset is the transmitting and receiving antenna for the Gemini radar, which will be located on the front end of the man-carrying craft. It will give range and location of the target. Such practice will help astronauts perfect techniques they'll need later in rendezvousing with an Agena rocket. Radar and evaluation pod are Westinghouse developments.





*Spaceships, a "people wall," trips through yesterday and tomorrow  
—here's how the World's Fair wonders will work*

**By John P. McNeel**

**H**IGH OVERHEAD, the slim, elegant shape of a space ferry vehicle moves slowly into sight of awed spectators waiting below. It changes course slightly as it nears an orbiting space station; tension mounts as the two vehicles maneuver for the delicate docking procedure.

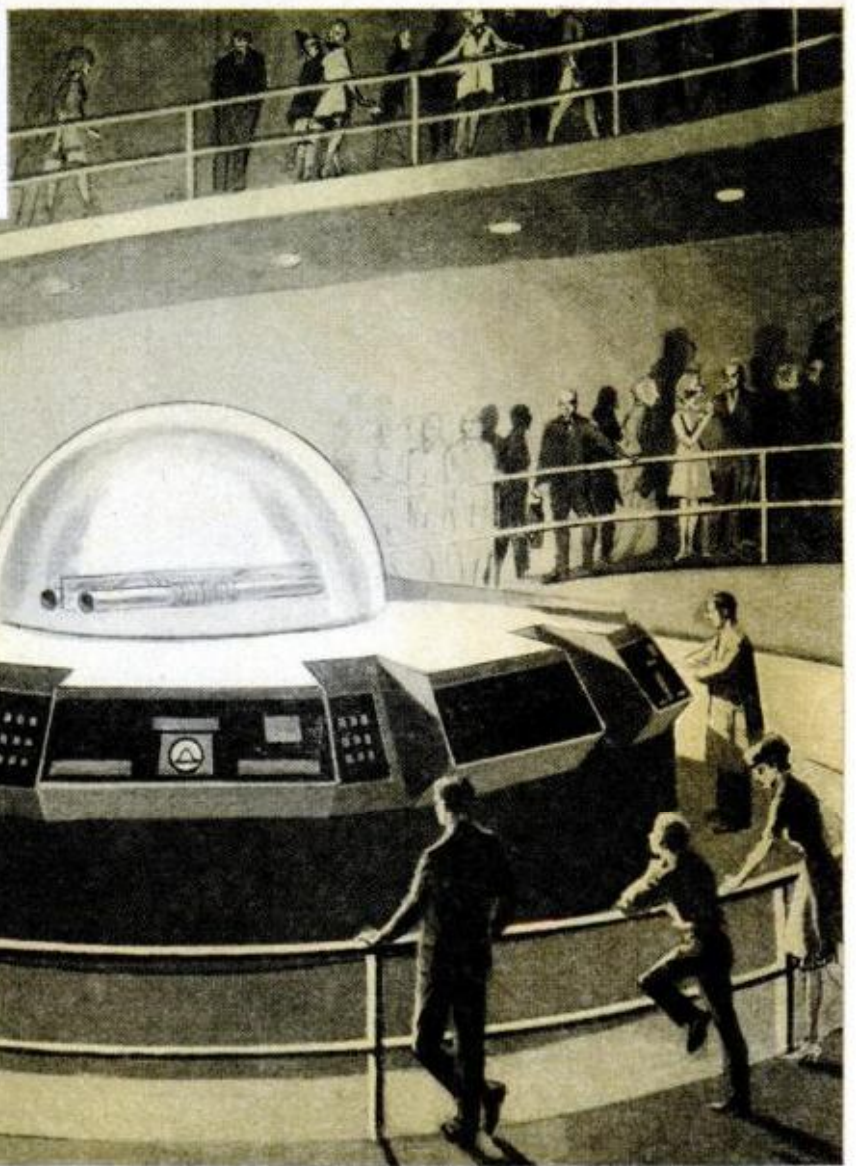
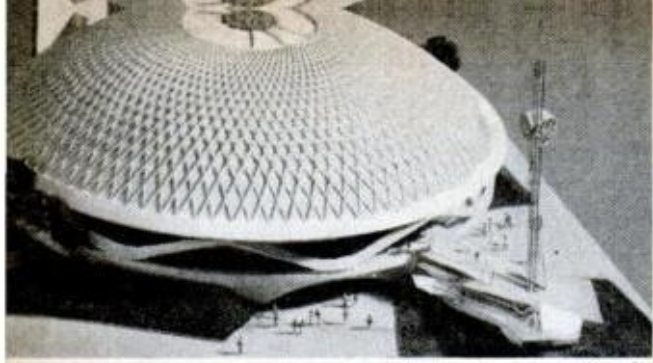
Gradually, the space between them narrows as the ferry points its tapered nose toward the docking aperture. One false

move at this point in an actual space rendezvous and the two vehicles might bounce apart in a disastrous collision, damaged beyond repair or skewered into wild orbital paths.

But all goes well as the ferry makes a bull's-eye thrust into the docking aperture at one end of the space station and is locked into place.

The space procedure just described is





**THERMONUCLEAR FUSION**, simulating the awesome power of the sun, will be demonstrated publicly for the first time in GE's unique domed pavilion

realistic enough to be a true rendezvous. Actually, it is a simulated rendezvous at the New York World's Fair, due to open on April 22.

Space travel is only one of the scientific and industrial marvels you'll be seeing at 1964's biggest show on earth.

At Flushing Meadow, in Queens, N.Y., you'll see an actual demonstration of thermonuclear fusion, the awesome power of the sun that makes the atomic bomb look like a firecracker.

Man's future settlements on the moon, his exploration of the planets, a journey to the heart of a living cell, and research at the bottom of the sea are only a few of the dazzling exhibits that will be on view.

Billed as the world's first billion-dollar extravaganza, New York's glittering global show will present the visitor with

enough scientific and industrial wonders to dazzle the mind and beguile stay-at-homes for years to come.

Exhibits and pavilions, now being rushed to completion on the same identical 646 acres which held the 1939 World's Fair, are roughly divided among five categories: Industrial, international, federal and state, transportation and a lakeside amusement area. Some 150 pavilions include exhibits from nearly 40 foreign lands, two dozen states, the federal government, major religious denominations and scores of industrial corporations.

The Hall of Science, located in the transportation area, will be the home of the space docking show, as well as a dozen other exhibitions, including the Atomic Energy Commission.

Meticulous care is being taken to insure



absolute authenticity in the space show. "We're not doing final mock-ups on the ferry vehicle or the space station until the last minute," says George Bunker, president of Martin-Marietta Corporation. "The vehicles will be as near the real thing as we can make them, and we will keep the craft up to date if the technology changes while the fair is still in progress."

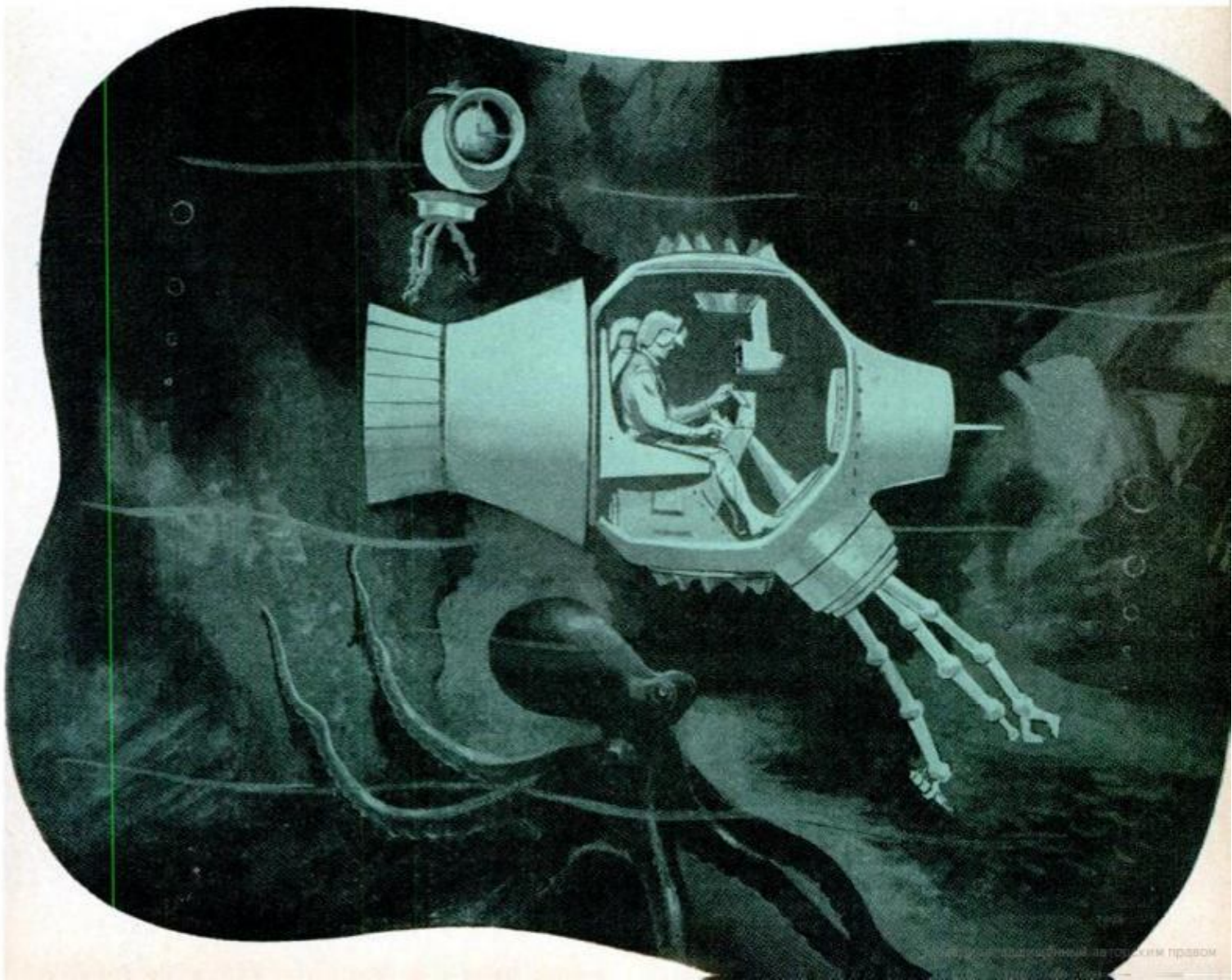
The ferry vehicle will be the exact size and weight (about 2200 pounds) of the capsule which is expected to perform an actual space rendezvous procedure in the Gemini program, possibly in a year or two, or while the fair is still open. The five-ton orbiting space laboratory also will be an exact replica.

The company and its design firm, Gardner Displays, are in close consultation with the Air Force and the National Aeronautics and Space Administration on design details.

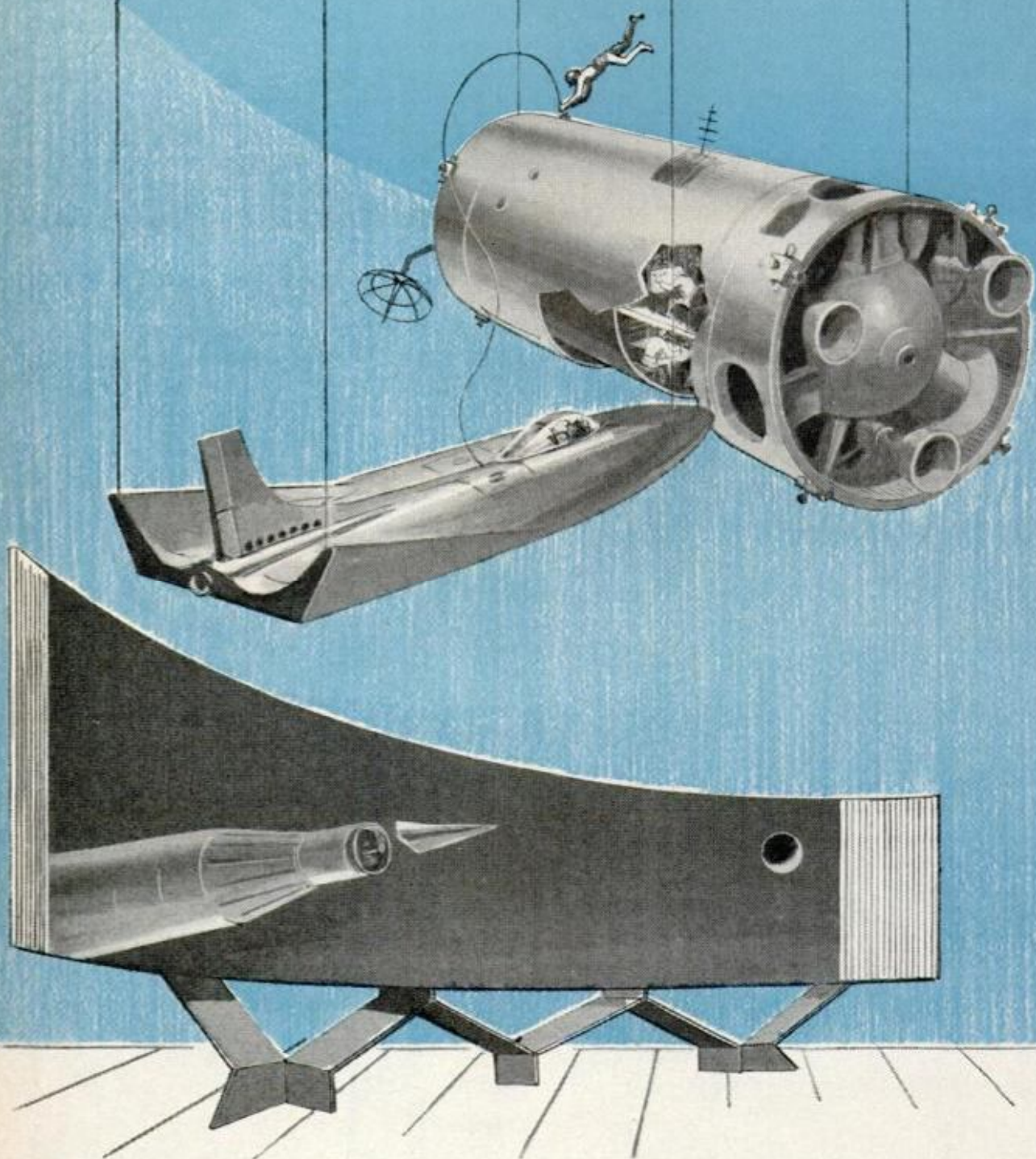
They will probably use such gimmicks as rear projection screen materials or smoked plastic to show operations inside the space lab. As the ferry docks, lights go on inside the floating space station. You'll see three-dimensional spacemen walking up the walls, performing scientific chores. Other astronauts may emerge, floating on tethers, to work outside the station. A tricky arrangement of traveling cranes and invisible cables does the job (see illustration on next page).

In the AEC's "Radiation and Man" exhibit, you'll be able to "make" atoms, or what look like atoms. By manipulating knobs on a "black box" you can trace the electronic paths of any given atom by projecting a strob light on a screen. Also in the AEC corner is a scaled-down children's museum; parents will never make it through the four-foot-high door, but they will be able to keep track of their

**GENERAL MOTORS** is showing a new version of its 1939 hit, *Futurama*, which will treat visitors to a peek into the future, including deep ocean exploration

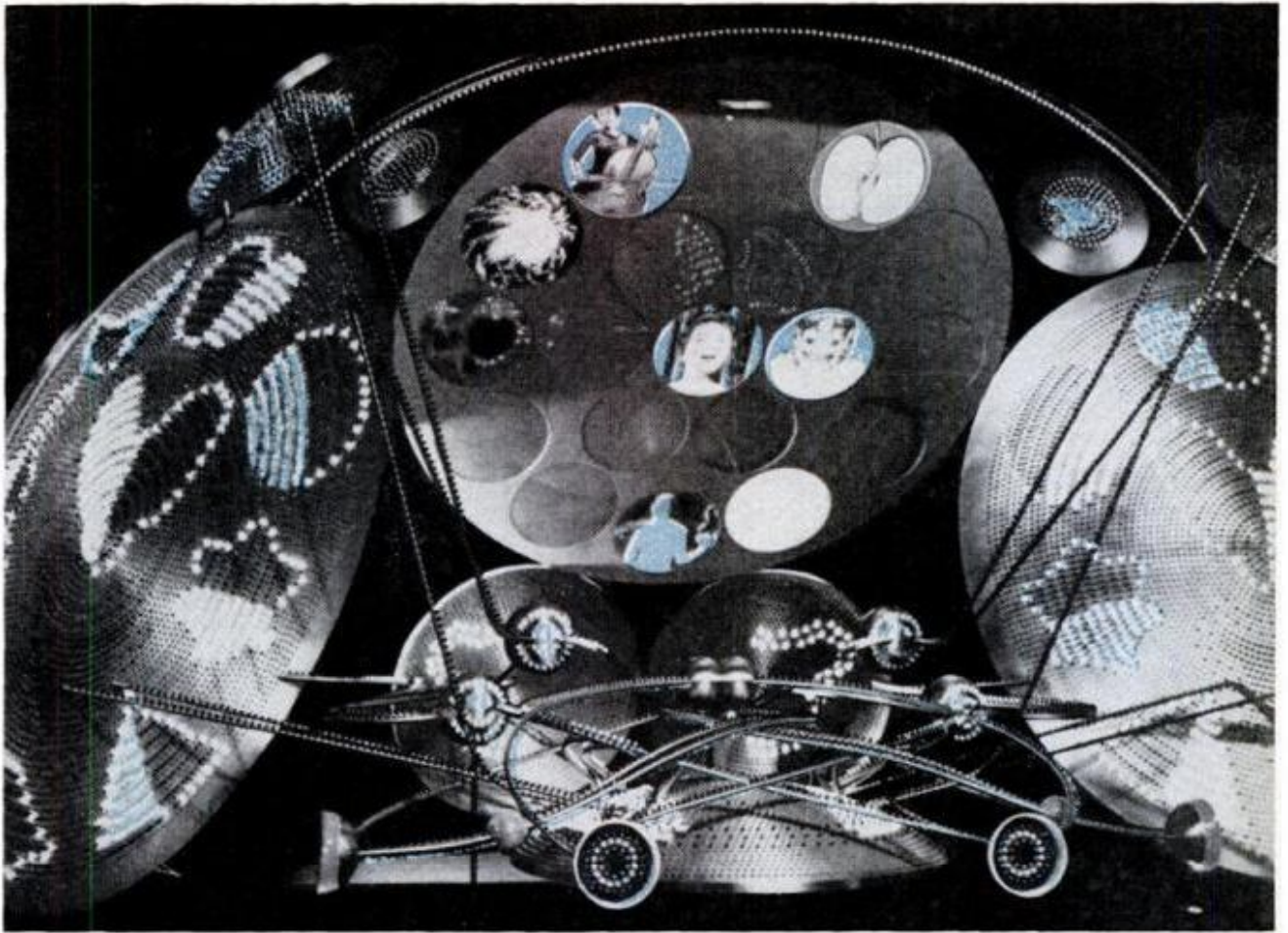






**HALL OF SCIENCE** headliner will be a simulated rendezvous in space between a transport ferry and an orbiting space laboratory. Part of the sequence of events, including the blast-off of the booster rocket and the re-entry phase, will be shown on a giant curving screen. Actual docking procedure will take place high overhead in the 80-foot-high second floor of the hall. Slated to be a permanent feature of the city park which is to be built on the site of the fair, the Hall of Science will present a dozen major exhibits besides the space show





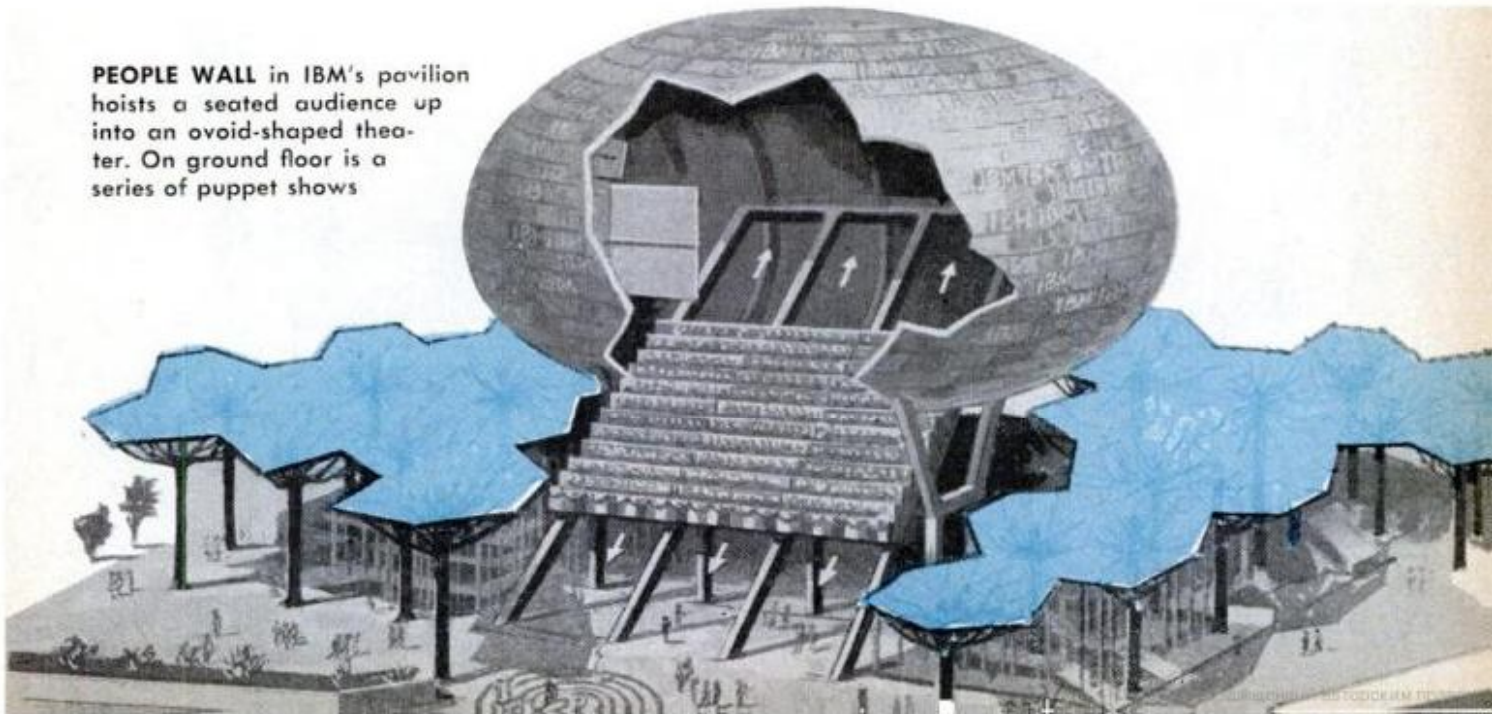
**HOW THE BRAIN** processes impulses from the eyes and ears into the miracle of sight and sound is demonstrated by this brain model in the Hall of Science

offspring on three television screens in an adjoining room.

A giant Rube Goldberg-like contraption 24 feet in diameter and 12 feet high dominates another space in the hall—Upjohn's human brain. Flashing lights speed along tubes and wires between huge aluminum disks, each studded with tiny lights. This weird creation illustrates how two highly important human senses—

vision and hearing—are handled within the brain. Most of the disks represent the topbrain, or cortex. Electrical impulses are shown traveling from the creature's "eyes", through the optic chiasma into the two halves of the visual cortex. Here the signals show half an image (an opera singer) before they're carried into an area of the upper brainstem where two halves are merged into a single complete image.

**PEOPLE WALL** in IBM's pavilion hoists a seated audience up into an ovoid-shaped theater. On ground floor is a series of puppet shows





Hearing is demonstrated in a similar way.

In other areas of the Hall of Science you'll see experiments illustrating problems in biology, mathematics, chemistry, physics, color notation, aircraft landing systems and diagnostic techniques.

During ideal weather conditions, you might not have to go any nearer the fair site than the Washington Monument or Boston Common to see one nighttime spectacular. A gigantic tower of light, throwing 12 billion candle power of light into the heavens is now being assembled for the Electric Power and Light exhibit. The right kind of cloud layer could reflect this powerful beam for hundreds of miles.

In fact, fears have been expressed that such a beam could blind pilots on the approaches to nearby LaGuardia and Idlewild Airports. Also, naturalists were afraid the light may confuse migrating birds, or attract them into a danger zone under certain atmospheric conditions.

Elaborate testing has allayed most fears. But, if a pilot radios in that "that damn light's blinding me," the beam can be doused instantly from switches at New York airports.

An ornithologist from Rutgers University will be on duty every night. If he feels the light is endangering bird life all he has to do is cut the power source.

Where other shows peek into the past as well as into the future, GM is keeping its eye strictly on the crystal ball, and the future it sees is a rosy one indeed.

"We're in the mobility business," says GM Vice President William L. Mitchell, "not the space business. We're going to show people new frontiers right here on earth."

Visitors at the rate of one a second (70,000 a day compared to 1939 Futurama's 28,000) will board comfortable contour chairs for GM's ride into the future. You'll start by approaching earth in a space cap-

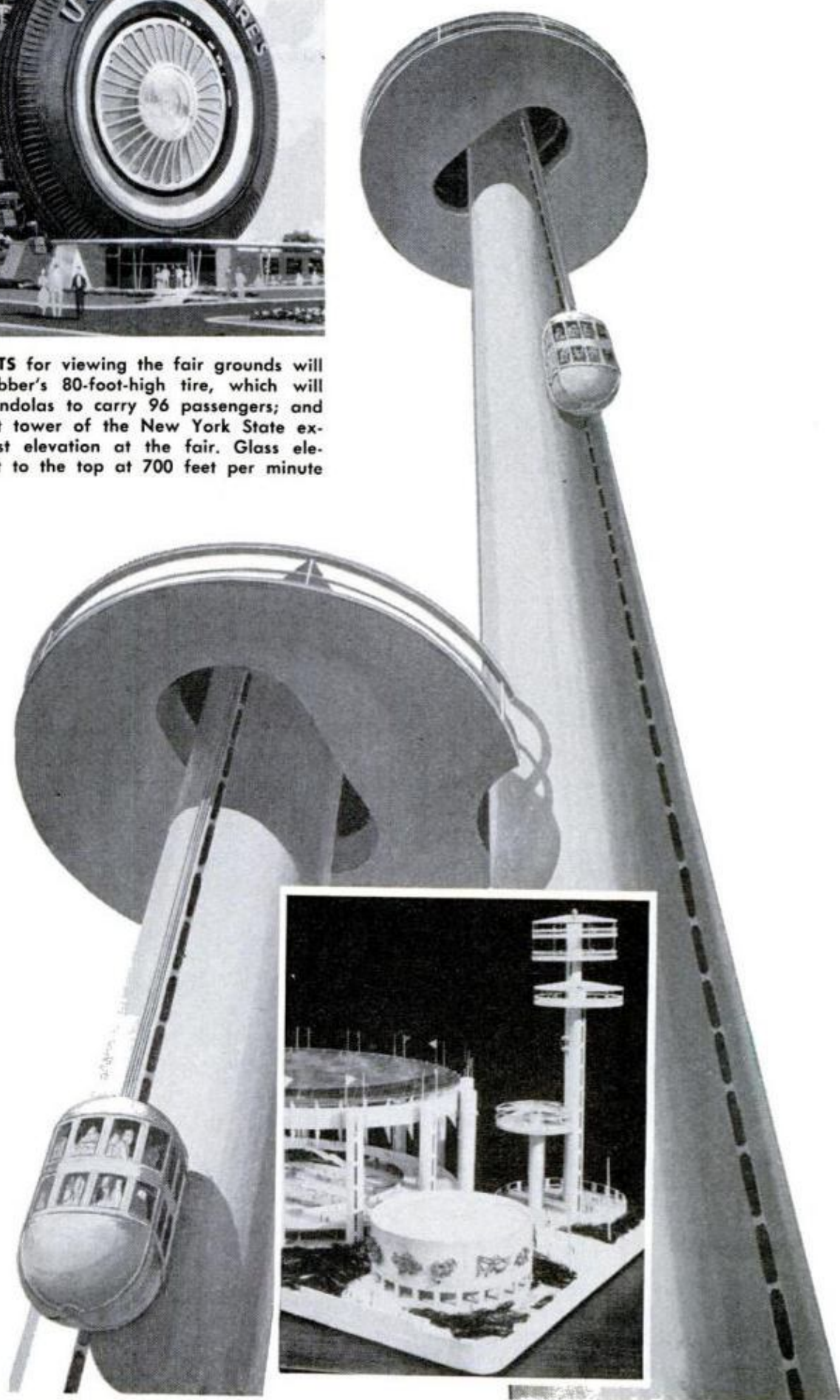
**ANIMATED CAVE MEN**, who move and "talk" in amazingly realistic fashion, were made at Walt Disney's studios for Ford's journey into past and future



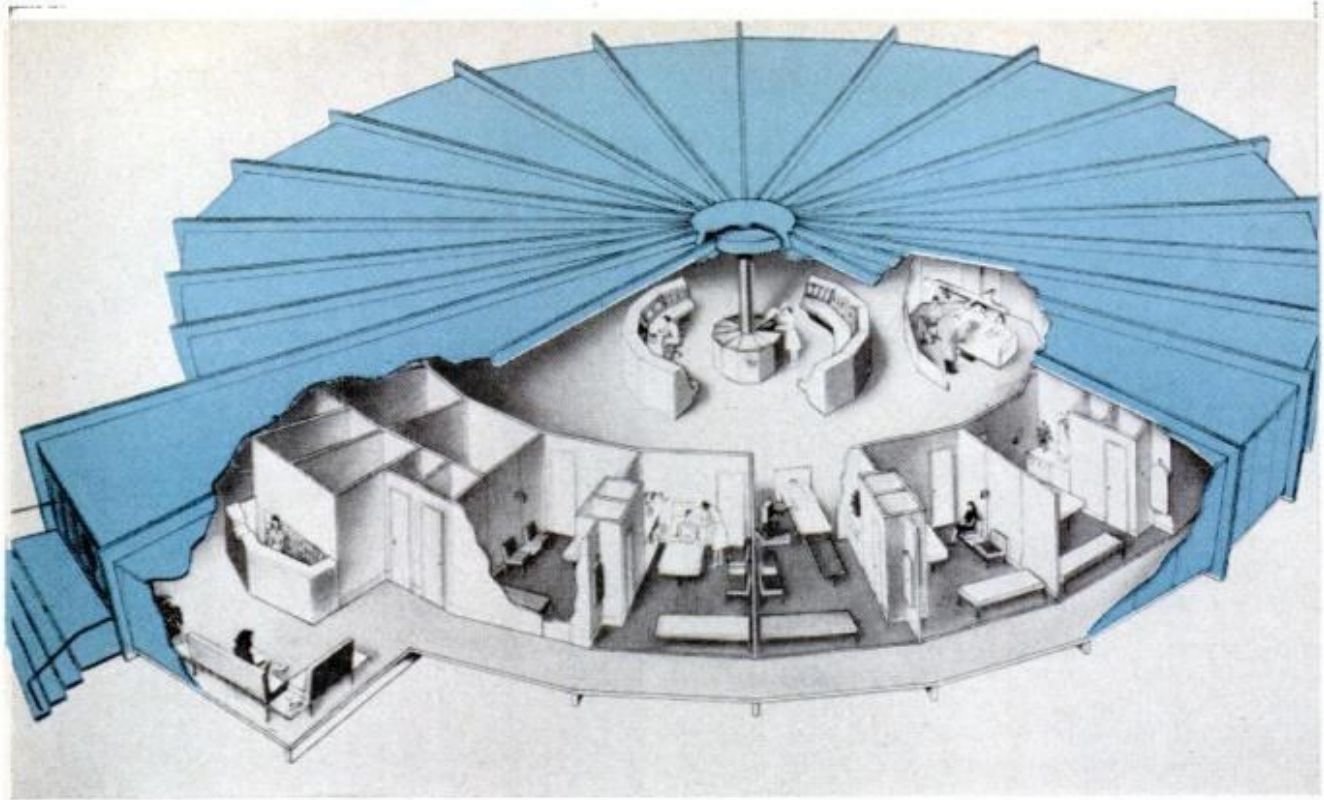




**HIGH POINTS** for viewing the fair grounds will be U.S. Rubber's 80-foot-high tire, which will have 24 gondolas to carry 96 passengers; and the 226-foot tower of the New York State exhibit, highest elevation at the fair. Glass elevators shoot to the top at 700 feet per minute







**TREATMENT FOR SICK** will be provided in the Atomedic (atom-age medicine) hospital, a lightweight air-transportable unit designed for use in emergencies

sule, past an uninhabited moon on which weird lunar crawlers move over the moon's surface. You'll move through the Aurora Australis and come to earth in an all-weather port cut into the permanent ice shelf off Antarctica.

You'll see atom-powered submarine trains sailing under the ice shelf to keep the base supplied; watch fantastic crawling vehicles crossing Antarctic terrain; and see huge tunnels being bored into the ice for permanent buildings.

Visiting explorers will leave the polar area to enter an underwater world, past the wreckage of an old three-masted whaling vessel, and journey out into the deeps. An aquacopter, a two-man undersea craft with claw-handed arms, inspects the ocean floor for mineral deposits. Drills probe for ocean-bottom oil.

In an underwater recreational area, you'll see resort hotels secured to the ocean floor. Behind over-sized windows undersea vacationers dance, eat and play. Undersea sports vehicles and aquascooters glide eerily by with fishing parties.

From this water-world you'll plunge into the depths of a jungle where a road-building vehicle five stories high and as long as three football fields is laying a multi-laned highway through the wilderness. Through tunnels bored through rock

walls you'll emerge onto a desert plateau where advanced farming techniques have made the arid land bloom. Here farmers manipulate irrigated croplands—by push-button—from an office.

From here you'll enter a suburban wonderland where futuristic houses show the prosperity and affluence to come. Past the suburbs looms the city of the future, with elevated traffic lanes, moving walkways, landing pads for vertical-takeoff aircraft, recreation plazas and transportation centers.

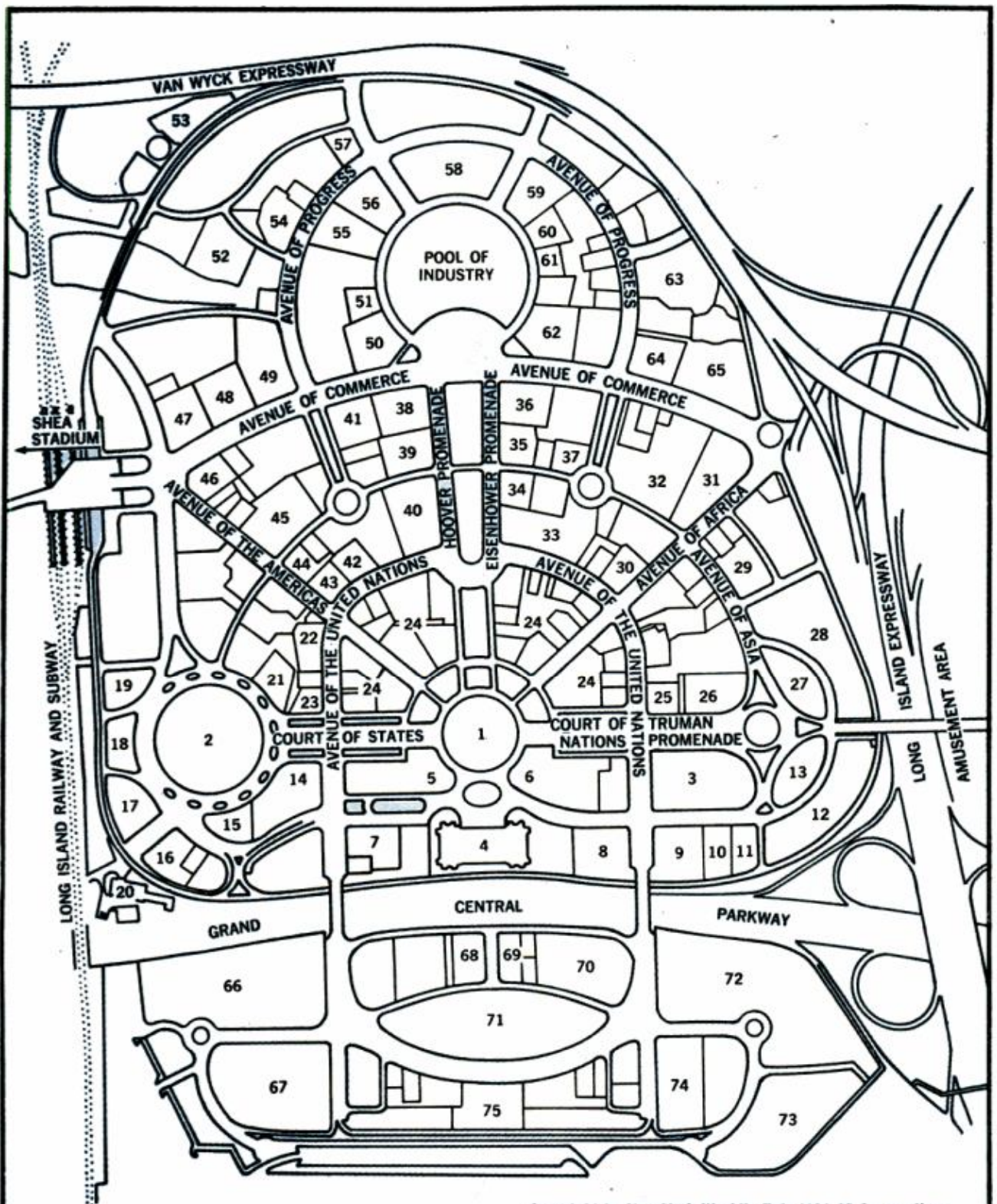
Walt Disney Enterprises won't be officially represented at the fair, but the man who created Mickey Mouse is exercising a decisive influence on more than one exhibit, including General Electric and Ford.

### Redblooded Robots

In GE's 200-foot Progressland dome, visitors enter a unique six-staged theater. Each stage will present a story or vignette describing progress in electricity from 1890 to the present. The stage platforms are arranged in a gigantic wheel shape, with the six audience sections revolving around them. Disney magic is evident in the "human" figures which will animate the stories. Electronically-controlled on a programmed tape, the figures are eerily

[\(Please turn to page 224\)](#)





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- |                  |                    |                    |                    |
|------------------|--------------------|--------------------|--------------------|
| 1 Unisphere      | 20 Press Bldg.     | 39 Seven-Up        | 58 Bell Sys.       |
| 2 U.S.           | 21 India           | 40 Spain           | 59 Liebman         |
| 3 N.Y. State     | 22 Korea           | 41 Coca Cola       | 60 Scott Paper     |
| 4 N.Y. City      | 23 Ireland         | 42 Hong Kong       | 61 Parker Pen      |
| 5 New England    | 24 International   | 43 Venezuela       | 62 G.E.            |
| 6 New Jersey     | 25 Sweden          | 44 Denmark         | 63 Better Living   |
| 7 Arkansas       | 26 France          | 45 Protestant      | 64 Schaefer        |
| 8 Tennessee      | 27 Vatican         | 46 R.C.A.          | 65 Pepsi Cola      |
| 9 Missouri       | 28 Belgium         | 47 World of Food   | 66 Ford            |
| 10 Alaska        | 29 Christ. Science | 48 Mormon          | 67 Hall Of Science |
| 11 Westinghouse  | 30 Guinea          | 49 Festival Gas    | 68 Sinclair        |
| 12 Louisiana     | 31 Kodak           | 50 I.B.M.          | 69 U.S. Rubber     |
| 13 Minnesota     | 32 Pan Am. Garden  | 51 Equitable       | 70 Transportation  |
| 14 Oklahoma      | 33 Japan           | 52 Oregon          | 71 Chrysler        |
| 15 Wisconsin     | 34 Austria         | 53 Post Office     | 72 G.M.            |
| 16 New Mexico    | 35 Johnson's Wax   | 54 Amer. Interiors | 73 Auto Thrill     |
| 17 Illinois      | 36 Elec. Power     | 55 Education       | 74 Greyhound       |
| 18 West Virginia | 37 Gen. Cigar      | 56 Travellers Ins. | 75 Port Authority  |
| 19 Maryland      | 38 Du Pont         | 57 Formica         |                    |



# PREFINISHED PARTY CART

By Dave Swartwout

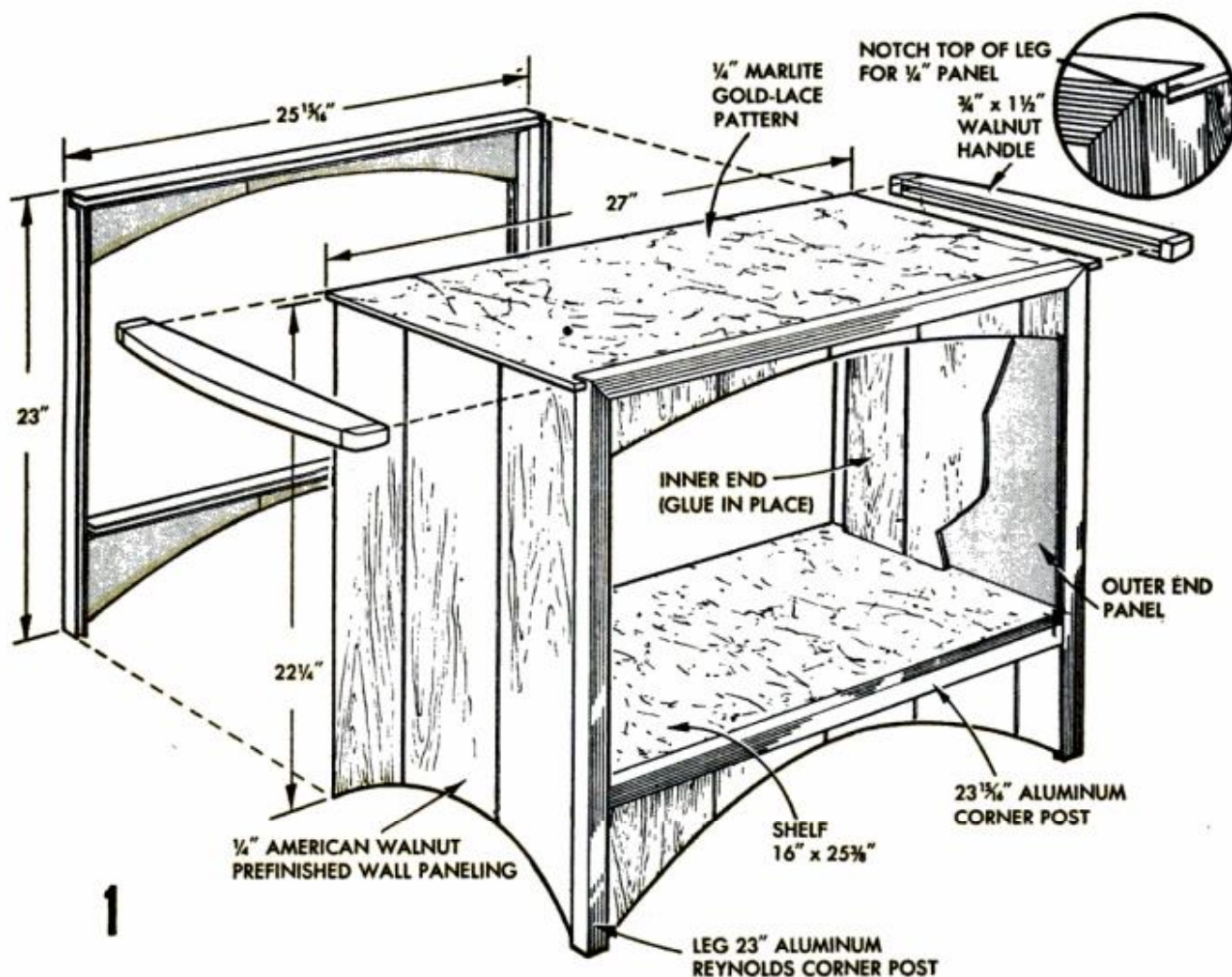
WITH THE EXCEPTION of its walnut handles, there is no finish to apply to this smart hostess cart once you get it put together—it's made of materials which are already finished before you start.

While the cart you see here was made of random plank and marble-pattern Marlite, Reynolds aluminum corner posts and 3-in. Shepherd ball casters, you can pick any prefinished hardboard and casters you wish.

The first step is to study the general pull-apart drawing in Fig. 1. Then lay out full-size paper patterns for the side brackets following Fig. 2. You'll notice that each bracket is made in two pieces which are glued and butted end to end during assembly. The brackets and the inner and

outer ends of the original cart were cut from walnut-finish hardboard, and Fig. 5 shows how you can get all of the parts out of a single 16 x 96-in. plank. The top and shelf of the cart were cut from a marbleized pattern called Gold Lace. Keep in mind that the cart top will overhang  $\frac{1}{2}$  in. at each end to provide for attaching the handles.

