

Falcon Owners Report • Lifetime Boat Caulking

POPULAR MECHANICS

APRIL 1965
35 CENTS

SPRING TONICS for HOMES

Foldaway Pantry • Ceiling Beams That Light
Mobile Cooking-Eating Island
Five Fuel-Tank Camouflages
Quicker, Easier Drywall Remodeling
New Work-Saving Home and Lawn Products

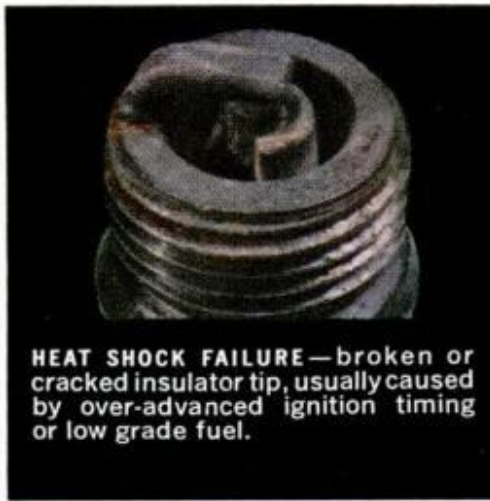


Plans for PM's PATIO GARAGE

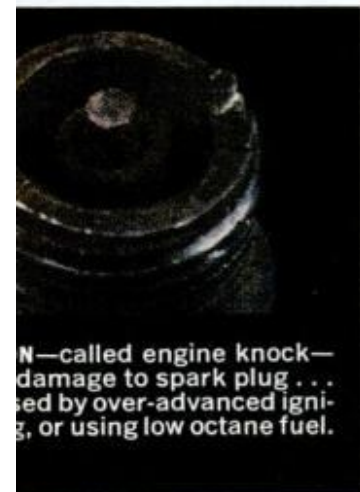




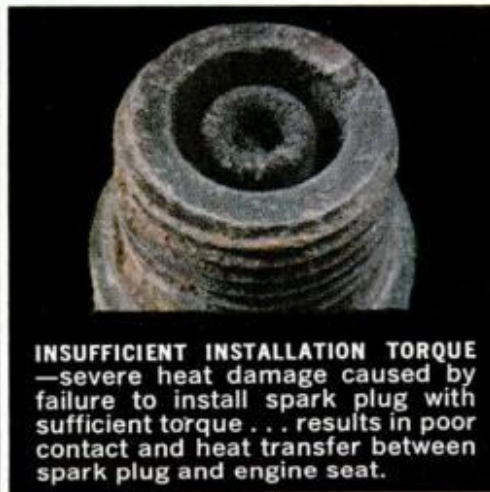
shiny yellow glaze coating, caused by applying sudden throttle as wide open throttle . . . results in shorting spark plug.



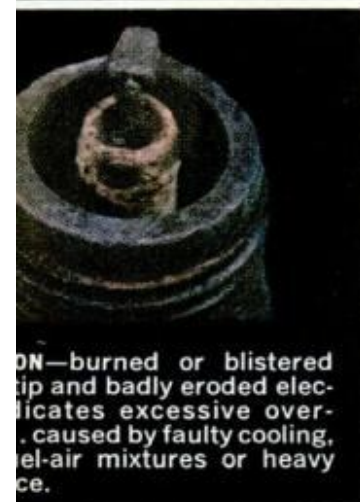
HEAT SHOCK FAILURE—broken or cracked insulator tip, usually caused by over-advanced ignition timing or low grade fuel.



ENGINE KNOCK—called engine knock—damage to spark plug . . . caused by over-advanced ignition timing, or using low octane fuel.



INSUFFICIENT INSTALLATION TORQUE—severe heat damage caused by failure to install spark plug with sufficient torque . . . results in poor contact and heat transfer between spark plug and engine seat.



OVER-IGNITION—burned or blistered tip and badly eroded electrodes indicates excessive over-ignition, caused by faulty cooling, rich fuel-air mixtures or heavy engine load.



IMPROPER INSTALLATION—dirty threads often result in spark plug seizing before engine seat gasket is seated, causing poor heat transfer and severe heat damage.



Engine trouble ... and the best way to boost engine power

engine performance can tip you into trouble. Engine problems above the hood are likely to cost you more money. Remember, AC's

exclusive Hot Tip Insulator burns away fouling deposits as you drive . . . helps prevent many engine problems before they have a chance to start. So power up for spring with ACs . . . the spark plugs best for all makes of cars, trucks, outboard motors and power mowers. Ask for AC Fire-Ring Spark Plugs wherever better products are sold!



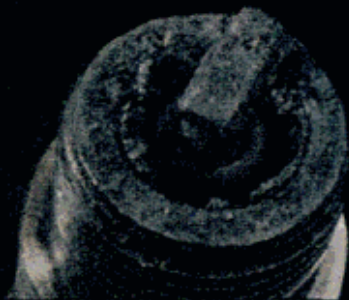
**FIRE-RING
SPARK PLUGS**

THE ELECTRONICS DIVISION OF GENERAL MOTORS



CARBON FOULING—dry fluffy black carbon deposits caused by over-rich fuel mixture, excessive choking, poor ignition, or excessive idling.

GLAZING
usual
load
accel
out th



OIL FOULING—wet oily deposits often caused by worn rings, porous vacuum booster pump diaphragm, or excessive valve stem guide clearance.

DETONATION
result
often
tion t




DEPOSIT FOULING—variously-colored powdery deposits caused by combustion of fuel and oil additives . . . may cause missing under high speed and heavy load conditions.

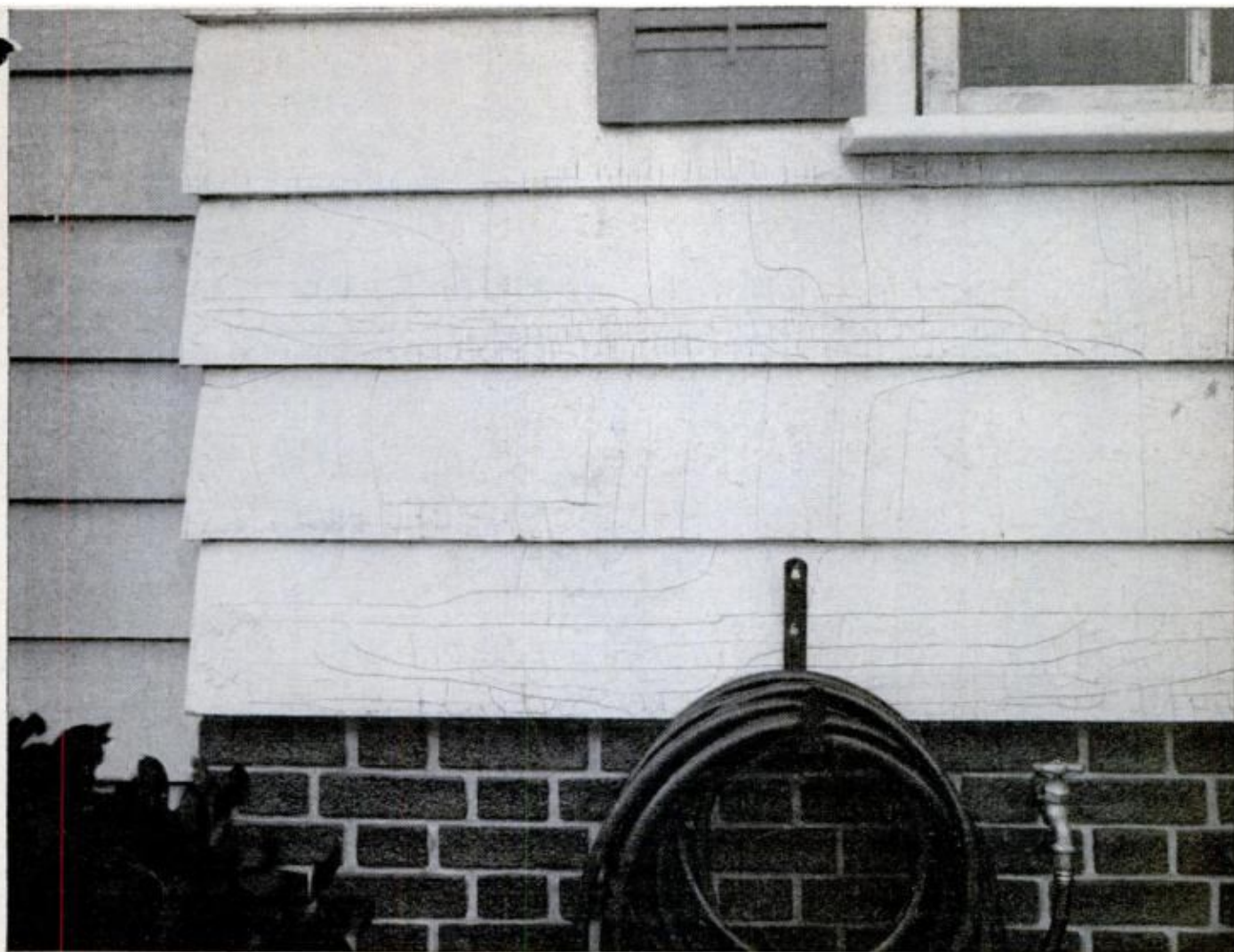
PRE-IGNITION
insula
trode
heatin
valves
load s

Nine ways to spot engine

Spark plugs serve as the heart of your engine's performance. A look at your spark plug can tell you a lot off to possible engine problems. Illustrations below indicate various engine troubles that can show up at the spark plug tip. When you see these problems call for a change of spark plug. Try our self-cleaning AC Fire-Ring Spark Plug.

AC SPARK PLUG 

**Nine
ways to spot
engine
trouble . . .
and the best way to**



Know why this happens? Know how to prevent it?

When the temperature changes, material expands or contracts. Most house paints will expand less than the surfaces they cover. Eventually, the paint cracks.

Du Pont LUCITE® House Paint is *flexible*. It expands or contracts *with* the surface it covers. Painting with Du Pont LUCITE House Paint means great protection against cracking.

It means other things, too.

You can paint when it's damp (even just after rain!). The job will dry before the bugs can spoil it. It will hold its color far longer

than oil-base paints will. You need a priming coat only on spots where old paint has *really* failed. You can paint wood, masonry, stucco—almost anything. And you clean up (hands and brushes) with only soap and water.

Less work, more wear.

The name is Du Pont LUCITE House Paint.



BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY

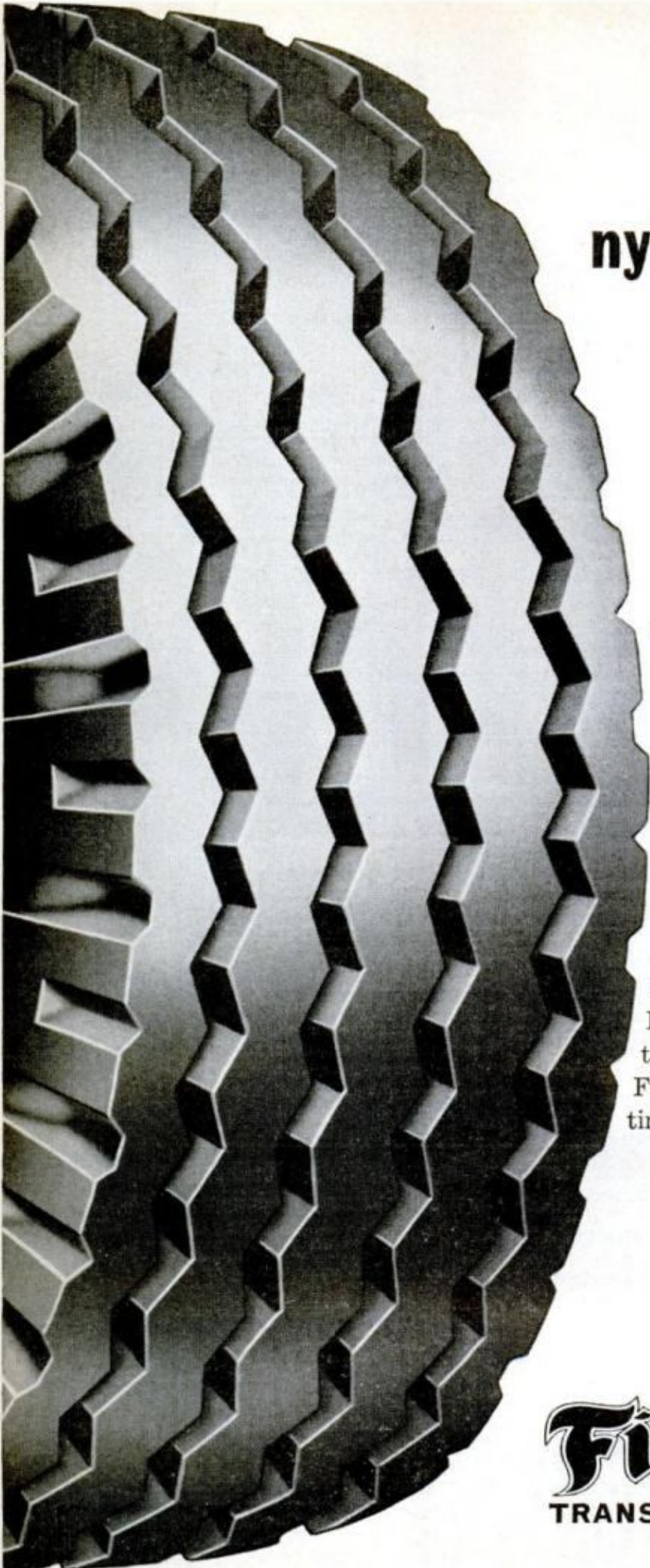
Less work... more wear

This One



TXKL-UL6-HU3T





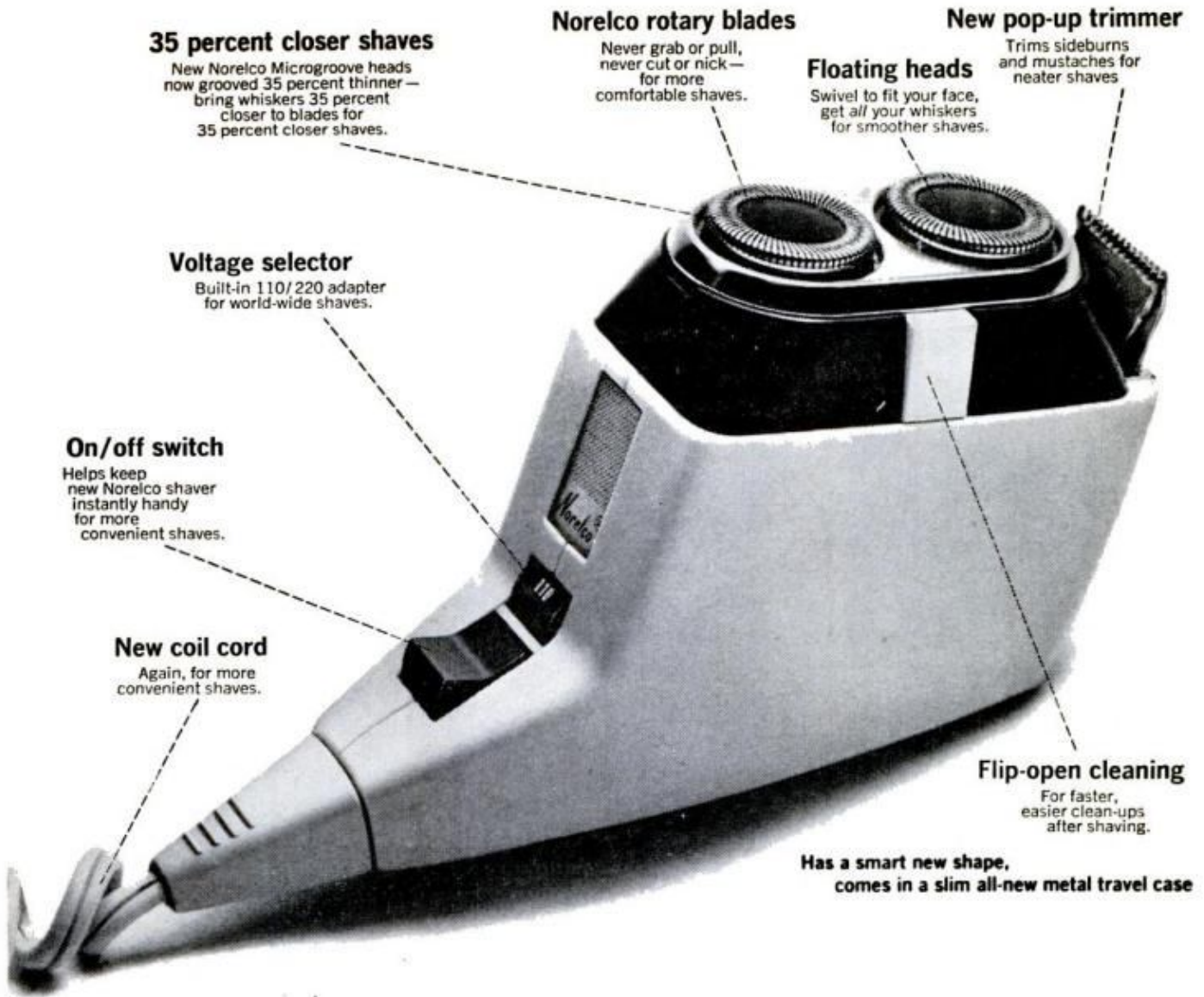
Now! A Firestone nylon truck tire... at passenger tire prices

Everything you need in a pickup or delivery truck tire — you'll get in our Firestone Transport nylon tire. A rugged Shock-Fortified nylon cord body, for example. And a deep, gear-grip non-skid tread design that'll keep you in control—even on slick pavements. Mileage? We made it with our exclusive long-wearing Sup-R-Tuf rubber. It's strictly the high quality you expect from Firestone . . . at a new low price. Firestone Transport nylon truck tires are now on sale at your nearby Firestone Dealer or Store, at passenger tire prices. Transport®, Sup-R-Tuf—Firestone T.M.s

...so why not buy two?

Firestone

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35 percent closer shaves

New Norelco Microgroove heads now grooved 35 percent thinner — bring whiskers 35 percent closer to blades for 35 percent closer shaves.

Norelco rotary blades

Never grab or pull, never cut or nick — for more comfortable shaves.

New pop-up trimmer

Trims sideburns and mustaches for neater shaves

Floating heads

Swivel to fit your face, get all your whiskers for smoother shaves.

Voltage selector

Built-in 110/220 adapter for world-wide shaves.

On/off switch

Helps keep new Norelco shaver instantly handy for more convenient shaves.

New coil cord

Again, for more convenient shaves.

Flip-open cleaning

For faster, easier clean-ups after shaving.

Has a smart new shape, comes in a slim all-new metal travel case

New Norelco Speedshaver is a better way to shave because it has more shaving features than any other shaver.

This Norelco Speedshaver is totally new. Should you buy it just because it's new? No. Take a good look at all those shaving features up there. Then buy this new Norelco shaver for closer shaves. Neater

shaves. More comfortable shaves. Smoother shaves. More convenient shaves. Shaves in foreign lands. In short, buy it for a better way to shave. Isn't that what you've been looking for?

World's largest-selling shaver model. Popular price Norelco 'Flip-Top' Speedshaver® 20. On/off switch, flip-top cleaning, rotary blades.

Shaves anywhere — Norelco Cordless Speedshaver 20C. Uses ordinary penlight batteries. Zipper case with mirror. Rotary blades. Surprisingly inexpensive.

Norelco®/The Comfort Shave

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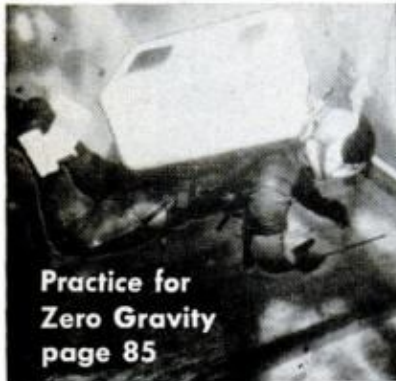
POPULAR MECHANICS®

APRIL 1965
VOL. 123 NO. 4

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NEW YORK, N.Y. 10022

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

Features of Special Interest



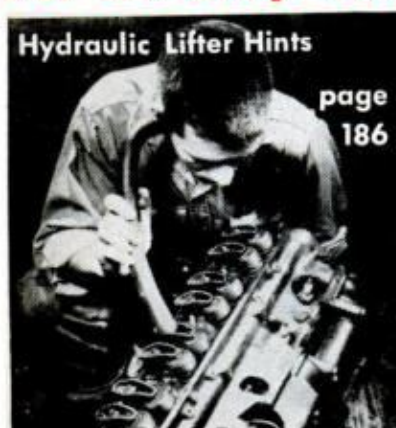
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NEXT MONTH: What's new for campers? How good are those picnic coolers? What do owners like and dislike about different pickup campers? The answers are in May *PM's* 26-page camping section, plus an owner's report on the '65 Corvair, a rundown on Corfam shoes one year later, and a champions' report on this year's Race at Indy

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APRIL 1965



"WIN THE PACE CAR IN MONROE'S 'INDY SPECIAL' CONTEST"

—says Sam Hanks,
Indianapolis "500" champion
and driving safety expert.



Here's all you do: Stop in at a dealer displaying the yellow and blue Monroe Indy Special banner. Ask for a free shock absorber test. While there, fill out the "Indy 500 Special" contest entry, estimating the speed of the winning car at this year's Indianapolis "500".

If you're the winner, you'll receive a Plymouth Sport Fury, the 1965 pace car. Over 150 other prizes, too!

Drive in for your free shock absorber test and ask for an entry blank today. Contest closes May 14, 1965.

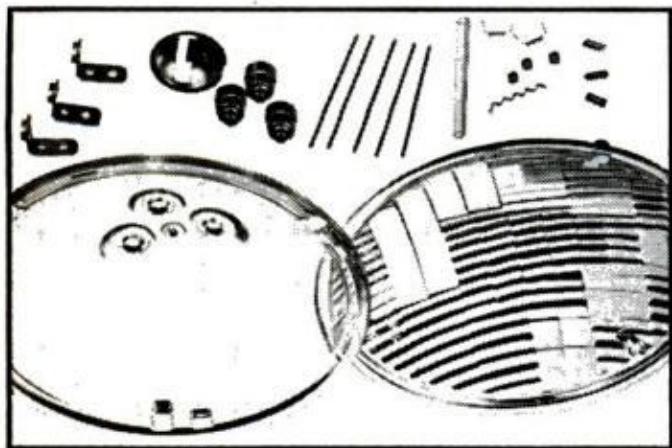
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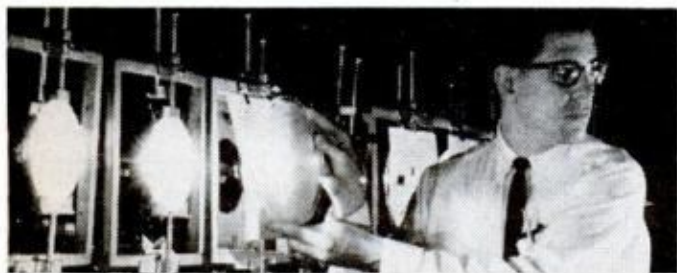
World leader on highway and speedway

MONROE AUTO EQUIPMENT COMPANY • Monroe, Mich.

How General Electric headlamps help you see farther down the road at night

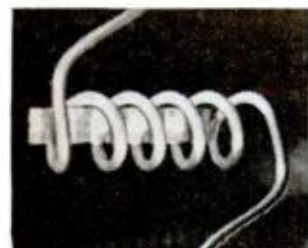


1. Your car headlamp has 22 precision parts. The quality of each part can affect a lamp's light and life. Only G.E. makes each of these parts—from tungsten to glass.



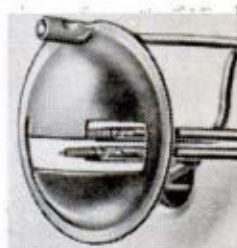
2. Your headlamp lenses have more than 100 prisms to beam light ahead of your car for maximum safety and eye comfort. G-E lenses and reflectors must pass 129 quality checks before they are assembled.

3. Even a thumb print inside the glass reflector of your headlamp would reduce reflectivity, impair your night vision. An alcohol rub cleans every G-E reflector before the mirror surface is applied.



4. Reflectors in your G-E headlamps *never* tarnish. A 2000-degree "poof" transforms an aluminum hairpin into a vapor that deposits evenly over the glass and becomes a reflector. G.E. pioneered this process, as well as the sealed beam headlamp itself.

5. You see easier in rain and fog. G-E's *split-center fog shield* keeps the lower beam from bouncing upward off bumpers. Shield and filaments are independently mounted to resist vibration.



6. Your G-E headlamps are made oven-hard to shrug off impact and thermal shock from rain and snow. This is one reason G-E headlamps burn bright so long.

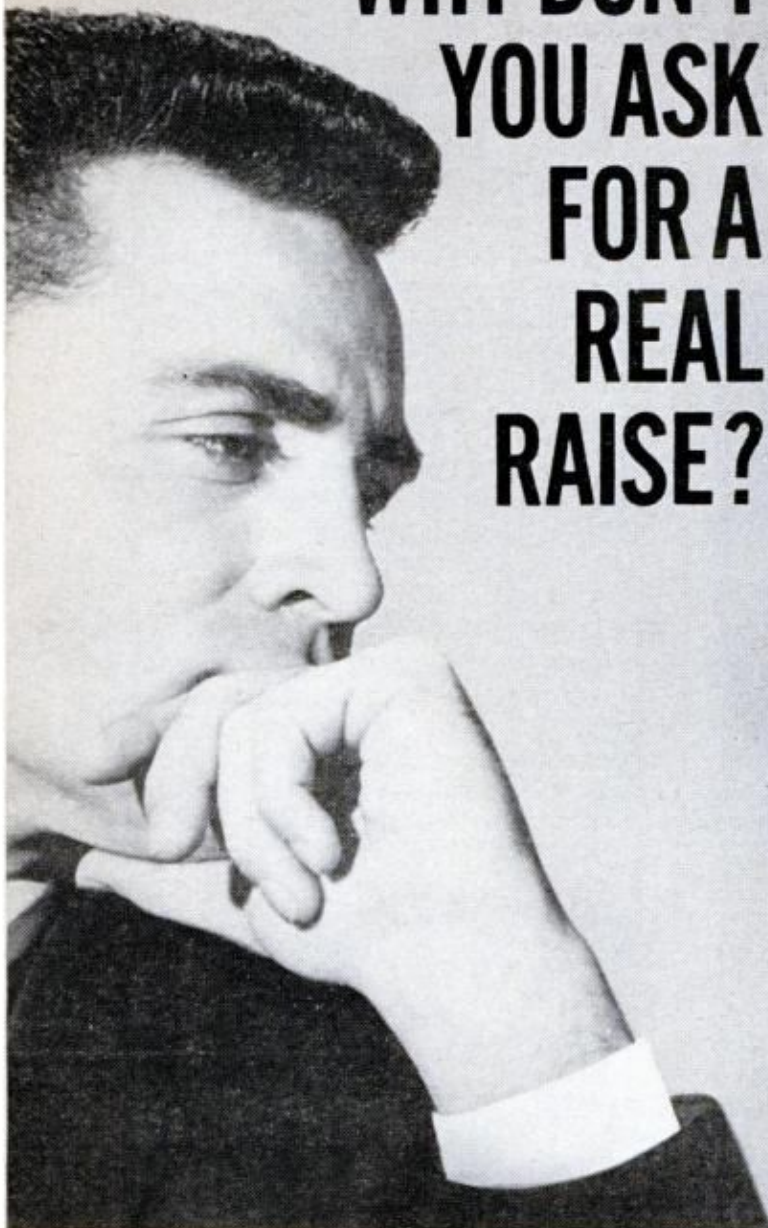
7. Since 1920, your car's headlamps have been constantly improved through practical research by General Electric engineers—with test cars, such as this venerable Reo, long since worn out in your service. Constant attention to minute details insures years of dependable service for pennies cost.



No wonder most drivers prefer G-E auto lamp performance. Next time you drive, push the brake, pull the switch to check your lights. Or have 'em checked where you normally have your car serviced. If you need a replacement, demand a dependable G-E lamp. General Electric Co., Miniature Lamp Dept. M4-24, Nela Park, Cleveland, Ohio 44112.

Progress Is Our Most Important Product

GENERAL  ELECTRIC



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Canadian residents, write: LaSalle, Box 1001, Montreal 3, Quebec

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Over the Editor's Desk

For a Lady Driver

I built a *Sidewalk Classic* (page 146, November 1963 *PM*) for this past Christmas. My daughter is 3½ years old and had little trouble learning to drive it.

Construction closely followed your plans. I used a 12-volt battery and a 6-volt gen-



erator. Bicycle head lamps were used, and the seat was upholstered in sponge rubber and real leather.

San Pedro, Calif.

BRUNO V. MISEVIC

Year of Spare Time

My *Hydro Dynamic* (page 144, March 1963 *PM*) has a removable windshield and my own design in back-to-back seats.

I built the boat and fibreglassed the hull in a year of spare time. Though powered



by only a 28-hp. Evinrude, it has proved very satisfactory in performance and easy for the youngsters to handle.

Springfield, Mass.

ALBERT NORMAND

Partly Clear Crystal Ball

If you'll refer to *Stormy Figure on the Weather Front* (page 166, Oct. 1961 *PM*), you'll see that Dr. Irving P. Krick made this prediction for Inauguration Day, 1965:

"The weather in Washington, D.C., on January 20, 1965, will be fair with unseasonably high temperatures."

This forecast of ours made over three years ago accurately predicted the weather for this important occasion.

Irving P. Krick Assoc. PAUL J. CAUBIN
Denver, Colo. Vice President

It was a partly sunny day with the temperature one degree below normal (high was 46; low, 25), so Dr. Krick's only error was a matter of degree.

Tabs for PM

I bought a small loose-leaf binder and took the indexes out of each copy of *PM* and put them in the binder. Now there is no pulling down a dozen magazines to find the article I want.

Broderick, Calif.

DALE HOWELL

That's one way to put your finger on the story you want in a hurry—but with this issue of *PM* we're starting an even easier way for you home craftsmen to locate those how-to articles in past issues.

From now on, our major maintenance



and construction articles (five in this issue) will have their own built-in filing tabs. All you have to do is cut around the outline of the tab, fold it out and strengthen it with cellophane tape. The first filing tab, with instructions for use, is on page 137. Let us know how you like 'em!

The Editor

POPULAR MECHANICS

Материал, защищенный авторским правом

NEW!
CTI ADDS
HEATING
to this
great course!

MORE GOOD JOBS— LESS COMPETITION

in
**AIR CONDITIONING
and REFRIGERATION**

**Practical Home Training
Gets You Ready Fast!**



Your spare time is valuable. Use those extra hours each evening and week-end to train yourself for a good job or a business of your own! Many opportunities are available today for mechanics and technicians in the air conditioning and refrigeration field. Qualify for a rewarding career by means of easy CTI Home Study.

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—Commercial Trades Institute, Chicago

Did you know that air conditioning is one of America's two fastest-growing industries? It's a fact! During a 12-year period, production increased a whopping 400%. Here are estimated sales figures for last year: 1,600,000 room air conditioners; 425,000 unitary systems; 900,000 auto air conditioners; and \$900,000,000 worth of big air conditioning systems.

The industry is expanding so rapidly that 20,000 mechanics must be trained each year! No wonder pay is high and work is steady. Build a secure future in air conditioning and refrigeration. Get into profitable repair and service. Get ready through practical CTI Home Study.

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Without cost or obligation, mail me your FREE booklet, *Be a Success in Air Conditioning, Refrigeration and Heating*; and a sample lesson.

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RADICALLY NEW WAY TO STOP RUST FOREVER!

- Works by revolutionary new process
- Turns rust into a rust-proof metallic coat
- No rust remains under coat to eat the metal
- Takes any paint—oil, metallic, cellulose

KURUST

Just brush away loose, powdery rust from metal surface—then paint with **KURUST**. In an hour you will have a clean metallic surface ready to take any paint.

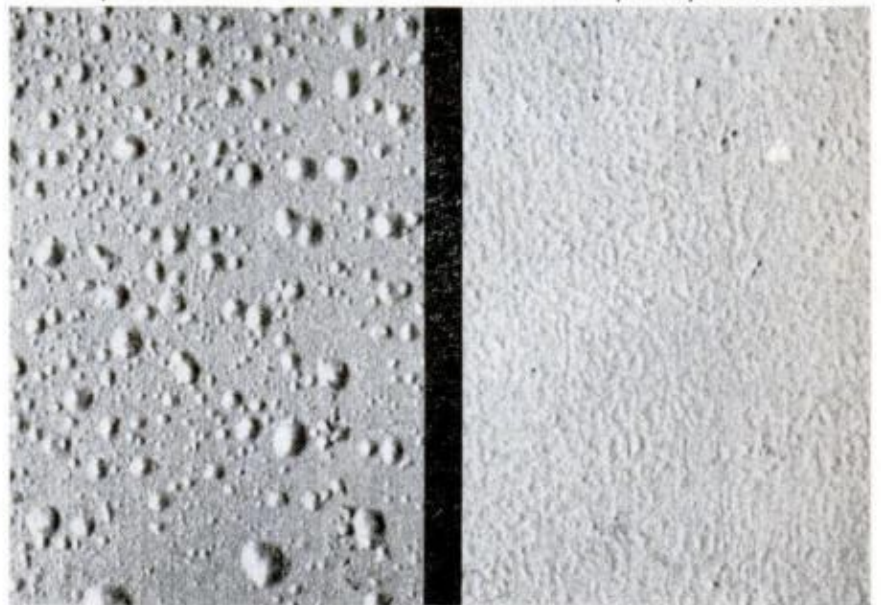
KURUST protects against all corrosive conditions—humidity, salt water, fumes, exposure. It works by a new chemical process that forms a rust-proof metallic coat. When **KURUST** touches a rusty surface, the chemical action neutralizes and removes all rust and transforms the treated area into a tough new metal substance. No layer of active rust remains under the coated surface (as happens with leading sprays and other so-called rust-proofers).

Even if the **KURUST** coat is scratched, rust will not spread under it because the coating is in direct contact with the metal, bonding firmly and smoothly to insulate the metal from corrosion. Use on any rusty iron or steel surface. Results are guaranteed.

Red Lead applied to rusty metal subjected to 10 days at 100% steam humidity. Note rust causing the paint to break down.

KURUST over rusty metal subjected to 10 days at 100% steam humidity. Note the film remains sound.

Both panels were overcoated with aluminum paint prior to test



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Move Up Faster — Make More Money With N.T.S. "PROJECT METHOD" HOME TRAINING

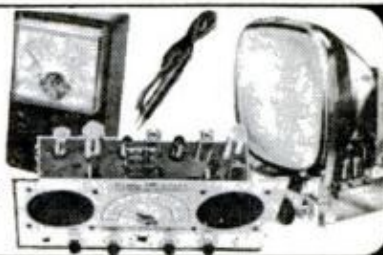
Looking for your first real job in industry? Are you stalemated in a dead-end job? Or, are you being left behind because you're not up on new industry methods? Don't let technical progress — automation — pass you up. There's an N.T.S. Project Method training program to help you MOVE UP FASTER and MAKE MORE MONEY!

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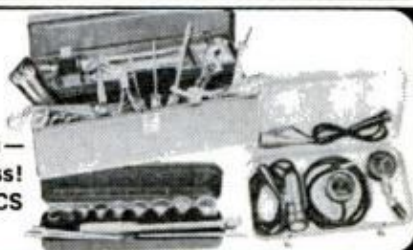
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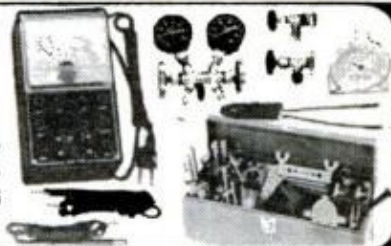
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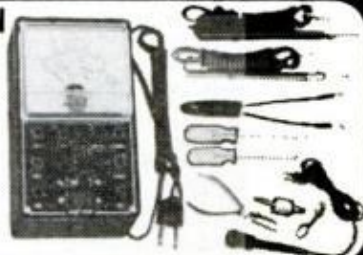


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Boost for fluoridation. When Antigo, Wis., dropped fluoridation in 1960 after having had treated water for a decade, the State Board of Health made a study of the incidence of tooth decay among Antigo's schoolchildren. A similar study was made a few months ago.

The results: In four years, tooth decay had risen 92 percent among kindergarten children, 183 percent among second graders and 100 percent among fourth graders.

American scientists have discovered a spiderlike mite living in a mountain range only 309 miles from the South Pole, the farthest south that animal life has ever been detected. Barely 1/100th of an inch long, the mite apparently feeds on microscopic fungi and algae.

Spray it with diamonds, for a really smooth polishing job. That's the theory behind an aerosol compound of diamond dust developed by British engineers. The spray method, they say, applies the diamond dust abrasive evenly to all parts of whatever is to be polished. It is claimed that there is no danger of getting more on one place than another, with consequent gouging.

A **"do-it-yourself"** computer service is now available in Chicago. Open 24 hours a day, seven days a week, the service offers customers the use of any of four computer systems and a private office for preparing data. Cost is based on the number of hours the equipment is actually used, starting at \$20 per hour.

High-flying rockets, radio telescopes, balloon-borne telescopes and other glamorous devices are providing us with a wide range of new information on the heavens. Does this mean that the earth-based optical telescope is obsolete?

"Not at all," says Dr. Harlan Smith, professor of astronomy at the University of Texas. "Terrestrial telescopes won't be outmoded until observation by large or-

biting telescopes becomes routine.

"Those we have today will serve another generation of astronomers," Dr. Smith told *PM*. "They will be useful for another 30 years or so."

Observing that some telescopes still in use are about 100 years old, Dr. Smith asks, "What other scientific tool has lasted that long?"

Do other intelligent societies exist within radio range of earth? Many scientists think so and are working on message systems. A comprehensive report on this "far out" subject can be found in *We Are Not Alone*, a new book by Walter Sullivan, science editor of *The New York Times*.

Heart patients who have been equipped with pacemakers (heartbeat assisters) should not open the hood of an automobile, according to an article in the *Journal of the American Medical Association*. Reason: The electronic devices that stimulate the heart may be disrupted by the distributor or sparkplugs.

A pretty rug is like a melody. That thought must have run through the mind of a Netherlands designer when he was commissioned to create a rug for a Dutch hotel. He explains that he analyzed a fugue by Johann Sebastian Bach, fed the mathematical pattern into a computer and allowed it to control the rug loom. Result: a harmonious design executed in various shades of brown.

Like most girls, female mosquitoes—they're the ones that bite—prefer male victims. That was demonstrated in a recent series of tests on volunteers by Department of Agriculture researchers. One reason might be that men perspire more, which mosquitoes seem to find attractive.

The earth gains weight daily. In its whirl through space, it picks up specks of cosmic dust—about a trillion bits a day, which adds up to millions of tons each year. So says one British scientist.

How does he know? By reading from the mud on ocean bottoms. Minute specks of extraterrestrial matter sift through the atmosphere to the water and sink to the bottom.

Successful plastic tooth implants in monkeys and baboons give promise of a new means of tooth replacement in humans. Writing in the *Journal of the American Dental Association*, three Boston researchers report placing 73 implants into the mouths of 16 animals during the past

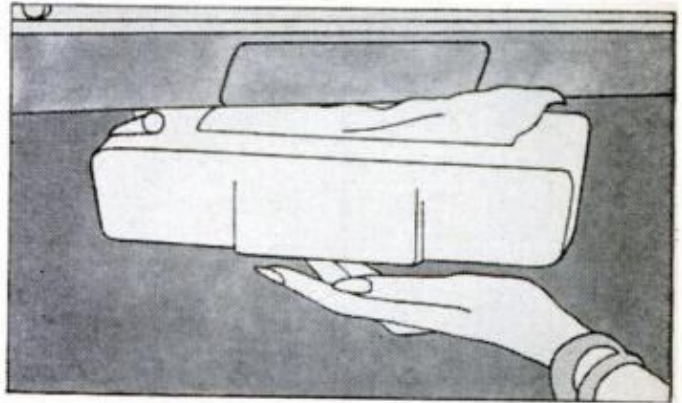
(Please turn to page 14)

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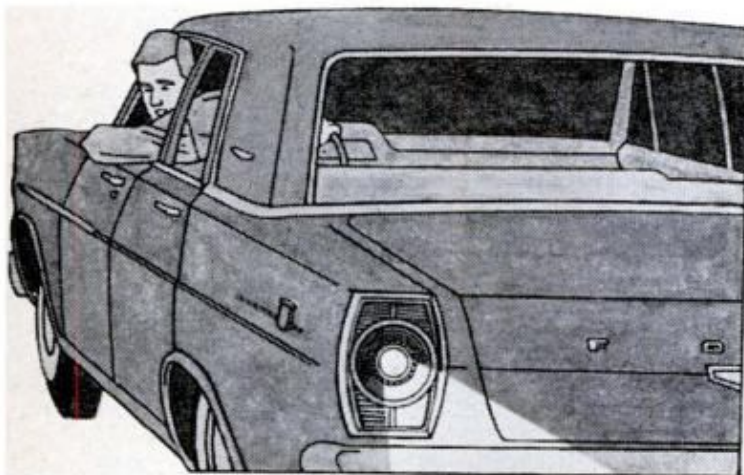


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Science Worldwide

(Continued from page 12)

year and a half.

"Not only have these teeth been accepted by the peridontal (gum) tissues," say the scientists, "but they have also appeared to assume reasonably normal function." Baboons were preferred as subjects because they "closely simulate the human in both physiology and dentition."

After two years, attempts to grow fresh vegetables aboard a nuclear submarine have been declared a failure. U.S. scientists are now trying to figure out why the hydroponic garden failed, why lettuce, parsley and other plants grew just so much, then died. The Navy had hoped the vegetables could be used to supplement the regular diet of crews during long periods of submersion.

It doesn't make sense to use high-speed gasoline vehicles in crowded cities. In addition to being cumbersome, they add greatly to air pollution. That's the thinking of Max L. Feldman, a General Electric scientist, who proposes the use of electric cars in cities. They "would be used to furnish short distance transportation to rapid transit lines, to reduce automotive traffic, to permit the design of autoless communities . . ."

The possibility of getting power from the moon has long interested Russian scientists. They have come up with various schemes, including covering half of the satellite with photocells to turn moonlight into electricity, which could then be beamed to earth.

Now they say there's an urgent reason for transferring power generation to the moon. Power generators release waste heat, and before long there'll be so much heat in the atmosphere that our climate will change perceptibly.

The trade in fake pre-Columbian clay idols and urns has become so brisk that Mexico's National Institute of Anthropology and History is trying to bring it under control. It's estimated that over 1000 artisans, many of whom work with assembly line efficiency, are involved. Inspectors from the National Institute don't confiscate the phony works of art, but see to it that honest prices are charged.

John F. Pearson
Science Editor



TOM McCAHILL SAYS:

"A lot of people could make themselves valuable FAST"

Everyone talks about high school dropouts and automation changing jobs and what to do after retirement. I know some full grown high school students who can't find summer jobs. I have known family men who thought the end of the world had come when the plant moved out of town.

I hope this doesn't sound like a two-bit sermon, but there are solutions to remedy almost any situation. A lot of people could make themselves valuable fast in a job field that nobody seems to know much about—yet, and that's fixing electrical appliances.

As you know, the day is long past when the average home had only one or two electrical appliances. Most homes today are loaded with electrical gadgets that are used for everything from drying milady's hair to cooking dinner and cooling or heating the house.

These appliances break down and that's where you come in.

Appliances have become a major part in our living habits, and in most areas, good appliance repairmen are as scarce as old maids in Corvettes.

What makes sense about this field is that it offers opportunities to men of any age. You'd be surprised at the extra income you can pick up doing good appliance servicing for your neighbors—or the possibilities of starting your own business with little or no investment. There are also good jobs to be had working for some one else who's already in the business.

How easy is it to break into this field?

A lot easier than you think, if you take a look at

the home-study course offered by the Appliance Division of the National Radio Institute. You've probably seen the NRI ads. They've been one of the biggest and best schools around since 1914.

The course is good. It's easy. It costs less than many people shell out for one month's payment on that Detroit monster parked in the driveway. They train you fast, in an interesting way, to do some real *professional* appliance servicing on just about every type of appliance from small to large, including most farm and commercial appliances. It even covers small gasoline engines. And they have a separate arrangement to teach you air conditioning and refrigeration.

The point I want to make is this: About the worst thing anyone can do is to sit down and worry about where the extra bucks are coming from. It's not good for your digestive system. It isn't good for those who have to live with you. About the best thing any man can do is help himself.

Do a favor for the guy you see in the mirror every day. Get the details about this course. They send you some books that are worth reading—FREE. Send the coupon below or drop them a note.

No need to tell them I recommended the course. Get the details and see for yourself. Might be a whale of a smart move to do this today.

TOM McCAHILL

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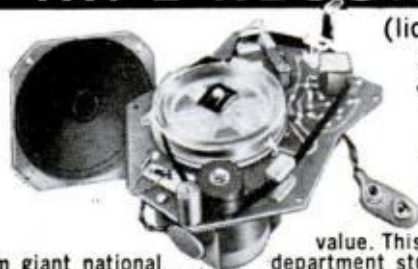


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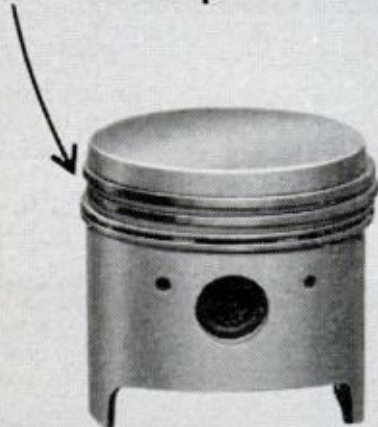


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A.M. to _____

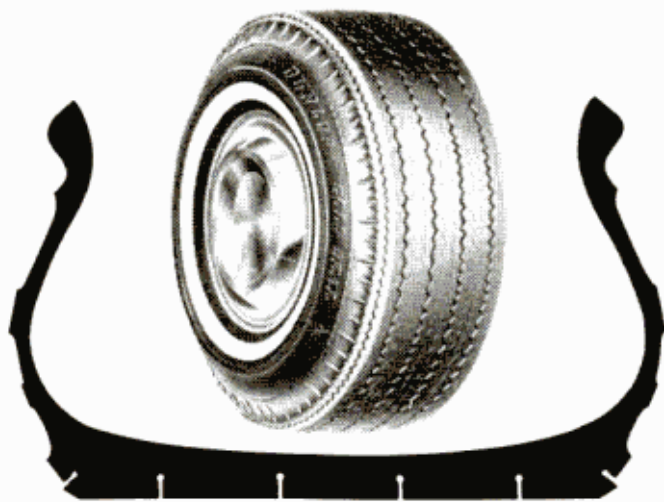
P.M.

Occupation _____

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Certified safe at 100 mph*

A First . . . the new popularly priced Dunlop Gold Seal Low Profile tire has been tested and proved safe at sustained speeds of 100 mph, to make certain you have a wide margin of safety even at today's freeway limits.

You also get new mileage and traction advantages in the Gold Seal:

LOW PROFILE The new Gold Seal is designed low to complement today's road-hugging automotive styles.

LONG MILEAGE A wider footprint area spreads out the load for longer wear. Tyrex or nylon full four-ply construction for greater strength.

TRACTION-WIDE PRINT There's more surface contact with the Gold Seal, and tread sipes are more plentiful for phenomenal traction, especially on wet pavements. You also get patented Dunlop Safety-Shoulders to carry you up, down, and diagonally over obstructions without a lurch.

NEW INNERLINER Our new pressure-seal innerliner holds air four to five times longer than ordinary tires.

Ask your local Dunlop dealer to show you all the benefits we've engineered and built into the low profile of this new Gold Seal. From 100 mph safety to innerliner, it's the real tire for a change.

*We certify that Gold Seal Low Profile tires were in excellent condition after numerous tests at sustained speeds of 100 mph.
Tire Engineering Service Testing, Inc., Carson City, Nev.



DUNLOP

TIRE AND RUBBER CORPORATION, BUFFALO, N. Y. 14240



Sidelights from the **SERVICES**

By William R. Kreh

Two engineers are none the worse for wear after spending 60 hours sealed in a *Minuteman* ICBM control center, 43 feet underground at Vandenberg Air Force Base, Calif. It was a test to see how men would fare should they need to stay in the control center because of nuclear attack. During the experiment, the men lived on emergency rations and used only the emergency self-contained power system in the tiny capsule.

A "high voltage" safety device is protecting pilots at Camp Pendleton, Calif. Bright orange spheres have been strung on power lines to enable helicopter and light-plane pilots to see the lines.

Coal to cornhusks could be used as fuel for a portable electric generator being developed for the Army. Designed for use in isolated areas, the compact unit can be fueled by a wide range of materials, including wood, coal, grain, husks or grass.

Empty briefcases can carry secrets, the Air Force has warned its people. It seems that the tan imitation leather or plastic portfolios everyone seems to tote these days will pick up impressions of typed notes and documents. The impressions are reversed, of course, but any secret agent worth his salt can read them by holding the portfolio in front of a mirror. The Air Force wants its men who handle classified documents to be alert to the danger.

Ice-chipping on a big scale is possible with a unique new Army vehicle being used to whittle down ice pressure ridges in the arctic and antarctic. The ice-chipper is the first advanced machine for high-speed road construction through solid ice. A single pass of the vehicle removes eight inches of solid ice.

Ping-Pong is now a military game. The Army has successfully tested a new reusable reconnaissance missile that foot soldiers can use to take a peek at enemy positions from miles away. Appropriately called "Ping-Pong," the rocket is launched from the ground. It arcs over an obstacle, such as a mountain. On the other side, it takes pictures. Then it turns back, returns to the launch spot and lands by parachute.

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Earn To \$15 An Hour ★ Work Part-Time Or Full-Time ★ Car Furnished — Expenses Paid ★ No Selling — No Previous Experience Needed ★ Only Average Education Required

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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.

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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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We CAN and WILL show you how to rapidly build your own full-time or part-time business. Or if you wish a big-pay job as Company Claims Investigator, our Placement Service will give you *real* assistance. Hundreds of firms needing men call upon Universal. *We place far more men in this booming field than any other individual, company or school.*

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Write today for complete information. Costs are less than you'd imagine. And even on these low costs you need pay only a portion—less than half—in order to complete your training. We finance the rest for you. You may pay out of actual earnings. And you can keep present job while learning. Send now for free book. No salesman will call. You are not committed in any way.

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Let us show you how easy it is to get into this exciting new career in just a matter of weeks. You need NO prior experience or higher education. There's NO investment in expensive equipment. You do NO selling. Furthermore, this fast-growing Accident Investigation field has no seasonal layoffs... no time out for strikes... no oversupply of men... no worry about automation. We ask you to compare these terrific advantages with the job you now have! Cash in on this big demand for trained men NOW. *Write today!*

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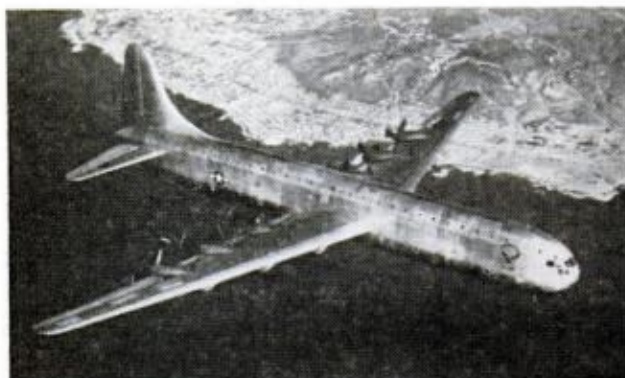
Sidelights on

AVIATION

World's largest airliner, recently proposed by President Johnson, would carry from 500 to 750 passengers and weigh more than 300 tons fully loaded.

Quick now, what was the world's largest land-based airplane up to now?

Unless you're a real aviation buff, chances are you'd guess wrong. There was only one built and it was called the XC-99.



CONVAIR XC-99 was, and still is, world's largest plane

Made by Convair, it was a cargo version of the old pusher-prop bomber, the B-36. At 182 feet in length, it was 20 feet longer than the B-36 with a fuselage twice as big, and 10 feet higher—57 feet from the ground to the top of its vertical stabilizer.

Its range and cargo capacity were prodigious. Its double-deck fuselage had a cargo space equal to 10 freight cars and once carried 212 troops, a record, and again a 104,000-pound payload. It could fly nonstop 8100 miles, the equivalent of a



RETIRED CHAMP on display near Kelly Air Force Base

flight from New York to Bombay, India.

The XC-99 flew more than 5000 hours before it was retired, a record for an experimental plane, setting 21 international records for cargo carrying.

The plane is still intact and is on display at Kelly Air Force Base, near San Antonio, Tex.

Kevin V. Brown
Aviation Editor

HOT SHOT HOT SHOT

Amazing New **BENJAMIN**
30 30 CO₂ GAS
BB CARBINE REPEATER

—Packs a PUNCH that's so POWERFUL it will Drive STEEL BBs thru Both Sides of a 5 Gal. Steel Pail at close range!
(26 ga. .018")

You're in for a thrill you'll never forget the first time you shoot HOT SHOT! The Hardest Shooting CO₂ Gun on the market—New Model 30 30 embodies features that also assure Flawless Performance: Permanent Alnico V Cast Magnet Shot Holder . . . a Positive, Jam-proof method of loading Ammo in firing position; Convenient, Positive Hammer Safety; 30-BB Mag.; 30 Shots per cartridge; Quality Built. Lightweight—Accurate—Field Tested—Lowest Shooting Costs—use Indoors/Outdoors.

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FREE Catalog Benjamin Single Shot and Repeaters—Cal. BB or 177 or 22. Also Special Hunting Knife Offer. Write today!

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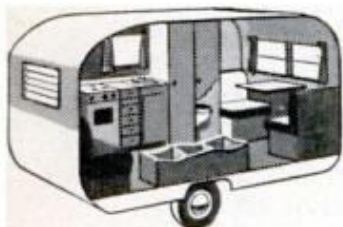
Why rough it when you can camp in **Convenient comfort with a travel trailer?**

No tent to pitch. No water to haul. No wood to chop. In fact, no camping chores at all with a travel trailer. You take along your own comfortable beds, convenient cooking and eating facilities. Plus heat, water, lights, refrigeration and bathroom.

Fortunately, today's ruggedly-built travel trailer is

lightweight. Tows easily. Hitches and unhitches quickly, freeing the car for short side trips.

Models are priced from \$895 to \$2000 (and up). Easy monthly terms. Dealers are in the Yellow Pages or classified ads under "Mobile Homes," "Trailers-House" or "Trailers-Coach."



Look for the MHMA-TCA American Standard A119.2 seal on all Mobile Homes Manufacturers Association and Trailer Coach Association models. It assures heating, wiring and plumbing systems built to nationally recognized, rigid standards of the American Standards Association. TCA products may also use California Division of Housing seal.

For more information on travel trailers, pick-up coaches and camping tent trailers, write for new booklet on Travel Trailer Fun. Send 25¢ to Travel Trailer Division, Mobile Homes Manufacturers Association, Dept. PM-45, Box 1516, Chicago, Ill. 60690

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Address _____

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Ronson introduces the

(Complete with large

Burns for hours on butane gas. Adjusts from pinpoint to



STARTS LOG FIRES.



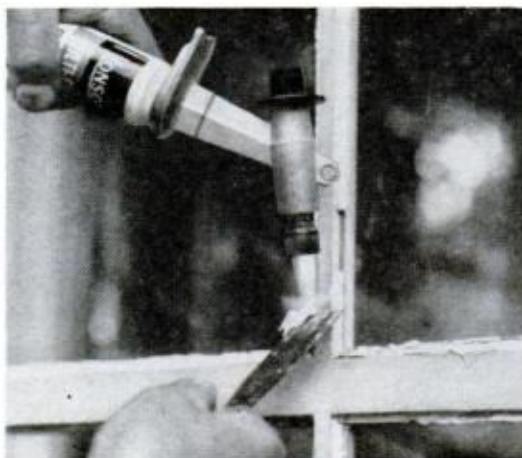
MELTS ICE.



STARTS CHARCOAL FIRES.



REMOVES PAINT.



SOFTENS PUTTY.



FOR HARD-SOLDERING METALS SUCH AS THIS METAL CHAIR.

O.K. You own a hammer, a chisel, a screwdriver—a lot of good, hardworking tools.

So when something at your house needs fixing, you're ready, willing and able to go to work.

Or are you?

Ever try to thaw a frozen water pipe with that hammer?

Or unstick a cracked floor tile with that screwdriver?

Or chip ice off the front steps with that chisel?

Humiliating, isn't it?

(Not having the right tool at the right time can make you feel about as self-sufficient as an old-maid schoolteacher fixing her first flat tire.)

But now Ronson has a new torch that can do all those

things. And more.

You don't have to be a handyman to put it to work. It starts charcoal and log fires quickly. It burns leaves and caterpillar nests. You can even use it to put a nice brown meringue on Baked Alaska!

It weighs less than 13 ounces. Much smaller than other leading torches, it takes very little storage space. It's as compact and easy to handle as a flashlight.

A blast from this torch can spot-kill a weed faster than you can yell "Crabgrass!"

A broken wire fence needs mending?

This torch can do a perfect soft-solder job in less than a minute.

It can hard-solder a 1/2" copper tube to a brass elbow in just a few minutes.

It can help remove old paint.

Soften old putty.

Fix a kid's toy.

Help refinish furniture.

Sweat copper tubing.

(Whew!)

Loosen rusted pipe fittings and connectors. (Just try to get in and around pipes and fittings with a larger torch.)

Free frozen nuts and bolts.

And even stand up like a laboratory burner.

(This comes in handy when you need both hands free.)

How did Ronson put this new torch together?

We used butane gas, and the

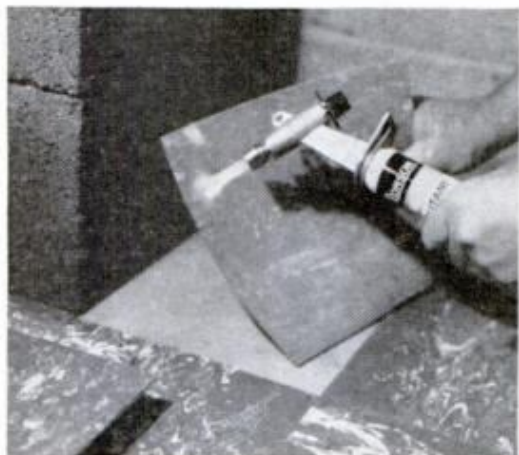
Varaflame Torch. \$4.95*

(size butane Multi-Fill.)

blow torch flame. Lightweight. Compact. Easiest to handle.



BURNS OUT WEEDS AND CATERPILLAR TENTS.



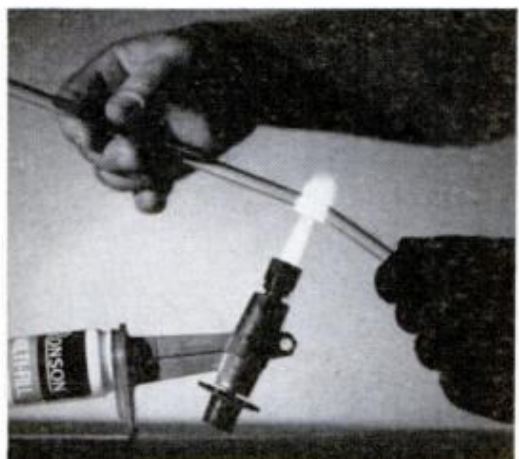
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SOFT-SOLDERS BROKEN TOYS.



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COMES APART EASILY FOR STORAGE.

same Ronson Multi-Fill® injector that fuels our gas lighters.

(The Multi-Fill injector lasts for hours, but when it runs dry, you can buy a new one almost anywhere in town.)

And we developed an entirely new kind of torch head.

It snaps onto the Multi-Fill injector. You don't have to be a professional plumber to use it.

A fingertip knob controls the flame precisely. You get the bluest flame possible. The steadiest pinpoint flame. (The steadier and bluer the flame, the more intense the heat, the faster the job gets done.)

And you won't have to take this torch apart to clean it between jobs. It's completely self-

cleaning. It just won't clog.

Now.

Where can you get your hands on the new Ronson Varaflame Torch?

Anywhere hardware is sold. The price, complete with large-size, 76 gram Ronson butane Multi-Fill injector, just \$4.95.*

Isn't that a small price for this amazing torch?

RONSON® Varaflame Butane Torch



SOLDERING TIPS FOR HOUSEHOLD REPAIRS



USE A HEAVY FILM OF SOLDER

Keep it between the soldering tip and the work. This helps conduct and spread the heat, makes the soldering job faster and easier.



USE A DUAL HEAT GUN

High heat is essential for a good flow of solder when you join or mend metal. You get both high and low heat from a single tool with a Weller Heavy-Duty Dual Heat Soldering Gun.

When you pull the trigger of a Weller Heavy-Duty Dual Heat Gun, heat and spotlight come on instantly. Two trigger positions let you switch instantly to high 325-watt or low 240-watt heat to suit the job. Special tips do many jobs other than soldering—such as cutting floor tile, sealing bags, and repairing utensils made of thermoplastics.

Kit includes dual heat gun; tips for soldering, cutting and smoothing; tip-changing wrench; solder; rugged utility case. Model D-550PK—\$12.95 list. Weller Electric Corp., Easton, Pa.

Weller

WORLD LEADER IN SOLDERING TECHNOLOGY

Noteworthy New INVENTIONS

By M. J. Pedersen

Bowling from a wheelchair is possible for the disabled with the aid of a slidelike device. The trackway, which consists of two aluminum bars and braces, may be adjusted by the handicapped bowler, who then shoves the ball down the slide, aiming the ball by positioning the slide. Robert V. Ikenberry, Mason City, Iowa, received patent 3,159,401 for his idea.

Tap-proof cable, to be used in communications, earned patent 3,160,871 for Solomon Rubinstein of Fanwood, N.J. Twisted wires contained in spiralled ribs of the inner layer of the cable, are completely encased by an outer jacket over the ribbed surface. Like the usual cables having a layer of straight outer wires which are fairly easy to bypass, the twisted wires also carry an electric current designed to sound an alarm when the cable is bugged. However, the spiral structure of the ribs, and the twists in the wires contained in them, make it virtually impossible to unpeel the outer covering and unbraided the wire to form a bypass.

Legislation that would substantially increase patent fees has again been introduced in Congress. Each of two bills, one proposed by Senator Thomas J. Dodd of Connecticut and the other by Senator John L. McClellan for the Administration, is intended to make the Patent Office more nearly self-sustaining. Following is a list of present fees and those proposed in the new bills:

	Now	Dodd	McClellan
Filing application	\$30	\$70	\$50
Patent issue	\$30	\$70*	\$75
Appeal	\$25	\$25	\$25
Supporting brief		\$25	\$50
Oral hearing		\$25	
Recording assignment	\$3	\$20	\$20
Reissue application	\$30	\$70	\$50

*In an effort to get his bill passed, Senator Dodd reportedly will request, when his bill goes to Committee, that the issuance fee be raised to \$150.

In addition to the basic application fees, claims (which now cost \$1 each over 20) would cost \$5 each over 10, as proposed in

(Please turn to page 35)

Noteworthy New Inventions

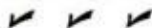
(Continued from page 26)

the Dodd bill; in the McClellan bill they'd cost \$10 for each independent claim over one up to nine and \$2 for each claim (independent or dependent) over 10. Out of a current average of 12 claims (descriptive paragraphs) appended to an application, between 8 and 10 are usually independent, which means that a claims charge of \$78 to \$94 (depending on the type of claim) would be added to the basic Administration application fee, bringing the total cost of filing an application somewhere between \$125 and \$150. The average extra charge to be added to the Dodd basic fee would be \$10, bringing the total to \$80.

Then at the time of issuance, the McClellan bill would require a further charge of \$10 for each printed page of specifications (the average is around six) and \$2 per page of drawings (two is average) tacked onto the basic fee; and \$10 for each claim over 10 would be added to the Dodd fee.

Now we come to the provision of the McClellan bill which proved so controversial in the Senate when the bill was first introduced last year, namely a maintenance fee. As modified, the bill offers an inventor the option to pay at the outset (in addition to the \$75 patent issuance fee) a \$75 maintenance charge to cover the entire 17-year life of his patent. The alternative would be to pay, not \$75 but \$300, in three installments as follows: \$50 after the fifth year, \$100 after the ninth, and \$150 after the thirteenth. Nonpayment would void the patent unless it has not earned as much as the maintenance fee. In the event it has not, either or both of the first two payments may be deferred until the next due date. But after the thirteenth year the full amount must be coughed up or the patent will lapse.

The theory behind this aspect of the Administration bill is that a patent which has not earned as much as its maintenance fees during the first 13 years would be permitted to lapse for the remaining four years of its life, thus saving the inventor \$300.



Portable sleep-inducing apparatus, which passes an electric current to the brain through electrodes attached to the patient's head, earned patent 3,160,159 for Jusha Borisovich Hoody, Viacheslav P. Kootinov and Vasily S. Bulba-Popkov, all of Moscow, U.S.S.R. A means for treating various diseases, the device is especially designed for use away from a hospital—at home, transporting patients or under field conditions.

APRIL 1965

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is making grass
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these days



Parker is making grass greener these days with the Thatch-O-Matic Power Rake. Here's an easy way to remove thatch (matted dead grass imbedded in the turf) that makes lawns brown, ugly. No more arduous hand raking... no more damage to living grass. You can rent the Thatch-O-Matic at most Hardware Stores and Garden Centers.

PARKER is keeping grass **GREENER** these days

After de-thatching your lawn, keep it greener by regularly using a Parker Lawn Sweeper or Vacuum. Unlike the bag-type mower that catches only a portion of the grass clippings as you mow, a Parker Sweeper easily removes practically all of the grass clippings, leaves and other debris; prevents thatch build-up... keeps your lawn greener. Manual, trailer and powered sweepers and vacuums are available for rent or sale.

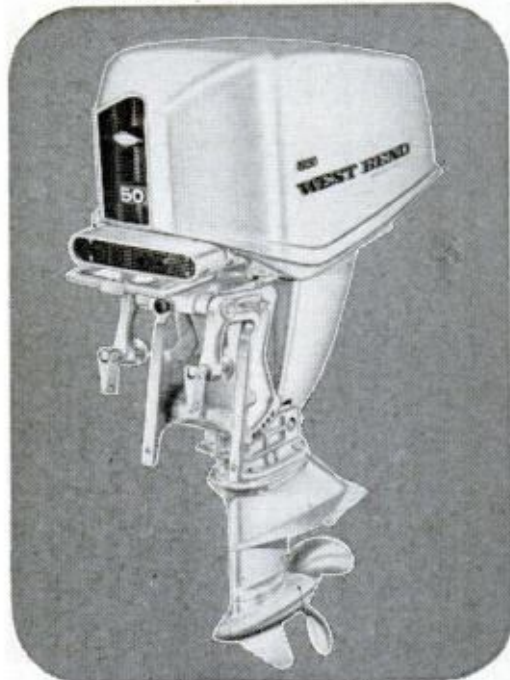


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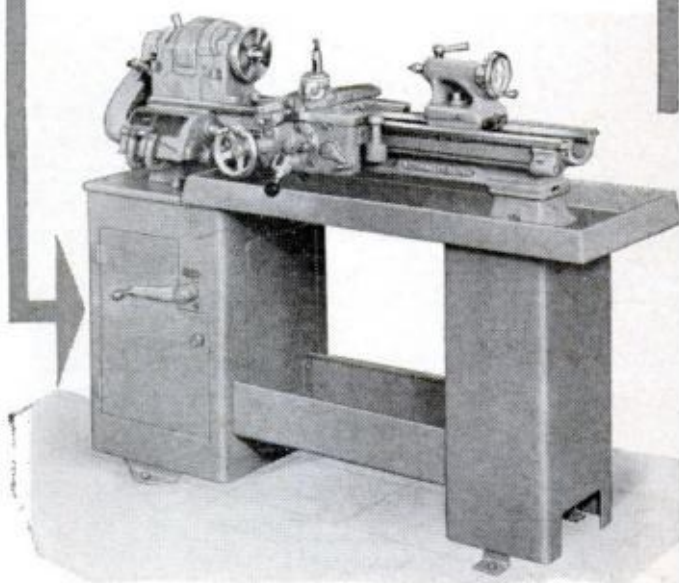
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10" LATHES

with new
welded steel
floor legs



- New, trim floor legs . . . reinforced construction of welded, heavy gauge steel . . . maximum rigidity with minimum weight . . . no increase in price!
- Famous South Bend dependability.
- Superfinished spindles and bearings for uniform accuracy and fine finishes.
- 70 screw threads (4 to 480 per in.) . . . 70 longitudinal feeds . . . 70 cross feeds.
- Tool room and Engine Lathe models . . . prices start at \$1396 f.o.b. factory.

WRITE FOR CATALOG

*of South Bend Lathes, Milling Machines,
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SOUTH BEND LATHE, INC.

South Bend 22, Indiana

Building Better Tools Since 1906

up to 36 months to pay



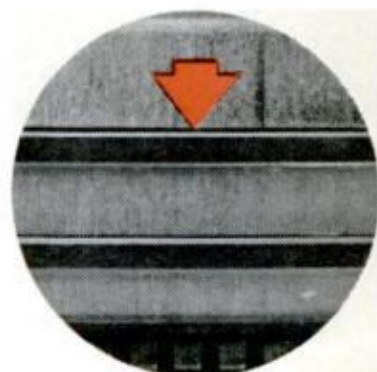
"It's doubtful that we could have won the Indy 500 without Perfect Circle ductile iron top rings."



Left: George Bignotti Right: A. J. Foyt

That's what A. J. Foyt's chief mechanic and world-famous racing engine expert, George Bignotti, thinks of PC durability. The piston at right dramatizes his point. It's an actual nurlized piston from A. J.'s winning 1964 car. The wear in the top compression ring groove is *three times* greater

than normal — caused by fire extinguisher chemical residue on the track. Yet, despite this unusual punishment, new Perfect Circle ductile iron top rings on all four pistons continued to perform perfectly. No wonder Perfect Circle piston rings rate so high with top racing experts.



Top ring groove in piston from Foyt's Sheraton-Thompson Special wore to side clearance of .010". Normal clearance is .003" to .0035".

PERFECT CIRCLE

A SUBSIDIARY OF  DANA CORPORATION

CLINIC FOR HOMEOWNERS

Q In repainting my kitchen, how can I remove the decals at the corners of the cabinet doors? Sanding has proved too slow, and scraping is not very effective. Is there an easier way?—N.D., Calif.

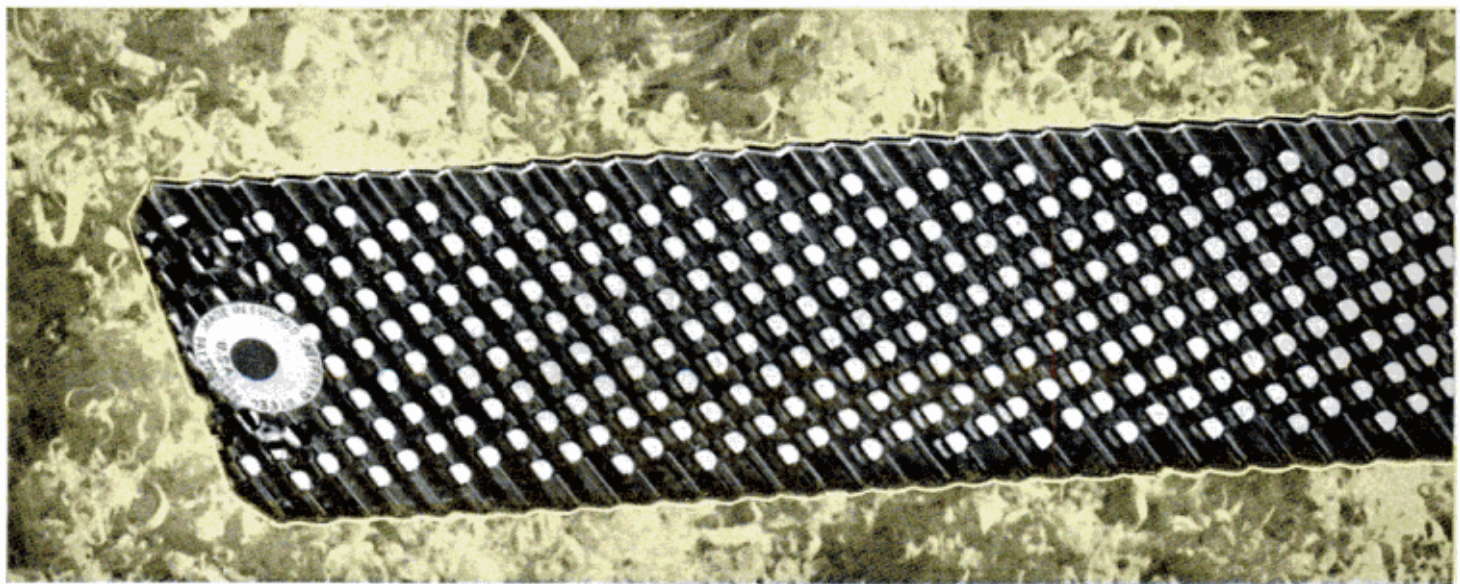
A If the old paint on the cabinet doors is to be removed, the remover will take off the decals along with the paint. But if the old paint is to remain, the decals can be removed by wiping with a cloth pad saturated with lacquer thinner. Wear rubber gloves to prevent the thinner from contacting your hands and remember that lacquer thinner is a highly flammable, volatile solvent and must be handled accordingly. Have doors and windows open to provide ventilation. When not too many decals are involved, ordinary nail polish remover is a good substitute for the lacquer thinner. Before applying new

paint or enamel, sand the spots where decals have been removed.

Q I've recently bought an older home, a bungalow, with a stone and concrete porch. The porch roof is supported by stone posts or pillars. House walls are of brick. I've just noticed that the hardwood floor along the front, inside from the porch, has pulled away from the wall. The ends of some of the floor boards are now exposed at the edge of the quarter round. What's happening and what can I do?—P.G., Mich.

A We can't tell just what is happening from your brief description. However, we'll guess that the porch has tilted slightly outward, taking the house wall with it. A check with a builder's level will probably show the house wall, and basement wall (if there is a basement) out of plumb. As you describe it, the porch is unusually heavy. If not installed on an adequate footing it probably has settled in front, causing the forward tilt. Assuming the porch has a concrete floor, the latter has probably bonded solidly to the wall. Thus, the porch's forward tilt would tend to pull the house wall outward. If

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Surform Tools are the fastest way ever invented to shape, file, smooth, trim and form. At the business end, you get a unique Sheffield tool steel blade with 450 razor-sharp, offset cutting edges that can't clog—because all the shavings pass clean through the holes.

Just try a lightweight, Surform Tool on wood, plastics, soft metal, composition board or Fiberglas®. And you'll discover why this is truly the quality tool of 1001 uses. Surform Tools—exclusively from Stanley Tools, Division of The Stanley Works, New Britain, Conn. File, plane, pocket and drum types sold practically everywhere.

there is a basement, there may be a crack—probably invisible—at the point where the porch floor joins the wall. It is possible that the condition has stabilized and that settling has ceased. If so, there is nothing to worry about presently. However, check on the visible crack between the floor boards and the wall periodically. If the crack continues to open or that portion of the structure involved shows any other appreciable sign of change—such as bad cracks in the plaster or drywall, binding of doors and windows, cracks in the foundation wall, and the like—have the condition checked by a contractor with equipment and skill for a corrective job.

Q I'm told one should never paint a ladder. Right? If so, can you explain why?—L.T., Colorado

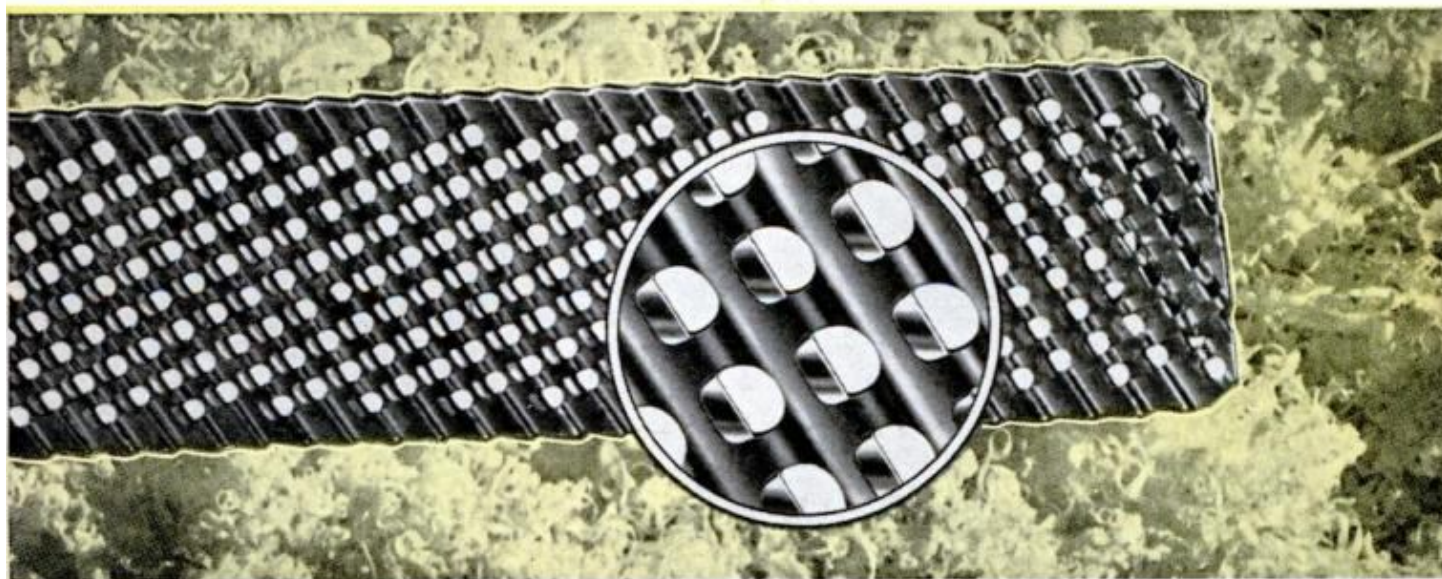
A Right, at least theoretically. However, such a "rule," really applies to heavy extension ladders and perhaps the larger stepladders made of wood. Painting such ladders increases their weight and may even make the steps or rungs slippery. In addition, some of the paint on a ladder chips and wears away, admitting moisture to the wood. The re-

maining paint will then retard the wood's drying. If the ladder is kept out of the weather at all times when not in use, it's permissible to coat it with a varnish that has been reduced with turpentine, or with one of the new penetrating oil and resin base finishes.

Q I wish to make a "wall scrapbook" by pasting old newspaper clippings, old maps, etc., to one wall of a room. What paste or adhesive should I use? Will wallpaper paste do it?—A.Y., Ariz.

A If you mix wallpaper paste to a fairly heavy consistency you probably would have little trouble with the ink on old newspaper clippings running or blotting. But unless you are careful to spread the paste thinly and uniformly the type on the paste side may show through the front. It would be well to experiment by pasting waste clippings to a similar surface, such as a piece of plasterboard. You also might try a white glue thinned about 25 percent with clean water. Apply with a fine-bristle brush, being careful to spread the adhesive to a thin, uniform film. Wash the brush occasionally in clean water as white glue sets quite rapidly.

450 razor-sharp reasons why:



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Here is one field where mature men can earn better pay—have unlimited job opportunities. No need to wonder how you'll make ends meet if laid off, replaced by a machine, disabled, forced to retire! Locksmithing skill lets you say goodbye to such worries—CASH IN FAST in a big opportunity job or your own high-profit business spare-time, or full-time.

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Items from All Outdoors

When we are not worrying about the whooping crane or the decimation of the elk herds, we can always work ourselves into a good state of despondency over the pollution of the nation's streams. In recent conversations with five top outdoors writers from different parts of the country, I have been surprised to hear all of them say exactly the same thing: *within 20 years there will be no inland fishing in the U.S.* And they attribute this mainly to continuing pollution.

Intrepid mountaineers without the knowledge or experience to tackle an expedition will welcome the California Mountaineering Guide Service, a group of young climbers who have set up a schedule of guided tours that will run from June 25 to Sept. 1. This is an exciting undertaking, and if the U.S. Dept. of the Interior is correct in its estimate that 5000 Americans take up this sport every year, there should be plenty of customers.

One of the tours is a month-long trek of the Teton and Wind River Ranges, the Canadian Rockies and the Bugaboo Mts. in British Columbia. No experience is required, and all you bring along is your clothing, a sleeping bag, boots and backpack. All other equipment, food, shelter and transportation from San Francisco is supplied. Cost for the full month is \$550, but you can also go for a week or two.

They have also scheduled shorter trips in the Sierras, and they'll be running a climbing school near Lake Tahoe. Write to 308 Columbus Ave., San Francisco, Calif., for their brochure.

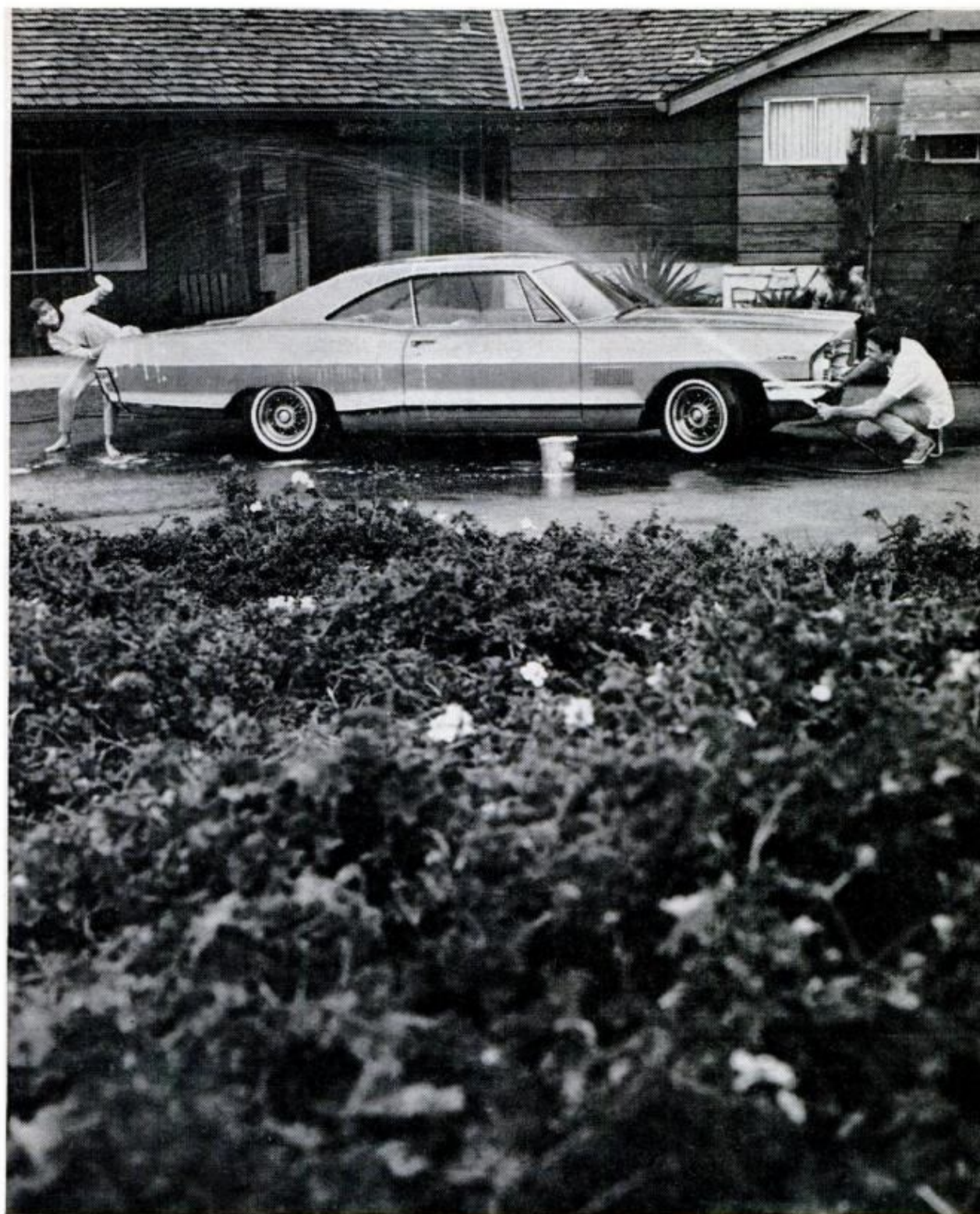
For the serious backpacker, the pack frame is a crucial piece of equipment, and a good one has always been expensive. But now you can get a top-quality frame in a kit for only \$9.95. It was designed by Dick Mack, a veteran hiker.

When it's assembled, you have an aluminum contour frame that rides above the shoulders for easy carrying. Called the Teton Pak-Kit, it comes with simple and complete assembly instructions, and the only tools required are a screwdriver, pliers, hammer and knife. You can get a brochure from Himalayan Pak Co., Cannery Row, Monterey, Calif.

STUART JAMES

Outdoors Editor

POPULAR MECHANICS



Pontiac Motor Division • General Motors Corporation

Stop telling me I'm beautiful. Love me for what's inside.

Of course the 2+2 is beautiful. If it was ugly it wouldn't be a Pontiac, right? The real reasons for wanting a 2+2 are unseen mechanical things. But they can be felt, oh boy, can they be felt. (The 421-cu. in. V-8 engine can also be heard occasionally. It makes a very stirring noise.) The 2+2 has a standard equipment 3-speed all-synchro transmission, with a Hurst shifter, lemme-at-em suspension that makes it handle and stick to the road like a little-bitty old sports car, and very secure-feeling bucket seats—all silent, but very impressive. There's a lot of wild optional stuff too. To be honest, we think the insides are as beautiful as the outside, but then we build it.

Wide-Track Tigers: 2+2/GTO

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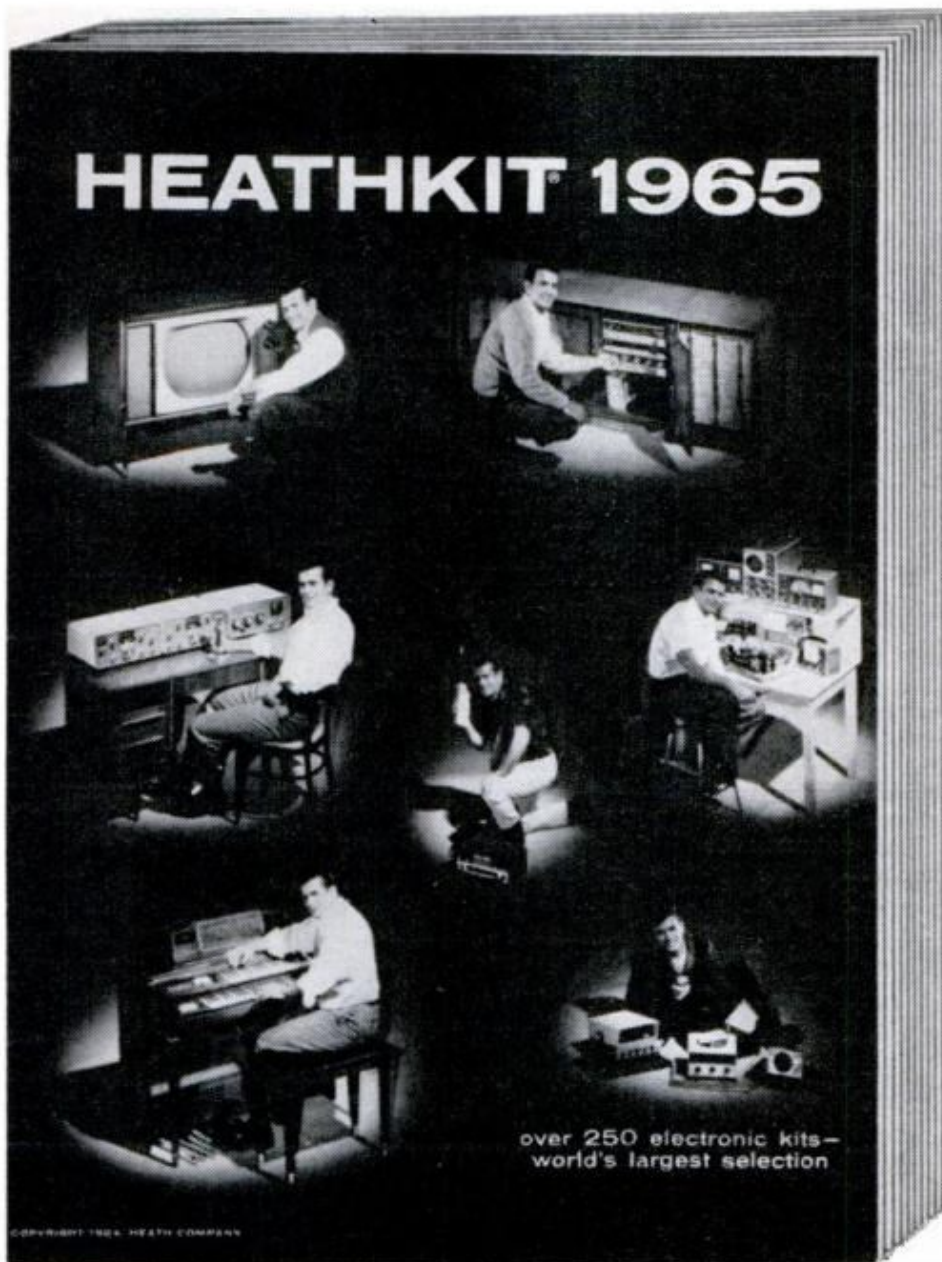
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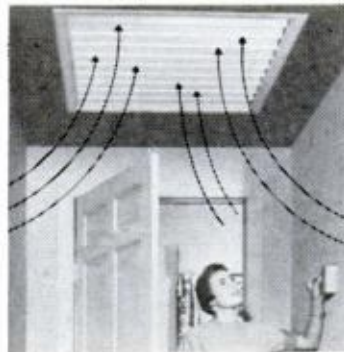
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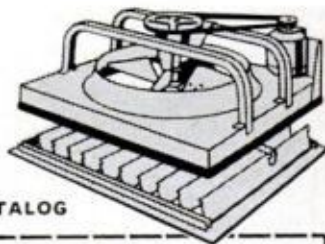


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“Get the message your plugs give you”

*says Parnelli Jones,
1963 Indianapolis winner*

Every time you pull the spark plugs from your engine, look 'em over. They can tell you a lot about the engine's condition.

If you find one or two plugs, say, fouled by wet, sludgy deposits, suspect worn rings or pistons or too much clearance between valve stems and guides for those cylinders. Worn or loose bearings are another possibility. Burned or overheated plugs—with white, burned or blistered noses and eroded electrodes—generally indicate inefficient engine cooling, overheating due to wrong ignition timing or a need for “colder” plugs. If just a couple show that condition, however, the trouble might be as simple as loose plugs!

It's mighty important to tighten plugs properly. Do it with a torque wrench. Here's a table that shows the amount of torque for different plugs:

Plug Hex. Size	Thread Size	Correct torque in foot-pounds	
		Cast iron heads	Aluminum heads
5/8"	10MM	15	10
13/16"	14MM	30	25
7/8**	18MM	40	35
15/16"	7/8"-18	45	40

*13/16" with tapered seat—torque to 15 to 20 ft.-lbs.

In a pinch, use a ratchet wrench with short handle and tighten each plug about $\frac{3}{4}$ of a turn after plug begins to compress the gasket.

It's mighty important to use high-quality plugs, too. I like Autolites. Autolite heat-seals every plug it makes, fusing the center electrode to the insulator under tremendous heat and pressure to prevent compression leakage. Nearly everyone does this with racing and aircraft plugs. But not everyone does it with regular passenger-car plugs. Autolite thinks the extra protection is worth it. I think so, too.

AUTOLITE SPARK PLUGS

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HERE ARE SOME OF PARNELLI JONES' RACING ACCOMPLISHMENTS: Indianapolis 500—Winner, 1963; top qualifier, 1963, 1962; Pikes Peak—Stock Division champion, 1964, 1963; Milwaukee—Seven stock car wins and a USAC 200-mile championship victory in past two years!; Trenton—Winner, USAC 200-miler, 1964; Riverside—Winner 200-mile Sports Car Grand Prix, 1964 (his 1st sports car race!).

Take Charge of Your **CAREER**

(Where are the good jobs today and tomorrow? What do you need to land them? How can you "fireproof" yourself against automation, and how are others succeeding in cashing in on automation's challenge? Beginning in this issue, PM will bring you no-nonsense answers to the questions that can determine your future.)

By Richard Dunlop

AUTOMATION is not the job-devouring monster many experts thought it would be. As New York University economist Peter Drucker points out, the total number of available jobs in the U.S. has been growing at an annual rate of 1 to 1.5 million per year.

Factory jobs—those reputed to be the most vulnerable to automation—have been growing at *twice* the rate of other types of jobs since 1961.

Even as they grow in number, though, job opportunities are changing in an important way: More ingenuity and more training are required to land them and hold them. Korean War veteran Herb Eggleston found this out. Herb operated a turret lathe in General Electric's sprawling Cleveland plant. But he learned on the company grapevine that his job eventually would be automated out from under him, not a pleasant thought to a man who had been a securely entrenched home provider for seven years.

Dodging Pink Slips

Herb decided not to wait for the inevitable pink slip. He did some digging and found out that there were jobs, demanding more training, going unfilled in the plant where he worked. One job with a good future was that of draftsman. The trouble was that Chesterland, the suburb where the Egglestons lived, was too far from downtown Cleveland for Herb to take night courses in a trade school. So he enrolled for the International Correspondence School's mail order course in machine design.

Taking a break only for his two-week vacation, Herb finished his 700 study hours in about a year. At his request, the school

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Your water can have excess chlorine, and taste like the bottom of a swimming pool. Or, it can be loaded with hydrogen sulphide, and have a rotten-egg taste. Or it can be rusty, so that it stains toilet bowls, sinks, and laundry. Or, it can be filled with algae, dirt . . . even worms!

Worse still, water can be contaminated with disease-causing bacteria.

What you can do

Three basic products — used separately or in combination — will solve the majority of your water problems. These products are simple to understand, low in cost, and quite easily installed.

Get good-tasting water!

The Aqua-Pure Taste and Odor filter makes water taste *good*. It removes excess chlorine, removes sulphur, removes other bad tastes or odors — to give your family all the spring-fresh water they can ever use. You'll really *enjoy* drinking water again! Coffee, tea, and iced-drinks, too!



had informed GE of his studies and when he had completed his course, his company handed him, not a pink slip, but a new job as a beginner in their drafting department—at a raise in pay. Herb then went on to take an advanced machine design course. He is now a detail draftsman and, for good measure, the proud father of his first child.

Meanwhile, back at Herb's old turret lathe, a revolution is taking place. It and other types of shop machinery are being automated to run by tape- or card-activated systems. This means two new specialists—men who can *program* and men who can *maintain* the more sophisticated monsters—will have to be found. Learning computer programming or, as Herb did, the elements of machine designing, will make you a likely candidate to ride herd on the automated shop equipment of today and tomorrow.

"Fireproofing" Yourself

Herb, by the way, has just signed up for additional courses which will lead to a degree in mechanical engineering. He has the right idea: Nonstop education is the key to "fireproofing" yourself today.

Maintenance of automation's brain-children is indeed a critical need these

days. We know of one steel company that spent two years getting ready to change over to a new oxygen steel process. They carefully trained a maintenance force to handle the new equipment *before* they began using it. Result: On opening day the new mill started running smooth as molten syrup, and it has been running smoothly ever since.

Meanwhile, another steel company ordered new equipment but forgot that it would take newly trained specialists to maintain it. Result: a crash training program at overtime pay to secure these badly needed specialists. Meanwhile, the shiny new equipment stands idle.

Success When Depressed

Lloyd Boudreau's problem differed from Herb Eggleston's. Lloyd, who lives in the depressed Upper Michigan Peninsula town of Gladstone, was laid off at the Harnischfeger plant in nearby Escanaba. For four months he was jobless. Then he moved into a boarding house at Marquette, 60 miles away from his wife and kids, so he could study welding at Northern Michigan University, under a program sponsored by his union, United Auto Workers Local 632, and the Har-

(Please turn to page 50)

Remove bad taste, rust, dirt... kill bacteria!

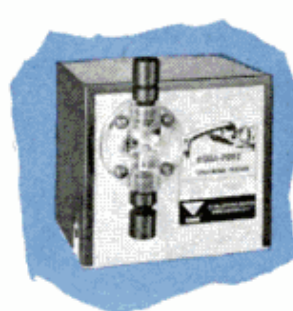
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16 PAGES OF FACTS EVERY HOME-OWNER NEEDS

Take Charge of Your Career

(Continued from page 49)

nischfeger management. Through the Federal Manpower Development and Training Act, Lloyd received a training allowance roughly equivalent to what he would have received in unemployment compensation, plus a subsistence allowance because he had to live away from home. When he had learned welding, Harnischfeger had a job for him.

Altogether, 86 percent of the unemployed men retrained under this MDTA program on the Upper Michigan Peninsula have already found new jobs.

Aerospace's Gold Tarnish

Much has been written about the golden opportunities in that glamour business—the aerospace industry. Now Arthur D. Little, Inc., industrial research and management consulting firm in Cambridge, Mass., reports that the aerospace industry faces a saturated market.

Aerospace defense production will decline about 30 percent, and aerospace research will drop 15 percent, the Little report notes. Over 30 percent of the scientists and engineers employed in private industry work in the aerospace field, and many will have to find other jobs.

At the same time, a recent check by *PM's* West Coast editor showed that the aerospace industry is still hiring. A Sunday issue of the *Los Angeles Times* carried 75 full columns of employment opportunities in aerospace. Most of the jobs required technical or scientific schooling and/or experience. Some of the jobs: computer key punch operators, computer programmers, semiconductor specialists, astrodynamicists, cryogenic specialists.

The Overlooked Skill

Market saturation also caught up with an exterminator in Paterson, New Jersey. He exterminated insects with such zeal that he exterminated his own job.

He was unemployed for six months before he was interviewed by Bernard Haldane of the Foundation for Re-Employment, 745 Fifth Avenue, N.Y.C. Haldane, as he usually does, asked him what he thought his earliest achievement was.

"When I was a kid, I made the first crystal set on my block," he said. "I made crystal sets for everybody who bought me the parts. I must have made forty."

He also made radios, and he could repair six kinds of TVs.

"I like to invent things," he said. "When I was working as an exterminator I invented an electronic device which amplified the sound of termites chewing inside a

piece of wood. You stuck one of these gadgets against a wood house, and when the property owner heard the bugs chomping, he bought our services. Then there were no termites left."

"Why don't you become an electronics technician?" asked Haldane, impressed by his ingenuity.

"I never finished high school."

At Haldane's urging he went to evening school and studied electronics. Now he is a well-paid troubleshooter on an electronics production line.

Because they are accustomed to fixing things, many farmers, faced by dwindling prospects in farming, find new careers servicing equipment in a nearby town.

Farmer Harold Davis of Junction City, Oregon, decided the electronics industry had the best prospects for him. So he kept on farming while he took a home course in electronics through the National Radio Institute, 3939 Wisconsin Avenue, N.W., Washington, D.C. Even before finishing the course, he began repairing neighbors' gear. Today, five years later, he owns Davis' Radio and TV Service. He has 600 regular customers, his own service wagon, and his stock of parts, tubes and test equipment is all paid for.

List Industries That Need Help

Want to do some career crystal-balling on your own? There are interesting area and job studies contained in a series of Manpower Research Bulletins. You can obtain them by writing to the Office of Information Publications and Reports, Dept. of Labor, 14 St. and Constitution Ave., Washington, D.C.

Bulletin No. 1, for example, lists some critical occupations in which there is a current shortage of help. Those which do not require one or more college degrees or equivalent experience include: aircraft and engine mechanic; forging die setter; electronics mechanic; lab apparatus glassblower; instrument repairman; jig and template maker, machinist; patternmaker; tool and die designer; tool and die maker; and technicians and vocational teachers in these critical areas.

If you are interested in obtaining a free directory of schools which offer courses in these and other technical specialties, write to the Careers Editor of *Popular Mechanics*, 575 Lexington Ave., New York 10022, N.Y.

He would also like to hear from any of you who have, in the last few years, turned a pink slip or the threat of one into a ticket to a bright future. It's up to individuals to meet the changing challenge in today's job market, and we want to report how some are turning the trick. ★★★

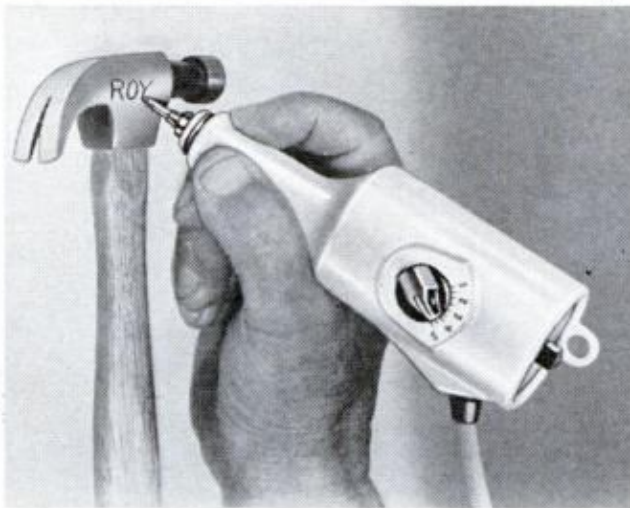
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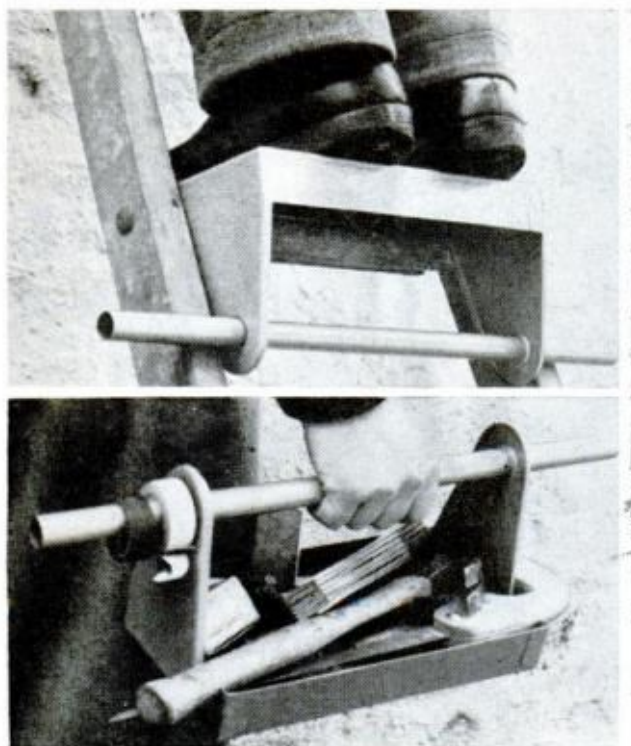
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New on the Market

REPAIR GUTTERS AND DOWNSPOUTS with Duro-Plastic patch kit. For pinholes, it contains a plastic rubber coating. For rusted out areas, there's 48 sq. in. of plastic-impregnated, adhesive-backed paper which you press over the opening, then coat with the pin-hole sealer. Retail price is \$1.35. Made by Woodhill Chemical, 18731 Cranwood Pkway., Cleveland, Ohio



THE TOTE STEP is a tread which hooks over the rung of a ladder to create a broad surface to stand on. Besides easing the burden on your feet, it reduces the chance of your slipping off. Also makes a good tool carrier (bottom photo). Costs \$5.60 in steel, \$8.60 in aluminum. Reyco Gifts, Box 187, Mt. Morris, Illinois



BRILLIANT WELDING LIGHT—15,000 candle power—fastens to arc welder's helmet to permit viewing the work right through the protective glass. Using power from the welding rig, it switches on automatically when mask is in working position, switches off when the arc is struck. Weld-Lite fits any helmet, sells for \$24.95. Henes Mfg., 4301 E. Madison St., Phoenix, Ariz.

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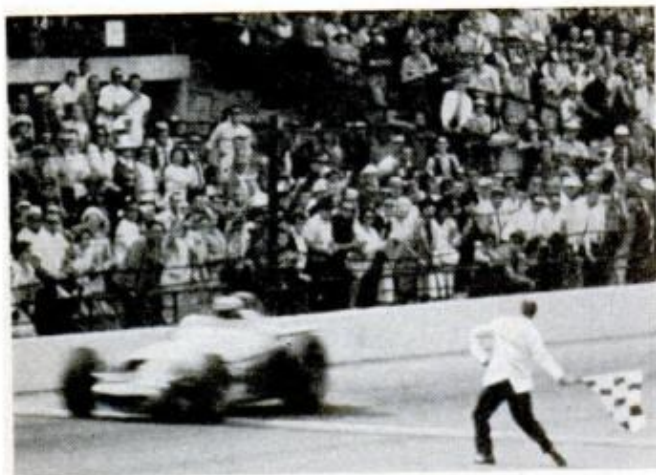
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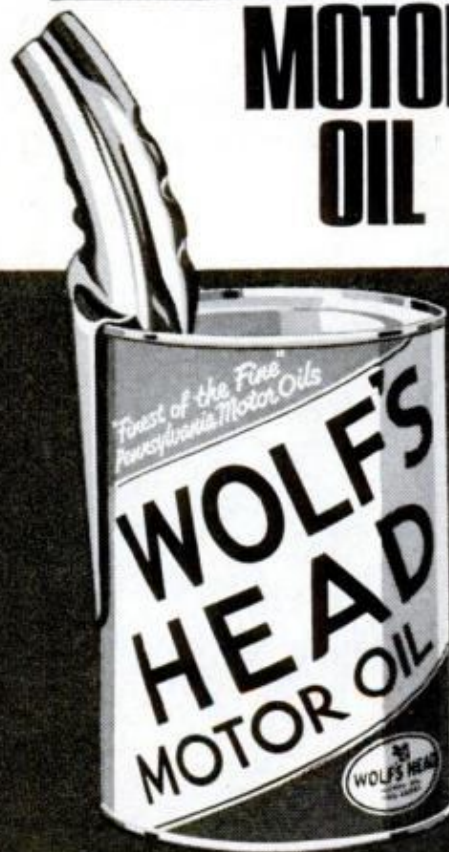
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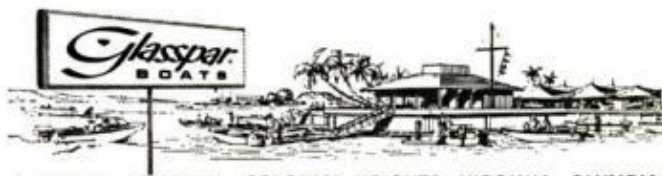
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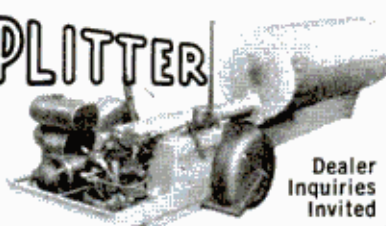
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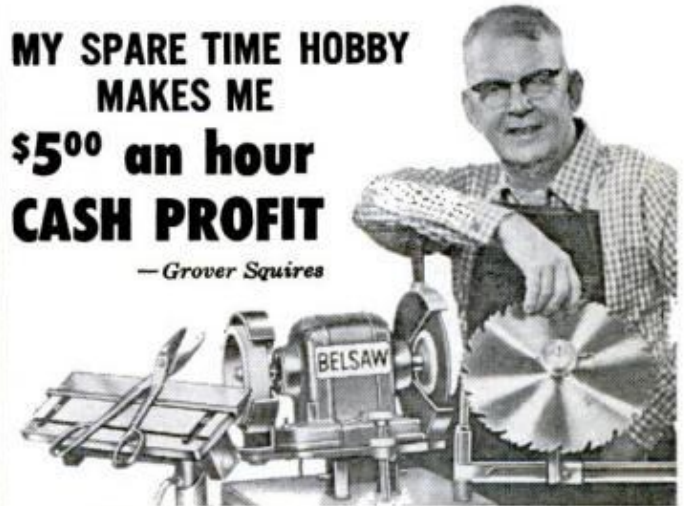
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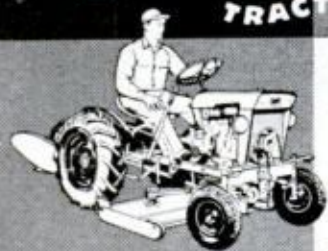


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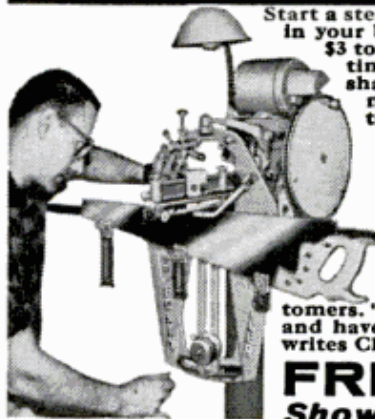
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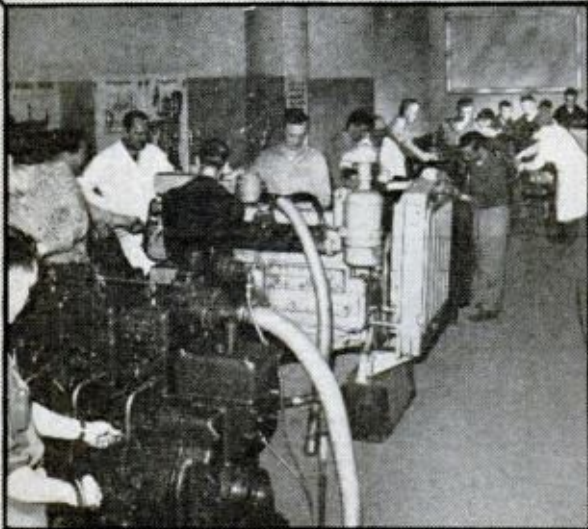
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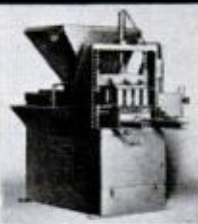


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FREE Booklet! Profitable, spare-time business bronzing, Pearl-koting baby shoes! Complete set-up on order. Kiktavi, Box 34861-B, Los Angeles, California.

TO \$100.00 weekly! Mailing catalogs! Sample, instructions, 25¢. Costar, GPO Box 972-PM, New York 10001.

BAKE New greasless doughnuts in kitchen. Stores buy output. Start spare time. Profit 29¢ dozen. Small appliance. Free recipes. Montgomery, 3605 South 15th, Minneapolis 7, Minnesota.

STOP Throwing away box-tops! They're worth money! Some, 25¢! Inquire: "Box-tops-MB", Cedar Hill, Texas.

INVESTIGATE Fires, storm damage, accidents for Insurance Companies. Pays up to \$1,000 a month, part or full time. No college necessary. Car furnished; expense paid. We train you at home in spare time. Keep present job until ready to switch. Pick your location. Men badly needed now. Full information free. Write Liberty School, Dept. C-511, 1139 W. Park, Libertyville, Illinois.

PROFITABLE Mail order business. Be independent. Details free. Ideal, Box 357-DZ, Valley Stream, N.Y.

DIRECT Rock bottom wholesale sources! Buy for pennies! Sell for dollars! Free Details. Joric, Dept. 504, Box 6751, Portland, Oregon 97266.

76 MILLION Prospects! Immediate profits! Selling Champion, AC, Autolite spark plugs. Precision reconditioned, silvery-plated, guarantee 10,000 miles. Up to 308% profit. Free samples, details. Indy 500 Spark Plug Co., 4620 Braeswood, Houston, Texas 77035.

CONCRETE Facts: Cement Artists make big money. Home Shop—Simple Equipment—Copyrighted Methods and Formulas. Make, Color and Marble Glaze beautiful Cement Pottery without molds. Wishing Wells, Bird Baths, Waterfall, Rustic Garden and Patio items. For free illustrated Brochure, write Hollywood Cementcraft, 602 E. Athens St., Altadena, California 91001.

ESTABLISH Your own home operated, profitable business! Particulars free! MacMillan, 2020-C Marlowe, Lakewood, Ohio 44107.

FREE "Franchise Profit Letter" tells how unique NFR service is helping thousands seeking profitable businesses. Write today. National Franchise Reports, W-528, 333 North Michigan, Chicago 1.

SECRETS! Secrets! Mail order success revealed by internationally famous expert who discovered how to make home business fortunes. Beginners: Get free copy "How to Make Money in Mail Order." Discloses free advertising, profitable products, everything! No obligation. Write Mallico, 1554 Sepulveda, Dept. P-704, Los Angeles 25.

PACKAGE At home for profit! We supply everything. No "selling." Free home business details. HPC, 807HPJ Sunset, Los Angeles 12.

REPAIR Hydraulic jacks. Details free. Write: Hydraulic Parts Supply, Box 3645, El Paso, Texas.

FREE Facts and descriptive bulletin. Be an air conditioning, refrigeration, and heating serviceman. High pay, jobs open everywhere, operate your own service business, no school or correspondence necessary. Write Doolco, Trouble Shooter, 2016 Canton, Dallas, Texas.

"MAILORDER — Stop looking!" Get your own catalog! Methods, 1808-FD, Lafayette Hill, Pennsylvania, 19444.

START Your own business on credit. Your own boss. Hundreds of dealers making \$100 to \$300 and more weekly. We supply stocks, equipment on credit. 300 home necessities. Sales experience unnecessary. Pleasant profitable business backed by world-wide industry. Write Rawleigh, Dept. D-U-PPM, Freeport, Ill.

\$70.00 WEEKLY—home, spare time. Simplified mail bookkeeping. Immediate income, easy. Auditax, 34741a, Los Angeles 34.