All of the cutting should, of course, be done with a fine-toothed blade. If you are working with a jigsaw, where the cutting action takes place on the down stroke, the panel should be sawed face up to avoid roughing up the visible side. On the other hand, if you are using a saber saw, the pattern should be traced on the back of the panel which is then turned face down





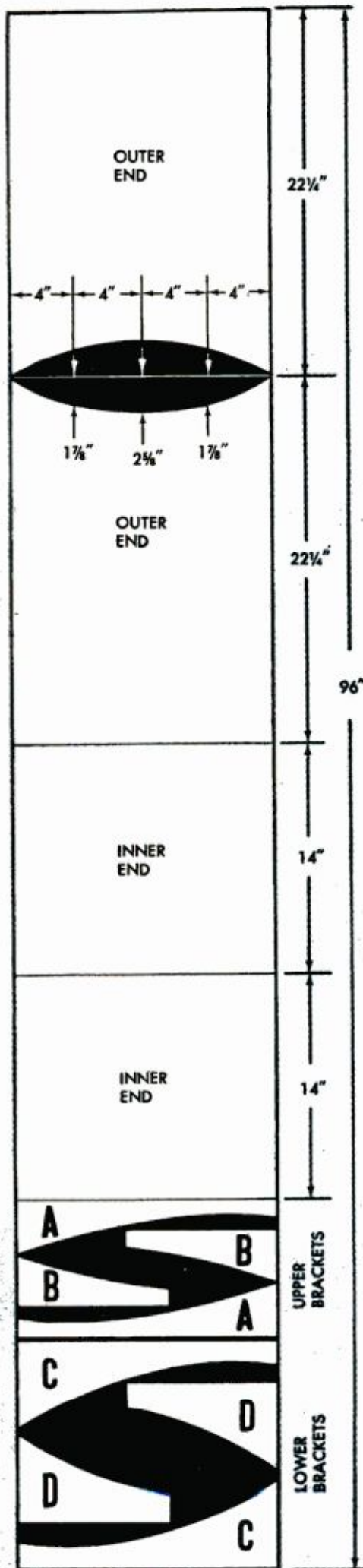


for the cut. As a precaution, test your saw on a piece of scrap panel and, if working with the face side down, guard against scratching the surface of the slick finish. If the blade is fine enough, you may find that you can saw right on the line. A coarser blade will have to be guided about  $\frac{1}{16}$  in. outside the cutting line, then

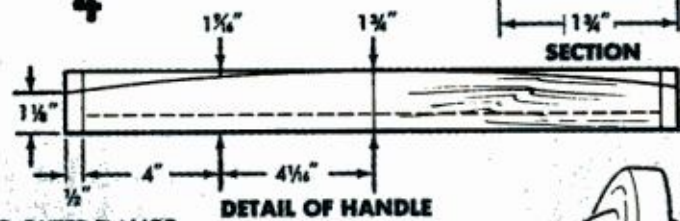
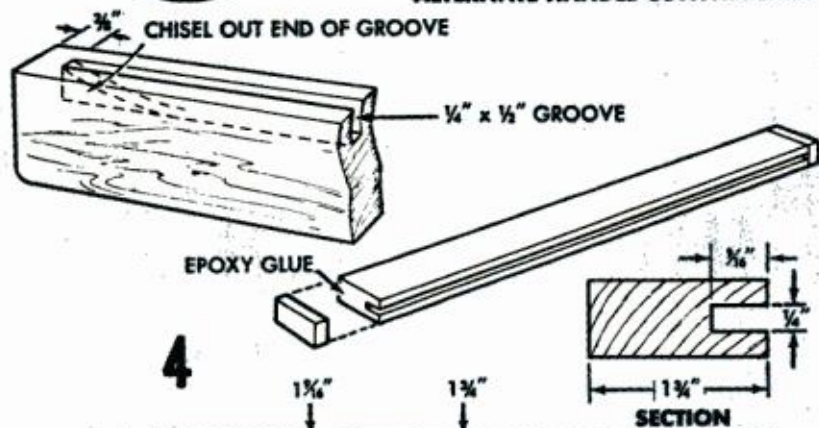
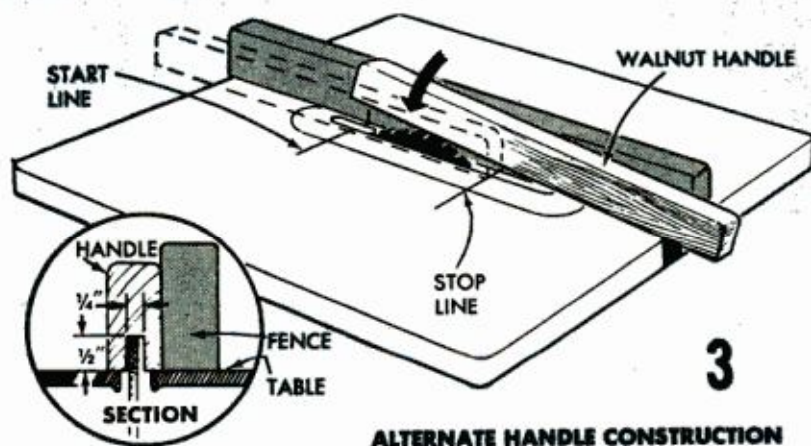
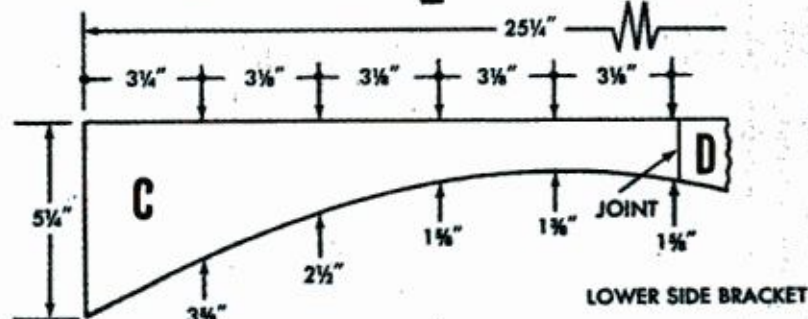
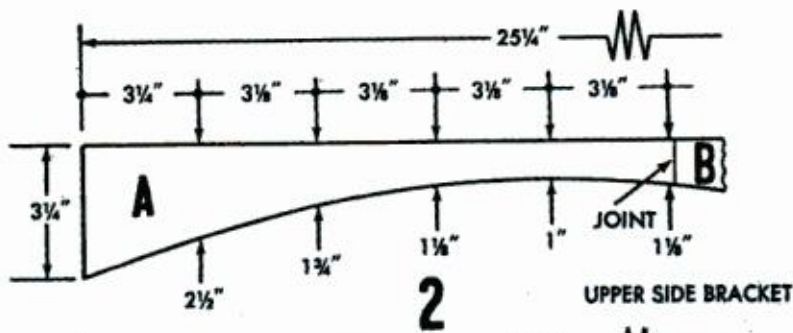
a file and sandpaper, or a spokeshave, can be used to work to the finish line. Since random plank hardboard has tongue-and-groove edges, it is necessary to plane the edge to remove the tongue.

The aluminum corner posts can be mitered accurately by hand with a hacksaw and a simple miter box as in Fig. 9.

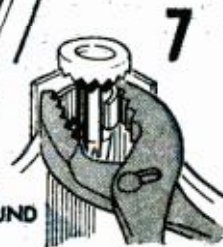




**5** END AND SIDE PANEL LAYOUTS

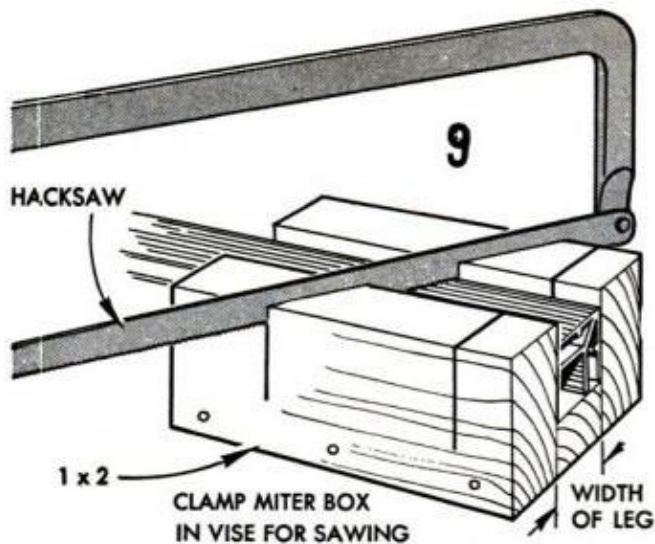


**6** BEND SAWED FLANGE AROUND SLEEVE



**8** CEMENT SLEEVE AND CASTER IN PLACE



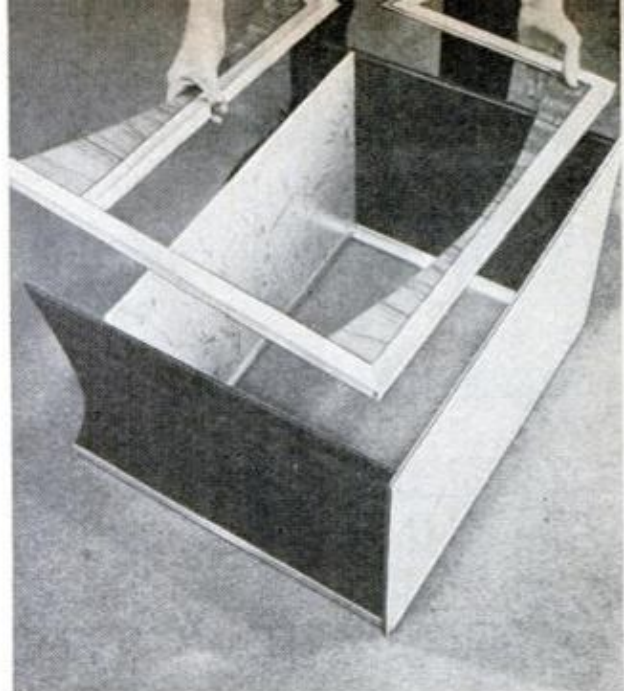


If you prefer, a cut-off wheel mounted on a radial arm or table saw may be used. Don't forget to wear goggles to protect your eyes from flying particles if you are doing the job with a power saw and abrasive wheel.

Just to be on the safe side, it's a good idea to test-assemble the cart without glue to make certain that all of the parts fit properly. Then take the cart apart, apply epoxy cement along each joint, and reassemble. For the strongest possible joints, it's best to use the type of epoxy that comes in two tubes, the contents of which are combined just before use. When you are applying the epoxy, keep in mind that it will stain the face of the panels. Don't let excess run down the surface.

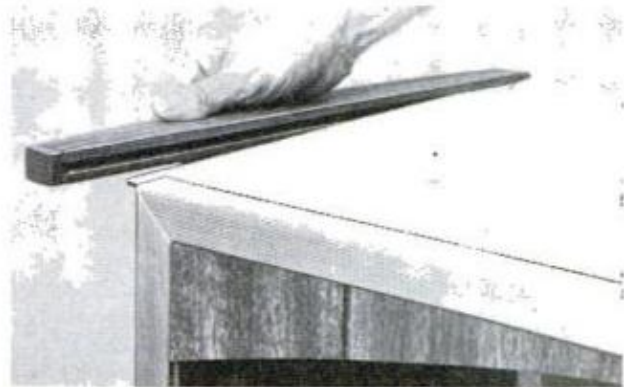
After the epoxy has set, the cart can be turned face down on the floor so that the inner flange of each leg may be cut as shown in Fig. 6. The cut should be made as deep as possible, using the outer flange as a stop. Then as Fig. 7 indicates, the sawed flange is bent around the caster sleeve with a pair of pliers. After inserting the casters into the sleeves, cement the sleeves with epoxy to the ends of each corner post as in Fig. 8. Enough epoxy should be used to surround the socket and provide a permanent bond.

The solid-walnut handles are made on the table saw, using a dado head or repeated passes with an ordinary blade. Two ways of making the handle are shown in Fig. 3 and 4. The first method illustrated is to cut a blind dado, that is, start the cut by lowering the stock onto the turning blade, then stop the pass before the blade cuts through the end nearest you. To be sure that the cut does not go too far, make pencil marks on the saw table to line up with the ends of the stock. After cutting the dado, finish with a chisel. The other way is to run the groove full length and cap the ends with walnut. ★★★



**BEFORE GLUING**, it is best to test-assemble all parts to make sure that everything fits properly. Then the cart may be taken apart, glued and reassembled

**EPOXY CEMENT** applied to the dado secures the handles to the top. It's best to finish them first, by rubbing on linseed oil—but keep oil out of the dado

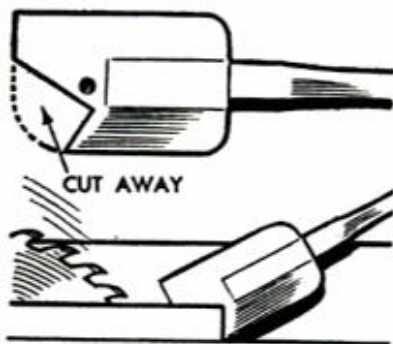


**THE CART** really comes into its own at parties but there's no need for it to stand idle when you are not entertaining. It is sturdy enough to support a sewing machine or could serve as a projector table

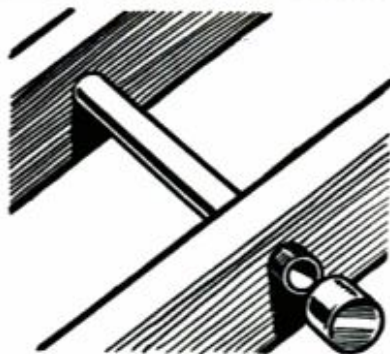




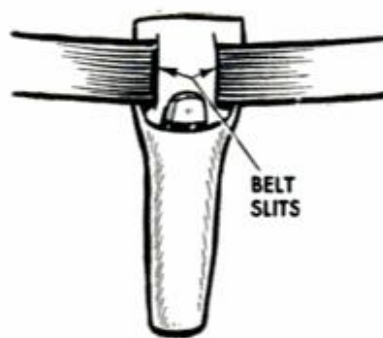
## TAKE A HINT FROM READERS



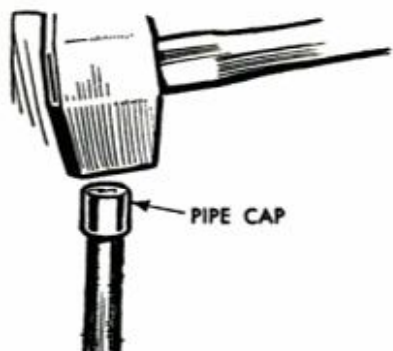
**A CARDINAL RULE** of shop safety is to always use a push stick when ripping narrow stock on a table saw. A rubber plate scraper can be made into an excellent nonslip push stick by notching it as shown. Drill a hole in the handle for hanging



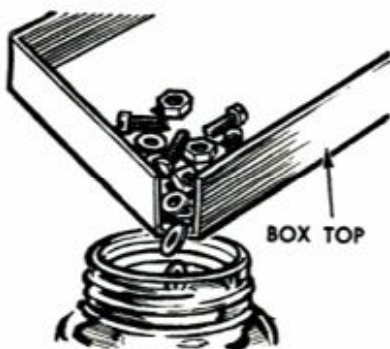
**YOU WON'T** break the same ladder rung more than once if you replace the broken one with a length of  $\frac{3}{4}$ -in. water pipe. The pipe should be threaded at each end and should protrude enough so that pipe caps may be attached to anchor the rung



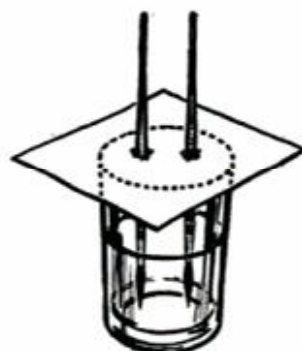
**FREQUENT NEED** for a pocket-knife when fishing means reaching into your pocket with wet hands. It's easy to avoid this by making a sheath from the finger and palm of an old rubber glove. Cut two slits in the palm to hang it on your belt



**BEAN POLES,** tent stakes or fence posts that are pounded into the ground with a heavy hammer are usually badly splintered and cracked in the process. If a pipe cap is placed over the top of the pole, blows can be delivered without damage



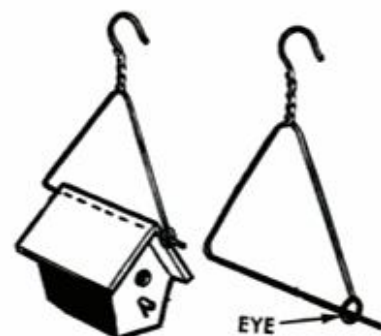
**SMALL PARTS** are easily sorted when the lid from a cardboard box is used as a tray. The lid is especially handy for returning parts to the jar if the corner is cut as shown. For a more durable sorting tray, a discarded rectangular cake tin can be used



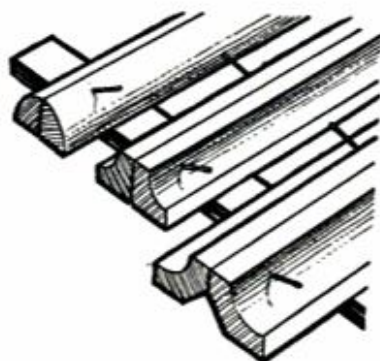
**ART BRUSHES** may be suspended in a jar of solvent by simply forcing the handles through a piece of cardboard and covering the jar with it. This will slow down evaporation and protect the bristles by holding them above the bottom of the jar



**REPAIRING HARNESES** and other leather items with rivets and washers is sometimes a difficult job because the washer tends to jump when the rivet is peened. This may be overcome by holding the washer in place with an old kitchen fork



**A WREN HOUSE** may be hung from a tree limb by using a wire coat hanger. The cross bar of the hanger is cut at one end and the opposite wire is bent to form a loop. The cross bar is inserted through holes in the peak and then through the loop



**QUARTER ROUND** and other molding can be painted twice as fast two at a time. The molding is placed back to back across sawhorses and tacked together with nails so that it won't slip when being painted. Let the nail heads protrude



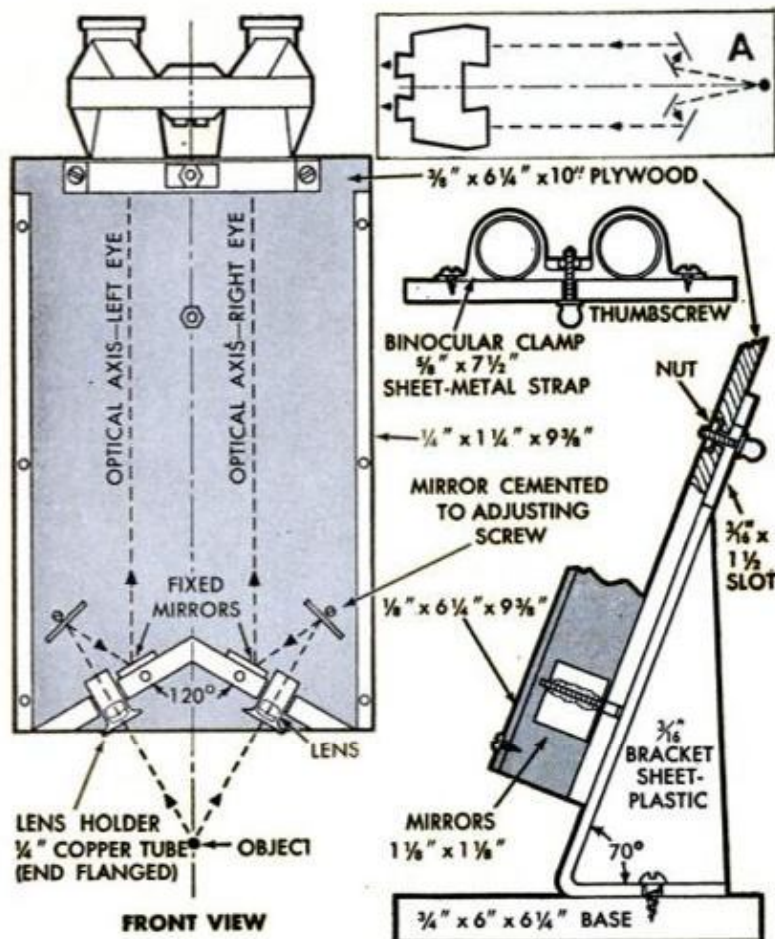
# STEREO MICROSCOPE

ARE your binoculars out of use 99 percent of the time? Make them serve a dual purpose—as binoculars and as a microscope. A stereo microscope magnifies objects from 15X up to 150X for a 3D effect.

Actually, the opera glasses shown here serve as the eyepiece for the microscope; they're just clamped in place. If your binoculars are like the wide field (7 x 25) type used here, you locate the mirrors as shown in the front view. If your binoculars have widely separated objectives, you position them as in detail (A).

The two microscope objective lenses should be achromatic, 11.5-mm ( $\frac{7}{16}$ -in. dia.) and have a focal length of about 57mm (2 $\frac{1}{4}$  in.). They fit nicely in the flanged end of  $\frac{1}{2}$ -in. I.D. chrome-plated tubing used in bathroom plumbing. The important thing to remember in mounting the mirrors and lenses is to set them at angles which cause all optical axes to be parallel to the bottom board. Paint the box flat black inside and out.

Adjustment of the microscope is made with the front board removed. Draw fine crosshairs on a small card and place it in front of the two lenses. With the naked eye, sight down the optical axis before clamping the binoculars in place. If the horizontal crosshairs do not merge, then one or more of the mirrors is not positioned 90 deg. to the plane of the bottom board. Now with the binoculars clamped in place, sight through each ocular separately to obtain a clear view of the crosshairs in the center of the field. Then finally sight through the two oculars simultaneously. Adjust the movable mirrors to make the vertical crosshairs merge. Focusing is done by either sliding the box to and from the object or focusing the oculars individually—*Charles Metcalf, Ph.D.*





# OUTRIGGER SKI SLED

By H. B. Dabkowski

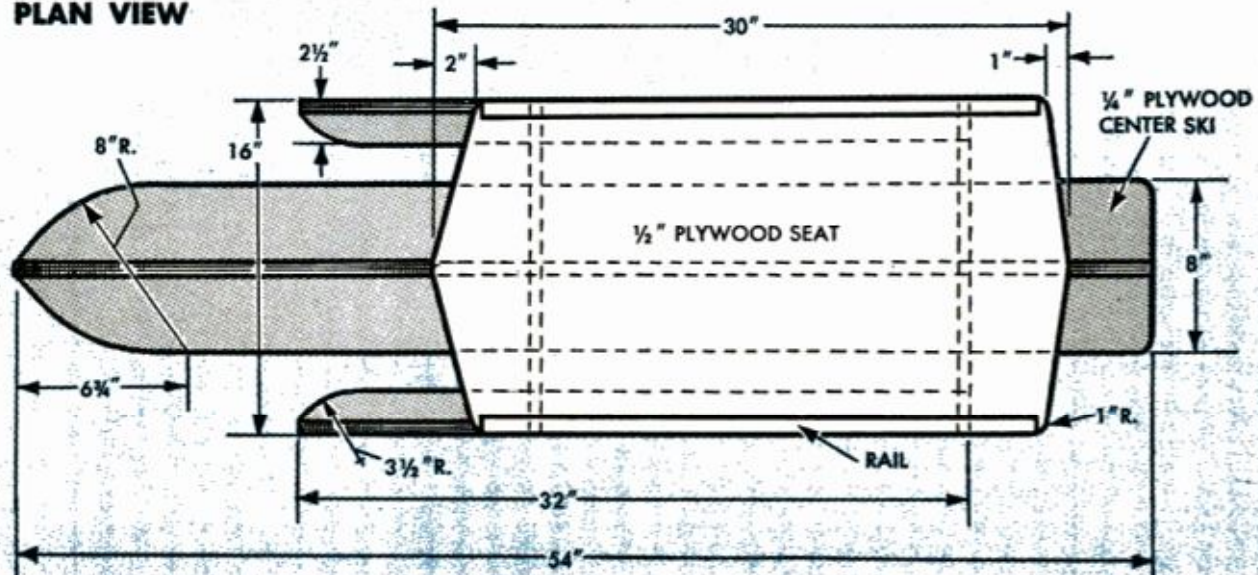


STEEL-RUNNER SLEDS are no match for this speedster. Even on the lightest snow its broad center runner skims the ground light as the wind. Like training wheels on a bike, outrigger skis keep you balanced as you streak along. Steering is done by leaning from side to side.

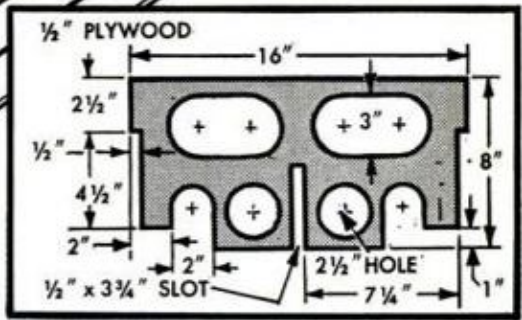
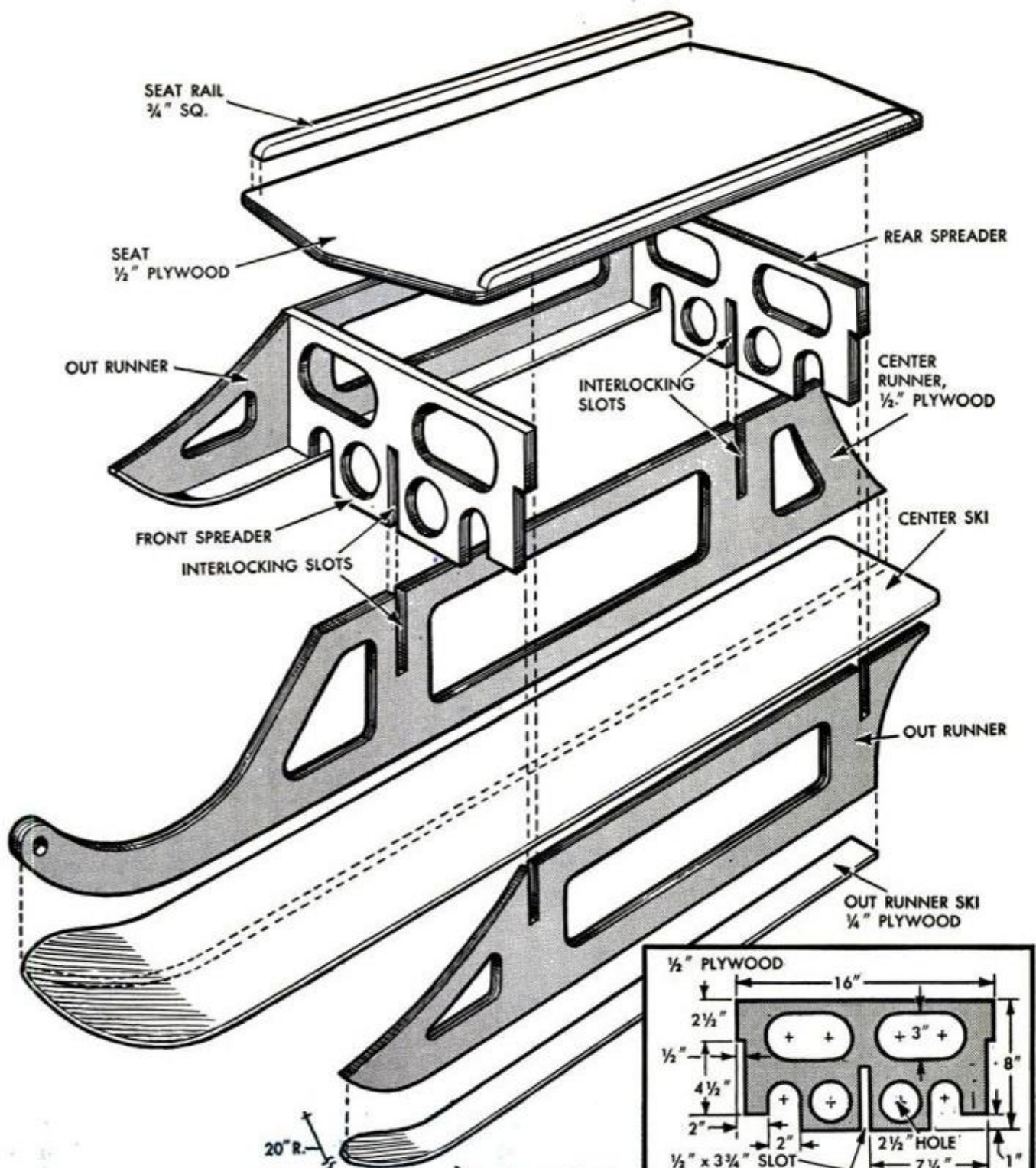
The whole thing is made of plywood, marine or exterior. You'll need  $\frac{1}{2}$  in. for the seat, runners and spreaders,  $\frac{1}{4}$ -in. for the skis. The pull-apart drawing shows how the parts interlock with half-lapped slots. The cut-out areas are made merely to lighten the sled but are something you can skip, at least in the spreaders, if you find they are a job to cut. Use a waterproof glue and #6- $1\frac{1}{2}$ -in. flathead wood screws to assemble the parts.

The ski runners won't give you any trouble if you start at the curved end. Shape the ends according to the plan view and cut the strips extra long. Now, with the sled upside down and the help of an extra pair of hands, fasten the tip of the ski to the curved section of the runner, using glue and several screws placed 1 in. apart. If you have a C-clamp, use it too. Next wring out a hot towel and place it along the bend. As the wood becomes pliable, pull the ski down a little more and add another screw. Once you are past the curve of the runner you'll have easy going and you can space the remaining screws a foot or so apart. After painting, varnish the skis and wax them. Then head for the hills for fun galore.

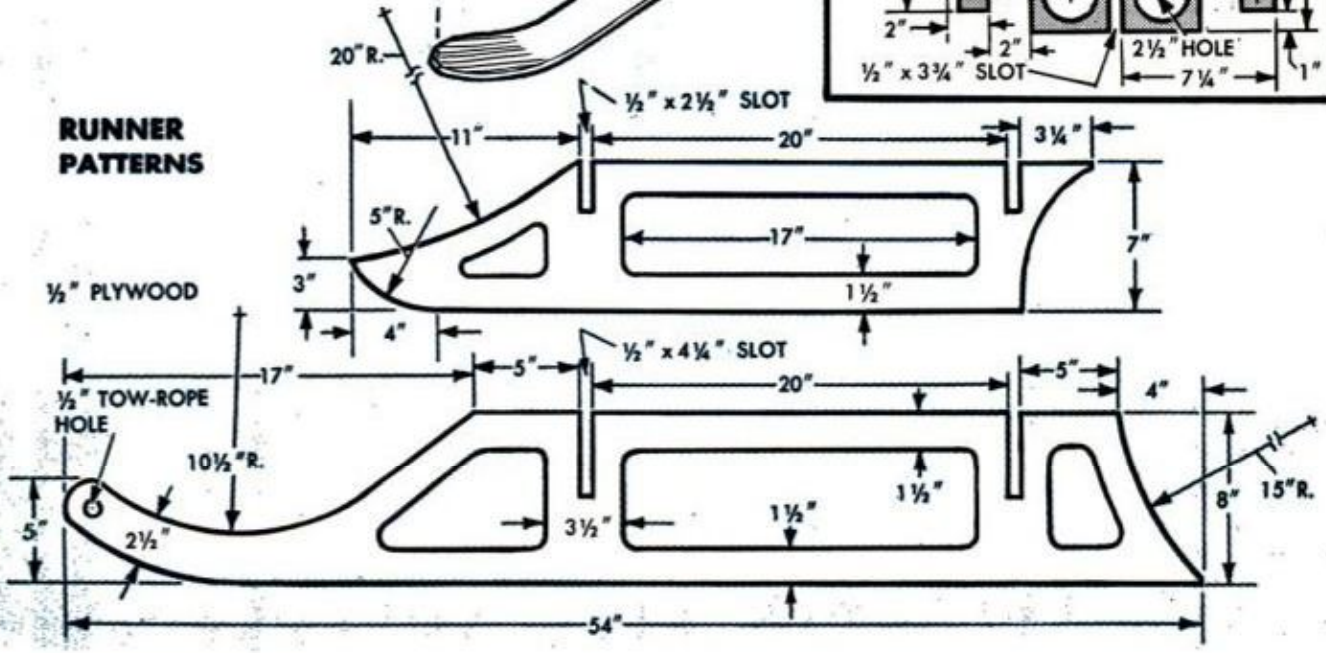
PLAN VIEW





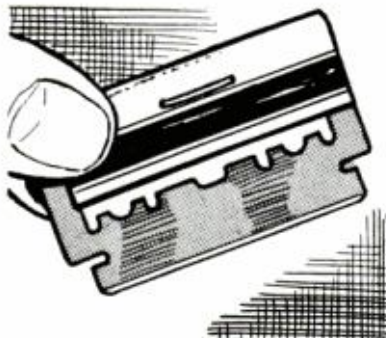


**RUNNER PATTERNS**





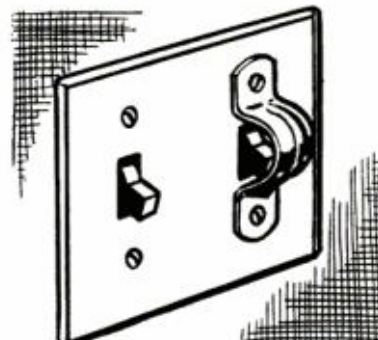
## TAKE A HINT FROM READERS



**HANDY HOLDER** for a double-edged razor blade is just the stapled portion of a match book. Slide one edge between the two pieces of cardboard from which the matches were torn and it's ready for use



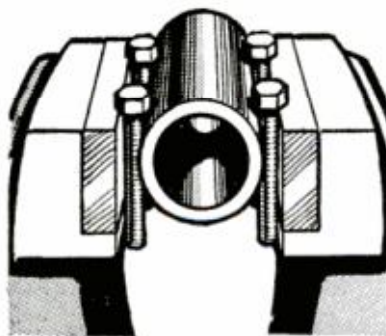
**WHEN PUTTING UP** cardboard signs on trees or posts, drive each nail through the center of a bottle cap. Signs mounted this way are less likely to be torn loose by heavy winds than those attached with common nails only



**WHERE** the accidental flipping of a switch on a gang switch plate could turn off a vital appliance such as an oil burner or a freezer, a pipe strap will provide a neat safety cover yet still permit use of the switch



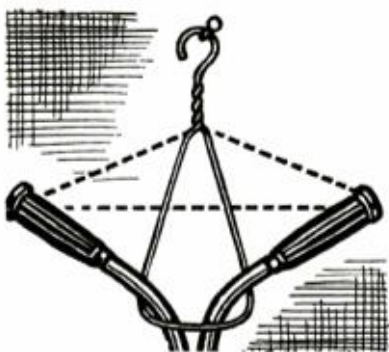
**LONG-REACH TORCH** makes it possible to burn caterpillar nests located in the upper branches of a tree. To make it, impale oil-soaked corncob on a stiff wire wrapped around the end of a long cane pole



**IF PIPE VISE** is not available when needed, try substituting four bolts of equal diameter in your bench vise. When the bolts are clamped in the vise with the work, their threads will serve as holding teeth



**TO ANCHOR LAG SCREW** in a hole in concrete, try sawing off the head of a clothespin and driving it into the hole. The legs of the clothespin will be pushed together, allowing for expansion when screw is inserted



**TO SAVE SPACE**, hang your lawnmower against the garage wall. Just bend a heavy wire coathanger to the shape shown above and slip this loop over mower handles. Nail will serve as a hook



**DOUBLE-TROUGH** holder for art brushes used on a sloping drawing board is made by splitting a short section of rubber hose and joining the halves with rivets or cement. Friction of the rubber keeps it in place

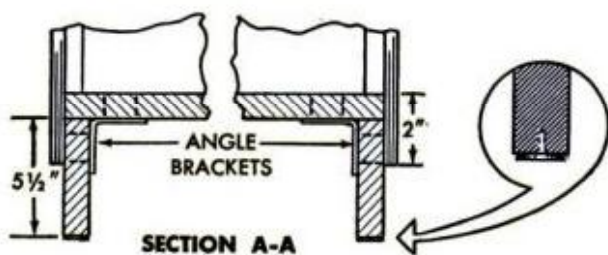
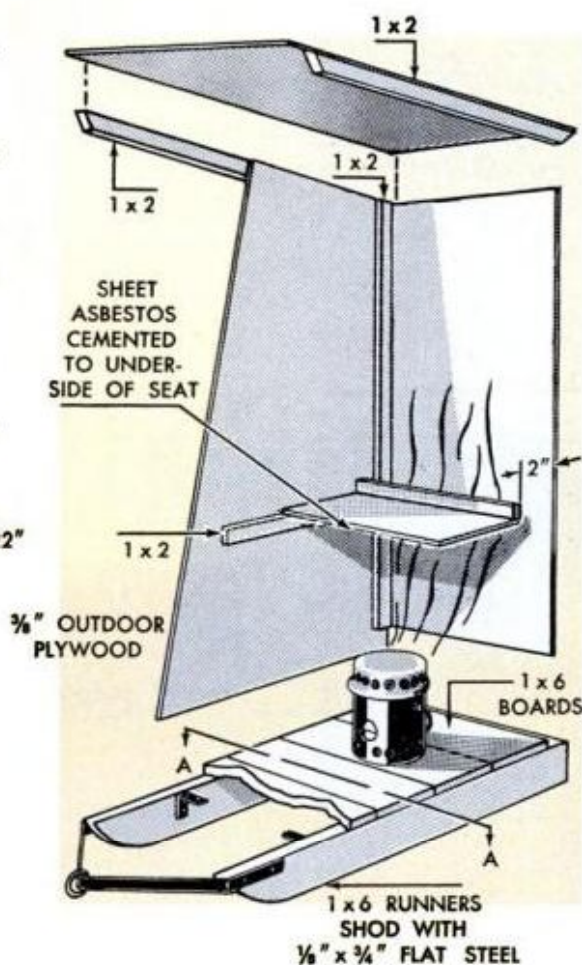
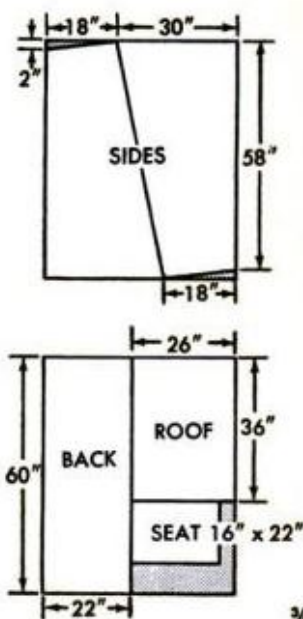
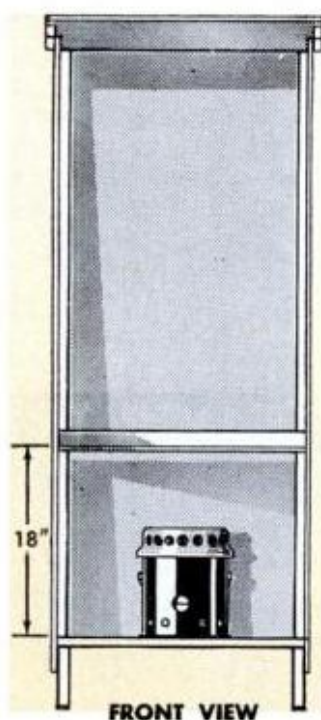


**SMALL MOTOR** used at different places around the farm or home will be much easier to carry if you improvise a carrying handle. Simply invert the motor and loop the driving belt around the ends of the base, as shown



# Southern Comfort for the Arctic Angler

THE INCREASINGLY popular flameless stoves have solved an age-old problem for the ice fisherman—how to keep warm. There are several on the market, such as those called Heat-Pal and Therm'x. The fuel is alcohol, gasoline or naphtha, depending on which stove you select. When used inside a windbreak, such as the three-sided fishing shack shown below, the portable, explosion-safe heater assures the fisherman of ample warmth. The shack is of simple construction:  $\frac{3}{8}$ -in. outdoor plywood is glued and nailed to 1x2 strips, then the whole thing is given two coats of paint. Flat steel is used to shod the runners and to form a tow bar for a length of rope. The shack is light enough so that it may be easily transported to your favorite fishing spot by tying it on the roof of your car.—Hi Sibley





# WHO SAYS YOU CAN'T LAY CERAMIC TILE?

The pros say so—and they have a point when the job calls for special techniques. But most home tiling applications don't—and that's where you take over

By Steven J. Howard

**A** CONTROVERSY is raging among professional tilemen, and you're right in the middle of it.

One group (those who do nothing but contract work) argues that the average homeowner *cannot* install ceramic tile himself, that the services of a pro are needed. The other faction (those who may do contract work but primarily run shops that sell tile directly to the public) says "No such thing!" They contend that with products now on the market anyone can install ceramic tile.

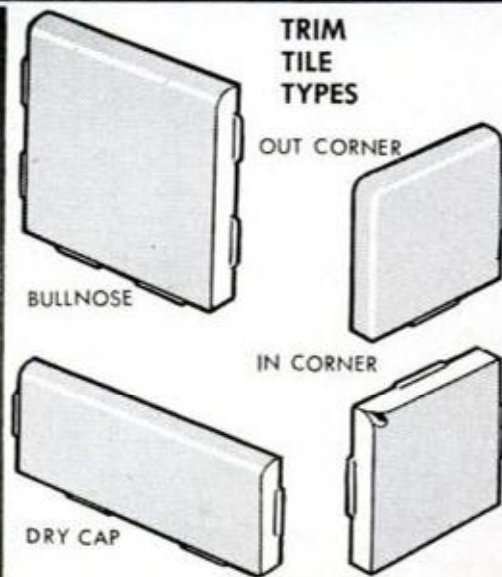
There's some truth on each side. Two factors *did* until recently put ceramic tile beyond the reach of the do-it-yourselfer: its sale was restricted to professional contractors, so you couldn't *buy* either the tile or the materials to lay it; and, secondly, the spacing of the tile for a neat

grout line used to be tricky—most pros did it by eye. But today's ceramic tile have little lugs projecting from their edges, to space the tile automatically.

At the heart of the argument is the fact that there are two *ways* to lay ceramic tile—the dry method and the old mud method. The first is much like the technique do-it-yourselfers have long used for plastic tile. But the second is a tricky process in which wire lath must first be attached to the walls. Then a cement-and-sand undercoating is carefully mixed and applied, the tile is soaked in water and pressed evenly into this mud coating while it's wet.

Some tiling jobs still call for this professional method—notably installations subjected to a flood of water. So the *type* of job you have in mind determines whether you should do the work yourself. As a

## BEFORE YOU START: FACTS ABOUT FLOOR TILE





rule-of-thumb, the dry method is adequate for kitchen walls and countertops, for powder rooms—and for bathrooms where the tub isn't constantly used as a shower. If a shower stall is involved, however, you'd better turn the job over to an expert. In all likelihood, he'll use the mud method in the shower area and the dry method on the other walls. We've even seen pros skip the mud method on tub-alcove walls where there was a shower head, since these don't get the direct surge of water a shower stall does.

● Ceramic tile is divided into two general categories: glazed and unglazed. Glazed tile resembles finely polished chinaware, while unglazed has a non-luster finish. Both are available in all sizes and shapes, and in about 200 shades of basic colors.

The glazed type is generally considered wall tile. Unglazed tile, because of its indestructible nature, is often thought of as a floor covering. However, this is not a hard and fast rule, and homeowners have diverged from it, especially in the case of unglazed tile, with striking results.

It's also generally believed that glazed tile of a particular size made by one manufacturer is of the exact same size as glazed tile produced by other manufacturers. This is *not* true, and you should keep this in mind when purchasing tile.

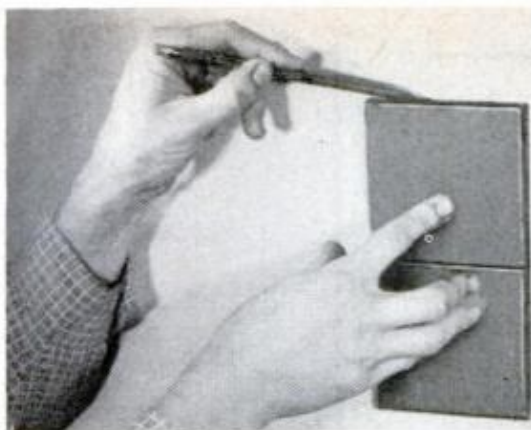
The size of glazed tile, whether advertised as 4¼ in. sq. (the size generally used for standard installations) or 6-in. sq., varies from manufacturer to manufacturer. It might be exactly 4¼ in. sq. or it might be ¼, ⅛ or even ¼ in. smaller or larger.

The first rule, then, is *always* use the tile of one manufacturer throughout any one job. This avoids the problem of size discrepancy.

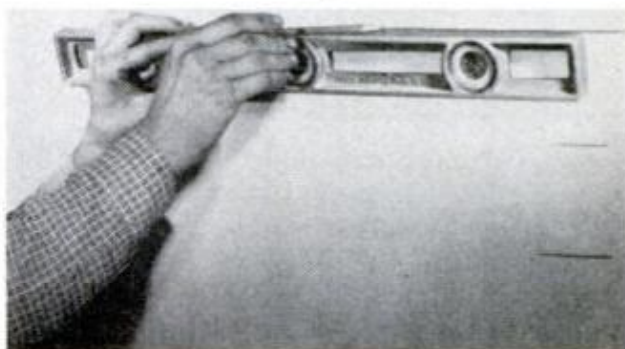
● As for tools, you probably have many of them around the home. Those that aren't handy can be purchased or rented cheaply from your dealer.

You'll need a paint brush for spreading primer; a pair of pliers or carbide-tipped nippers for nipping out small sections of tile to fit around pipes, etc.; a carborundum stone for smoothing cut edges; sponges for spreading grout and cleaning; a margin or pointing trowel for mixing grout; a notched trowel for spreading mastic; a carpenter's level for truing the lines; a ruler and pencil; a window squeegee for removing excess grout; a joint-striking tool, such as an old toothbrush handle or a rounded stick; a glass cutter or ceramic-tile cutter; and a carbide-tipped drill for drilling holes.

● Materials you'll need are: primer (if you are covering a surface in an area that's subjected to moisture), mastic, grout



**FIRST STEP** in laying tile involves walking two tile up wall until you reach proposed height of top row



**AFTER DETERMINING** the height of top row of tile, use carpenter's level to extend guideline around room

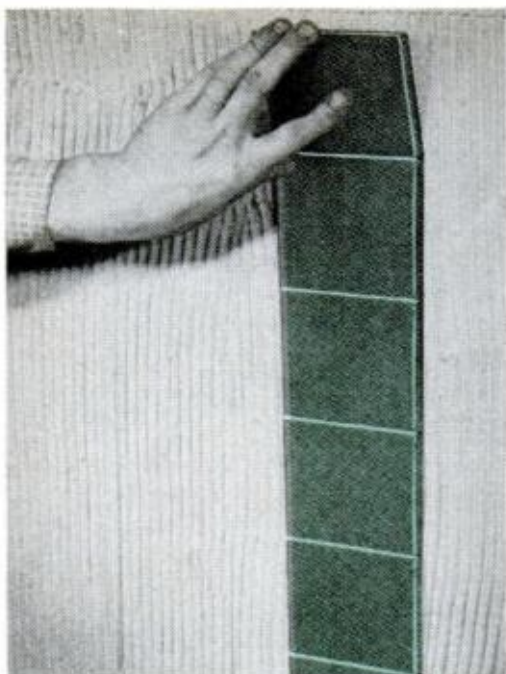
**ONE COAT** of primer is usually sufficient, but in high moisture areas, you should apply two coats



**SPREAD MASTIC** evenly over primed wall, using notched side of trowel so as to leave ridges in material







**AFTER ESTABLISHING** a vertical guideline with a plumb line, install one complete vertical row of tile at floor's lowest point (where you walked up two tile). Then, starting with the top row, lay tile along the guideline which will be visible through the mastic. Work down from this row, one course at a time, until you reach the bottom row. Unless floor is perfectly level, some of these tile will have to be trimmed for a perfect fit

—and silicone, if the job calls for it.

If a primer is called for, don't buy just any type. There are special ceramic primers available containing chemicals that make them suitable for use under tile. A gallon of this material will cover 225 to 250 sq. ft.

Make sure the mastic (adhesive) you buy bears the seal of the U. S. Department of Commerce on the package, attesting to the fact that the material meets Commercial Standard Specifications CS 181-52. A gallon of ceramic tile mastic for walls covers 45 to 50 sq. ft., while a gallon of mastic for floors does about 60 sq. ft.

That's right—there are different types of mastics for walls and floors. Each has a different chemical content. Floor mastic doesn't contain oil, since it slows setting and this would keep the floor out of service too long.

Furthermore, there are different types of mastics for various wall surfaces. Be sure to stipulate which type of surface you're tiling when buying mastic. There's a mastic, for example, specifically made for wallboard. This will not adhere well to plywood, for which there's also a specific mastic.

Wall grout comes in powdered form and has to be mixed with water. A 25 lb. bag will cover from 200 to 250 sq. ft.

If you're tiling a floor, countertop, or any other area that's subjected to heavy soiling, you should add liquid silicone to the grout in an amount specified in the instructions accompanying the silicone.

● There are dozens of different sizes and shapes of so-called wall trim tile that are used for top, bottom, corners and edges. Most people, though, will find that they can make do with only four kinds of

trim for a standard type of installation.

These are the 2 x 6-in. dry cap (S 4269) used as top trim, 2 x 2-in. out-corner trim (SN 4269), 2 x 2-in. fly (in-corner) trim (SM 4269), and 4¼-in. bullnose trim (S 4449). All these numbers are standard throughout the industry.

● Here's a rule-of-thumb you can use for estimating how much tile you'll need for a wall installation. Add the length and width of your room and double this sum, then multiply by the height of the proposed tile installation. The result will be the total area to be covered.

For example, suppose you're working in a bathroom that is 5 by 7 ft. Add 5 to 7 and multiply by 2, giving you 24. Then, multiply 24 by 4½—the standard height of the surface one usually wishes to cover in a bathroom. This gives you a total of 108 sq. ft. to be tiled.

From this figure, your tile dealer can estimate how many tile you'll need. If you use 4¼-in. sq. tile, you'll require eight tile for each square foot. Going back to our example, this would mean about 864 tiles for the installation. This figure allows for windows, doors and waste. Most tile dealers will allow you to return unused tile for a refund.

As for trim pieces, it would be a good idea to bring the dealer a sketch of the floor plan. If you own a Polaroid-Land camera bring a photo of the room, instead.

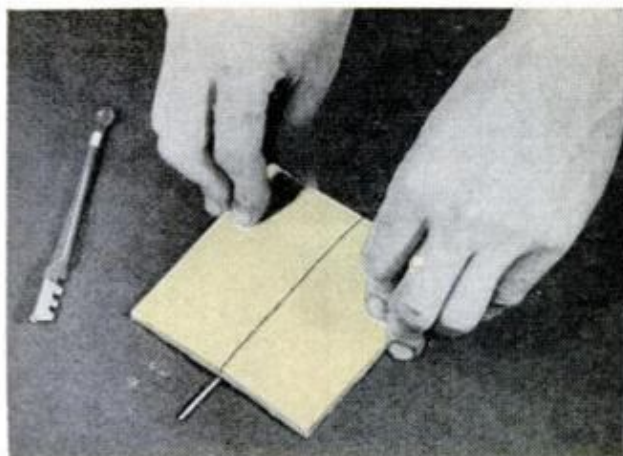
Wall tile can be installed on any surface except tongue-and-groove boards or unseasoned boards. These expand and contract and, in time, will cause tile to pop off the wall.

● You should be sure the grout you buy doesn't call for soaking of tiles prior to installation. Dry method grout is specially

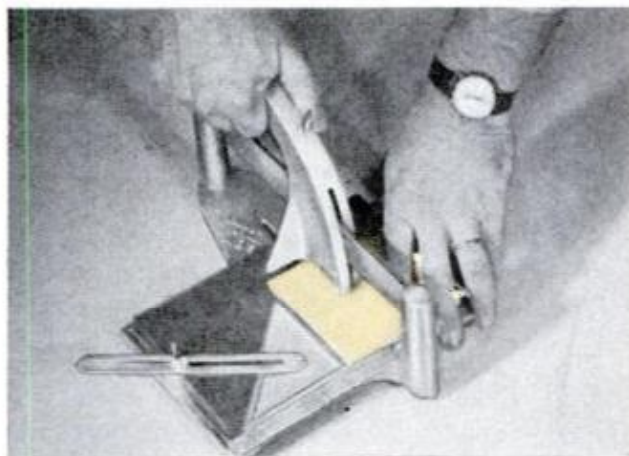




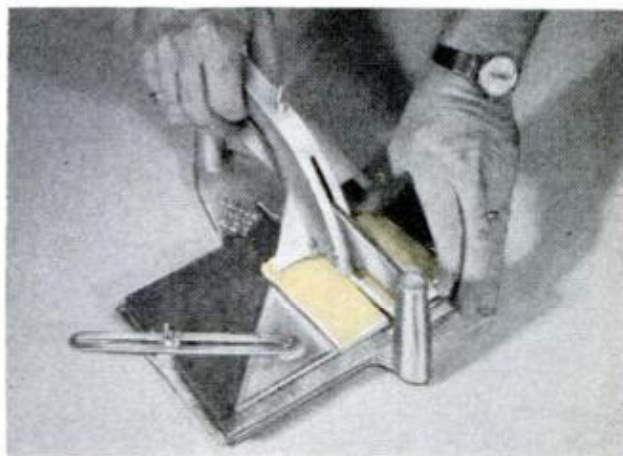
**CUTTING TILE** is a simple operation. Just score a line on the glazed surface with an ordinary glass cutter



**ONCE SURFACE** has been scored you can easily break the tile over a finishing nail or the edge of a table



**CERAMIC TILE CUTTER** is easier to use than a glass cutter. Most tile dealers will have these for rent



**TO BREAK** tile, just press down on the cutter handle and cams on the bottom of the lever will do the rest

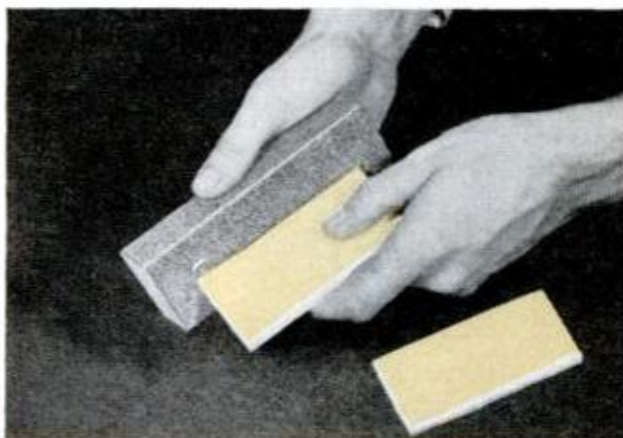
treated so that the grout doesn't absorb moisture from the tile.

The actual installation of tile on a straight wall is simple enough. First remove all moldings, baseboards and fixtures. Then scrape away any loose plaster or paint, and sand irregular surfaces. Fill holes with patching plaster.

If a wall is just too rough, you can save yourself a lot of work by covering it with gypsum wallboard. However, make sure all joints and corners are taped and cemented securely.

In a room without a bathtub, use a carpenter's level to find the lowest point along the bottom of the walls. Now, walk two tile up the wall at this point until you reach the height at which you want your top row of tile. Scribe a line along the upper edge of the top tile.

With a carpenter's level, extend this line around the room, making sure it's perfectly straight. After priming and applying mastic, lay in the first vertical row of tile, placing the first tile flush with the floor at the lowest point in the room. Extend this row right to the level line, making



**BEFORE INSTALLING** a cut tile, be sure that you smooth the edges of the cut with a carborundum stone

**CUTOUPS IN TILE** can be made with carbide-tipped nippers or even a pair of pliers. Take small bites





sure that it's plumb. You can now work out from this row in both directions.

When you emplace the bottom row of tile (the row nearest the floor), you will have to trim with a carborundum stone or cut off the bottom of the tile wherever the floor slopes higher than at the spot you started. You want to keep irregularly cut tile in the least conspicuous place—near the floor.

If a room has a bathtub, use the top edge of the tub as your layout guide. Find the lowest point along this edge with a level. Follow the same procedure as you would in a room without a tub,



**GROUTING** is the final step. Mix the powdered grout with water to form a paste and sponge it over tile



**AFTER ALL JOINTS** have been filled with grout, wipe off all excess grout with a common window squeegee



**RAKE JOINTS** with a striking tool. You can use any blunt-pointed stick—or even a toothbrush handle

installing tile along the top edge of the tub after all others are in place.

Next, apply the primer. One coat is usually sufficient except in high moisture areas. In these, apply two coats—one vertically and the other horizontally.

When the primer has dried, apply a thin coat of mastic to the surface with the flat side of a notched trowel. (Until you become proficient, do only about 10 or 15 sq. ft. at a time.) Then apply another coating of mastic, this time using the notched side of the trowel so as to leave ridges in the material. The mastic must be evenly spread since tile follows the contour of this adhesive coating.

If the mastic begins to skin over before tile can be applied, scratch the surface with the notched end of the trowel to loosen it up. As a starter, apply mastic to one wall only; you might tire of the job or be called unexpectedly away. If you're the persevering type, of course, you can coat the entire room.

Anchoring the tile is no problem. Just press each tile into place against the tile next to it and shift it from side to side about  $\frac{1}{8}$  in. Then slide it back against the previously applied block. This insures good transfer of mastic to the tile.

● The row of tile along the top edge of the tub is one of those areas where you could hit a problem later on if the job isn't done carefully now. Several tilemen suggest that the joint between tub and tile be sealed with tub calk. However, others we spoke to claimed that tub calk will eventually loosen and allow the tile to pop out. These people suggest that instead of calk, the wall above the tub be covered with mastic, as with other areas, but that the mastic be lapped onto the edge of the tub almost as far as the tile will project. Then, when you apply the grout, give particular attention to this joint between tub and tile. Fill it thoroughly and don't rake it as deep as the other grout lines. The grout makes a firm seat from which tiles will never pop.

Another spot for special attention is around fixtures that fit in the wall, such as soap dishes. Tilemen suggest that after the area is cut out for the fixture, it be stuffed with a crumpled newspaper or wire mesh. Plaster of Paris should then be spread on the newspaper or mesh and over the back of the fixture. The fixture is then placed in the wall. (This is done after tile is installed and grouted.)

One thing to keep in mind is that cut tile should be hidden whenever possible behind such places as the toilet tank and door, so they won't be conspicuous.

● Cutting tile is easy. For straight cuts,

[\(Please turn to page 201\)](#)





# NOVELTY LAMPS

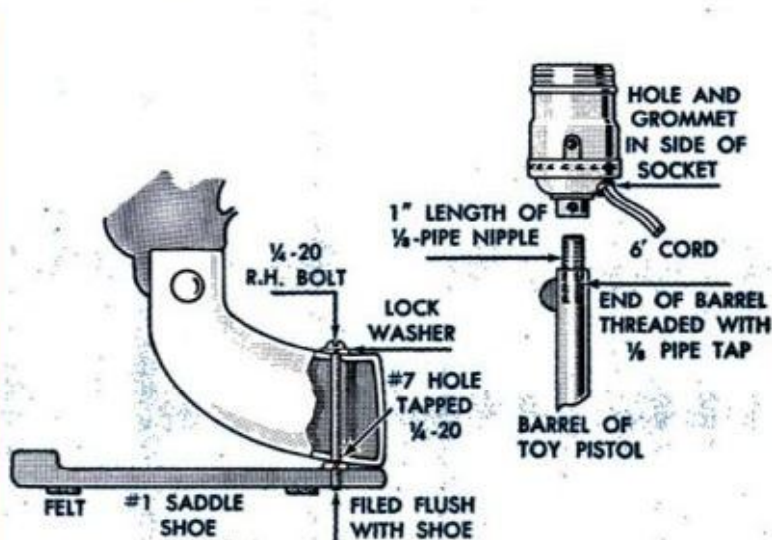
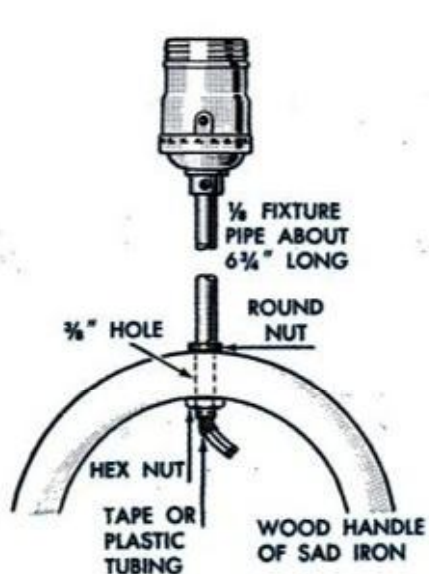
By  
**Art Trauffer**

HERE ARE two novel lamp bases which are built around nostalgic items of the past—a sad iron and a horseshoe.

The sad iron is converted into a lamp by drilling a  $\frac{3}{8}$ -in. hole through the wooden handle for a length of  $\frac{1}{8}$ -in. electrical fixture pipe, threaded at each end. The upper end is fitted with a standard pushbutton socket and the lower end is attached to the wooden handle with a round and a hex nut. A bit of rubber tape is wrapped around the lampcord where it enters the pipe. The lamp is completed by brightening the pipe standard with steel

wool, cementing felt pads to the iron bottom and adding a clip-on shade.

The second lamp is a cute one for a young cowpoke's room. Here both the horseshoe and the toy pistol are drilled for a  $\frac{1}{4}$ -20 stove bolt, the hole in the shoe being tapped. It is important that the hole in the pistol handle be drilled parallel with the barrel so that the revolver will stand vertically when bolted to the shoe. A short  $\frac{1}{8}$ -in. pipe nipple is cemented in the end of the barrel with epoxy for attaching a socket. Finally, a hole is made in the cap of the socket for the lampcord.



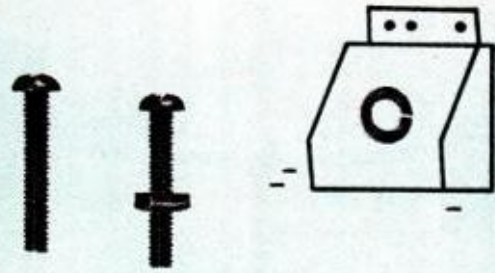


# TALKING SHOP

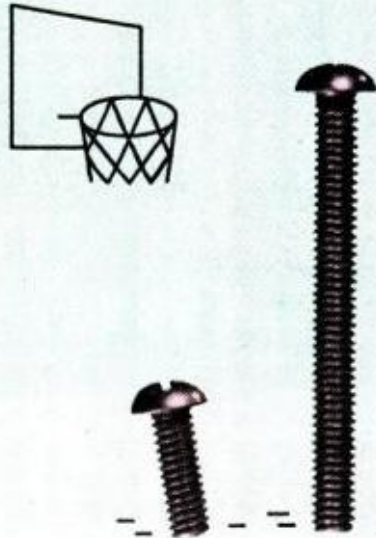
By Bob Laughlin



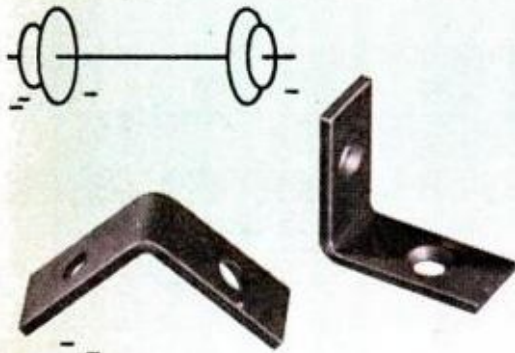
"Those big airliners are all right, but there's nothing like flying your own plane!"



"There it is, dear—your new washer!"



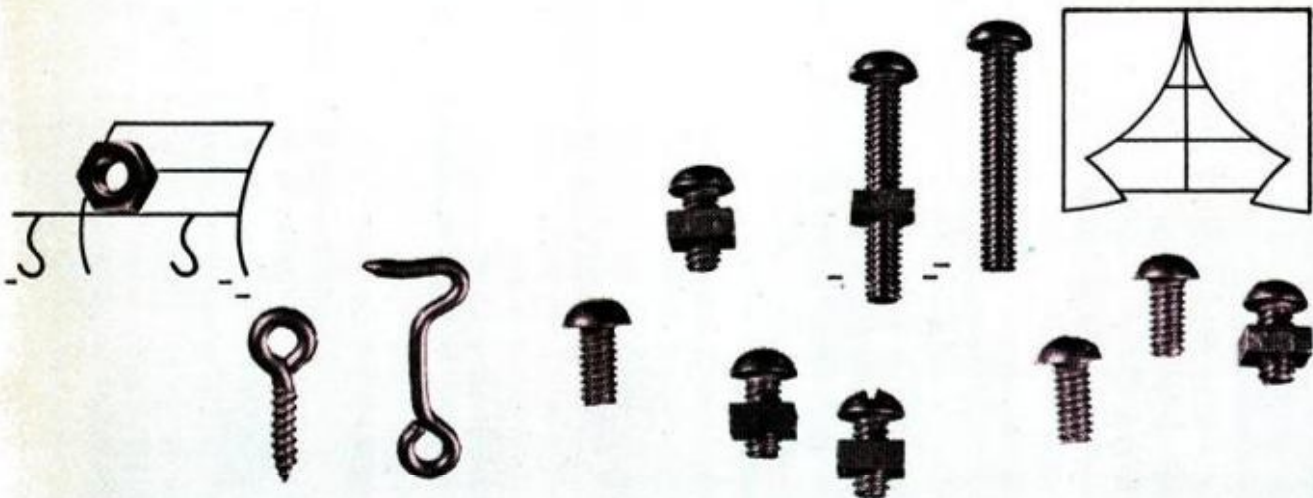
"Congratulations on signing your pro contract!"



"That's enough push-ups—now try a few of these sit-ups."



"Have you tried Vic Tanny's?"



"Don't even talk to him—he's some kind of a nut!"

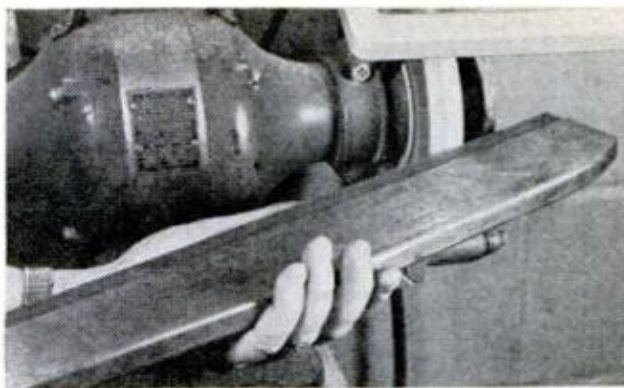
"What was it we said—'a girl for you and a boy for me'?"



## SHOP SHORT CUTS

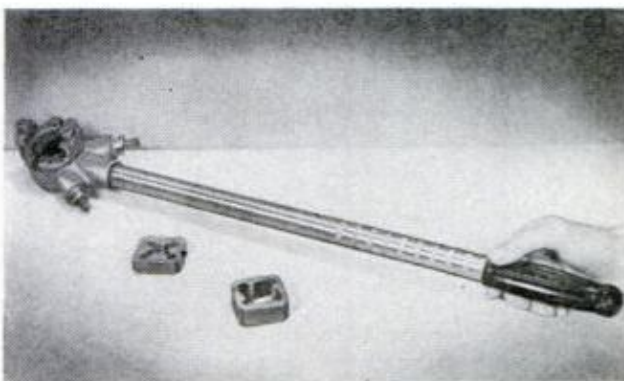
### Grinding Long Work

On small bench grinders, the wheel does not protrude far enough beyond the front of the motor housing to let you grind long work. You can remedy this by dressing off a bevel on the outside edge of the wheel. The work can then be held at an angle as it is moved across the wheel.



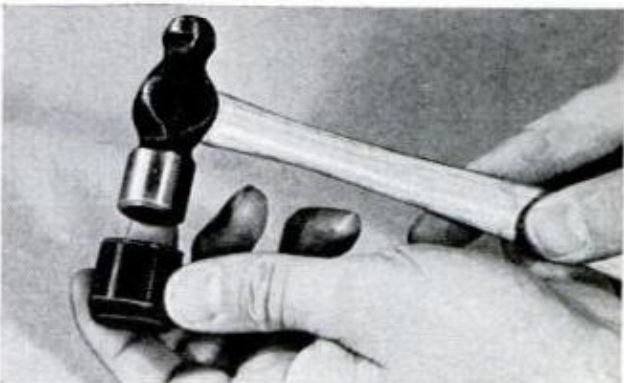
### Get a Good Grip

Cutting threads on pipe can be tough on the hands, but fortunately the problem is easy to solve. All you have to do is slip a bicycle handlebar grip over the handle of the die stock. This will provide a comfortable, non-slip surface that is easy to grasp even when hands are oily. You will find that the handlebar grip is especially effective when cutting threads on large diameter pipe.—R. Hanscom



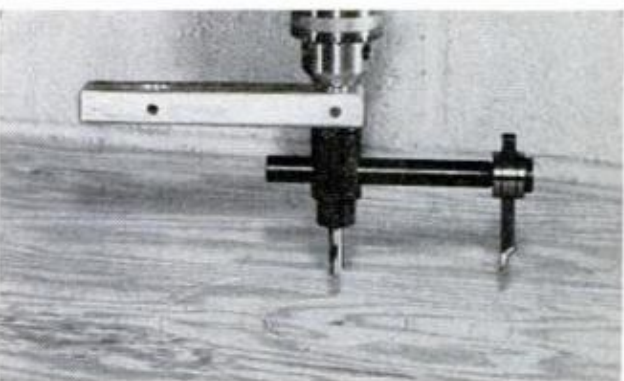
### Soften the Blow

There are many jobs that call for a soft-faced mallet because an ordinary hammer would mar the surface of the stock. But if you have only occasional need for such a mallet, you can improvise a small one by slipping a rubber or plastic furniture glide of the appropriate size over the face of a ball-peen or regular hammer. Glides of this type are sold in a range of sizes at hardware stores.—H. J. Gerber



### Cure for the Shakes

Circle cutters vibrate because they are out of balance. This can be corrected by making a counterbalance from a metal bar about  $\frac{1}{2} \times \frac{3}{4} \times 4$  in. Two or more  $\frac{1}{4}$ -in. holes drilled through the bar accept the shank that goes into the chuck. Drill and tap for a setscrew at each hole so that the unit may be attached securely. The holes allow proper counterbalancing for various cutter settings.—K. Krausse



### Piggyback Lathe Wrench

To a machinist, time is money and I realized one day as I was hunting for my toolholder wrench that I frequently wasted a lot of time looking around the shop for it. Now I've licked the problem; as shown in the photograph, I sawed off the toolholder wrench and welded it to the box end of the tool post wrench. This combination saves time not only in tracking down a lost wrench but in using the tool as well.





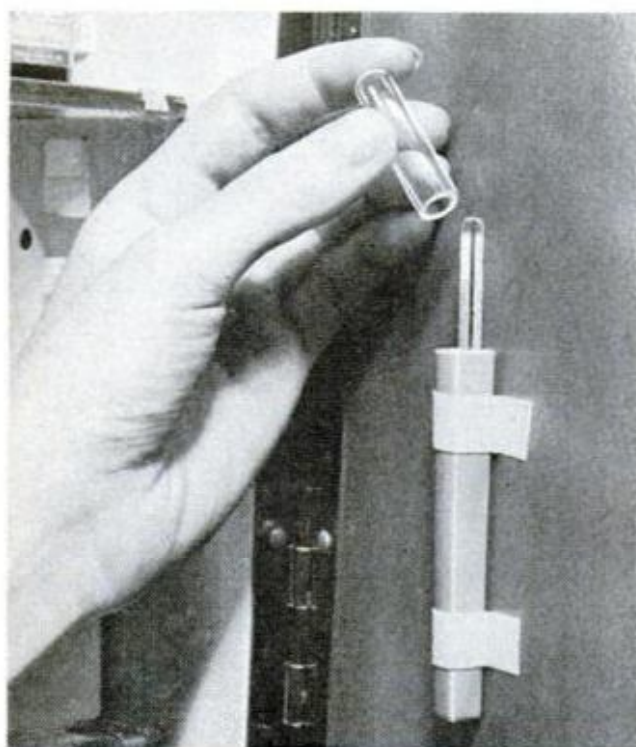
# Solving HOME PROBLEMS

**HIGH-GLOSS SHINE** for your shoes is a breeze if you sprinkle a few drops of rubbing alcohol over that fresh coat of shoe polish and buff lightly. After three or four "tipsy" shines, give the shoes a coat of saddle soap to replace the oil removed by the alcohol

**PEG BOX** for toddlers is a simple, inexpensive toy that will keep a two-year-old amused for hours. Make it from scraps of perforated hardboard and glue to a framework of 1 x 1s. Paint the box a bright color and provide a dozen colored golf tees



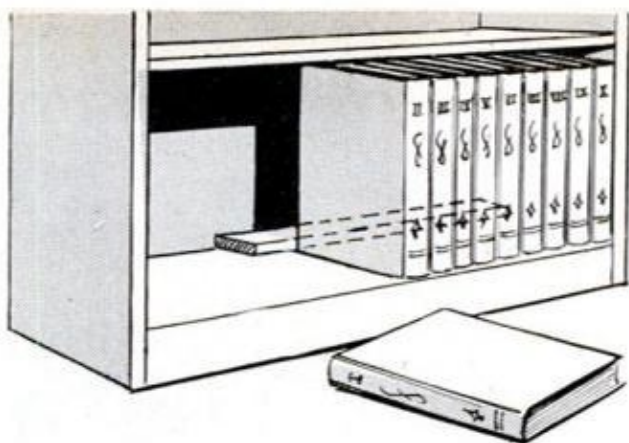
**THERMOMETER** will always be available in emergencies if you tape the holder to the medicine-chest door. This will also cut down the danger of accidentally breaking thermometer by knocking it off shelf



**CARDBOARD TURNTABLE** improvised on your workbench will make it possible to rotate small projects easily when applying the finish. Just push a thumbtack through the center of the cardboard sheet

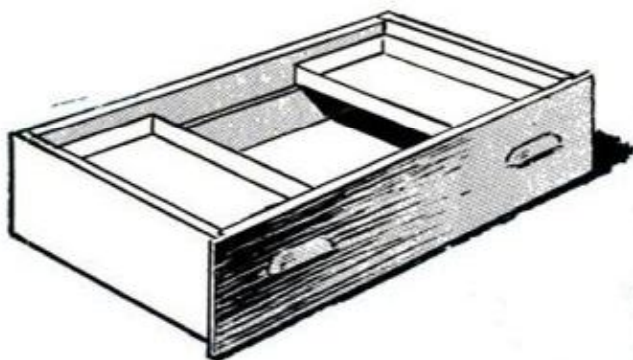




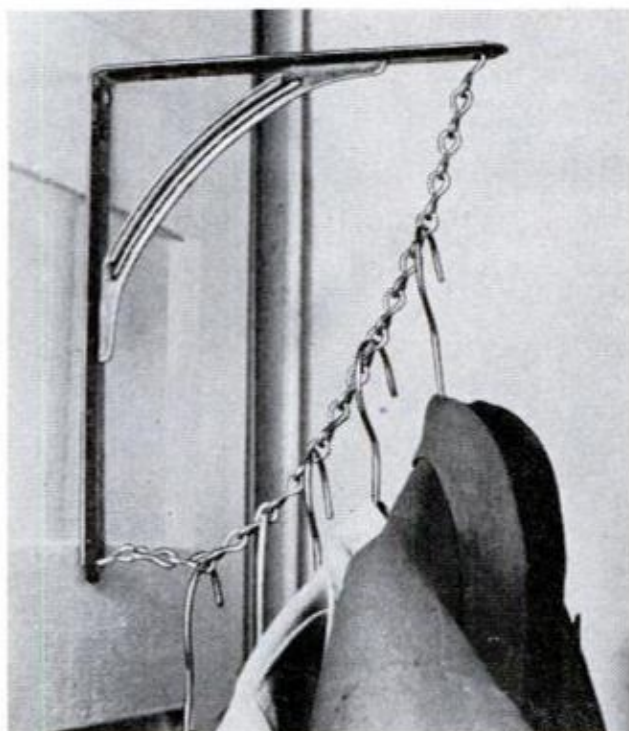


**SET OF BOOKS** will stay neatly aligned if you place a suitable width board behind them to act as a stop. Don't attach the board to the shelf, since you may decide later to move the set to a different shelf

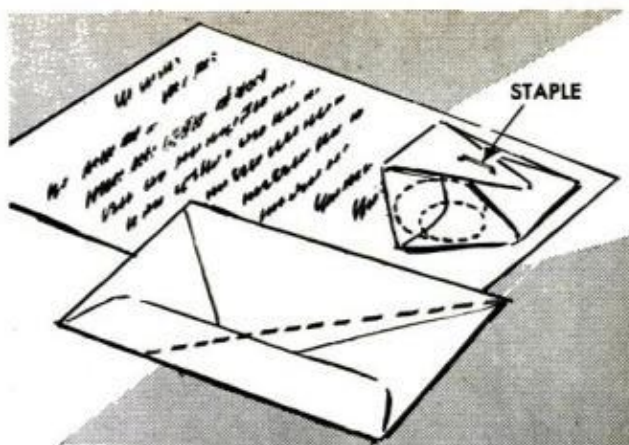
**SHOE-BOX LIDS** make perfect sliding storage trays for shallow drawers. After making sure that the lids fit the drawer, mount  $\frac{1}{2}$ -in. wood tracks on both front and rear walls about 2 in. below the top



**YOU CAN IMPROVISE** a closet door hanger from a shelf bracket and a short length of chain. Use screws to attach bracket to door and stretch chain between ends. Slip garment hangers through links



FEBRUARY 1964

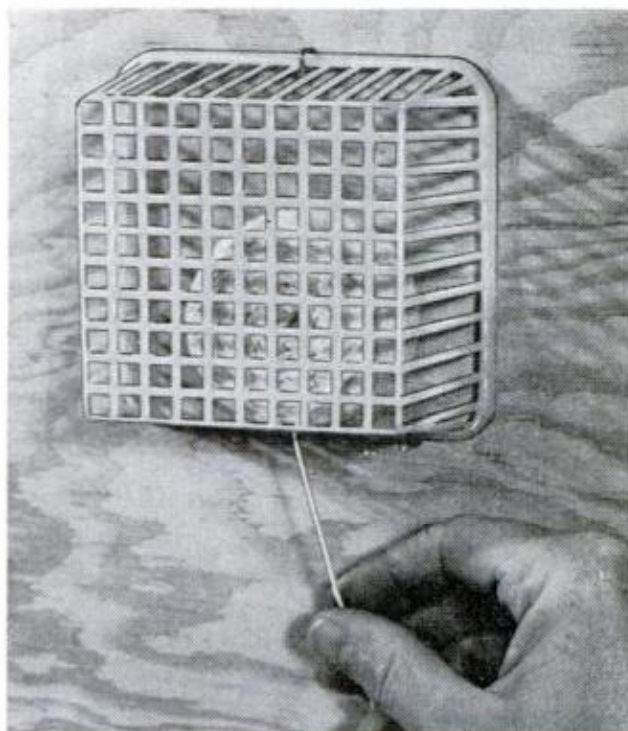


**COIN MAILER** made from a discarded envelope provides a safe means of enclosing coins in a letter. To make one, cut corner from an envelope, fold and staple it to the letter so that staple holds coin inside

**FOR NATURAL LOOK** in your fishbowl, use splitshot sinkers to anchor aquatic plants and prevent them from floating to the surface. Simply slip one or two small sinkers over each stem and crimp them shut



**STRING DISPENSER** for the kitchen is simply a small plastic fruit basket which can be mounted on the inside of a cupboard door. Hang the basket from cup hooks and run the string out through the bottom



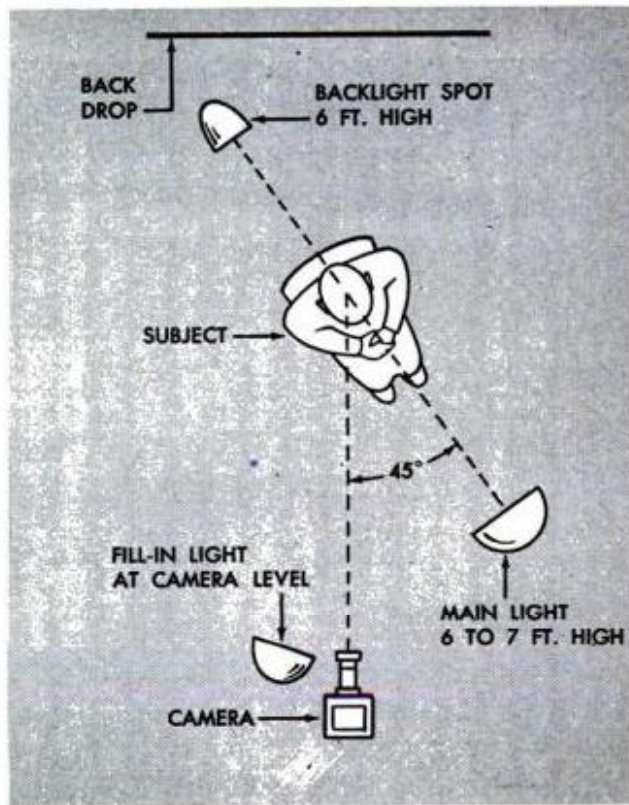
165





**USE METER TO POSITION LAMPS**

**STANDARD THREE-LIGHT SETUP**



**By John Burroughs**

Team up your camera with a bit of lighting know-how. The result—striking portraits to rival those made by a professional studio



## FRONT LIGHTING ADDS GLAMOUR TO SUBJECT



**MAIN LIGHT** is placed above and in line with the subject's nose



**FILL LIGHT** is then positioned at lens level to soften the shadows



**EFFECT LIGHT** highlights the hair and softens harsh shoulder line

**H**OME STUDIO portraiture might seem a lot more complicated than it really is. It's true that a knowledge of lighting technique is absolutely essential, but, if this scares you, you're due for a pleasant surprise—just one basic lighting arrangement is all you need to master. Best of all, despite its simplicity, this setup does not sacrifice quality; in fact, the identical positioning is used in professional portrait studios.

The three floodlights you will need of either the clamp-on or stand type, equipped with 12-in. spun aluminum re-

flectors, will cost from \$10-\$20. It's a good idea to buy 3200-deg. Kelvin, 500-watt photofloods. These radiate less heat, have a longer life than the regular 3400-deg. No. 2 floods, and are the better choice for portraiture. You can safely use as many as four on a 20-amp. household circuit since each bulb draws only 4.4 amps.

But how about camera equipment? Don't you need an elaborate bellows rig with a ground-glass back for focusing under a tent of black cloth? Nope. Any camera, even a modest one, can fill the bill for home portraits. Cameras using large-size

## SIDE LIGHTING IS BEST FOR MALE PORTRAITS

**MAIN LIGHT** is positioned high and to the side of the subject



**FILL AND EFFECT** lights are added to complete this lighting setup



**SWITCHING ANGLE** of subject's shoulders improved composition







### REAR FLOOD MAKES VEIL GLOW

**STRIKING BRIDAL PORTRAIT** results when subject is seated before dark background with rear effect light directed at the veil. Shoot from fairly low angle

### PET MELTS CAMERA FREEZE-UP

**A SEMI-CANDID** photograph of a youngster engaged in some familiar activity may have more appeal than a formal pose, and will banish self-conscious stiffness



film make it easier, of course, to produce sharp, grainless prints, and a long focal length lens is helpful in minimizing distortion. But a camera with a non-interchangeable normal-focal-length lens will give you perfectly satisfactory portrait negatives when fitted with a plus-1 supplementary lens to permit close focusing.

For a head-and-shoulders portrait, the camera should be placed on a rock-steady tripod at a distance from the subject that will fill the negative as nearly as possible without distorting the person's features. Ordinarily, if a standard focal length lens is used and the camera is close enough so that the subject fills more than one-half of the negative, objectionable distortion will result.

Studio photographers have learned that a triangular placement of three floodlights is best for portrait work. The floods that are used in this setup are known as the main, fill and effect lights.

The main light, placed closest to the subject, should give the strongest illumination; it highlights contours and provides modeling. If only the main light were used, however, portions of the face left in shadow would photograph as if they were jet black. This is usually undesirable, except in special work such as theatrical portraits. For that reason, the second flood, the fill, is positioned to illuminate the subject from another angle at somewhat lower intensity and "fill" or lighten the shadows. The function of the effect light (or back-light spot), placed high and behind the subject, is to liven the hair with natural-looking highlights.

The three floods are always used in the same basic pattern, but here's a refinement: the main light, depending on its placement, can provide either front-lighting or side-lighting.

Take a look at a magazine cover shot of a pretty girl or child. You'll notice that the subject's face has no deep shadow areas and that the eyes and mouth are emphasized. A pro would call this a "high-key" picture; it is achieved by the use of front lighting. The main light is positioned in line with and above the subject's nose. When properly placed, it casts a small butterfly-wing-shaped shadow, just under the nostrils. The fill light is then set up beside the camera lens on the side opposite the main light. The effect light occupies its usual spot, high and to the rear of the subject.

Side-lighting, because of its emphasis on facial planes and skin texture is especially suitable for portraits of men. Here the main light is placed high and to one side of the face to cross-light the features. It floods one cheek with light and forms



a small triangular highlight on the far cheek. When positioning the main light to side-light his subject, a studio photographer watches the reflections of the light that appear in the eyes. When the catch-lights are in either the 2 o'clock or 10 o'clock position, depending on which side the light is placed, the flood is in the right spot. The fill and effect lights stay at their customary locations.

With the floods approximately positioned in either arrangement, they are then balanced, that is, their relative intensity is adjusted by moving them closer to or farther from the subject. Most commercial portrait photographers favor a 2-to-1 ratio between main light and fill; the main light illuminates the subject with twice the intensity of the fill. If you switch the lights on one at a time, you can check the relative intensity of the illumination with an exposure meter.

This 2-to-1 main-to-fill ratio gives soft, transparent, natural looking shading on the face. But the 2-to-1 ratio is not sacred and there's no reason to avoid varying it if you think that changing the ratio will improve the picture. For example, in shooting a side-lighted portrait of a man, you may back off the fill light enough to give a 3-to-1 or even 4-to-1 ratio. The result will be a dramatic photograph with rich shadow areas. One word of caution—remember to steer clear of these high ratios when working with an inherently high contrast film, such as slow speed black and white or a color emulsion.

The most suitable relative intensity for the effect light will depend upon the color and texture of the subject's hair. Dull, dark hair requires considerably stronger



### YOU DON'T NEED PRO EQUIPMENT

ANY CAMERA will serve, but one of the best rigs is a reflex with a long-focal-length lens to give you a large head image. This one has a 150-mm lens

backlighting than does shiny, blonde hair. As a starting point, try positioning the effect light the same distance from the subject as is the main light. If your lens is uncoated it is especially important to guard against flare by shielding the effect light.

### AVOID THESE COMMON PORTRAIT PITFALLS

**RIGID TRIPOD** and fast shutter speed must be used to avoid blur



**WEAK FILL** leaves dense shadows while strong effect kills outline



**POOR TONAL SEPARATION** causes clothing to merge with background







### PICK BEST FROM GANG PRINT

**SELECTOR SHEET** showing entire roll can be contact-printed with a single exposure by placing negatives on paper under glass

Processing your portraits doesn't require a bank loan for darkroom equipment. You can follow the practice of many a pro and simply develop and contact-proof your film, then send it to a commercial processor for enlargements. That way you won't need an elaborate darkroom setup and an

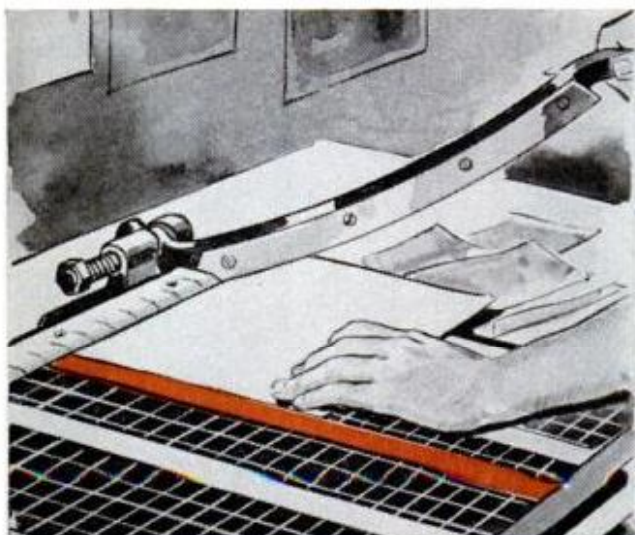


### SPOT-OUT SECOND EYE LIGHTS

**ONLY ONE** catch light should appear in each eye. Use spotting color for retouching

enlarger. In fact, all you'll need for developing and contact printing is chemicals, a few trays, thermometer, developing tank and a sheet of glass to use as a makeshift printing frame. If you load the tank in a closet at night, with room lights off, the rest can be done in the kitchen. ★★★

## Tape Guides on Bed of Print Trimmer Saves Time



If you have misplaced the guide bar for your print trimmer or if you find it awkward to keep resetting the guide while working under a dim safelight, try using colored tape as a stop. Yellow tape shows up well, but any light color will do. Apply three or four strips to accommodate the sizes most often cut. You will find that the tape is a big timesaver when cutting paper of varying sizes since there is no need to reset the guide.—*C. Shaw*

**An old trick** among professional portrait photographers, but one little known to the camera fan, is to print portraits a bit on the light side. That way they will show up well under subdued room illumination.





**SET CHAIR** upside down on table or bench and remove dust cover. This can be reused if undamaged



**LIGHT UP** spring assembly with flashlight to examine it. If OK, start applying the steel webbing

# UPLIFT FOR TIRED CHAIRS

By E. R. Haan

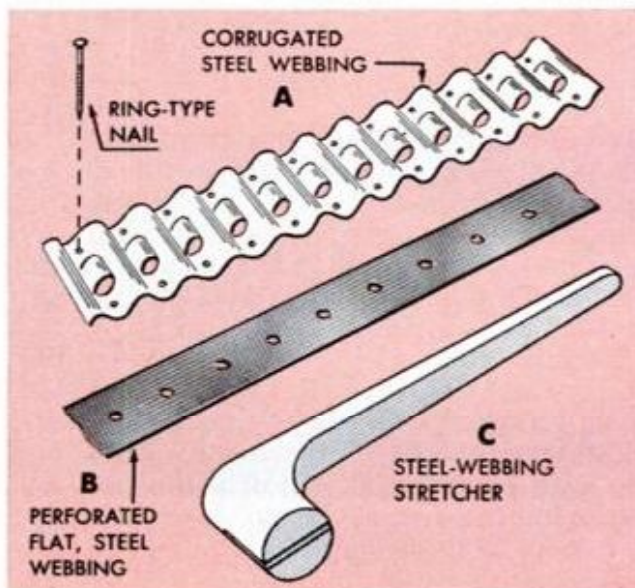
**C**OIL-SPRING SEATS that sag, lose their comfort and good looks often can be put back in good shape permanently by using steel webbing.

First diagnose the chair's condition. Set it upside down and remove the dust cover under the seat. Then, with the aid of a flashlight, examine the spring assembly. If the springs have not broken away from the twine tied across their top coils, and are not bent, all you have to do is truss

up the spring assembly with steel webbing which you nail or screw to the under-edges of the seat rails. The old webbing is not removed.