MAKE \$46 From square foot plywood: jigsaw necessary. Free details. Woodart, Bridgewater, Mass.

EARN Money raising fishworms for us! Write: Oakhaven-38, Cedar Hill, Texas.

HAWAIIAN Jewelry sells fast because it is new and exciting. Details free. Chandlers, Wailuku, Hawaii, Dept. 345.

MAKE \$50.00 Daily! Sell air operated vacuum cleaners to service stations for \$19.50. Your cost \$9.50 postpaid. Free details. Inka Industries, 2401 Crocker, Houston 6, Texas.

I MADE \$40,000.00 year by mailorder! Helped others make money! Start with \$10.00—Free proof. Torrey, Box 3566-Y, Oklahoma City 6, Oklahoma.

MAILORDER Laws, \$2.00. Calvin Kahn, Attorney, 4504 Pine, Philadelphia, Pa.

BUILD Custom cases at home for profit. Get orders by mail. We supply materials, instructions, everything. Free home business details. Customcase, 805CPJ Sunset, Los Angeles 12.

IMPORT-Export opportunity, profitable world-wide, mailorder business from home, without capital; or travel abroad. We ship proven plan, for no risk examination. Experience unnecessary. Free details. Melinger, P704, Los Angeles 90025.

MAIL Baby catalogs to new mothers for big profits! Details, catalog 25¢. Volz-PM, Ypsilanti, Michigan.

HIGH Weekly Earnings. Address-mail letters featuring real merchandise. Receive \$10 with every order—keep \$8 profit. Supplies furnished. Free particulars. Modern Merchandising, Box 357, Oceanside, New York.

BIG Money—Operate your own fix-it shop. Service all household appliances: irons, fans, refrigerators, automatic washer-dryers, etc. Know how they work, what goes wrong, and how to fix them. Learn how to do house wiring, commercial wiring, rewind motors of all sizes, sharpen mowers, skates, saws. How to get business, buy spare parts wholesale. What to charge for your work. Free Book. Christy Trades School Inc., Dept. A7103, 3214 W. Lawrence Ave., Chicago, Ill. 60625.

SHARPEN And serrate steak knives, scissors, pinking shears, etc., for profit. One low cost machine. Free details. Beaver Machine, Box 121, Gardena, California 90247.

\$50 PER 1000 possible. Addressing 1000 envelopes. Longhand-typewriter home-spare time. Free particulars. General Enterprises, Box 303, Island Park, New York.

JUST 3 Servicemen bring you \$18 hourly profit. Duraclean dealers gross \$6.00 hourly each serviceman . . . \$9.00 hourly on own service, using national price guide. Quickly learned, easy to do. We show you step by step. Few hundred dollars builds your own nationally advertised business while continuing present job. Operate from home. Start small, grow big in booming business. Investigate immediately . . . before your territory is taken. Free illustrated booklet explains everything. Send for it, then decide. Duraclean, C5-162 Duraclean Building, Deerfield, Illinois.

MAKE \$32 From 49¢ piece vinyl. PMA-1834 Edgeland, Louisville, Ky. 40204.

LEARN Bonsai! Duplicate exactly \$500 imported Oriental Tiny Trees in few hours! Grow living miniatures too; and tiny forests in bowls. Profitable home business! Request free fact pack, free sample seeds! Minitree, Box 23023-TA, Los Angeles 90023.

FABULOUS Profits! Operate successful mail order business. Receive \$25 with every order—keep \$20 profit. Orders filled Free. Write for details. Home Industries, Box C-13, Atlantic Beach, New York.

PIANO Tuning learned quickly at home. Tremendous field! Musical knowledge unnecessary. Information free. Empire School of Piano Tuning, Box 327, Shenandoah Station, Miami, Florida 33145. (Founded 1935).

400,000 BARGAINS below wholesale! Many free. Liquidations, job lots, single samples. Free details. Bargainhunters Opportunities, Box 730-A, Holland, Michigan.

HOME Manufacturing opportunities. Formula catalog 10¢ Ideal, 179-P, Park Ridge, Illinois.

WATCH Repairing. Learn to repair American and Swiss watches in spare time at home. Tuition only \$5 monthly. Diploma awarded. Free sample lesson. No obligation. Chicago School, Dept. YQA, Fox River Grove, Illinois.

MAKE Money from old tires. Operators clearing \$400 weekly. Equipment costs \$800. Get facts. S & S Patents, Inc., 3511 N. Lincoln, Chicago 13.

HOW And where to raise capital. Details free. Financial, Box 785-PM, Springfield, Missouri 65801.

RAISE Capital money fast—easy proven sources—free particulars. Advisor, Box 48337-PM-1, Los Angeles 90048.

AMAZING Information on starting your own business. Details free. Snyder, Wyatt 4, Ind. 46595.

COMPLETE Business propositions available quarterly. Mail, local, agents. Gordon Products, 2508-B So. Salina, Syracuse, New York 13205.

MAILORDER Classified advertising—Make your fortune. Write: Franklin, Box 304P, Salem, Ohio.

MAILORDER Guidance service. 20 complete setup services; not just instructions. Hermes Company, 152 West 42, New York City 10036.

VACUUM Mold at home! Hundreds full 3-D plastic products. Big profit, new machineryless method. Free facts, samples. Nationwide Plastics, Box 23321-HV, Los Angeles 90023.

BIG Profits with new home oil portrait business. Write today: Art, Box 63831B, Oklahoma City, Oklahoma.

REALLY Different moneymaking ideas from—Private Enterprise Reports, Box 16127C, San Francisco, California.

BECOME Tax consultant. Our students earn \$1,000-\$3,000 every tax season preparing returns evenings. State approved. National Tax Training School, Monsey Z-2, New York.

READ Progressive Mailtrade, the magazine that tells how to make money by mail. Quarter brings sample and special offer. Mailtrade, P.O. Box 357, Sheboygan, Wis. 53082.

IMPORT-Export, two-way profitable business. Represent manufacturers, be distributor foreign/domestic, no investment. Details 10¢. Benko, Box 188-A, New York 21, N.Y.

MAILORDERS Top four trade magazines \$1.00. Mailway, Box 1221, Los Gatos, California.

MAKE 400% Profit selling books by mail. Specialties, Box 148A, Ypsilanti, Michigan.

NEW Mail-order opportunity can earn excellent living. No investment in merchandise. No experience necessary. Free details. Ideal Co., P.O. Box 62-C, Jeanette, Pa.

SELL Information by mail. 2400% Profit. Instructions, \$2.00. Saxe, Milan, Ohio 44846.

\$140.00—DAY'S Homework! (Proof!) Burque, 839 Avenue A, Marrero, La. 70072.

RAISE Funds for churches, hospitals, clubs. Pays big. Short course establishes you. Thirty years experience. Free details. Wm. Arbogast, Box 331, Harlingen 1, Texas.

MAILORDER Business all your own. Details. Mailway, Box 1221, Los Gatos, Calif.

NEW Plastic laminating process. Big home profits easy. Free details. Craft-O-Lam, Box 8302-A45, Minneapolis, Minnesota 55426.

CASH In on your ideas. Amazing book shows how! Details free. Franzeng, Planagan, Illinois.

\$6.00 HOURLY Possible with my instructions and plans. Details free. Jacobs Enterprise, 712 Willis, Rapid City, So. Dak.

SAVE Building costs, new material molded on site. 7212 Lisbon, San Diego, Calif. 92114.

QUALIFY For motel manager by approved home study. Opportunities for men, women, couples. Free booklet = 102. Motel-Hotel Careers, Inc., Box 726, Encino, California 91317.

START Ad agency for used goods. Work home. Details rushed. Ad Market, Box 331, Harlingen 1, Texas.

MOLD Statuary, pottery, tiles, novelties; 5¢ material makes dollar seller! Particulars free. Rapid Marbleizing Service, Edwardsville, Illinois.

NEED More money? Unlimited opportunity in distributing products for home and industry. Details, write; Chandler, 16299 Canelones, Hacienda Heights, California 91745.

OPERATE Profitable lifetime repeat mail order business. write; Wayne's Services, Washington, D.C. 20018.

\$25.00-75.00 WEEKLY Possible clipping newspaper items. Spare Time. Details free. Graham, 1255-N, Englewood, Colorado 80110.

INTERNATIONAL Mailorder business made easy. Complete setup service; not just instructions. Hermes, 152 West 42, New York City, 10036.

JAPAN, Hong Kong directory. 100 Manufacturing exporters. Asia trade journal information, trade opportunities. Just \$1.00 today. Nippon Bookii, Medina, Washington 98039.

HOW To get finance capital, loans, grants, cash to start a business. Free details. Counselor Reports, Box 331, Harlingen 17, Texas.

FREE Book "202 Successful Home-Mail-order Businesses." Publishers, 6380-M Wilshire, Los Angeles 48.

BEST Promotional sales letter Gems. 10 Samples, 50¢. Dyskantors, 75465 Sanford, Los Angeles 90005.

PROFITABLE Mailorder methods and offers for quarter. Yuneli, Box 1141, Burlingame, Calif.

PROFITABLE Office-homework! Refundable nationalized system, \$1.00. Interstate, 37-1 Besch, Albany 9, New York.

PROFITABLE Catalog mailorder business! Vikari's, 468-PM, Third Avenue, Salt Lake City, Utah 84103.

\$60.00 DAY. Manufacturing concrete posts. Carlayne, 1803 Fremont, Rapid City, South Dakota.

BUY Appliances, cameras, watches, etc. at factory prices plus 10%! Free details! Cam Company, 436-13 Bloomfield Ave., Verona, N.J. 07044.

LEARN Correspondence school operation and management, put your own ideas across. Easy to understand operational guide. For information and trial offer write; Director, Dept. M-45, P.O. Box 652, Encino, Calif. 91317.

\$3 TO \$4 Per hour easy, operating information research service at home. No special qualifications necessary. Details Free. Sweetser, 615 East Second, Albany, Oregon. PM-A5.

NO Expensive courses. Complete chrome, nickel, copper plating shop setup manual, \$3.95. Van's Station, 1703 Raymond Road, Jackson, Miss.

NET \$250.00 week. Pleasant mailorder. Write Crestmore, 409 West Liberty Street, Rome, N.Y. 13440.

\$10,000 ANNUALLY Selling sewing machines. \$10.00 starts you. Free details. Johnson Sewing Center, Searcy, Arkansas.

EARN \$\$\$ Full or part time. Dealerships available for new civil emergency monitor that adapts to car radio or CB rig to receive Police, Fire, etc. Write DMI, Dept. PM, Box 8124, Dallas, Texas 75205.

300,000 ITEMS At bottom wholesale prices. Write: Foster, Box 154-L, Brooklyn, New York 11234.

OPERATE Restaurant or diner. Free booklet reveals profitable plan. Write Restaurant Business School, Dept. EC-45, 1920 Sunnyside, Chicago 40, Illinois.

FREE Copy money-making mail order newsletter. Address Newsletter, 3207-PM Southern Hills, Springfield, Missouri 65804.

INCREASE Profits in mail order using this research report, \$2.00. Thistle Shoppe, B346, Angola, N.Y.

BECOME A printing broker, make extra money, sell printing to businesses, friends, no investment. Send 25¢ for Wholesale Price Lists, offset printing, letterheads, envelopes, post cards, etc. Send to: Dept. M, Valco, P.O. Box 3, Brooklyn 35, N.Y.

BE A real estate broker. Insure security for yourself and your family. Study at home. Prepare for state examination. Write for Free book today. Weaver School of Real Estate, 3517-P Broadway, Kansas City, Mo. 64111.

PROFIT From the sensational new Electro-sonic fish attracting device. Millions of fishermen want it. Direct and mail-order sales aids available. Write Water Wonderland, Box 6312-PM, Detroit, Mich. 48234.

INSTALL Burglar alarms without previous experience or costly equipment. Big profit. Free details. Nasco, 11071 Massachusetts, Dept. P704, Los Angeles, 90025.

MOTEL Opportunity. Franchising, financing available. Turnkey job, low investment. Economical rates assure high occupancy, exceptional profits. Prime locations. Contact Econo-Lodges, Inc., Box 796, Parsons, Kansas.

COPUBLISH "Mail Sale Advertiser," leading mailorder paper. Copy and details 25¢. Vanroy Shirk, Lebanon, Pa. 17042.

MONEYMAKING OPPORTUNITIES

EARN \$1000.00 month operating Book-keeping Tax Service. Details free. Universal Bookkeeping, Box 664, Springfield, Missouri.

MAKE Plastic novelties for extra income. Low cost home training now available. Write for free booklet. Interstate Training Service, Dept. D-3, Portland 12, Oregon.

MAKE Money writing short paragraphs! No tedious study! I tell you what to write, where and how to sell, and supply list of editors buying from beginners. Many small checks add up quickly. Write to sell, right away. Send for free facts. Benson Barrett, Dept. C-27-DA 6216 Clark, Chicago 26.

RAISE Rabbits and fishworms on \$500 month plan. Free details. White's Rabbitry, Mt. Vernon, Ohio.

START Your own home mailorder business, sparetime! Easy; Fascinating, profitable! Alfano, 19-PM Pine, Closter, New Jersey.

PAINT Signs for yourself—others! Easy with our letter patterns, supplies. Also "Raised Letters." Paulow, Crystal Falls, Michigan 49920.

EARN Big commissions full or part time. Show America's largest line low priced business printing and advertising specialties. Calendars in season. Big free sales kit samples hundred items used daily by business people. Build profitable repeat business. Start right now. National Press, Dept. 19, North Chicago, Illinois.

LEARN The secrets of repairing junk batteries. "Fabulous Profits" at home. Details. Batteryman, Prunedale P.O., Salinas, California.

UNUSUAL Moneymaking opportunities. Free literature. Eaton's, 708PM Gold, Centralia, Wash. 98531.

MAKE Figurines, plaques, lawn ornaments. Molds, plastercraft kits, liquid rubber. Sample and catalogue 10¢. Wooley Company, Box 29-B, Peoria, Illinois.

VENDING Machines. No selling. Operate a route of coin machines and earn amazing profits. 32-page catalogue free. Parkway Machine Corporation, 715 PMM Ensor Street, Baltimore 2, Maryland.

MAILORDER! \$25.00 Orders! Keep \$16.67! Distributing \$3.25 product. JanMar. Box 572-M, Washington, D. C. 20044.

EARN Money evenings, copying and duplicating comic cartoons for advertisers. Advertiser, Argyle-1, Wisconsin.

BECOME A Notary Public! Win extra income, prestige, business contacts. Details free. Stationers Exchange, P.O. Box 617, Kilgore, Texas 75662.

CIGARETTES. Make 20 plain or filter-tip for 9¢. Factory-fresh pipe tobaccos. Mild tropical flavored Philippine cigars. Facts free. Moberly, Box 904, Owensboro, Kentucky.

FABULOUS Profits raising fishworms. Picture folder free. Excello, Kosciusko 6, Mississippi.

SELL Titania gems: more brilliant than diamonds. Catalog 10¢. Diamondite, 2420-G 77th, Oakland 5, California.

MAKE Money gathering wild roots, herbs, weeds, leaves, tree seeds, flowers, plants! Over 200 varieties! Buyers listed for all you can ship! Easy! Pleasant! World wide! Rush postcard! Allain, 69-P Hollis, Worcester, Mass. 01610.

EARN \$240.00 a month at home, spare time, doing only two \$5.00 invisible mending jobs a day. Big money paid for service that makes cuts, tears disappear from fabrics. Steady demand. Details free. Fabricon, 1532 Howard, Chicago 26, Ill.

OPPORTUNITIES 501 Ways to earn money. Part—full time, young—old, men—women. Free information. Opportunities, Box 1331, Merchantville, New Jersey.

MINK Raising information free. Lake Superior Mink Farm Inc., Superior, EE1, Wisconsin.

WATCH Repairing. Swiss and American watches. Develop skill step by step in spare time at home. Tuition only \$5 monthly. Diploma awarded. Free sample lesson. Chicago School, Dept. YQB, Fox River Grove, Illinois.

"HOW To run mail order business profitably." Write Jester, 524 W. Godfrey Ave., Philadelphia, Pa. 19126.

FABULOUS Mailorder. Can net \$10,000 year. Budget, Box 501P, Monterey Park, Calif.

FREE! Mailorder success formula. Based on successful experience. Write: Mounier's, 209 Armand, Ville Platte, Louisiana 70586.

BIG Money raising fishworms and crickets. Free literature. Carter Hatchery, Plains, Georgia.

ELECTRONIC Fish call for pleasure or profit. Free details. M. Bishop Co., Front Street, South Whitley, Indiana.

MAILORDERS Top four trade magazines \$1.00. Mailway, Box 1221, Los Gatos, California.

MAKE \$5,000 Yearly, sparetime, raising mink, chinchilla, nutria, etc. Free booklet reveals proved plans. Write: Furs, 588 Mt. Pleasant Road, Toronto 2, Canada.

SCASH, Making marble, pearl jewelry. Free catalog. Boycan's, Sharon 35, Penna.

NEW Instant invisible mending. Learn in one hour, repair in five minutes. Make \$150.00 week. Literature free. Louis Rosenstein, P.O. Box 6136-6, Philadelphia, Pa. 19115.

INSTANT Money! Plastics are the wave of the future. Big profits now! At home! Spare time! Materials costing 11¢ bring \$2.58 profits immediately! Free information! Rush name on postcard to: Warner, 1512 Jarvis, Dept. CL-2-DW, Chicago 60626.

OVER \$10.20 an hour, Spare Time at home! Rubber stamp industry needs small manufacturers. We furnish all equipment and know-how! Particulars Free! Write: Roberts, 1512 Jarvis, Room CR-2-DW, Chicago, 60626.

WE Purchase items you make at home for us. Send stamp for details. Wolfe Specialties, Box 171, Center Line, Michigan 48015.

CASH From leathercraft. Free booklet tells how. Tandy Leather Co., Box 791J54, Fort Worth, Texas.

BE Your own boss! Learn to operate iron and auto salvage yard. Box 806, Mason City, Iowa.

AD Agency for used goods. Start one. I'll help you. Free details. David Magee, Box 331, Harlingen 4, Texas.

YOUR Own business. No inventory required. Suppliers ship for you. Details. Jenkins Publications, Box 1490, Oceanside 1, Cal.

LOANS For little businesses. Start or expand. Details rushed. National Counselor, Box 331, Harlingen 5, Texas.

TRAVEL Bargains! Exciting introduction! Free catalog. Harrison Bro's, 1-P.O. 260, Brigham City, Utah 84302.

CLIP Items from daily newspapers. Get \$1.00 to \$5.00 each. Details free. Walter, Box 1023-P, Erie, Penna.

EXCLUSIVE Modern Guide tells how to build profitable mail order business. Guaranteed. Buchwalter Sales, 834—175th St., Dept. 64, Hammond, Indiana 46324.

NEED Extra money? Cash in on news clippings! Southwestern Order & Sales Co., Box 13397, San Antonio, Texas 78230.

AMAZING Income from ideas. New manual tells how. Free details. Thompson, 9414 Aspen, Shreveport, La. 71108.

CAPITAL Available—ready prime sources. details free. Advisor, Box 48337-E, Los Angeles 90048.

NEW! How—where to get hundreds of dollars worth new products absolutely free! Manual tells all! Only \$4.95. National Brokers, 1219 Haddon, Camden, New Jersey.

SWEEPSTAKES. Let us help you win. Write for free information. General Contests, 1609 1/2 East 5th, Duluth, Minnesota.

HOT Money making line! Show line of business printing, advertising specialties, calendars. Watch orders pour in. All repeat items. Terrific commissions in full or spare time. No experience, no investment. Cash discounts to customers. Free bonus gifts to you. Free sales kits. Willens-David Lionel Press, Dept. W-27, Waukegan, Illinois.

INCOME From hobbies, free information. Elmac, 5415-A San Jose Blvd., Jacksonville 7, Fla.

SELL \$1.75 fire extinguisher. Make 90¢. Sold by Fire Depts., J.C.'s, Lions Clubs etc., and individuals. Send \$2.00 for details and sample extinguisher. Flame-Out Inc., 318 West High St., Springfield, Ohio.

WIN Cash! Monthly contests, information, assistance! Year's trial, \$1.00. Prize-winner, Box 11569, St. Petersburg, Fla.

AMAZING Successes through franchises! Become exclusive franchise holder your territory. Information rushed. National Franchise Reports, WP-528, 333 North Michigan, Chicago 1.

PROFITABLE OCCUPATIONS

MAKE Money writing short paragraphs. Information free. Barrett, Dept. C-27-DB, 6216 No. Clark, Chicago 26.

WHOLESALE Magazine subscriptions. Highest commissions! Bonus! Box 151DA, Freshmeadows, N.Y. 11365.

BECOME Independent with your own franchise business. Thousands earning handsome incomes. Request interesting facts today. National Franchise Reports, PM-528, 333 North Michigan, Chicago 1.

CHROME Plating. Instructions, equipment and supplies. Platers' Supply, P.O. Box 565, Lugo Station, Los Angeles, Calif.

YOUR Own sign shop—Signs, 1017 W. Mulberry, Springfield, Ohio.

BAKE New greaseless doughnuts in kitchen. Sell stores. Free recipes. Michael, 3605 South 15th, Minneapolis 7, Minn.

RAISE Pheasants on \$100 week plan. Little capital and space can make you independent. Free details. Great Central System, Columbus 1, Kansas.

BIG Money raising fishworms and crickets. Free literature. Carter Wormery, Plains, Georgia.

EARN \$240.00 A month at home, spare time, doing only two \$5.00 invisible mending jobs a day. Big money paid for service that makes cuts, tears disappear from fabrics. Steady demand. Details free. Fabricon, 1586 Howard, Chicago 26, Ill.

AUCTIONEERING—Resident and home study courses. Auction School, Ft. Smith, Ark.

SHARPEN—Scissor, pinkers, skates. Inexpensive machines, supplies. Blackhawk's, Sheldahl, Iowa.

VENDING Machines. No selling. Operate a route of coin machines and earn amazing profits. 32-page catalogue free. Parkway Machine Corporation, 715 PMP Ensor Street, Baltimore 2, Maryland.

INVESTIGATE Accidents. Earn \$750 to \$1,400 monthly. Car furnished. Expenses paid. No selling. No college education necessary. Pick own job location. Investigate full time. Or earn \$8.44 hour spare time. Men urgently needed now. Write for Free Literature. No obligation. Universal, CPM-4, 6801 Hillcrest, Dallas 5, Texas.

MANAGE Motel or resort. Man, woman, couple can make high salary plus apartment. Pick your own location with our employment assistance. Learn at home. Free booklet. Motel Managers Training School, Dept. PMC45, 612 South Serrano, Los Angeles, California 90005.

CIVIL Service opportunities information: Yours free: "Publications," Greenhills, 6723, Nashville 12, Tenn.

MOULDED Monuments. One man operation. No machinery. Local material. Granitex, Dyersburg, Tenn.

\$15.00 TO \$30.00 an hour de-liming steamcleaner and laundromat coils. Little competition, large profit, total investment less than \$100.00. One steamcleaner coil can pay for total investment. Write for free information. Champaign Coil Company, 305 West Springfield Ave., Urbana, Illinois 61801, Dept. 5.

OIL Reclaiming. Plans, \$2.00. Holcomb, Box 681, Pampa, Texas 79066.

FREE Book "990 Successful, Little-Known Businesses." Work home! Plymouth 87A, Brooklyn 4, New York.

AGENTS WANTED

YOUR Own business—Used suits \$1.50, overcoats 65¢; mackinaws 35¢; shoes 12 1/2¢; ladies coats 30¢; dresses 15¢. Enormous profits. Catalog free. Nathan Portnoy Associates, 2109-AA Roosevelt Road, Chicago 8, Ill.

ESTABLISH Your own business. Low prices on used clothing, shoes, household goods. Unlimited profits. Free catalog. Northwestern Distributors, 2129 No. Western Avenue, Chicago 47, Illinois.

SALESMEN Make big profits selling "do-it-yourself" sign kits to merchants. Information free. Signmakers, Inc., Dept. PM4, Box 6626, Denver 16, Colorado.

RAISE Rabbits for us on \$500 month plan. Free details. White's Rabbitry, Mt Vernon, Ohio.

PRINTING. Office supplies, rubber stamps. Save 50%. Modern, Box 3P, Southfield, Michigan.

FABULOUS Opportunity for women, any age. Earn \$25 day or more as beauty advisor. No experience. Get details, sample Hollywood cosmetics: Studio Girl, Dept OP-339, Glendale, California.

MAKE Up to \$50.00 daily soliciting delinquent accounts. Terrific commissions. General Finance Co., Dept. LG-76, Pickwick Bldg., Kansas City, Mo. 64106.

AGENTS—300% Profit selling genuine gold window letters; stores and offices. Free samples. Metallic Sign Letter Co., 1217-D West Newport, Chicago.

BUSINESS Kit free! Postcard puts you in business! Complete line 275 shoe styles, jackets! New discoveries pay big commissions. No investment. Send for free kit. Mason, Chippewa Falls, K-510, Wisconsin.

EXTRA Cash aplenty! Show 'em and you'll sell 'em—sensationally beautiful, handpainted plastic photo enlargements, personalized compacts, costume jewelry. Take orders—collect 40% commission. Self-selling sales kit free. Novelco, 3343 North Avenue, Chicago 47.

HIGHEST Commissions, qualified leads correspondence courses, full or part time. S. T. C., P.O. 266, West Memphis, Arkansas.

AGENTS, 400% Profit selling 25 letter collection book to stores, offices. Retail for \$19.88, sample \$1.00. Mutual Adjustment Bureau, Inc., 505 Fifth Ave., N.Y.C.

PRINTING. Advertising salesmen—Excellent moneymaking sideline selling decalomania name plates, small quantities. Automobile initials, sign letters. Free samples. Ralco, XL, Boston 19, Mass.

BE The Popular Mechanics representative in your neighborhood and earn big profits in your spare time. Write Popular Mechanics, Room 4A, 250 West 55th St., New York 19, N.Y.

SALESMEN—DISTRIBUTORS

\$1,000.00 a month for making dramatic 3-second demonstration of amazing lightweight Presto Fire Extinguisher. New chemicals used by Airforce snuffs out fires instantly. Only \$4.95. Terrific commissions. Millions want it. Free Kit, Merlite, 114 E. 32nd, Dept. P-66H, New York 16.

SENSATIONAL New longer-burning light bulb. Amazing free replacement guarantee—never again buy light bulbs. No competition. Multi-million dollar market yours alone. Make small fortune even spare time. Incredibly quick sales. Free sales kit. Merlite (Bulb Div.), 114 E. 32nd, Dept. C-73H, New York 16.

FREE To salesmen who want more money. Send name, age and occupation for free copy Opportunity Magazine describing 200 new, fast sellers. Entirely free. Opportunity, 850 N. Dearborn, Dept. 17A, Chicago, Illinois 60610.

DISTRIBUTORS Wanted. Stainless razor blades. Buhl, Box 34, Princeton, Florida.

SELL Advertising book matches. Write us today, we put you in business by return mail; handling complete line ad book matches in demand by every business right in your town! No investment; everything furnished free! Top commissions daily! Superior Match, Dept. M-465, 7530 S. Greenwood, Chicago 19, Illinois.

ADD New hammer holster to your line. 50% Profit. Contact hardware, lumber yards. Repeat sales, send 50¢ for sample. Stutting Constr. Co., 3318 Christine, Lansing, Michigan.

EARN Cash commissions plus free gifts. Sell matchbook advertising. Sales kit furnished. Matchcorp, Dept. PM-45, Chicago 60632.

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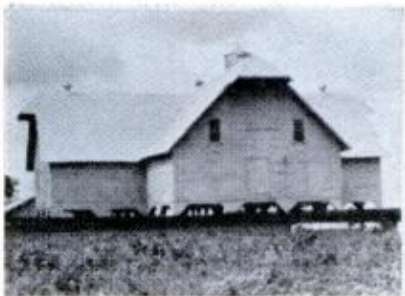
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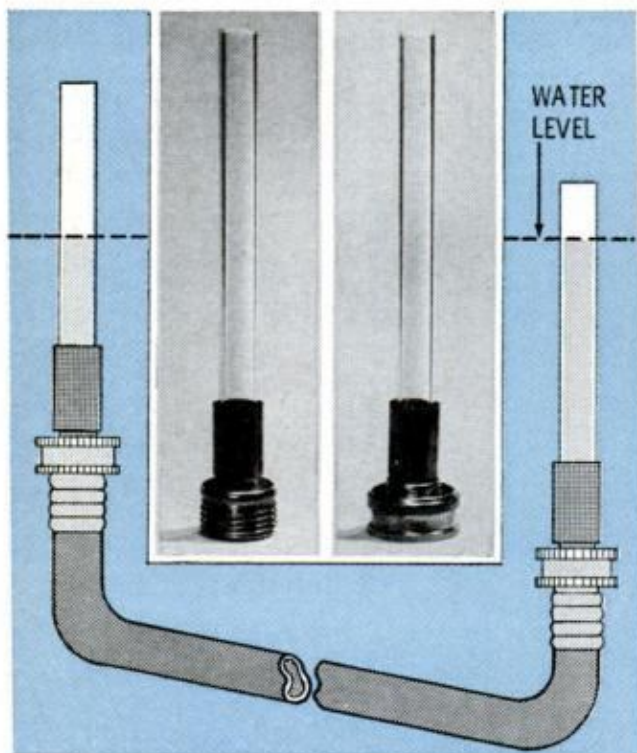
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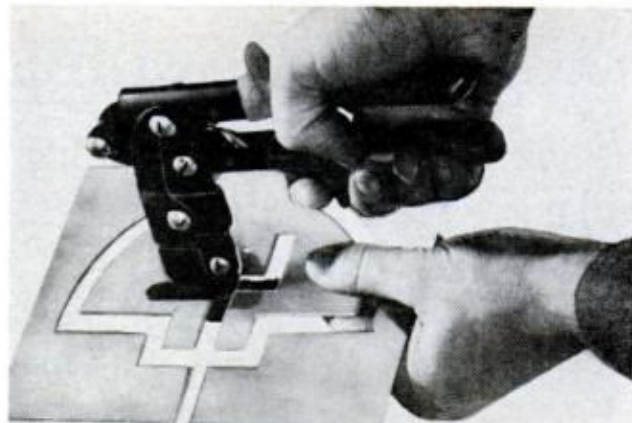
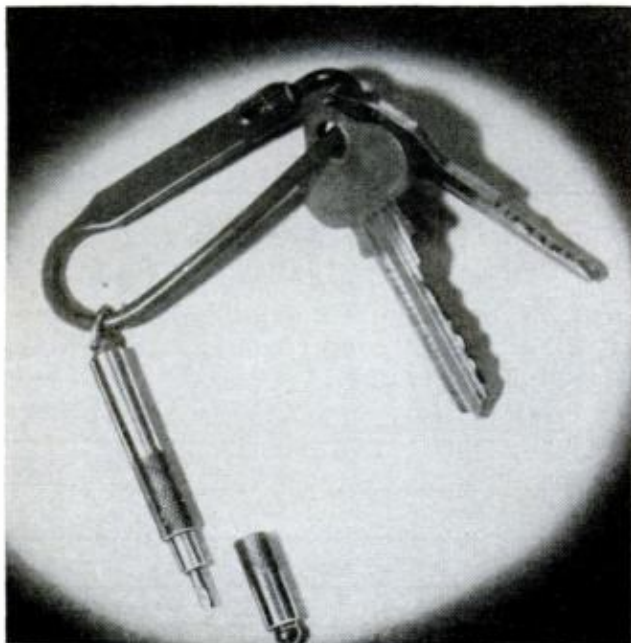
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Shopping for Tools

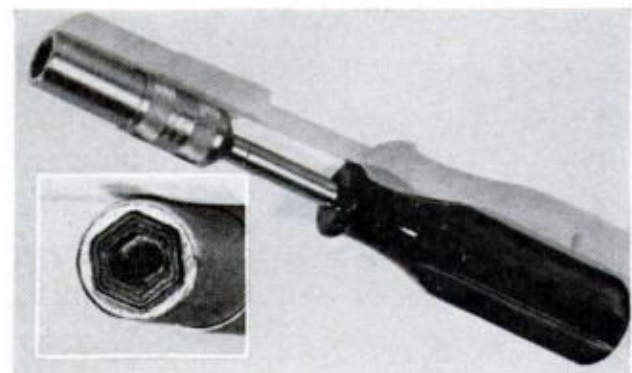
TURN YOUR GARDEN HOSE INTO A LEVEL with the Aqualevels. You screw one of these devices onto each end of your garden hose, then fill the hose with water. The water line in each level then serves as a reference point for setting fence posts, grade stakes, etc. at same height. Available for \$2.95 a pair from Gartin Specialties Co., 34 George St., Grayslake, Ill.



TINY SCREWDRIVER, which comes attached to a handy key ring, is small enough to fit the hinge screws of eyeglass frames, camera body screws, etc. For safe carrying in your pocket, the blade of the screwdriver is covered with a screw-on cap. Sells for 50¢. Moody Machine Prods. Co., Dudley Street, Providence 5, R.I.

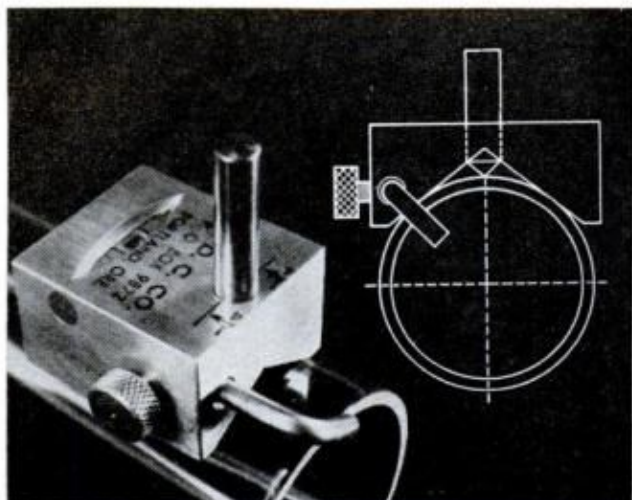


NIBBLING SHEARS are specifically designed for cutting angles, circles, scrolls and intricate patterns in plastic laminates such as Formica and Micarta. For easy replacement of parts, this tool is constructed with bolts and nuts. It also has a safety clip to hold blades in closed position when idle. \$12.50. Karl Klenk, Inc., 107 E. 5th St., Wilmington, Del. 19801



SOCKET-O-MATIC WRENCH does the work of four individual wrenches. The socket has three spring-loaded inserts. When you push it onto any hex nut from $\frac{1}{4}$ to $\frac{7}{16}$ in., one, two, or all three of these inserts recede, automatically creating an opening of the proper size. Ideal for assembly work. \$6.95. Silverbrook Manufacturing Corp., 1341 Hamburg Tpk., Wayne, N.J.

PUNCH GAUGE LOCATES top dead center of tubing or round stock. With the work clamped in a drillpress vise, you place the device on top, center the bubble and tap a built-in punch with a hammer. Mark will be on top dead center. Costs \$7.95. Available from T.D.C. Company, P.O. Box 9872, Portland, Ore. 97207



"A. J. FOYT RIDES WITH A TIGER IN HIS TANK"

Watercolor by Maurice Lewis



Color print for framing--only 50¢ Get a beautiful full-color 17" x 12" reproduction of this dramatic painting by Maurice Lewis for just 50¢ to cover all handling charges. Perfect for den or library, it shows 4-time U.S. Auto Club Champion A. J. Foyt at a pit stop enroute to victory in the 1964 Indianapolis "500." Like many of the world's greatest drivers, Foyt uses Special Esso Racing Fuels. He rides with "a Tiger in his tank." While they last get your copy of this print. Send your name and address and 50¢ in coin to: "PIT STOP," P. O. Box 66762, Houston, Texas 77006.

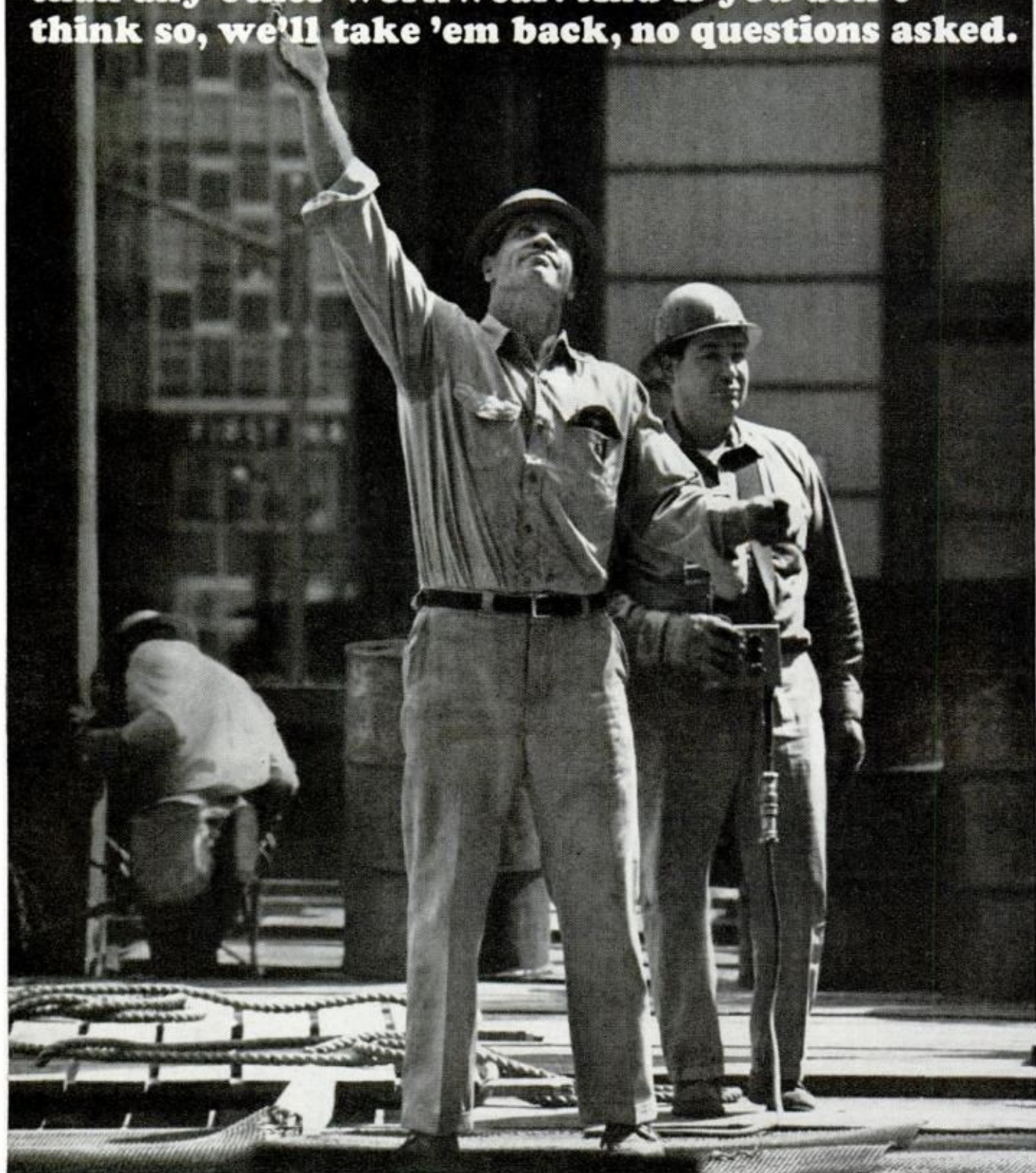
PUT A TIGER IN YOUR TANK! Now your Esso Dealer can put a Tiger in *your* tank with new Power-formula Esso Extra. It's the High-energy gasoline that: (1) cleans up fouled carburetors to restore lost power and mileage; (2) neutralizes harmful deposits to renew full firing power; (3) gives you the high octane for winning performance. Take a tip from A. J. Foyt and other famous drivers and fill up at the sign of **HAPPY MOTORING!**[®]



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... AMERICA'S LEADING ENERGY COMPANY ... SUPPLIERS OF ESSO PRODUCTS

Look for steel...and the foreman who moves it. And you'll find Lee Chetopa Twills. We make 'em in more sizes with more stay-on-the-job features than any other workwear. And if you don't think so, we'll take 'em back, no questions asked.



Lee 
CHETOPA TWILLS
H. D. Lee Company Inc., Kansas City 41, Missouri
World's Largest Manufacturer of Union-Made Workwear

Guaranteed, the hardest working workwear

Underneath it all, this GMC pickup is misunderstood. People think it costs more than it really does.

Ordinary pickups have only two headlamps. The GMC pickup has four headlamps. See the light?

Think of this when you see these letters — made by truck people, sold by truck people, serviced by truck people. Remember that, before you buy a pickup.

Independent front springs take the sting out of road bumps — before they reach you and the cargo.

Most competitive engines don't have as much torque as this in-line six engine. Or as much cooling and lubricating capacity. Maybe that's why people think GMC costs a lot more.

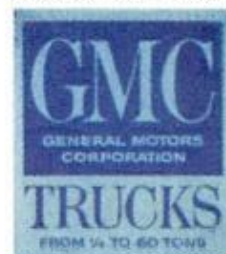
Two walls of steel and a thick slice of insulation in the cab roof keep out sound and weather. (Some other truck-makers are content with a single wall and little, if any, insulation.)

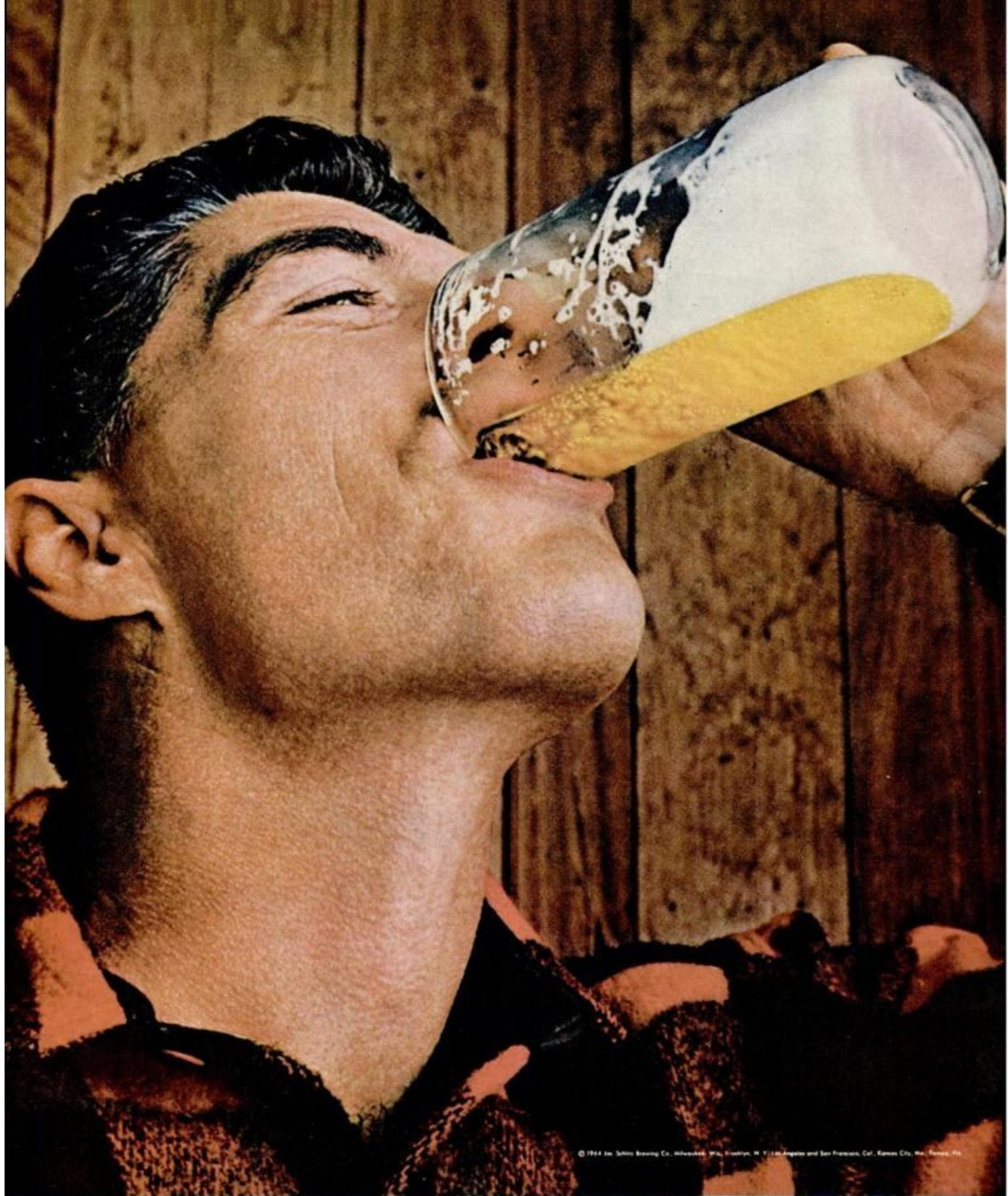
Every inch of the metal is rust-proofed. *Every inch.* Even the metal you can't see.

The progressive-type rear springs automatically adjust to the weight of the load. The load is protected, the pickup body is protected, and so are you.

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

Its price is only \$49* more than others.
Please tell your friends.





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Down. Down. Down. Down. Right to the bottom of your thirst. Mmmm. Satisfying Schlitz.

real gusto
in a great light beer



Материал защищен авторским правом
The Beer that made Milwaukee Famous

ZERO GRAVITY

Can Our Spacemen Survive Its Destructive Effects?

Weightlessness didn't cause John Glenn's ear trouble, but it creates other problems. Here's how we'll overcome them



By Kevin V. Brown

LA TE THIS YEAR two of our astronauts will be launched into an Earth orbit in a *Gemini* capsule for a seven-day voyage in space. It will be the longest flight ever made by any spaceman, Russian or American—and as long as Project *Apollo*, our proposed trip to the moon.

And it will revive, once again, the puzzling problem of just how long a man can stay in space without suffering ill effects.

Cmdr. Alan Shepard, who made America's first suborbital flight, later incurred an ear infection and still hasn't returned to active training.

Col. John Glenn, who made our first full-orbital flight, later injured his ear in a fall and has since resigned from the space program.

Lt. Cmdr. Walter Schirra, who made six orbits, had an increased heart rate (up to 100 beats per minute) each time he stood



DOUBLE TRAMPOLINE bounces subject back and forth, on motorized bed, "exercising" blood vessels to keep them in trim even though body stays inactive

DECONDITIONED VESSELS can be caused by weightlessness and its inactivity, resulting in fainting, unless astronaut exercises or has mechanical help

up after landing, and the symptoms persisted for 24 hours.

Maj. Gordon Cooper, who made our first full-day flight, fainted when he got back.

Gherman Titov, who made Russia's first 24-hour flight, complained of dizziness and nausea during his mission.

All but three of the Russian cosmonauts, some of whom were weightless for up to five days, reported symptoms similar to those experienced by Schirra and Cooper.

All of these problems, either directly or indirectly, are blamed by some on weightlessness.

And one Russian scientist went so far as to say that the maximum safe period without gravity is 24 hours. Beyond that, he said, irreversible physiological changes begin to occur in the human system "which, if not corrected, will eventually lead to death."

Sounds bad, doesn't it?

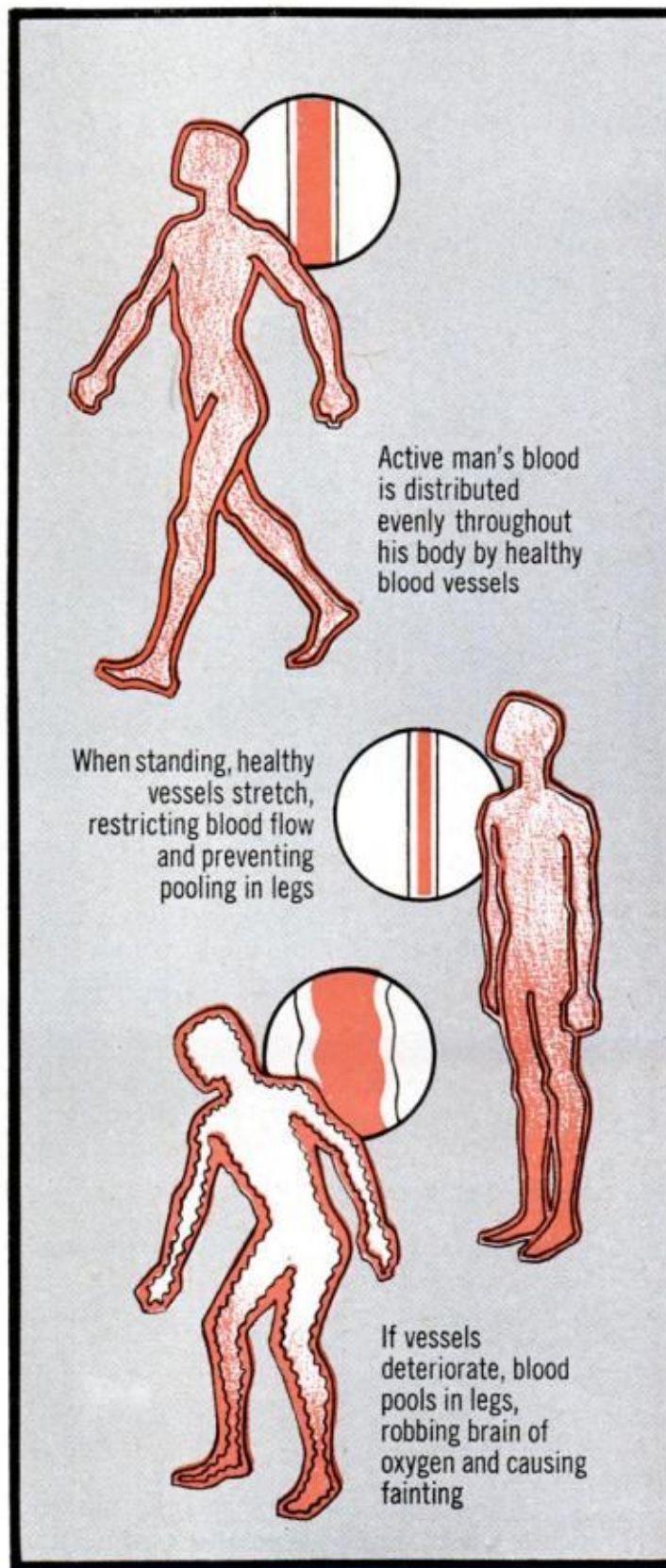
Well, it isn't, and the men who say so are directly involved in the study of weightlessness and its effect on the body.

To clear up some of the misconceptions about this perplexing subject, *Popular Mechanics* interviewed some of these scientists, notably within the Air Force's Aerospace Medical Division. At the AMD's School of Aerospace Medicine (SAM) on Brooks Air Force Base near San Antonio, Tex., and at nearby Wilford Hall Hospital, tests are being conducted for the Air Force's manned orbital laboratory (MOL) which, if built, would fly manned space missions up to 30 days long, much longer than anything now planned for either *Gemini* or *Apollo*.

Can man stand it?

Before answering the question, let's weed out some misinformation and establish a few fundamentals. First, what about the problems suffered by the astronauts and cosmonauts? Real or fancied?

One officer at Wilford Hall (where both Shepard and Glenn were treated) told us, "In the first place, Shepard was only weightless five minutes. From all the evi-



Active man's blood is distributed evenly throughout his body by healthy blood vessels

When standing, healthy vessels stretch, restricting blood flow and preventing pooling in legs

If vessels deteriorate, blood pools in legs, robbing brain of oxygen and causing fainting

dence, it was a classic case of an ear infection unrelated to his space flight."

Period.

"As for Glenn, from all his symptoms, it was a simple case of a blow on the head that caused his problem."

Period.

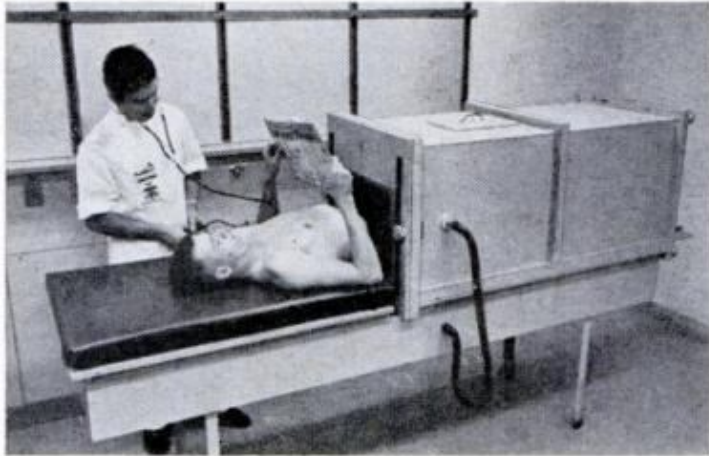
Titov was a special case.

"From what we can read, and from interviews with Russian scientists (three of

them lectured at Brooks last year), it seems likely that Titov was hypersensitive to motion sickness and, consequently, a poor choice for an astronaut."

An added problem was that his space capsule apparently had no mechanism for controlling its attitude and it may have been tumbling through most of his flight.

As for the others, those who had an increased heart rate or fainted, the general

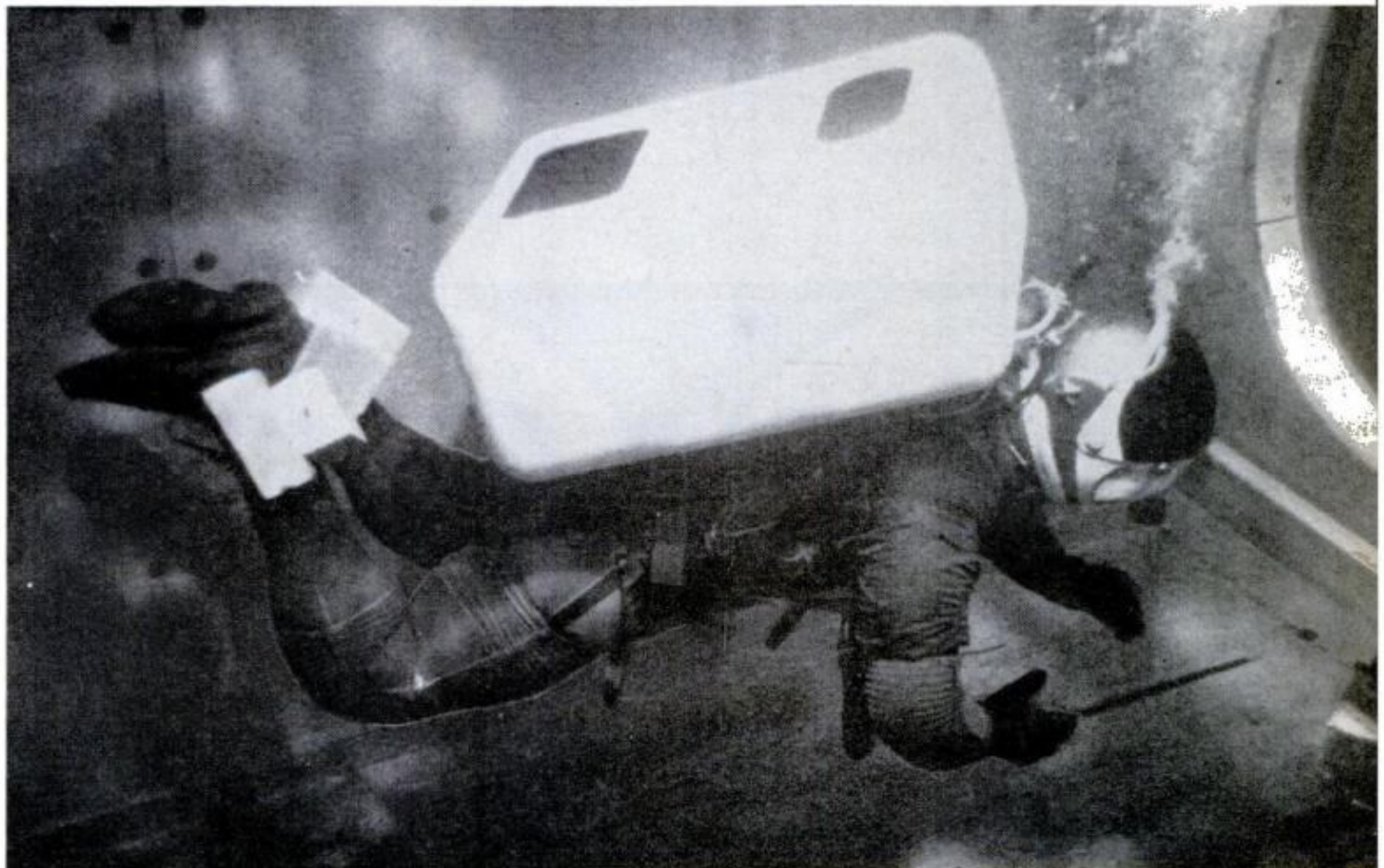


NEGATIVE-PRESSURE BOX creates partial vacuum around lower extremities, actually "sucking" blood down to legs, thus mechanically exercising vessels

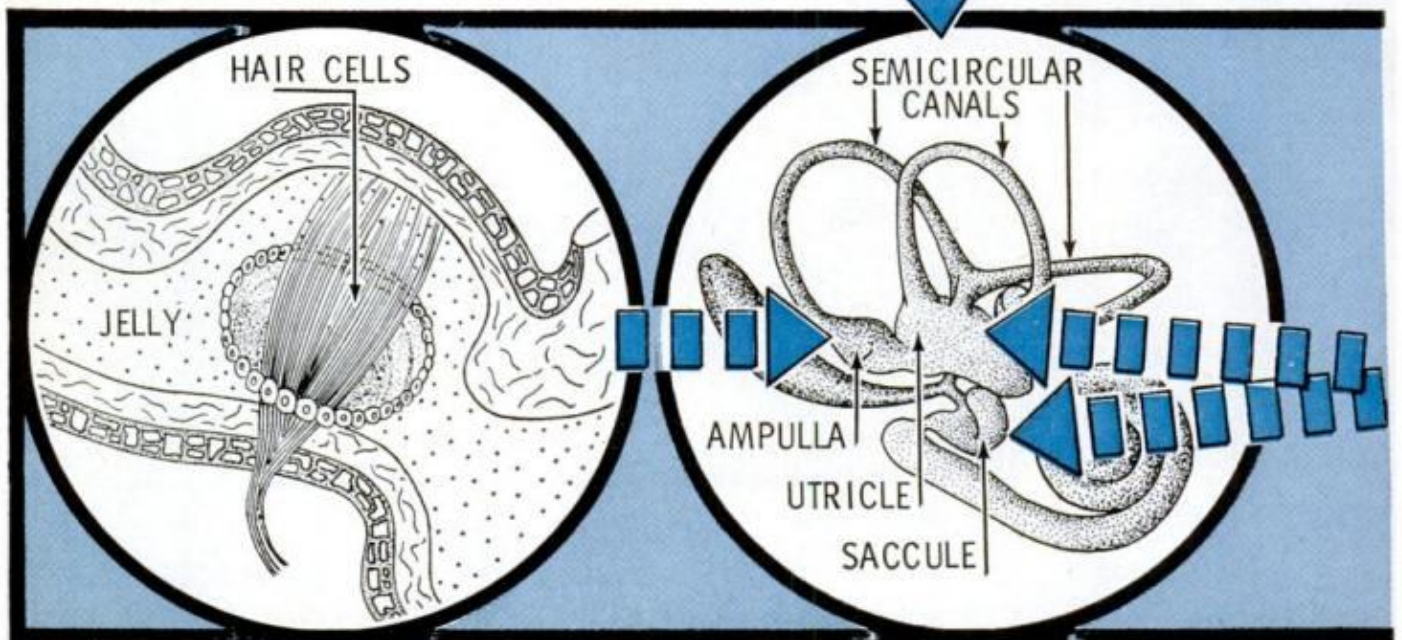
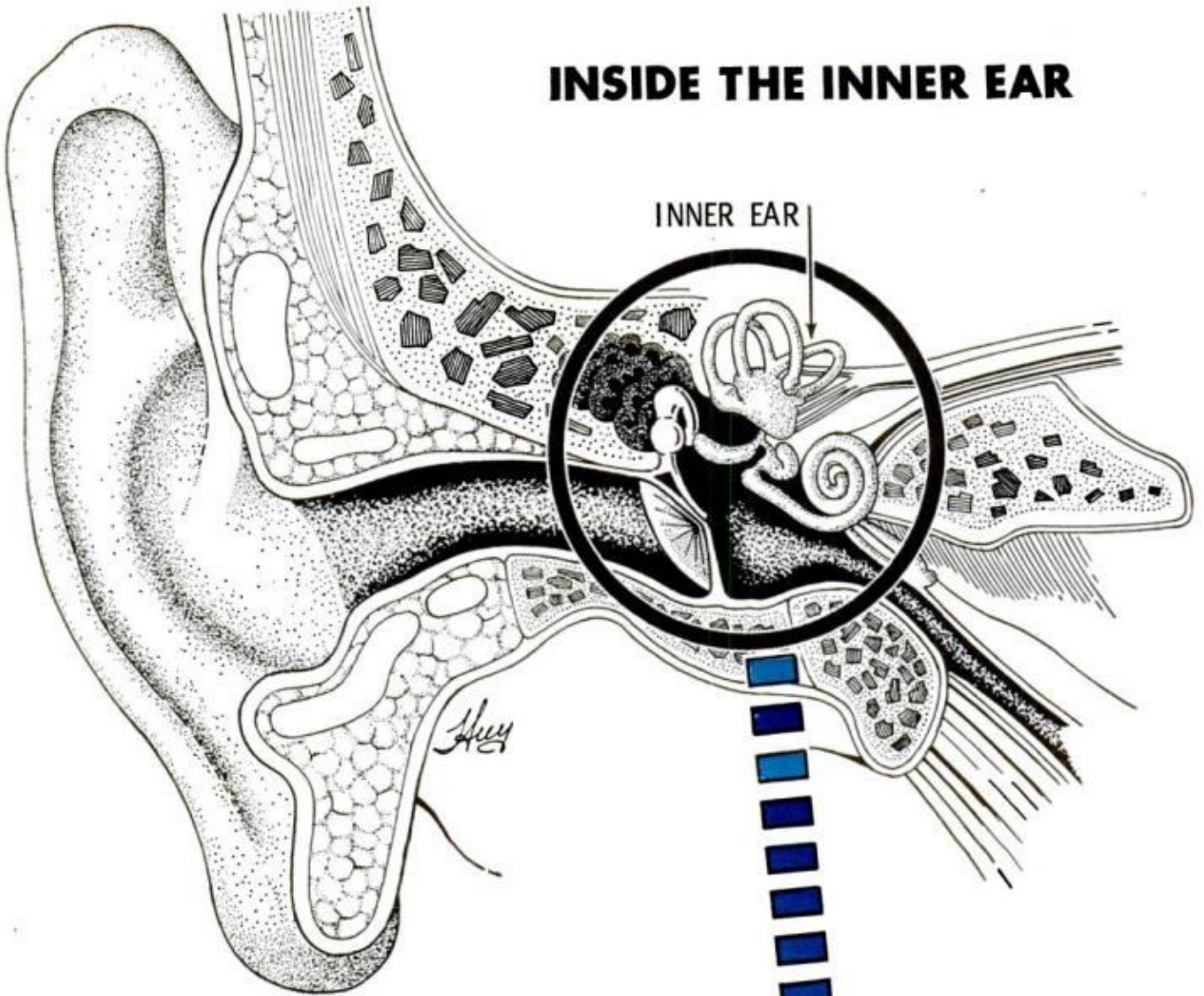


BICYCLE ERGOMETER can exercise lower body muscles and increase oxygen consumption, thus keeping blood system in shape to deliver it even while weightless

WATER IMMERSION is another method of simulating weightlessness, removing body's work load and initiating deconditioning process. Test subjects, after deconditioning, are put through re-entry profile on G-making centrifuge



INSIDE THE INNER EAR



attitude is, "What did you expect?"

This pinpoints a basic misconception about weightlessness—that weightlessness itself is the culprit. Zero gravity cannot be ignored, but it's not the weightlessness as much as the inactivity it causes.

Take yourself. If you lift an arm or a leg, it puts a work load on the body, a work load equal to the force of gravity. Remove this work load and it gives the muscles and its supporting systems nothing to do. Like a well-trained athlete who suddenly stops training, the body begins to deteriorate. It doesn't have to work as hard now.

Patients in hospitals for long stays, with nothing to do, have to recondition themselves gradually before leaving bed, sitting up first, then standing, then walking short distances.

All the American astronauts reported that weightlessness itself—a floating sensation—was really "very pleasant." Like the athlete, they could not notice the deterioration that was going on, especially on the longer flights, until they tried to resume their normal activity—their work load—within the field of gravity.

This pinpoints the second fundamental, that the body can adapt itself to the weightless state and function efficiently within it. It isn't until the body comes within the field of gravity again, and especially during the multiple Gs of re-entry, that the trouble begins.

To avoid this trouble, and to keep the body from deteriorating beyond a safe level, is the purpose of the studies at

Brooks, Wilford Hall and elsewhere. Some bodily functions are definitely known to be affected by gravity, some definitely are not. Others are in the limbo of the indefinite and the unknown—and scientists admit it. Although, at this point, none of these functions seem incapable of adjusting to weightlessness.

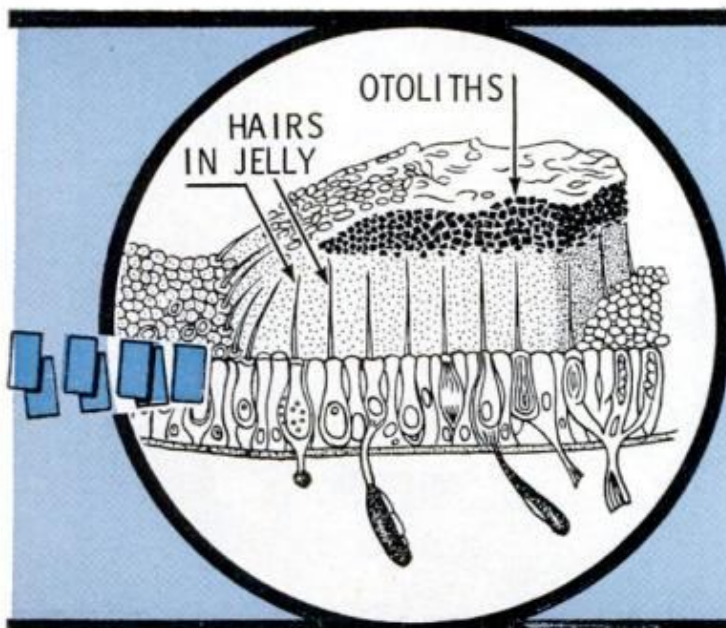
Here, then, is a rundown on some of the things that weightlessness is known to do to the human body, and some of the things being planned to help overcome them.

The cardiovascular system—the heart and blood vessels—is one of the major areas affected by the inactivity of weightlessness. A classic comparison to an astronaut who faints is the picture of a Buckingham Palace guard, in his tall woolly hat, keeled over on the parade ground while the Queen passes by.

What happens is that in a normally active man, the blood flows freely throughout the body. When he stands at attention for long periods, reflexes stretch the blood vessels and muscle tensing helps restrict them so that not as much blood flows through them. This prevents pooling. If the blood vessels are allowed to get sluggish from inactivity, as they do in long bed rest or while weightless, the walls become flabby and allow the blood to pool. As more blood pools in the lower extremities, less is available to the brain. If the blood doesn't bring sufficient oxygen to the brain, the man will pass out when he stands for long periods.

The problem snowballs. Inactivity re-

[\(Please turn to page 232\)](#)



INNER EAR gets all the publicity but is less affected by weightlessness than blood system, muscles and bones. Its balance mechanisms include semi-circular canals and otoliths. Hair in ampulla of canals (far left) is sensitive to angular or rotating motions. Hair on floor of utricle (far right), rubbed by beady otoliths, is sensitive to linear or straight-line motions. Saccule also has otoliths, but no one understands their function. Scientists believe canals go right on working in space, but otoliths become insensitive. Body, however, receives additional orientation from skin and muscle sensors to relate to its environment

430-MPH Tilt-Wing Can Hover

BUILT FOR THE MILITARY, the new XC-142—which can take off and land straight up and straight down by tilting its wing—may have commercial use.

When the wing is tilted up, the four big props—each powered by 3000-hp turbine engines—hang the 18-ton plane in space. A smaller prop, mounted horizontally in the tail, gives it longitudinal stability. When the wing is tilted down, the plane can cruise at speeds up to 430-mph. When hanging on the props the XC-142 can even

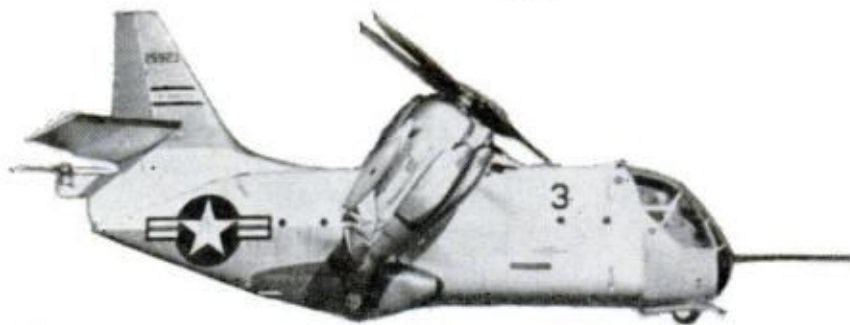
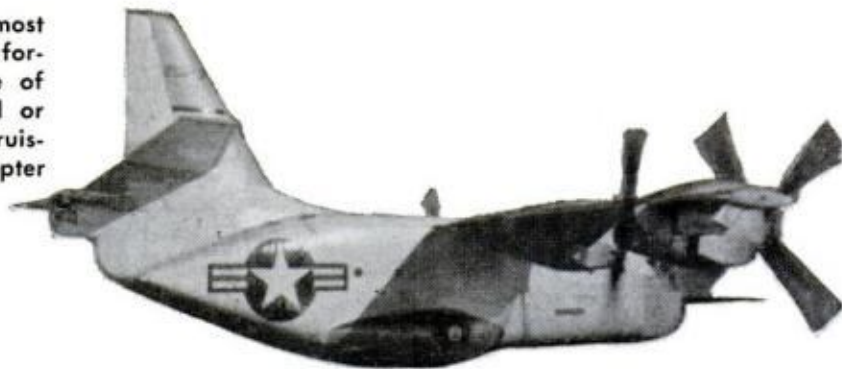
fly backwards or spin in a complete circle.

The unique aircraft is the first to be built for three services, the Army, Navy and Air Force. The prime contractor is Ling-Temco-Vought, Dallas, Tex.

It could land in small clearings in guerilla warfare or on a city heliport.

Its commercial promise, however, is still in the future. Its primary purpose is to carry troops (32 maximum) or cargo (up to 8000 lbs.). Its operational range is 470 miles, but with special tanks, 3800 miles.

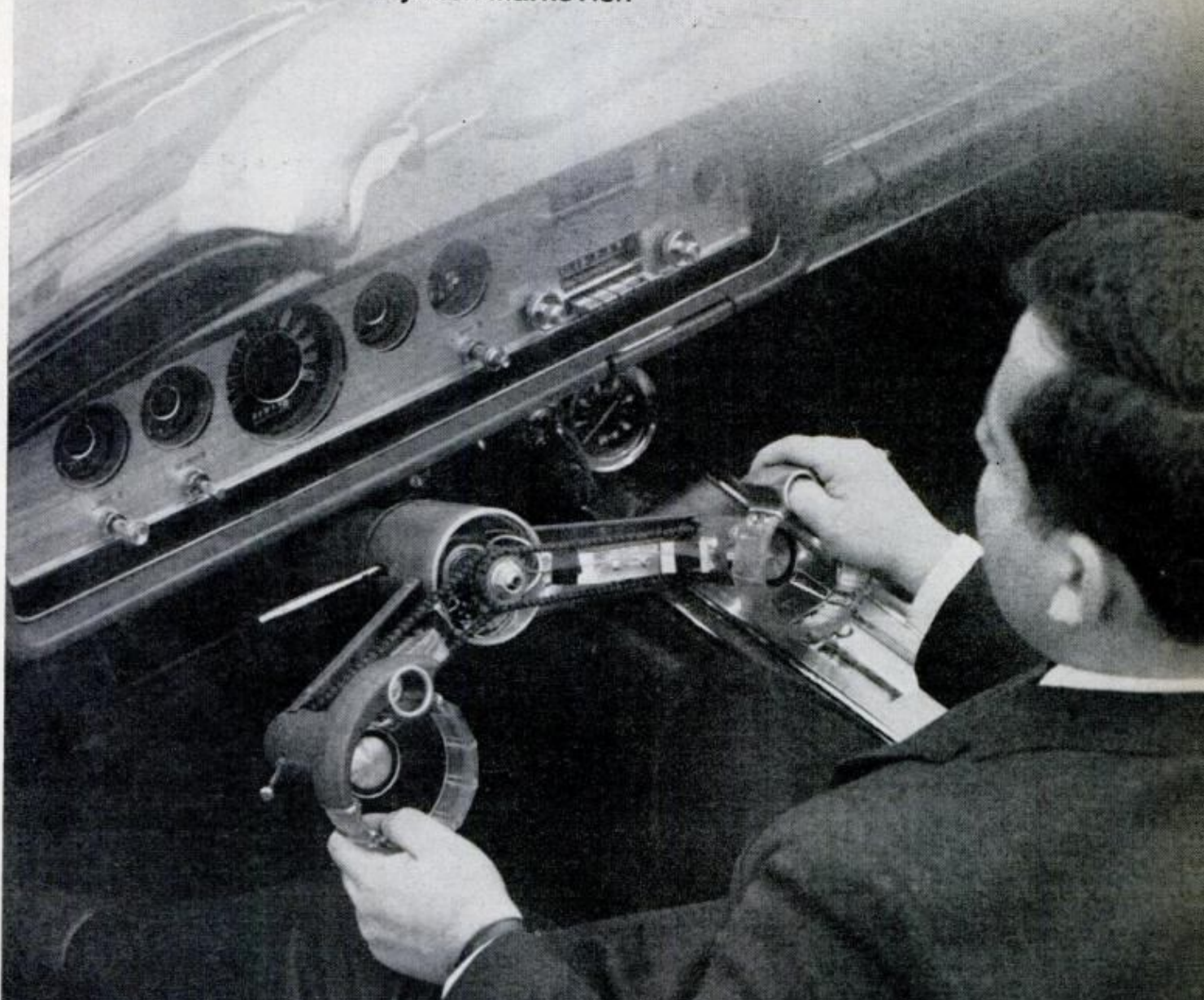
XC-142 TILT-WING plane takes off almost straight up, tilting wings down for forward flight. It has remarkable range of from zero to 430 mph, standing still or turning circles while hovering, and cruising much faster than any helicopter



Look, Ma—No Wheel!

Drive Mercury's weird wrist-twist steering and you'll be in for a few wacky surprises

By Alex Markovich



I KNEW I wouldn't like Mercury's experimental steering system even before I tried it. There's no steering wheel, just two bracelet-size plastic rings that you twist to steer the car. It's like turning king-size knobs on a radio.

Poor Chuck Mulcahy. He's the Mercury public-relations man. I like Chuck, he's a friendly, soft-spoken guy. He'd take it hard when he saw my story.

At the Ford proving ground, Chuck introduced me to Bob Rumpf, a former missile engineer who headed the "XR-50" steering project. Rumpf

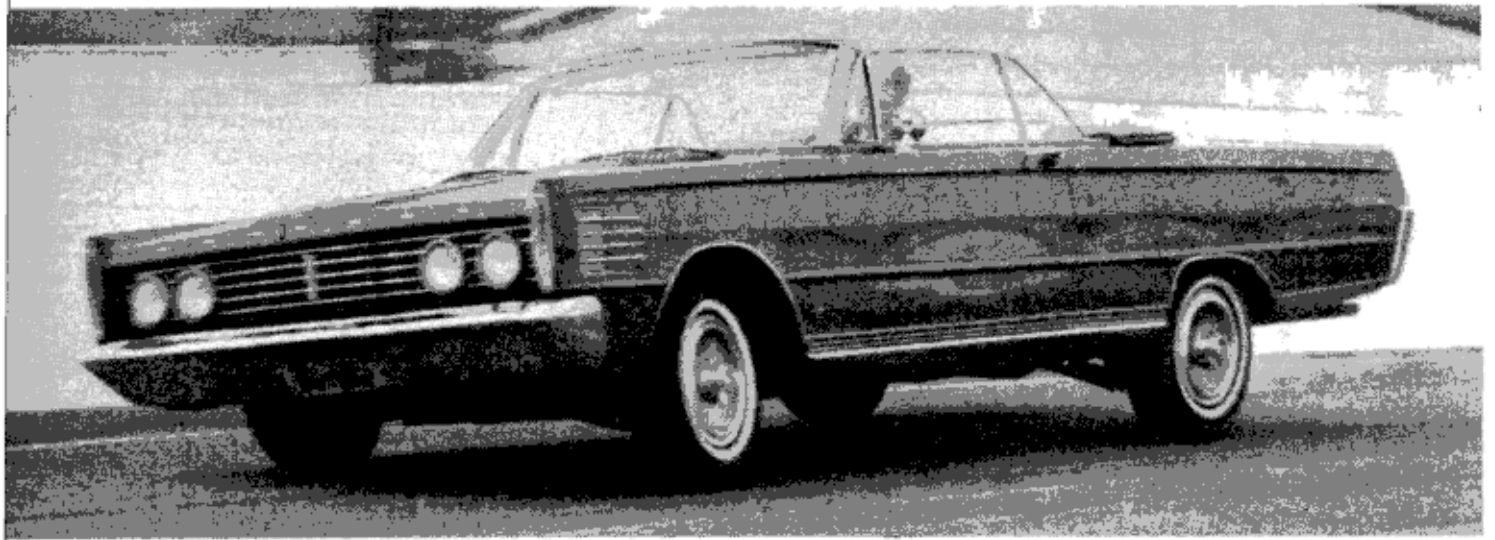
pointed out a big Merc convertible, stock except for steering, that was waiting for us.

Production? Not Now

"Frankly," Rumpf said, "you probably won't see this system in production in the near future. People won't give up that old steering wheel easily."

He motioned me into the driver's seat and slid in beside me. "You can tilt the steering column down by pulling that lever," he said, pointing.

With the steering rings low over my lap and my elbows resting on the seat's



ON THE HANDLING COURSE, the big Merc felt as responsive as a compact car. Reaction time is faster with twist-wrist controls—and a fraction of a second often can make the difference between safety and an accident

built-in arm rests, I felt comfortable—but odd. Visibility was splendid, but I missed the support of a steering wheel. I felt like the first astronaut.

“Simple chains and sprockets link the two steering rings to the column,” Rumpf explained. “Everything from the top of the steering column forward is stock, except for an auxiliary power source which cuts in automatically if the power steering fails. This is important, because these rings don’t offer much leverage.”

“Why do you call the system ‘constant ratio’ steering?” I asked “Will future wrist-twists have a variable ratio, speeding up with increasing lock?”

Rumpf shrugged noncommittally.

The proving-ground gate lay ahead. I panicked. “You mean you want me to drive this thing outside? On the street?”

He smiled and nodded. Rumpf is a serious and dedicated man, but his sense of humor often shows through the surface.

I fired up the engine, went through a mental count-down, and eased the Merc through the gate, as gingerly as a nudist in a cactus patch. On the street, I found myself holding my breath. Every twitch of the wrist resulted in a jerk. The car felt like a kangaroo with hiccups.

Corner coming up. I pushed down on one ring and up on the other, trying to twist the entire yoke. The car wobbled embarrassingly and continued straight ahead.

As we approached the next corner, I concentrated very hard. “Just twist the little bracelets,” I thought, “not the whole bloody car.” I twisted, and the car lurched

toward the right. It almost climbed the curb before I corrected.

Rumpf kept his composure beautifully: “Oh yes, we’ve speeded up the steering ratio to 15:1; it gives us about $1\frac{3}{4}$ turns of the rings lock-to-lock.”

I made the next turn with less drama. You do get used to the blasted thing.

Back at the proving ground, we set up a slalom course with rubber pylons. My first run resulted in a high pylon mortality rate, but by the third time through I was clearing the cones and making good time. It was a strange and pleasant feeling to have such a big car responding so quickly. Occasionally, during violent full-lock maneuvers, I ran out of power boost. This happens in production power-steering systems too, but a steering wheel makes the situation easier to handle. A bigger power-steering pump would help.

I tested the auxiliary system by killing the engine and flicking the ignition switch back on to activate the electric motor. There wasn’t much boost—just enough to get you to a garage safely.

Next came the tight, winding Ford handling track. I started slowly, but was soon sliding around the corners like Barney Oldfield. Each time something wanted to break loose, my wrist automatically twitched and the car recovered.

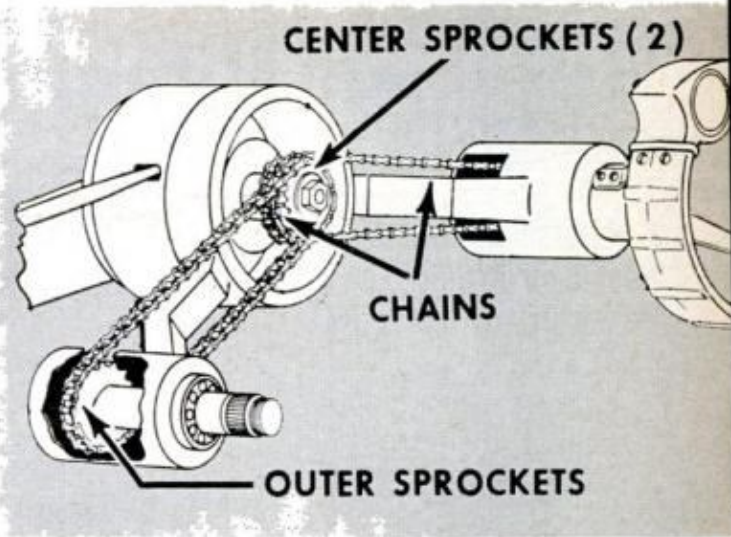
By the end of the day, I was a confirmed wrist-twist fan. Chuck was happy.

Back in my own car, I cranked that big steering wheel. It didn’t feel right.

I took my first corner much too wide. It all depends on what you’re accustomed to, I guess. ★ ★ ★



BACKING IS EASY; no need to crank a big wheel 3.6 times lock-to-lock, and there's no loss of directional orientation. Cover hides chains, sprockets



SIMPLICITY OF SYSTEM is obvious. Both rings turn together; normally you hold outer edges of rings, but thumb holes are handy for tight maneuvering

MY FIRST RUN through the slalom was inauspicious. But with practice, I learned to shift my hands back and forth, my thumbs in the thumb holes. My times improved for half a dozen runs, then seemed to level off





A Nationwide Survey
Based on 810,000
Owner-Driven Miles

Nimble Falcons Have Some Gearbox Woes

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

"MY WIFE HAS NO TROUBLE handling the car," the Air Force sergeant told us, "and she's just learning to drive. To me, the Falcon is the perfect car for a small family."

He could find togetherness in lots of U.S. compacts—but the Florida airman would have a hard time finding another car that so satisfies its owners. Two of the questions in *PM's* owners reports usually bring us the best information about owners' over-all reaction to their cars—how many would buy the same car again, and how many vote it Excellent. Falcon hit the gong louder on both counts than any of the other '65s we've tested. The 94.6% who'd buy one again tops the most enthusiastic response to date. Other '65s averaged 10 percentage points less. And the 61.9% who tag the car Excellent were passed up only by the big Ford's 62.3%.

A Pennsylvania bank teller backed up the Excellent rating:

THE ABSENCE OF BULGES DREW APPROVAL from Falcon owners although a few complained that parking light-directional signals tucked into the bumper are vulnerable to damage and easily obscured by mud, dirt—even winter ice

A piddling 0.4% →
called their
Falcons 'Poor'





GASOLINE GEYSERS COMING FROM THE sharply kinked Falcon fill pipe got a full measure of protests by owners. Some also found the trunk sill too high



STEP-OVER HEIGHT OF FALCON'S DOOR sill drew some complaints, but other owners (with normal size feet) praised entry and exit room. Seat padding is thin

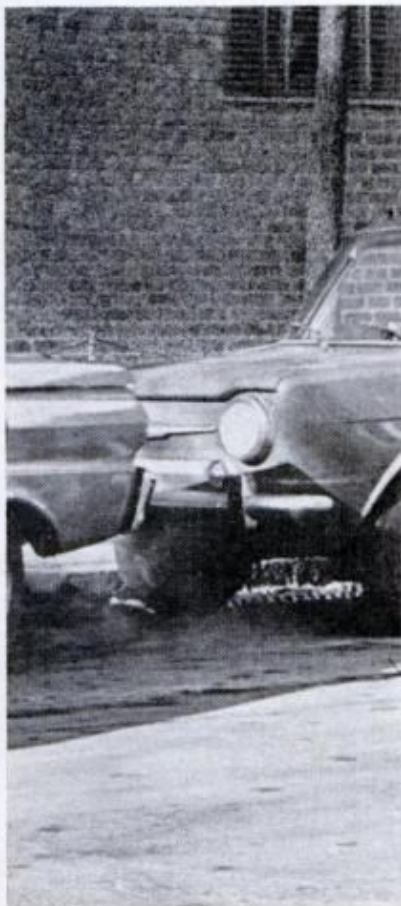
EXCELLENT FALCON FUEL MILEAGE was no more than owners expected. Their comments weren't widespread enough to put it in the top three best-liked features (below). Most reported they got about what they expected

Owners Like

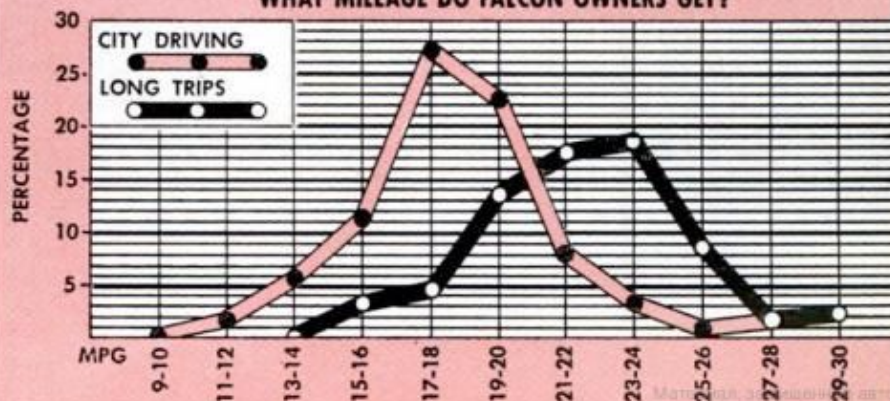
Driving ease	(42.3%)
Uncluttered styling	(26.4%)
Thrifty operation	(21.1%)

But Don't Like

Gearbox failure	(9.3%)
Shoddy glove box	(8.8%)
Careless assembly	(7.9%)



WHAT MILEAGE DO FALCON OWNERS GET?





INSTRUMENT CLUSTER houses Christmas-tree speedometer and idiot lights, but owners were pleased with uncluttered instrument layout and attractive padding

Seal problems that gave trouble have been engineered out, says Ford engineering →

"This is my dream car," he told *PM*, then added: "... as soon as it's paid for."

The problems that showed up in our survey, however, were significant. For the first time in many owners reports, the top complaint focused on the failure of a mechanical component—the Falcon's automatic gearbox. Not quite 52% of our Falcon owners bought automatics, yet fluid leaks from the box caused more complaints than anything else. The troubles of an editor in Ohio were typical: "Automatic transmission fluid leaked out when couplings under the car came loose." Ford tells us most complaints are traceable to a single supplier who, without permission, put a new surface on the neoprene lines to the transmission. It was harder, thus didn't seal well at the clamped joints.

According to the owners, Falcons continue to give good gas mileage. Most people (22%) reported getting 19-20 mpg. Another 15.4% said they got 21-22 mpg.

We checked fuel consumption on a test four-door with manual transmission and found Ford's junior-size bird doing an outstanding job. Our Tracktest electric speedometer and odometer eliminated optimism in the Falcon's speedometer (it ranged from 8% fast at 50 to 5% at 40 mph). The car's odometer was 5.3% slow. Here's how our test car, with the 105-hp engine, performed:

True mph	30	40	50	60	70
Mpg	33.92	29.16	27.45	27.19	22.55

A '64 101-hp automatic
 ← ranged from 24.5
 mpg down to only 15.7

Throughout our entire test, which included some brisk city driving as well as the performance checks, we averaged an excellent 19.72 mpg.

Falcon owners who contented themselves with the standard transmission complained in several instances of vibration at low speeds. Actually, the little 105-hp Falcon Six probably has begun lugging whenever they let High-gear speed drop below about 25 mph. In normal driving, downshifting was always necessary by the time speed dropped to 20. For best acceleration figures, we kept the transmission in Low until 30 mph and in Second until 53. A PM editor did 0-60 in an average 13.7 seconds, 40-60 in 7.3, and 50-70 in 9.2, all entirely respectable times for the little economy engine we had.

← Ford dropped the
 4-speed option from the
 Sixes—where it would
 be of use to drivers

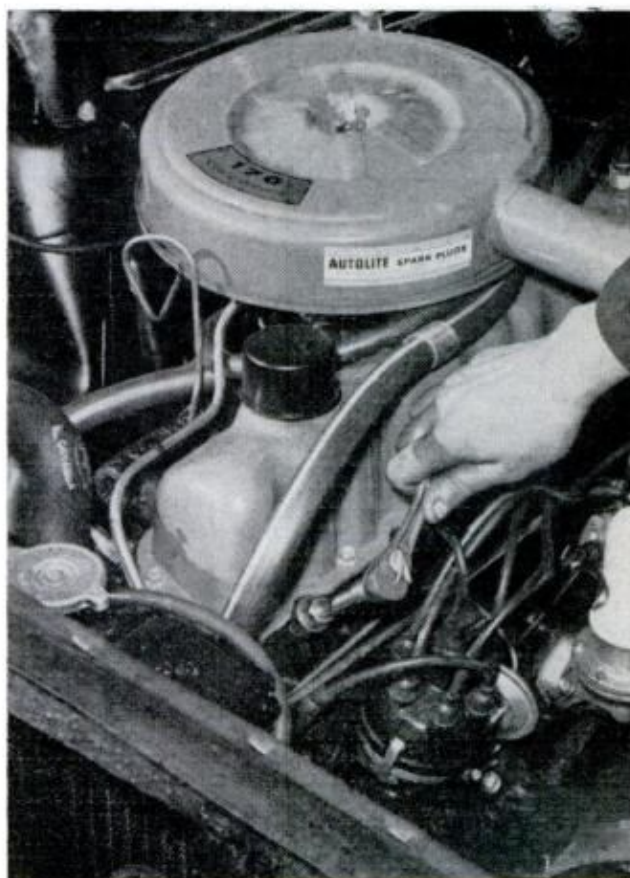
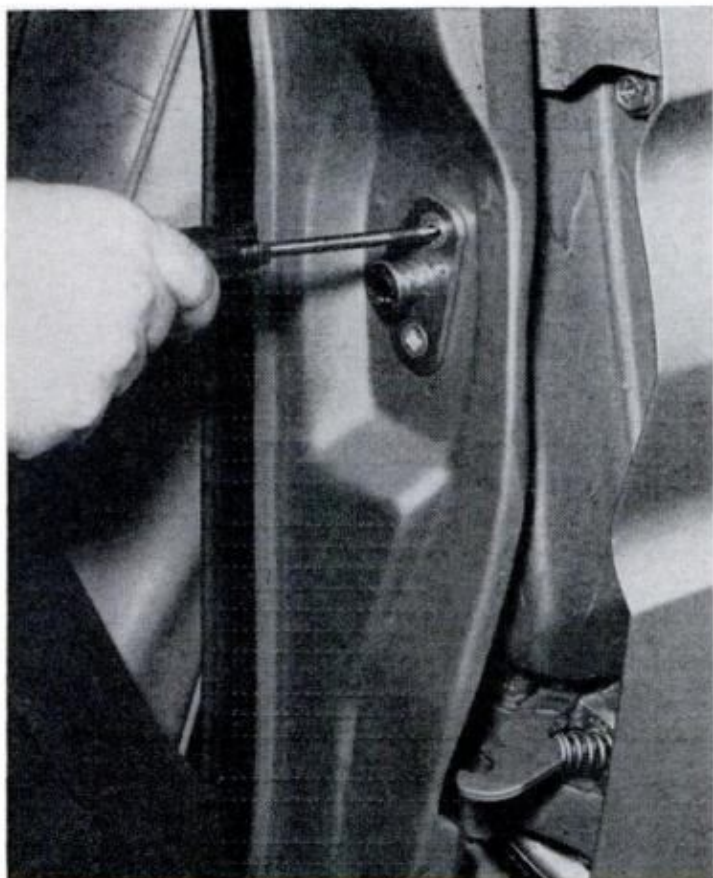
Brake fade showed up in our regular braking test, but not as badly as it has in some domestic cars. The pedal pressure for 17-ft/sec/sec stops climbed, during six runs, from 30 pounds to 52. After the last run, the drums smelled hot and 10 minutes later they hadn't yet fully recovered. We ran these tests on slightly wet roads and found the brakes sensitive to puddles. The brakes pulled sharply to the right as water was splashed into the system.

The engineers' problem:
 How to shield brakes
 ← from water, yet let
 cooling air flow in?

The ultimate judgment, however, comes from the owners—day-to-day drivers who have racked up nearly a million miles in their Falcons, with every kind of trip from a trans-continental tour to an errand for a loaf of bread. We tabulated their responses, from praises for easy handling to complaints

HARD-TO-CLOSE DOORS prompted beefs by a substantial number of Falcon owners, but they or dealers should find moving the striker plate slightly a help

SPARK PLUG ACCESSIBILITY around the little Falcon Six is good enough to encourage do-it-yourself maintenance. Only 17% bought the space-grabbing V8



Steering is light despite the common-place 54-46 front-rear weight ratio →

The only styling beef is about chopped rear end—yet they like the abbreviated length →

Tooling on most parts was amortized long ago, so costs should be held down →

That's with the V8. → He still reports 20 mpg overall—economy enough to pay for the tires he'll need

of sloshing gasoline, and ranked them according to which were found most often. Here are the top five salutes:

"The car is easy to handle in city driving. Surprisingly it also handles better than I expected at turnpike speeds."—Oklahoma service manager.

"The car is quick in tight places."—Connecticut office clerk.

"Ease of handling without power steering sold me."—Illinois farmer.

"Does not look like a little tub anymore."—Vermont department store merchandiser.

"A simple car, not overly long or crumbed up with unnecessary trim."—Ohio artist-teacher.

"Simple ordinary lines, not flashy. Sets example for others against ostentation. I'm a simple, ordinary man myself, I guess."—New York clergyman.

"It is economical on both gas and repairs and has given excellent service."—Florida sales engineer.

"The upholstery takes a lot of punishment from my four sons."—Florida salesman.

"Futura interior is very elegant for a compact car."—New York engineer.

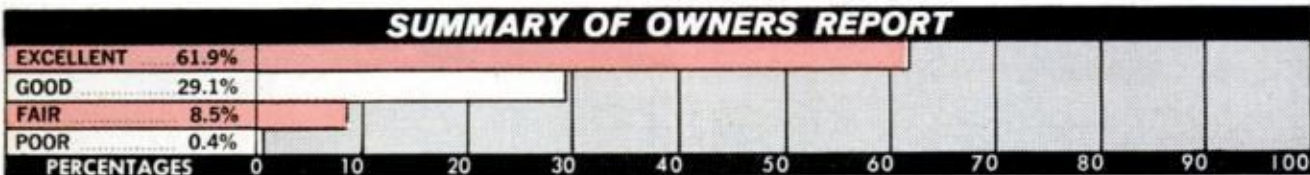
"It has surprising passing power (with 120-hp engine)."—Texas soldier.

"I have very little trouble when pulling away from traffic lights against bigger cars. I once measured 145 ft. of solid rubber without trying."—California industrial worker.

Naturally, there are thorns among the roses. From automatic transmission trouble to difficult manual shifting, here are the five most common complaints:

"There's a leaky seal on the automatic transmission."—

(Please turn to page 242)



Best-liked features		Least-liked features		Other car considered, if any	
Ease of handling	42.3%	Transmission trouble	9.3%	None	37.0%
Styling	26.4	Glove box	8.8	Chevrolet	12.3
Economy of operation	21.1	Poor assembly	7.9	Chevy II	8.8
Upholstery	19.7	Poor seats	7.0	Corvaire	7.5
Power and performance	19.4	Hard to shift	6.6	Ford	5.3
Ride	18.1	Rattles and squeaks	6.2	Is Falcon family's only car?	
Overall size	14.5	Doors hard to shut	6.2	Yes	56.5
Dashboard	13.7	Unlighted shift quadrant	5.7	No	43.5
Gas mileage	12.3	Gas-tank fill pipe	4.4	Make of other car	
Ease of parking	11.5	Carburetor trouble	4.4	Ford	15.0
Roominess	10.6	Gas tank	4.4	Another Falcon	6.6
Comfort	9.7	Water leaks	4.0	Chevrolet	6.6
Easy starting	7.0	Headlights	4.0	Buick	3.1
Visibility	5.7	Not enough room	4.0	Make of car traded in	
Paint	5.3	Vibration	3.5	Falcon	31.8
Driving ease	5.3	Dashboard	3.5	Ford	14.1
Heater	4.4	Boxy shape	3.5	Chevrolet	5.7
Transmission	4.0	Heater	3.1	Rambler	2.2
Price	4.0	Tires	3.1	Corvaire	2.2
Quietness	3.5	Styling	2.6	Volkswagen	2.2
Taillights	3.5	Bumpers	2.6	No trade-in	15.9
Visibility	3.5	Windows	2.6	Dealer Service	
Brakes	2.2	Falcon decision based on		Excellent	52.4
Side trim	2.2	Price	34.8	Average	33.5
Headlights	2.2	Economy	30.4	Poor	9.3
Tires	2.2	Styling	22.0	Would you buy from him again?	
Instrument panel	2.2	Previous Falcon ownership	19.4	Yes	70.1
Fuel Economy		Size	17.2	No	10.1
About as expected	57.3	Ford reputation	9.3	Buy another Falcon?	
Better than expected	14.5	Gas mileage	7.9	Yes	94.6
Not as good	20.3	Ease of handling	7.0	No	5.4



Compact Stereo

Tucked away into the normally wasted space under the Miracord changer is the amplifier of a new stereo set. The combination is dual 18-watt set that measures only 18½ by 16 by 9½ inches. Pushbuttons (above) control all functions of the all-transistor Benjamin 200. FM stereo can be added later. Price is \$229.50



Family Hovercraft

Designed to hold three adults, a 20-foot hovercraft attains speeds of 45 mph.

Called the *Mini-Hovercraft* by its British designer, it is powered by two automobile engines, one for lift and the other for drive. Production models will be made of fiberglass and will feature fully enclosed cabins.



Muzzling a Wife

Putting a muzzle on a wife is not a new idea, but a Vienna doctor has now advanced the idea that it might be good for her health. Snoring, according to Dr. Hermann Klaus, places an undue strain on the heart, and he has designed a mask that acts as a gag while a person sleeps, forcing the wearer to breathe through the nose.





By Ed Nelson



More Accurate Car Mileage and Speed for All; While Ford's Hemis May Drag, Chevy Porcupine May Race

The Chrysler hemi-head racing engines that cut such a swift swath through NASCAR racing events last year aren't sulking in their crates. After Bill France relegated them to NASCAR's ashcan with the wave of a ruling, the Plymouths and **Dodges** (and their talented drivers and crews) were concentrated on dragster events.

Along with them went about a dozen experimental overhead-cam hemis **Ford** had built before the new NASCAR rules changed all the signals—and the fun.

Tony Nancy, a Van Nuys, Calif., veteran, has his eye on one of the Fords, although he has been using **Chrysler** engines. Not that his **Chryslers** haven't done well. They've put out 503 hp at 6800 rpm, factory-fresh with only new jets and plugs. Blown, Nancy figures his latest **Chrysler** for 800 hp at 6800 rpm.

Ford's overhead-cam hemis, with minimum valve-train inertia, peak at above 7000 rpm and should do even better.

Many **Ford** engineers believe, incidentally, that the overhead-cam is the coming thing—that eventually you might even find an OHC Six in your **Falcon**.

There's still lots of engineering work to be done, and improvements developed for competition may deserve the credit if these powerful units ever reach the consumer market. One problem at present: Valve-train lash adjustments. As this is written, **Ford** is working on a set-screw modification that may turn the trick.

Lots of doubt has been expressed, some by **General Motors** brass, about racing's supposed improvements to the breed. But **GM's** newest engine, **Chevrolet's** 396-cube V8, is obviously descended from the "porcupine-head" engine (valve stems jut in all directions) developed for a NASCAR 6½-liter limit of a couple of years ago.

The angles of the valves help keep the path of the incoming fuel-air charge less tortuous than, for example, it is on the old 409-inch **Chevy** engine. In other words, the porcupine-descended version breathes more freely. And the combustion chamber is somewhat rounded—similar to the **Chrysler** hemi—even though **Chevy**

sources insist it is, technically, wedge-shaped. **Chevy's** 396, called the Mark IV, hasn't been banned from NASCAR competition, so maybe that curve is a wedge. Such are the glories of semantics!

A top man from one of the big NASCAR tracks, trying to encourage competition, told a California group that 60,000 of **Chevy's** Mark IVs engines would be available by March for under \$500 apiece.

At the price, this could really wedge **Chevy** into racing.

Normally knowledgeable sources swear you'll see a rear engine **Chevrolet** in the **Chevelle** size range, perhaps by next fall. **Chevy** men deny it as, at best, a silly rumor. And indeed, why should they go that route with a new **Corvair** to sell?

Nudged by complaints from car rental customers, U.S. automobile manufacturers have decided to slow down their eager odometers. Instead of a tolerance of 0% slow to 5% fast, the new spread will be from 3.75% slow to 3.75% fast.

Yes, the allowed range of error seems greater (7½% compared to 5%). But practical considerations make it smaller. Making use of the "low" side of the odometer tolerance can affect speedometer indication too, an SAE man told us. And as Pete Estes, **Pontiac's** general manager, put it: "Think what would happen the first time a **Pontiac** owner got a speeding ticket when our speedometer said he was within the limit!" So, to be practical, Detroit will shoot for a 0-to-plus-3.75% spread.

All fleet cars built after January first will have the more accurate system. And, as old parts are used up, the new instruments will be phased into every new car.

Speedometers will never be absolutely precise. Variations in tire size, pressure, and wear introduce error. Also, costs would rise. There'd have to be a speedometer gear set for every rear-end ratio.


The big **Olds** avoids this problem by driving the speedometer cable off the left front wheel instead of the transmission output shaft. We asked Estes why **Pontiac** didn't follow **Olds'** lead. Finding a safe path for the cable through **Pontiac's** front suspension is rough, he told us.

Unraveling the Terrible TWISTERS

Radar, U-2 planes, computers and satellites are providing tornado data faster than ever, and even more effective tools are on the way

By Theodore Berland

DARK FUNNEL OF TWISTER jabs menacingly at Medaryville, Ind., during 1963 storm. Though it was losing its force, the tornado still had enough power to cause considerable damage. It finally petered out east of town



JOSEPH G. GALWAY is a 42-year-old ex-Bostonian who takes his job seriously. He has to. His finger is on a panic button.

If he presses it, a giant organization will spring to life. In cities and towns perhaps 1000 miles or more from Galway's Kansas City desk, civil defense sirens will wail their warnings and frightened people will scurry for cover. Tornado!

Joe Galway is a duty forecaster at the U. S. Weather Bureau's Severe Local Storm Forecast Center in Kansas City, Mo. He and his colleagues work toward a single goal: to give vulnerable areas warning in time for them to "dig in" against the approaching fury. To do that

successfully, the meteorologists must be able to detect the twisters even before they're spawned.

New tools and new knowledge have helped to triple the accuracy of the Center's predictions in the past 10 years. Today, the forecaster refines his estimates with information brought in by powerful radar, high-flying U-2s and earth-circling satellites. He turns to a computer for on-the-spot calculations. And before long he may be calling on light radar (lidar), which uses laser light, to peer into suspicious clouds. Because of the frequency of its radiations, lidar can provide more details than conventional radar.

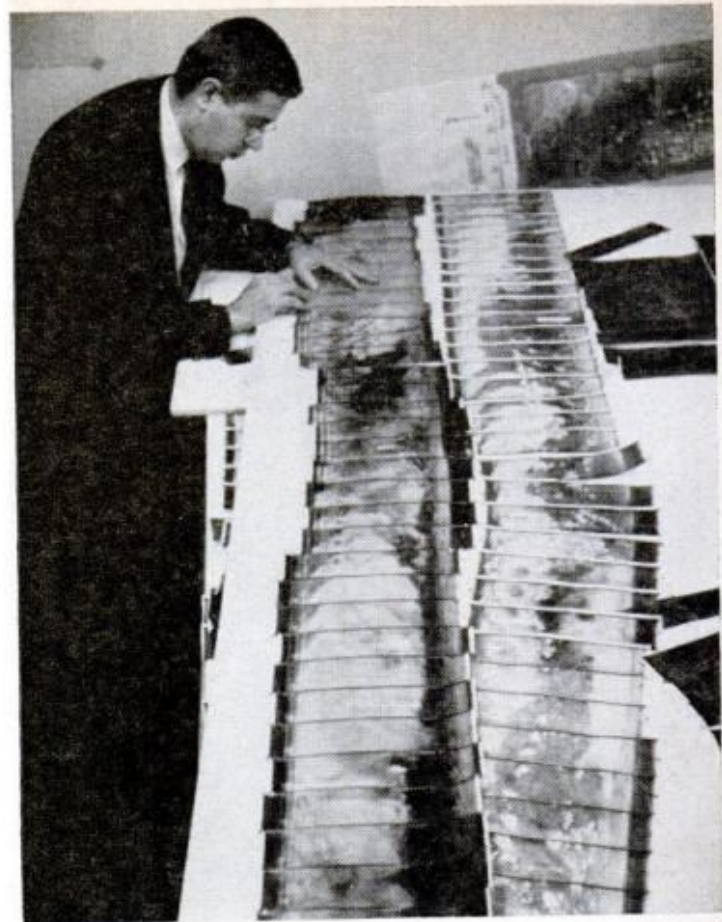
Meteorologists are also digging deeper into the mysteries that surround the twister. They're discovering new and curious facts about the forces that shape it and how it develops its awesome power. Funnel-shaped clouds filled with blue electrical light have been observed. The significance of this may be the key to the entire existence of the tornado's powerhouse. One noted investigator is pursuing the electrical phenomena in tornadoes and believes the mysterious blue glow holds the secret that will lead to development of the simple electrical tool that will become man's ultimate weapon against the whirlwinds.

Meanwhile, Joe Galway wages a daily battle of wits with the capricious twisters. He knows personally the damage they can do. Three years ago one hit the suburb where he lives.

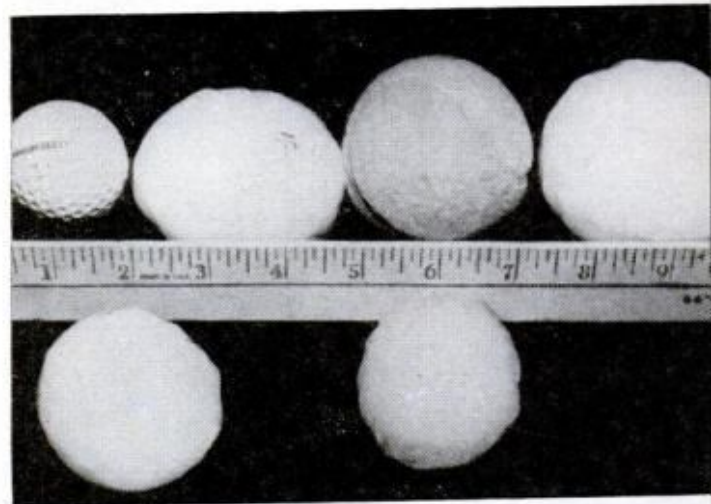
"I was off work that day," he explains. "I looked out and there it was, about four miles northwest of the house. I hustled my wife and our five kids into the basement. Luckily, it missed us. But it tore up half a dozen houses nearby."

Joe's radio had told him the tornado was coming. One of the other five duty forecasters at the Center had issued the warning.

There's no magic to tornado forecasting. It's the result of the tedious examination of stacks of weather and radar reports. Forecasters like Galway are only able to foresee the development of weather environments that can produce tornadoes. In the spring and summer, these are squall lines, or thunderstorm echelons. In the fall, they are landbound hurricanes that can spawn tornadoes on their eastern and trailing edges—as happened in Louisiana last year.