To determine the amount of steel webbing needed, you measure the total length of the old webbing and add a few feet for waste. The average easy chair requires less than 25 ft. Two kinds of steel webbing are shown below; one is corrugated, the other is flat and perforated. It usually

**COMPRESS** rows of springs with wood strips screwed to rails. Allow space between them for the webbing







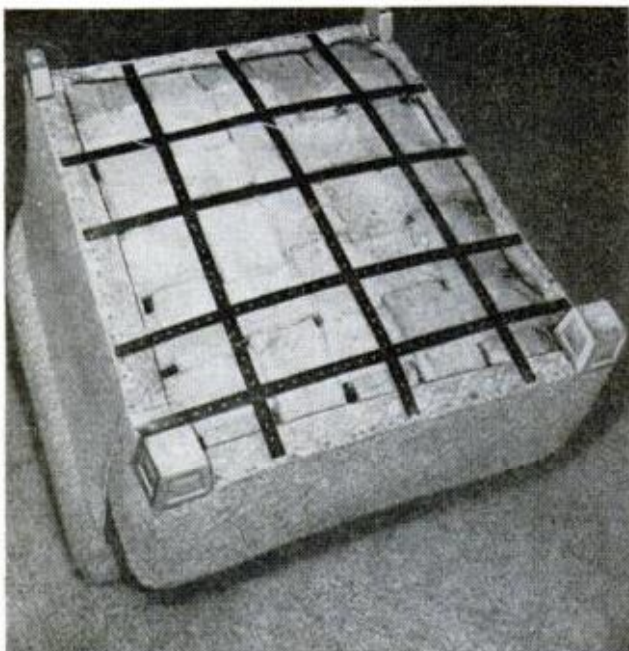
**PLIERS** or webbing stretcher pulls webbing taut at rear rail after nailing webbing to opposite rail

is available at a large upholstery shop; can be purchased from mail-order houses.

Also get a steel-webbing stretcher. One for flat-perforated webbing is shown in detail C. If you can't get one, you can use a pair of large pliers, preferably the self-locking type. Also needed are some 1½-in. ring-type nails to fasten the webbing. If you've ruined the dust cover when removing it, get enough black cambric, replace it.

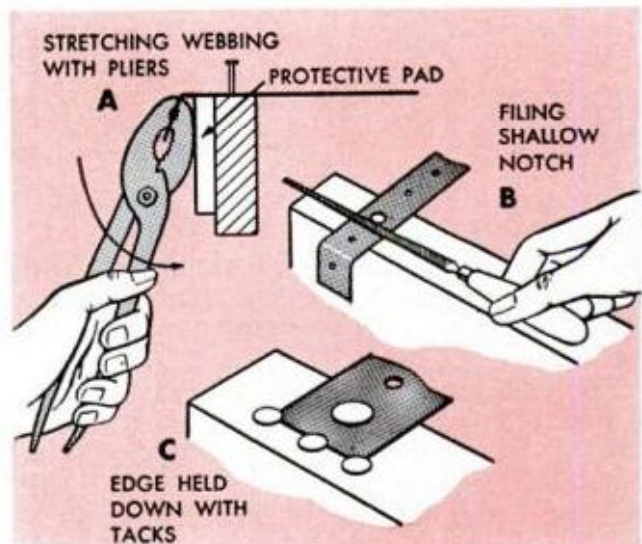
Next, cut two 1 by 2-in. wood strips a couple inches longer than the maximum span between seat rails. These are used

**EASY-CHAIR SEAT** restored by using steel webbing to raise springs. Applying dust cover finishes job



to compress rows of springs to eliminate strain on the webbing when installing it. Drill holes through the strips edgewise to take the wood screws, which you drive into the rails. Drilling pilot holes in the rails for screws will eliminate the risk of splitting the wood.

Start by compressing the center row of springs from front to back, and nailing the end of the webbing to the front rail not less than ½ in. from the rail edge. Then use the webbing stretcher or pliers at the rear rail. When using the stretcher cut the webbing after it has been nailed, but when using pliers, cut the webbing off about an inch beyond the edge of the rail before pulling the webbing taut and nailing it. In either case use a piece of hardboard or plywood from ⅛ to ¼ in. thick as a protective pad under the tool to prevent marring wood finish in detail A at the right. Should the nail hole of perforated webbing come too close to the



edge of the rail, drill an extra hole.

After you have nailed the webbing to the rear rail, cut it off inside the rail edge so that it won't show when the dust cover is installed over it, and so that a sharp projecting edge cannot cause injury. To saw, cut the webbing near the nail head, file a shallow groove with a three-cornered file as in detail B, after which you bend the waste portion up and down with a pair of pliers until it breaks off. If the broken end is high, fasten it down with two or three tacks as in detail C.

Follow the same procedure with the other two front-to-back and side-to-side rows of springs. The cross strips of webbing usually are "interwoven" with the front-to-back strips. Finish the job by replacing the dust cover, pulling it smoothly and tacking or stapling it to the underside of the seat frame. ★ ★ ★



## CONCLUSION



# ARC WELDING BASICS

Last month you learned how to lay a practice bead. Now let's put it to work on actual weld joints

By Art Youngquist

ONCE YOU'RE SATISFIED you can lay a good practice bead as described in January's *PM*, you're ready for the advanced "course"—welding two or more pieces together. The first step to master in making a joint is tack-welding.

Tack welds are used to hold two or more pieces of steel together during assembly and prior to running the finish welds. Make all tack welds at least  $\frac{1}{2}$ -in. long, spaced about 3 in. apart. Fill the craters before breaking the arc to avoid starting a weld crack at this point. Now, let's consider the types and techniques of finish welding.

**Butt Welding** is simply the laying of a bead along the seam of two plates, placed edge to edge. Use  $\frac{1}{8}$ -in. thick scraps. You'll notice, as you're laying this bead, that the weld puddle seems to sink deeper into the metal than it did when you laid

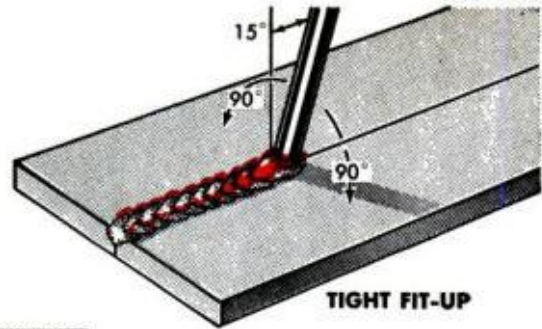
a practice bead down the center of a plate. This is called weld penetration and the resulting depth of penetration determines the strength of the weld. Make the weld about 4 in. long. Then grip the welded piece in a vise with the top of the jaws just below the weld line, and break the joint to inspect the quality of your weld. Do this by striking the top plate with a hammer to bend it toward the welded side. The fractured weld should show that it has penetrated  $\frac{1}{16}$  in. or half the thickness of the scraps. The weld should be about  $\frac{3}{32}$ -in. thick, uniform along its full length, and free of gas pockets or slag inclusions.

Now, place two more practice pieces side by side, but this time leave about  $\frac{1}{16}$ -in. gap between them. While welding this seam, you'll notice that the puddle sinks even deeper than before, so you must

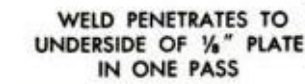




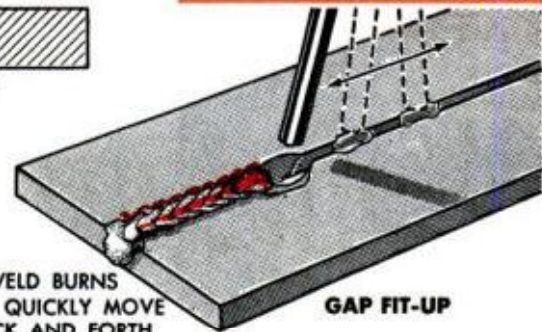
**GOOD BUTT WELD** with tight fit-up. Underside of bad gap-fit-up weld (below) shows burn-through gobs



**TIGHT FIT-UP**



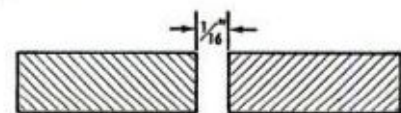
## BUTT WELDING



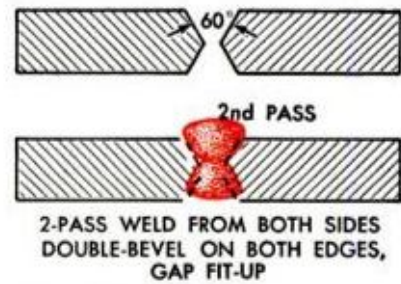
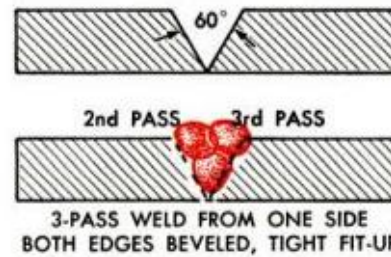
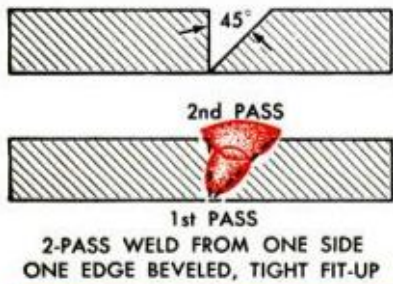
**GAP FIT-UP**



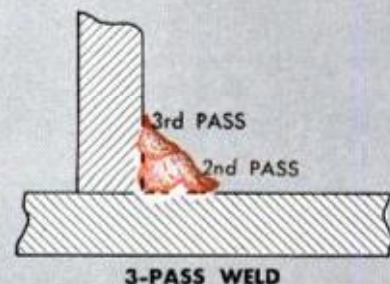
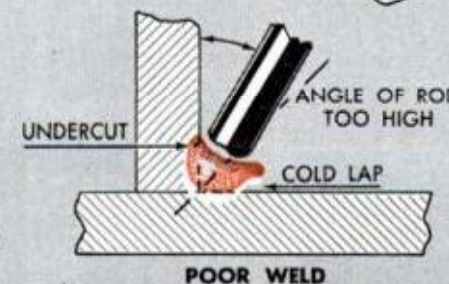
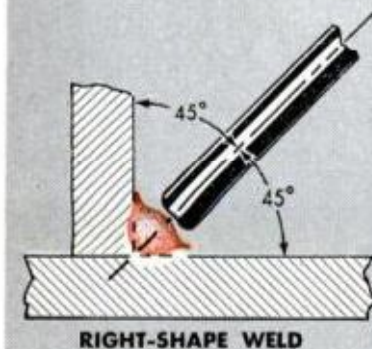
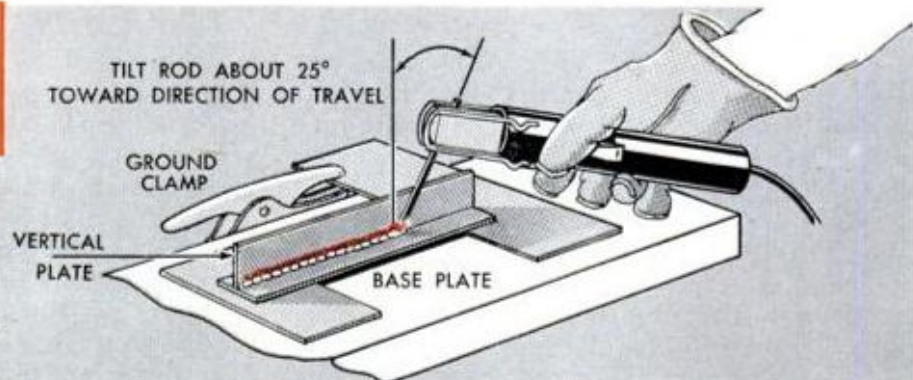
IF WELD BURNS THROUGH QUICKLY MOVE ROD BACK AND FORTH



### OTHER TYPES OF BUTT JOINTS—100% PENETRATION

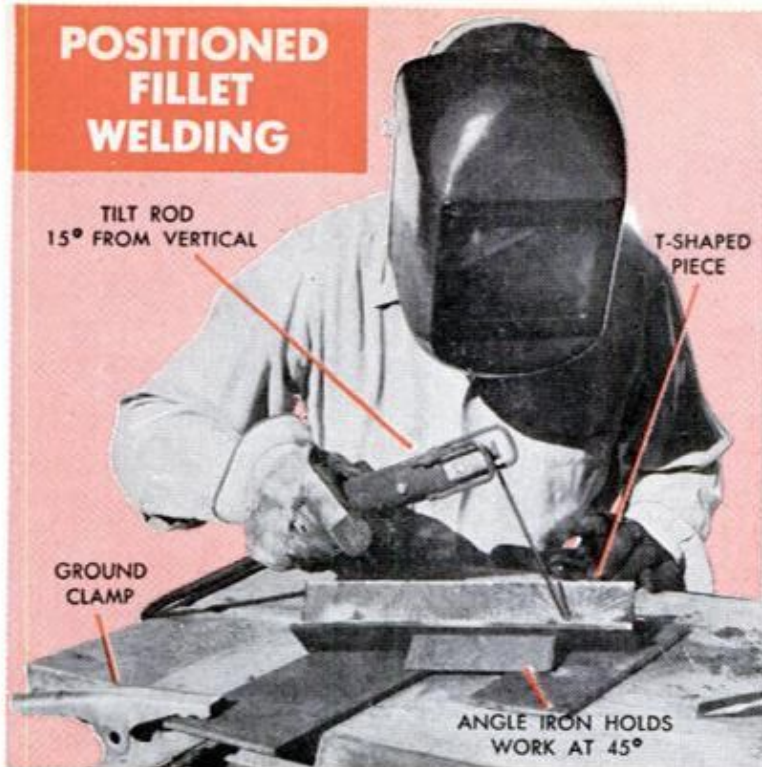


## HORIZONTAL FILLET WELDING





# POSITIONED FILLET WELDING

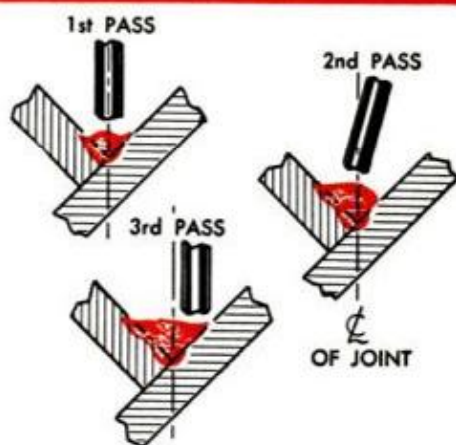
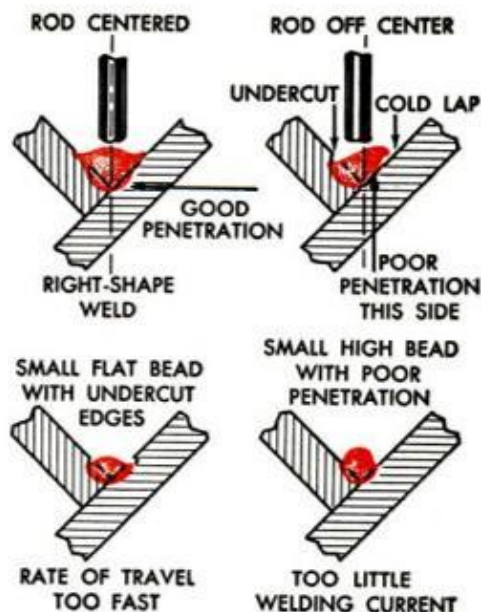


reduce the rate of travel to fill the crater and build up a  $\frac{1}{32}$ -in. reinforcement (see sketch, left).

With  $\frac{1}{8}$ -in. or thinner scraps and a gap of over  $\frac{1}{16}$  in., you may find the weld puddle burns completely through, letting molten metal run out beneath as shown in the photo, far left. Burn-through is due to poor fit-up—a condition you'll meet often while welding, particularly with 12-ga. and thinner metal.

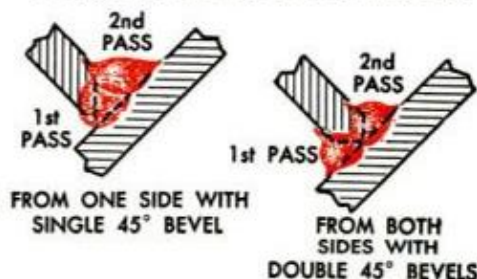
To prevent burn-through, quickly move the rod out of the weld puddle in the direction of travel and, once the puddle solidifies and starts to sink, move the rod back of it. This quick back-and-forth movement, while maintaining the arc, will not only give the puddle a chance to set but also deposits small globules of metal to bridge the gap ahead of the puddle, preventing further burn-through. However, if burn-through persists even where the fit-up is fairly good, you're using too high a current. Reset the welder to the next lower amperage.

After welding, flip the work to inspect the underside. The weld should have completely penetrated the  $\frac{1}{8}$ -in. metal, forming the small bead along the seam. Where the edges of the gap show as in the second photo, facing page, penetration is insuf-

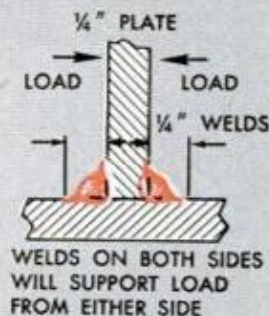
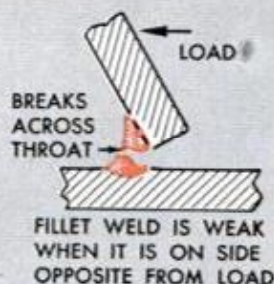
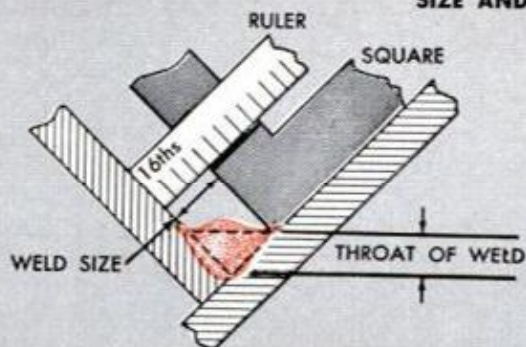


## 3-PASS POSITIONED FILLET WELDING

## 2-PASS WELDS—100% PENETRATION



## SIZE AND STRENGTH OF FILLET WELDS









ficient. When you try to break this piece as you did the first one, the weld should be ductile enough to bend but not break. Bending it back and forth will, of course, break it so you can inspect it for density.

These two practice butt welds (tight fit-up and gap fit-up) illustrate that: (1) you can achieve 100-percent weld penetration on  $\frac{1}{8}$ -in.-thick metal with tight fit-up by welding it on both sides, and (2) that the metal must be spaced so that a gap exists between the pieces to achieve 100-percent penetration when the piece can only be welded from one side.

When welding  $\frac{3}{16}$  or  $\frac{1}{4}$ -in.-thick steel, leave a gap and use a  $\frac{1}{8}$  or  $\frac{3}{32}$ -in. electrode with the highest amperage setting you can handle. The second (underside) weld can be laid with a still higher amperage setting to assure complete penetration, since there's no danger of burn-through.

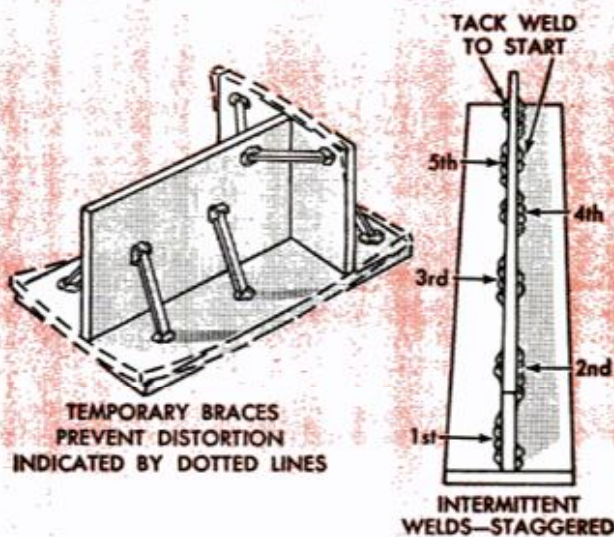
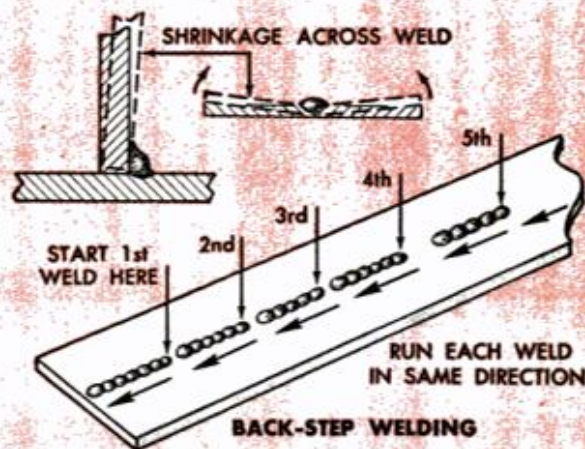
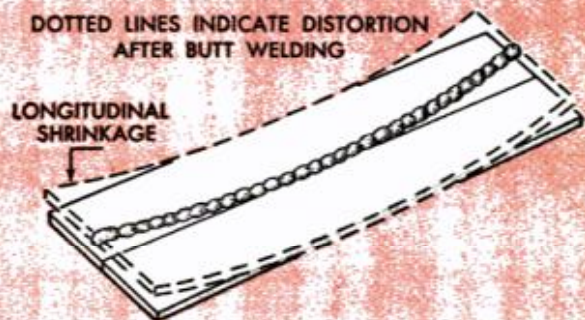
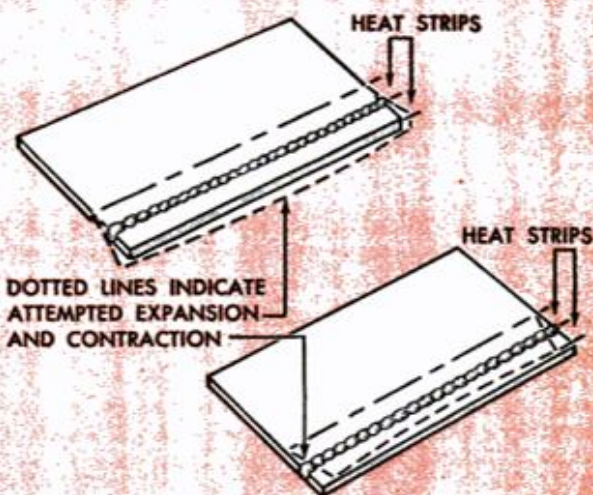
**Multiple-pass Welding.** When  $\frac{3}{16}$  or  $\frac{1}{4}$ -in. steel cannot be welded from both sides, grind a bevel along the edges to be welded and run both welds from the same side—one on top the other. Be sure to chip the slag off the first pass and brighten it with a wire brush before laying the second pass. Theoretically, beveling the edges and laying pass upon pass makes it possible to weld steel of any thickness with 100-percent penetration, using a 180-amp. a. c. welder. The beveled edges may be on one or both sides of the pieces to be welded, as shown in the center sketches on page 174. The number of passes needed to fill the beveled space between the pieces will depend upon the thickness of the steel and the size of the electrode used.

Always use the largest electrode possible to reduce the number of passes needed and save welding time. Also, always try to arrange the work so that the joint can be welded from both sides, because this will reduce the size of the weld you need (you'll save both time and rod). It will also equalize weld shrinkage stresses which cause distortion and warping. You probably noticed, after completing a number of weld beads on a practice piece, that the ends lifted, as in the third sketch at right. This distortion is caused by shrinkage of the weld metal as it solidifies.

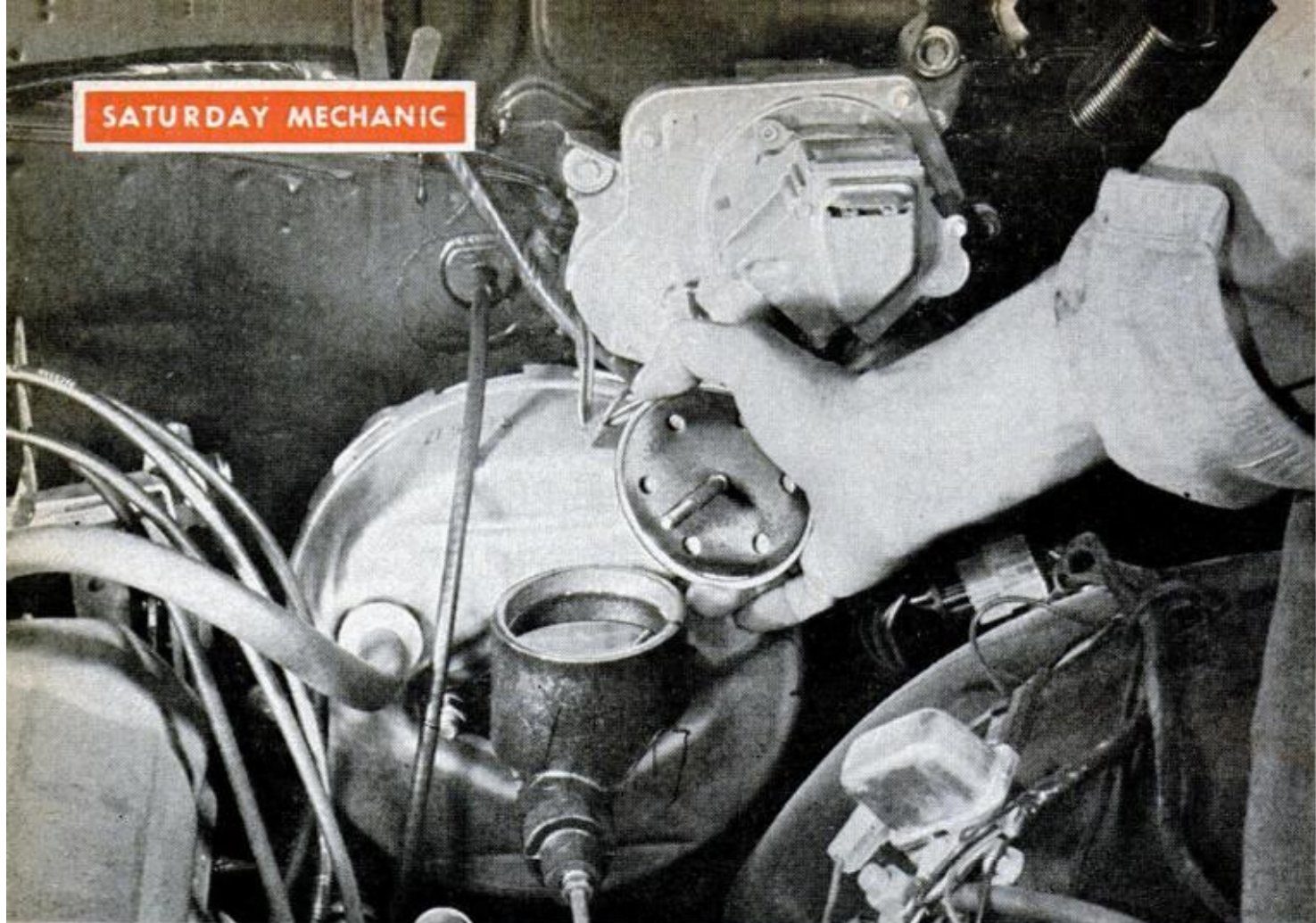
Butt welding thin sheet metal— $\frac{1}{16}$ -in. thick (16-ga.) or less—requires considerable welding skill, so don't use it for practice work, unless you intend to do quite a bit of sheet-metal welding. In that case use  $\frac{5}{64}$ -in. electrodes at 40 to 60 amps. and move the rod as fast as possible to avoid burn-through. For short-length seams, a copper back-up bar clamped directly beneath the seam will help draw the heat of the arc out of the sheet metal and pre-

(Continued on page 208)

## CAUSE AND CONTROL OF DISTORTION







# LIFTING THE LID ON POWER BRAKES

Too much mystery has meant too little maintenance for one of the most critical systems in today's cars

By Morton J. Schultz

**PART I** **T**HERE'S SOMETHING about the "power" label that makes most motorists wary. Even those that will tackle almost anything that goes wrong with their cars back off when confronted with the "power" systems. And when this awe is coupled with a natural reluctance to fool around with something as life-or-death as their *brakes*, it's not too surprising that few motorists know much about power-brake systems.

Assuming you have such a system in your car, how would you fare on the following quiz?

- Which type of power brake system is it?
- How does it work?
- What maintenance does it need?
- How do you go about troubleshooting it?

It isn't too surprising that a certain amount of mystery surrounds power brakes when you consider that the five major manufacturers of these systems have produced no less than 16 variations for American-made cars since 1955. Little effort has been made to boil down the mass of technical data represented by so many systems into concise, understandable language that would apply to owners of all cars with power brakes.

Furthermore, power-brake systems are practically trouble-free in their early years of operation. Though problems can be expected with age, many car owners are content to let the subject lie. Unfortunately they're robbing their systems of additional miles of service because they don't know



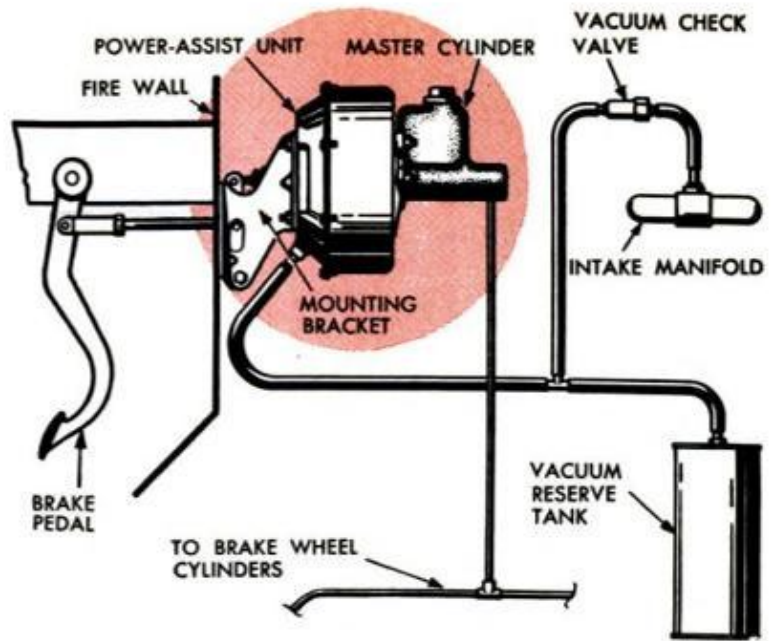
the facts of proper maintenance.

It may surprise you to know that power-brake principles are easy to understand. Perhaps even more unexpected is the fact that the unit is one of the simplest in a car to work on. As a matter of fact, if you had the time you could probably even rebuild your unit, should it go bad.

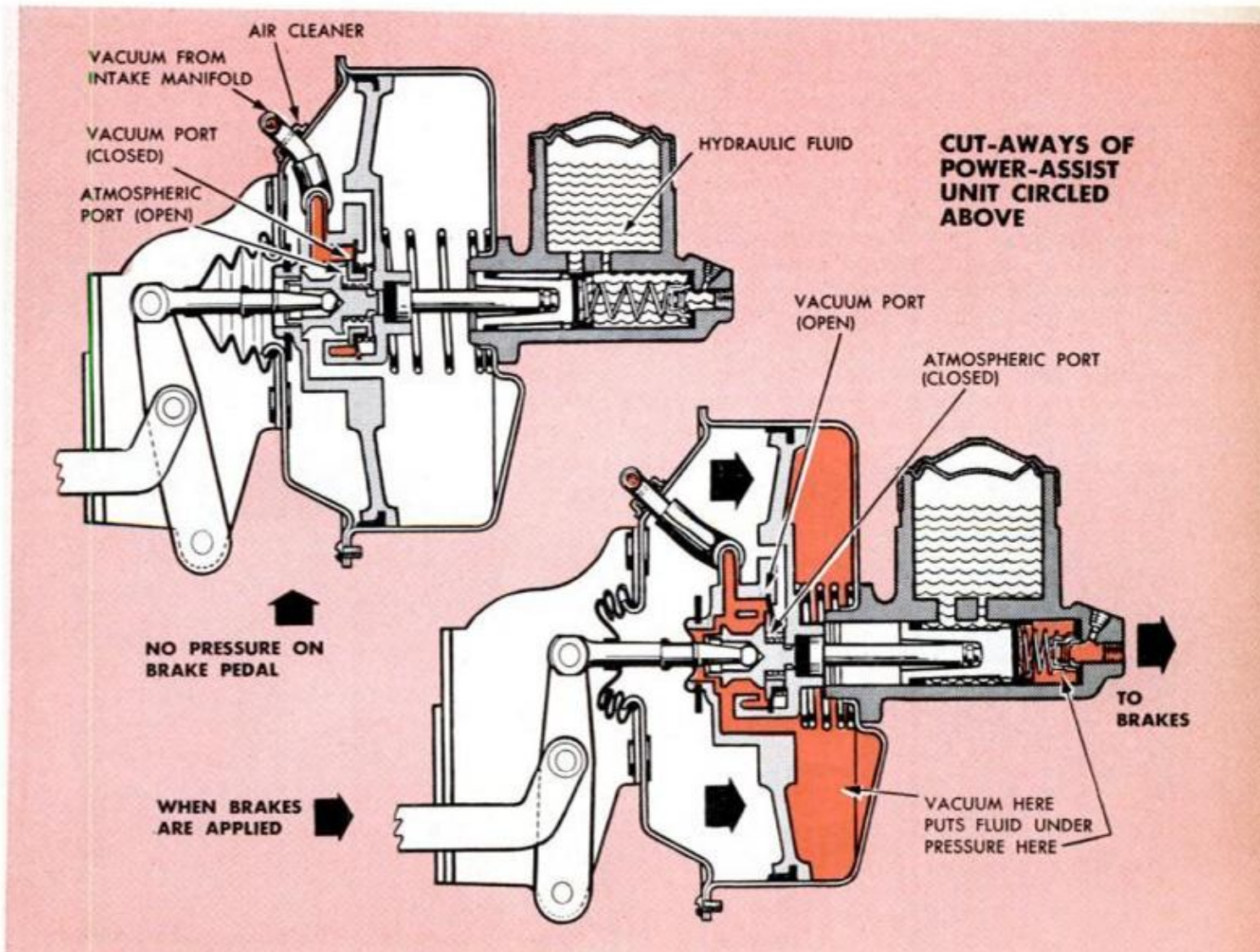
A power brake is nothing more than a conventional brake with a power-assist unit added. Should this unit fail, you'd still be able to stop your car by exerting extra force on the brake pedal.

That's why power brake troubles are easy to spot. When a problem arises, you either have power or you don't. There's no halfway point. And there's no mystery about the origin of the trouble. It's either in the power-assist unit (in which case this unit must be rebuilt or replaced) or in the vacuum source or lines.

There are no adjustments to make on these units. Most cars do

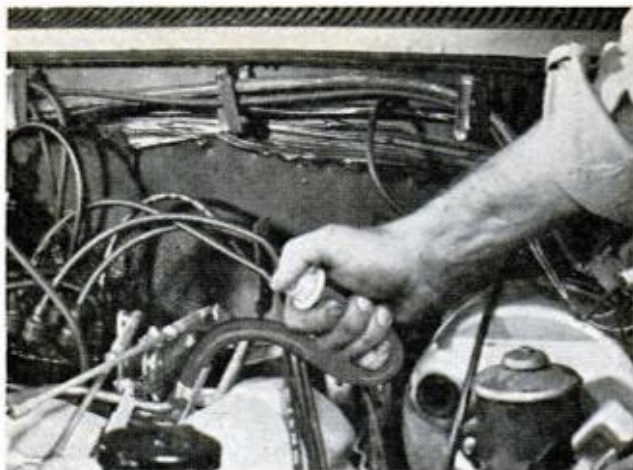


**TYPICAL POWER-ASSIST UNIT** is air-suspended type shown in circle above and in cutaways below (this one's the Bendix Master-Vac). With brake unapplied, vacuum port is closed and atmospheric port open; air enters on both sides of powering source to keep it from moving (below, left). When pedal is pressed, vacuum port opens while other closes; this lets manifold vacuum suction out air. Power source moves toward vacuum chamber, puts fluid in brake lines under pressure (color areas)

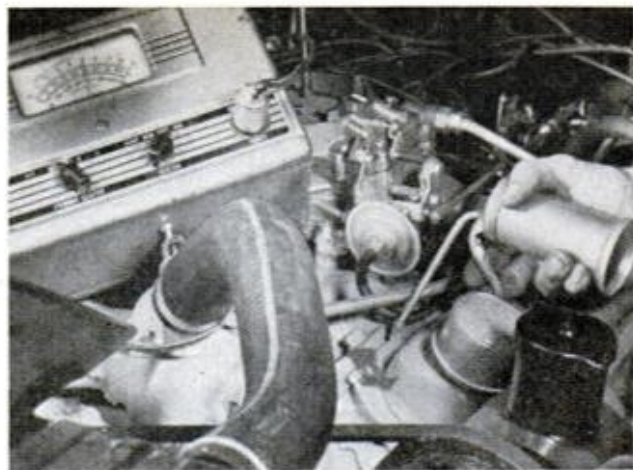


**CUT-AWAYS OF POWER-ASSIST UNIT CIRCLED ABOVE**





**1. SUCTION TEST** tells if hose to manifold is defective. Disconnect at power-assist unit, start car and hold thumb over end. You should feel strong suction



**2. TACHOMETER TEST** tells if manifold gasket is bad. Spread oil around the manifold, then start engine. If there's a leak, oil will be sucked in to seal it

have a pedal free-play adjustable connection between the unit and the brake pedal or linkage, but this is the same free-play adjustment that regular brakes have.

A power brake, then, could be handled as two separate systems. One system is the power assist unit—the other is the braking system, which is maintained and repaired just as any other braking system.

A spongy brake pedal, for example, often means that there is air in the lines which has to be bled. It's the same whether the brake is power or conventional. Grease on brake linings makes brakes grab, whether they are powered or conventional.

A car equipped with a power assist unit uses intake manifold vacuum or a combination of intake manifold vacuum and atmospheric pressure to increase the pressure in the brake hydraulic system. This cuts down on the amount of effort that must be applied to the brake pedal to stop

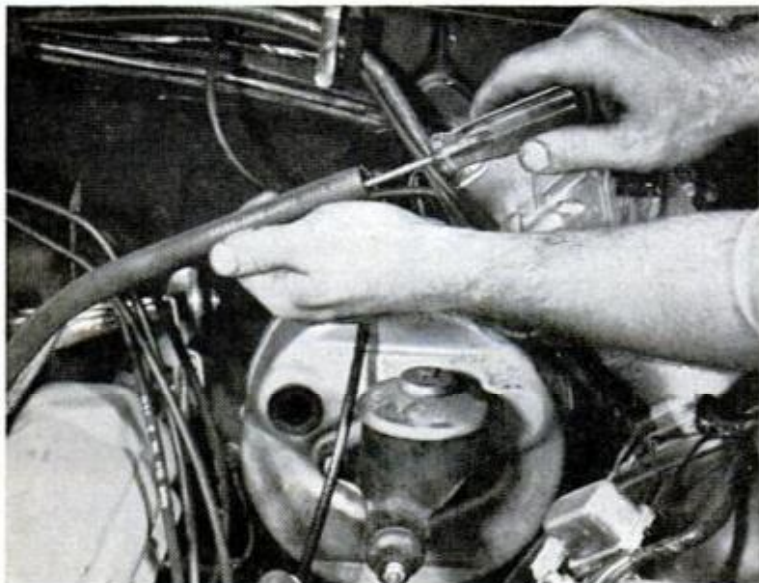
the car. It also reduces the amount of brake pedal movement.

Despite the 16 variations in power brake systems, all power units operate the same way once the brake pedal is applied. The fundamental difference between the 16 types lies simply in how the power unit is suspended when the brakes are *not* in use.

In air-suspended systems, when the pedal is pressed, a vacuum is created on one side of the power device—which could be a piston, a diaphragm or a bellows, depending on the type of unit you have. This vacuum causes the piston or diaphragm to move (or the bellows to collapse), putting hydraulic fluid under pressure.

In vacuum-suspended systems, vacuum exists equally on both sides of the powering device when the brakes are unapplied and the engine is running. This is made possible by a valve that draws air out of the unit to the intake manifold.

**3. WHILE DISCONNECTED**, manifold hose can clue you to internal leaks in power-assist unit. If hose has vacuum check valve at end (as in Fig. 1) remove it and twirl screwdriver inside to see if hose is coated with brake fluid. Valve itself can be cause of poor vacuum: check it by blowing through both sides as at right



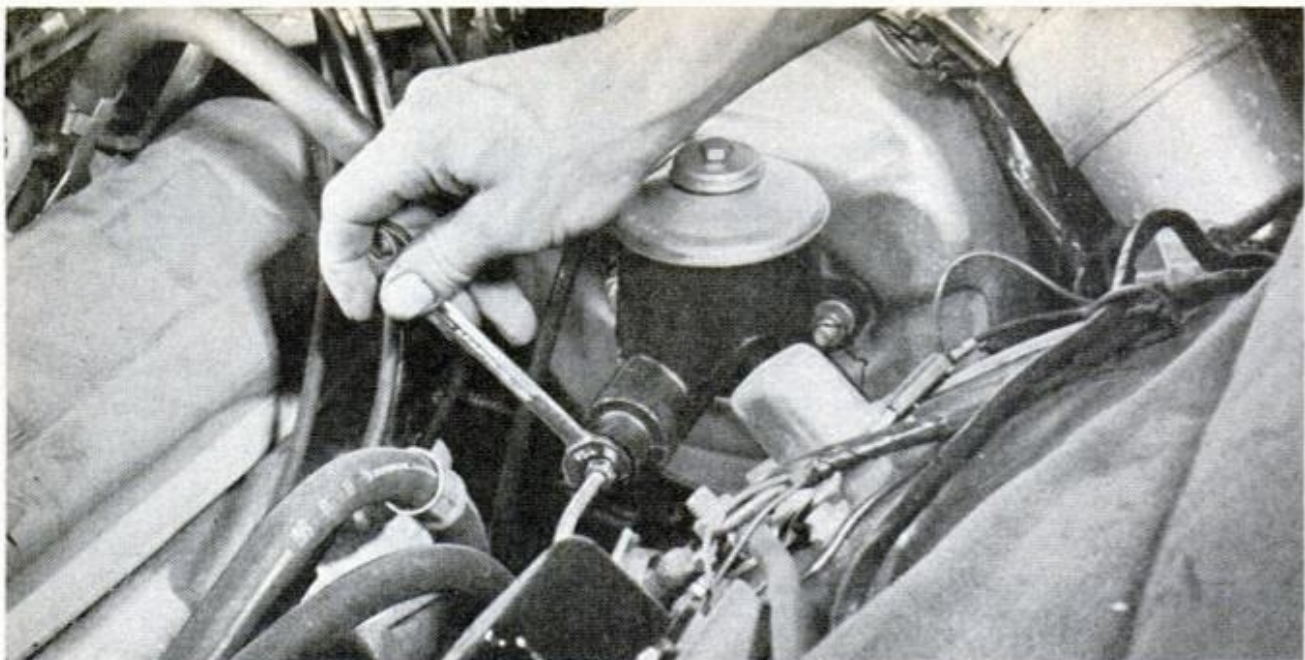


# TROUBLE-SHOOTING YOUR POWER BRAKES

CONDITION	CAUSE	CURE
<b>Hard Pedal</b>	Engine intake manifold does not have 17 to 21 points of vacuum	Tune up engine
	Faulty vacuum check valve	Replace with new valve. Never try to repair or oil old valve
	Plugged vacuum line fittings and hose	Clean out passages or replace with new fittings. Straighten out hose if kinked. Replace hose if collapsed or torn
	Leaks in vacuum reserve tank (if system has one)	Replace tank
	Loose vacuum connections	Tighten all vacuum connections
	Internal leaks in power assist unit	Overhaul unit or install a rebuilt unit
	Wrong type of brake linings	Replace with linings recommended for your car
	Restricted power assist unit air filter, if external	Wash filter in non-oil-base cleaning fluid. Let it dry before replacing. If filter is old and badly clogged, replace with new one
	Grease, oil, brake fluid or foreign matter on brake linings	Correct leaks and reline brakes with recommended linings for your car
	Frozen brake pedal linkage	Free up linkage and replace necessary parts
	Blocked air passage in the power assist unit's guide sleeve	Overhaul unit or install a rebuilt unit
	Jammed power assist unit power cylinder	Overhaul unit or install a rebuilt unit
<b>Over-Sensitive (Grabbing) Brakes</b>	Grease, oil, or brake fluid on brake lining surface	Correct leaks and reline brakes with recommended linings for your car
	Leak in power assist unit's reaction diaphragm	Overhaul unit or install a rebuilt unit
	Restricted or closed atmospheric port in power assist unit	Overhaul unit or install a rebuilt unit
	Sticking slide valve in power assist unit	Overhaul unit or install a rebuilt unit
	Binding brake pedal linkage	Check brake pedal for freeness, relieve condition, and lubricate with recommended brake pedal lubricant
	Binding rubber seals in power assist unit	Overhaul unit or install a rebuilt unit
<b>Brake Pedal Slow to Release (or Fails to Release)</b>	Frozen brake pedal linkage	Free linkage and replace necessary parts
	Plugged compensator port in power assist unit	Flush fluid from unit and adjust pedal linkage. If this doesn't relieve the condition, overhaul unit or install a rebuilt one
	Excessive hydraulic seal friction in power assist unit or in wheel cylinders	Overhaul the old power assist unit or replace with a rebuilt one, or replace the wheel cylinders
	Interference with piston stroke in power assist unit	Overhaul unit or replace with a rebuilt unit
	Sticking slide valve in power assist unit	Overhaul unit or replace with a rebuilt unit
	Broken power source return spring in power assist unit	Overhaul unit, replacing the spring, or replace with a rebuilt unit
	Dry power source packing seal in power assist unit	Overhaul unit, replacing all seals as well as this one, or install a rebuilt unit
<b>Brake Pedal Goes to Floor</b>	Brakes worn out	Reline with linings recommended for your car
	Low hydraulic fluid level	Fill master cylinder
	External hydraulic fluid leaks	Check for leaks and replace faulty line or tighten loose connections
	Leaks inside power assist unit	If above checks for this condition fail to uncover the cause, this is it. Overhaul unit or replace with a rebuilt unit
<b>Brake Pedal Vibrates and Power Brakes Chatter*</b>	Improperly-adjusted brake pedal free play	Adjust brake pedal free play
<b>Brake Pedal Chatter*</b>	Bent or out-of-adjustment power brake trigger	Replace trigger and adjust linkage
	Out-of-adjustment master cylinder push rod	Adjust push rod to proper clearance
	Missing or damaged rubber collar for power brake trigger	Replace with new rubber collar
	Binding inside power assist unit	Overhaul unit or replace with rebuilt unit

\*Only occurs in cars where power assist unit has bellows-type powering source





**BLEED A POWER UNIT** to force air from system. If unit has no bleeder valve, remove hydraulic line fitting—often attached to master cylinder, as here. Bleed by stroking brake pedal several times, then reattach line

When the brakes are applied, this valve closes and another valve opens to the atmosphere, letting air into the unit. This unbalances the pressure in the unit and sends the powering device into motion.