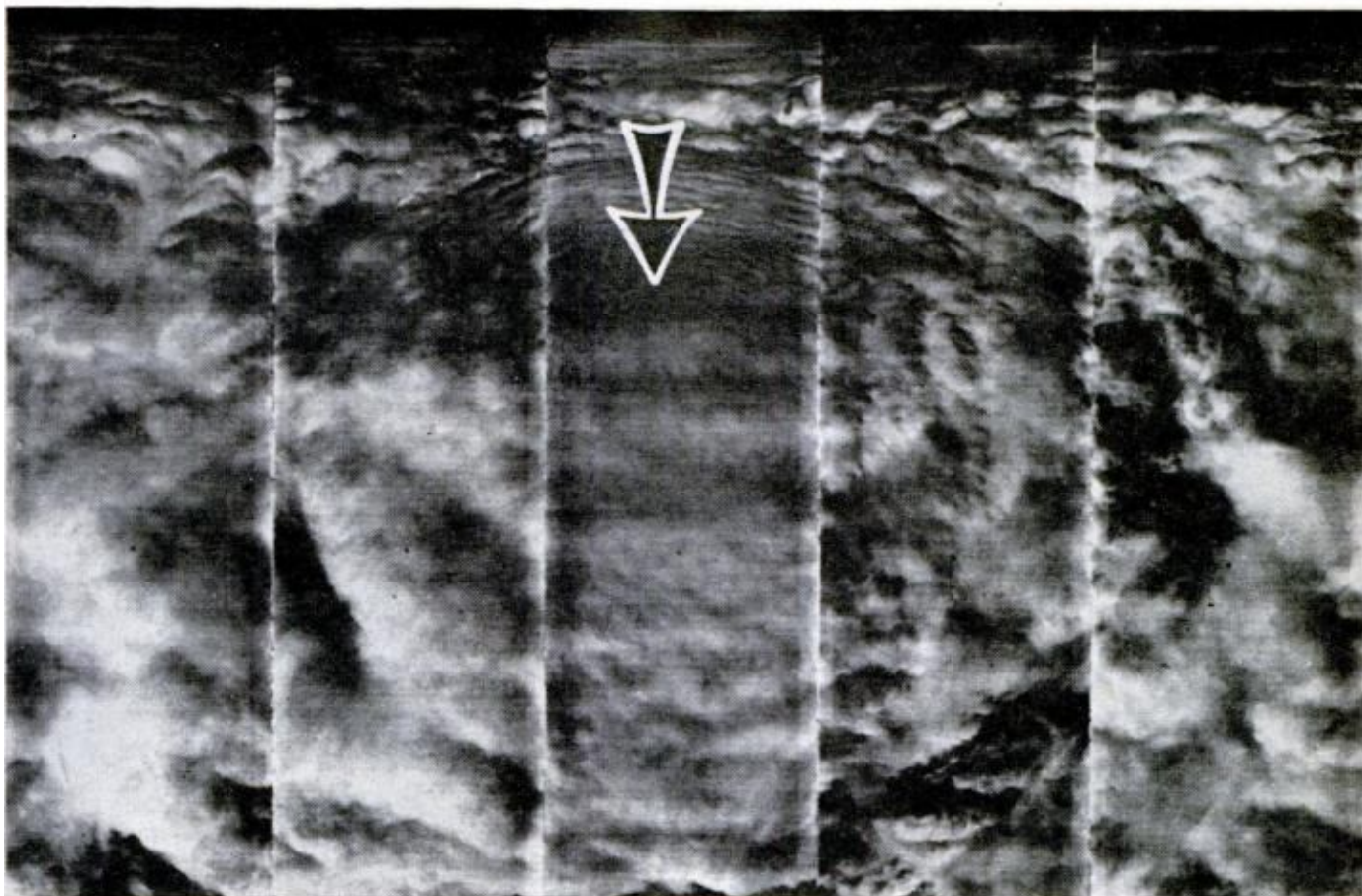


THUNDERSTORM PORTRAIT provides clues to how tornadoes are formed. Here, meteorologist Donald R. Fitzgerald pieces together photos from U-2 flight

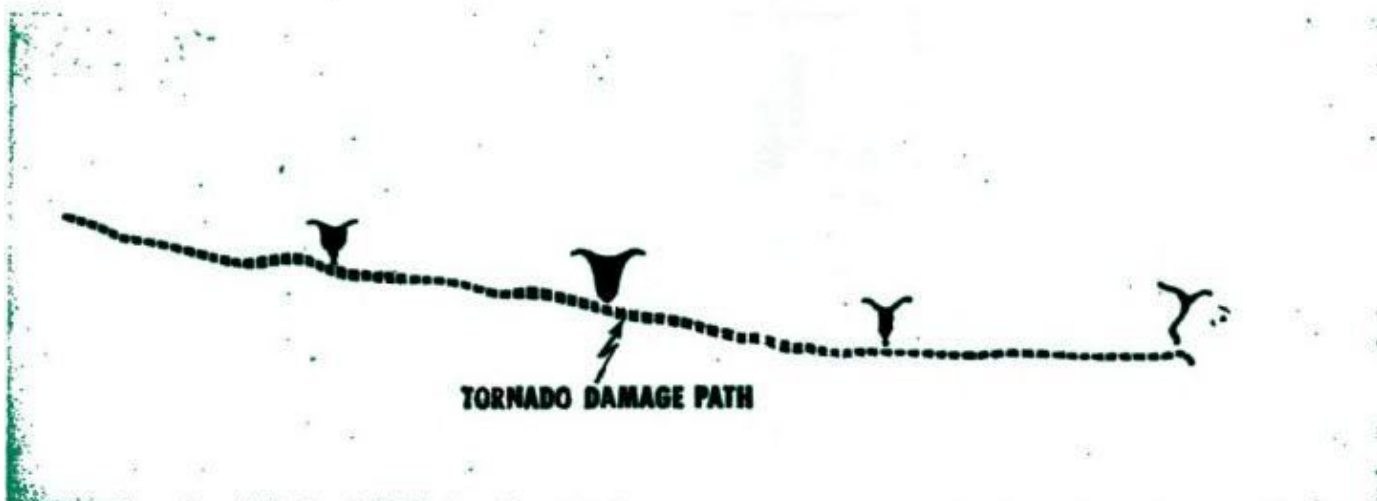


HAILSTONES AS BIG as a tennis ball—much larger than golf ball (upper left)—were lifted by tremendous updrafts in tornado-producing thunderstorm

The data from which tornado forecasts are built come in various ways. There are hourly weather observations from 500 stations across the country. These are punched out by Teletype machines in symbols that represent wind direction and velocity, temperature, dewpoint, etc., at the ground and at various altitudes. The banks of machines at Kansas City eat up close to 100 pounds of paper rolls a day as



HERE'S HOW GIANT WHIRLPOOL looks from U-2 flying above it at 51,000 feet. It seems certain, scientists say, that these vortexes extend all the way down (arrow) through thunder cloud. They rotate a speeds up to 300 mph



MEDARYVILLE TORNADO WAS SPAWNED near Essex, Ill., and moved east on a 70-mile rampage through Illinois and Indiana (dotted line). The storm killed a woman in Illinois and destroyed a trailer camp near Kankakee

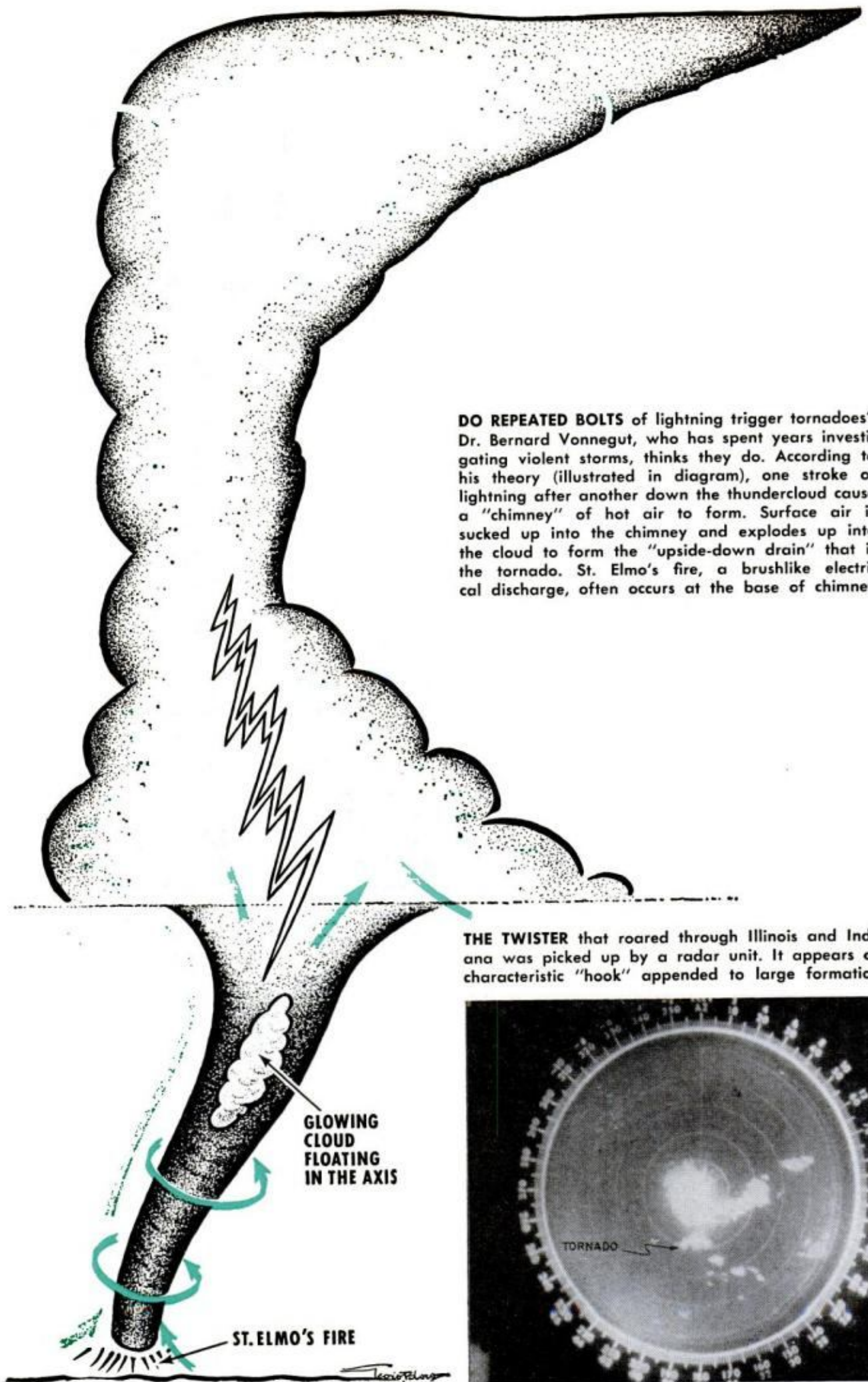
they record some two million bits of data.

Pictures come via facsimile 16 times a day from the network of 80 Weather Bureau and U.S. Air Force radar sets that scan the skies. Each is so good it can spot light drizzle 250 miles away. National weather charts for various levels of the atmosphere—1 mile up, 2 miles, etc.—also arrive via facsimile. And large-scale pictures are transmitted from the Tiros satel-

lite brain center at Wallops Island, Va.

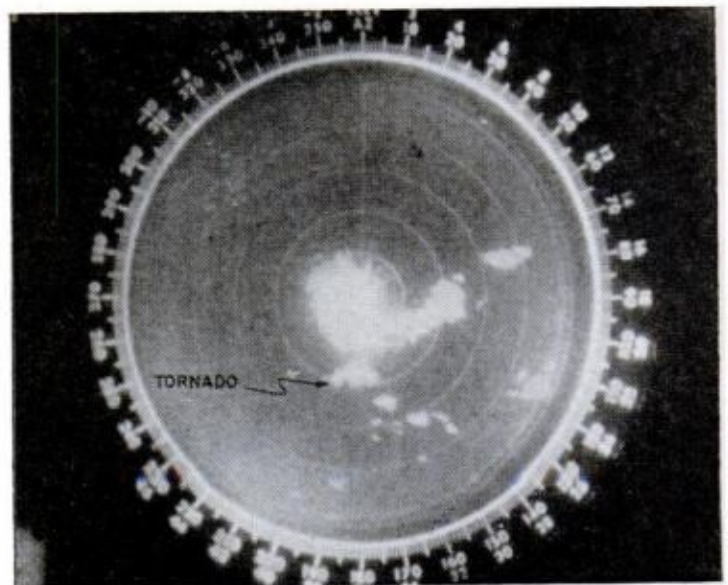
Most forecasters concern themselves with a limited area. But Joe Galway looks at the whole country. He scans radar and weather maps, seeking signs that can tell him that fierce storms, the kind that spawn tornadoes, can form.

He looks for the beginnings of what he calls "low-pressure monsters." They are born when warm, moist streams of air



DO REPEATED BOLTS of lightning trigger tornadoes? Dr. Bernard Vonnegut, who has spent years investigating violent storms, thinks they do. According to his theory (illustrated in diagram), one stroke of lightning after another down the thundercloud cause a "chimney" of hot air to form. Surface air is sucked up into the chimney and explodes up into the cloud to form the "upside-down drain" that is the tornado. St. Elmo's fire, a brushlike electrical discharge, often occurs at the base of chimney

THE TWISTER that roared through Illinois and Indiana was picked up by a radar unit. It appears as characteristic "hook" appended to large formation



GLOWING
CLOUD
FLOATING
IN THE AXIS

ST. ELMO'S FIRE

move up from the Gulf of Mexico and hit cold, dry air from the Canadian Rockies. The Great Plains are such a likely intersection for these collisions that more tornadoes are born there than in any other part of the world. This is Tornado Alley.

The violent mixing and bubbling of air results in thunderstorms. Puffy, gentle-looking pillars of white boil up to more than 10 miles above the ground, where they form "anvil tops" of ice crystals. Serene looking outside, they become teeming violence inside. Joe Galway keeps close tabs on the formation of such storms. They can breed twisters.

There is much still unknown about tornadoes. But essentially these funnels of destruction act like giant upside-down bathtub drains. They are violent vortexes of air that suck up anything in their paths, then fling them away at better than 100 mph. They are powerful enough to drive straw through tree trunks, to hurl cars around like toys, to crush houses.

The tornado-spawning thunderstorm must have a belly full of strong updrafts. Rising at 50 mph these currents easily lift hailstones three-quarters of an inch in diameter; at 100 mph they can fling baseball-sized stones.

The second requirement is fast ground winds, 60 mph or more. As they converge, they start the updrafts spinning. Joe Galway looks for sharp temperature differences between sides of a squall line to indicate that such winds will blow. He checks to see how close is the high-flying

jet stream, which also exerts an influence.

This is an oversimplification, of course. There are complicated mathematical formulas involved, many of which are handled by an electronic computer. In half an hour it does the computations of 400 meteorologists.

When a picture of "instability" seems to be forming—usually after lunchtime in Kansas City—Joe Galway springs into action. He'll first discuss the situation over the phone with the forecast center involved—Chicago, Boston, Miami, Washington, D.C., New Orleans, Denver, San Francisco or Seattle.

Then he issues tornado warnings for specific areas, usually 200 by 120-mile rectangles on a map. These go out via Teletype two to four hours before the thunderstorm is fully formed!

Says Galway, "Nothing is as humbling as issuing a tornado forecast and being told later that the sun shone all day. When we started this service 10 years ago, that happened often. But not now."

In those early days of tornado forecasting, the score was 20 percent right, explains his boss, Dr. Donald C. House, chief meteorologist at the Kansas City Weather Bureau Office. Now predictions are on target more than 60 percent of the time.

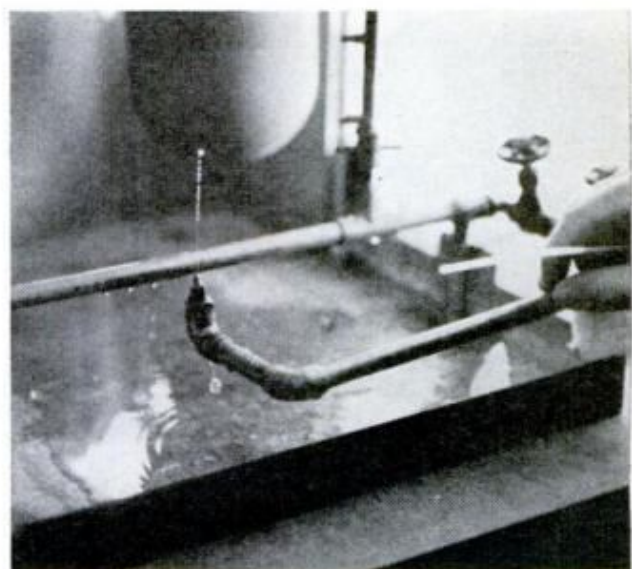
Another forecaster, Don Foster tells of a tornado warning he issued for parts of Arkansas: "The Memphis, Tenn., radar operator called me and said the skies were clear. He couldn't even pick up a small

[\(Please turn to page 216\)](#)

SMALL FOUNTAIN of water in Dr. Vonnegut's laboratory breaks up into crown of droplets a few inches above outlet. The droplets continue to form until . . .



. . . **CHARGED COMB** is introduced. Electricity jumps from comb to water, making drops combine. The same thing, says Dr. Vonnegut, occurs in thunderclouds



Armory on Wheels for

NOON-HOUR TRAFFIC in mid-Manhattan, as usual, was almost at a standstill. Slowly we edged the low-slung, gun-metal gray sports car around a corner but obstinate pedestrians packed the crosswalk, refusing to let us through. Casually I flipped open the cover of the armrest between the front seats and snapped a pair of toggles. The parking lights dropped forward and the muzzles of a pair of Browning machine guns peeked out. "Look!" squeaked an enormous wom-

an in a tiny hat. She jumped back. Goggling pedestrians opened a path and we eased through, grinning like a couple of full-fledged halfwits.

We were driving about the most lethal car ever built: Special Agent James Bond's Aston Martin, the Espionage Special DB5. The \$45,000 car (ordinary Astons run about \$13,000) was built for "Goldfinger," newest and probably money-makingest of the Bond movies. The car is in the U.S. to help fuel the publicity machine

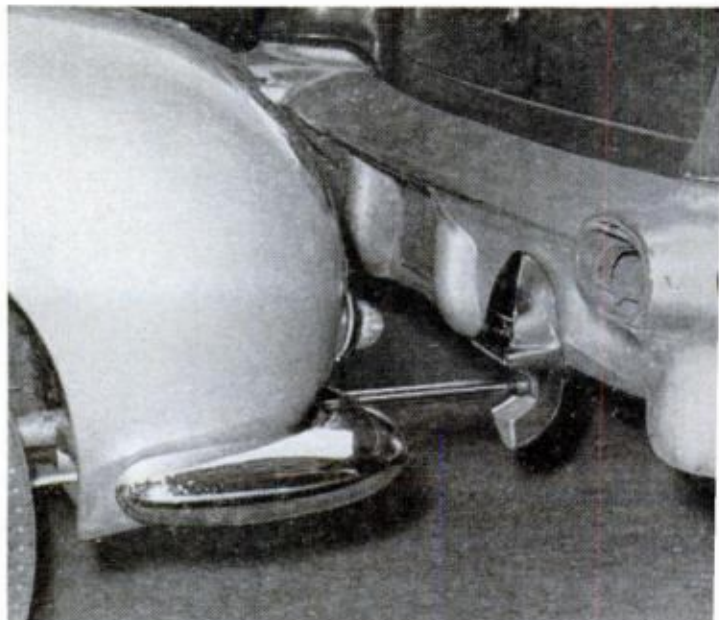
"YOU'LL NEVER GET US, GOLDFINGER," seemed to be the line by Agent 007 as he fled the enemy's agents in this special Aston Martin. A *PM* author tried the military smoke cannister hooked under the car—and got dramatic results



FLATTENED SPRAY NOZZLE hidden behind the tail-light of the Espionage Special DB5 is controlled from the driver's seat. It coats the road surface with oil



SPIES BLOCKED INTO A TIGHT parking spot don't have the trouble most of us have. Hydraulic bumpers on Bond's car effectively create room for maneuvering



Special Agent 007

and for the New York auto show.

My guide to the machine's accessories—the gadgets Detroit forgot—was Aston's test driver Michael Ashley.

A cab slipped in front of us, then stalled in the crosstown traffic. Ashley blinked innocent British eyes and said, "Guns! We'll blow the bloke up and clear the debris away with the rams." He jabbed a button in the console.

Nothing happened. "Ah!" he sighed. "No firing mechanisms. We had to remove them

PURSUERS CAN'T GET A SHOT at the driver of the specially rigged Aston when the driver elevates this slab of armor plate, normally concealed in the trunk



AN EFFECTIVE WAY to get through crowds, the author found, is to pop open the parking lamps exposing cold muzzles of a pair of Browning machine guns



to pass customs. Pity."

Cars for super spies must be able to escape from enemy agents. Two levers on the floor of Bond's car flip taillights up and down via flexible cable. Concealed behind one is a fish-tail-shaped oil sprayer, fed from a pressurized drum in the trunk. Behind the other, a coffee-can-size container holds multi-spiked nails, like jacks with the points sharpened. Spewed out, they raise hob with enemy agents' tires. British police, afraid other motorists might get ideas, refused to license the car until the tack-spreader was deactivated.

To ward off pursuers' bullets, the auto boasts a retractable sheet of armor in the trunk to cover the rear window.

In the movie, Ashley acted as Bond's stand-in (sit-in, rather) in most of the chase scenes. He was driving, for example, when the smoke screen system (a military smoke cannister) was fired electrically; the evil enemy agents following in a Mercedes were enveloped and crashed. And he was sitting in for Bond when the tire slasher ripped through the wheels of a passing Ford Mustang. This handy weapon is a revolving cutter extending two feet out from a rear wheel hub. It was supposed to telescope, but design was too difficult; it was bolted on for the movie.

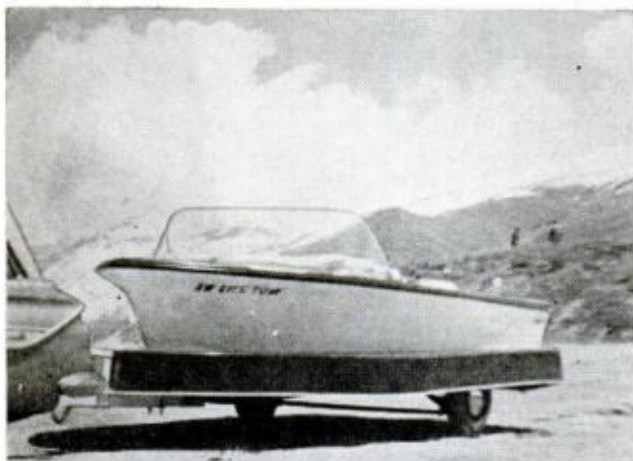
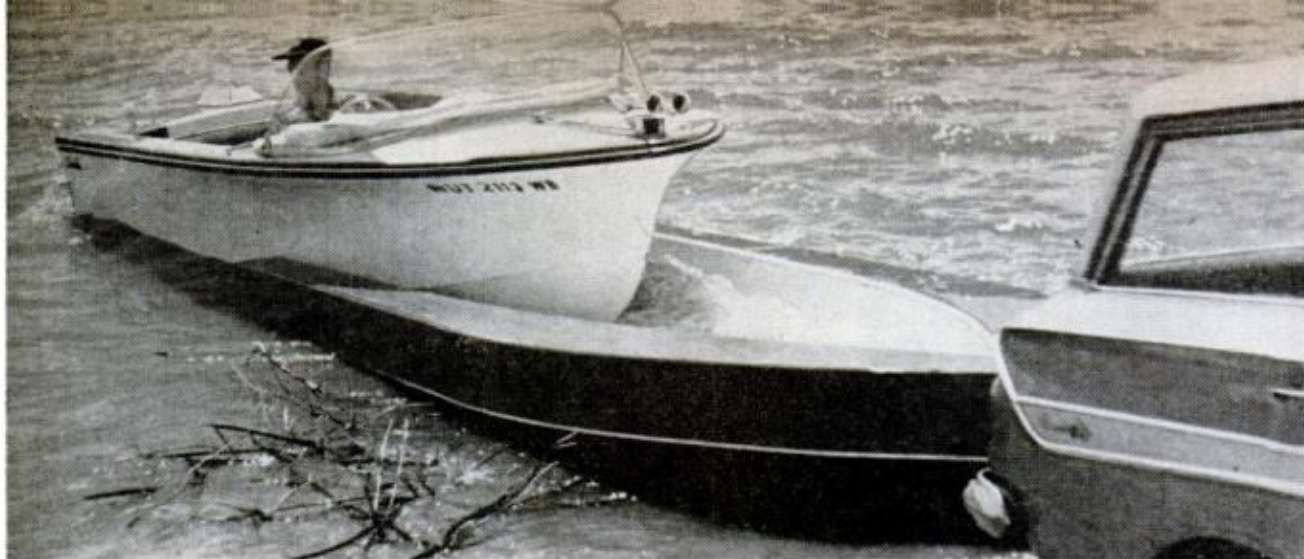
Designers also had trouble with the ejector seat. The device worked too well—a 150-pound test weight went 40 feet into the air. The studio couldn't find a volunteer. In the movie, that's a dummy sailing through the roof.

Plates from a Chameleon?

The extra equipment—half a ton of it—slices top speed by 14 m.p.h., says Ashley. "Now it'll do only 140."

To foil questioning police, British, French and Swiss license plates can be switched from inside the car. We parked illegally and waited for a cop—just to see his expression when he found French plates in front and Swiss in back. But the casual New York City police ignored us.

At least one of the gadgets would be handy on your own buggy: the hydraulic rams. We left the car at a Manhattan curb for a time, returned to find it blocked by a Cadillac in front, a Ford station bus behind. Ashley revved the engine and activated hydraulic bumper rams front and rear, pushing against both cars at once. To the applause of onlookers, we pulled out in a single sweep.—Robert Gannon



Trailer Is a Mobile Dry Dock

A floating fiberglass trailer not only carries a boat behind a car but can itself be used as a dock, a swimming float or (with an accessory transom) a fishing boat.

To launch or recover a boat, the trailer is simply backed into the water and the boat backed off or driven aboard it.

Flotation chambers around the trailer form walkways which passengers use to board the boat—keeping their feet dry.

The Gudmundson trailer is made by Astro Marine, Inc., Bountiful, Utah.



Do-It-Yourself Post Office Does Everything but Lick Stamps

It's self-service now at the post office. An experimental mailing center, open 24 hours a day, is in operation at a Maryland shopping center near Washington, D.C.

The post office will dispense stamps, change paper money and dispense money orders. Information about postal rates is

posted, so the sender can tell how much postage he needs. In addition, there's a scale that will weigh packages up to 50 pounds.

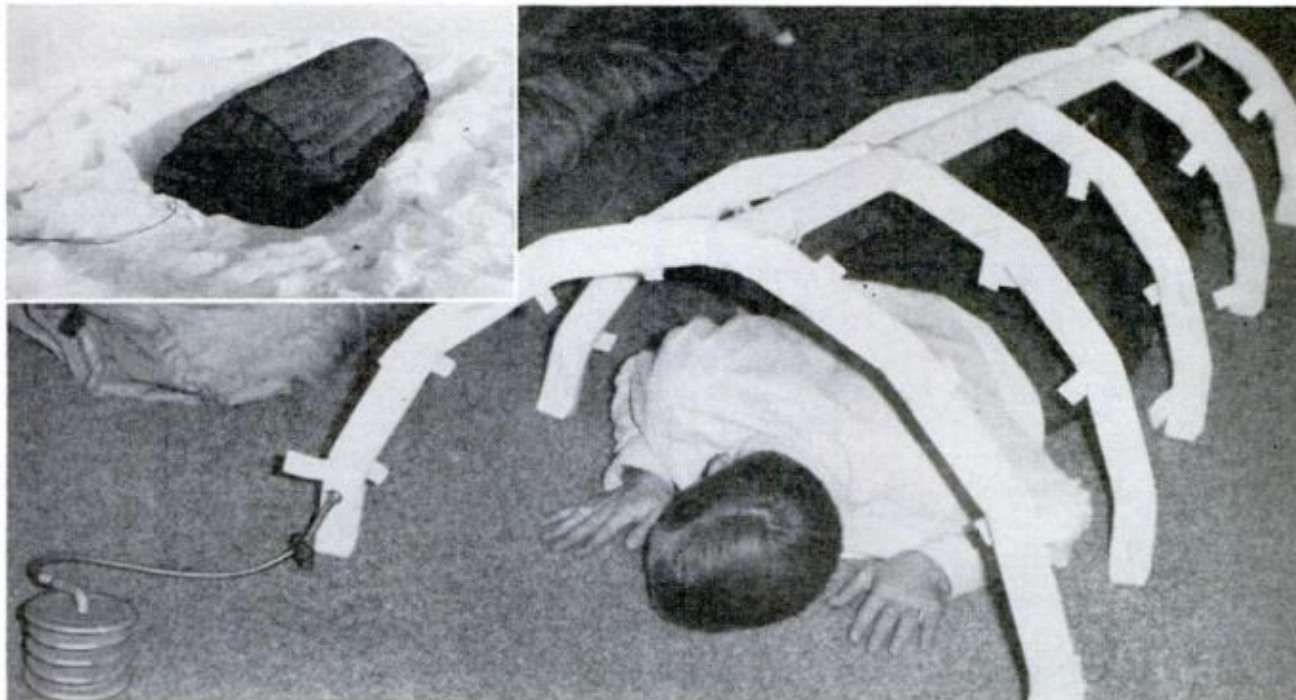
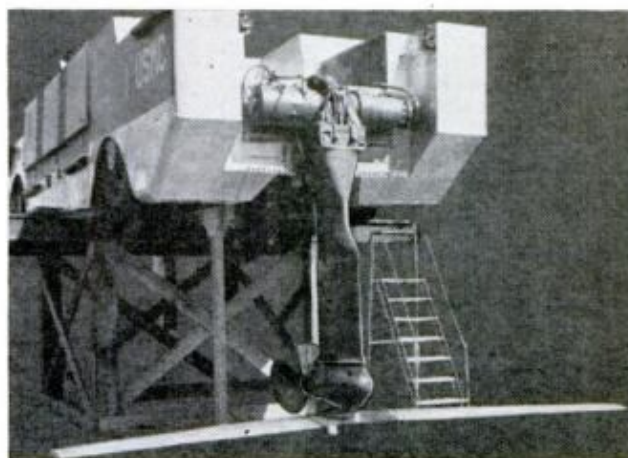
Mail deposited at the self-service post office is picked up every hour during the day and twice during the night.



Triple-Threat Hydrofoil

Designed to operate from a mother ship 50 miles offshore, a new amphibious assault craft can hit 35 knots riding on its retractable foils, 12 knots with its hull in the water and do up to 40 mph on land—all with 10,000 pounds of men and equipment aboard.

The craft has two propellers—one at the base of the rear foil strut (right) for “flying” operations, the second under the hull for conventional boating. Power is supplied by turbine engine rated at 1000 shaft hp.



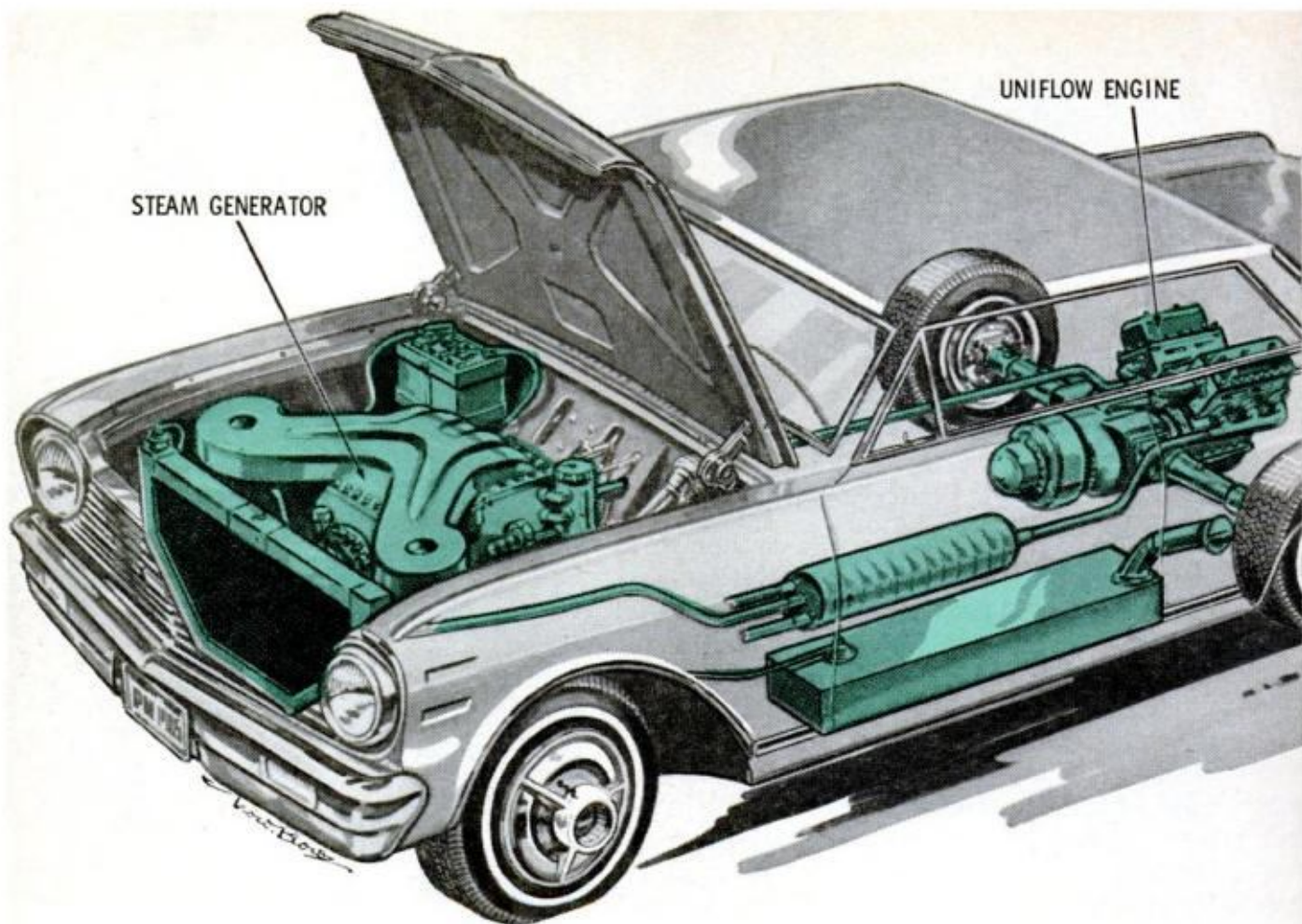
Inflatable Shelter for Flyers Downed in the Arctic

Erected in one minute, a portable shelter that measures 15 by 15 by 3 inches when folded can be inflated to protect a man from freezing in Arctic weather.

Developed by the Air Force for downed airmen, it consists of an inflatable frame of mylar-dacron and nylon walls filled

with northern goose down, which fluffs out to four-inch thickness when unpacked.

In tests, airmen wearing standard winter clothing, and lying on river ice or frozen ground, warmed up the shelter interior with body heat to 50 degrees above zero when outside temperatures were 50 below.



STEAM-POWERED CHEVY II? Not so fanciful, according to at least one engineer. There'd be room if you put the engine behind the rear axle, and you could expect 25-mpg at 65 and 0-to-60 accelerations of less than 10 seconds

DON'T HOLD YOUR BREATH, but there could be a steam car in your future.

Some of the best automobiles of 50 years ago were steam-propelled. To raise steam in one of those old timers the owner would light the fire under the boiler and then go back in the house for breakfast. Half an hour later he had enough pressure to head for town—if there were no long hills in the way. The steamer was a climbing fool but it often ran out of power on a long grade.

If that's the case, what's so hot about steam?

Behind the scenes, steam has been going through the same kind of evolution that has brought improvements to the "infernal combustion" engine. Modern steam engineering can give you a powerplant that's ready to go within 15 seconds from a cold start, that never runs out of power. It can use almost any fuel, climb hills all day long. And it will burn rubber if you hit the throttle too hard at 70 or 80.

It's been said that we might all be driv-

ing steamers today except for an epidemic of hoof and mouth disease that broke out in 1914. To help control the disease in horses, all the watering troughs were removed from roadsides, and this was a serious inconvenience to steam cars that depended on the troughs for frequent water refills! In any event, the trend toward gasoline became stronger about then.

A steamer requires no costly transmission, for it develops maximum torque at low rpm. It has no complicated carburetor, no delicate ignition system. There are no critical tuning adjustments. And the whole powerplant can be overhauled with a couple of wrenches and a handful of steamfitter's supplies.

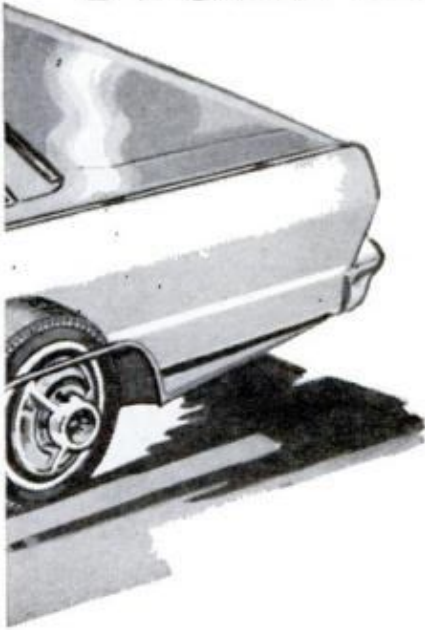
Recently the Convair division of General Dynamics "shook up" an Army board by proposing a steam engine for military tanks. At first the officials grinned at the quaint, old-fashioned idea, then some of them could hardly believe the figures that engineer Victor Millman presented.

Millman showed that a small steam plant

Fresh Head of Steam for Cars

Steam cars didn't go out with the Stanley. Now they're even putting boilers on go-karts, surfboards and a 170-mph Bonneville racer

By Thomas E. Stimson



THE IN-LINE, FOUR-CYLINDER steam engine in this creation by a pair of Pennsylvania brothers is based on a special cycle they patented. The car is built on a Ford chassis shortened to a 100-inch wheelbase. It has gone 85 mph

using five gallons of water as the working fluid could deliver 500 honest horsepower all day long, in Arctic weather or desert heat. It would be lighter and smaller than a tank's big diesel, easier to maintain. It could burn almost any fuel, including high-octane, jet kerosene, diesel oil or crankcase drainings. It would be so quiet (and this is something the Army wants badly) that it couldn't be heard 100 yards away.

It would propel a 42-ton tank at 40 mph.

Millman emphasized that the system involved no unknowns, although detailed engineering studies would be required. Being a "closed" system like a refrigerator, it would need little or no make-up water.

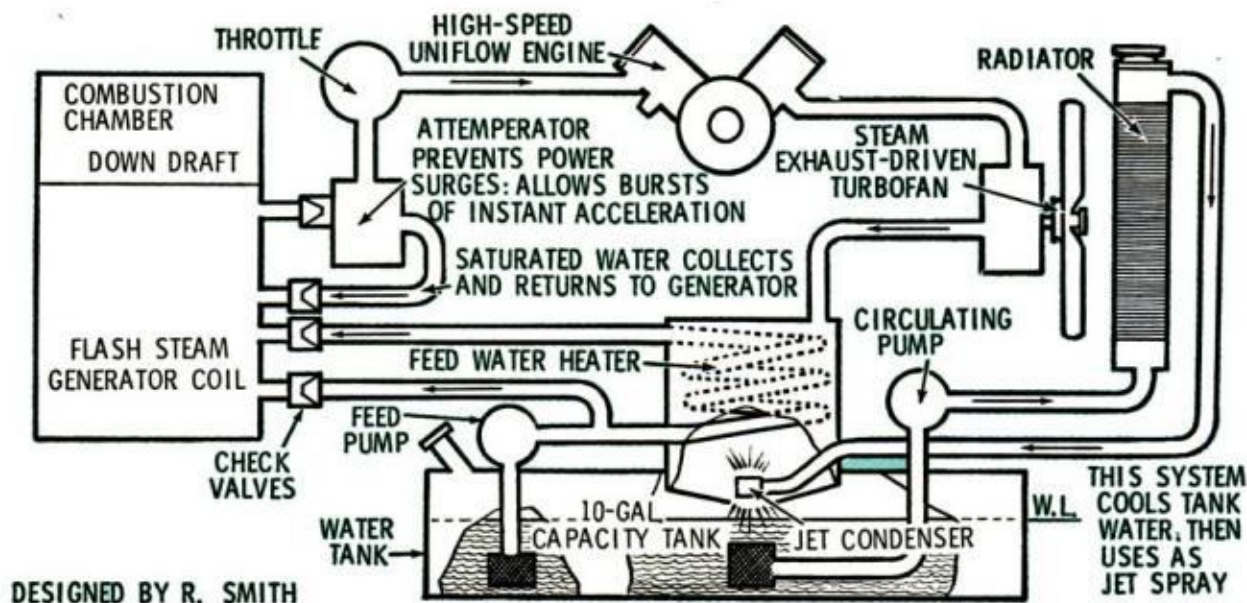
What If the Boiler Explodes?

When a steam Locomobile blew up in 1906, its passengers were tossed tree-high. A seat landed on top of the church, and windows half a block away were shattered. Four wheels and the frame were all that were left of the exploded automobile.

But this is now an outdated bugaboo. It can't happen today. A modern steam generator manufactures steam only on demand and doesn't store it. No more than a cupful of water exists as steam at any one time. The generator merely goes *pfst* if the tube ruptures. Engineers casually stand within a few feet of a modern generator when they are testing it to destructive overpressures.

Steam plants have been installed in Jaguars and Buicks, among other cars. One enthusiast, Ford Walters, has a steam race car that he expects will exceed 170 mph at Bonneville this year. One engineer powered his lawn mower with a tiny steam plant. Others have built steam motorcycles, steam-powered karts, even a steam-driven surfboard. There's talk of a steam plant you could carry in a suitcase, fueled with bottled propane, to provide electricity on camping trips. It would be entirely silent, with none of the staccato "rap-rap-rap" of the usual gas-powered lighting plant.

One of the appeals of steam is its basic



simplicity. A typical plant has an open flame that boils the water, producing steam that is piped to the throttle valve and on to the engine. Here the steam pressure forces down the pistons (which rotate the axle or driveshaft) and the exhaust steam is then piped through a heat exchanger to a condenser where it is converted back into water. The water is pumped to the storage tank for re-use.

The last major attempt to bring back steam was in the early '50s when the McCulloch Corporation (chain saws, outboard engines, etc.) designed the Paxton steam car. The car's "Phoenix" propulsion unit was a vast improvement over the steam system of, say, the early and famed Stanley Steamer. The "Phoenix" monotube boiler produces steam at 200 psi pressure versus 600 psi for the Stanley, and at a temperature of 1200 degrees versus the

800 degrees of the Stanley. After extensive dynamometer tests the "Phoenix" powerplant was installed in the chassis of a Ford coupe. Then the project was dropped because of complications in the engine design and the doubts of some of the company officials.

A lot of people concluded that this was steam's last gasp, but a lot of other people haven't accepted the verdict. Meanwhile steam car concepts have changed.

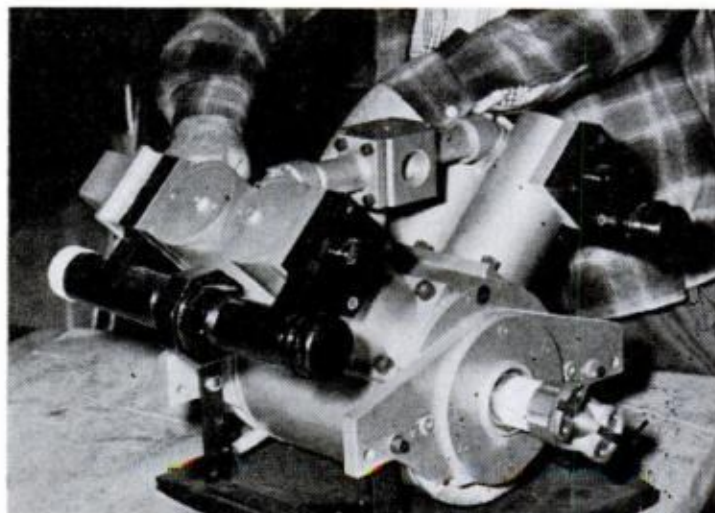
New Engine, Old Chassis

Thomas P. Hall, mechanical engineer, sums up the new idea this way: "It's silly to wait for some manufacturer to develop a completely new steam automobile. What's needed instead is a steam plant that would take the place of the gasoline engine and transmission in any modern chassis.

"With this combination we'd have all

STEAM PROPULSION UNIT proposed by Convair division of General Dynamics would, their engineer says, move 42-ton tank like model at 40 miles an hour

THIS FOUR-CYLINDER 'UNIFLOW' is suitable for use in a passenger car according to one experimenter-specialist. He's also built same marine-use versions

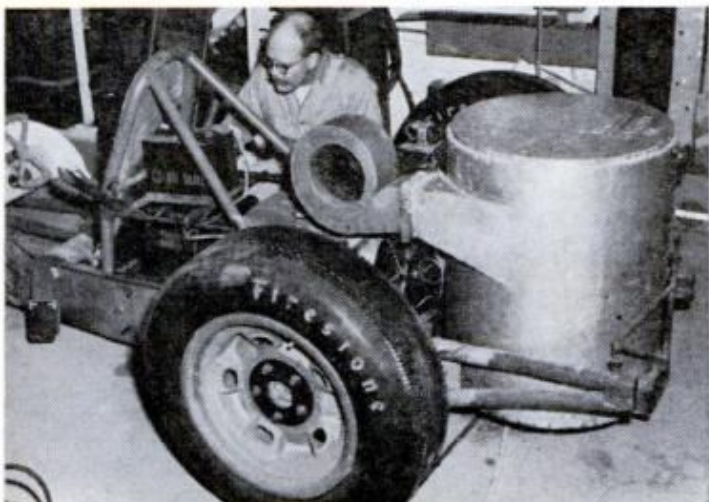


EVEN KARTS ARE POWERED BY STEAM. This model has two small steam engines powered by a single steam generator. Steam whistle replaces the horn beloved by small fry—and gets extra attention from pedestrians

◀ **SCHEMATIC** drawing shows four-cylinder auto steam plant as proposed by Richard Smith. The "at-temperator" holds stand-by steam for acceleration bursts and smooths out surges of power. Flexibility is a major feature



170 MPH PLUS ACROSS the Bonneville salt flats: That's Ford Walters' goal with the racer he's working on here. Large tank holds the steam generator



APRIL 1965

IT'S MORE THAN A MODEL. This miniature steam engine, which will drive a surfboard and rider as fast as 4 mph, demonstrates steam's multiple uses



113

the comforts of a modern chassis plus all the advantages of modern steam. The steam plant would have rapid start-up and built-in self-protection. It would be the perfect answer to the smog problem which is plaguing today's cities.

"Only two new instruments would be needed on the panel: a water level gauge and a steam pressure gauge. We'd use the standard accelerator pedal to operate the steam throttle, and use the transmission selector for reverse and cut-off. If a busy parking lot attendant got into the car he should have no trouble handling it.

100 MPH and 25 MPG

"Installed in a Chevy II or other compact and carrying a 1000-lb. load, we'd expect a relatively small steam plant to produce a top speed in excess of 100 mph, to deliver about 25 miles per gallon at 65 mph, and to accelerate to 60 from a standing start in well under 10 seconds. Normal maintenance, consisting of boiler blow-down, cleaning the burner and flushing the water system, ought to cost no more than \$10 at 10,000 mile intervals."

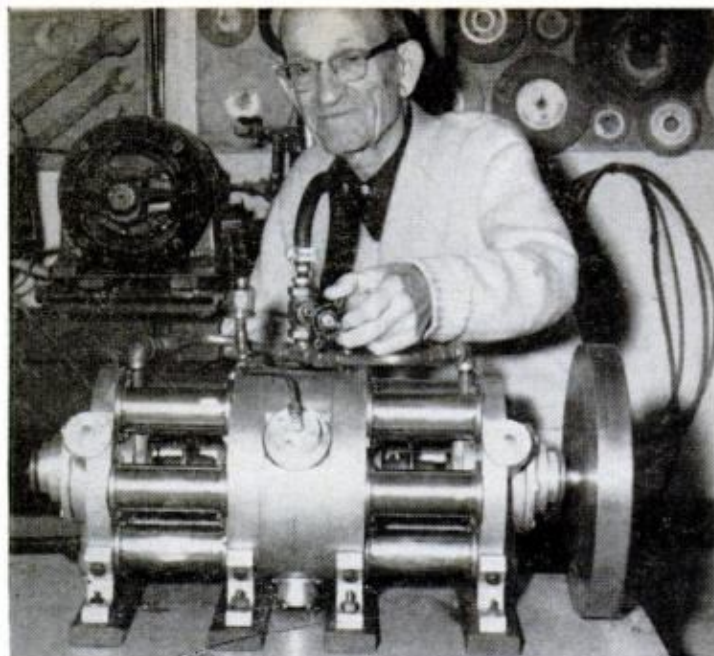
A lot of engineers, professional and amateur, are working toward those specifications.

One of them, Richard Smith of Westminster, Calif., has some advanced ideas that are attracting more and more attention from the more conventional "steam nuts." In the several powerplants that he has built, Smith uses soft copper tubing for both the generator and its super heat portion. Soft copper is the most efficient conductor of heat, yet rapidly loses its strength as the heat goes up. Most other designers favor stainless steel or Inconel, thick-walled, as being stronger even though less efficient.

Fail-Safe Shut-off Kills Flame

So, to prevent burn-outs with copper (or any other metal) Smith developed a control system that he calls "as reliable as a door knob." His system automatically and mechanically shuts off the burner flame if steam pressure or temperature exceeds the operating maximum, or if the water supply fails. Smith lets a test installation run out of water time after time, and invariably, his control system shuts down the fire, right now. Nothing blows up, nothing ruptures.

At the request of *Popular Mechanics*,



OVER 300 HP can be developed by an 80-pound steam engine, points out Walter Bagge, who uses compressed air here to demonstrate his powerplant

Smith recently drew up his concept of a modern automotive steam plant, illustrated on page 112.

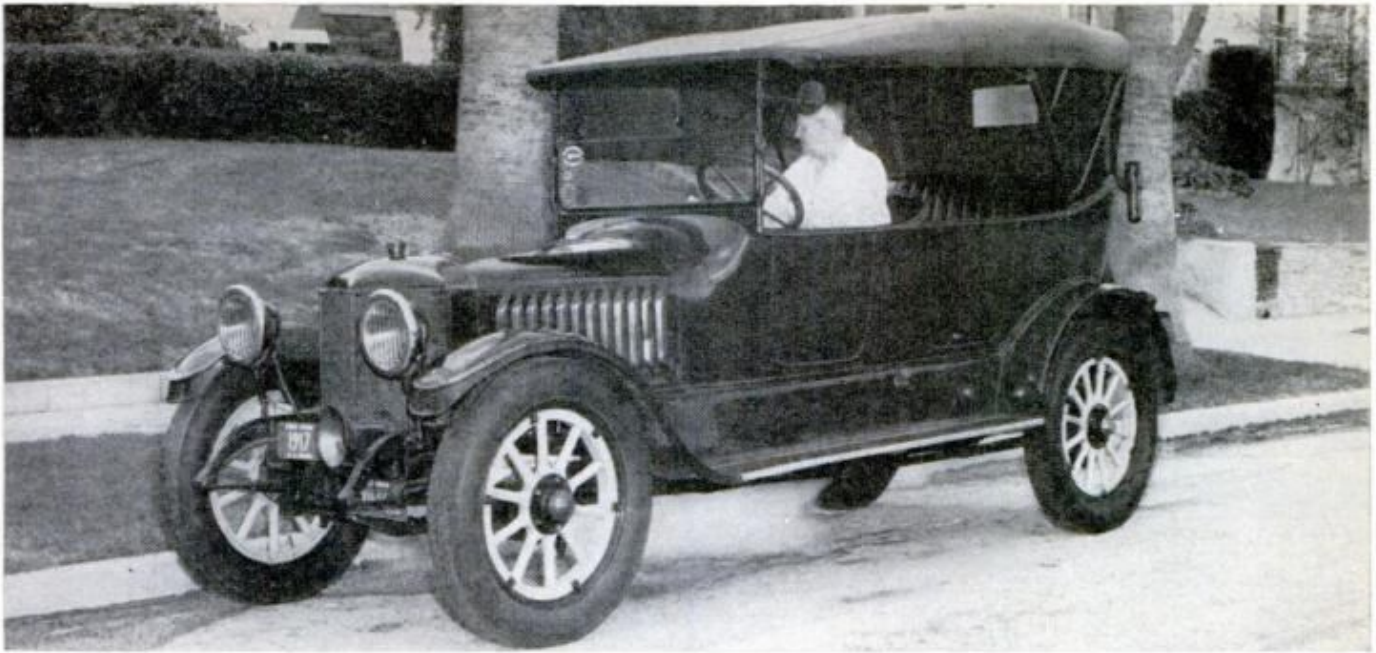
It contains several innovations. Steam from the monotube flash generator is ducted to a small "attemperator" storage chamber that smooths out power surges and that contains enough steam to provide instant acceleration upon demand, during the time the generator is catching up with the need. Instead of a compound or triple expansion engine, Smith calls for a high-speed four-cylinder "uniflow" engine that is efficient at all speeds and flexible enough to meet the random power demands of modern traffic.

The steam that exhausts from the engine would operate a radiator fan, then would be piped to a chamber where it would heat some of the feed water before being condensed back into water by the cooling action of a jet condenser.

All sorts of other ideas are being examined. Roy Ferrier, who specializes in building steam engines, has been experimenting with a "forced-recirculation boiler" that includes a steam separator and that he thinks may prove better than the monotube boiler. Others have been examining the merits of counter-flow engines, and even of swash-plate engines that will be designed for as many as eight cylinders.

224 MPH—on Steam

Meanwhile, Smith is completing a "featherweight" steam plant for a dragster that



A LOS ANGELES DRIVER, WAYNE NUTTING, drives his 1917 Stanley Steamer each week. More and more often, however, steam enthusiasts are focusing on new possibilities they see for their favorite power, instead of on the past

has a calculated top speed (less wind resistance) of 224 mph at the end of the quarter mile. The whole powerplant, including fluids, weighs 120 pounds and develops 200 hp. Eventually Smith hopes to use the same dragster steam generator to provide hot water and space heating in a home he plans to build.

Once upon a time the 950 members of the Steam Automobile Club of America met several times a year (in regional meetings) to talk about the good old days of steam and to discuss the vagaries of the early steamers. Owners of antique steam cars drove their vehicles to the meetings to take fellow members on rides.

At the club's meetings today there's less talk about the past. Instead, members listen to engineering discussions of some of the newest developments. They hear progress reports on various projects.

The Customers Line Up

Robert L. Lyon, president of SACA, 1937 E. 71st Street, Chicago, reports that a good percentage of the membership is ready to buy a modern steam car and that some say they would pay as high as \$8000. But there's no reason why a good combination (modern steam in a modern chassis) should have that high a price.

The flexibility of the piston engine seems to make it a natural for a steam car, yet interest is being shown, too, in small steam turbines. Convair's proposal for the steam-driven tank calls for a pair of turbines,

each rated at 250 hp at 24,000 rpm. Including its 3-to-1 reduction gear, each turbine would be a mere 18 inches long, nine inches in diameter.

Steam for the turbines would be delivered by a "once through" generator 30 inches tall and 24 inches in diameter, with a pressurized combustion chamber. This would provide 1000-degree steam at 1200 psi. A smaller version of such a generator, with a single turbine, could be suitable for automobiles and trucks, and there's even the possibility that it might find an application for small boats.

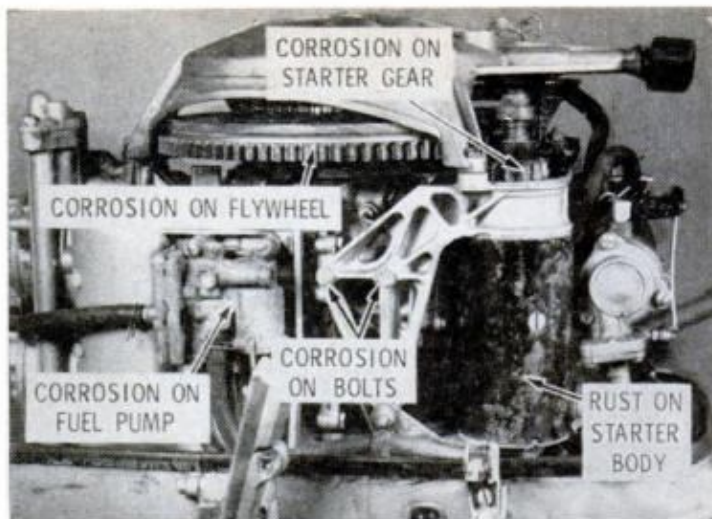
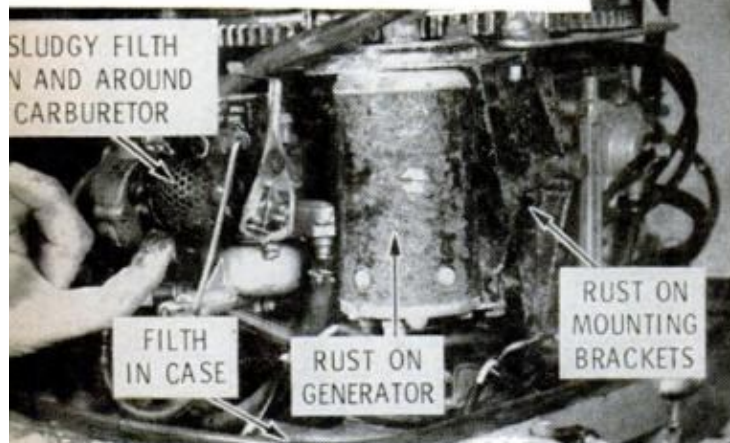
Putting On the Squeeze

Still in the future is another possibility, the development of small, portable "super critical" generators that produce steam at 3200 psi, so high a pressure that the steam is compressed to the volume of a liquid. Most large, modern central power stations use steam at this pressure. They operate at 45-percent efficiency, way above the effective efficiency of internal combustion engines, which is usually less than 25 percent.

It's a surprise to the uninformed to learn that our most modern atomic submarines are actually old-fashioned steamboats. The only thing that the nuclear energy does is boil the working fluid, producing steam. And steam is being recommended as the best kind of power for space vehicles that would use solar energy as the heat source.

So don't be surprised: there *could* be a steam car in your future! ★★ ★

PM SHOPPING GUIDE



HOW TO TELL A LEMON from a peach doesn't always require a bench check, as you can see from these photos of a rust-covered engine. You probably won't run into such obvious warning signs on a dealer's rack, but watch it

The Art of Finding a Bargain Outboard

Booming sales are flooding the market with good late-model engines taken in trade. But it takes a savvy shopper to spot the bargains

BY HENRY B. NOTROM

THE TIME IS RIGHT if you've been thinking about buying a used outboard. Dealers' racks are full of two- and three-year-old trade-ins, and the opportunities for getting a good buy have never been better. But it's still not a sure thing.

Whether you're buying from your local distributor or a gas station down at the corner, you'd better know how to judge the condition of a motor and how to tell whether the price tag matches this condition before you pull out your checkbook. The more you know about motors and markets, the less risk you run of winding up with a shiny dud, and the greater your odds for spotting a real bargain.

Most people shopping for a used motor are interested in saving on cost. If they weren't, they'd head for a new motor with its built-in long-term warranty, latest improvements and the pleasure of owning a fresh-from-the-line piece of precision machinery.

Even a good used motor will carry only

a one- or two-month warranty at best, and it will lack the engineering refinements plugged in this year's ad. But it costs a lot less.

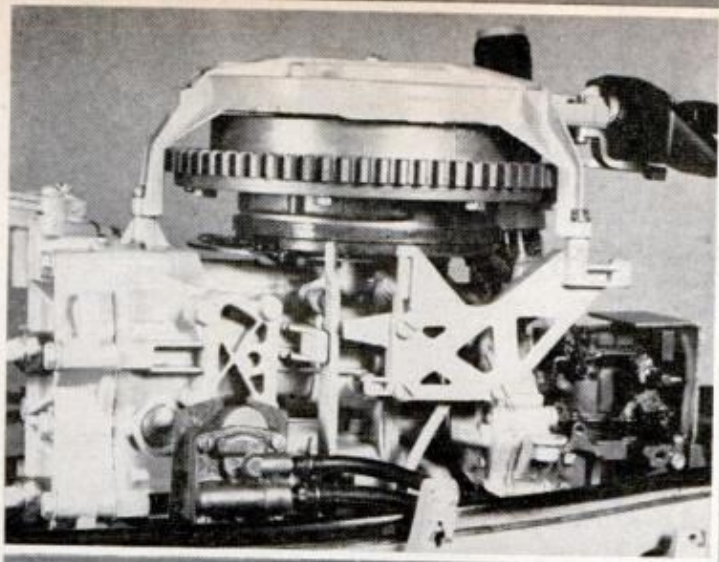
So it boils down to a question of value.

What Is the Motor Worth?