Naturally, other differences exist among the various power brake systems. Another major one is the location of the brake master cylinder in relation to the power assist unit. On cars which have "integrated" units, the master cylinder is contained right in the power unit.

If your power brakes act up, or if you just want to check them occasionally to make sure they're operating properly, there are several tests to perform.

A malfunctioning power brake unit leads to the six problems listed in the trouble-shooting chart. The origin of any of these problems, however, could be in other parts of the braking system. Thus if your power-assist unit tests fail to uncover the causes of a problem, you must turn your attention to the rest of the system.

The first test is a check for vacuum. Pump the brake pedal several times with the engine off. Now, step on the pedal firmly, hold it steady, and start the engine. The pedal should move forward slightly and less pressure should be needed to maintain it in a steady position.

If there is no movement and the pedal feels "hard," the cause of the trouble is either *external* (at the intake manifold or in lines and connections), or *internal* (within the power assist unit).

To check out the hose connecting the unit to the intake manifold, perform the simple test shown in Fig. 1, page 180. If you don't feel a strong suction when the

car's running, check the hose for kinks, tears and collapsed areas. If you find a bad hose, replace it.

If the hose is OK, the reason for lack of suction could be a vacuum leak at the intake manifold, caused by a bad gasket. The tachometer check for this is demonstrated in Fig. 2. If there's a leak, the oil you spread will be sucked into it. This causes a speed-up in engine r.p.m., since the sealed leak prevents air from seeping into the manifold and diluting the fuel mixture going to the combustion chambers. The tachometer will record this r.p.m. increase, telling you that the manifold gasket is bad and should be replaced.

Another cause of insufficient vacuum in the power brake system could be an engine out of tune or a malfunction within the engine, such as a sticky or burned valve, a weak valve spring or worn rings.

Check the vacuum supply at the intake manifold with a vacuum pressure gauge. The gauge should read 17 to 21 points and hold steady. If it doesn't, tune the engine.

Still no vacuum? Then the trouble may lie with the vacuum check valve of the power assist unit. To check it, remove it and blow through one end—then through the other. This valve is a "one-way" affair. It should let air rush out of the power assist unit to the intake manifold, thereby creating the vacuum in the unit. But it shouldn't let air come back into the unit.

When you blow into the side of the valve that's attached to the power-assist-unit-to-intake-manifold hose, no air should come out the other side. When you blow through the side of the valve attached

(Please turn to page 202)



# AUTO CLINIC

**Q** My 1961 Ford Fairlane 6-cylinder is raising a racket. I think it's the timing chain. Can I replace it with a new set of sprockets and chain from a '62 or '63 Ford?—F.S., Ohio.

**A** Your diagnosis is right, doctor, but your cure isn't sound since the timing chains for the '62 and '63 Fords are the same as those used in '61. These chains jut out and are adjusted loosely, which causes them to hit against the timing case and raise the racket. Ford recognized the problem soon after the '61 models hit the road and came out with a dampner to prevent driver headaches. This same unit is now used in the '62 and '63 models as well. Take your car back to the dealer and have him install Part No. C2ZA-6284A.

**Q** My 1960 Valiant vibrates terribly when idling. The carburetor has been cleaned and adjusted, and I've even changed my brand of gasoline. What can the trouble be?—I.L.C., Tenn.

**A** Most likely it's the distributor. It was in 1960 that cast aluminum distributors with silicone contacts were first used in these cars. They were found to be highly susceptible to condensation and would lead to many problems, including the one you describe. Since then, the manufacturer has issued new Part No. 2448273.

**Q** The temperature gauge of my '62 Mercury shows that the car's overheating. It isn't, so why?—W.P.S., Fla.

**A** The trouble probably lies with the temperature-sensing device in a tapped hole in the cylinder head. The part should be calibrated at 250 degrees F. and shouldn't be the 190 degree part that might have been used. If the numeral "250" isn't stamped into the hexagon wrench fitting, replace with part number CIAZ-10884A.

**Q** I have a ping in my 1959 Chevrolet 6-cylinder that's being caused by improper timing. To avoid this noise I had to retard the distributor about 6 degrees from top dead center. In checking the timing, I find that the timing ball moves and is never in a steady position. I know this is at the root of the ping, but how do I stop it?—W.E., Puerto Rico.

**A** Check two things if that timing ball insists on moving. Make sure the distributor doesn't have too much play in it and that you're timing the car at the correct idle speed. The correct idle r.p.m. for a straight stick Chevy of this year is 475. For a car equipped with automatic transmission, the idle r.p.m. should be 450 and the car should be timed with the transmission in Drive position.

**Q** Vapor lock is a constant problem in my 1961 6-cylinder Ford. Could this be a design defect?—F.S.C., Va.

**A** Yes, but a simple external one: the fuel-pump-to-carburetor line runs over the top of and across the engine, and comes very close to the manifold. Heat from the manifold is causing fuel in the line to vaporize. One cure is to wrap asbestos around the line. Another is to fashion a new line—one that juts out away from the manifold.

**Q** My 1962 Tempest runs so rough that it often dies out while at idle. I've had points, plugs, carburetor and coil changed and the engine tuned up every 500 miles to try and cure it. I'm going broke paying for parts and labor. What can I do?—P.P.Z., Ill.

**A** Stop spending your money and look to the carburetor. It's probably flooding. That two-barrel unit on this car has a tendency to flood over when you stop suddenly. This leads, of course, to rough idle and stalling. To cure it, lower the carburetor float level. This will close the needle valve sooner and prevent excess gas from drowning out the engine.

## Monthly Service Tip

★ Oldsmobile urges owners of 1963 88 and 98 models to double-check service at the time of oil change, making sure the HydraMatic transmission throttle linkage pivot points are lubricated with SAE 10W-30 engine oil. If this is neglected, the lower throttle-valve-rod-to-throttle-valve-lever connection could accumulate enough foreign matter to freeze up and prevent the accelerator from returning to idle. If this safety hazard occurs, you must disconnect the throttle valve linkage, clean it with a wire brush and lubricate it with the recommended oil.



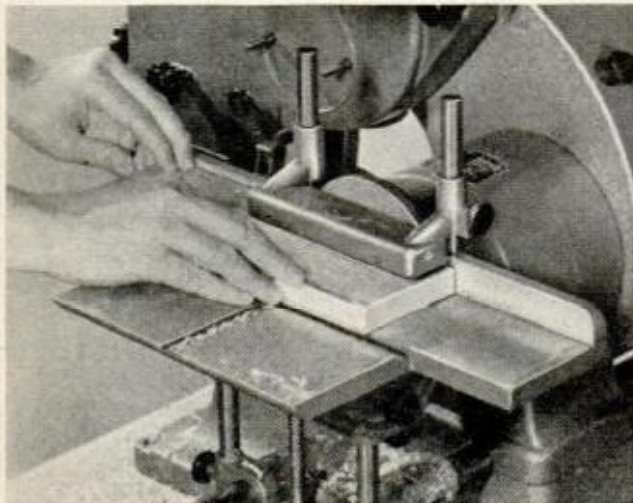
## PRODUCT REPORT

**CIRCULAR SAW AND LATHE** set-up shows difference in working heights. Standard  $\frac{5}{8}$ -in.-bore blade gives  $2\frac{1}{8}$ -in. depth capacity. For long pieces, stock support clamps to tubular ways (like tool rest). Ways slip through base; without sanding table on far end, bed extends full 36 in.



## PM Tests the MULTI-MATIC

**MOLDER** head and roller hold-down are accessories. Eleven sets of cutters form tongues, grooves, door lips. Or buy blanks for grinding your own shapes. Table measures  $5\frac{1}{4}$  x 8 in. and tilts 45 degrees

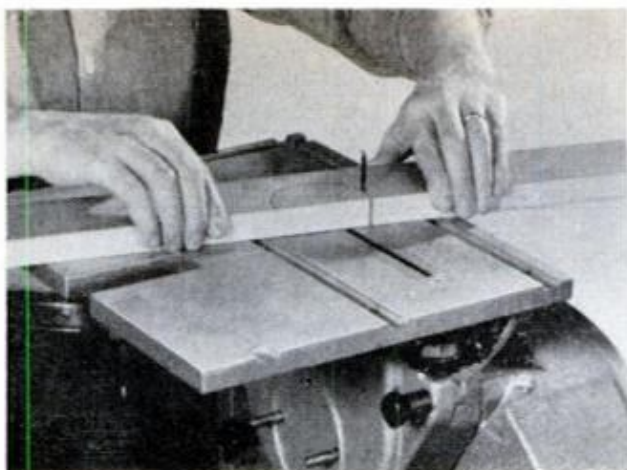


**B**OASTING more basic tools than any other multipurpose machine, this Austrian import is an 8-in-1 tool that even includes a bandsaw.

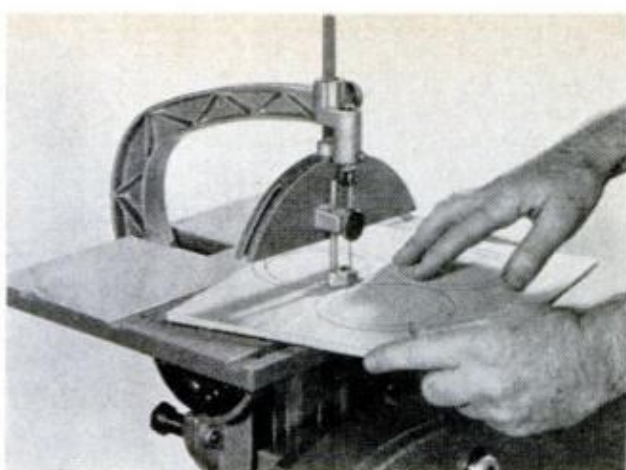
The basic tool combines an 8-in. circular saw, a 7-in. disk sander, a 2-in. belt sander, an  $8\frac{1}{2}$ -in. jigsaw, a saber saw, a 6-in. bandsaw, a 36-in. wood lathe and what the manufacturer calls a molder—all powered by a two-speed,  $\frac{3}{4}$ -hp. motor.

Its unique design is built around its swing-up bandsaw housing which not only contains the disk and the belt sanders but incorporates the circular saw. Pivoting the bandsaw from a horizontal to a vertical position swings the circular saw with it and automatically cuts it off from the motor. A separate dual-purpose table clamps to the tubular ways to serve as both a sander table and—when you shift

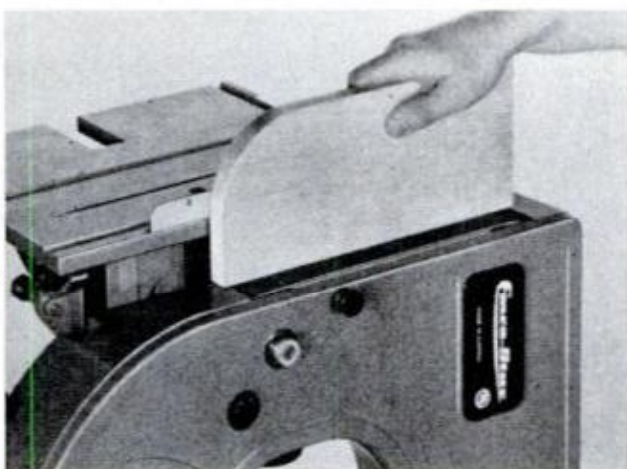




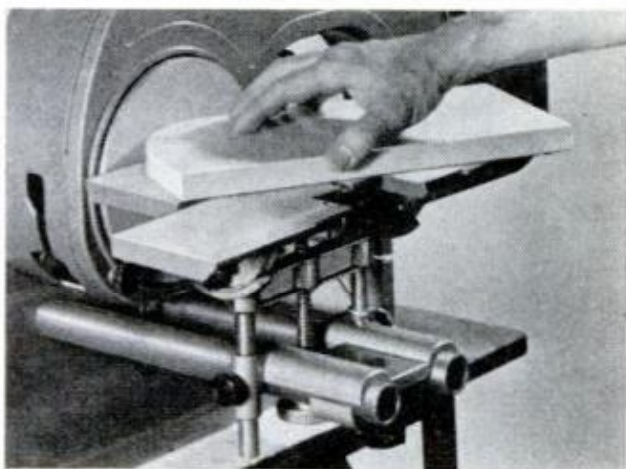
**SABER SAW** has unlimited capacity for large-panel cutouts since you don't need jigsaw's overarm. You use the circular saw table, inserting rigid blade through hole and into chuck beneath table surface



**JIG SAW** has ¼-in. stroke; two speeds plus variety of blades let you cut many materials. Circular-saw sheath hangs from arm to provide for attaching hold-down. You can use fence and miter gauge



**BELT SANDER** on side of band saw housing is always ready. With blade lowered, saw table can serve as supporting surface for sanding faces of wide boards. Push-button clutch connects sander to power source



**DISK SANDER** uses table that clamps to tubular ways, has full 45-deg. tilt in both directions. Disk spins with machine in either bandsaw or circular-saw position, for instant use after making any cut

**BAND SAW** conversion is simple matter of swinging housing upward—balance is such that there's no risk of backstrain. Tightening a pivot clamp to lock in either position is optional; tube-wrench is supplied

it to the opposite end of the motor—a table for rabbeting and molding work. The circular-saw table doubles as the table for jigsawing and saber sawing.

In putting this tool through its eight basic operations we noted that in order to have the circular saw at a convenient working height as in the large photo, you'd have to sit to use the lathe. We found that the 8-in. blade supplied leaves only 3½ in. of table support in front of it, barely enough to crosscut a 2x4. In the model we tested, we found too much play in the saw table miter-gauge grooves. We noted also that the saw lacks a regular saw guard to provide safety in all crosscut and ripping operations. These reservations aside, it's the most compact power shop you could hope to buy.

The machine is being distributed by American Edestaal, Inc., 350 Broadway, New York, N. Y. and retails for \$299.00.





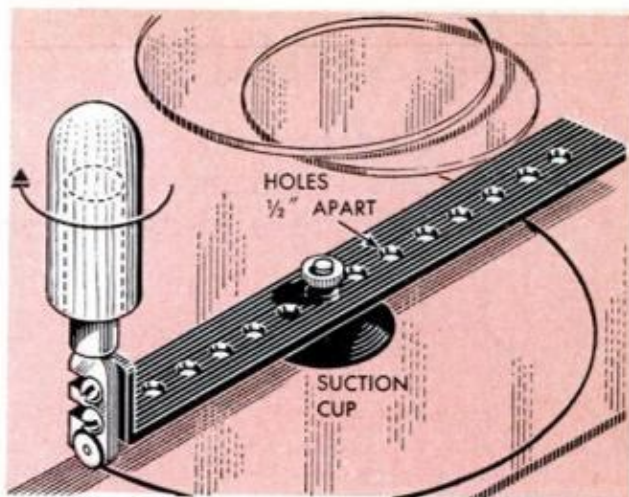




## SHOP SHORT CUTS

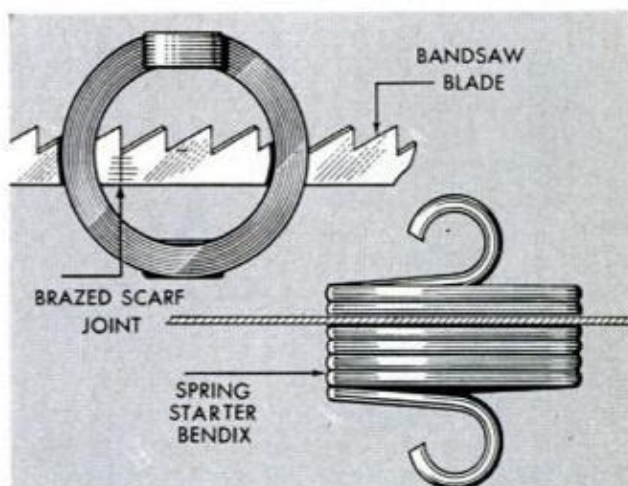
### Glass-Cutter Compass

Perfect circles every time are a cinch with this homemade adjustable glass cutter. As you see, it's nothing more than a flat metal strip drilled at  $\frac{1}{2}$ -in. intervals for the screw of a rubber suction cup and bent 90 deg. to hold a regular glass cutter. The handle of the cutter is shortened and fitted with a free-turning knob. The two short bolts which hold the cutter are spaced to engage the notches in the cutter.—*Jack Eisner*



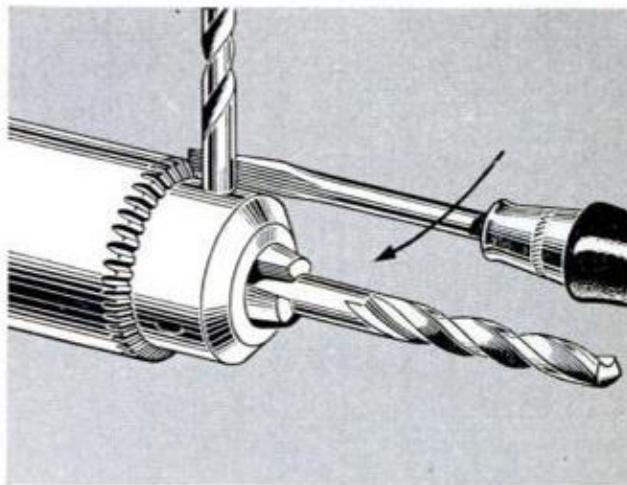
### Blade Brazing Clamp

Holding the lapped, scarfed ends of a broken bandsaw blade in alignment for brazing usually requires a special holding device, but a discarded Bendix starter spring will serve as a dandy substitute. The tightly wound turns of this flat-coil spring will hold the lapped ends of the blade securely if you wedge them between the coils, and the opening through the center of the spring makes it convenient to add the silver solder to the joint and to play the flame of the torch directly on the ends.—*W. C. Wilhite*



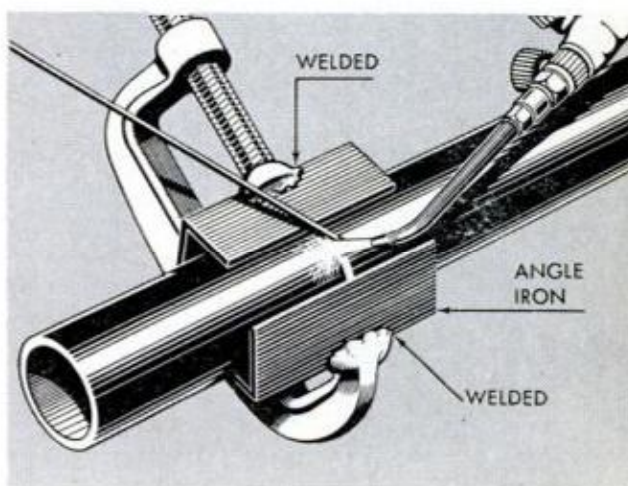
### Emergency Chuck Key

Unless a drill-chuck key is virtually chained to the tool, you can spend half your work time looking for it. Recently I just couldn't find the key for my portable electric drill and was forced to think up another way to tighten the jaws. Here's how I did it. I selected a twist drill which would fit the regular key hole in the chuck. Then, using the twist drill as a fulcrum, I simply inserted the blade of a screwdriver in the teeth of the chuck's ring gear and pressed sideways to tighten the jaws.—*B. Borsody*



### Jig for Welding Pipe

Anyone who knows how to weld will tell you that usually the most difficult part of the job is holding the work together while it is being joined. With the possible exception of an occasional job where accuracy may not be a factor, the parts must be held in precise alignment. The jig shown in the drawing assures perfect alignment when welding pipe or other round stock, end to end. The jig can be made in a few minutes. All that is required is a C-clamp with a piece of angle iron welded across each.—*Dean Merrill*





# Electronic Drill-Press Drive

Like increasing the speed of a model train, this variable-speed power drive lets you dial drill-press speeds from 1000 to 10,000 r.p.m.

By Frank L. Greenwald

**E**VEN at a top speed of 5000 r.p.m., the average drill press when used as a shaper, is no match for the smooth cut you get with the real thing—it just doesn't turn fast enough.

Of course, by fussing with a special jackshaft of additional belts and pulleys you can up the speed in a series of clumsy steps. But with my drill press, I'm able to "dial" speeds from below 1000 r.p.m. on up to 10,000 r.p.m., without extra belts and pulleys, by simply turning a knob.

It's all made possible by a variable-speed drive which takes the place of the regular drill-press motor and gives a range of speeds for any drill-press operation.

Teamed up with a universal vacuum cleaner motor, a silicon controlled rectifier (SCR) regulates the voltage to the motor to let you slow it down or speed it up with the smoothness of a rheostat. A potentiometer gives you "dial" control of the power passing through the SCR.

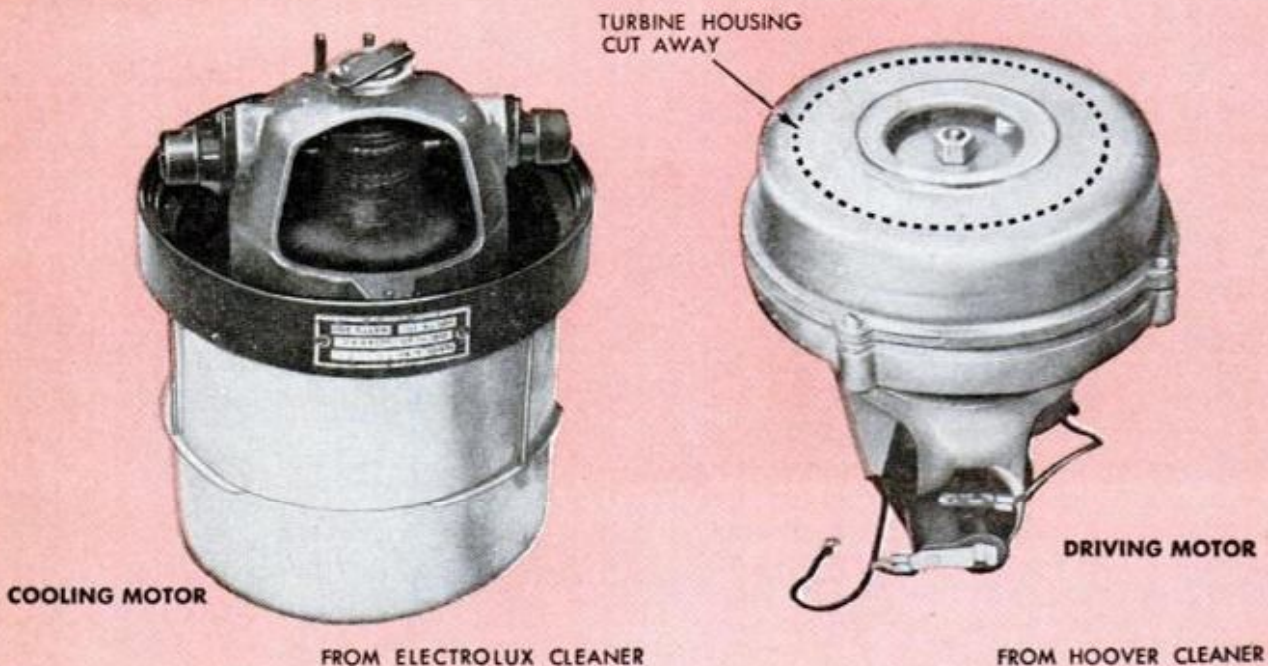
The device cuts the nuisance of frequent belt-switching. Just one belt change (at

mid-point) lets you pick from the entire range the cutting speed that suits the material and the job.

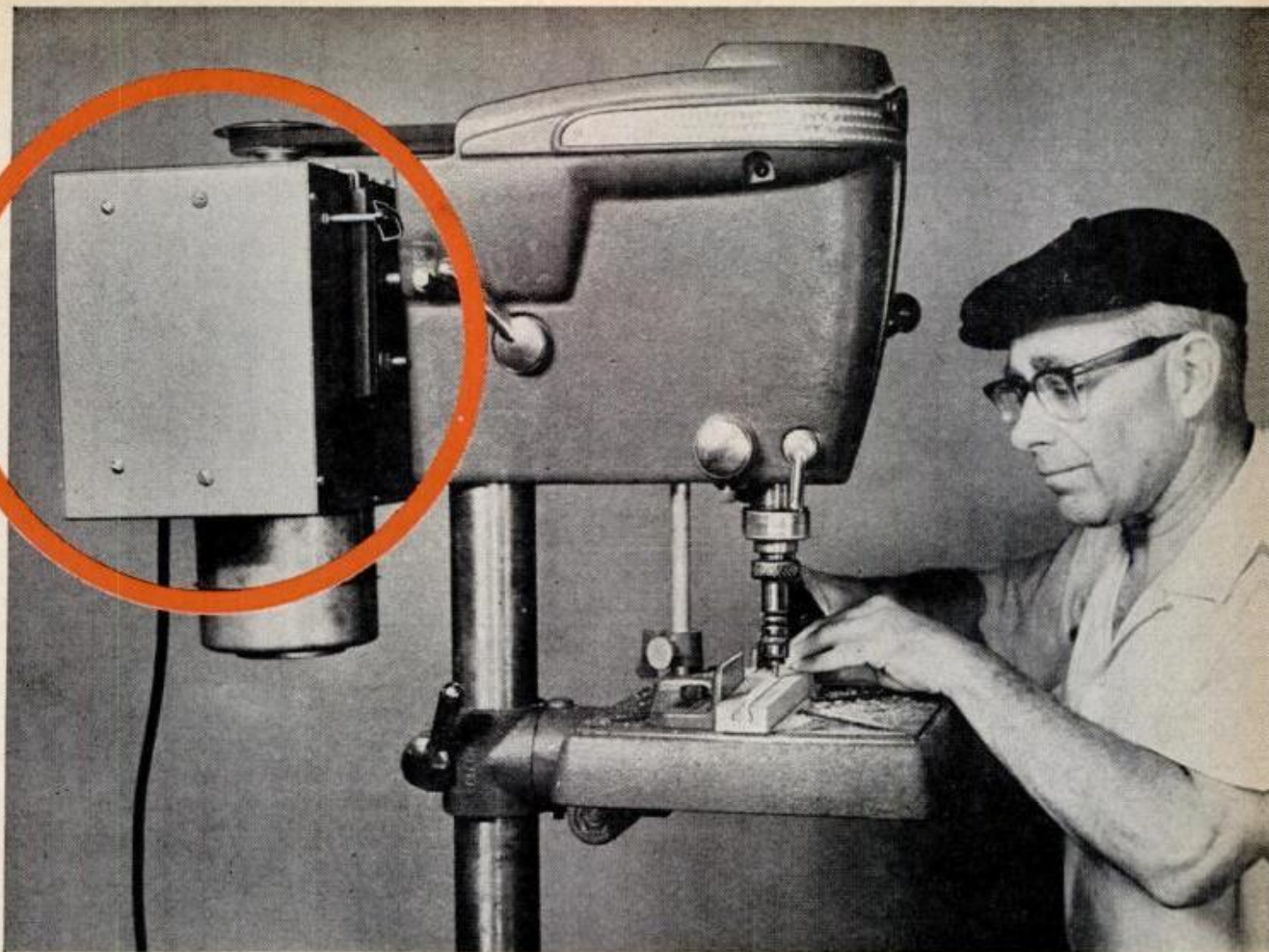
The drive unit uses two vacuum-cleaner motors, one as a cooling motor, which are housed in a standard 8 x 8 x 10-in. utility box. The cooling motor is installed in the bottom of the box, directly below the driving motor, and cools both the latter and the SCR with a stream of air sucked in at the bottom and passed out holes at the top of the box. I used a 1-hp. motor from a Hoover canister-type cleaner for the driving motor and the motor and blower from an Electrolux tank-type cleaner for the fan. Such motors, rated at 7 amps., are available at low cost from old trade-in cleaners. The ones shown below cost me \$5 (left) and \$7.50 (right). A GE silicon-controlled rectifier with a 7.4 amp. rating will cost you a little over \$3.00.

Your first step is to remove the motors and blower assemblies from the cleaners. Disassemble the drive motor, discard the blower rotors and check the condition of

**THESE ARE THE TWO** vacuum-cleaner motors I used. If you can't find the some motors, you can adapt other makes easily enough. Note that the top of the turbine housing of the driving motor must be cut out to the dotted line to accommodate a new bearing housing and permit passage of air from the cooling motor



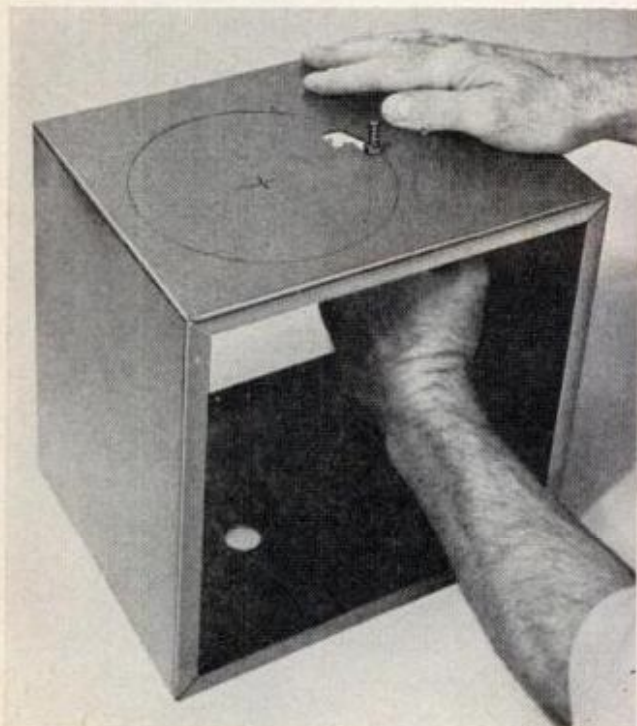




**WITH THE BELT** on the upper step of the two-step drive pulley and the motor switched to full speed, spindle speeds up to 10,000 r.p.m. can be dialed for efficient high-speed routing and shaping operations

**IF YOUR FLY CUTTER** is large enough, you can use it to cut the hole for the cooling motor. If not, you can cut it neatly with a sheet-metal nibbler

**THE COOLING MOTOR** and its blower hang through the hole in the bottom of the box and is held with small screws located around the edge of the hole





STANDARD UTILITY BOX  
8" x 10" x 10"

1/4" AIR HOLES

DISTANCE TO SUIT

2 3/4" x 3 1/2" CIRCUIT BOARD

1/4" x 1" FLAT STEEL, 15" LONG

3/16"-18 BOLTS 1 3/4" LONG

SCR

1/4" HOLE FOR SCR

1/4"-20 x 3/8" BOLT

INSULATOR

HEAT SINK

1/2"

3"

4 1/4"

30"

3/4" x 2 1/4" NOTCH

1 1/16" x 6" x 8 1/2" ALUMINUM

1/4"-20 x 1/4" BOLT

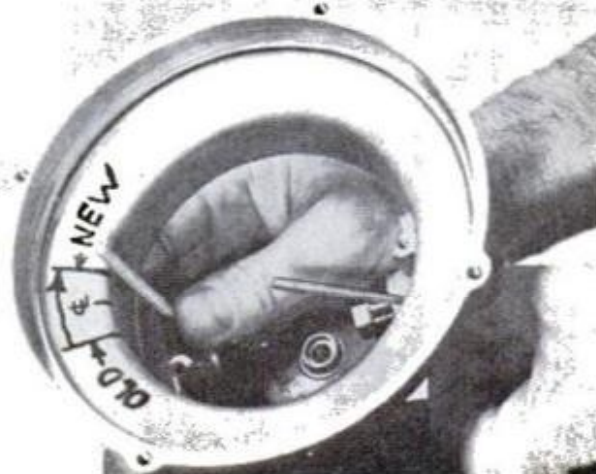
the commutator and brushes. Since the motor rotates in the wrong direction, it must be reversed. In some universal motors (the Hoover's included) you'll have to shift the pole and coil assemblies to the opposite side of the brush holder centerline as shown in photo below. Here the original bolts which held the field assembly in place were discarded and replaced with new bolts bent L-shape.

Since vacuum-cleaner motor bearings and shafts are not designed to take side loads, extra bearings must be added. I used two New Departure bearings, #3202, pressing them into a housing machined from cold-rolled steel. This made it necessary to cut away the top of the turbine housing (indicated by the dotted line) so as to clear the new bearing housing and to allow the cooling air to pass through. Longer motor spacers were also needed which I made by drilling pieces of wooden dowel centrally for 10/32 bolts.

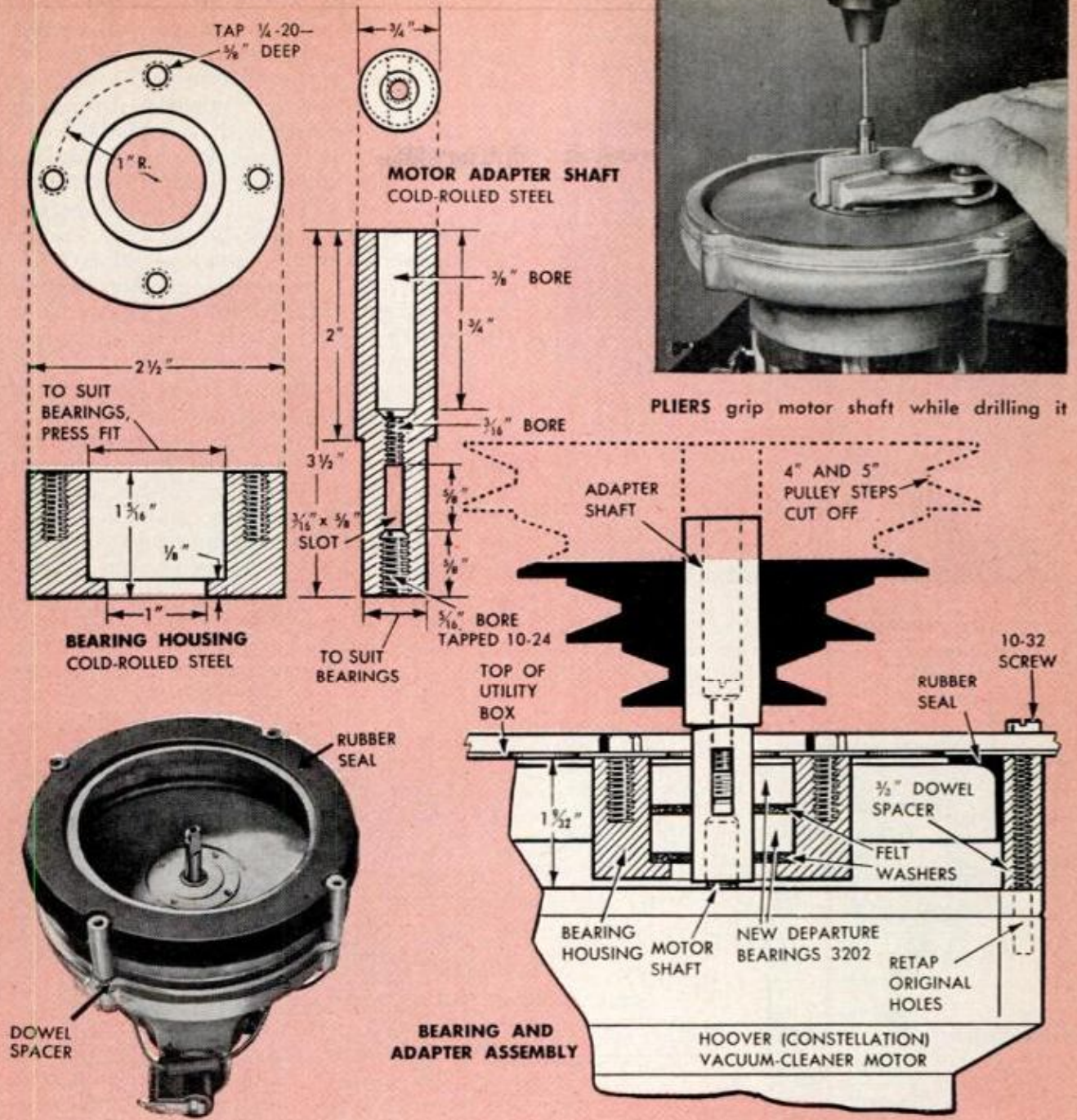
In addition to the bearing housing you'll need to machine an extension for the motor shaft. This is detailed along with the bearing housing on page 191. The extension is locked securely to the end of the motor shaft with a socket-head machine screw which passes through the center of the extension and into a tapped hole in the end of the shaft. Tightening of the screw draws the flattened end of the shaft into a keyway formed by drilling and filing a slot crosswise through the extension. The flat on the end of the motor shaft should be carefully filed the same amount on each side so it fits the keyway snugly. This is done, of course, after the shaft has been center-drilled and tapped. A cutdown 5-in. cone pulley with a 3/4-in. bore is placed on the shaft extension after the assembly has been installed in the utility box.

The utility box can be purchased from

**TO REVERSE THE DIRECTION** of rotation of the Hoover universal motor you have to shift the pole and coil unit to opposite side of brush-holder centerline

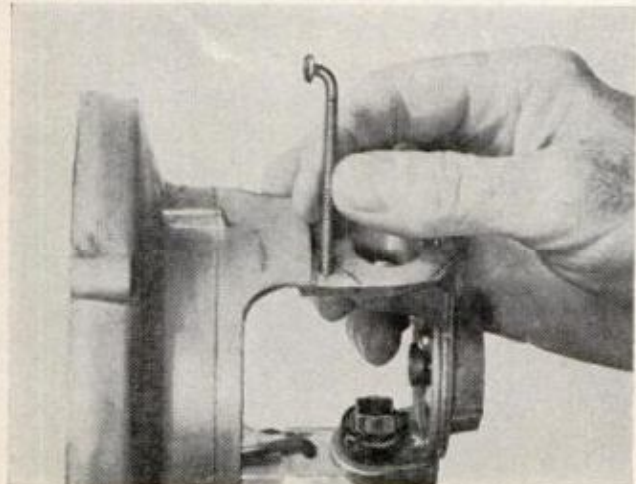




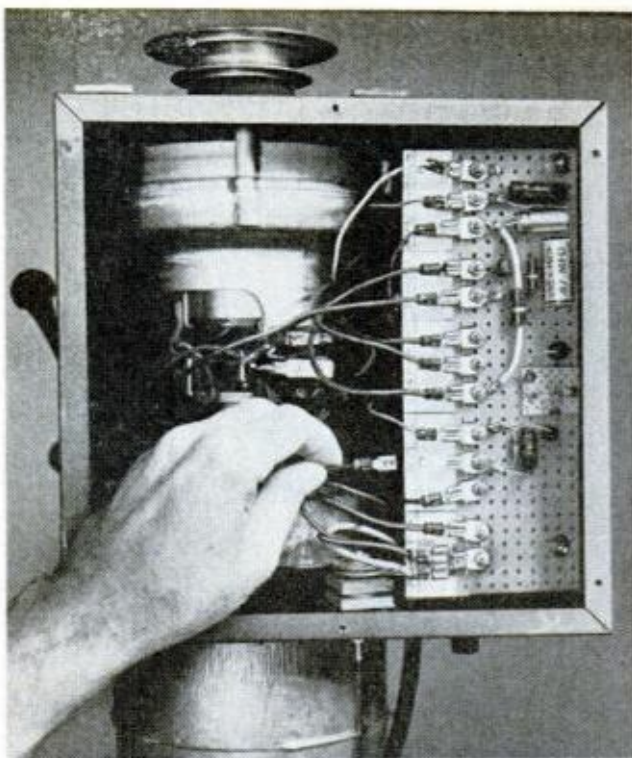


WHERE THE FIELDS aren't centered with the brush holders, you can't use the original bolts after making the shift. New hook bolts (below) must be used

AFTER DRILLING and tapping the threaded end of the motor shaft, two flat faces are filed on opposite sides to engage a keyway inside the extension shaft





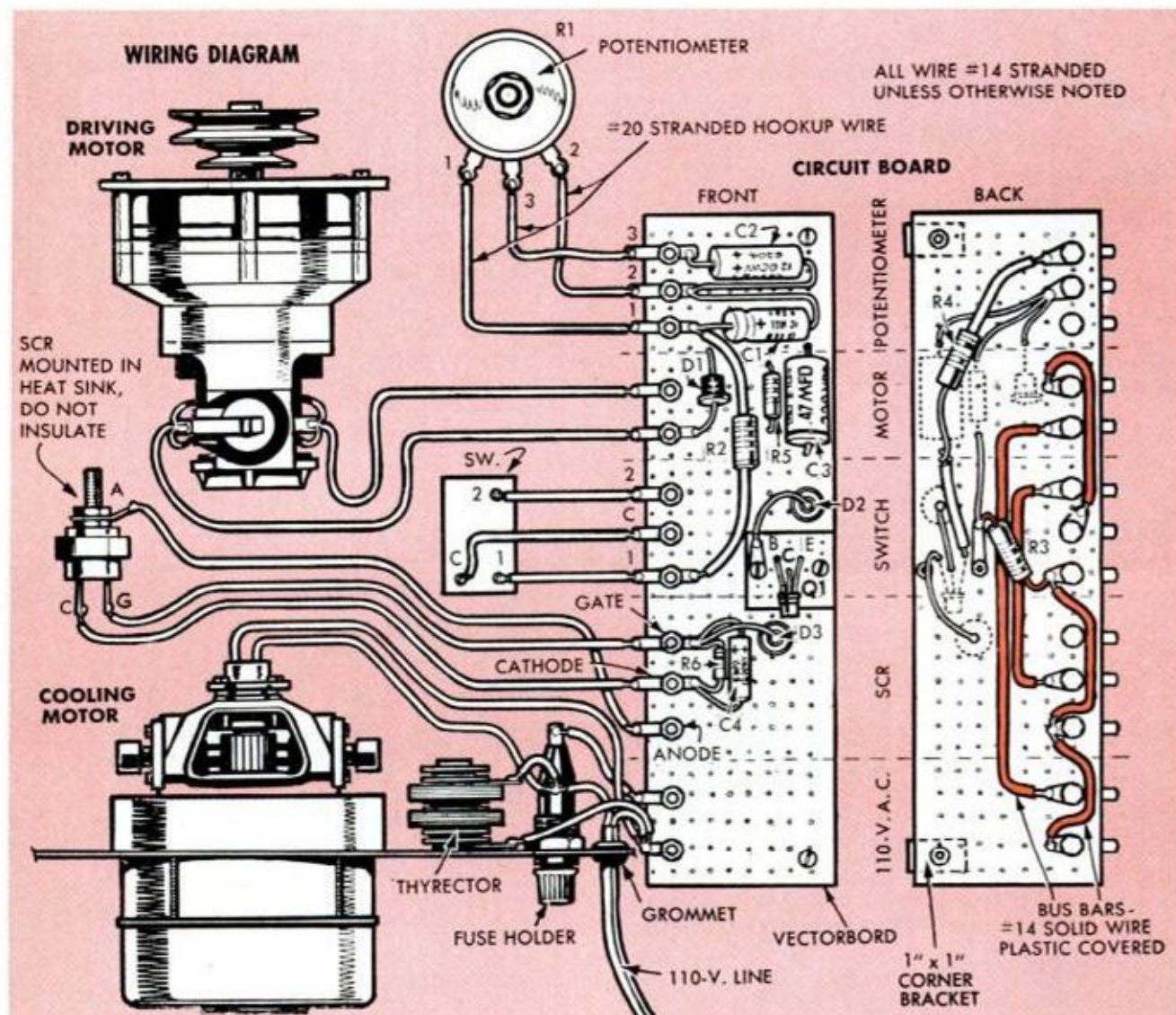


A ROW OF TERMINALS is added to the edge of the circuit board to make connections of the components which are not mounted on the circuit board itself

any radio supply house. I used a fly cutter in the drill press to form holes in the top of the box for the extension shaft and the air vents. My fly cutter was too small to cut the large hole in the bottom of the box for the cooling motor so I scribed the circle and cut the opening with a nibbler.

The details on page 190 show how to make the heat sink that supports the SCR. Paint the two parts flat black before assembling them to give better heat transmission, and apply a thin coat of silicone grease between the two parts when bolting them together. The completed heat sink is attached to the side of the box with stand-off insulators of fiber tubing.

The wiring is simplified by the use of a circuit board which carries all of the components except the thyrector, fuse holder, potentiometer, SPDT switch and the SCR. Connections for all the components not mounted on the board are made at a row of terminals equipped with Faston connectors. Start by laying out the terminal holes and installing  $\frac{3}{32}$  x  $\frac{1}{2}$ -in. screws with solder lugs. While I used a thin piece of punched phenolic fitted with flea clips to serve as a transistor socket, a regular





socket can be installed if you wish. Note that certain wires (shown in color) must be 14-ga. or larger since they carry heavy current. Note also that the only components mounted on the underside of the circuit board are two resistors.

The potentiometer and switch are installed on the front cover of the box and it is important that they do not touch the heat sink. The completed drive is hung on the drill-press motor pad by flatheaded bolts fitted in strap hangers and then belted to the drill-press pulley. In each pulley ratio, the highest speeds are attained by positioning the toggle switch in the "full speed" (No. 1) position. Be sure to turn the dial to the "slow speed" (No. 2) position, though, before starting or stopping the motor; otherwise you may shorten the life of the SCR.

Though omitted from the wiring diagram on the opposite page, a SPST on-off toggle switch can be spliced into the 110-volt line—or a push-button type mounted on the box. This saves you having to unplug the machine after each use. ★★

#### ELECTRONIC PARTS

R1—1000 ohms 3W Potentiometer  
R2—2200 ohms 2W Carbon resistor  
R3—2200 ohms 2W Carbon resistor  
R4—10,000 ohms 2W Carbon resistor  
R5—220 ohms 1W Carbon resistor  
R6—1000 ohms 1/2W Carbon resistor  
C1—2MFD 100V Electrolytic capacitor  
C2—50 MFD 12V Electrolytic capacitor  
C3—.47 MFD 200V Paper capacitor  
C4—5MFD 12V Electrolytic capacitor  
D1—Silicon rectifier 1N1693  
D2—Silicon rectifier 1N1692  
D3—Silicon rectifier 1N1693  
SCR—GE Silicon controlled rectifier type C20B  
Thyrector—GE 6RS21SA5D5  
Q1—2N2923 Silicon transistor  
Fuse holder—Buss type HKP  
Fuse—7 Amp. 125V Buss type MDXqS/ Fusetron  
SW1—Single-pole, double-throw toggle switch  
Mounting board—Victorbord #32AA18

## Cement, Lime and Chloride Seals Cinder-Block Walls

In your January Homeowners Clinic I read where a reader from Pennsylvania inquired about finishing the cinder-block walls in his basement. On several of my construction jobs I have used the following preparation, both as a sealer and as a finish coat, with excellent results: 50 lb. Atlas white cement, 10 lb. lime and 2½

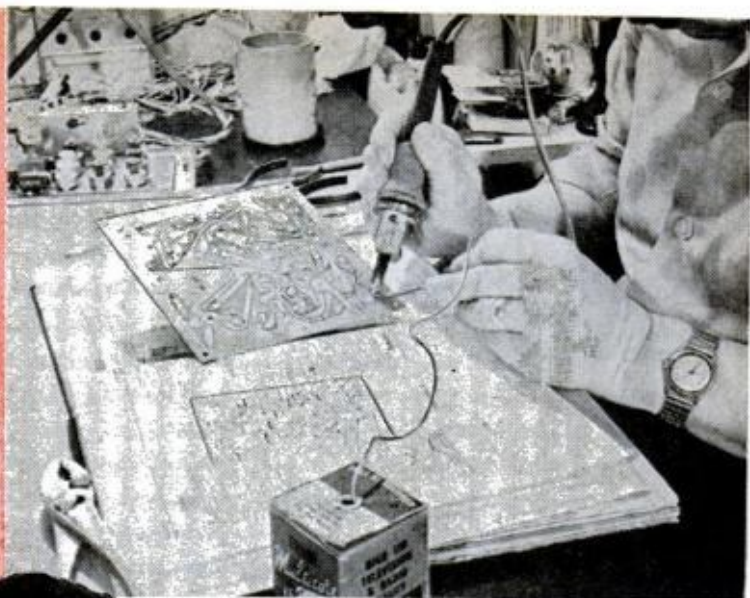
lb. calcium chloride. Mix all three to a heavy paint consistency and apply with a stiff brush. This will fill the pores in the blocks completely and a second application will serve as a finish coat without painting. However, if you want to add color, you can paint the surface with oil or latex paint.—Clinton Strohmeyer

## NEXT MONTH IN SHOP AND CRAFTS

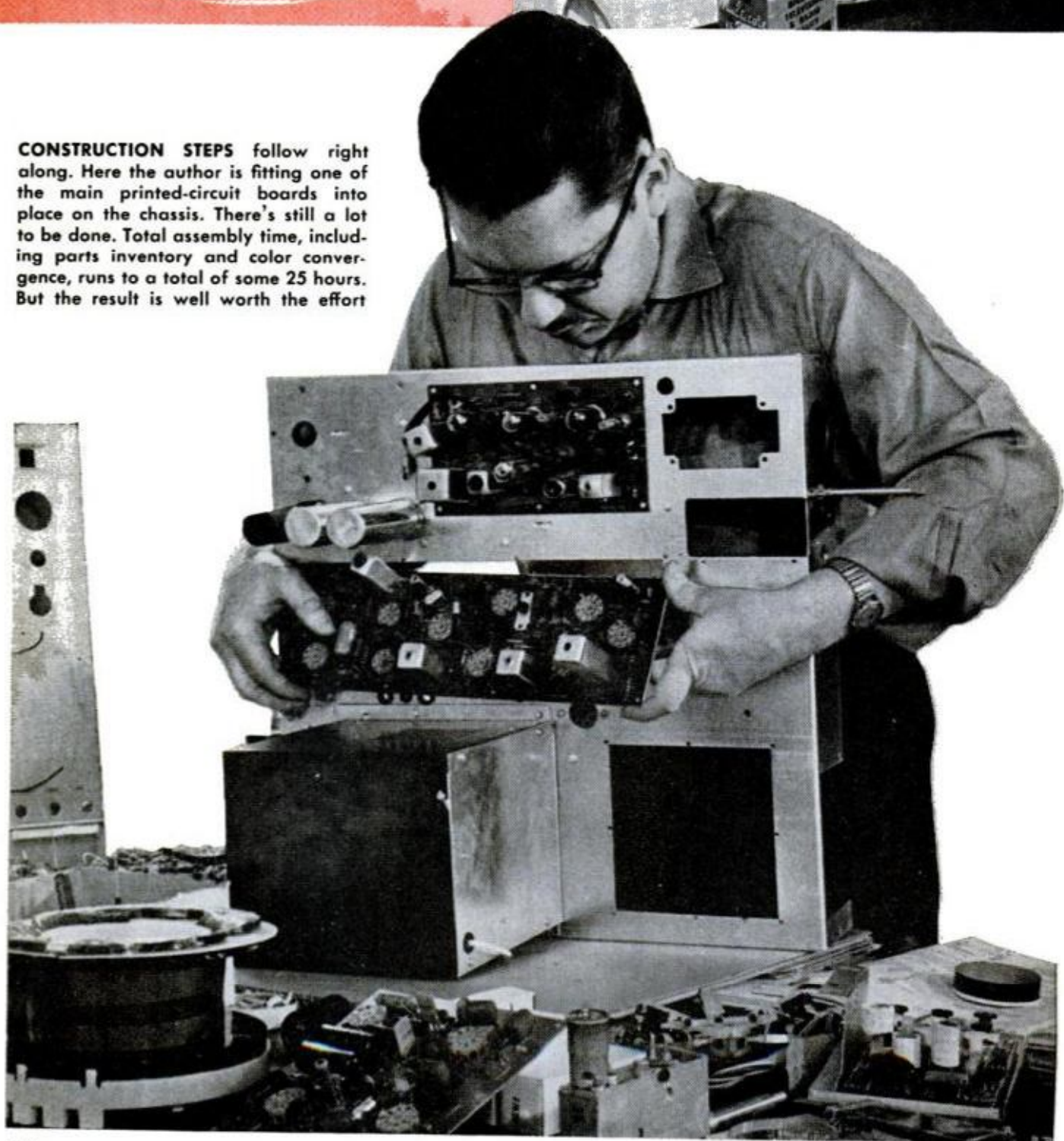
- ★ **YOUNGSTER'S BEDROOM-IN-A-WALL.** In the March issue you'll find complete plans for building a fun-packed storage wall that will double the capacity of any child's bedroom. Featuring fold-down Navy-style bunks, this rugged built-in also includes storage galore in cabinets and roll-out toy bins, plus a roomy study desk. Watch for this space-saving special
- ★ **SKITTLES.** Here's an old-time game that originally was played in the pubs in England. It's played with a top, 15 miniature bowling pins and a board which is partitioned off into eight rooms. Spin the top and it wanders from room to room knocking over the pins. Now popular in this country, it's an exciting game the whole family will enjoy. You'll find complete plans for it in the March issue
- ★ **PUTTING A KEEN EDGE ON CHISELS.** An expert tool grinder may spend years learning to put a good edge on a tool freehand. Next month, *PM* shows you how to achieve the same professional results in much less time. You'll find plans for simple jigs and attachments that take the guesswork out of grinding, plus plenty of helpful hints on how to use them
- ★ **SPORTS BOAT.** Next month's *PM* will feature plans for a slick new boat designed just for sportsmen. This rugged 16-ft. inverted-V hull includes a 10-ft. walkaround cockpit plus plenty of storage space for all types of sports gear. Perfect for fishing, skin diving, skiing or camping, it's also a good all-around family boat. Don't miss the March issue



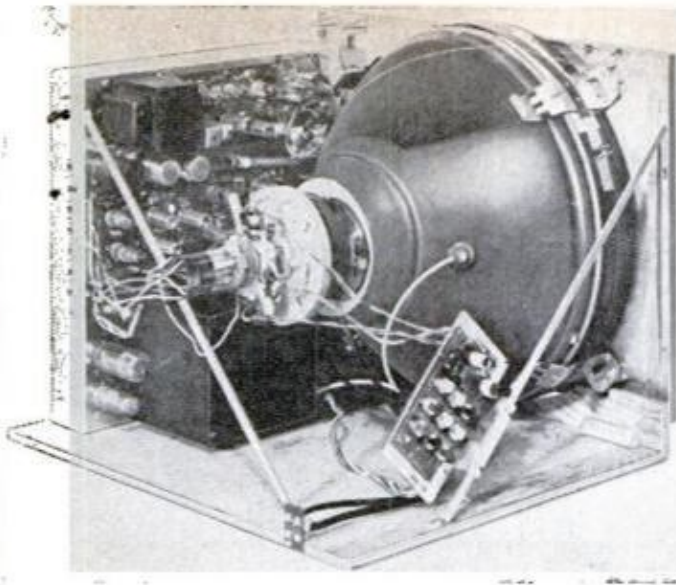
# Color TV in Pieces



**CONSTRUCTION STEPS** follow right along. Here the author is fitting one of the main printed-circuit boards into place on the chassis. There's still a lot to be done. Total assembly time, including parts inventory and color convergence, runs to a total of some 25 hours. But the result is well worth the effort







**COMPLETED CHASSIS** appears here with the custom mounting kit. The set is ready for installation in a living room wall or a cabinet of the builder's choice



**IF YOU USE** the manufacturer's optional console cabinet, your finished color TV receiver will look like this when it is set up for viewing in your living room

*Mounted, prealigned critical circuits enable beginners to assemble. Picture quality is topnotch*

**By C. P. Gilmore**

**W**ITH EVERYTHING from digital computers to electronic organs already available in put-it-together-yourself form, it was inevitable: Sooner or later the color TV set had to come out as a kit.

It has, and it's available now from the Heath Company.

Although any color TV—including this one—has a terrifically complex circuit, you'd never know it from building the kit. The more complex assemblies, including the i.f. strip and the tuner, are prewired and prealigned, so you need no instruments to make the set work. You wire two other circuit boards from scratch, then put the whole business together. The entire assembly job took me about 20 hours.

The really startling features of this kit come to light after you've finished building it, plug it in, and turn on the power. For you not only do the preliminary adjustments such as size, shape, linearity and location of the picture on the tube face—but you also converge the colors. The latter is a job many TV service technicians hate to tackle. What's more, with the help of the detailed instructions and one built-in electronic alignment instrument, you'll find it's not so tough.

Normally, the job requires a service instrument called a dot generator. With this kit, though, you won't need one. It's built in. Just flip a switch on the back, and the dot pattern is on the screen.

The convergence job is tedious—it took about two hours—but isn't difficult. Follow the directions to the letter and you'll

stay out of trouble. To make the job as simple as possible, 31 full-color pictures of the screen at every stage of the process are included, so you'll know exactly what you're aiming for.

Convergence isn't the whole story. You'll also have to adjust color purity, red, green and blue screen drive and other back panel color controls. (Before you're through, you'll adjust some 33 controls, plus a handful of magnets, yokes, etc. That's not counting the usual half dozen or so front panel controls.)

In addition to giving you a great sense of accomplishment, the do-it-yourself alignment, color balance and purity adjustments, and others you make with the help of the instruction book have another advantage: When your set eventually needs touching up, you won't have to call the serviceman.

You may not even need him when it develops troubles. Included in the manual is a comprehensive section on troubleshooting, showing you how to track down difficulties and make the repairs.

The basic color chassis costs \$349; the handsome walnut cabinet is another \$49. The set has two sound outputs—one for a speaker, the other to feed your hi-fi set. A custom kit for mounting in the wall is \$4 and an optional u.h.f. tuner is \$20.

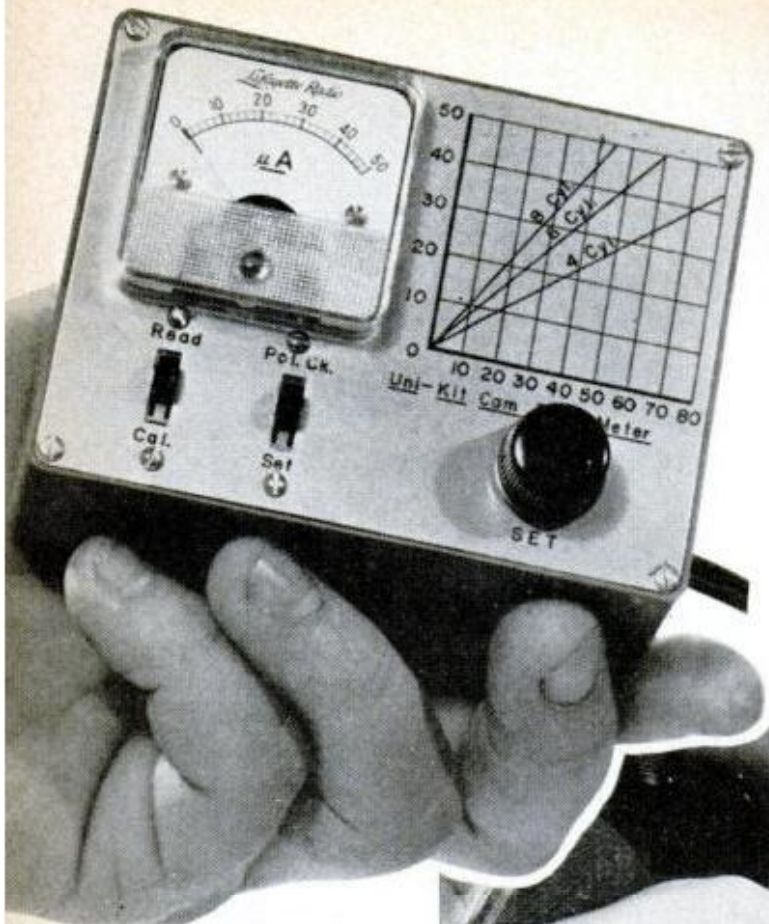
A final word on the set's performance: I've had other color sets in my home and was well pleased with them. But the Heath color picture is topnotch in every respect. And that's the real payoff. ★ ★ ★



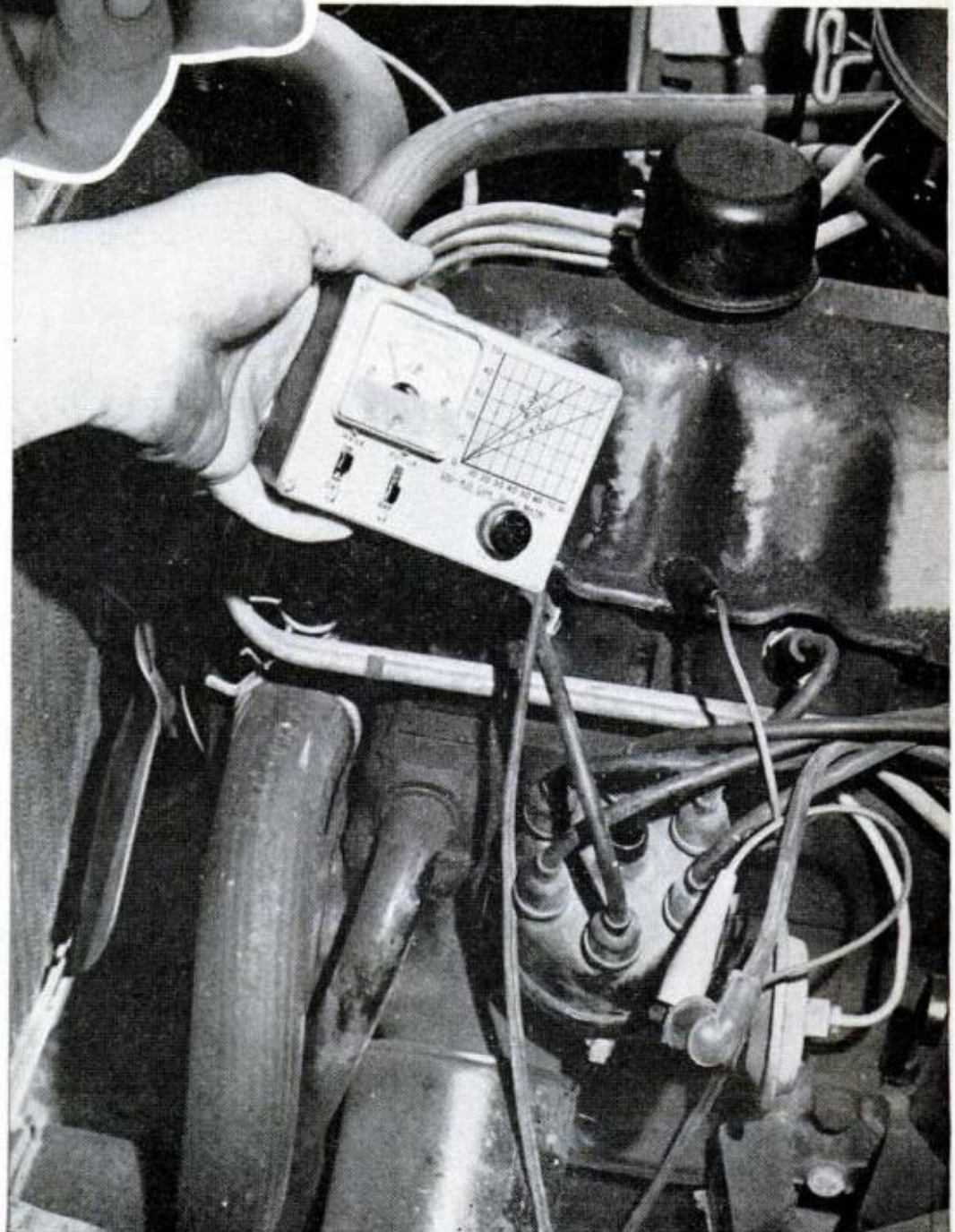
# Cam-Dwell Meter

*\$15 semiconductor unit that'll fit in your pocket sets dwell—detects bouncing, pitted or burned points and spots any shorted capacitors*

By Brice Ward



HERE'S a dwell-meter use not covered in the text. Connect the leads across the ignition coil. Full-scale reading indicates open coil. Zero reading means everything's OK





# for Quick, Sure Auto Tuneup

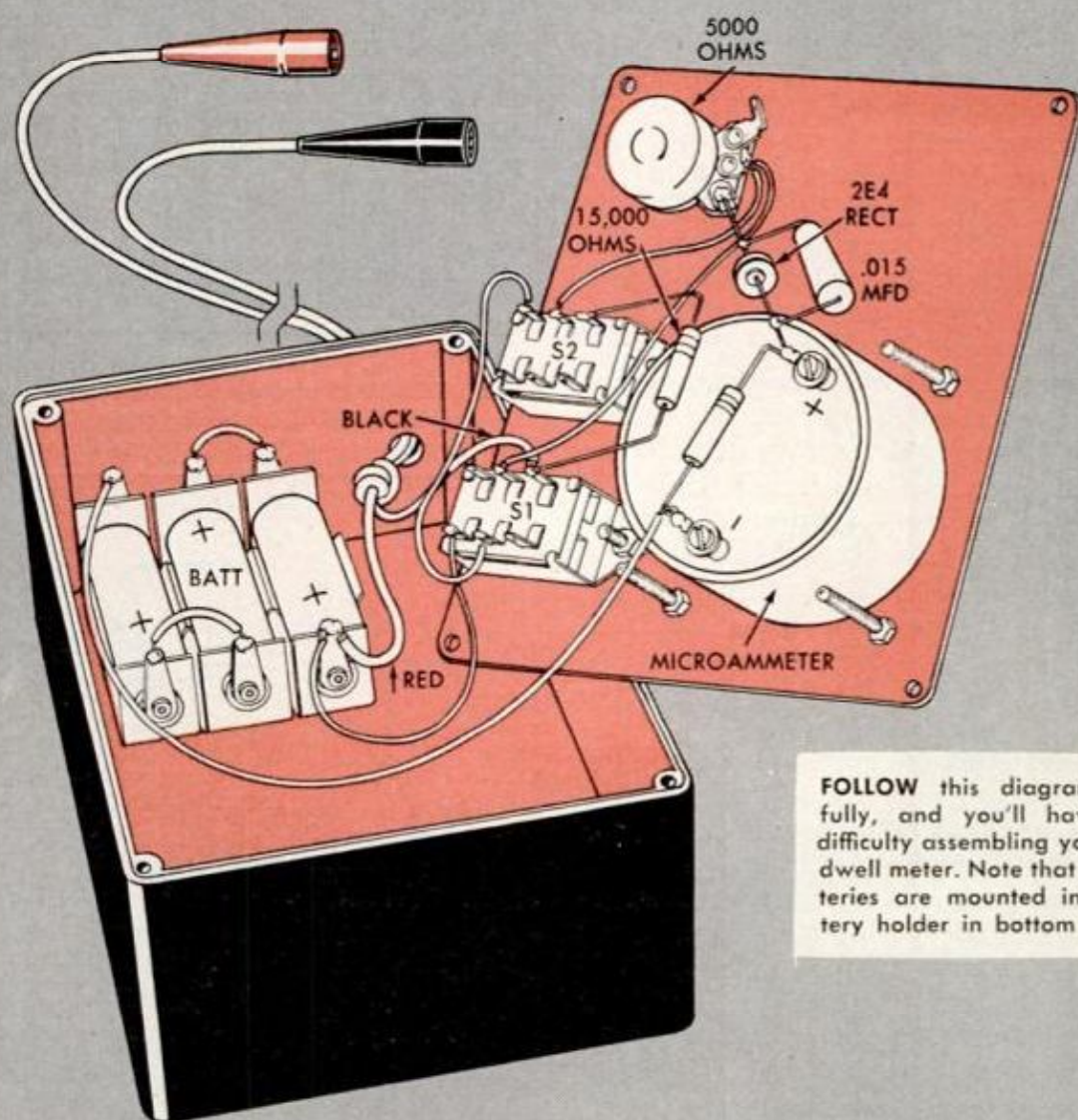
**E**VER HAVE POINT TROUBLE? Or maybe that spitfire auto is spitting more fire and less power lately. If this is your trouble, here is an instrument that takes up little more space than a pack of cigarettes yet will help you get the engine running smoothly once again.

This precision ultra-miniature cam-dwell meter will let you set your points to better than .001 inches (three degrees dwell) of the desired dwell setting. It will

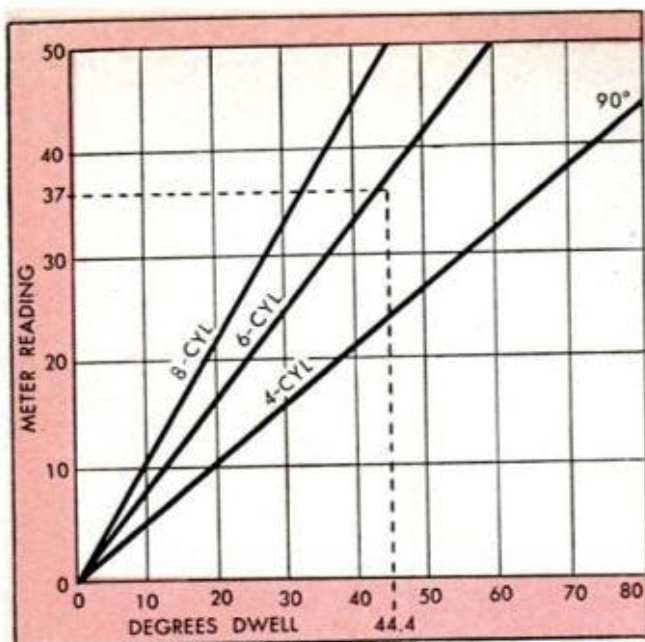
detect bouncing points and high resistance points and do everything the large units will do—all at a cost of about \$15.

If you are going to build from scratch, you'll need a case and panel. Drill and punch these to fit the components. Routing of wiring and parts layout are not critical, so construction won't be too tough.

Testing your assembled meter is simple. Place the READ-CAL switch in the CAL position. Place the POL CK-SET switch







**IF YOU BUILD** from scratch, you'll want to make a copy of this chart to cement to the face of your meter. With it you can read dwell degrees directly

in the SET position. Adjust the SET knob for full-scale deflection on the meter. Switch the POL CK-SET switch to POL CK and the meter should read 0.

Now connect the test leads together and the meter should indicate somewhere between 0 and 10. With the READ-CAL switch in the READ position and the test leads still shorted, the meter should again read full scale. With the test leads disconnected, the meter should read 0. If your unit meets these tests it is ready to use.

Connect one lead to ground, the other to the coil terminal at the distributor. Set the switches to CAL and POL CK. If the meter reads strongly up scale, reverse leads; the meter should read below 10.

Set the switches to CAL and SET and adjust the SET knob for full-scale indication on the meter. Set the switches to READ and SET, and read percentage dwell on the meter.

The meter reading must be multiplied by two for true percentage-dwell reading, but for a quick dwell indication go to the chart. Follow a line over from the meter reading on the chart to the 8, 6 or 4-cylinder line and drop straight down to get the dwell reading. For example, as indicated in dotted lines on the chart, a meter reading of 37 is 44° dwell.

For an even closer dwell indication multiply the meter reading by two, which gives percentage dwell, then multiply by 45° for 8-cylinder cars, 60° for 6 cylinders and 90° for 4 cylinders.

For example, in the reading just taken,  $0.37 \text{ times } 2 = 0.74$  (or 74% dwell time) and  $0.74 \text{ times } 60^\circ = 44.4^\circ$  dwell.

To check for bouncing points, increase engine r.p.m. A slight decrease in meter reading is normal. But if you get a pronounced decrease, the points are bouncing.

Erratic meter readings mean pitted or burned points and possibly even a worn distributor bearing or a bad cam.

With the engine stopped and points closed, the meter should read full scale. Anything less indicates high contact resistance or pitted and burned contacts.

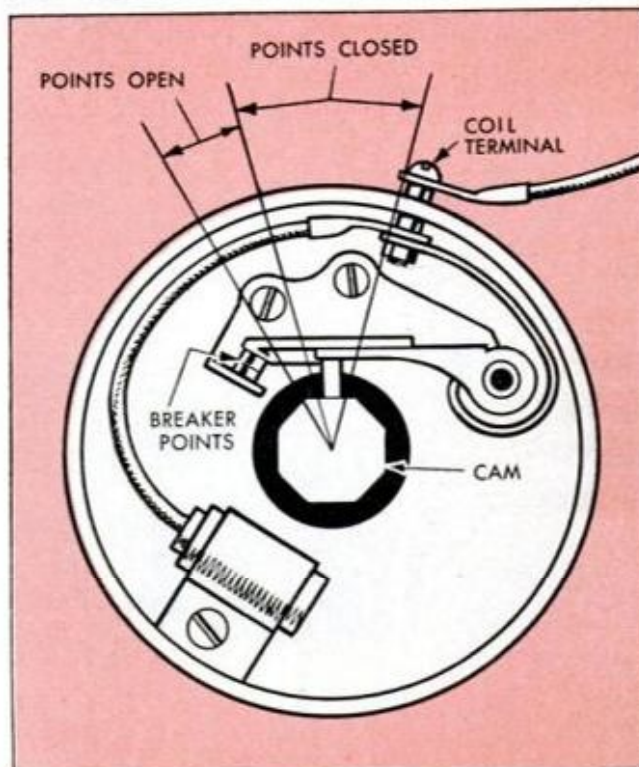
A shorted condenser is indicated by a full-scale reading with the points open.

Anytime you can't get a full-scale reading in the CAL-SET switch positions it is time for new batteries. ★★★

#### PARTS LIST

- 1—Resistor, 15,000 ohms, 1/2 watt, carbon
  - 1—Resistor, 22 ohms, 1/2 watt, carbon
  - 1—Potentiometer, 5000 ohms, Lafayette VC-33
  - 1—Capacitor, .015 MFD 600, volts, Centralab DD163
  - 1—Rectifier, silicon diode type 2E4
  - 1—Meter, 50 microamps, Lafayette TM-200
  - 2—Slide switches, dpdt, Wirt G-126
  - 1—Battery box, Keystone 156
  - 3—Batteries, penlight, 1 1/2 volts
  - 2—Insulators, Mueller 47
  - 2—Test clips, Mueller 45
  - 5-ft. lamp cord
  - Panel, 6 1/4 x 3 3/4, Lafayette MS-217
  - Case, Bakelite, 6 1/4 x 3 3/4 x 2 inches, Lafayette MS216
- For your convenience, we have arranged with Techni-Kits Inc., 350 Broadway, New York 13, N. Y. a complete kit of parts including a precut and labeled front panel and case for \$14.95.

**METER MEASURES** the points-closed angle with the aid of panel-mounted conversion chart. Connect meter leads to ground and the distributor coil terminal post





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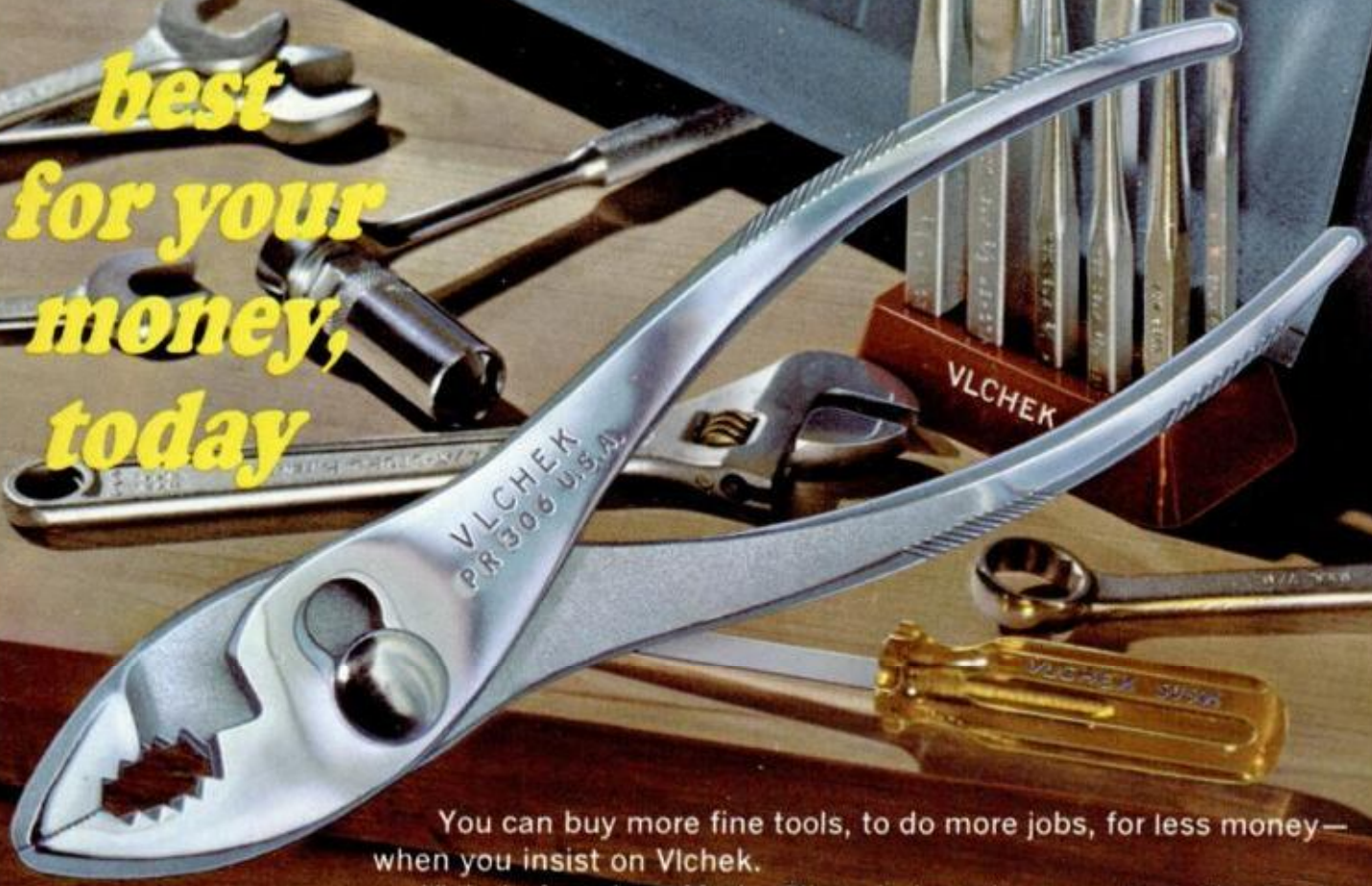
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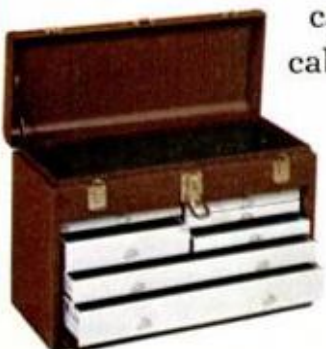
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## Ceramic Tile

(Continued from page 160)

just draw your glass or ceramic tile cutter across the face of the tile's glazed side. If you use a glass cutter, you can break the tile by centering the scribe over a hard edge and pressing on both sides of the scribe.

If you use a ceramic tile cutter, the break is made right on the cutter. Smooth off the edges with a carborundum stone.

If you have to cut arcs or notches for pipes, make your scribe and break off the section with a pair of pliers or ceramic tile nippers. Always take small bites. Since most cutouts are covered by an escutcheon plate, a snug-fitting cutout is not essential.

Make holes for fixture screws with a carbide-tipped drill.

● Grouting is the next step. Mix the powdered grout with water to form a paste and sponge this over the tile, pushing the grout firmly into joints. You can even use your fingers to do this, but be sure to wear a pair of rubber gloves since grout contains lye. (If you should get a little on your skin, flush immediately with water.)

Grout about 25 sq. ft. at a time. Then immediately wipe the surface of the tile with a window squeegee.

When the first section develops a film over the tile's surface, go back and rake the joints with a striking tool. Then take clear water and a sponge or rag and remove the film. If the grout sets up before you can finish your clean-up, you'll have to moisten the cloth with gasoline in order to remove it, so work quickly.

If liquid silicone has been added to the grout, the procedure is the same except for the final step. To remove the film, use a rough-surfaced cleaner, such as a burlap bag or turkish towel, dipped in water.

● If a tile should come loose in time, carefully pry it up and scrape or sandpaper away old adhesive and grout from the back of the tile and the wall area. Then apply fresh mastic to the wall and tile and press it firmly into place. Let it set for awhile and then grout the area.

If a tile should break and you cannot match the color, you can try to repair the cracked tile by prying it carefully from its position and applying epoxy glue to the edges. Press the pieces firmly together. Then, after it has dried, replace it.

Since tile is often difficult to match after the original job has been in for awhile, it's a good idea to include a few extra in your initial purchase and store them. This will insure that you have the correct color and size if one ever breaks. ★★

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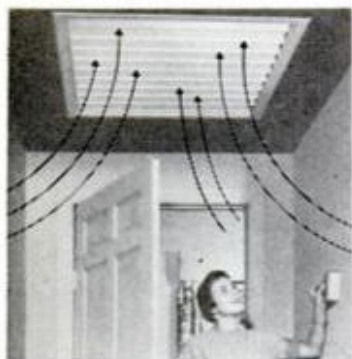
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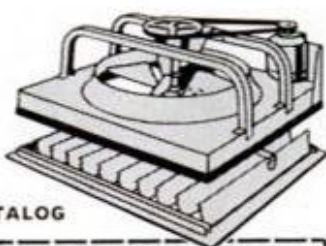


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## Troubleshooting Power Brakes

(Continued from page 182)

nearest to the power assist unit, air should come out the other side. If the valve is faulty, replace it.

If you still have no vacuum, the trouble is inside the power assist unit which will have to be removed for overhaul.

The next test to perform is the brake drag test. Before doing this, however, make sure the brake shoes are properly adjusted so both front wheels spin freely. If shoes are misaligned, they could put a drag on the wheels that may cause you to condemn the power assist unit unjustly.

Raise both front wheels off the ground and have someone spin both wheels. Immediately start the engine and run it at idle speed. Leave your foot off the brake.

When both wheels come to a complete stop by themselves, turn them by hand. If a drag is noticed, it indicates trouble in the power assist unit. It could be a restricted passage or interference with the powering device. In any event, the unit has to be torn down and repaired.

Never let a drag condition continue. You'll keep wearing out one set of brake linings after another, if you do.

The hydraulic system should be tested next. With the engine off, apply the brake pedal several times to get rid of all vacuum remaining in the system. Keep the engine off and step on the brake pedal firmly, holding your foot steady.

A pedal that remains firm indicates satisfactory operation of the hydraulic system. If the pedal gradually sinks away under pressure, though, check all hydraulic lines and connections for leaks, and replace any that are damaged.

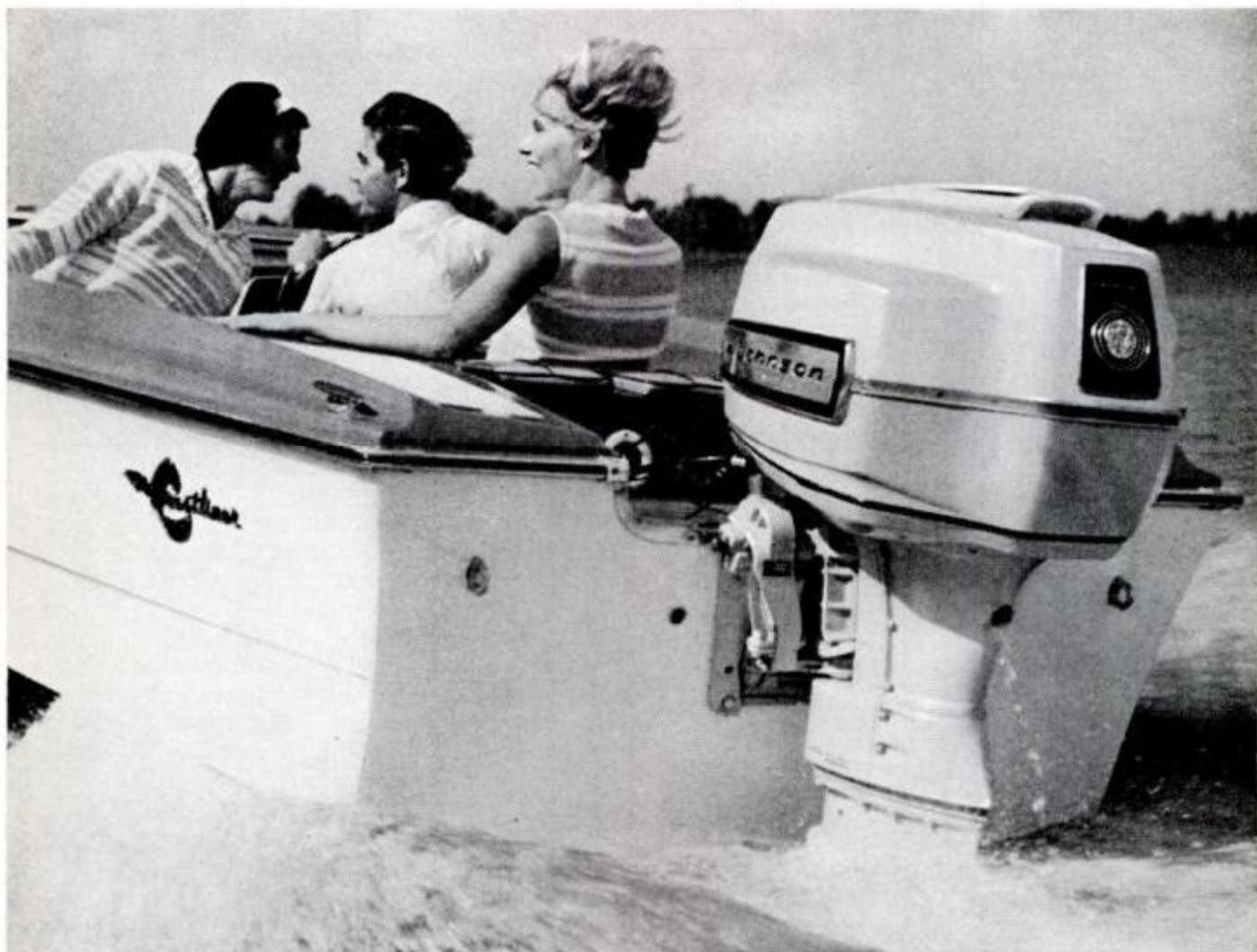
If you don't find an external leak, remove the hose from the power assist unit to the manifold and try the test shown in Fig. 3. If the screwdriver (or stick) comes away moist with brake fluid, it means that fluid is being sucked from the hydraulic system into the manifold.

In this case, the power assist unit must be torn down and repaired to stop internal leakage. If the condition is permitted to continue, brake fluid being sucked into the engine will cause rough idle and poor engine performance.

In using the trouble-shooting chart to solve your problem, it would be wise to first perform those tests which are the easiest. But for problems that require more drastic measures, the second part of this article, next month, will show the step-by-step tear-down of a representative unit. It will also present a comprehensive chart of the major types of units and the cars on which they're used. ★★



# NEW 90<sup>H</sup><sub>P</sub> JOHNSON GOLDEN METEOR



**Never has so much outboard power needed so little fuel!**

Meet the mighty Meteor . . . the most motor ever built by the outboard builder who's built the most. This V-4 bomb has a 4-barrel carburetor with a straight-through induction system. What other motors waste, this one turns to wallop.


Uses a gas-oil mix of 50 to 1. Cuts oil costs in half! Also has Electramatic Drive (no extra cost), 20-amp. alternator-generator, and automatic choke. And like all '64 Johnsons, it's made to resist salt water corrosion.

Check your Johnson dealer. (He's in the Yellow Pages.) And check the other dependable Johnsons: 13 new models in 9 power classes; 90, 75, 60, 40, 28, 18, 9½, 5½, and 3. All covered by Johnson's special 2-year warranty.\*

Johnson Motors, 1631 Pershing Rd., Waukegan, Ill., Division Outboard Marine Corporation.

\*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.

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Just turn the dial and you're set to go with this new Irwin Expansive bit. No hunting for the size you need. Fits all hand bit braces. Clean, fast, accurate boring action from  $\frac{1}{8}$ " to 3"—35 standard hole sizes in all!

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clear plastic finish  
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Ideal for floors, stairways  
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paint, building supply stores.



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**Those Hopped-Up Sailboats**

(Continued from page 112)

speed, designers began to produce hull shapes that defied this formula—broad-beamed scows that plane like flying fish; slender unballasted featherweights like the *Flying Dutchman* with one crew member braced window-cleaner-style over the weather rail in a trapeze; and finally—ultimately, some say—the catamarans.

While acknowledging the supremacy of the cat today, some specific innovations in high-speed sailing should be noted.

**Hiking Devices**

Of all the mechanical tricks used to achieve stability and speed, hiking devices are by far the most spectacular. On centerboarders up to 25 ft. long which depend on live ballast (the crew) rather than fixed ballast (a heavy keel), sailors have always placed their weight outboard to the weather in order to increase stability and speed to windward. Hiking, as this brand of acrobatics is known, can be facilitated by a number of accessories, all rather scary to Sunday sailors.

The hiking strap attached fore and aft to the floorboard, one port and one starboard, enables the crew to sit on the gunwale and lean far out to windward by just slipping their ankles under the straps. It's probably the most common hiking aid.

The trapeze, so successful it has given its name to a whole class of boats, is a canvas seat slung on a stainless steel wire from a point high on the mast. It allows the crewman to climb right out of the boat when hiking, bracing himself with both feet on the weather rail to help the boat stand on her feet.

The hiking board, a less efficient device which is seldom used today, is mounted athwartships and slides out to protrude over the weather side. Used successfully on International Decked Sailing Canoes, it requires the addition of a hiking stick, a push-pull tiller extension.

All of these devices have been used on light monohulls to achieve the stability which is inherent in the catamaran design.

**Sailing Hydrofoils**

The only design that might offer serious competition to the cats is that perennial drawing-board dream, the sailing hydrofoil. Such boats have been built, and while their performance was, to say the least, erratic, they have been known to top 30 knots when conditions were just right.