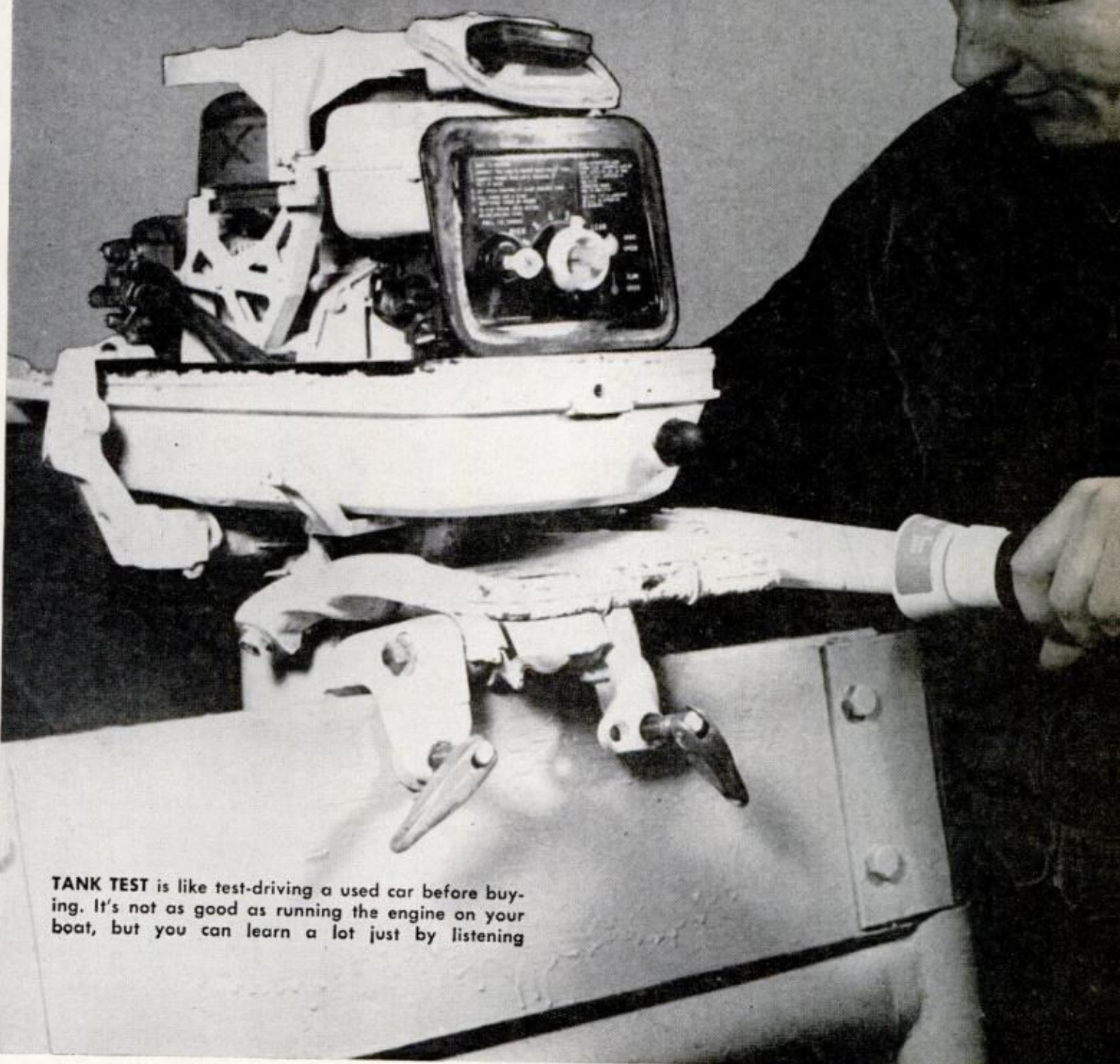
The value of a used outboard is established not by you or the seller, but by the outboard market as a whole.

You can become a knowledgeable buyer in this market for only three dollars—the price of *Abos Official Outboard Motor Trade-In Guide Blue Book* (from Marine Division of Technical Publications, Inc., 1014 Wyandotte Street, Kansas City 5, Missouri) or if you'd prefer to put that three dollars into the motor, ask your dealer to let you look over his copy. He just might let you do that.

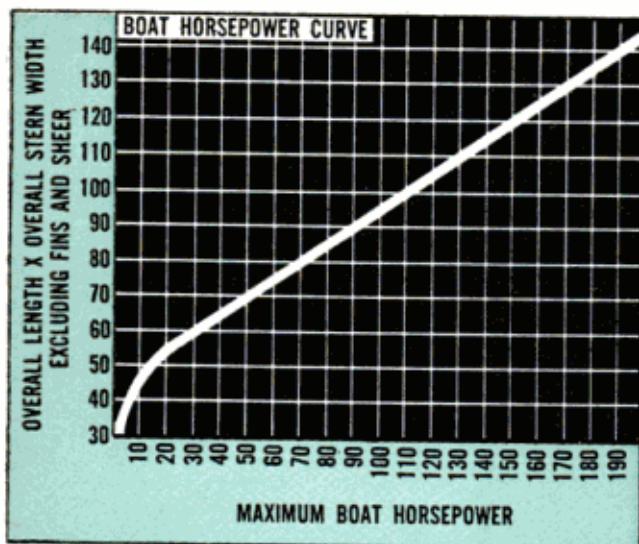
There's a knack to reading this guide, though. The entries serve a dual purpose. They help the dealer establish a price to offer a customer who's trading in a used



GOOD BUY was the clean engine at left, put up for sale by a franchised dealer. Because of excellent care by previous owner, it required no overhaul



TANK TEST is like test-driving a used car before buying. It's not as good as running the engine on your boat, but you can learn a lot just by listening



outboard, and they also tell him the price at which the industry believes the engine can be sold if it's in good condition.

Let's take a sample entry to show how it might work for a 1964 Evinrude model 9422. The columns read:

Model Number	Starting Serial Number Plus	FOB Price
9422	01001	355
Estimated Current Values Less Repair	Average Value	Code
Low	High	
159	202	180
		246E00

With model number and starting serial number you can identify the engine.

CHECKLIST FOR USED OUTBOARDS

Showroom Checks

APPEARANCE . . . Look for those little signs of wear that could indicate misuse: Dents and scratches on outer covers; corrosion and rust of bolt heads and other metal areas, particularly starter and flywheel gear teeth; sludge on bottom of upper case; frayed wiring; and beat-up propeller. Ask dealer to supply you with the name and address of the previous owner and check with owner to determine how the engine was used. An engine used mainly for water-skiing and racing would have more strain placed on it than one used for fishing or pleasure. An engine used primarily in salt water would have been subjected to more corrosive conditions than one used in fresh water. Also ask previous owner what service bulletins had been applied to the engine. Later, if you buy the engine, you can write the company and see what service bulletins were issued for the particular model, and then determine what has not been done. Many modifications outlined in service bulletins are supposed to be done free-of-charge by the selling dealer. Consider an inclusion of this nature into the warranty agreement.

Bench Checks

GENERAL APPEARANCE . . . Remove cover and examine engine closely. Corrosion, rust

Check the model and serial numbers engraved on the engine against the book.

The FOB price is the approximate retail selling price of the engine when it was new.

High estimated current value (in this case, \$202) is the limit to which a dealer should go on a trade-in for a particular engine. But that engine must be in excellent condition, one that can go right to the showroom floor without any work.

Low estimated current value (in our example: \$159) is the approximate trade-in value of an engine that's in bad shape. The spread between this figure and the average value of the engine permits the dealer leeway to make necessary repairs.

The average value column (\$180) is nothing more than the low and high estimated current values averaged out. A dealer tries to buy an engine for around this amount, going higher if he must for one that's in good condition and lower for one that needs work.

As the dealer does, you can use these three figures to place your approximate worth on the engine, taking apparent repairs into consideration.

This leads us to the suggested retail price of used outboards, which is hidden

and sludge indicate shoddy treatment and risky purchase.

OVERALL MECHANICAL . . . Put engine in neutral and pull recoil starter, which should be free, easy and extend all the way. If not, chances are internal parts are rusted (maybe engine was submerged), and it may have to be dismantled for cleaning. It's a risky buy, unless dealer corrects it for you.

IGNITION . . . Remove sparkplug, hold to ground and pull recoil starter (crank if battery operated). Hot spark should jump plug gap. If not, detailed checks are needed to isolate trouble. If magneto ignition, remove flywheel and check for: cracks (if found, replace); coil clearance (incorrect clearance leaves carbon tracks on magnetos) and point condition. Magnetos that aren't shiny and free of rust may indicate cracked or bent flywheel or bent crankshaft, both expensive to fix. If engine's electrically operated, battery, alternator (or generator), regulator, solenoid, cables and ignition switch should be instrument tested. If dealer refuses to allow checks, it's a risky buy since breakdown can be in a major part that's expensive to regulate.

FUEL SYSTEM . . . Hook up fuel tank, unscrew carburetor's bottom drain bolt and pump up fuel pressure. Steady flow of gas should come from drain hole. If not, remove fuel line at carburetor. If gas pours out, trouble's inside the carb, and this is expensive to overhaul. If there's no gas, the problem's in the

away in the "Code" column.

The suggested retail price for the 1964 Evinrude Model 9422 is \$246. The E in the code number (246E00) stands for the first letter of the motor's name and merely replaces the decimal point between dollars and cents.

Once you know the seller's asking price and have established the value you place on the engine, you can then evaluate the engine's worth to you at this price and begin to barter. But before you do, you should consider whether this engine actually fits your needs. Too much power is wasteful, too little power can result in disappointing performance.

How Many Horses Do You Need?

Outboard Industry Association has drawn up a chart (top of page 126) you can use to compute the *maximum* safe horsepower your boat can handle. The OIA's formula involves multiplying the overall length of your boat (in feet) by its widest beam at the stern (excluding any fins). Locate this measurement on the chart's vertical axis, then find this figure on the chart.

Now, move horizontally across the chart

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

fuel filter element or a clogged gas line, also expensive to fix. Check condition of fuel tank PROPELLER AND SHAFT SEALS . . . Bent, damaged prop should be replaced by dealer. Grab hold of prop and push it up and down on its shaft. Look for seepage around shaft and excess play, indicating worn bushings inside—and buy an engine like this and you've a big repair bill coming up.

Tank Checks

OVERALL . . . Engine should start easy and "roll" as it runs. Rapping inside could mean a busted piston or bad bearings—big expense. Rev it up and make sure shift lever and throttle control lever offer immediate response. If not, it could mean a major fix. Does engine vibrate to excess on transom? If so, look for worn shock mounts that dealer should replace before you buy.

WATER PUMP . . . Look at exhaust port in lower unit. An engine without a thermostat should have water spitting out port as soon as it starts. If thermostat-equipped, allow a three-minute warm-up before water comes out port. No water means a bad water pump, and a big expensive repair the dealer should do.

STERN BRACKET SCREWS . . . Engine should bolt firmly to tank tester or boat. If not, bracket screws are worn or have crossed or broken threads. Dealer should be responsible for this.

Outboard Clinic

Q The starter rope of my 1964 Mercury 200 has frayed badly, I intend to replace it, but how do I keep the same trouble from recurring?—A.J.P., New Jersey

A The problem was probably created by the rope rubbing against sharp metal edges of the top cowl starter rewind opening or against a sharp edge inside the top cowl. It can be corrected by replacing the aluminum rope-guide insert with new nylon insert (part number A-37938.) The condition could also affect 1964 Merc 60s and 110s. Your dealer has the full information on it in Service Bulletin No. 2, Section VII, dated July 14, 1964.

Q Here's an odd one. My Johnson 18 Compact runs smooth as glass at about 1900 rpm. Step it up just 200 rpm more and in about 75 yards, it starts to pop and cuts out. What do you think?—H.W., Connecticut.

A The trouble's probably either ignition or carburetion. You could, for example, have an ignition leak in spark-plug leads, coil or through a crack in the distributor. This shows up at higher speed, because when the speed is increased, the voltage on the secondary side of the ignition circuit also rises,

There's also a chance spark-plug gap is too great for high-speed operation. I'd also look into the possibility of a weak ignition point spring that could be causing point bounce.

If ignition checks out, look for dirt in the fuel line from tank to carburetor that might be restricting fuel flow. Also, look for leaks in the line, and check the high-speed adjustment of the carburetor, since it could be providing too weak a fuel mixture at high speed.

As a service to the readers of **POPULAR MECHANICS** in solving problems relating to their outboard engines, you are invited to submit your questions to this column. All questions will be answered, either in the column or by mail. Address Outboard Clinic, Popular Mechanics Magazine, 575 Lexington Avenue, New York, New York 10022 and enclose a 5 cent stamp.



EXHIBITION FLY-CASTER and teacher, Ellis Newman, works with a student, keeping the rod in the correct position for the overhead cast. His revolutionary teaching method simplifies fly-casting and enables the complete novice to begin working a lake or stream with a fly on the first day of instruction



Skilled Fly-Casting in Just

Here, at last, are the ABCs of fly casting—a method so simple that you'll be able to teach yourself

By Lawton Carver

IT'S ABOUT TIME somebody exploded the fiction that it takes at least five years to become a competent fly fisherman.

Fully mastering the art of fly-casting can take years, and I know experts who have been at it most of their lives and are still learning. But a complete novice can learn enough in one hour to cast a fly out onto a lake or stream, and if the fish are rising he'll catch his share along with the experts.

Ellis Newman, a soft-spoken, burly outdoorsman who divides his time between giving trick casting exhibitions at sportsmen's shows and operating a fishing camp at Livingston Manor, N.Y., has devised a teaching method that is simple and infallible.

The basic idea in fly-casting is to drop an imitation fly on the surface of the water so that it looks like the real thing to a wary, but hungry trout. The rod and the

line are the tools for getting the fly out there. The function of the reel is simply to store the line and to take up the slack as you fight the fish.

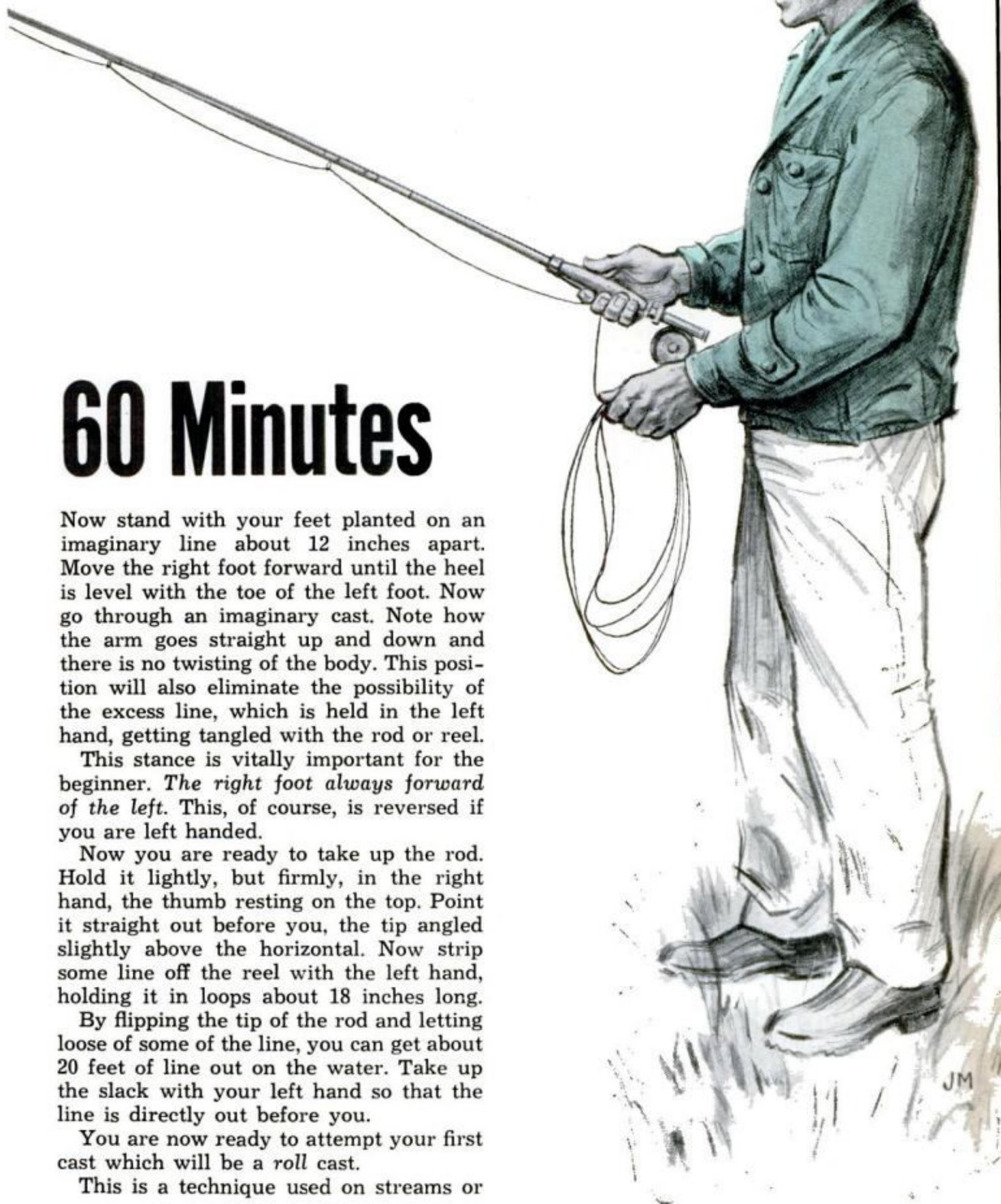
The fly line is specially designed for its task. It is heavy to compensate for the lack of weight on the end, and it is tapered down to the end where it attaches to the fine silk or monofilament leader to which the fly is tied. For fishing dry flies the line is treated to float on the water.

A fly rod is generally longer than a bait casting or spinning rod, the eyelets are larger to allow the line to run freely, and it has more "whip" to the end, increasing the catapulting action.

The beginner can equip himself with a complete outfit, rod, reel, line, leaders and an assortment of flies, for as little as \$25. And with Newman's simple system, which we illustrate here, you can teach yourself. You don't even need a stream or a lake. You can practice on a lawn or a rooftop in the city.

The proper stance is of primary importance. Make believe you are going to make a cast. The left foot goes out, as though you are going to throw a ball, and the body twists slightly to the right. This is wrong!

BASIC STANCE is vital. The right foot is always slightly ahead of the left. The rod is held lightly, but firmly in the right hand, the thumb on the top. About 12 feet of line is stripped off the reel and looped over the fingers of the left hand, and held away from the rod and reel to prevent fouling when the rod is whipped up to begin the cast



60 Minutes

Now stand with your feet planted on an imaginary line about 12 inches apart. Move the right foot forward until the heel is level with the toe of the left foot. Now go through an imaginary cast. Note how the arm goes straight up and down and there is no twisting of the body. This position will also eliminate the possibility of the excess line, which is held in the left hand, getting tangled with the rod or reel.

This stance is vitally important for the beginner. *The right foot always forward of the left.* This, of course, is reversed if you are left handed.

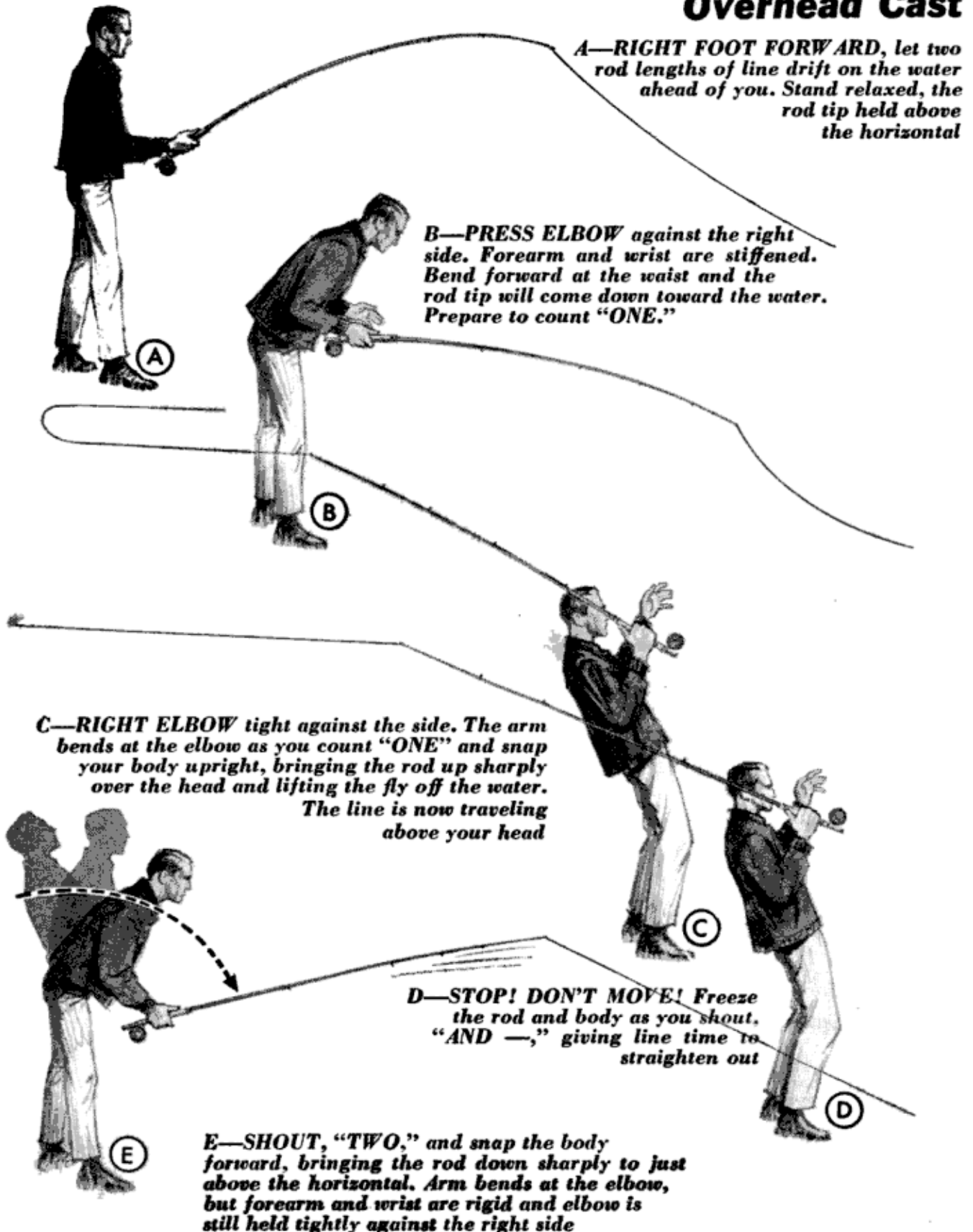
Now you are ready to take up the rod. Hold it lightly, but firmly, in the right hand, the thumb resting on the top. Point it straight out before you, the tip angled slightly above the horizontal. Now strip some line off the reel with the left hand, holding it in loops about 18 inches long.

By flipping the tip of the rod and letting loose of some of the line, you can get about 20 feet of line out on the water. Take up the slack with your left hand so that the line is directly out before you.

You are now ready to attempt your first cast which will be a *roll* cast.

This is a technique used on streams or

Overhead Cast

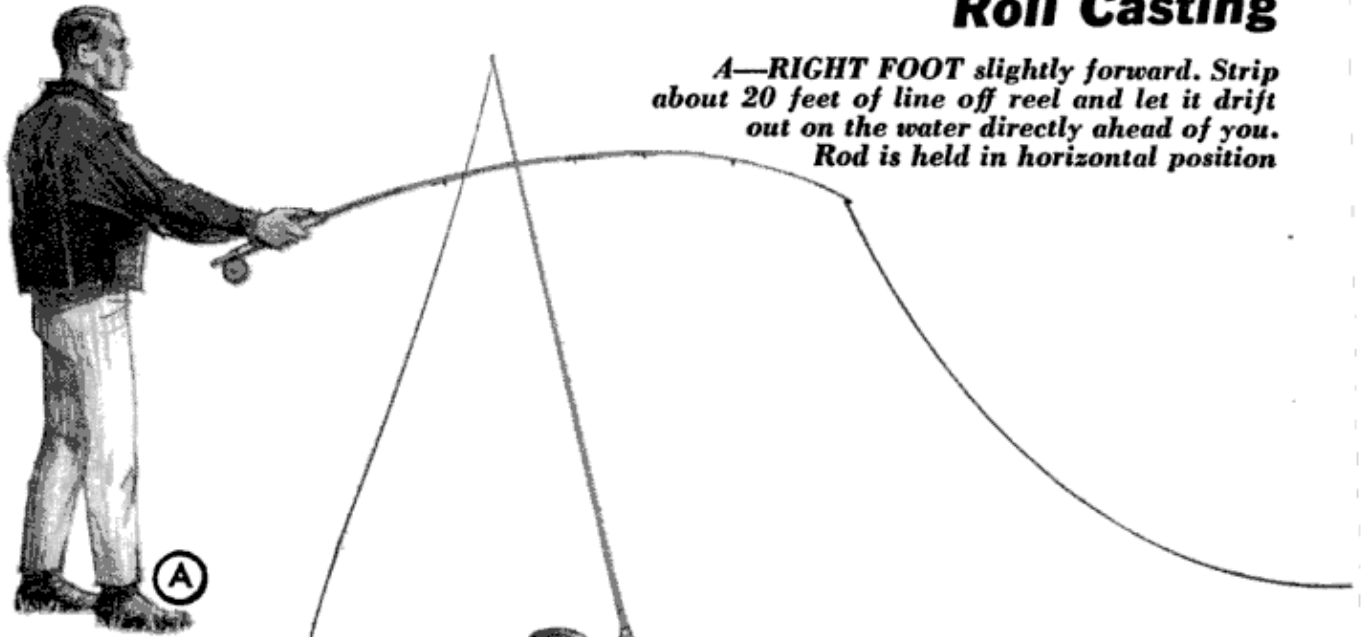


lakes where trees and heavy brush prohibit the use of the overhead cast. Most fly fishermen add this cast to their repertoire after they have experienced the problem of insufficient casting room, but Newman uses it as a starter because it is easy and enables the beginner to get the feel of using the rod and the line.

Standing with the right foot advanced, the rod held out horizontal to the ground and about 20 feet of line floating directly out ahead of you, slowly lift the tip of the rod, drawing the line toward you. Hold the rod so that the tip is above and behind your head, in a position that would be pointing to the numeral "11" if it were

Roll Casting

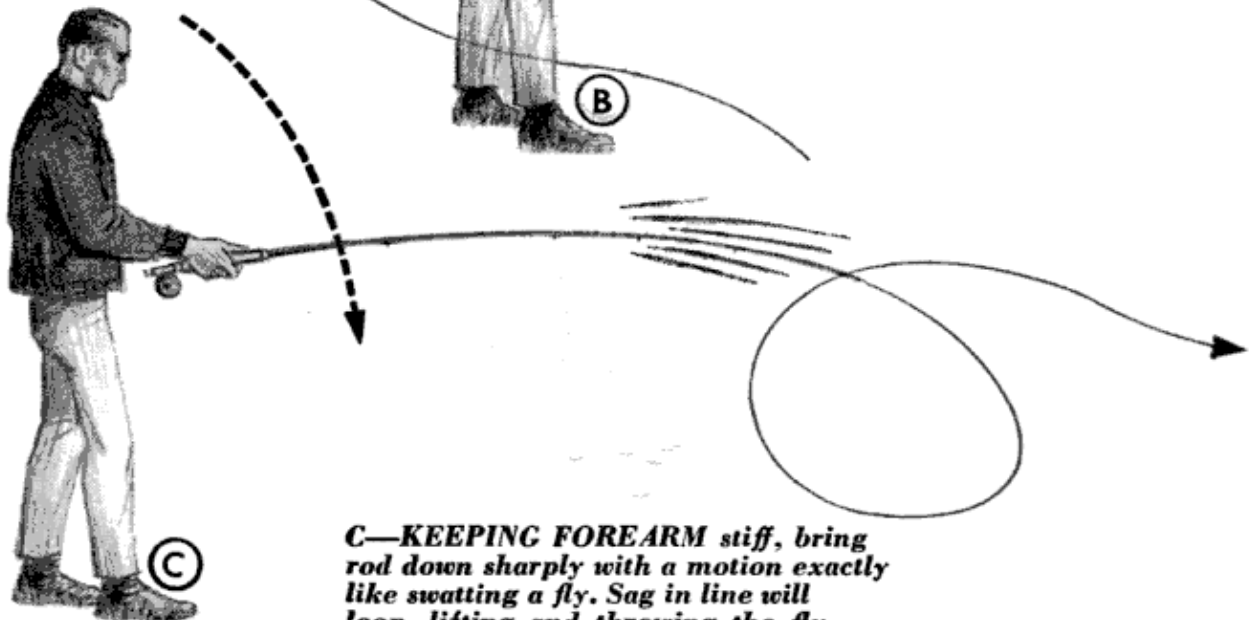
A—**RIGHT FOOT** slightly forward. Strip about 20 feet of line off reel and let it drift out on the water directly ahead of you. Rod is held in horizontal position



B—**LIFT ROD TIP** slowly and hold it at "Eleven O'clock" position. The line will be draped down from the rod tip, lying close to the right foot and drifting out onto the water



C—**KEEPING FOREARM** stiff, bring rod down sharply with a motion exactly like swatting a fly. Sag in line will loop, lifting and throwing the fly

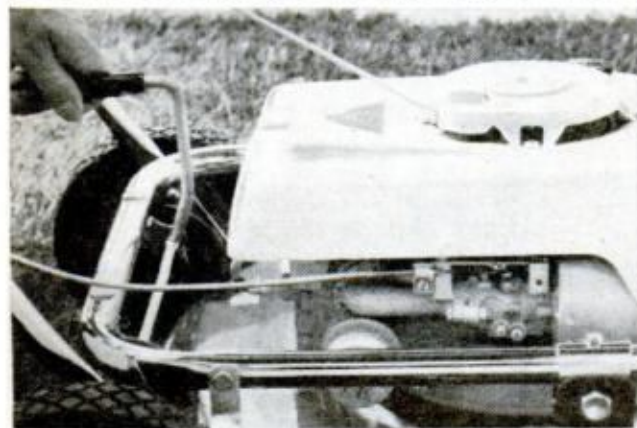


the hand of a clock. The line will drape down from the tip of the rod and run close to your right foot. (See illustration B on page 123.) Press your right elbow close to your side. Now, with the forearm and wrist as rigid as possible, bring the rod down sharply with exactly the same motion as you'd use swatting a fly. Do not

bring it down below the horizontal. The sag in the line will go into a loop, neatly picking the fly off the water and dropping it again well beyond the rod tip.

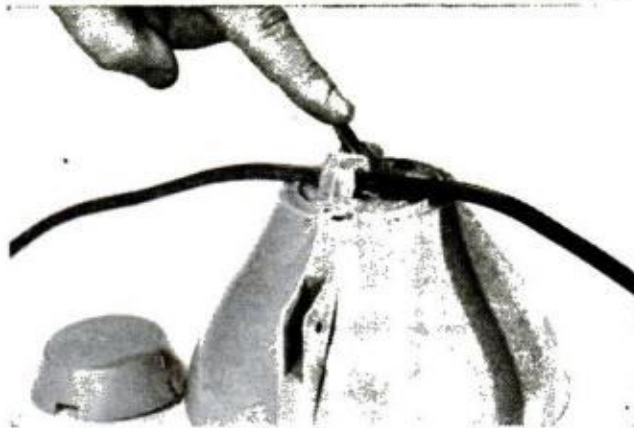
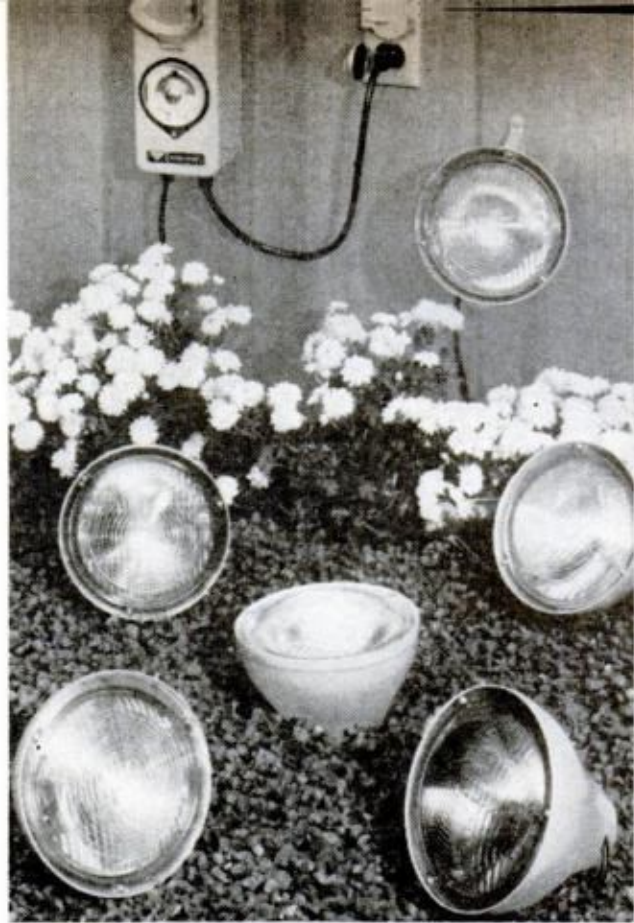
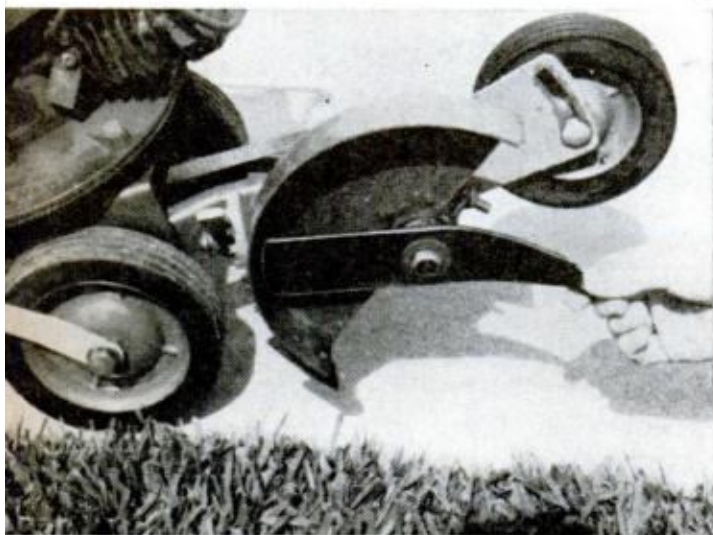
That's all there is to the roll cast. It sounds easy and it is. It is also an extremely practical cast used by the experts in

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



"MONORAIL" CONSTRUCTION of Homko mower allows chassis and blade to be raised or lowered by single lever (bottom). Handle features tool carrier

FLEXIBLE BLADE for a lawn edger is made of rubber, nylon and fine wire cables so it flexes when it hits obstructions. Manufacturer: Industrial Rubber Corp.



LOW-VOLTAGE GARDEN LIGHTS are set in ground on spikes or on wall in brackets. Six Wen-Mac lights clip in anywhere (bottom) along a 100-foot cable

GAS GAUGE appears on Jacobsen's mowers and other gas-powered equipment this year. It lets operator know at a glance how much fuel he has left in tank





WATER FALLS on lawn and shrubs all the way around a house equipped with Dew Drop sprinkler system. Source of water is simply an outside faucet.

FLOWER GUN cuts—and holds—flowers when the trigger is squeezed. Price is \$4.98 postpaid from the Postamatic Co., Box 160, LaFayette Hill, Pa.



New Lineup for Lawn Keepers

Want to lie in a hammock while you mow? Or sprinkle the lawn from the housetop? Here's how

READY TO EASE the homeowner's job in his annual contest with the lawn are a number of new pieces of equipment.

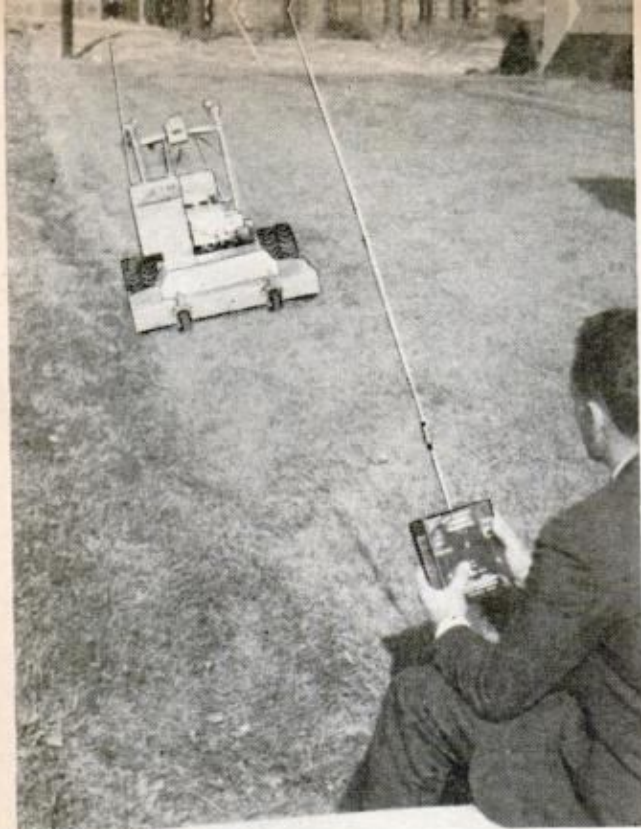
Just one lever need be operated, for instance, to adjust the cutting height (from one to three inches) of AMF's Homko Ambassador rotary mower. The 19 and 22-inch models sell for \$89.95 and \$99.95 respectively. AMF also has a new set of Wen-Mac California Outdoor Lights that can be spaced anywhere along a 100-foot cord simply by snapping them into place on the cord. The lights operate on 12-volt current which won't harm you even if you should accidentally cut the wire. With an on-off switch, the set of six lights is \$69.95; with a timer, \$79.95.

If you're the kind who'd rather lie in a hammock than cut grass, you can do both—for \$1168.50. That's the price of the Bunton Electronic Lawn Lark which will mow as far as 1000 feet from the control box. (Without radio controls, it's \$671.)

Watering shrubs and grass around the house can be just a matter of turning on the outside faucet. An unusual new sprinkler consists of five-foot lengths of perforated aluminum tubing joined around the periphery of a house and connected to the faucet by garden hose. Made by Dew Drop Sprinkler System Co., 70 Forest Drive, Jericho, N.Y., complete packages range from 25 to 150 feet (\$14.95 to \$49.95).

You can afford to be a bit forgetful in storing the garden hose in the fall if it's B. F. Goodrich's Everflex, which remains limp even in below-freezing weather. Price is \$3.95 for a 25-foot length with 1/2-inch inside diameter. Other diameters are 5/8 and 3/4 of an inch.

And you can worry a little less about hitting the sidewalk when edging with a flexible Safety-Flex blade. A product of Industrial Rubber Corp., 6933 Clinton Drive, Houston, Tex., it sells for \$2.



RADIO-CONTROLLED MOWER turns lawn cutting into an armchair job. The Bunton Lawn Lark may also be guided by an operator on foot or on a small sulky



STAND-UP TRIMMER takes the backache out of edge trimming. Priced at \$5.85, the Border Shear is made by Seymour Smith & Son, Inc., Oakville, Conn.



LIMBER and easy to roll up even in freezing weather, Goodrich's Everflex vinyl-and-nylon garden hose contrasts with older plastic type (left) which stiffens

TREES up to 20 feet high, as well as lawns and shrubs, can be sprayed with H. D. Hudson's new gas-engine-powered Spray-Boy. Price is under \$100



Surgeons Cut with Air

The latest technique in bone surgery employs air-powered "Air-tomes" similar to high-speed dental drills.

Rotating at up to 100,000 rpms, these tools are said to make cartilage and bone cutting as easy as cutting tissue. Yet, since they will not harm tissue they accidentally touch, they can safely remove hardened calcium deposits from the heart. Advantages include much faster surgery, reduced pain and shock, faster post-operative recovery. Photo at right illustrates delicacy of new tools: Operator cuts into an egg shell without affecting membrane.



Snow Pickup

Sprockets that replace the rear wheels of this half-ton pickup drive the rubber-and-steel tracks that carry the vehicle over snow. Steering is done by braking the tracks.

The track unit was designed, built and attached by M. R. Gullickson, Mono Road, Ont.

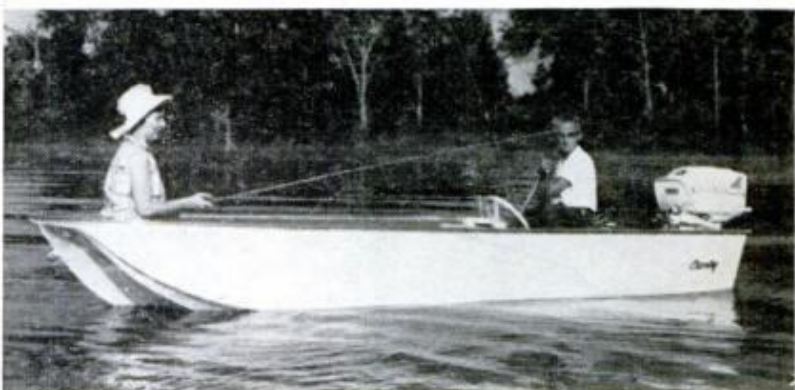


More Dropped Decks

One-upping this year's trend toward recessed foredecks, Crosby carries the dropped-deck approach back to the transom in its 1965 Sea Sleds.

In the larger models, such as the 15-foot runabout, above right, this means cockpit-length troughs to hold water skis, rods, boat hook, etc. In the smaller utility sleds, the troughs are divided by the center seat which is a part of the same mold, but they still provide plenty of space for lures, sunglasses and other small objects.

The 15-foot sled sells for \$645 and the 14-foot model with steering, \$445, both f.o.b. Crosby Aero-marine Co., Municipal Airport, Marianna, Fla.



Wall tile you stick on with tape, plastic gutters you don't have to paint and clip-on aluminum siding are just a few of the newest building products that . . .

Make Remodeling Easy

By Arthur J. Maher

THE MANUFACTURERS of building supplies are finding more and more ways to make life easy for the amateur remodeler.

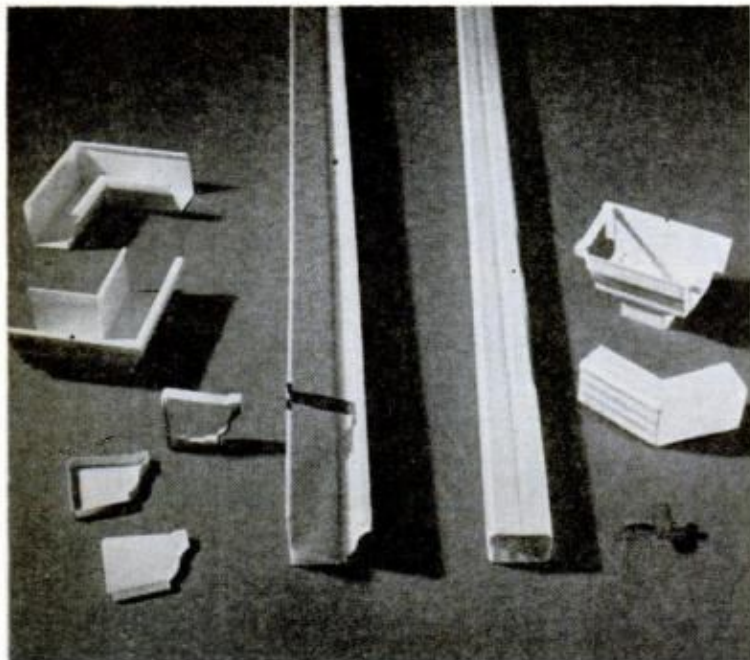
For example, a new line of metal wall tile is applied rapidly without mastic. With every three square feet of the tile, you get a square of double-adhesive tape which you cut up into small tabs. After placing several of these tabs on the back of a tile, you push the tile against the wall and it stays on. Trying this system out, we found the tiles held securely to the wall, and could be pried off only with great difficulty. They are made by Vikon, and sell for \$4.02 to \$6.42 per three square feet, including the tape. Extra tape costs 66 cents a square.

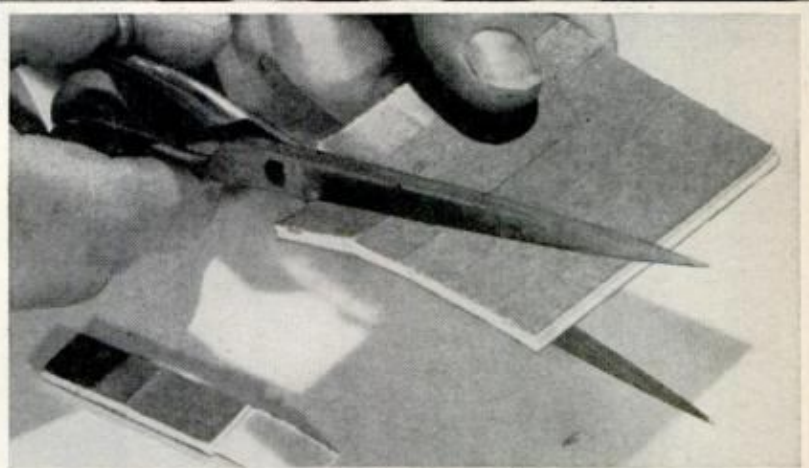
Another work saver is a $\frac{3}{4}$ -inch vinyl tape called Ceiling 'n Wall Cove, which you can use in place of molding to conceal the cut edges of an acoustical tile ceiling. Instead of measuring, coping, nailing and finishing wood moldings, you merely press this tape into place. The product is made by My-Ko Chemical, and sells for 10 cents a foot.

If your aluminum storm doors and windows are looking the worse for wear, there's a product called Instant White Coating that's said to give them a white finish similar to baked enamel. Actually, this brush-applied urethane product has been used

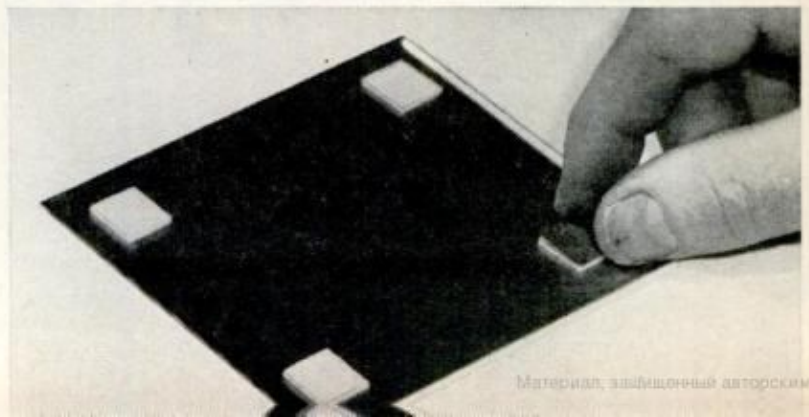
[\(Please turn to page 132\)](#)

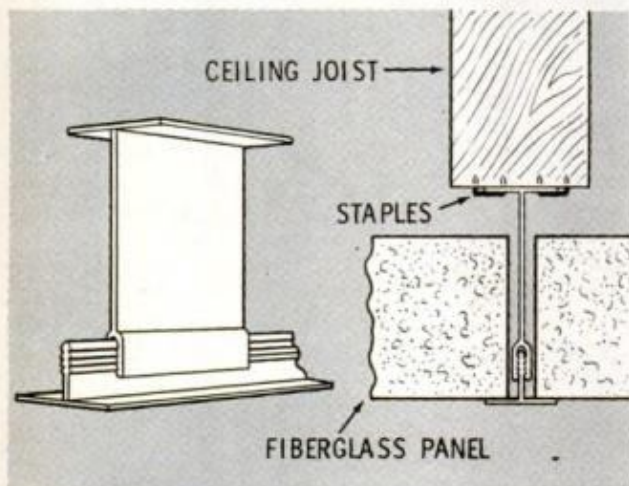
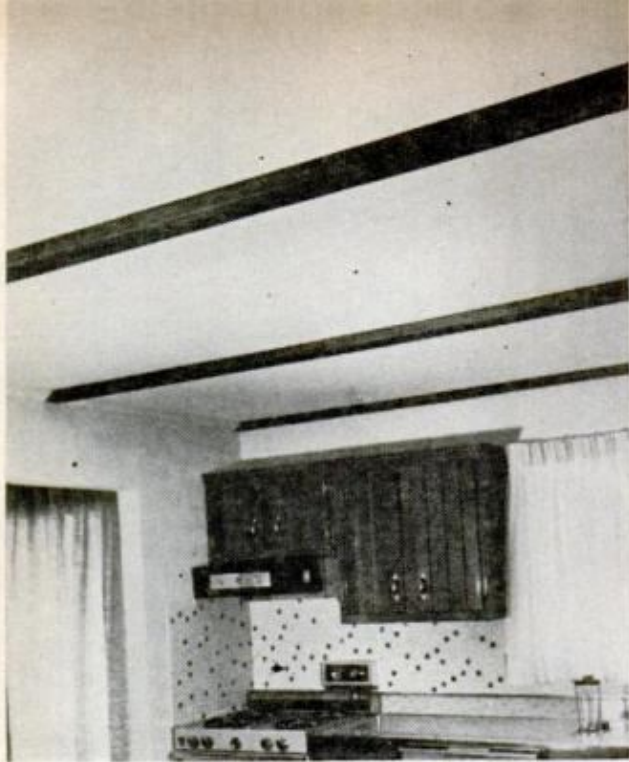
MADE OF RIGID VINYL plastic, a new gutter and downspout system is said not to rust, dent, chip, wear, blister, peel, support fire or conduct electricity. Needs no paint. Various parts are solvent-welded together as you assemble them on roof. Manufactured by Monsanto, in white, and priced at 50¢ a foot





STICK-ON TABS speed application of Vikon metal wall tile. With the tile you get prescored square of tape which you cut into tabs. After placing tabs on back of tile, press tile on the wall. Tiles come in aluminum, stainless steel and four types of copper. Especially good behind sinks, stoves, countertops





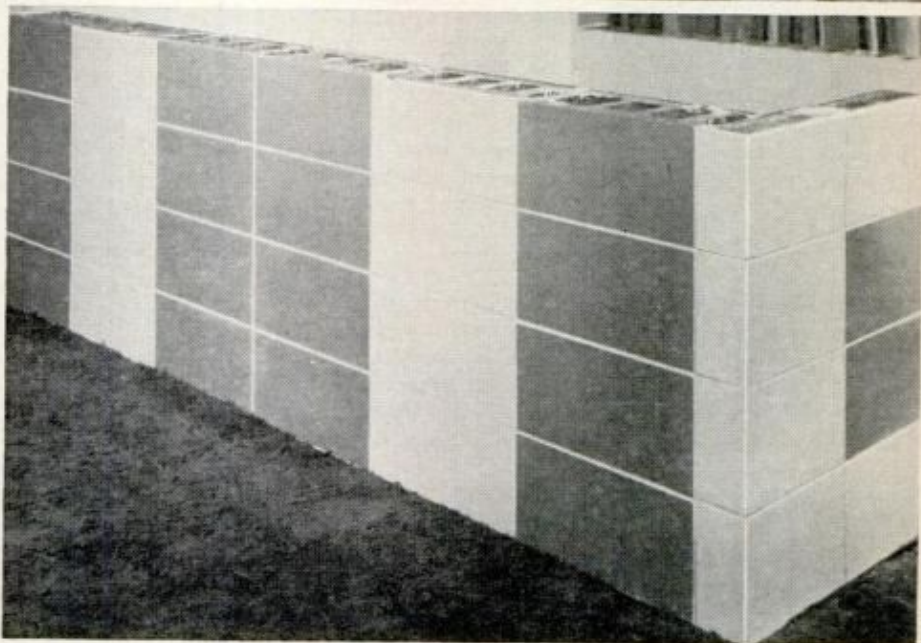
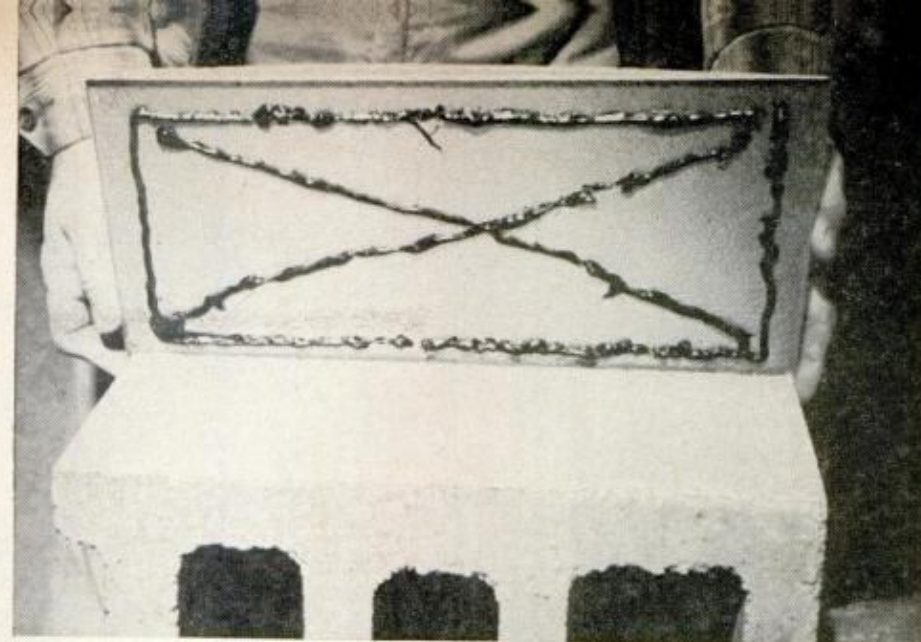
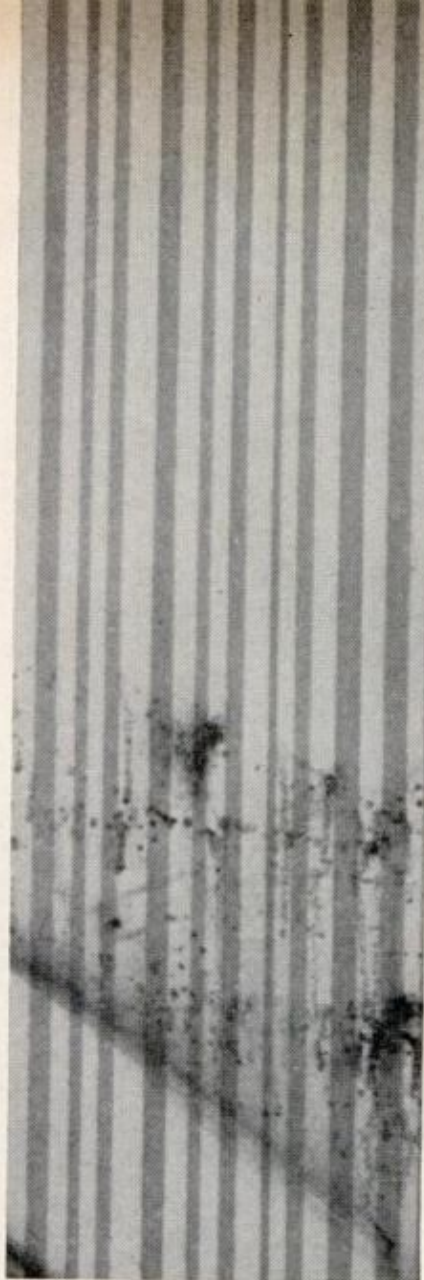
LARGE FIBERGLASS PANELS, with white-textured finish, greatly reduce the number of visible joints on a suspended ceiling. They can be used with exposed false beams, as in the photo above, or with Snap-In tees and clips of white vinyl (drawing). Installed cost of panels should run under \$1 a square foot



SAFE, DURABLE WALL CLOTH, aside from being resistant to stains, greases and scuffing, is treated with a fire retarding chemical so it can't smoke or flame. It's made of nylon, Dacron and cellulose with a vinyl coating. Vinyl-Royal, from The Birge Co., sells for \$4.95 to \$15 a 36-square-foot roll

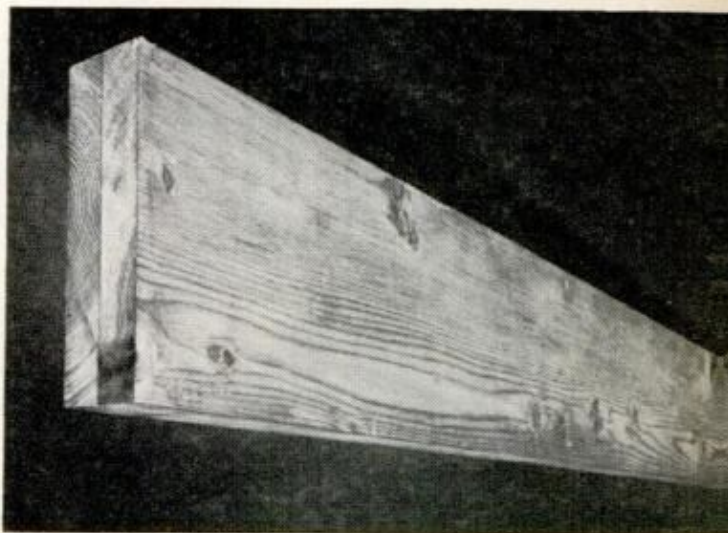
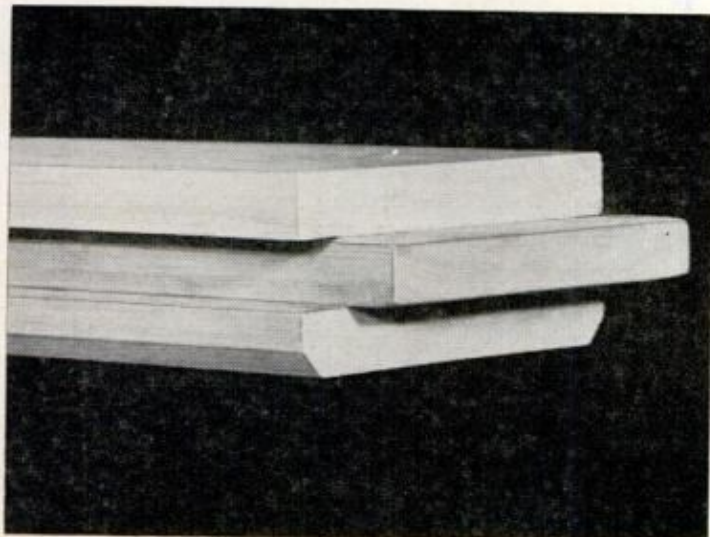
FASCIA HANGERS give Q-Lok gutters a trim appearance plus extra strength. Hangers come in 10-foot and 1½-inch lengths. You nail them to the fascia, set the gutters in them, then force locking strips into the gutters. Made of aluminum with Tedlar or acrylic finish by Howe Sound Co. Cost, 50¢ to \$1 a foot

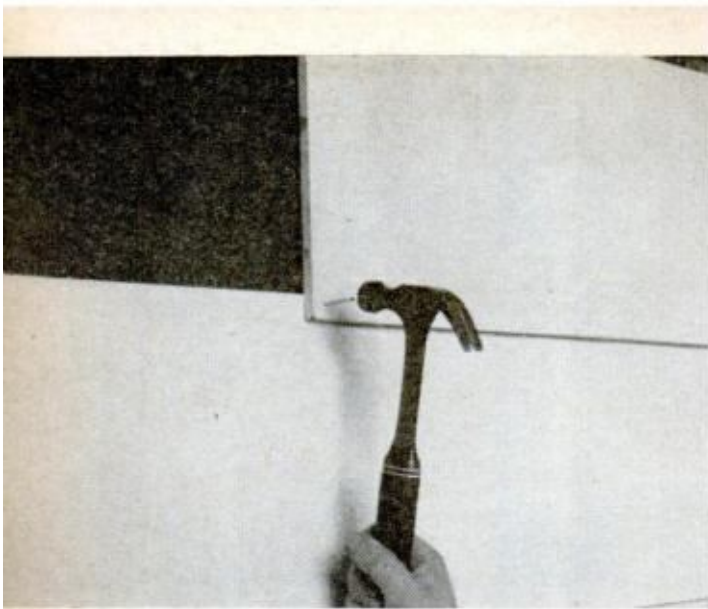




CONVERT CONCRETE BLOCK to structural tile with Cap-A-Tile trays. You apply mastic to the back of a tray (top photo) with a caulking gun, then press tray onto block. This is best done before blocks are laid-up, but can be done to existing walls if mortar joints are deep enough, or if they are grooved with a masonry saw. Trays are available in 10 colors and shades. Applied cost is about 38 to 45¢ per square foot. From Cap-A-Tile, Incorporated

LAMINATED DECKING (below, left) is said to save \$25 to \$50 a house in labor costs. When laid over roof beams and left exposed underneath, it forms both roof and finished ceiling. Vertically laminated beams (bottom, right) are kiln dried, making them stronger, more stable than green beams. They come in sizes up to 6x12 inches, starting at 15¢ to 25¢ a lineal foot. Both from Weyerhaeuser Company





COMPOSITION SIDING can be sawed, nailed and painted like wood, but is fire- and termite proof. It comes with factory applied primer that takes either latex or oil-base paints. The manufacturer, National Gypsum, says it needs less frequent painting than wood. Woodrock sells for 22 to 25¢ per square foot

DURASOTE T&G WALLBOARD, for interior or exterior use, can be nailed right to the studs, and needs no joint treatment. If water enters a joint, material swells slightly, tightening the seal. Pre-coated in white, red, green and beige. Sizes are 16x96 in. to 4x12 feet. About 18¢ a square foot and up. Homasote



for eight years now in the marine and industrial fields, to protect steel, aluminum, concrete, wood, etc., from weather, salt water, abrasion and mild chemicals. However, the manufacturer, Magna Bond Coatings & Chemicals, now offers it to the consumer market. For \$6.95 you get enough Instant White, plus a special primer, for 10 average windows and one storm door.