Then again, they're funny looking, and anyone who says that they might ultimately conquer the cats is sure to be laughed off the dock. ★★★

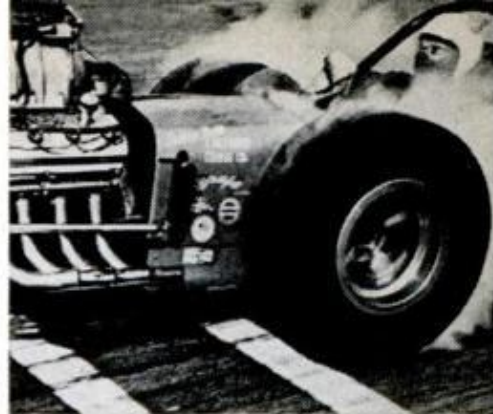




Champion-sparked Offy wins Indy 500



Champion-sparked outboards win all APBA classes



Champion-sparked Chrysler dragste wins NHRA Nationals



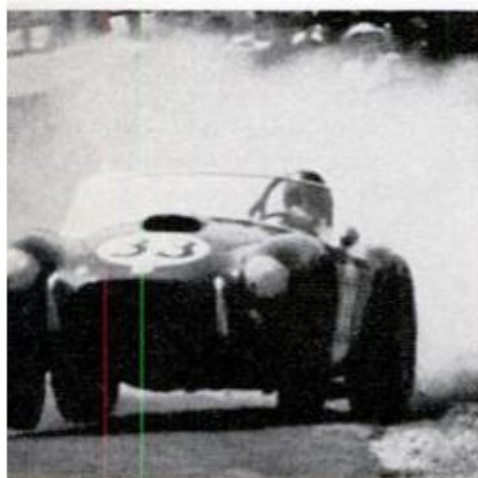
Champion-sparked Rolls-Royce wins Gold Cup



Champion-sparked Lycoming wins Powder Puff Derby



Champion-sparked Ferrari wins Sebring GT



Champion-sparked Cobra-Ford wins Watkins Glen



Champion-sparked Plymouth wins USAC Manufacturers Award



Champion-sparked Chevrolet wins Pikes Peak climb

Again in 1963, the overwhelming majority of major race winners used Champion spark plugs because Champions have no equal for performance. Why settle for less in your car?



To feel new power in your car instantly, install new Champions now and every 10,000 miles



# CLINIC FOR HOMEOWNERS

**Q** One wall of a room I'm decorating apparently has been "replastered" with a light coat about 1/4-in. thick. A portion of this is loosened from that underneath. The area is quite large, about 18 in. wide and 3 ft. long. What does one do in a case like this, have the wall replastered, take off the top coating or patch the area?—H.O., Wyo.

**A** It's rather hard to say offhand just what is best to do. Apparently a white coat has been laid over existing plaster and has failed to bond properly to that underneath in the area involved. If this latter coating is bonded solidly to the old plaster at points other than that where you have removed it, then perhaps the cheapest repair would be to patch the area, using a patching plaster which is specially prepared for the purpose. If you attempt the job yourself you will need a plasterer's trowel, but in the end it may be cheaper to buy one than to hire the job done. Mix the plaster according to the instructions and then wet the area to be patched thoroughly. Lay the mixed plaster on quickly and smooth to a depth of about 1/8 in. Allow this to dry and then finish with a second application, troweling the new flush with the old at the edges all the way around. Keep the trowel wet as you smooth the plaster. After the patch is dry, sand flush at the edges.

**Q** My older home has been reroofed three times, and now the last roof is going bad, leaking in several places. The original roof was wood shingles. I'm wondering what to do, reroof again, or remove the whole and start over. But the roof boards are spaced. What's best to do about that?—L.K., Pa.

**A** Judging from your description the last roof must be in rather bad shape. As a rule overroofing over an old wood shingle roof is not satisfactory, especially if the wood shingles were warped or curled appreciably at the butts when the first overroof was put on. Also, some of the nails miss the roof boards. Best thing to do is remove everything. It's going to be quite a chore, but in the long run may be just as cheap as overroofing again. Take everything off, pull all nails, then fill spaces between the roof boards with wood strips of the same thickness as the original boards. Then cover the deck with asphalted roofing paper and finish with com-

position shingles having cemented tabs.

**Q** My home, 1 year old, has walls of concrete blocks, plastered on the inside and stuccoed on the outside. In winter the walls and windows sweat badly, so badly that we have to use a mop to get the water off the floor. I heat my home with unvented gas heaters. What's the cause of this sweating and what can I do to prevent it during the winter months?—M.K., Miss.

**A** The cause of your trouble is mainly the unvented heaters. The reason is that one of the products of the combustion of concentrated fuels such as natural gas, heating oil and bottled gas is water vapor. This vapor is vented into your home in large quantities, raising the moisture content of the air in the rooms to a very high level. This will condense on any surface which is colder than the air with which the surface is in contact, in your case the walls and windows. The only sure remedy is to vent the heaters to the outside, making sure that they are fully vented, that there are no leaks in the vent pipes.

**Q** Framed pictures have hung on our papered walls for some years and on taking them down to change to smaller sizes, also to relocate several, I find that an area roughly the size of the hanging picture shows up prominently. What causes this, and is there any way to prevent it, other than repapering the rooms?—D.R., Mont.

**A** The cause is, mainly, a lack of air circulation back of the picture, plus a deposit of fine dust and the fact that the paper fades more slowly in the shaded area. Much the same thing happens when a picture hangs on a wooden wall, except that the wood tends to remain lighter in the shaded area, rather than appearing darker. Much can be done to reduce the prominence of the spots by going over the affected areas with a wall-paper cleaner. After this has been done it will be up to you to decide whether the remaining defacement warrants repapering. When rehanging the pictures, drive two brads at the lower corners of each frame, permitting the heads to project about 1/4 in. This will permit air circulation and minimize the collection of fine dust on the wall back of the picture.





## If you won't buy a good drill—borrow one!

"A ten-dollar drill makes the same size holes as a better drill—why should I pay more?"

That notion has cost a lot of men a good deal of disappointment. If the truth be told, it's wiser to rent a quality drill—or even borrow one from a neighbor—than gamble good money on a "bargain" drill that comes apart at the seams under rough service.

If you're seriously considering buying a drill, it's worth taking the next few minutes to know what makes a good drill worth a few dollars more. For comparison's sake, we'll use the Skil Model 503 quarter-inch drill.

### Most Important: The Motor

More than any other single feature, the motor is the key to the quality of a drill . . . determines whether it will stand up when the going gets stubborn. Working with soft wood isn't much of a problem, even for cheap drills. But in dense woods or materials like steel or masonry, a cheap drill will tend to peter out—and perhaps *burn out*.

To prevent any such misfortune, the Skil Model 503 is equipped with what is termed a "Super Burnout Protected Motor." That means its windings are coated with

a special high heat resistant resin that prevents overheating. It's an extra production step that costs more to perform—but the life of your drill could depend on it.

### Industrial-Quality Parts

Inside the Skil 503 drill are parts—shafts, gears, bearings—made to the same standards—in fact, on the same equipment—as Skil professional drills. Assembly and quality control, too, are every bit as exact as for Skil industrial 1/4" models costing \$65. The Skil 503 is a precision tool, not a stripped-down version made to meet minimum standards.

Even the housing on a Skil Model 503 is something special. It's made of a costly lightweight aluminum alloy that makes the drill easy to work with, but ready for more abuse than you'll ever give it.

### Don't Slight Service

When a Skil 1/4" drill leaves our plant it carries a *lifetime* guarantee against defects in material or workmanship. And we back up this guarantee with one of the most extensive nationwide networks of factory authorized serv-

ice centers in the field. Unlike most cheap drills, a Model 503 can be serviced anywhere in a matter of hours or a couple of days. (We know of instances—not too rare—where owners of other makes have waited a month or more while the tool is in repair.)

### Think About This

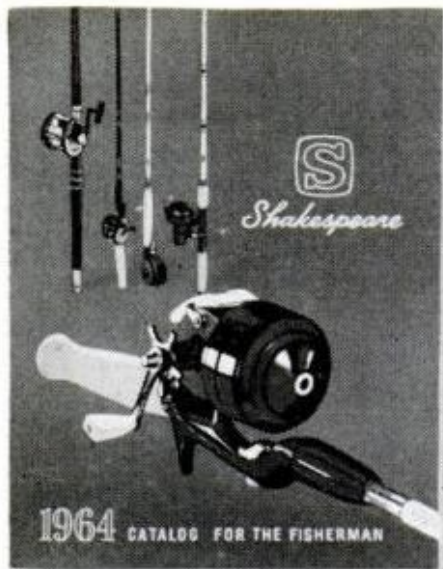
Those are the facts—the rest is up to you. You can buy a cheap drill for something like five or six bucks less than a Skil Model 503. The question is, are you saving five dollars or throwing away ten?

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## Arc Welding Basics

(Continued from page 177)

vent burn-through. If not objectionable, a strip of 16-ga. steel, tack welded or clamped to the underside of the seam, can be used. The strip then becomes a part of the job and is left in place after welding.

**Fillet Welding** is used to fasten two pieces of steel at right angles to one another, as shown at the bottom of page 174. The easiest way for a beginner to lay a fillet weld is to tilt the work at a 45° angle (as in the photo on page 175), so that the sides form a trough like a beveled butt weld. Since it is not always possible to tilt the work, however, horizontal fillet welding, where one piece stands vertical and the other lies flat, should also be practiced. Both are down-hand welding.

Practice positioned fillet welding first, after studying the sketches at the top of page 175. Tack weld two 1/8-in. or thicker pieces of steel together in the shape of a T and block them up with a piece of angle iron so that the sides are at a 45-deg. angle to the bench top. Use a 3/32 or 1/8-in. rod and, after striking an arc, move the rod at a steady pace as you did when making a beveled butt weld. Be sure to center the rod over the corner of the joint. If the rod is held off the center so as to be closer to one side than the other, the arc will melt one piece more than the other and cause undercutting on the hot side and a cold lap on the other.

The size of a fillet weld is determined to a certain extent by the rate of travel. If the travel is too fast, a thin fillet weld with undercutting at the edges will result. Watch the weld puddle and move the rod just fast enough to keep the molten slag from running in front of the puddle. Chip and clean the slag from each fillet weld you run and compare the surface of the weld with those in the photo chart on page 148 of the January issue. A good fillet weld should have a slight convex curvature and be "washed up" along the edges, forming a small concave cove.

Before laying a fillet weld on the other side of the T-shaped practice piece, break the weld apart by hammering the vertical member toward the weld. Inspect the fractured weld for penetration and soundness. The penetration should extend beyond the corner of the pieces.

If you need a fillet weld larger than you can make in one pass using the biggest rod your welding machine will handle, use one of the multiple-pass methods shown in the center sketches, page 175.

**Horizontal Fillet Welding.** Tack weld two pieces together to form a T-joint as

(Please turn to page 210)





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## Arc Welding Basics

(Continued from page 208)

before, only this time place the base piece flat on the bench top instead of tilting it. Point the electrode into the corner of the joint at a 45-deg. angle. Hold a short arc as though you were almost "dragging" the rod along, with the rod coating scraping against the corner of the joint. Do not expect to lay as large a fillet with a given rod size as you did in the tilted position. If, after cleaning off the slag, you find that the weld bead is uneven with more of it on the base plate and evidence of undercutting on the vertical plate, it indicates you are holding the rod at too high an angle or too close to the vertical plate. Lower the rod the next time as though you were directing more of the arc stream against the vertical plate. (Too slow a rate of travel will also deposit excess metal on the base plate, resulting in a cold lap.

**Size and Strength of Fillet Welds.** The size of a fillet weld is equal to the length of one of the small sides of the largest isosceles right triangle that can be drawn within the cross sectional area of the weld (see sketch at bottom of page 175). Fillet-weld gauges are available for measuring welds of various sizes. For practice work, however, you can measure the welds with a square and ruler as shown.

The strength of a fillet weld is determined by the throat dimension multiplied by the length of the weld. For example, if the throat measures 1/8 in. and the weld is 4 in. long,  $1/8 \times 4 = 1/2$  sq. in. Using a safe design strength of 15,000 psi. (pounds per square inch) the weld will support 7500 lbs. or 3 3/4 tons in tension.

Fillet welds should never be less than 5 to 6 times their size in length. For example, a 3/16-in. fillet weld should be at least 1 in. long not counting the crater—unless of course, the weld is intended as a tack weld for assembly purposes only.

To gain full strength from fillet welds on lap and T-joints, both sides should be welded. This was apparent when you broke the practice fillet welds run on one side only. If you had welded fillets on both sides before attempting to break it for inspection, you would have found it very difficult, if not impossible.

The size of the fillet welds need not be any larger than the thickness of the vertical plate as shown in the final sketch on page 175. This will produce a welded joint as strong as the plate itself. Welds larger than the plate itself would only be wasteful of welding electrodes and time. If it is not possible to weld both sides of a T-joint, the edge of the vertical plate should

(Please turn to page 212)

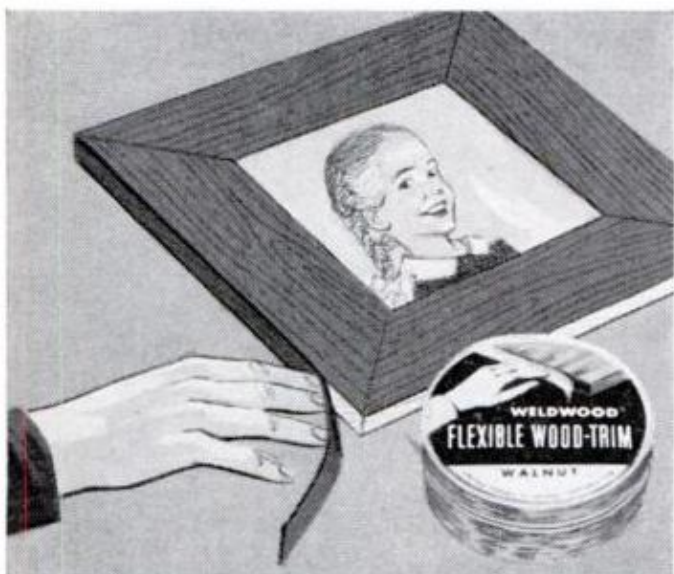




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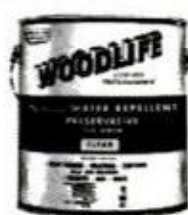
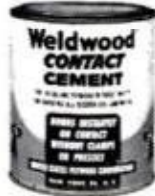
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## Arc Welding Basics

(Continued from page 210)

be beveled at 45 deg. so that 100 percent penetration can be achieved in two passes.

**Distortion Control.** There are four steps to keep in mind when welding a job to prevent it from warping and twisting out of shape. (1) Tack weld as many of the pieces together as possible before running any continuous welds; (2) use the minimum amount of welding consistent with making the joint strong enough to support the load; (3) skip-weld around the job so that the heat at each spot will be kept to a minimum and the shrinkage of one weld will counteract shrinkage of another; and (4) reinforce the job where necessary with bars and clamps to prevent warping.

Distortion is caused by the heat of the arc expanding, or rather trying to expand, a strip of metal on each side of the weld. Since expansion of these heated strips is restrained by the adjacent cooler metal, the strips are stressed beyond their yield point and plastic flow or permanent deformation of the metal in the strips takes place. When the weld is completed and the metal cools, it contracts. The surrounding metal, which was not stressed beyond its yield point, contracts to its original size.

But, the restrained metal tries to contract to its deformed length which is slightly shorter than its original length. These opposing forces create a highly stressed area between the strips and the adjacent metal which—unless the metal is thick enough to resist these forces—causes bending and twisting along the weld.

This type of distortion is further aggravated by shrinkage of the molten weld metal as it solidifies and cools. This was noticeable when you ran practice beads on 1/8-in.-thick steel, causing the ends to lift. Or when shrinkage across the weld caused the T-joint piece to pull toward the weld.

To control shrinkage across the weld when tack welding a job together, alternate the tack welds from one side to the other so that the shrinkage of the tack welds will counteract each other. Also tack weld all of the pieces to each other.

On long butt welds the back-step method shown on page 177 will help keep the job straight. On long fillet welds, distortion can be reduced by staggering intermittent welds (bottom sketch).

Temporarily bracing parts that are free to move or bend will hold them in place until all welding is completed. The braces can then be removed and the tack welds ground off to finish the job. ★★

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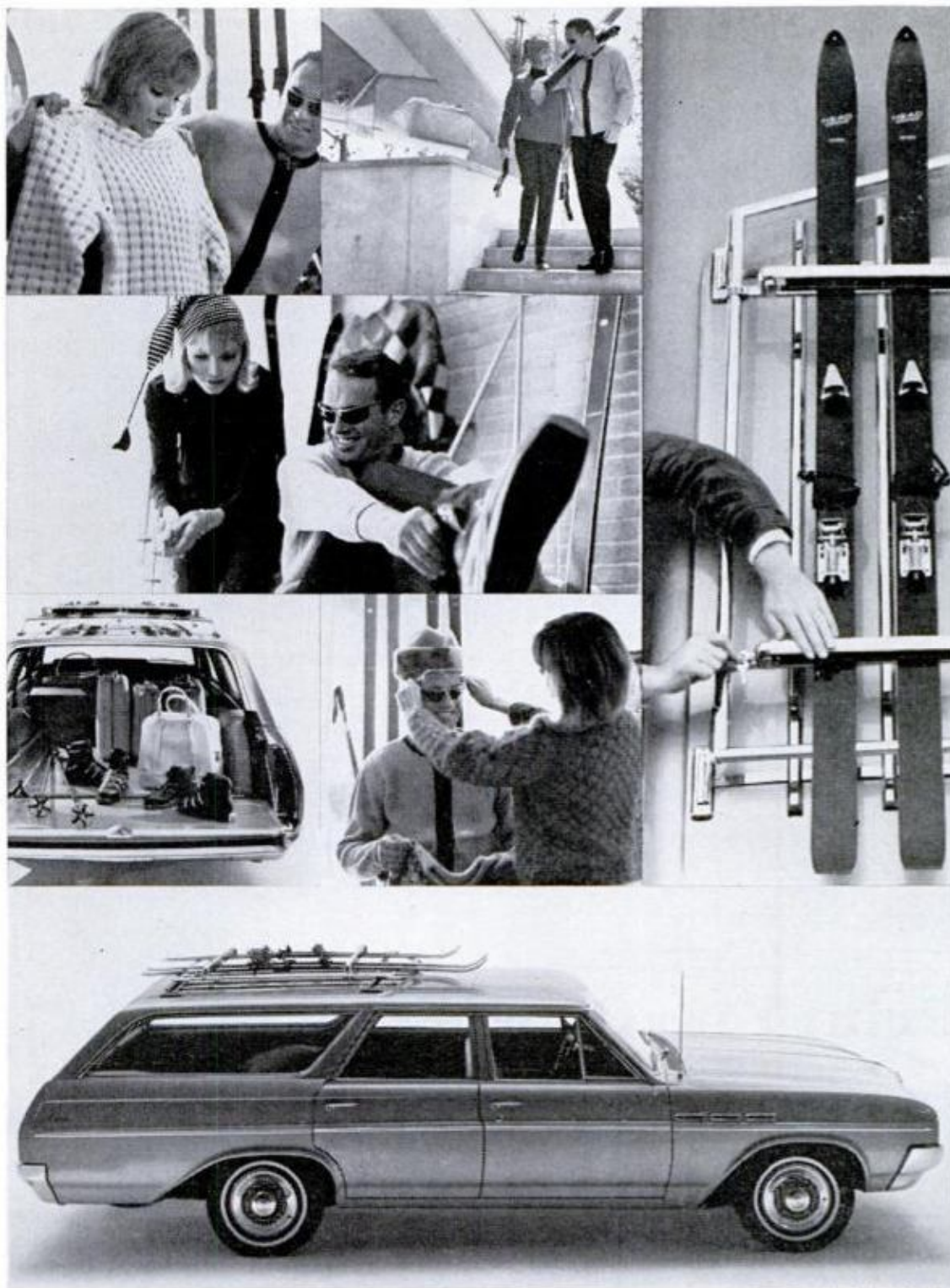
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## Little LeMans on Ice

(Continued from page 134)

drive with windows open, and it isn't unusual to see an open sports car sliding through the course with top down and red-nosed driver huddled in a bundle of wool.

Ideal conditions call for about two inches of semi-packed snow on the ice (it adds just enough traction for high-speed cornering). But conditions seldom are ideal at Naomi. Loose snow is quickly spun from the course; warm winter sun produces slushy thaws that re-freeze to lumpy horrors. Races have been run with two to four inches of water on top of the ice. When that happens, the contest looks more like a hydroplane race, with cars sprouting 30-foot rooster tails.

Since windshield wipers can't handle such deluges, drivers stick their heads out the windows into the freezing spray. Open car pilots simply hoist their tails and look over the windshield tops. During one such race, temperature skidded. Spray froze on everything it hit—including the drivers, who had to be "chipped out" at the finish line. Some cars collected more than 200 pounds of ice.

### Rules Rigidly Enforced

Jealous of his remarkable track safety record, Skip Miller enforces rigid rules. Drinking is strictly forbidden. Crash helmets and seat belts are a must, as are fire extinguishers. Convertibles must have roll bars. Rules call for uniform diameter wheels all around (to keep the wild ones on drag strips), and locked differentials are prohibited. Except for major features, cars run in engine displacement classes.

"Only experienced drivers race," says Skip. "Newcomers are encouraged to drive practice runs. We give them tips and some coaching if they look as though they can do it. If they don't get the idea, we encourage them to take up something else."

Irresponsible drivers are "black-flagged" off the course, and repeat offenders are asked to stay away, but such cases are rare. More typical of the spirit that prevails was exhibited by the driver who took to the woods, lost a wheel and smashed his front end rather than hit a car that had lost control. Spotters along the track carry radio-transmitters that tie them to the starter as well as Miller's mobile communications center carrying the P.A. system. If a pile-up blocks the course, it is known immediately and yellow caution flags wave down all cars.

Contestants as well as officials insist that racing on ice—once a driver has acquired the delicate sensitivity and judg-

(Please turn to page 216)





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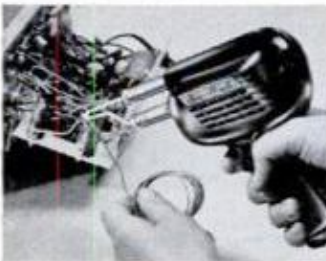
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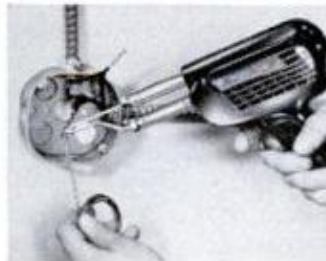
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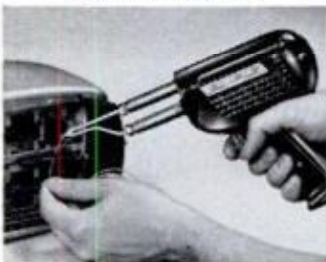
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## Little LeMans on Ice

(Continued from page 214)

ment it demands—is safer than regular road racing, even though track rules forbid use of snow tires, chains or other traction tricks. First, Naomi's ice runs to 30 inches thick during the season, so there's no danger of cars going through.

And while slight errors in judgment at high speed can and do result in complete loss of control, there's seldom any danger of catastrophe. "When a driver loses it," says Bob Stanton, a Binghamton trucking company traffic man who serves as chief steward for Miller, "he may go skating off in circles for a couple of hundred yards. But traction won't snap him as it does on pavement."

It isn't always that simple when cars slide through a corner together, like planes in formation. Often, they kiss fenders. There's always undenting going on in the pits. One of the two most serious accidents on the course involved a broken wrist a driver sustained when he reached through his window to straight-arm a car sliding into him. He kept it away, too. The other accident was a broken ankle. A photographer running up the track slipped and fell.

More spectacular, but less harmful to

life and limb are the occasional rollovers and snowbank dives. Half-sunken snags jut through the ice here and there. Cracks and potholes develop. Occasionally one of these will "trip up" a sliding car and flip it—or send it hurtling into the six-foot banks of snow bulldozed from the circuit. In the season's first race last year, two eager Saab drivers turned over. One lit on its side, bounced back and kept right on going. The other had to be dug out and up-ended. But the driver lashed the crumpled doors shut and finished the race.

Different cars offer different advantages on the ice—depending on conditions. Powerful vehicles with rear-wheel drive are happiest on a carpet of snow. It gives them the traction they need to open up on the straights. This writer was treated to his first run on a packed snow surface in a Porsche, piloted by frequent winner Sam Price. Sam swooped into the first "S" turn broadside, gracefully swung the other side into the second curve, straightened out and drove for the inside of a 180° turn at the end of the lake and used up the whole quarter-mile width of ploughed track (standard width at corners but the straights are 50 feet wide) before gunning it down the one-mile back

(Please turn to page 218)

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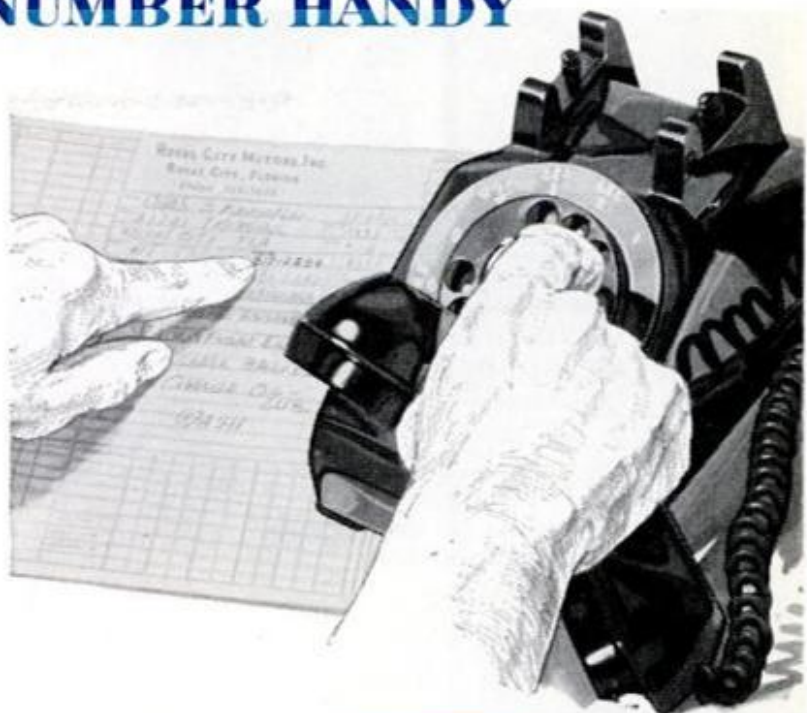
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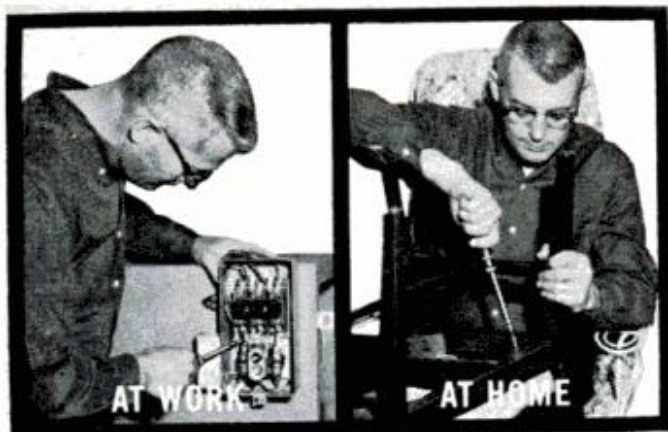
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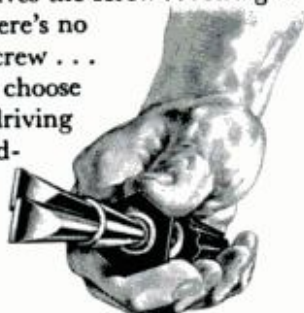
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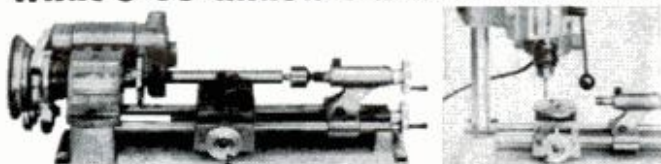
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**Little LeMans on Ice**

(Continued from page 216)

stretch at 90 m.p.h. plus. A hundred yards from the corner at the end, he tapped the brakes hung out a wagging tail, nudged the wheel—and rolled to a halt.

When glare ice exists, the Saab drivers cheer. These little front-wheel-drive bugs, with a top speed of 75 m.p.h. in production models, can out-perform anything on corners. One island around which the track loops is known as Saab Island, for two reasons: First, the curve is just right to encourage Saab drivers to put in everything they've got and jump to lead positions. Second, since they all try their mightiest, more than a few have overcooked it and wound up in the woods.

Since a normal winter weekend usually offers a variety of conditions on Naomi, however, things pretty much equalize.

**Ice Magnifies Virtues and Faults**

"You handle a car on ice just as you would on dry pavement—only more so," says George Sanderson, a regular Saab entry with a high record of wins. "Every maneuver is grotesquely exaggerated—like a slow motion movie. Different cars have different virtues and faults—all of them magnified by the ice."

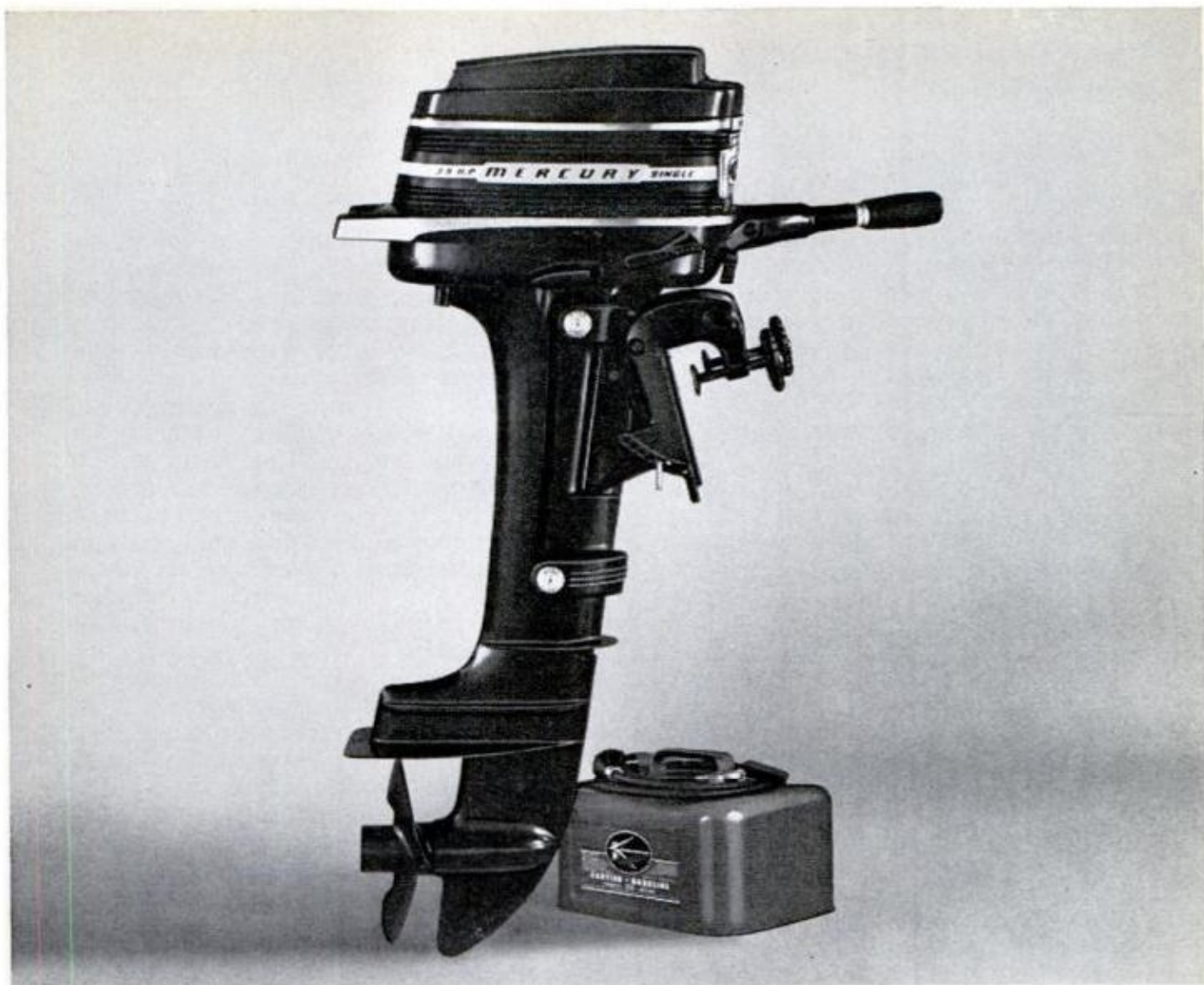
In general, a driver sets up a slide for a corner sooner than he would on a road, and puts in corrections sooner. Sliding can often add half a mile to every lap. "It's like going back to kindergarten," says Sanderson. "You listen and feel, your way. I start into corners shallow and get sideways as soon as possible. I look for pockets of snow or slush to provide resistance and slow my drift. High snow-banks help—you can carom off them. Once you've sliced across a corner to the outside, you turn your wheels gently toward the direction of slide until you feel traction; then dive into the straight."

On ice, a firm, confident hand on the wheel wins more races than a courageous lead foot on the throttle. Consequently, a tiny Volkswagen or Saab may run circles around a field of high-powered monsters.

If glare ice, hard snow, six inches of slush or four inches of water doesn't provide enough challenge, you can also try the same recipe with the added hazard of darkness in Naomi's "Dark Deepfreeze." The night race is wild. "There's nothing crazier than going around a corner and seeing tail lights turn into headlights going away from you," says an enthusiast.

But according to anyone you talk to at this winter clambake, once a man has entered an event at Naomi Lake he's an automobile-racer-on-ice for life. ★★★





## How come fishermen are paying more to get this 3.9 hp Merc?

Merc 39 costs a little more than other outboard motors in its power class because it has features which other small motors don't have.



This 3.9 hp Merc has a twist-grip throttle on the steering handle to give you one-hand control of steering and speed. It has full gear-shift (forward, neutral and reverse)... just like all the more powerful Mercs.

Instead of a single clamp bracket, Merc 39 has dual brackets for additional strength and added safety.



Jet-Prop exhaust, through the hub of the propeller, buries the sound deep underwater, reduces drag and gives smooth trolling.



Merc 39 has no shear pins to fail at critical moments. Its multiple-splined propeller hub has a live-rubber safety clutch that absorbs impact. The sturdy one-piece gearcase gives permanent, positive alignment of shafts, bearings and gears. There's no protruding



nose to hook logs and rocks or gather weeds.

Merc 39 has a separate 3¼ gallon fuel tank included in the price... instead of the integral tank found on most small outboards.



These are just a few of the reasons why the 3.9 hp Merc is worth more than other small motors. Besides these, you get the durability, lightweight, and remarkable fuel economy that is built into all the 1964 Mercurys... 100, 85, 65, 50, 35, 20, 9.8, 6 and 3.9 hp outboards and MerCruisers... 110 to 310 hp gasoline; 60 and 100 hp diesel.

# MERCURY



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## Dwarf to Guide Apollo

(Continued from page 119)

and the computer. The panel is simpler than those in airliners.

At eye level he will have a telescope with which to scan the heavens. A sextant is alongside the telescope; beneath it is a little joystick which will align the ship with any celestial object he chooses. Buttons and indicators at his fingertips would enable him to question the dwarf to be certain of the course.

The circuits operating G&N will be in trays at his knees. Other trays below them will contain the computer. If he suspected that any component was misbehaving, he could pull out one of the trays and shove in a spare module almost as easily as you open a bureau drawer and put on a clean shirt.

### To Circle Earth

Before heading off for the moon, Apollo will circle the earth two or three times. During those orbits, the navigator will use telescope, sextant and computer to pick the best time and place for the ship to enter a trajectory to the moon. He will also realign the inertial system. He would then tell G&N that he was preparing to ignite and to direct the rocket engines so as to put the ship into a long, imaginary traffic lane leading to a moon orbit.

Apollo will coast most of the way, but the human navigator will have work to do during that long part of the journey. At some point, for example, he might locate the star Fomalhaut by telescope. He would use the sextant to adjust the attitude of the ship with the joystick so that a prism in the optical system would superimpose Fomalhaut's image on that of some landmark on earth. He would then press a "mark" button to tell the computer the angle between star and landmark.

He might do the same sort of thing with the star Deneb and the star Antares, and might even choose a certain crater on the moon as a landmark rather than a bay or island back home.

Manual computations of a position in space would be fairly easy if three angles could be measured in this way simultaneously. But that would be too much to expect of any man. While determining first one angle, then a second and a third, the ship would move many miles. This would make it difficult to determine its exact position by manual computation. Apollo's speed, however, would not bother G&N's computer—which will do the figuring.

The navigator will probably make about 40 fixes on the way to the moon, and another 40 on the way home. But the flight's

planners doubt whether the ship's velocity would have to be changed as a result of such sightings more than perhaps three times on each of the journey's two legs.

Consulting the computer, if you were the navigator, might remind you of having to speak English very precisely. He will communicate with it by means of a 16-button keyboard to the right of the telescope. Numbers there would represent "nouns" and "verbs."

With one noun number he would indicate to the computer whether he was concerned with, say, "trans-lunar injection" or "mid-course navigation." Other verb and noun numbers, such as "read in . . . star planet angle" or "display value . . . position," tell the computer what to do.

If he punched a noun that did not make sense with the verb chosen, the computer would blink an "illegal order" light. It would not, in other words, give a foolish answer if asked a foolish question.

The command module of the Apollo will circle the moon at an altitude of about 80 miles but never descend to its surface. That is to be done by two men in a landing craft. After looking around a bit, the two explorers will ascend to the main ship for the ride home. To make such a rendezvous possible, their lunar excursion module (LEM) will have a guidance and navigation system identical, insofar as possible, to the one in the big ship; many parts, components and subsystems in the two will be interchangeable.

### Will Guide Landing

The work of the "intelligent servant" in the command module will not be done even after it has put Apollo into a trajectory back toward the earth. Again, it will help the astronauts cling to an imaginary line day after day, and finally it will get them back on *terra firma*.

"With the astronauts monitoring," the flight planners say, "G&N will command the proper initial angle of attack and roll rates to control re-entry, then continue altering roll as necessary to modulate aerodynamic lift and bring the vehicle to a safe landing on a predetermined spot."

The father of inertial guidance, Professor Charles Stark Draper, heads the M.I.T. laboratory in which this unique dwarf was designed. Milton B. Trageser, who previously worked on plans for sending an unmanned vehicle to Mars, has directed the Apollo project. The AC Spark Plug Division of General Motors, the Kollsman Instrument Company and the Raytheon Company helped design G&N.

Each one of the three principal parts of the G&N has novel features. The optical

(Please turn to page 222)



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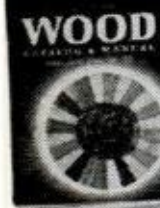
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## Dwarf to Guide Apollo

(Continued from page 220)

measuring system, for example, is so designed that the sextant can be slaved to the telescope and also used with a photometer. This brightness indicator will permit Apollo astronauts to use the earth's horizon or some other body as a reference if known landmarks are hidden by clouds.

The inertial measuring apparatus is not much larger than a basketball. Its gyroscopes are only about 2½ inches in diameter and its accelerometers about the size of spools of thread. These sensors are as delicate as fine watches, and the accelerometers will be kept jiggling slightly when no force is being exerted on the ship—to increase their accuracy when the engines let go.

The computer is only about half as big as its builders originally thought it would have to be. In its ropelike memory, tiny washers will retain data magnetically. It has "logic sticks" about the size of candy bars. It has switches, no bigger than pinheads, that contain transistors and resistors. All of these tiny parts are assembled in modules which can be replaced easily. This is the first general purpose, operational, parallel, electronic brain ever made for space guidance and navigation.

### Choose Beryllium

Even the skeleton that holds the optical and inertial measuring devices together above the computer will be unusual. This "navigation base" is one of the largest pieces of beryllium ever machined. Beryllium was chosen because of its strength, lightness, rigidity and stability over a wide range of temperatures.

G&N's developers tried, explained one of them, to achieve "an optimum balance between the complex, high-speed measurement and data processing operations of automatic equipment, and the wonderfully adaptable sensors and judgment of a man."

They have produced a kind of Robinson Crusoe's "Man Friday" for the astronauts heading for the moon. The passengers will leave the driving to their dwarf. At other times they will rely on its memory, its ability to solve mathematical problems faster than a whiz kid, and its library of maps and instructions on microfilm.

G&N has what the engineers call a new kind of "man-machine interface" (engineering talk for the communication relationship between man and machine). There will be more interactions between G&N and its human operators than the latter have with devices now used in many automated industries; yet men will be able to take full advantage of this robot's great capabilities. ★★★



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## World's Fair

(Continued from page 144)

human as they go about ordinary household chores, saying lines as they move realistically inside plastic skins.

"It's a weird sensation to shake the hand of one of these figures," says GE's Fair Manager Steven Van Voorhis. "It actually feels like a flesh and blood person; interior lights warm the substance to flesh temperatures. And, if one of them were accidentally cut open it would 'bleed' red from the hydraulic fluid operating it."

GE's actual flash of fusion power is set up in a huge concrete bunker on the ground level of the pavilion. Now being built in the company's Schenectady laboratory, it will be disassembled and brought to New York on flatcars. So bulky are the parts that one wall of the lab will have to be knocked down to get them out.

For a millionth of a second, under a transparent dome, the sun's tremendous power will be reproduced for all to see. The mechanism consists of a quartz tube containing a plasma of deuterium gas. Current is supplied from banks of capacitors, generating a magnetic field which "squeezes" the plasma to temperatures of approximately 20 million degrees. The deuterium atoms "fuse", converting matter into energy according to Einstein's classic equation,  $E = MC^2$ .

Because any atomic demonstration is likely to generate public fears, GE had to get clearances for the fusion exhibit from not only the fair authorities, but also the AEC, the N.Y. State Atomic Authority and the U. S. Department of Labor. Radiation, however, is not a hazard in such experiments because fusion, unlike fission, does not produce radiation fallout.

### Magic Skyway

For Ford Motor Company, Disney created a "magic skyway." The 12-minute ride will take you in new Ford cars through the world of the cave man, the present, and into the world of tomorrow. Visitors will step on a moving platform to board the cars, which move along at the same speed. In a moment you'll be whisked into the "time tunnel" which steers through the shadowy world of our savage ancestors. Dinosaurs fight it out as you ride along; animated cave men create fire, paint pictures on cave walls and develop a significant new means of locomotion—the wheel.

You approach the "city of tomorrow" through another time tunnel. Riding a serpentine highway seemingly miles above the city, you'll view a huge panorama of moving lights. The changing patterns of a

mighty super-highway system glide by underneath. Cargo rockets, headed for distant space stations, whoosh past in the distance.

The 1964 convertibles in which you'll ride are propelled along a track equipped with more than 1100 drive wheels. A 12-foot platen mounted under each car is in contact with drive wheels. A unique braking system works separately from the electrically-driven motors; they're automatically in the "on" position until power is applied. Thus, if the fair has a power failure, the cars would brake to a halt.

### Audience Taken for a Ride

The audience at IBM's odd-looking, ovoid-shaped theater will not only get a show, they'll also get a ride. Visitors will file through elevated walkways to a "People Wall" where they take seats in the 12-tiered seating section. Holding 400 at a time, the mechanism is then drawn up into the overhead theater by hydraulic action.

Along the dome wall of the theater are nine screens which, with music and narration, demonstrate the techniques of computer and information handling operations. The language of modern computers, binary mathematics, will be explained in simple, easy-to-understand terms.

In other areas, IBM's show designers, Charles Eames and the late Eero Saarinen, have set up puppet theaters to illustrate such concepts as miniaturization, computer logic and data processing. One puppet will impersonate Sherlock Holmes. The great detective is on the trail of some of the most dangerous (and gifted) criminals he's ever encountered. Their crime? In some mysterious way the thieves have made off with an entire railway train. This time, however, Holmes and the faithful Watson have a weapon the criminals didn't count on: a modern computer. The master detective solves the crime without ever stirring from his Baker Street home.

In Bell Telephone's airy, floating wing pavilion, visitors will relax in contour chairs with built-in sound systems; they will be taken through the world of communications, from the primitive skin drum of prehistoric man to the complex worldwide systems of today—and tomorrow.

In one area, a visible speech translator will analyze speech sounds by showing a breakdown of the human voice on a TV screen. One gadget will actually take your voice apart and put it back together again.

Federal and state exhibits will be grouped more or less in their own separate area. New York State will boast the highest point in the entire fair, a 226-foot tower; high-speed glass-enclosed eleva-

(Please turn to page 227)





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## World's Fair

(Continued from page 224)

tors will give you a moving panorama of the Fair as you shoot to the top at more than 700 feet per minute.

West Virginia will present the world of the stars as "seen" through giant radio telescopes. A huge dome will project an astronomer's "window on the universe" to dramatize the work of the Greenbank Radio Observatory.

Major religious denominations have set up attractive pavilions, including the Vatican, the Protestant Council, Christian Science, the Mormons and Dr. Billy Graham. One of the world's most famous pieces of sculpture, Michaelangelo's *Pieta*, which has never before been permitted to leave St. Peter's Basilica, will be one of the Fair's highlights.

And all these wonders are merely a sample of the fair's offerings. Fabulous as they are, they'll face stiff competition from scores of other exhibits.