Anyone who's about to install paneling over bare studs will be glad to hear about B. F. Goodrich's Plasticon 200 adhesive. This tough, rubbery material, which is applied to the studs with a caulking gun, gives a wave-free wall without your having to shim up out-of-line studs. When a panel is going over a stud that's bowed inward, you push the panel in, then let it spring back. It picks up enough adhesive to bridge a gap as wide as $\frac{3}{8}$ of an inch. The adhesive then sets, providing firm support for the panel. Price is about \$1.70 per $\frac{1}{10}$ -gallon cartridge.

Redoing the bathroom? A molded fiberglass shower stall from the Swan Corporation has a snail-shell design that permits you to stand inside without being seen from the outside. No shower curtain or door is needed. According to the manufacturer, this unit fits into a space of about 3½ by 4½ feet, and can be assembled by two men in less than an hour. Retail price is \$229, including a drain and ceiling light.

Does the wife want an accent wall in the living room? A simulated stone made of fiberglass, that looks and feels like the real thing, can be nailed over plaster, plasterboard, wood or bare studs. Suitable for interior and exterior use, this material comes in 12½ by 48½-inch panels. After the panels are in place, you shoot mortar into the joints from a caulking gun. This product is made in white, grey and rust shades by Terox Corp. of America and sells for \$3.54 a panel. Corner pieces and filler strips are also available.

A similar product, which looks like real brick, is made in 4 by 8-foot sheets by Cavrok Sales Corp. It comes in red, white or buff, costing about \$1.30 a square foot.

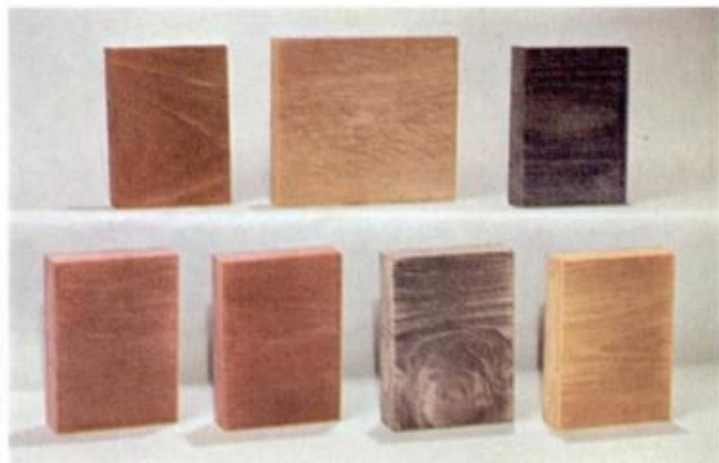
A new look in suspended ceilings has been achieved by Owens-Corning. That firm has introduced a system that employs large panels of fiberglass held in place by Snap-In vinyl "Ts." As shown on page 130, you nail or staple vinyl clips to the joists. These clips have ridged female sockets

(Please turn to page 224)



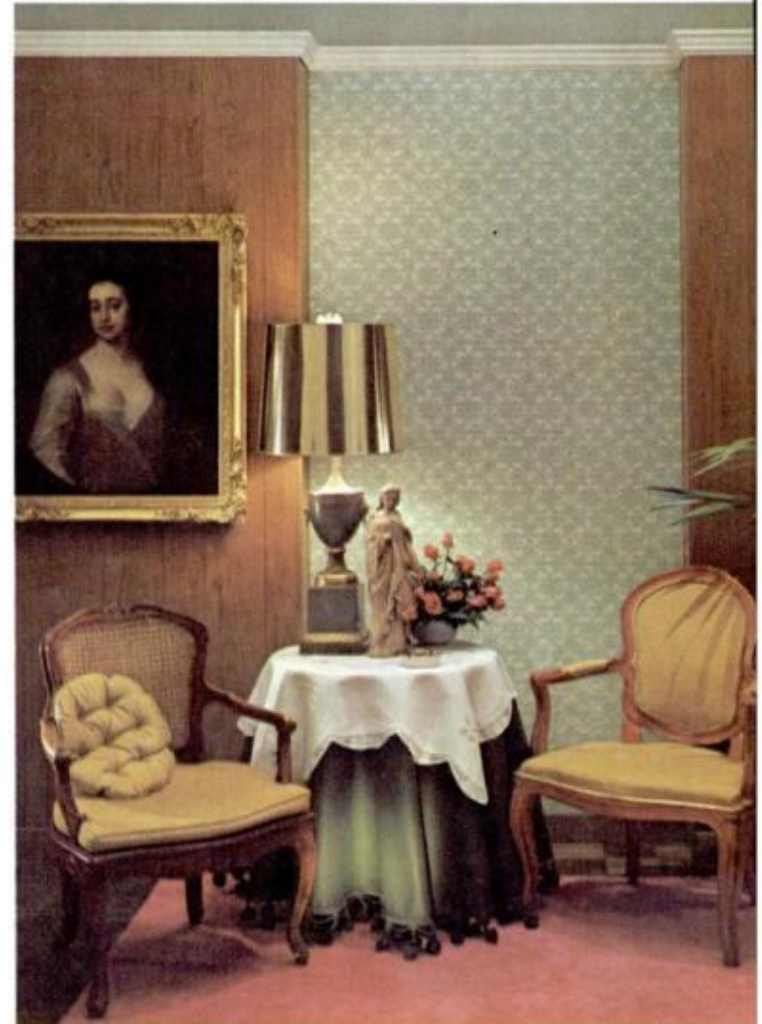
VINYL-SURFACED STEEL BEAMS from Wood Conversion Co. look like walnut. Called Nu-Grid Ceiling Beams, they measure 3 by 5 inches. Lengths are 12 and 14 feet. Price is about \$1.35 a foot, including hanger clips and end trim. To install, fasten clips to ceiling, push beam so its flanges engage the clips

COLORBESTOS SLATES (top photo, below) look like natural roofing slates, but are light enough in weight for many roofs designed for asphalt. Atomic age wood (bottom) is being tried as a flooring, may find other building applications. It's made by impregnating wood with plastic, which is then cured with radiation



REDWOOD SIDING comes with a clear urethane finish that's guaranteed not to flake, peel, blister or crack for 5 years. Made in bevel or tongue-and-groove styles. The former is applied with concealed fastener strips, the latter with conventional nails. RG-5 siding, made by Union Lumber Co., costs 80 to 90¢ a sq. ft.

PLASTIC SURFACED WALL PANELS of 1/8-inch Marlite have Chantilly lace patterns in beige, green, gold or rose on a white background. Available in 4 by 6 and 4 by 8-foot sizes for adhesive application to any solid backing such as wood, plasterboard, masonry. Made by Marsh Wall Products. Price is about 48¢ per sq. ft.



10 SPRING TONICS for Winter-Weary Homes

After a winter of hibernation most homes are ready for a Spring tonic — some fresh, sprightly touches that will spruce them up. Presented on the next 34 pages are ten proven Spring-tonic treatments that will help shake winter blues



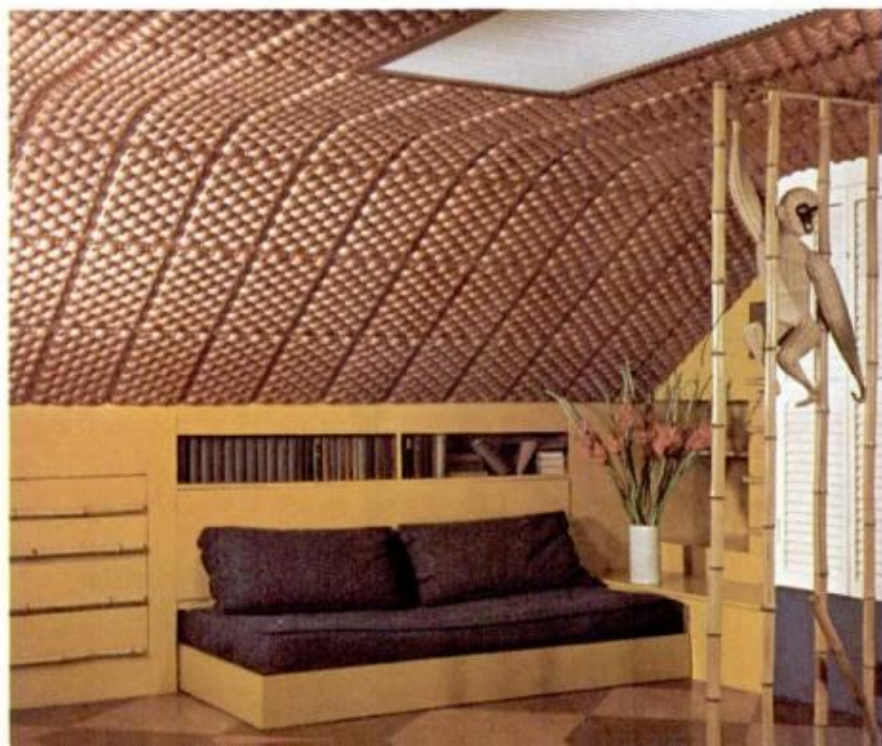
◀ **ROLLING RANGE** is tethered to an outlet in the center of the kitchen floor, travels to the sink or a view window, spins for best working light, seats four with drop-leaf up. See page 148

SWINGIN' PANTRY (lower left) packs 100 cans on its door backs and on double-faced pivoting shelves, lets you buy in budget-stretching quantity. Counter-high size on page 160

LITERATE DOORS do more than hide the contents of their storage cabinets — they keep your magazine supply neat and handy without stealing space for a separate rack. Plans, page 151



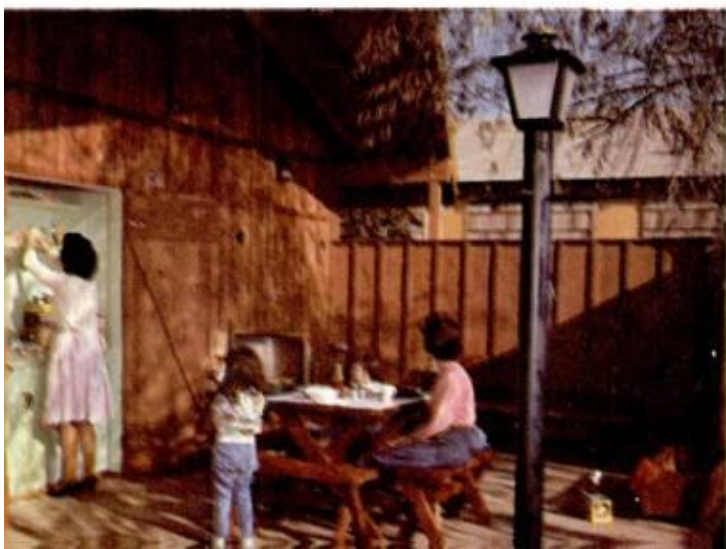
ENTRY DIVIDER stands proud and tall to create a front hall with its shuttered storage wall. And there's as much reason as rhyme to it, since the L-counter is a hi-fi control center. See blueprint on page 157



CLOSE TO HEAVEN, this skylighted studio is the most popular room in the house. A few months back, it was a cobwebbed attic. The divan pulls forward to convert to a guest bed. That "embossed-copper" ceiling is sprayed apple-packing trays! Details on page 146



WE SOUGHT A DESIGN that would blend with many styles of homes, that would include all two-car garage features and at the same time would create an exciting focus for outdoor entertaining. The dramatic thrust of that roof peak (above) shelters a cook-out center built into the end wall. A kitchen, complete with sink and cabinets, is recessed behind two doors (below left). Other doors give access to storage "closets" for a portable barbecue and patio furniture. The patio's other borders are marked by a privacy fence, bench, planter boxes and post lamps. Night or day, party fun is neatly screened from adjoining property (right)



Building PM's Patio-Garage

With the cooperation of Western Wood Products Association who furnished the lumber for this project, *Popular Mechanics* proudly presents its Patio-Garage. In this first of four articles, you'll be taken through the steps of laying out the foundation and pouring the patio slab

By Manly Banister, with Dick Chilson

DATING BACK to the days when a shed took over as shelter for the horseless carriage, the lowly garage has remained pretty much the same in design and purpose. Except when it's moved up front and made a part of the house, this structure still leads a detached sort of life.

Deciding it was high time to do something about making the lonely garage take a more important role in family affairs, the editors of *Popular Mechanics* tossed the challenge at a New York architectural firm. We asked that they turn it into a gay fun center, with emphasis on outdoor dining and entertaining.

From the fresh, exciting new concepts you see here, the commonplace garage has at last come into its own. With it now contributing a sink-and-cupboard alcove, shelter from a sudden shower, a storage wall for patio furniture and a wind screen for privacy, the garage takes on a dual role in making family cookouts twice the fun, while still finding time to be a garage.

To prove our point that the building of a garage is within the ability of any handy guy, we commissioned Manly Banister, author of many *PM* craft articles, to build our test model. Here in his own words, Manly takes over and tells how he and a friend built the *PM* Patio-Garage from the first shovel of dirt to the last swing of the paintbrush:

Knowing little about actual building construction myself (I'm a workshopper) I secured the services of a neighbor, Dick Chilson, who's a building contractor. I'll be passing his tips along to you, in case you don't have a pro next door. Dick believes in doing the job right by avoiding slip-shod shortcuts, and in building for permanence. So, when you walk on the roof of the *PM* garage, it's as solid underfoot as the concrete foundation. Working from the architects' blueprints (which are repro-

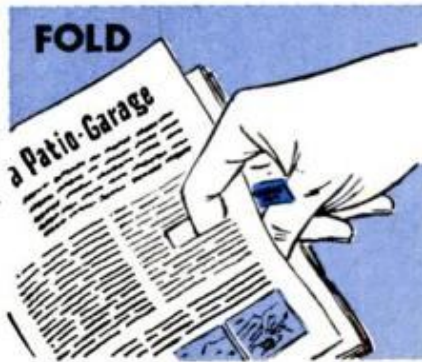
FILE FLAG

INTRODUCING PM's "FILE FLAG" INDEXING SYSTEM

In the tradition of developing fresh ideas for an ever-better magazine, *Popular Mechanics* begins, with this issue, a new service to readers: Fold-out tabs to make each issue self-indexing.

These tabs will be "built into" all major craft and maintenance articles, so that you'll be able to "flag" the ones you want to refer back to, later. Then, if you keep

a file of all issues, you'll be able to locate plans or instructions you remember seeing—without that long hunt through a stack of magazines. You tab the pages for quick reference by following the three easy steps shown below. We've located every File Flag so that you'll be cutting away no essential part of the text or plans, as in the example directly above.





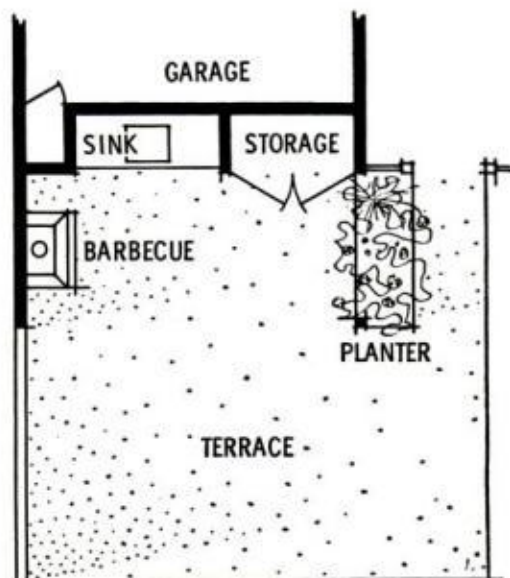
CUT,
FOLD,
TAPE

**GARAGE
PART 1**

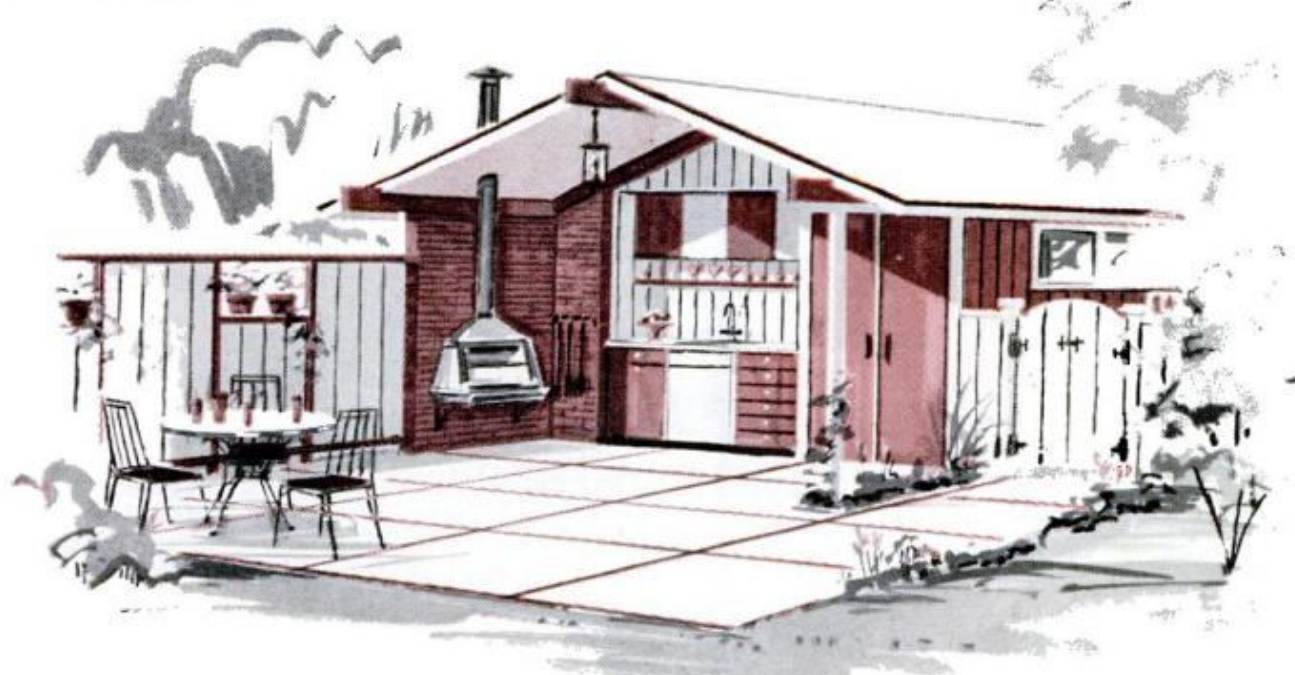
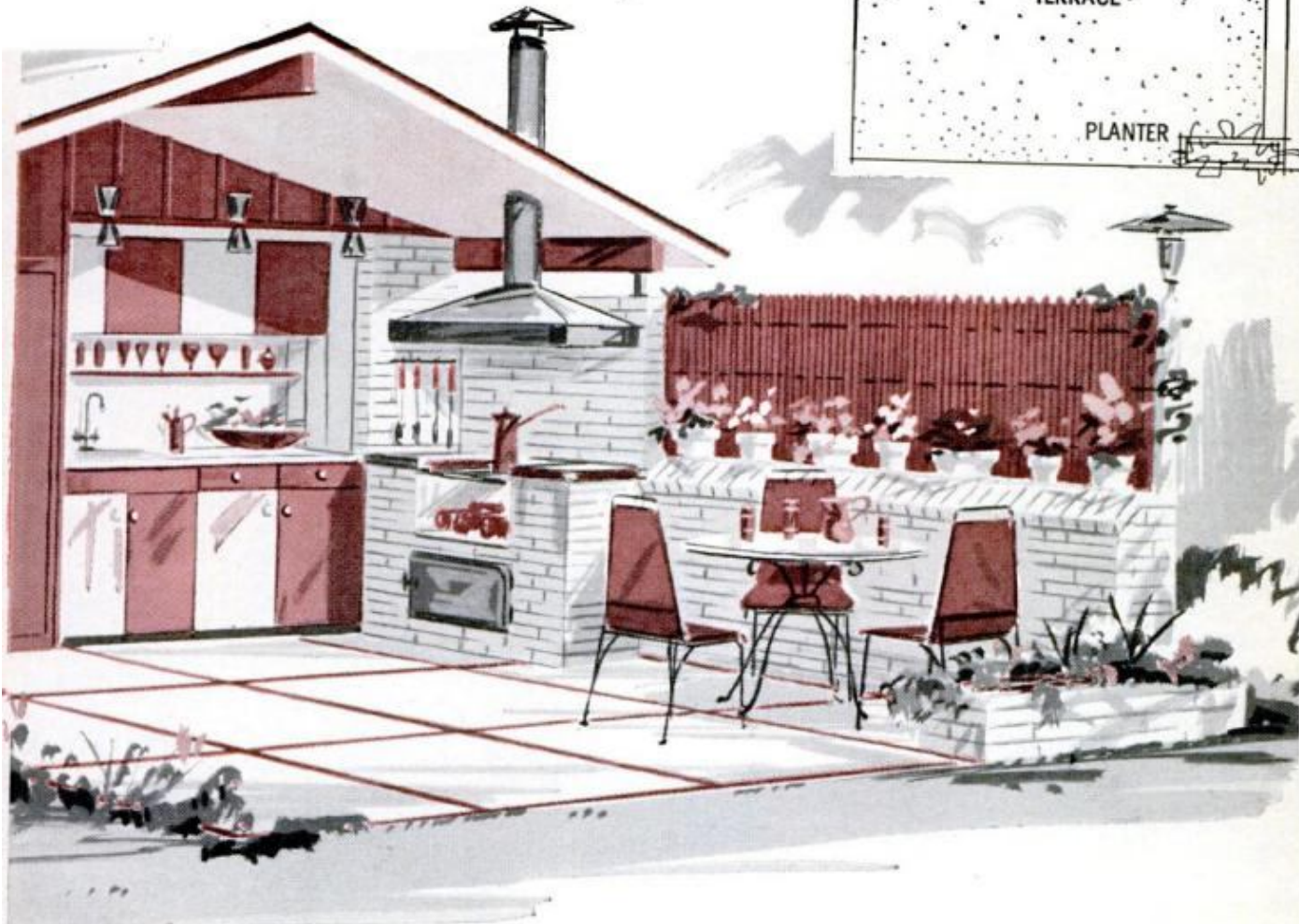
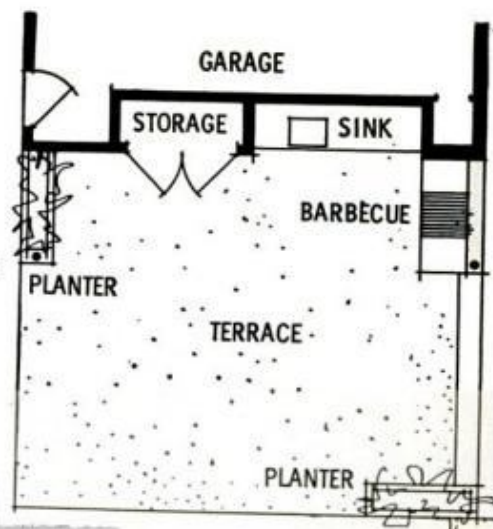
duced on pages 140 and 141), Dick planned and executed the framing and rough construction, and I attended to siding the garage-door and patio-walls, nailing the battens, and all the rest of the finishing work. Framewise, the garage is erected the same whether you cover the side walls with boards and battens as I did so it would match my house, or face it with siding or shingles. With boards and battens, however, you can forget about wall sheathing, which isn't true in the case of siding or shingles if you want a good job. But the choice is up to you.

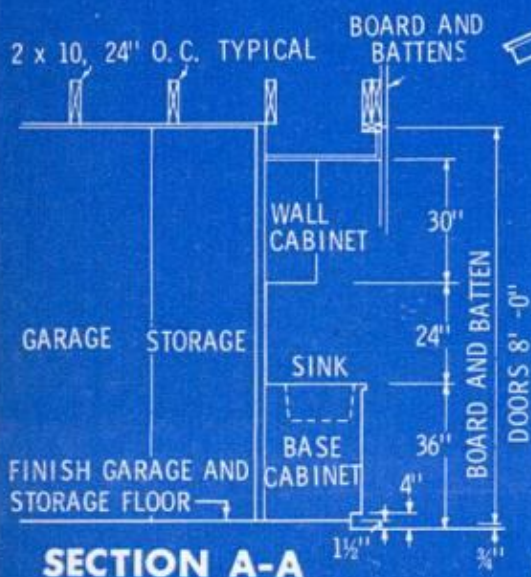
In staking out the garage and patio floor plan, you work from a property line; in my area, the building must set five feet inside this line. Check with your local planning commission for conditions prevailing in your locality. Drive stakes at the four corners of the garage and the two outside corners of the patio.

Your next step is to square up the layout, and this is best done by use of batterboards and masons' line, as on page 142. Since at least one of your building walls is to be parallel with a property line, work from this line to square up the rectangle. Stretch the masons' line from corner to corner as shown in the



DELUXE VARIATIONS on the master plan (blueprinted on the next two pages) elaborate on the "outdoor kitchen" treatment of the garage's patio end. As in the basic structure, photographed on previous color page, these roofs project beyond gable to provide shelter for built-in sink. If you're a bricklayer, add a hooded barbecue—or hang a metal unit from a brick wall (far below). Latter plan is for different corner of the lot

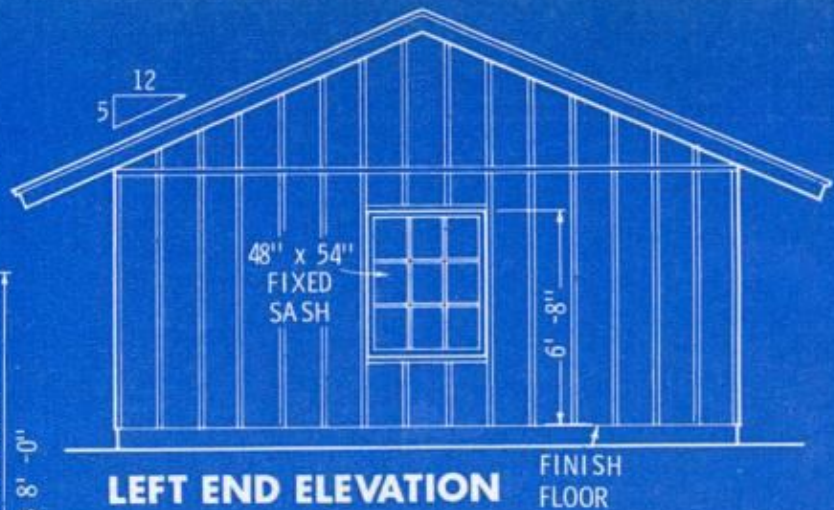




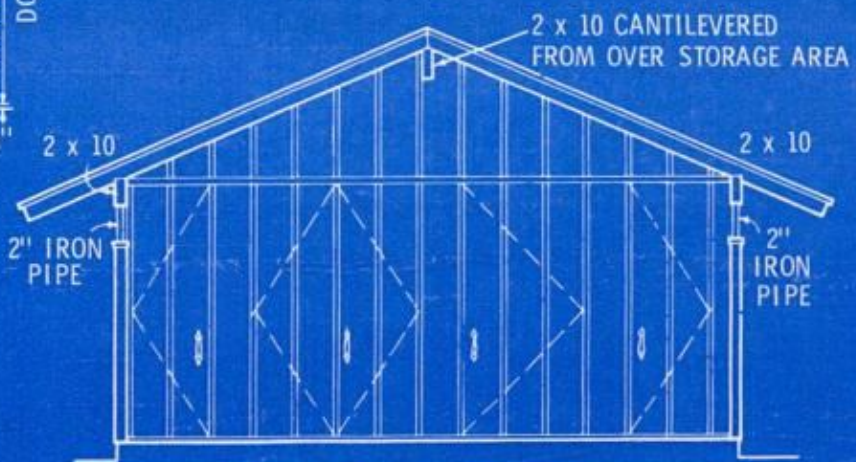
SECTION A-A

PLANS AVAILABLE

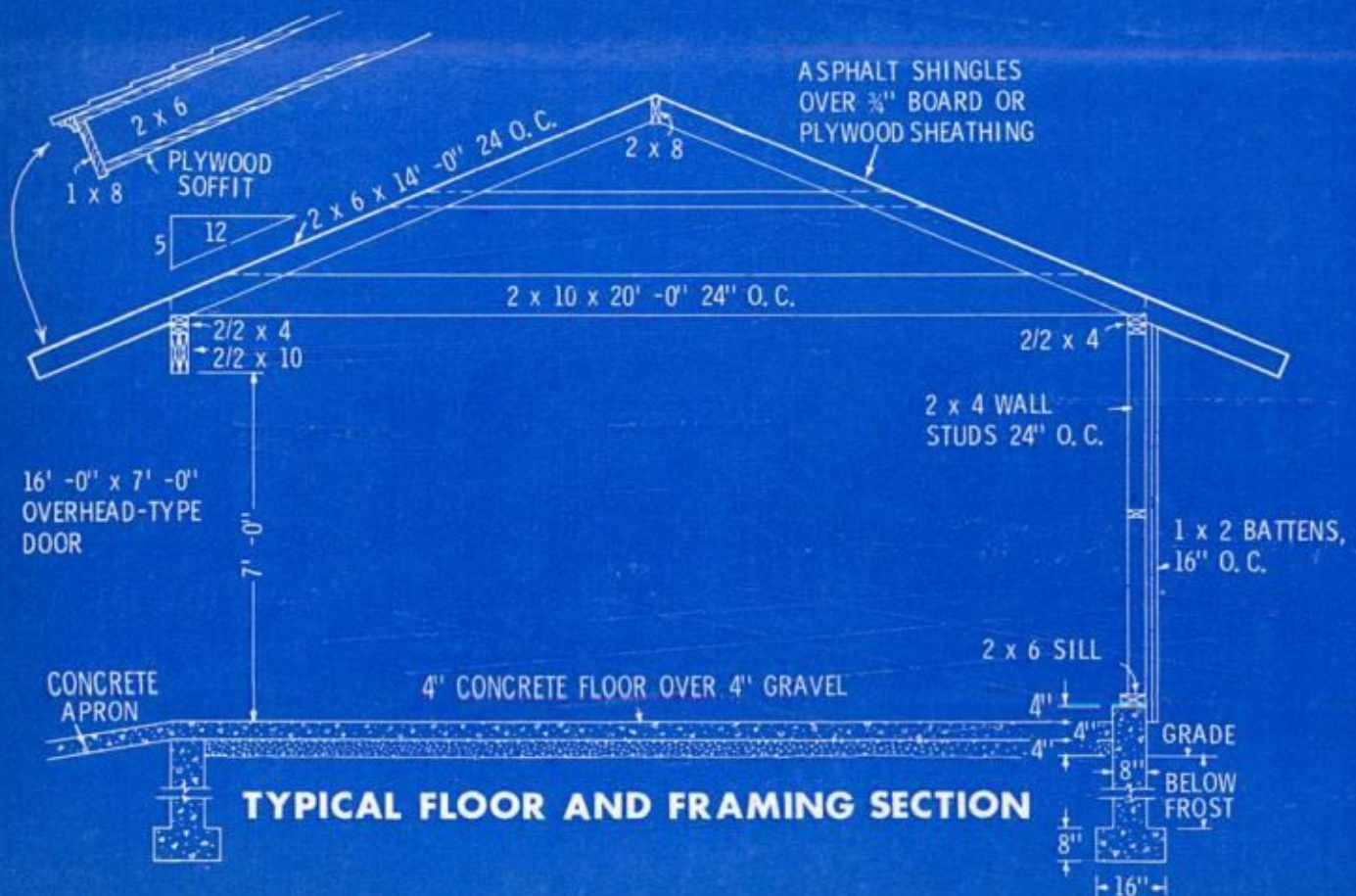
If you find that an architect's working blueprint is required to obtain a building permit, you can obtain a standard 17 x 23-in. plan (drawn to a scale of 1/4" = 1'-0") by sending \$1.00 to Popular Mechanics Magazine, 575 Lexington Ave., New York, N. Y.



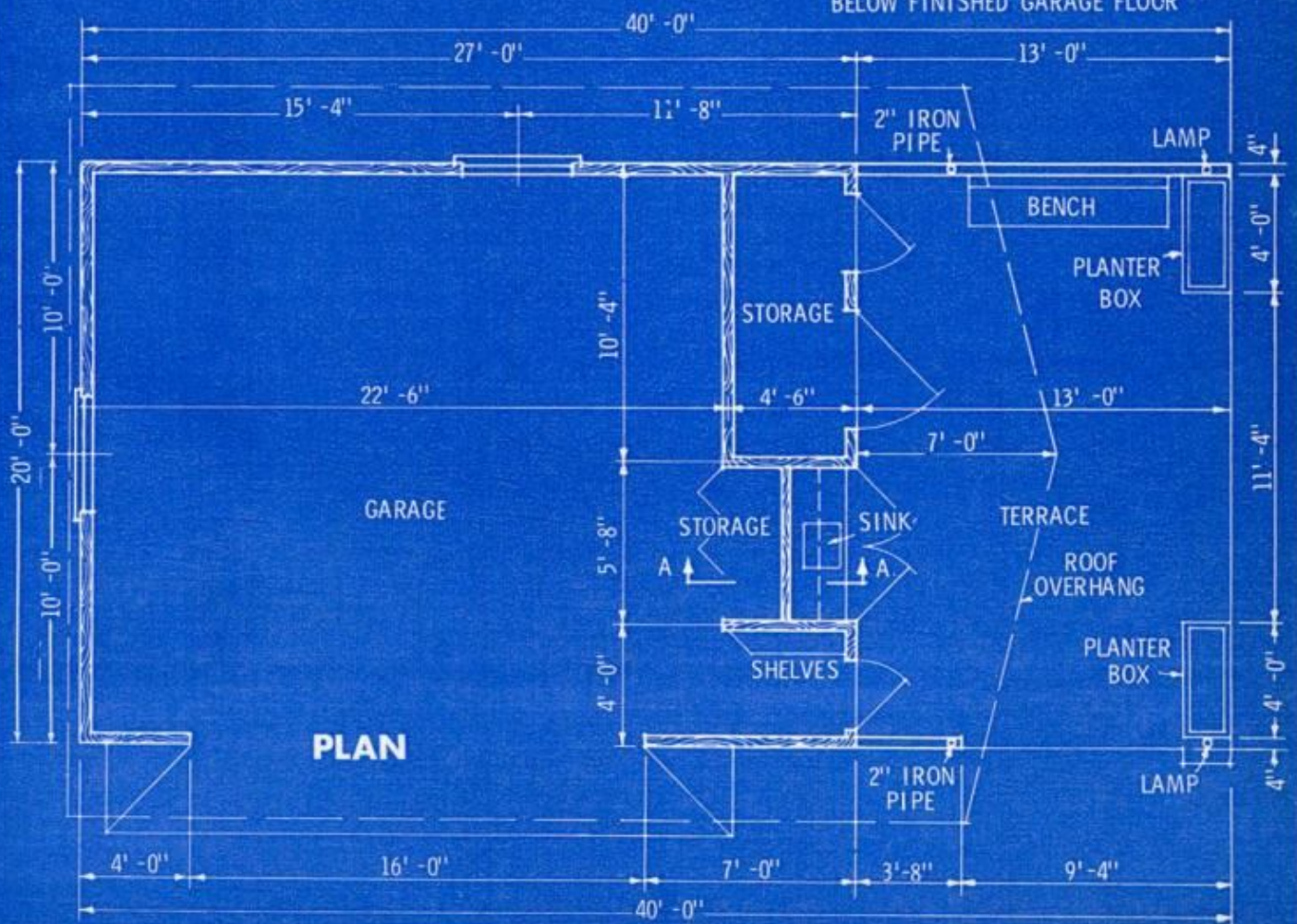
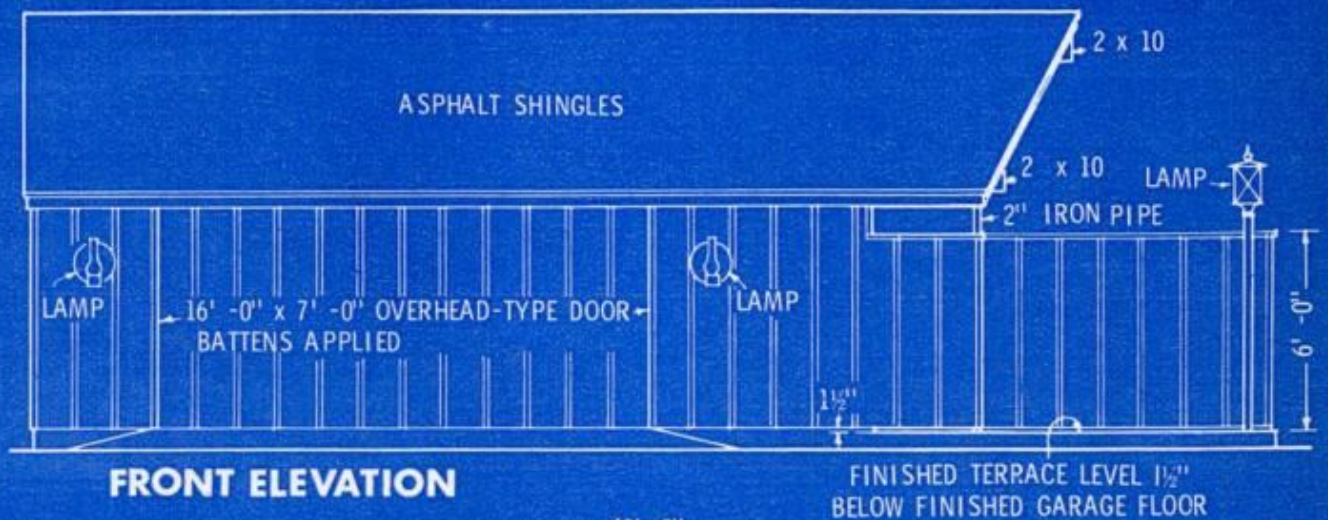
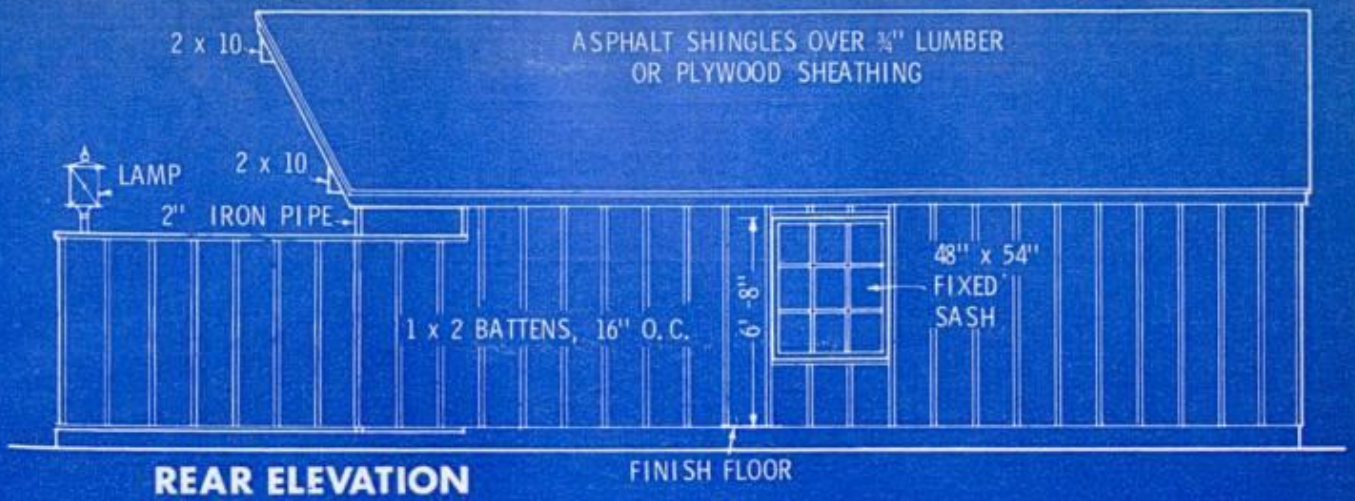
LEFT END ELEVATION

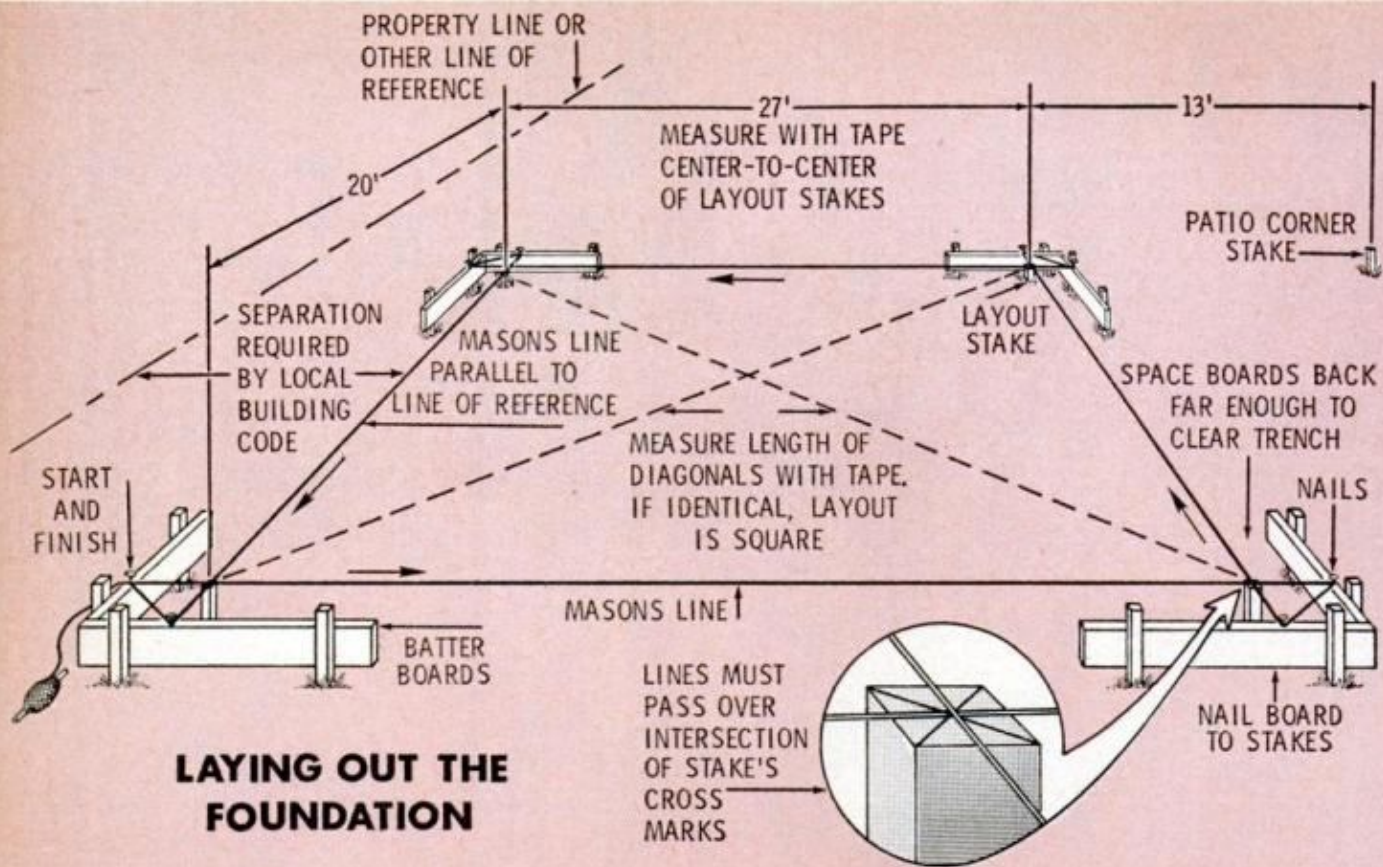


RIGHT END ELEVATION



TYPICAL FLOOR AND FRAMING SECTION





drawing, so that the cord passes over the center of each stake. The cords cross to provide index points at the stakes. Measure with a steel tape from stake to stake around the perimeter of the garage area only (the patio area is not concerned in this layout). Measurements should read exactly 20 ft. on both widths and 27 ft. on both lengths. If any measurement is off, shift one or more stakes and cord-crossings to bring measurements true. When this is done, measure across both diagonals as indicated in the drawing. If these two measurements are unequal, the rectangle isn't square. Shift the cords as required, and re-measure. When all side measurements read true and both diagonals are the same length, the layout is square. Leave the batterboards up throughout the construction, for reference, and use the masons' line as a guide while trenching for the foundation.

Consult your local building authorities about requirements for the concrete foundation. These vary from area to area because of climate. The foundation footing must be laid below frost-level and the thickness of the foundation wall depends on code specifications. In my home town, Portland, Ore., 12 in. below grade is sufficient, with a footing 12 in. wide and 6 in. deep; the foundation wall can be a minimum of 6 in. thick, so we saved quite a bit of money on both concrete and labor by adhering to the local code instead of the architects' blueprint. But in some

areas, their recommended foundation dimensions may be required. After trenching, use a transit-level to check out the depth to make sure the bottom is everywhere level. (The building trade calls this "shooting a few grades.")

The only preparation the area inside the forms received was the "skinning off" of the sod. Since we started construction at the height of the building season, we couldn't line up a bulldozer to do this scraping, so we cleared the patio area with hand mattocks. You'll be better off if you have a dozer in, first thing, to scrape and level the plot before you so much as drive a stake.

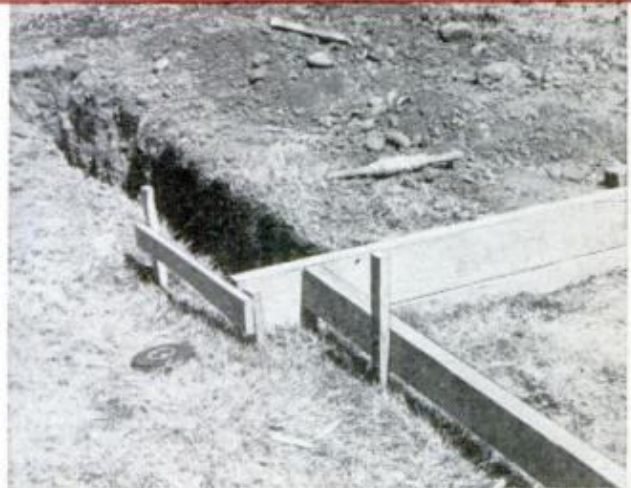
Your first concrete pour will include only the patio slab and the foundation footing for the garage. This took about five yards of concrete in my case, but will be more if a heavier, deeper footing is planned. The patio slab is to be 4 in. thick, so use 2x4s for the form, staking them out to the dimensions shown on page 144.

Keeping in mind that the patio slab is to be 1½ in. lower than the garage floor, we constructed a bulkhead to hang down the middle of the foundation trench along the left side of the patio slab, as shown in section on page 144. For emphasis in this sketch, the bulkhead projects above the form boards, but if you wish to use it as a bearing edge when rodding off the patio pour (as in bottom-left photo, page 145) it must set flush with the top edge of the form, then be raised 1½ in., later.