You'll see yourself on color TV at the RCA show . . . be matched (by computer analysis) for an ideal foreign Pen Pal at Parker Pen . . . take a ride on U.S. Rubber Company's 80-foot revolving tire . . . visit the exotic pavilions and sample the cuisine of Asian and African lands . . . see a full-size replica of Columbus' flagship, the *Santa Maria* . . . ride on the closed-loop monorail set up by American Machine & Foundry . . . watch the daredevil antics of the Auto Thrill Show.

### Global Symbol

You'll have a convenient rendezvous spot at Unisphere, the giant, 250-ton, 140-foot high symbol of the fair's global impact. Tilted on an axis identical with the earth's, the U.S. Steel Company's giant world takes the place of the 1939 fair's Tylon and Perisphere.

If by mischance you become ill at the fair, you'll get top medical treatment in the fair's own hospital of the future, the Atomedic (for atom-age medicine). The lightweight aluminum air-transportable unit is designed for use in emergencies. The circular structure has 22 wedge-shaped rooms, serves electronically cooked frozen foods, is equipped with a nurse-to-patient TV circuit and uses only paper sheets, gowns, drapes and uniforms.

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And if you get plumb tuckered out, you can always take a nap, for a fee, at the Simmons Mattress show. They'll give you a private room and set the alarm to waken you when your time is up. ★ ★ ★

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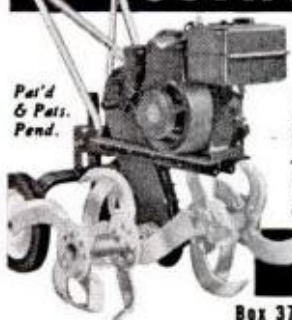


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(Continued from page 104)

construction has perhaps the highest strength-to-weight ratio of any material. Built like an aluminum beehive, it distributes its strength throughout each piece, with only a fraction of the weight contained in solid metal of the same size.

The BD-1 has ½-inch honeycomb aluminum in the floor, two sides and bulkheads of the cockpit, and the two sides and bulkheads of the rear fuselage. Further, the metal is purchased in large sheets and cut up economically. The two cockpit sides are identical, and the sides of the fuselage are designed to be cut from the same sheet so they are identical and interchangeable. The bulkheads are cut from the same sheet, each one cut smaller from inside the last one, so they all taper down toward the tail.

**Bonded construction**—Using phenolic and epoxy resins, the structural parts are literally glued together with, Bede says, 10 times the strength of rivets. Also, by bonding the parts, they eliminate the labor involved in putting each rivet into place, and they eliminate the drag inherent in rivets by presenting a smoother airflow.

**Removable wings**—Basically, the wings are built around that steel tube. Actually, the tube is in three sections. One section runs under the cockpit, bent upward 10 degrees, and extends beyond the wing fairings on each side. The other two sections, one in each wing, are slightly larger in diameter (6½ inches) and slip snugly over the center section. The wing panels have lips that fit even more snugly over the fairings, and the flap and aileron controls join up neatly. The fit is so snug, in fact, that only three screws are needed to hold the tubes together. Removing or replacing the wing takes slightly more than one minute. In production models, simple rack facilities will be built into the fuselage for carrying the wings while towing. Since the plane has a tricycle gear, it can be towed without a trailer.

**Stressed to 9.2 Gs**—The strength inherent in the honeycomb metal, the bonded construction and the steel spar are the three big factors.

**Interchangeable parts**—This is probably the most unique feature of the plane. The ailerons can be used on either left or right wing; so can the flaps, the wing tips and even the main wing panels, spar and all. The vertical and horizontal fins—all three—are interchangeable, and so are the rudder and two elevators and the tips of these three surfaces. The significance is the reduction in production cost: Make one part and it will serve two or three places.

**Glass-fiber landing gear**—Another innovation. Most landing gears are metal. The glass-fiber gear, however, is one-fourth the weight and it also dampens out the load on landing without shock absorbers.

**Engine swings out**—Still one more innovation. All the fuel and electric lines are on the right side of the engine mount, so the left side can be swung out for routine minor maintenance. For major maintenance, the entire engine assembly can be removed and the cowling (it's all one piece) slipped off. Bede claims an overhaul can be done in one day by one man.

Other features include three-position flaps (10, 20 and 30 degrees) spanning 70 percent of the wing, a full-swivel nose wheel and toe brakes. A gravity-flow fuel tank is in front of the cockpit.

But, back to the price. Is it accurate, or is it a come-on?

Yes, on both counts, and Bede agrees. The \$2500 tag is quite accurate, he says, but he doubts that he will get many orders at that level. It is a base price, figured on a plane that will have a 65-hp. rebuilt engine, a wood propeller, the minimum number of instruments required by the Federal Aviation Agency, and no radio. The BD-1 has had only the barest amount of publicity at this writing, but inquiries—and firm offers to buy—are coming in, and few of them ask about the lowest-price model.

As the auto makers in Detroit learned long ago, Bede admits, "We'll make our money on accessories."

For instance, the model with the 90-hp. new engine will list at \$3460, and the one with the top-rated 108-hp. new engine at \$3711. On top of that, other accessories most sought after will probably include a metal propeller (\$135 additional), a prop spinner (\$40), and radio equipment (up to \$895). Luxury items include wheel pants (\$150), three-color paint job (\$45), and "deluxe interior" (Ah, there, Detroit! —\$110). If a man wanted to buy every luxury item and all the top-priced functional items, his BD-1 could cost \$5376.

A man with a reasonable appetite, however, could probably bring in a reasonably well-equipped BD-1 for \$4000. And, as airplanes go, that's a pretty reasonable price. The upkeep—storage and maintenance—should be even more reasonable than any other plane around.

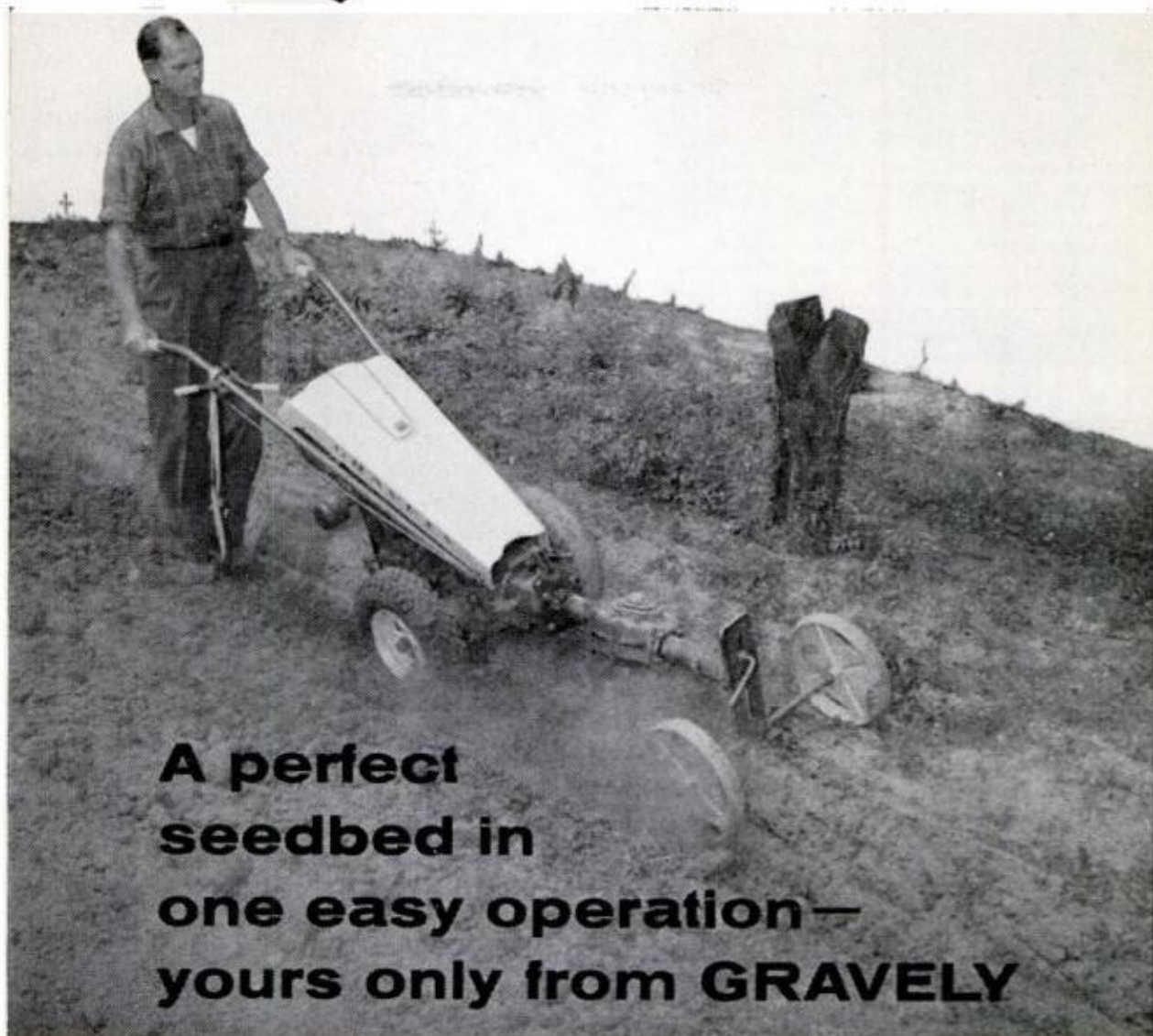
About all that's left is performance, and Bede claims performance superior to any of the other standard light planes, including some in the five-figure bracket. After flying in the prototype, we're inclined to agree that it's a real sporty airplane.

The prototype had the 108-hp. engine,

(Please turn to page 230)



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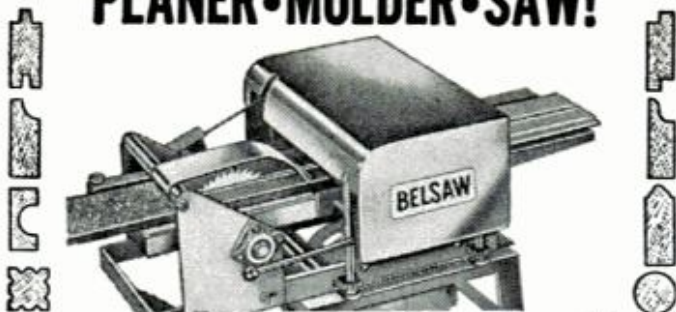


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## \$2500 Airplane

(Continued from page 228)

and it pretty well held up to its performance chart (see page 104). It was a gray day in Springfield when we flew, so with a limited ceiling our flight was limited to a few basic maneuvers. There was no chance, for instance, to check the rate of climb, but the 1150 feet-per-minute figure doesn't seem unreasonable for a plane so light and responsive.

### It's a Nimble Plane

Its nimbleness impressed us more than anything. It does, indeed, feel like a plane that is ready for aerobatics. There was no sluggishness on the controls, and it was especially responsive in tight turns. There was very little muscle power required. Bede went through the stall procedures for us, and there was no evidence of instability. In power-on stalls, in fact, we were wondering if it ever would stall. Because the rudder and vertical fin are perhaps a little higher than they should be (they're identical, remember, with the elevators and horizontal fins), it contributed to horizontal stability. We made turns without using rudder, but there was no adverse yaw tendency.

Straight and level, the BD-1 really scoots. The speedometer was erratic, but Bede estimated we were doing 144 m.p.h. at 2450 r.p.m. Using the old-timers' rule-of-thumb, 1 m.p.h. for every horsepower, it was obvious we were doing well over our rated 108-horsepower. We were close enough to the ground to notice that.

Bede made a few landings, all quite smooth, then we tried some and really "pranged" them in until we got the touch. But the glass-fiber gear absorbed them nicely. It's much lighter than any plane we're used to, so the touch is something that must come with practice. But there was certainly nothing erratic about its handling close to the ground.

Did this BD-1 have any faults at all? Of course it did. Any prototype would. Bede knows them all and has worked out solutions for each.

On takeoff, the stick must be brought all the way back in your lap, then as soon the plane leaves the ground it must be pushed forward hurriedly. We're old-fashioned, and prefer to let the plane fly itself off the ground, gentling it along with the stick near neutral. Bede says the main landing gear is too tall, so the plane is "tail high" on takeoff and the wing isn't angled into the wind enough to get sufficient lift without a lot of help from the elevators. He intends to drop the main

(Please turn to page 232)





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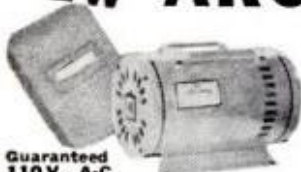


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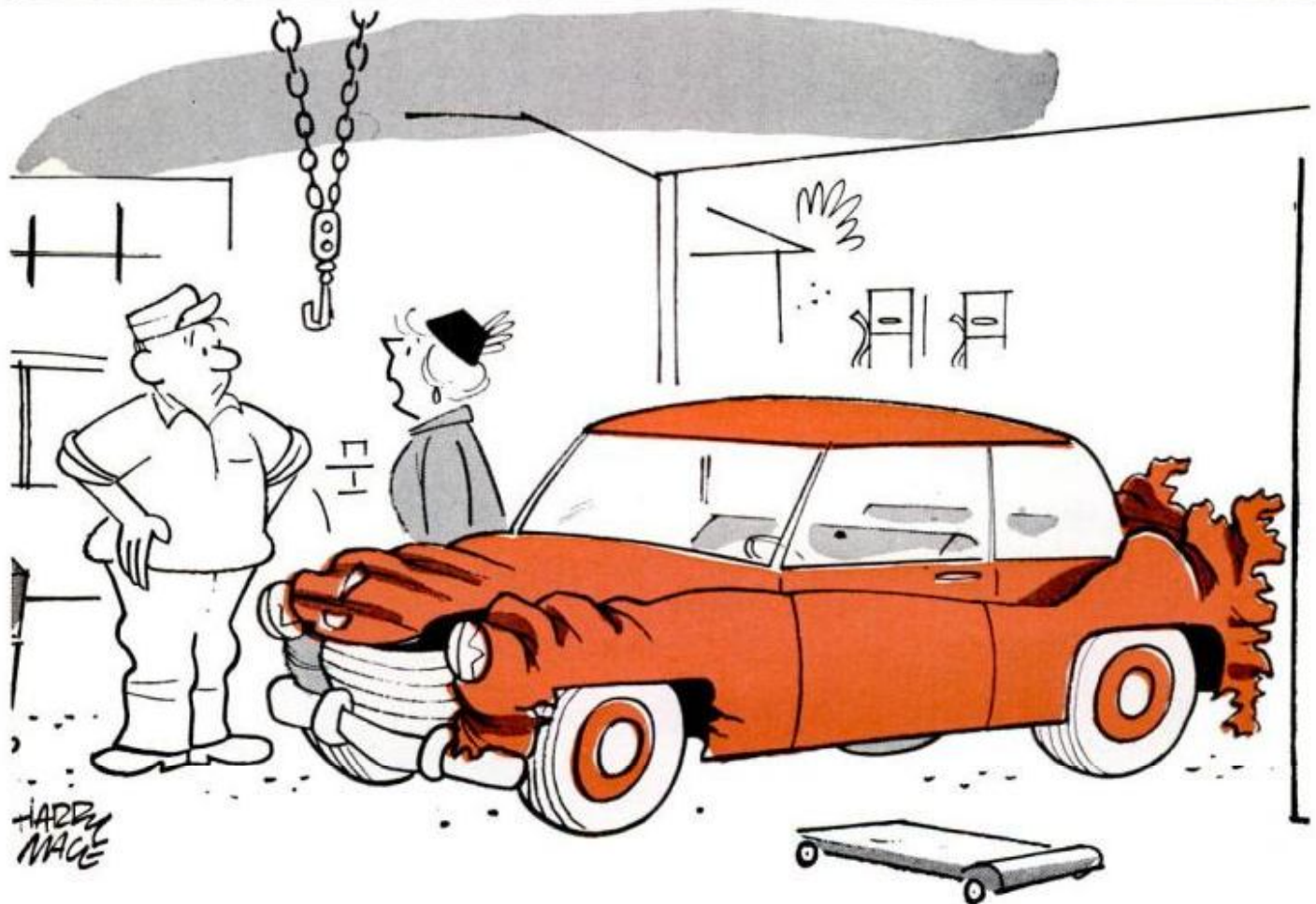
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## \$2500 Airplane

(Continued from page 230)

gear two inches which should give the plane the right angle-of-attack on takeoff.

Secondly, the elevators are overly sensitive, perhaps accounting for the easy tight turns. Straight and level, however, even a small adjustment really leaps the plane up or down, porpoising it unnecessarily. Bede intends to adjust the linkage to the elevators so that more stick movement is necessary for the same reaction.

Other improvements include fuel tanks in the wings—perhaps in the hollow tubular spars—with a fuel pump to force gas into the fuselage tank. The latter will still operate by gravity, however, so some aerobatic maneuvers will result in momentary "konk outs" of the engine. The flaps, which now span 70 percent of the wing spread, will be increased to angles of 20, 40 and 60 degrees. This may give it even better slow-speed characteristics, but they're quite good now. They might also put in trim tabs, although we noticed no grave need for them.

All in all, the BD-1 lives up to most of its claims, and its clean, well-designed lines and unusual features would make it a plane worth noting even without the

price. The price puts it in a class by itself and one that ought to be investigated.

Among those who will do the investigating, Bede says, are professional pilots who want an inexpensive plane to scoot around with on days off; private owners who want to replace their old planes; and, most of all, pilots or would-be pilots who could never before afford to own a plane because they were just too expensive. For all of them, the word is that production starts next month with first deliveries some time in summer.

One last thing. Most men bring their wives along when contemplating major purchases. The BD-1 is the kind of a plane that the women will call "a cute little thing."

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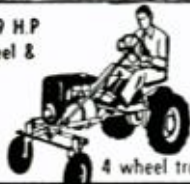
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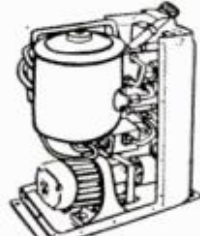
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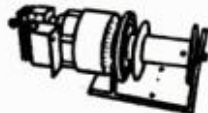
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(Continued from page 99)

sellers. The man who steps into a sporting goods store to buy a deer rifle or skeet gun will have no more trouble than he has now—at least for the present. It is the hunter who does not have access to urban markets (or who does not have the resources to meet over-the-counter price tags) who will be hurt by what may well become a virtual prohibition of mail-order gun sales. Inevitably, the anti-gun bigots will move to plug this loophole. Plainly if it is wise to require police approval on the purchase of mail-order guns, the same repressive strictures should be applied to all purchases of firearms from whatever source. In short, logical extension of Senator Dodd's bill would quickly require all gun buyers everywhere to obtain the blessing of the police prior to being authorized to purchase.

This is of a piece with the arguments made on behalf of universal firearms registration, an old chestnut that has been revived during the current wave of anti-gun hysteria. Well, why should honest sportsmen object to registering their firearms with the police? It'll help keep them out of the hands of criminals, won't it?

It will do no such thing. Like all laws against wrong-doing, registration would be gleefully ignored by criminals. A couple of years ago a burglar pinched a fine Belgian shotgun of mine. Registration would not have prevented theft of the weapon, nor would it have prevented use of the gun in commission of a subsequent crime. But suppose the gun had been registered, and had been found at the scene of a crime. All registration would have accomplished in these circumstances would have been to impel the cops to make me prove I hadn't committed the crime.

With the exception of reasonable regulations regarding concealed weapons, all gun laws advance the day when private ownership of firearms will be wholly illegal, which is to say will be confined to the ranks of lawbreakers. That has, sad to say, already happened in other countries. India was dismayed to discover that she lacked the most rudimentary means of defending herself from leisurely conquest by Communist China. In a desperate (and perhaps fatally tardy) attempt to correct this, India only recently commissioned the Daisy Air Rifle Co. to build a \$1 million plant in Punjab to turn out enough BB guns to begin the awesome task of training 55 million Indian children for the defense of their homeland.

Today, in South Vietnam, American officers are toiling feverishly to train a

peasant army made up of youths who almost literally don't know which end of a gun to point. I have listened time after time to these despairing Yank advisers complain that Vietnamese marksmen could not hit the broad side of an armory, much less a fleeing Viet Cong guerrilla.

Recently the House of Representatives District Committee (which drafts legislation for the Nation's Capital) considered a proposed bill, frankly patterned after the Sullivan Law, to control firearms in Washington. The usual platitudes were heard about how the law would keep firearms out of the hands of criminals, but it was not until Washington's respected Superintendent of Police, Robert V. Murray, took the witness stand that any element of reality entered the proceedings.

### Doesn't Deter Criminals

"If I felt that we could take the guns out of the hands of criminals with this bill or any other bill, I would be a hundred percent for it," he testified. "But a criminal who is going to hold up or assault somebody with a gun is not going to be deterred by a law that he cannot have a gun in his possession."

He continued: "It may be argued that any legislation that would reduce the number of pistols in circulation would substantially reduce the number of aggravated assaults. The argument rests upon two mistaken premises. First, it assumes that restrictive legislation will prevent criminals from obtaining guns. Experience has shown that legislation such as the Sullivan Law does not reduce the number of pistols in the hands of criminals. Second, the argument assumes that handguns are used in most aggravated assaults. The fact is that pistols are used in only a small percentage of assaults."

The committee quietly pigeonholed the bill, but whether it stays there in the face of the emotional deluge released by the assassination of the President is moot.

In sum, long experience has taught that restrictive firearms legislation deprives only honest people of the right to bear arms. The Dodd bill, for all its innocent trappings, would unquestionably be rigidly restrictive in practice. Finally, the realities of the world we live in dictate that freedom is given only to those who have the will and the means to defend it. With their talent for sowing confusion and doubt, right-wing extremists have distorted and perverted this basic necessity for maintaining a well-armed citizenry—but the need exists nonetheless. No one can say what the future holds for America's experiment in human liberty. But

(Please turn to page 236)



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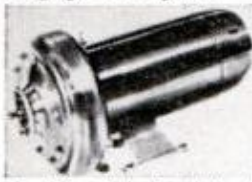


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- Designed to fit ALL cars ● Under dash mounting
- Install it yourself in minutes ● No splicing
- Heavy duty Tung-Sol flasher ● Flashing pilot light
- ICC Approved

Complete with flasher, pilot bulb, wiring, instructions.

**\$5.95 POSTPAID**

(CONN. RES. ADD 3-1/2% SALES TAX)

MONEY-BACK GUARANTEE — SEND CHECK OR M.O. SPECIFY YEAR AND MAKE OF CAR.

**EASY-ON CORP., BOX 6171, WOLCOTT, CT.**  
MANUFACTURERS OF AUTOMOTIVE SWITCHES

FEBRUARY 1964

## 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, ½ hp. motor. Write for Full Details. The Fate-Root-Heath Co., Dept. PM-2, Plymouth, Ohio

## INVENTORS

Your inventions, patented or unpatented, may be eligible for exhibition, and demonstration at the New York World's Fair 1964-65.

FOR COMPLETE INFORMATION USE COUPON BELOW

DO NOT SEND ANYTHING ELSE  
AT THIS TIME



N. Y. World's Fair Inventions Exhibit  
P. O. Box 810  
Flushing Meadows, N. Y. 11352

United States Steel  
1961 New York World's Fair 1964-1965 Corporation

Please send complete information about the exhibition of inventions at the New York World's Fair.

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PM



## Briggs & Stratton — Clinton New Gas Engine Sale

Never before and perhaps never again—this offer of brand new genuine Clinton and Briggs & Stratton engines including 1 yr. factory warranty at less than cost. Perfect power for go-carts, scooters, tractors, mowers, generators, pumps, sprayers, etc. We hauled out 3 big factories who needed cash and the savings are yours while quantities last. Act fast.



Clinton 2 1/2 hp. Mdl. 500—Re-coil starter Std. 5/8 shaft w. keyway—ready to go. Reg. price \$49.50 Special (item 1002)

**\$29.95**

2 for ..... \$59.50  
6 for ..... \$176.50



Briggs & Stratton 2 hp. Mdl. 60101 Rope start, std. 5/8 shaft w. keyway. Sturdy 4 cycle power.

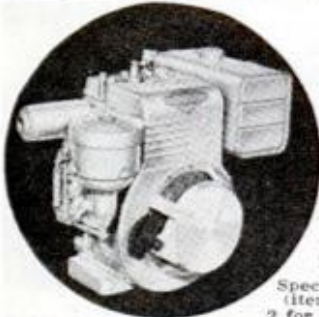
Regular price \$49.80 Special (item 106a)

**\$29.75**

2 for ..... \$58.90  
6 for ..... \$175.50

**\$67.50**  
**5 3/4 hp.**

**Briggs  
&  
Stratton**



**2 3/4 h.p. Clinton—34.95**

Model 400, rugged 4 cycle model. Alum. Block, castiron cylinder Rope start—5/8" std. shaft Item 1107 ..... 34.95  
2 For ..... 67.50

**3 1/2 h.p. Clinton—39.95**

A big engine with big power. Model 406. 4 cycle, rope start. 3/4" std. shaft. Item 406 ..... 39.95  
2 for ..... 77.50



**2 1/2 h.p. Lawn Mower  
Engine \$29.89**

Clinton Model 403, 4 cycle, 2 1/2 h.p. or 3 h.p. rotary mower. Standard 7/8" dia. shaft with female 3/8" thread. EZ recoil starter. Aluminum block with long life steel cylinder sleeve. It's less than the cost of an overhaul.

Weight 22 lbs.

Item 1119 ..... **\$29.89 ea.**



Remember these engines are absolutely perfect and standard and under factory warranty. Money back guarantee. Order now while stocks are complete. Factories—we buy new engines!

### STANDARD DIAL PHONES WITH BELL

Western Electric late model dial phones same as used by all telephone companies. Ideal as extensions on any system. Easy to connect. Several may be connected on one line. Easily modified for private inter-com system. Cost \$40.00 new—guaranteed excellent condition. ITEM 855 NC. Wt. 8 lbs. .... **\$6.95**



Send 10c for 100 page Catalog FREE with order. Prices f.o.b. factory—send check or MO.

**MASTER MECHANIC MFG. CO., Dept. A24, Burlington, Wis.**  
Southern Customers Write Dept. A24, Box 65, Sarasota, Florida

## Right to Bear Arms—Starnes

(Continued from page 234)

history warns us to expect endless and unrelenting assaults on it. In spite of nuclear weapons and all the sophisticated hardware of modern combat, every war we have fought has boiled down to one man with one piece of real estate. To the weapon trying to take or defend one credit of our forefathers this is still a trade that Americans excell at.

### Shouldn't Cause Hysteria

The murder of President Kennedy was a monstrous tragedy. But there is no virtue in compounding the tragedy by using it to fan flames of anti-gun hysteria.

Senator Dodd's bill will not deter one lawless person from arming himself. But it will advance the United States down the road toward a passive and disarmed population, and it ought to be defeated.

★★★

## Right to Bear Arms—Sen. Dodd

(Continued from page 99)

weapon in the hands of an unqualified person.

The typical sportsman will spend hours and hours instructing a novice in the safe and sane use of weapons. I cannot believe that such a man would object to a minor inconvenience which seeks to prevent weapons from easily falling into the hands of criminals.

### Bill Seeks Reasonable Control

My bill seeks to place reasonable controls on the interstate commerce in deadly weapons. It does not pretend to solve the gun problem in the United States. It will not make it impossible for undesirable people to obtain guns. No law ever drawn is foolproof. But it is a solid step in the right direction, a responsible step and a long overdue step.

Some are concerned that these controls may open the door to Federal regulation of other products which could conceivably be put to a harmful use.

This seems a bit far-fetched.

I urge any man who resents the bother of filling out an affidavit, which he can obtain from the local post office or the mail-order firm, to ask himself one question:

"Am I willing to put up with a little inconvenience in order that my children and myself and my neighbors will have some protection from mail order weapons wantonly used by criminals and depraved persons?"

The answer of every thoughtful American to that question will be, "yes." ★★★

# ECONOMY

## TRACTOR



## DOES MORE KINDS OF JOBS

MAN SIZE TRACTOR  
AT GARDEN SIZE PRICE

Powerful! America's big tractor value. Low price. Rugged, built-in quality. Easy to operate. 9 to 12 1/2 hp. ALL GEAR DRIVE incl. clutch, 3-spd. trans., diff., 176 to 1 reduction. Wt. 790 lb. 25 low-cost, quick-change tools for farm, lawn, snow, woodland. Write for FREE CATALOG & dealer name.

Engineering Products Co.  
1005 K-2 Anoka Ave., Waukesha, Wis.







## Owners Report—Chevelle

(Continued from page 91)

"I can't even wear my hat and I'm only 5 feet 8½ inches tall."—Pennsylvania salesman.

"I would like it about 1-1½ inches higher on the inside."—Pennsylvania steelworker.

**That's just about what's needed for tall or long-waisted hat wearers.**

"I don't like the way water comes in the tailgate."—Texas metal finisher.

"The weather stripping on the convertible roof does not fit properly. Water comes in over top of the curved windows. I have had the car in the dealer's repair shop on two different occasions and they have not been able to correct the leaking."—Texas policeman.

**That old problem again; those rubber moldings never seem to fit the way they did on the original drawing or prototype.**

"Car trunk leaks when it rains. Dealer took care of complaint."—Pennsylvania plant manager.

"Doors do not fit snugly, let in dust and snow on seats."—North Dakota farmer.

**This results from starting production before all tooling is completely "zeroed in". It's a case of hurry up and goof. Chevilles made next July should have neat-fitting doors.**

"There are large gaps inside between doors and frames."—Texas teacher.

"Doors fit poorly and leak."—Indiana teacher.

"Poorly inspected in the paint department."—Florida mail carrier.

"The paint isn't evenly sprayed and inside door trim (aluminum) doesn't fit snugly."—Colorado teacher.

"Primer shows through in spots."—Florida truck company operator.

*There were plenty of other bouquets, too. Here are numbers 6 through 10 with those mentioned most often listed first:*

"It is narrower outside, but roomy inside. Well-built."—Illinois plant foreman.

"Roomy inside yet handles like a small car."—Washington teacher.

**Chevelle represents an ideal compromise, giving both maneuverability and interior room. Now if they'll only raise that roof.**

"I like the very good gas mileage on long trips with six-cylinder, stick shift. The highest was 26½ miles per gallon."—Illinois minister.

"With 195-hp. V8, we get good mileage on regular-grade fuel."—Florida therapist.

"It's easy to parallel park."—Minnesota machine operator.

"It has a short turning radius which

makes for easy parking."—Tennessee housewife.

"Over-all length makes it easier for my wife to handle and park."—Washington fireman.

**Not too surprising. That wheelbase is only an inch or two longer than cars that bill themselves as compacts.**

"One sits up nicely and can see out well."—Pennsylvania realtor.

"The nearly flat windshield is distortion-free."—Texas retiree.

**Few people lament the passing of the wrap-around, fishbowl type windshield. This "new style" glass does the job—and more cheaply, too!**

"It's a small, well-balanced car that is easy to handle, takes bumps and dips well."—Colorado teacher.

**We felt that a bit more shock absorber control would be beneficial.**

*There's a spot of discontent somewhere to balance every rave notice. Here are owner complaints numbers 6 through 10:*

"Wind whistles in windows very badly."—Texas teacher.

"Air leak caused by workmanship of doors is so bad you can't hear the radio."—Illinois construction worker.

"There's too much wind noise."—Indiana IBM operator.

"Windows whistle no matter how hard they're shut."—Maine university registrar.

"The gas mileage is below what I expected—15.9 over-all on six-cylinder engine."—Wisconsin serviceman.

"With a car weighing approximately 300 lbs. lighter than regular-sized Chevrolets, our V8 with automatic gets 15 m.p.g."—Massachusetts medical administrator.

**Both Sixes and V8 engines would deliver significantly better mileage to average drivers in stop-and-go driving if Chevelle had more efficient automatic transmission.**

"The mileage is not what I expected—I'm getting 14 m.p.g. with six-cylinder automatic transmission."—Illinois receptionist.

"Springs in front rattle whenever I hit a bump."—Wisconsin farmer.

"Too many squeaks and rattles."—Texas pharmacist.

"I've had trouble in the carburetor linkage."—Arizona professional auto driver.

"Automatic choke isn't adjusted or is set high and car jumps out from under you. Had numerous corrections on it when first delivered."—Missouri electrician.

"The automatic choke gave trouble but is okay now."—Missouri mail carrier.

**Automatic chokes have been a problem for Chevrolet, but they can be tamed by patient, careful servicemen.**



"My complaint is no steel around curved window of hardtop."—Maine retiree.

**He has a point. Framing might make hardtop windows more rigid and a better fit.**

"Chevy should make better windows for their hardtops; they don't seal well enough. They should use soft rubber as on the doors with lots of compressing room."—North Dakota farmer.

**To wind up the affirmative argument, here are numbers 11 through 15 of the points owners consider praiseworthy:**

"I like the neat, well-finished look of the interior and the curved windows."—Illinois fireman.

"I like the large luggage and glove compartments."—Texas lab technician.

"Not a big car, but has plenty of legroom and trunk space."—Texas mortician.

**Hope he doesn't use that trunk for his business!**

"Like placement of the spare tire and there's lots of trunk space."—Pennsylvania boilermaker.

"Has very good steering and braking."—Wisconsin telephone worker.

"Steering so responsive that, even with 4.2 turns lock-to-lock and a short turning radius, the manual steering can throw you out of the bucket seat if you aren't strapped in."—Massachusetts chemist.

"I like it because it rides and drives like medium-priced cars."—Wisconsin lineman.

**We agree, but he should climb off that pole and look at the price on a loaded hardtop. It's pretty "medium" from where we sit.**

"I enjoy the "big car luxury" in a relatively inexpensive and economical automobile."—Texas life underwriter.

**To return to the dark side, here are points 11 through 15 that distressed Chevrolet owners, in order of frequency:**

"Tire size is entirely too small. On dirt roads the front suspension hits bottom in the slightest ruts. It is either tail-end high or front-end low."—Pennsylvania auto mechanic.

"The manual transmission didn't shift properly."—Missouri receiving clerk.

"The clutch's throw-out bearing was either bad or loose."—Texas lumber checker.

"The car "hangs" in front. Don't think the springs are heavy enough in front."—Maine nurse's aide.

**She may be right. All models use same size coil springs and V8 is about 150 pounds heavier up front.**

"Front suspension not heavy enough for V8 engine, car is nose-heavy."—Massachusetts arborist.

"Constant rumble in rear. Brought car back twice. Was told it was so on all Chevrolets."—Illinois businessman. ★ ★ ★

FEBRUARY 1964



## 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. M-24  
KANSAS CITY 11, MISSOURI

Please send me complete information

My Name \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

## EVERLITE\* World's THRIFTIEST Light Plants

(Item 869-12T)

### NEW TRANSISTOR ALTERNATOR REPLACES GENERATOR



Now a Service Free Light Plant built with a transistORIZED alternator. Offers 30% greater efficiency—more power for less fuel. Terrific service life—no brushes to arc and burn. No more commutator to wear, no collector ring trouble. And best of all it costs no more to "go modern with Everlite." Thrifty 1200 watt, 115v. AC plant powered by a rugged easy starting 4 cycle engine—leader priced. Model 869-12T. Wt. 65 lbs. as illustrated ..... **179.50**

f.o.b. factory

\*Trade-Mark Registered All sizes available—can finance. Write for catalog. Special models for public utilities—Approved for Civil Defense. Write

**MASTER MECHANIC MFG. CO., Dept. A-24, Burlington, Wis.**  
Southern Customers Write to Dept. A-24, Box 65, Sarasota, Florida



**Yours for only \$75 DOWN**  
**\$29 MONTH**

## NATIONAL'S SPORTSMAN COTTAGE

Where else can outdoorsmen find the perfect home-away-from-home for so little? The Sportsman's rugged redwood exterior shelters a kitchen, living-dining area and two bunk rooms—plenty of room to sleep six. And, you and a friend can erect it in 4 hours! Lot ownership not required. Send today for illustrated brochure.

### DEALERSHIPS NOW AVAILABLE

Write for complete details to:

DEPT. PMF

**NATIONAL HOMES CORP.**  
Lafayette, Indiana

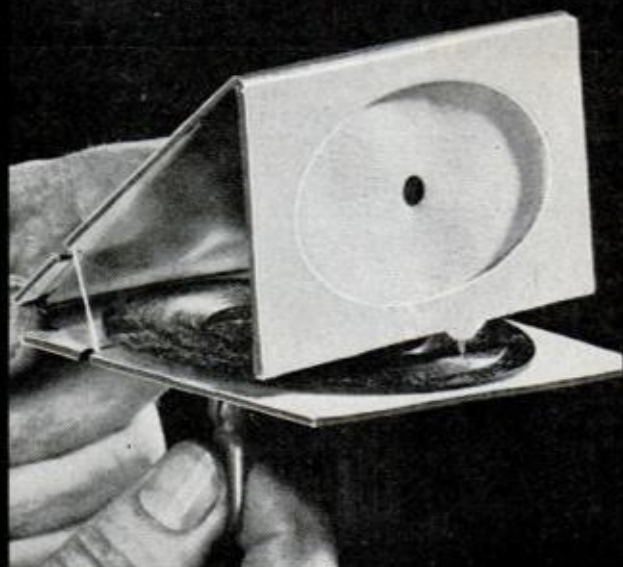


239



# New in Electronics

**WORLD'S SIMPLEST RECORD PLAYER** beats out the latest nursery rhymes as you turn the crank. Fidelity is far from the best, but with a little practice you can hear "Baa-Baa Black Sheep," etc. Comes with one record. Fits in a shirt pocket. \$1.95. Career Enterprises, Havertown, Pa.



**TRANSISTORS TAKE OVER** in this hi-fi pair: a stereo amplifier (A-1000T) and FM stereo tuner (F-1000T). Result is a hi-fi system that radiates a maximum of fidelity, minimum of heat and no hum. Stereo amplifier \$369.95. FM tuner \$229.95. Harman-Kardon, Plainview, New York.

**NO MORE FUMBLING** when changing flashlight batteries if you use this special one-piece 3-volt battery. It's a direct replacement for two standard D cells. Steel clad leakproof construction protects flashlights from damage. Acme Battery Corp., 200 Henry Street, Stamford, Conn.





# SURPLUS SALE

GOVT SURPLUS  
EXCESS INVENTORY  
BANKRUPT STOCK



**A-C SLOW SPEED MOTOR**  
 • Item #507. 115-v geared down A-C motor. Turns 3-2 rpm. Has good torque for barbecue spits, ejector sets, model train outfits, display stands, etc. Wt. 2 1/2 lbs. Size 3 1/2" x 4 1/2" x 5". List \$7. SALE ..... \$2.59 fob



**POWERFUL ELECTRIC LIFT UNIT**  
 • Item #508. Rugged, heavy-duty electric screw-jack. Operates on 6, 12 or 24-v battery. Excellent for raising and lowering plows on front of trucks. Lifts 1,500 lbs. on 6 volts, 3,000 lbs. on 12 volts. Shaft travels 11 in. Electrically reversible, reversing switch furnished. Size 26"x8"x5". Wt. 24 lbs. Govt. cost \$150. SALE ..... \$26.95 fob

**115-VOLT A-C GENERATOR**  
 • Item #626. Brand new (original crate) slow speed heavy duty generator that will last a lifetime. Insure yourself against power failures. Excellent for operating freezers, furnaces, water pumps, milkers, coolers, etc. Operates 1200 rpm, generates 3000-4000-w 115-v, 60-c power. Complete with rheostat, voltmeter, plugs ready to operate. Wt. 260 lbs. Govt. cost \$450. SALE ..... \$139.50 fob



**HEALTH CHAIR VIBRATOR MOTOR**  
 • Item #1019. Brand new expensive vibrating 115-v AC motor. Make your own massage chair, bed, etc., for winter aches. Easily attached. Also many industrial uses. Size 7"x2"x4". Wt. 4 lbs. List \$16.95. SALE \$6.95 fob



**BATTERY ELECTRIC WINCH**  
 • Item #318. Powerful 12-v winch. Reversing switch on winch. 3000-lb. pulling capacity. Drum holds 150 ft. 1/4" cable. Use on jeeps, trucks, tractors, etc. Size 19"x9"x7". Wt. 65 lbs. Govt. cost over \$300. SALE ..... \$59.95 fob  
 12 volt model available. same price.



## SPECIAL OF THE MONTH!

**3-HEAT WATER HEATER**  
 • Item #1127. Expensive Westinghouse immersion heater. 1 1/2" threads fit 55 gal. barrel opening. Works on 115-v. 3 connections for 200-400-800-w. 9" long. Excellent for water, oil, etc. Wt. 3 lbs. Govt. cost \$17. SALE ..... \$3.31 fob



**OTHER SPECIALS IN CATALOG**  
 • \$110 Step-By-Step Telephone Switch \$12.95  
 • \$75 Secret Motor Driven Coding Unit 3.95  
 • \$40 Stainless Steel Air Tank 15.95  
 • \$70 Double Acting Hyd. Cylinder 19.95  
 • \$80 Hi-Capacity Water Pump 19.49

**FREE BARGAIN CATALOG**  
 Send card for free big catalog. Hundreds other bargains in geared motors, electronics, electrical, water pumps, hydraulics, winches, binoculars, surveying equipment, generators, tools, wire, etc.. All Prices FOB Lincoln. Order from ad. Everything guaranteed.



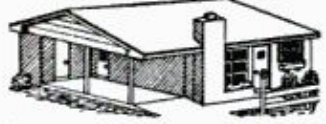
**SURPLUS CENTER**  
 Dept. 804 LINCOLN, NEBR.

**TESTOR'S SPRAY PLA**  
**MAKES THINGS LOOK NEW**  
**... NOT PAINTED!**  
**AT HOBBY, HARDWARE, VARIETY,**  
**DRUG AND DEPARTMENT STORES**

**PAGE FOR** TILLING  
 PLOWING  
 MOWING  
 A FULL LINE — 2 to 9 HP  
 with complete gear drive and reverse  
**FREE CATALOG • LOW PRICES • EASY TERMS**  
 Over 40 years experience  
**OVER 60 ATTACHMENTS AVAILABLE!**  
**PAGE** Richfield 4  
 Wisconsin **DEALERS WANTED**



**CONCRETE BLOCK HOME PLANS**  
**\$1600 RANCH HOME**  
 Build your own 24'x40' Ranch Home complete for \$1600. Liv. Room, Kit., two bedrooms, bath. Fireplace, slab or basement, carport or garage. Blueprints, instructions, and material list \$3.00 ppd. Money back guarantee. Other plans — \$600 and \$1000 Cottages, \$1200 Garage Apt., \$1900 and \$3000 Duplexes, \$2500, \$3800 and \$5400 4 Bed Rm. 2 Bath family room Ranch Home. Illustrated Folder, "How To Build Your Own Block Home", plus Plan Folder 10c.  
**QUALITY PLANS SINCE 1953**  
**BAILEY BUILDERS, 40-A Flag Rd., Little Rock, Arkansas**



**BASEMENT TOILET FLUSHES UP**  
**TO OVERHEAD SEWER OR SEPTIC TANK.**  
**NO DIGGING UP FLOORS. INSTALLS EASY. Write**  
**McPHERSON, INC. BOX 15133 TAMPA, FLA.**



**25c SAMPLE (\$1 Value)**  
 Make up to \$10. an hour in your spare time just showing this amazing little invention that threads a needle simply by pressing a button. Show it to women (men, too) and watch them grab it out of your hands for only \$1.00. No sales experience needed. Rush 25c for sample (\$1. value) and money-making facts, plus other self-selling money-makers.  
**UNIQUE PRODUCTS, Dept. 1442**  
 216 W. Jackson Blvd., Chicago 6, Ill.



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 Make money. Know how to break and train horses or ponies. Write today for this book FREE, together with special offer of a course in Animal Breeding. If you are interested in Gaiting and Riding the saddle horse, check here ( ). Do it today—now.  
**BEERY SCHOOL OF HORSEMANSHIP**  
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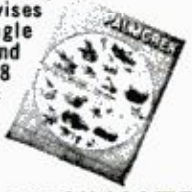
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**Stops Itch — Relieves Pain**  
 For the first time science has found a new healing substance with the astonishing ability to shrink hemorrhoids and to relieve pain — without surgery.  
 In case after case, while gently relieving pain, actual reduction (shrinkage) took place.  
 Most amazing of all—results were so thorough that sufferers made astonishing statements like "Piles have ceased to be a problem!"  
 The secret is a new healing substance (Bio-Dyne®)—discovery of a world-famous research institute.  
 This substance is now available in suppository or ointment form under the name Preparation H®. Ask for it at all drug counters.

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 YOU can turn your spare hours into cash (\$25 to \$100 a week) by selling products and services to friends and others. Famous Salesman's Opportunity Magazine shows you how. Contains hints, plans, hundreds of offers. No matter what your age, experience or occupation—write TODAY for next 5 issues—absolutely FREE. Send no money just name.  
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**No. X1 ANGLE VISE**  
 1 1/2" jaw width . . . \$18.95, other sizes up to 8" jaw widths.





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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 **Amco** 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, dados, makes coves and moldings. **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**

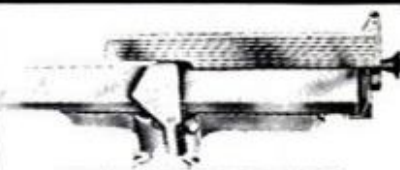
f.o.b. factory  
**Optional Faceplate** for turning bowls, trays, lamp bases, rosettes, etc. \$2.50



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 1/8" 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 cast 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**

**DELUXE BALL BEARING WOOD SHAPER KIT**  
**\$14.95**

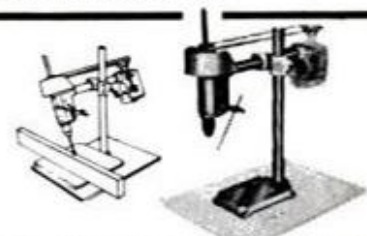
f.o.b. factory  
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