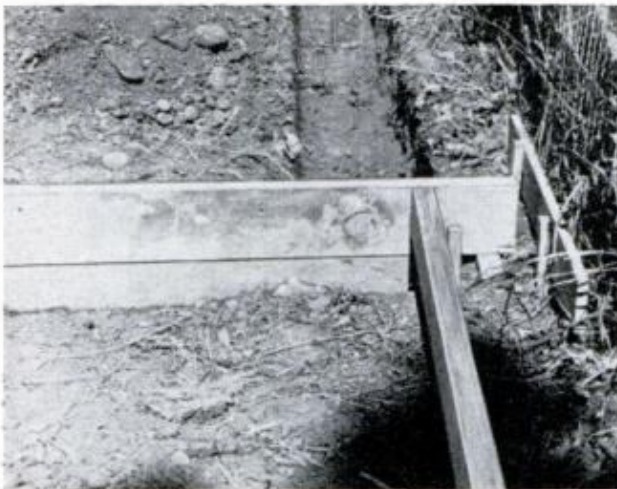
PATIO SLAB IS FORMED AND POURED FIRST



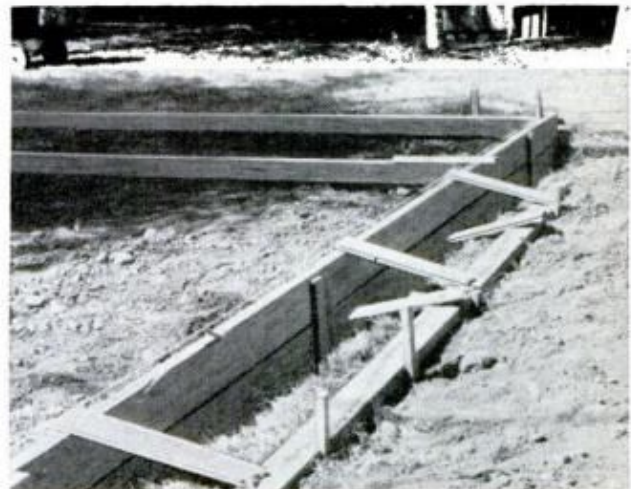
FOUNDATION TRENCHING is done to depth and width required by local code. Location shown needed only 12x12-in. trench for footing. Note no foundation is laid under the 16-ft. door space, left foreground



FRONT CORNER OF PATIO FORM shows how batter board was left in place to align bulkhead that is set into foundation trench. Form 2x4, right foreground, defines edge of patio; ground gap is from leveling



OPPOSITE END OF BULKHEAD has been blocked up, staked and leveled. Patio is now fully outlined; area in left-front corner must next have sod skinned off. Garage's rear foundation trench is shown at the top



GARAGE-SIDE VIEW of bulkhead just prior to pouring concrete. Note it is braced against pressure of pour by means of cleats that bridge the trench and are nailed to both bulkhead and staked-down 2x6

PLANT THE POSTS in foot-square pits, after wiring them to each other and bringing the plastic cable under the bulkhead, to tie into the garage wiring. Concrete flows into these pits to provide a firm footing

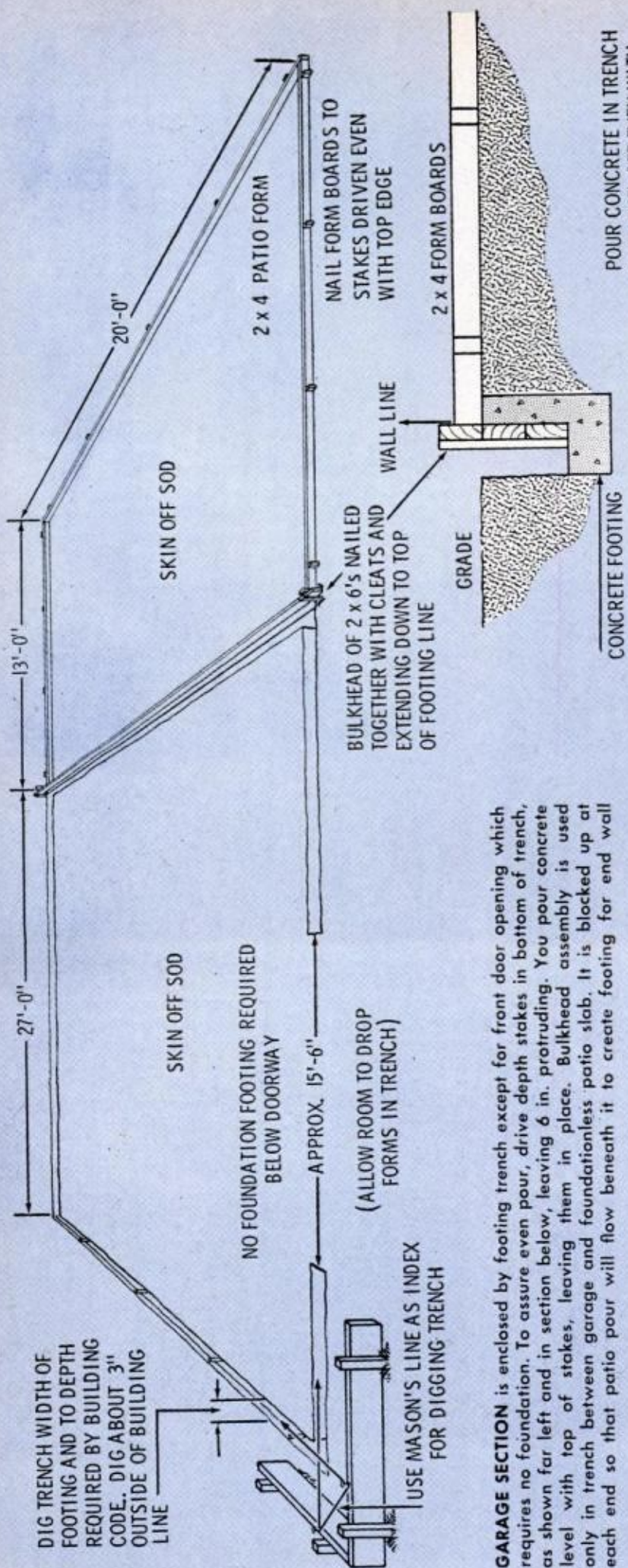


APRIL 1965

AFTER HOSING DOWN soil, pour concrete direct from readymix truck, coaxing it with shovels for an even fill to top of form boards. Note concrete is poured directly over lamp cables. Mix used here is 1:3:4

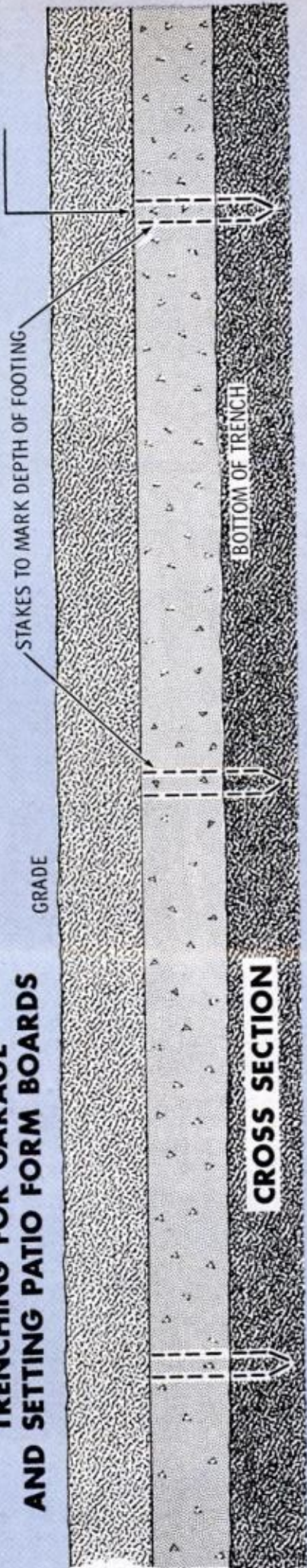


143

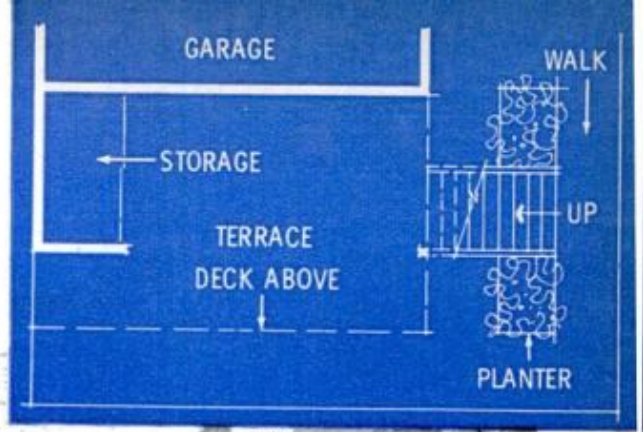
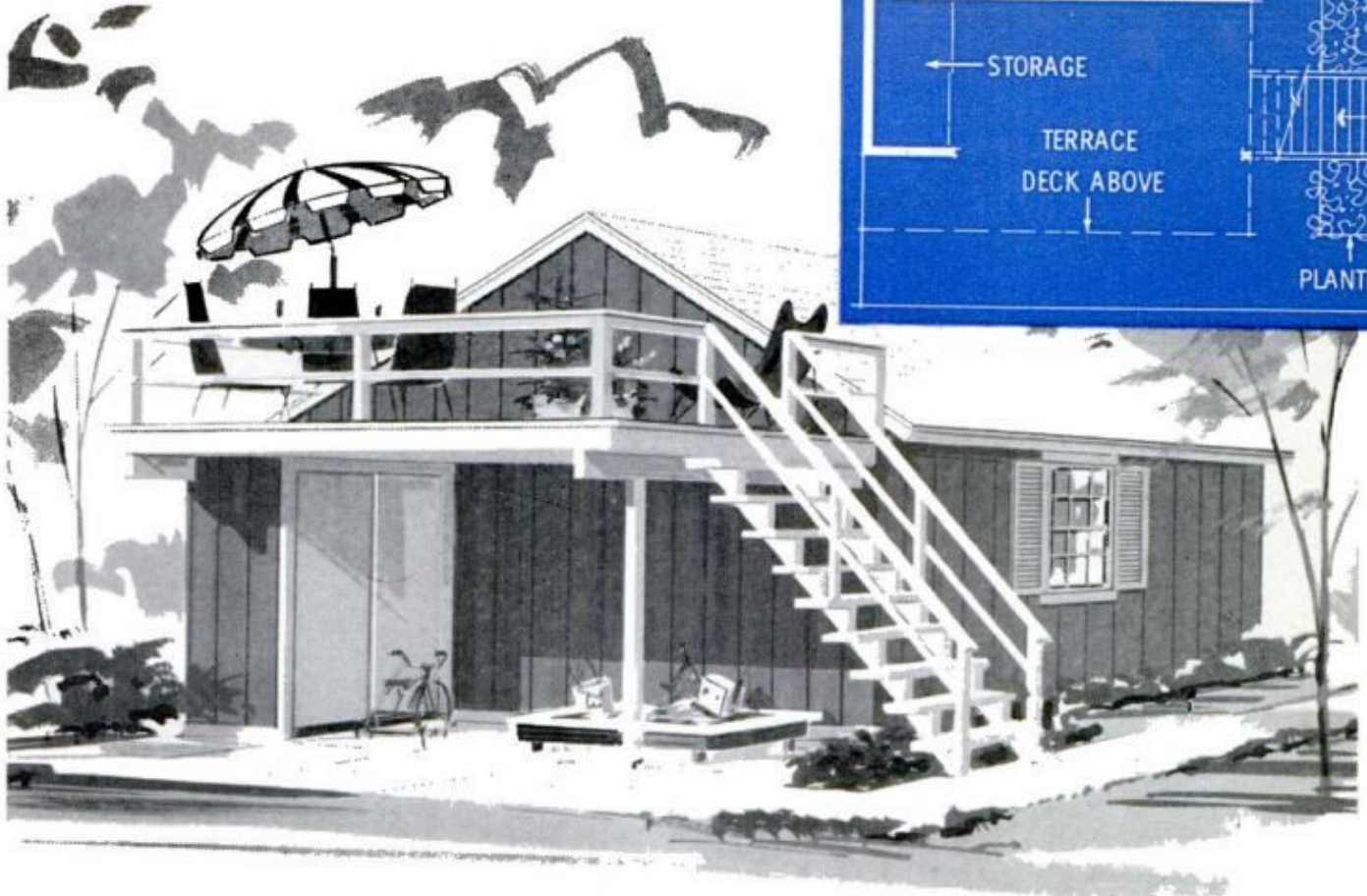


TRENCHING FOR GARAGE AND SETTING PATIO FORM BOARDS

GARAGE SECTION is enclosed by footing trench except for front door opening which requires no foundation. To assure even pour, drive depth stakes in bottom of trench, as shown far left and in section below, leaving 6 in. protruding. You pour concrete level with top of stakes, leaving them in place. Bulkhead assembly is used only in trench between garage and foundationless patio slab. It is blocked up at each end so that patio pour will flow beneath it to create footing for end wall



CROSS SECTION

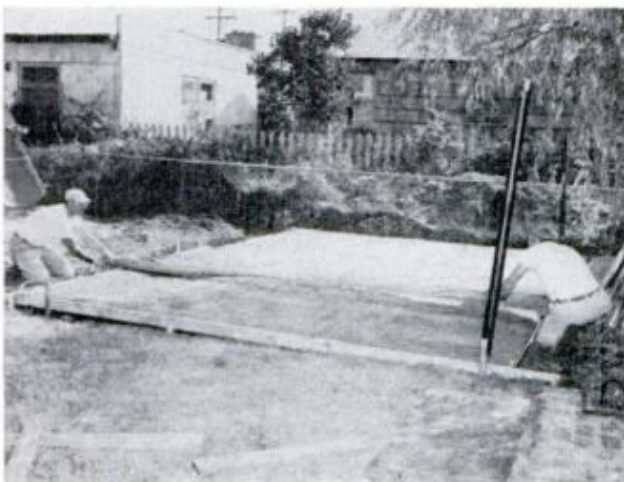


ANOTHER VARIATION has solid end wall with storage L that supports one end of sun deck. Note ridge is trimmed flush with gable for head clearance. Deck offers shelter for sandbox and while-it-rains storage

For drainage, the patio form was laid with a pitch of $\frac{1}{8}$ in. per 18 in. (the length of our level) away from the garage.

When we were ready to pour, we called in the county inspector for an OK, and the concrete was ordered for the next morning. Since the weather was dry, we reeled out the hose that night and wetted the area and forms thoroughly. We hosed down again the following morning. A dry base sucks moisture out of the concrete

RODDING OFF, after pour, is accomplished by "sawing" 2x4 across top of form. Loosely-set lamp post will be plumbed after concrete has stiffened enough



APRIL 1965

mix, and you're in for endless trouble if you let this happen.

To start the pour, feed concrete—a barrow-load at a time—into the trench in front of the bulkhead. The concrete flows *under* this suspended panel and is leveled off at footing depth along its opposite side. Keep adding concrete until the trench on the patio side of the bulkhead is filled flush with the ground line.

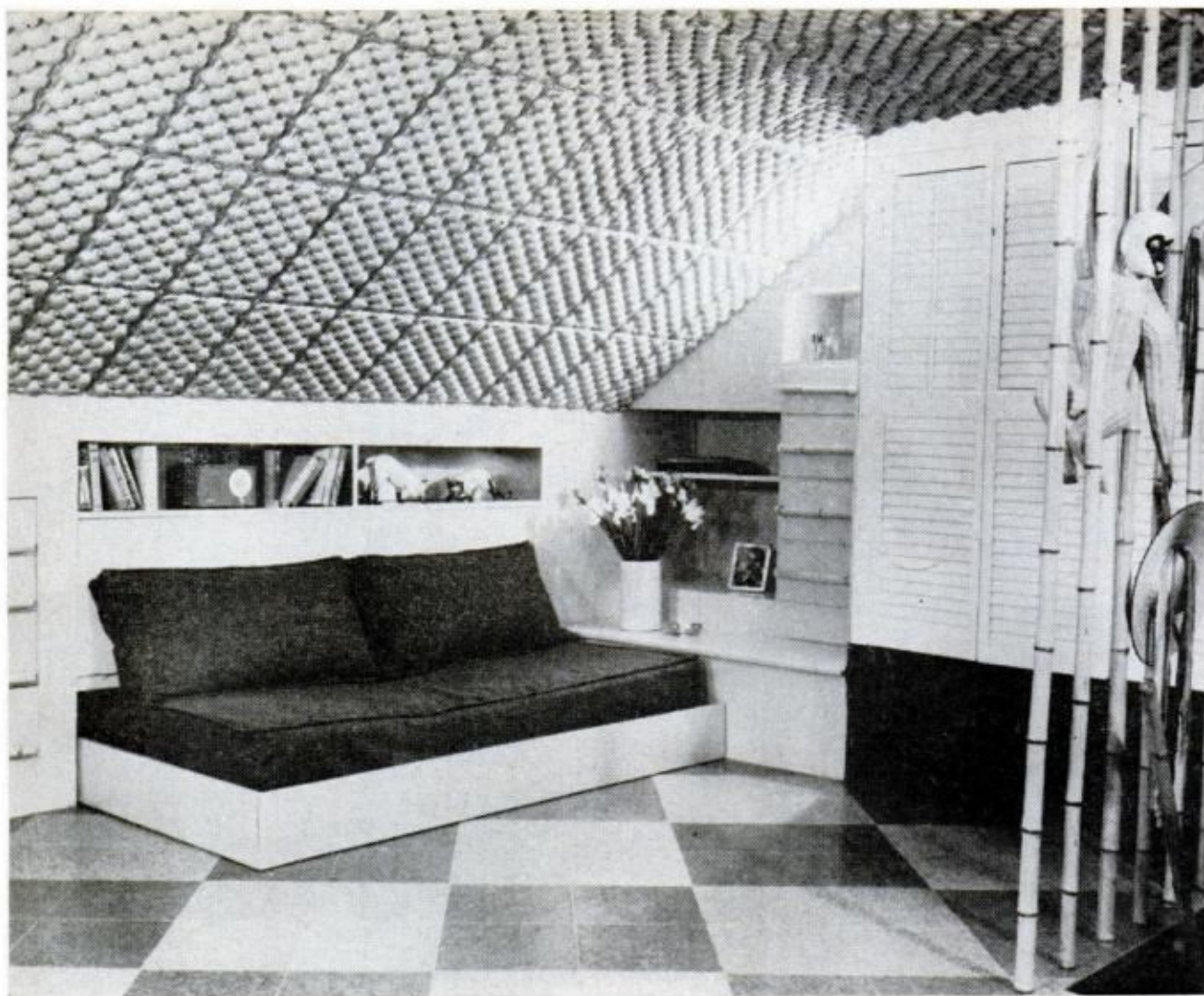
The step-by-step photos, starting on page 143, provide an account of the pouring and finishing of the patio itself. In

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

JITTERBUGGING levels and smooths pour, forces heavy gravel under surface. You walk backward, tamping rapidly with steel grille on pipe handle



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Attic Studio Bedroom

Unused space can blossom into the most striking room in your home. That divan, above, rolls further out of the wall to provide a guest bed

THAT LAST HURRICANE that roared through New England was an ill wind that blew *somebody* good. At least, it gave the Arthur Griffins of Winchester, Mass. the handsome room seen above. When a pine tree toppled through part of the roof, the Griffins decided to do more than just patch the damage. They installed a skylight, then proceeded to create a studio guest room with a character all its own. Some of their ideas, as detailed on the next page, are adaptable to the waste attic space in *your* home.

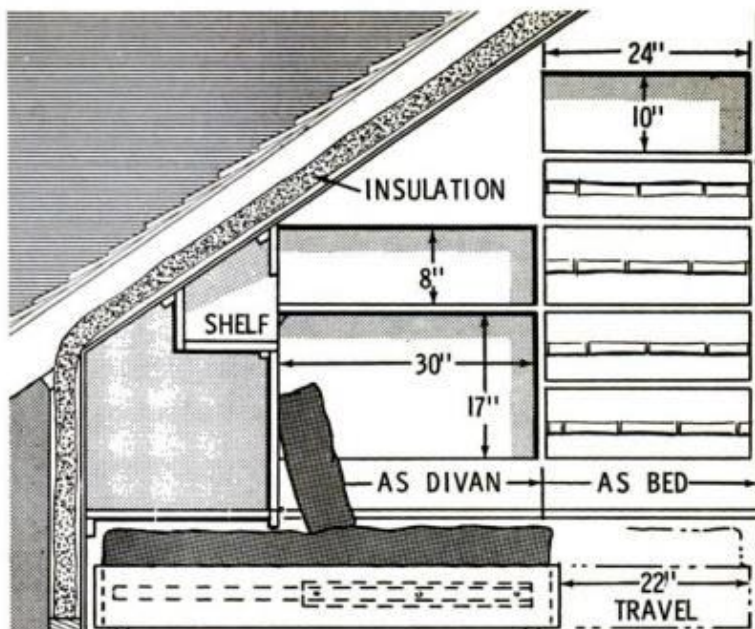
To utilize as much floor space as possible, the Griffins pushed the boundary of the room back to a 4-ft. "knee" wall, and then even put to work the wedge of space between this wall and the eaves—by designing an ingenious unit that rolls part-

way into that niche to change from a full double bed to a comfortable couch. The Griffins made use of an old flat spring already mounted on casters, but you can buy a rolling angle-iron frame from any bed dealer. Just box in the frame and springs, set a standard mattress in place (with an upholstery-cloth cover, of course) and construct the built-ins around it. In the design shown, the plywood ledge-seat (at right angles to the couch) provides a face-panel to which the bed-box can be attached for controlled movement. The cross section detail shows how you screw on the locking strip after you've fitted the frame's slot over the waxed slide-cleat. For smooth operation, the casters should be the non-swivel ball type.

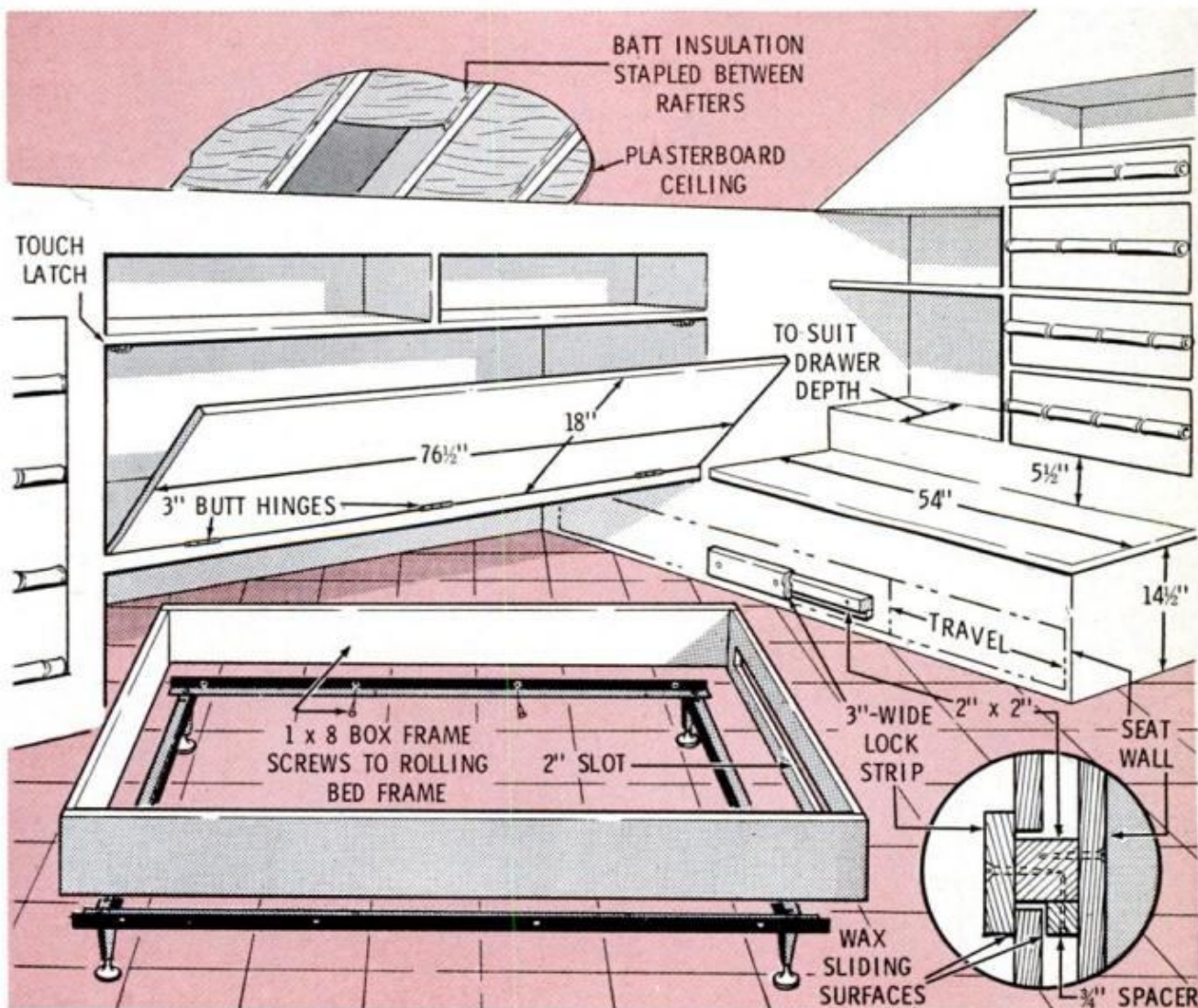
The space above the "bed slot" is en-

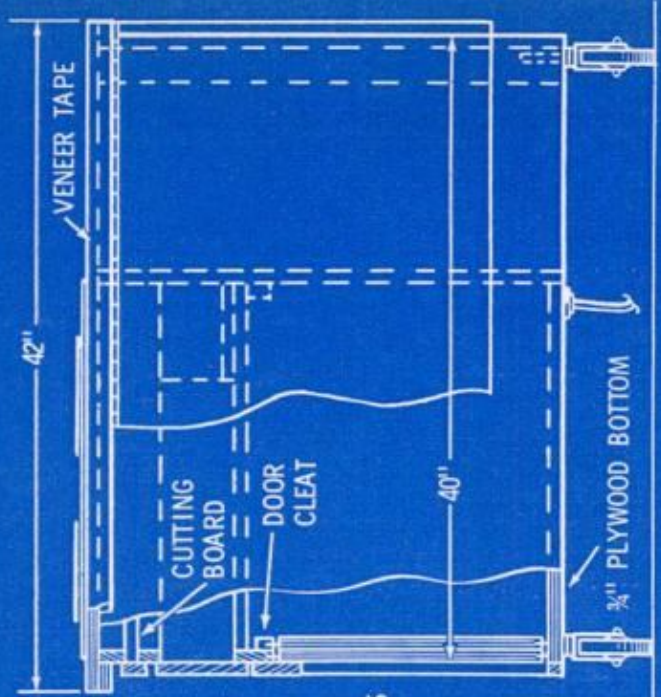
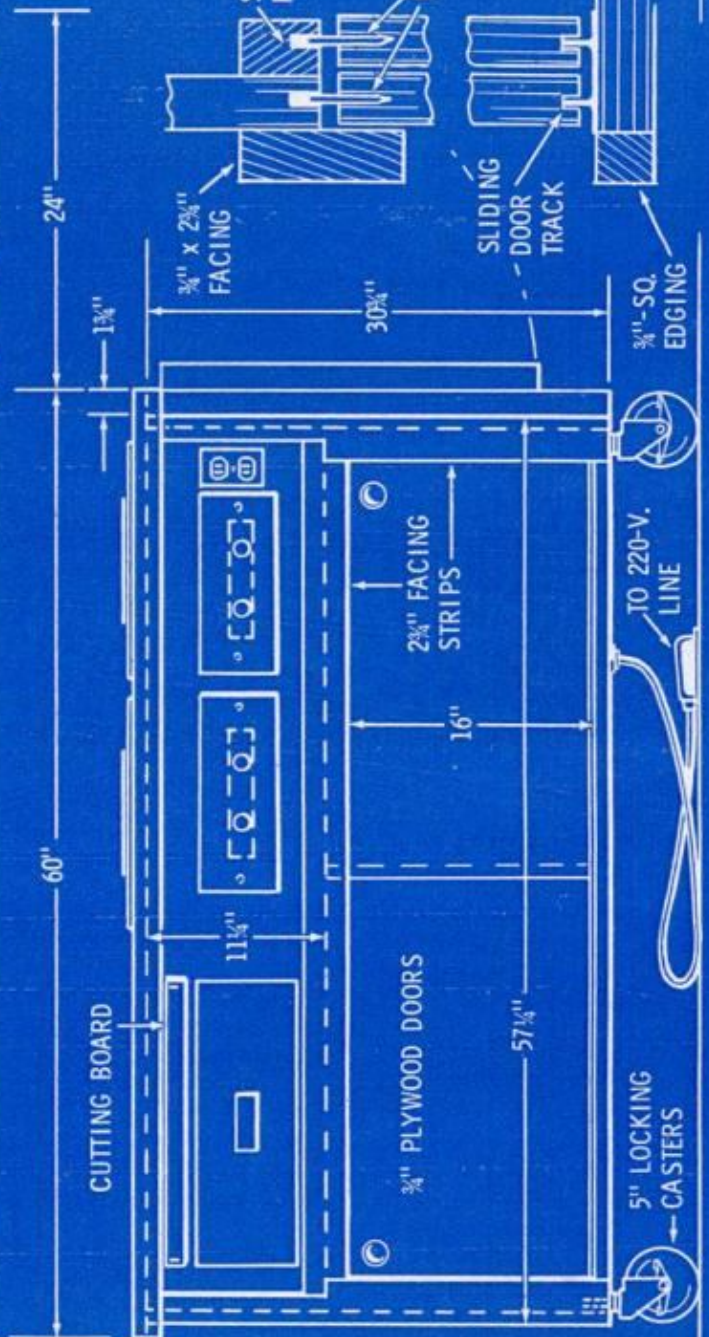
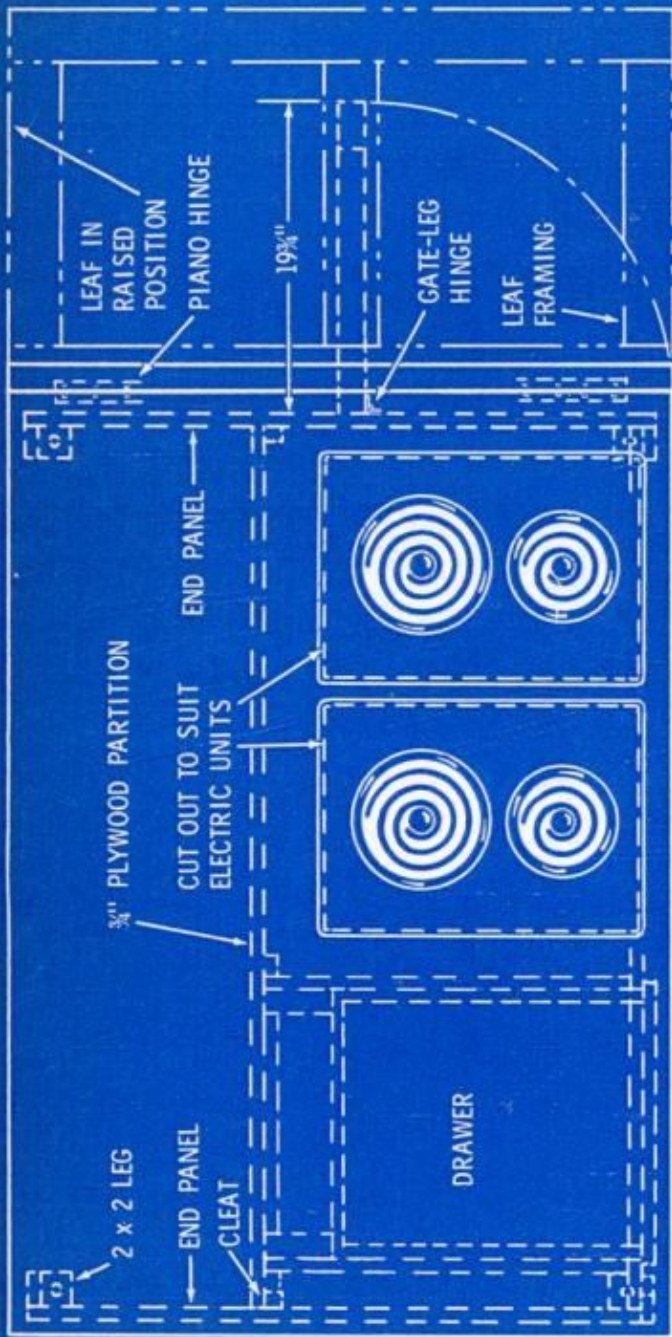
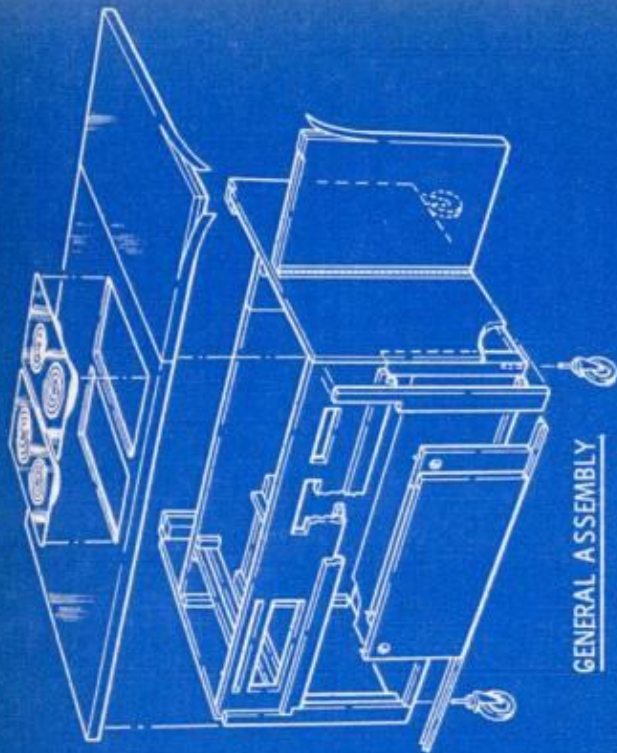
closed and provided with a plywood door, to create ample space for bed linen, pillows and blankets. The rest of the bed corner is designed to create shelves and storage. (You could even hinge that ledge-seat lid, if you wished). The bed is flanked by built-in stacks of drawers and a shutter-door wardrobe for your guests' use, and for storing the family's out-of-season clothing.

Bamboo was used as a decorative motif. Long poles screen the stair well, and short lengths are fastened to the drawer fronts as pulls. But the most strikingly original feature is the ceiling. The exposed rafters and beams were covered with plasterboard, and this, in turn, was covered with pressed-fiber trays designed for packing apples. Since the trays, as they came from the manufacturer, were dark purple and porous, it was necessary to spray them with shellac, then with copper-bronze paint, before stapling them to the ceiling. A little touch-up spraying along the joints where the plasterboard peeked through,



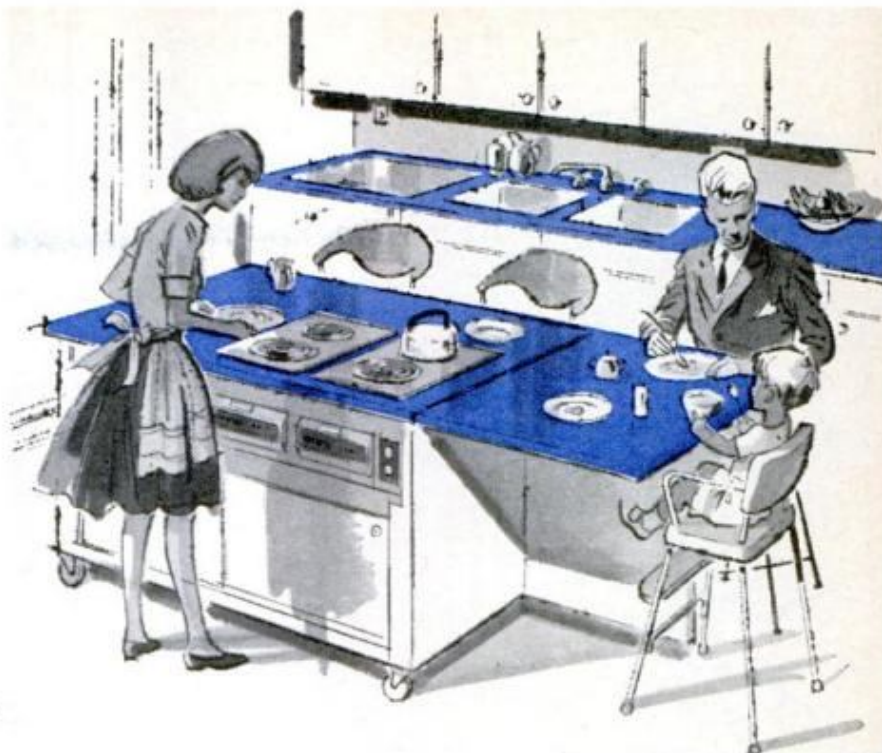
created a ceiling of uniform color—with a reflective quality that distributes the light well, day or night. (The skylight is just off the top of the page in the picture at the left.) But before you apply so elaborate a ceiling—or even tuck insulation between the rafters—make sure your roof doesn't leak!—*Eleanor Early*





Mobile Range-Bar

By Jenice Jordan



WHAT WOULD YOU nominate as the most unmovable accessory in a modern home? The kitchen stove, perhaps? Well, not when John Howald of Columbus, Ohio gets through with it! When the Howalds remodeled their kitchen, they replaced one whole wall with floor-to-ceiling glass panels, for an unobstructed view of their garden. But that was the wall the range stood against, so it had to be relocated as an "island" in the center of the floor.

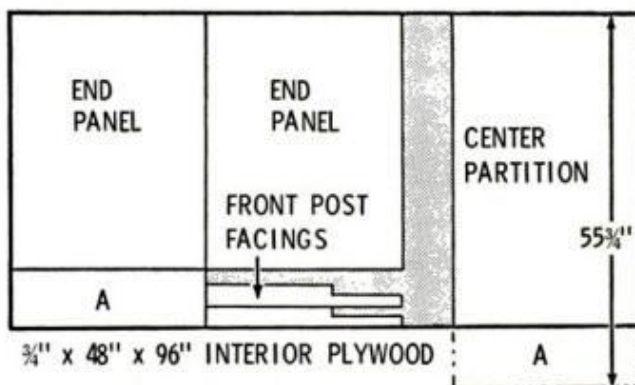
Instead of anchoring it permanently, however, Mr. Howald built it into a rolling cabinet, set on 5-in. locking casters, for greater flexibility. Now, on bright days, Mrs. Howald can roll the range right up to the glass wall, to enjoy her garden while she works. Then, for clean up, she merely moves the unit to the sink. And when it comes time to mop the floor, the range dodges out of the way, since it's tethered by a long cable to a 220-volt floor outlet.

The unit eliminates a kitchen table, too; the right end is provided with a full-width drop leaf (firmly supported on a swing-out panel) that converts the counter into a serving bar to seat four people on stools. This bar's ideal for informal meals, such as breakfast or late supper, and it's both festive and practical for cook-at-table dishes like sukiyaki or fondue.

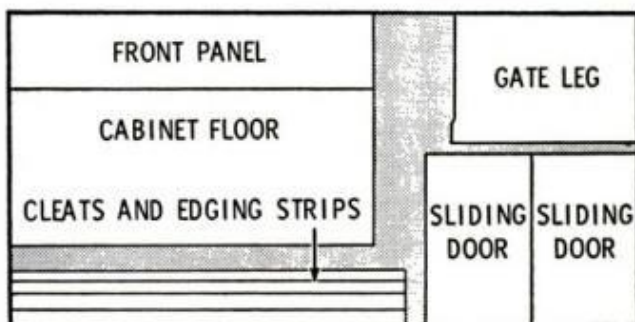
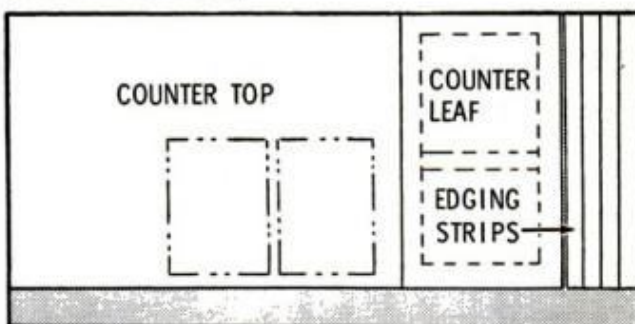
Mr. Howald chose two paired GE cook-tops with controls that mount on the side of the cabinet. Sliding doors, below, give access to generous storage place for such appliances as toaster, waffle iron and broiler. (For baking, there's a wall oven built into a nearby pantry.)

The top and leaf are thickened with 1½-in. strips, then both top and edges are covered with plastic laminate.

ALL PARTS CAN BE CUT from three panels—if you stretch out the partition by adding waste A as shown below. Position of edging strips on counter leaf (for double-thick effect) is also shown in dotted lines



CUTTING DIAGRAMS



Show-Off Corner Shelves



WHAT GOOD IS a collection if you don't have a space to show it off? This four-shelf corner unit provides the perfect answer to the problem of where to display your hobby collection.

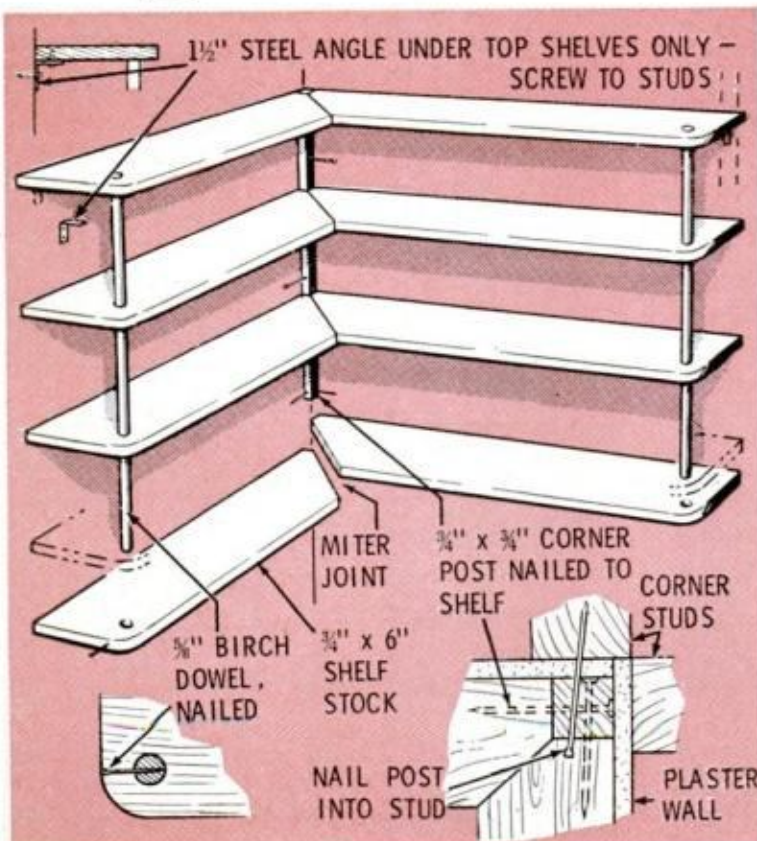
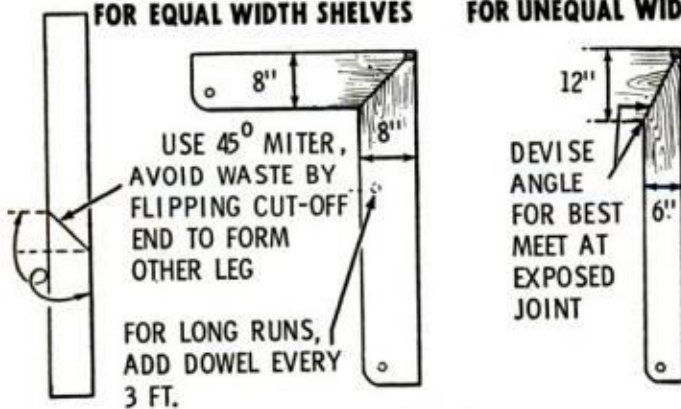
Originally developed to hold a boy's model planes and ships, it was mounted in an unused corner over a desk. Since the models were so light in weight, expensive commercial shelf standards and brackets would have been an unnecessary luxury. The mounting system shown here is sufficiently strong to support figurines, dolls and similar weight objects. For heavier loads, use corner irons with each shelf.

Construction should offer no problems, but be especially careful when cutting the joints at the corner so that the shelves will bear against both walls. Easiest way to assure this is to lap the boards at the corner, scribe a 45-deg. line on one board and make the cut, then place both boards in the corner and scribe the other board along the cut in the first. When using boards of different widths, the first cut should run from the corner out to where the edges of the boards meet.

To assure perfect alignment, drill the holes for the dowels through all four shelves at one time. Notch the shelves for the square corner post, and begin assembly by first gluing each pair of shelves together at the mitered joint. Then add the post and dowels. The completed unit is hung by nailing through the square post and into corner wall studs, and screwing angle brackets to the outer ends of the top shelves.—Hank Clark

FOR EQUAL WIDTH SHELVES

FOR UNEQUAL WIDTHS

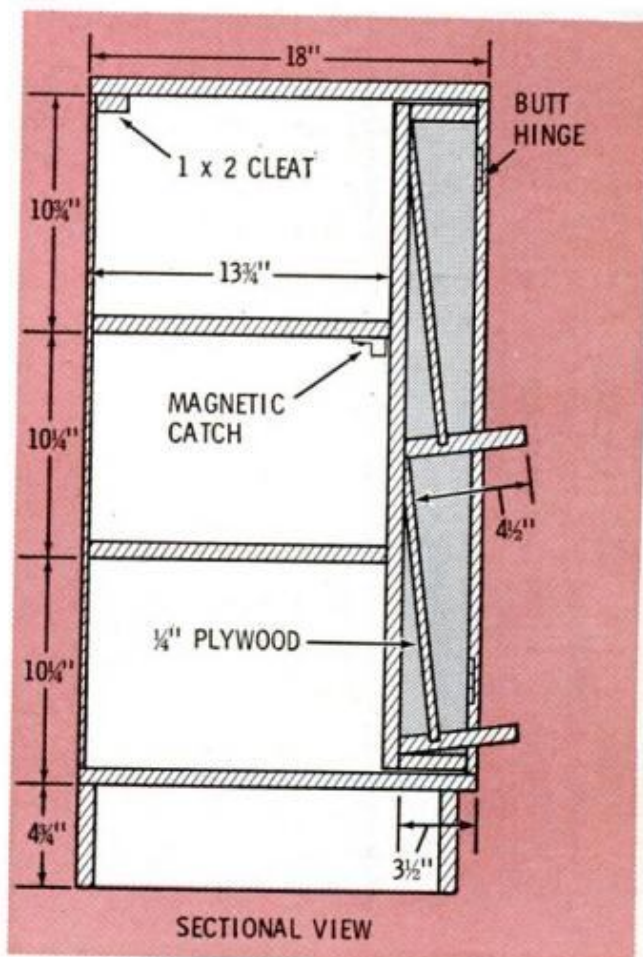


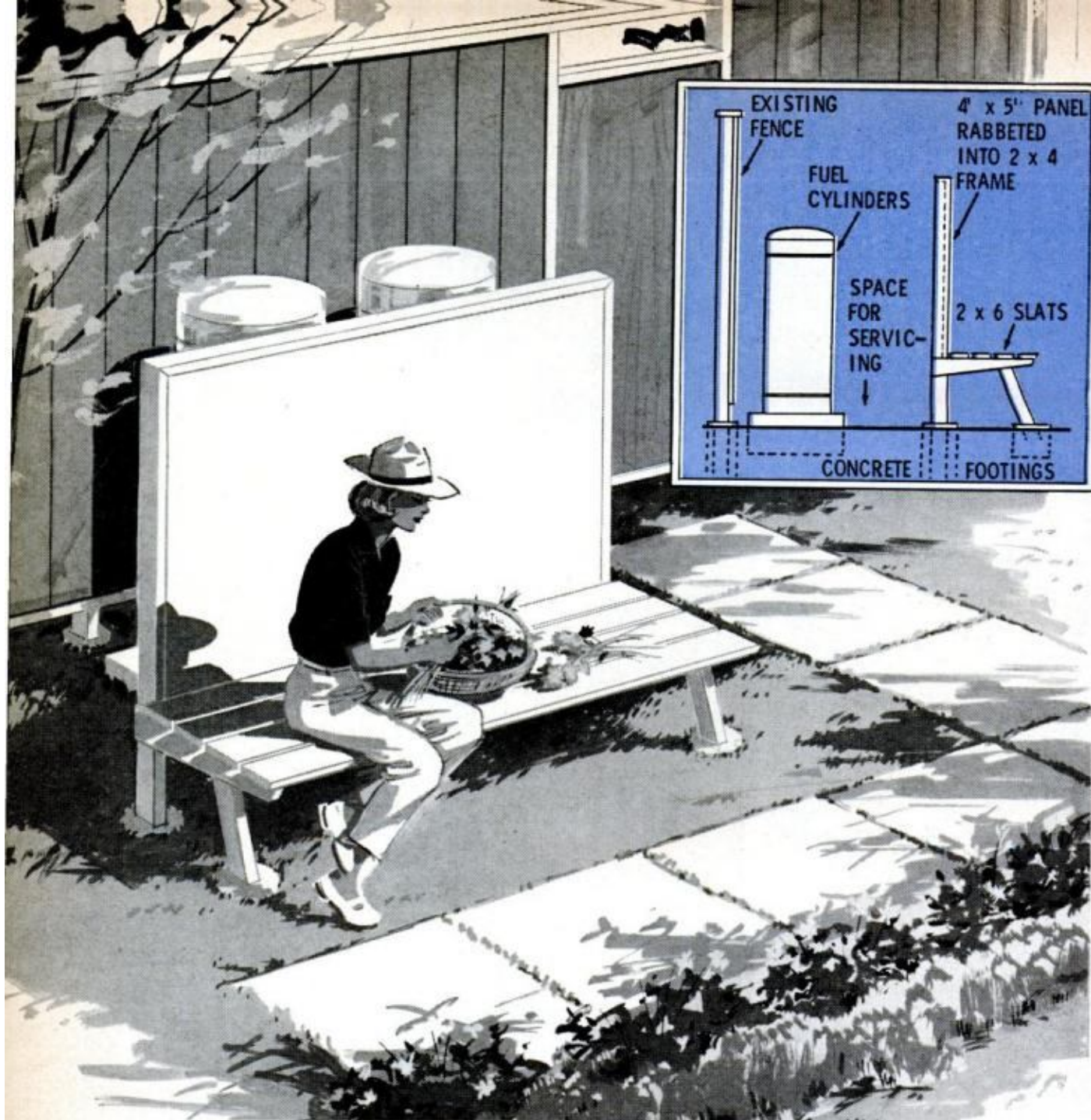


In-a-Door Bookrack

THERE ARE no lazy doors in this clever built-in—Dr. Paul D. Meyer of Columbus, Ohio saw to that. He put the doors to work holding books and magazines while they waited to provide access to a roomy storage cabinet in his den. Reserved for holding current periodicals for quick reference, the sunken doors with their slanting fronts will accommodate as many as a dozen magazines, undisturbed even when the doors are opened wide.

The sectional detail shows how the cabinet shelves are cut back to allow for the "thick" doors. Note that the meeting edges of the hinged doors must be framed to cant inward a bit so they will clear each other in closing.—*Jenice Jordon*





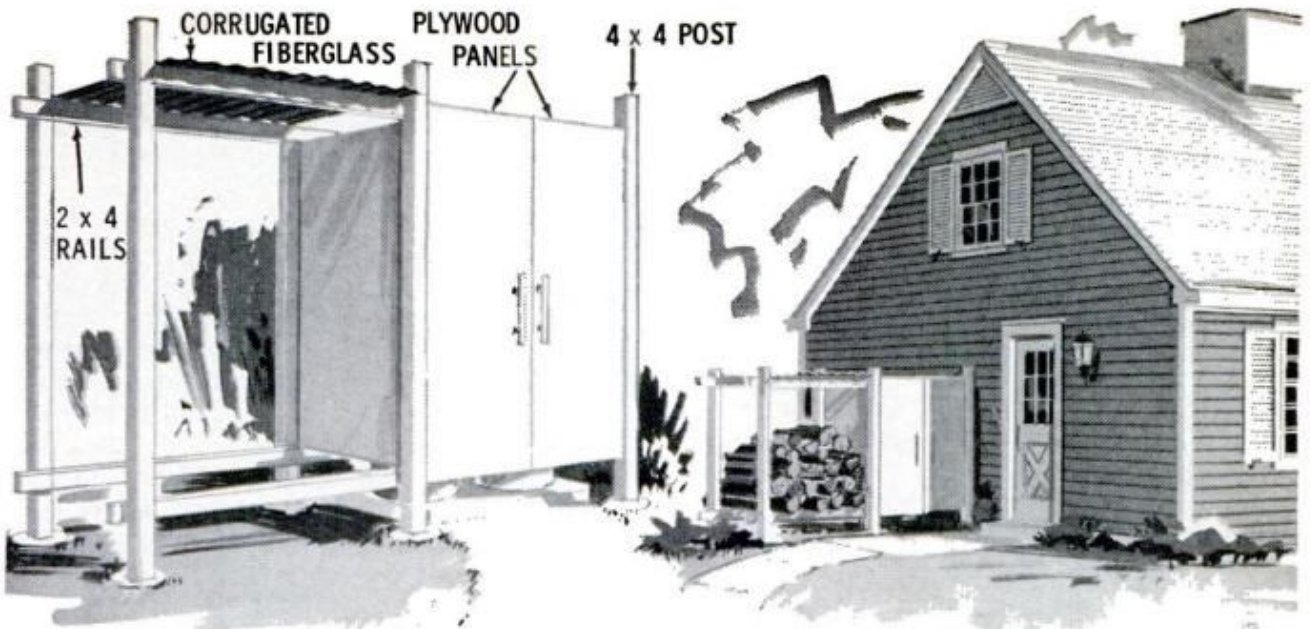
TWIN CYLINDERS set close to fence, or "blind" wall of house, can be screened by bench with high panel back

Hiding Fuel-Tank Eyesores

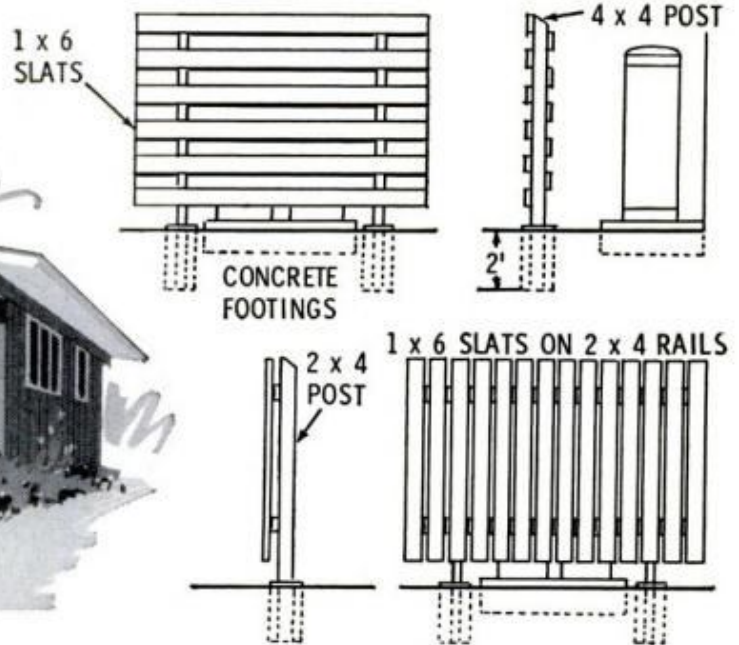
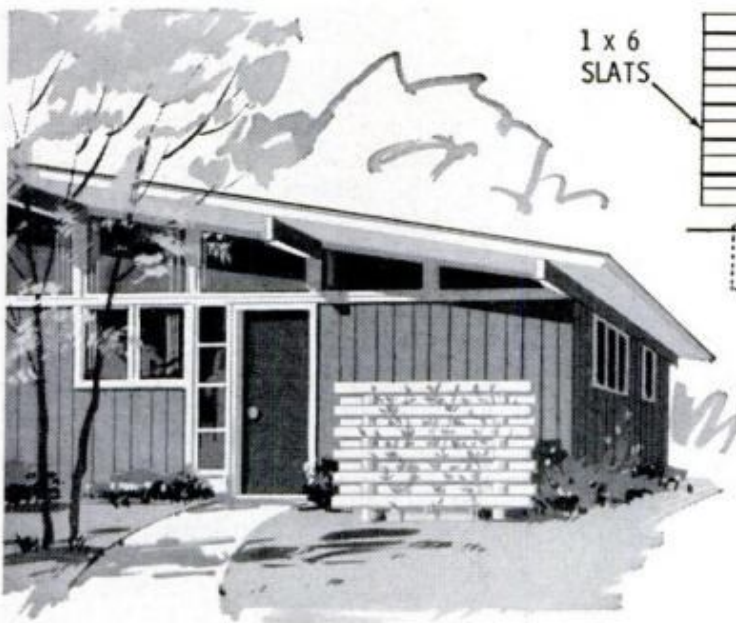
MODERN FUEL CYLINDERS aren't as ugly as old-time oil drums, but you still don't want them intruding on your lawn or garden. It used to be that you just tucked eyesores "out back," but with today's patios and carports, homes just don't *have* any unseen "back" any more.

Here are five ideas suggested by the National LP-Gas Council for concealing fuel storage tanks wherever they stand. No matter which design you chose, you'll end up with more than a mere screen—you'll have improved your property.

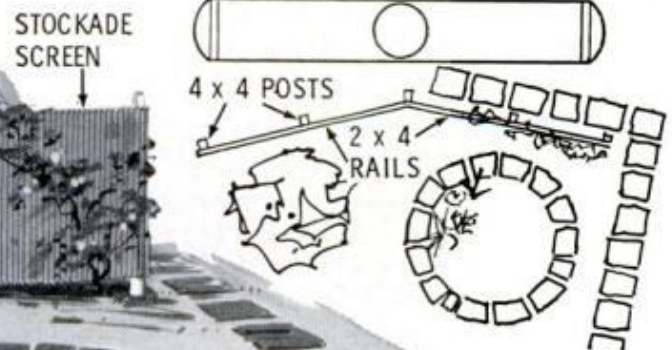
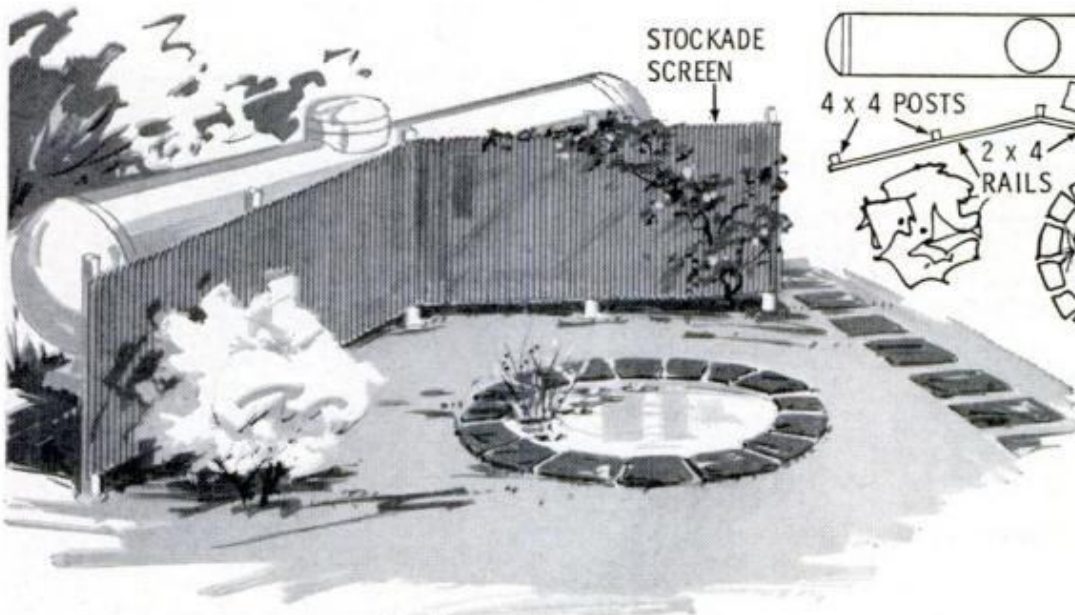
Note that each design leaves plenty of room for servicing the tanks. And since these screens were designed for LP cylinders, airspace is provided at the base as a precaution against leakage. LP-gas is heavier than air and would accumulate near the ground if the base were enclosed.



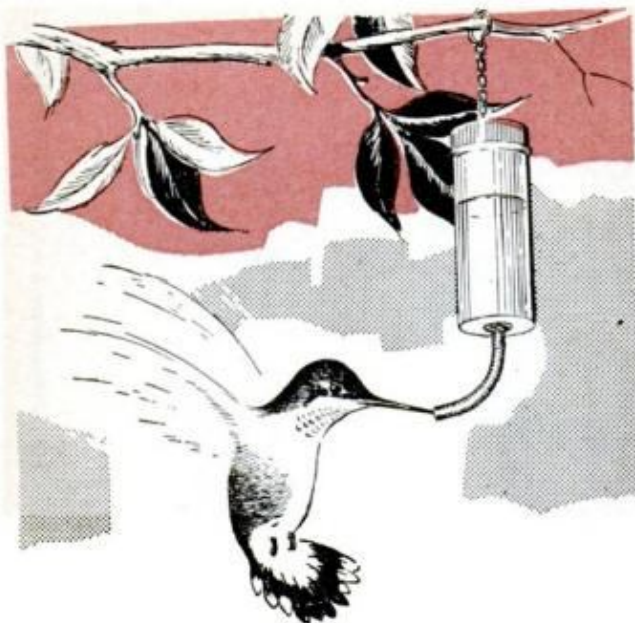
FUEL CENTER combines tank enclosure (hinged service doors) with firewood storage shelter at back door



PLAIN SCREEN can have horizontal or vertical slats. Former can be staggered to create vine trellis (left)



BULK TANK needs broad screen; it'll look less like a billboard if you angle it, and tie it into pool setting



It's for the Birds

A hummingbird feeder adds an interesting touch to lawn or garden and is easy and inexpensive to make. An empty plastic medicine bottle or vial having a water-tight cover is the first requirement. The bottom of the bottle is drilled so that a 1/4-in. plastic or glass tube, about 2 1/2 inches long, will fit snugly. The tube should be bent slightly as illustrated. Any one of the plastic-metal compounds or plastic cements may be used to secure the tube in position. The same adhesive is used to fasten a short piece of chain to the top of the cover. After the cement has dried, fill the bottle with a mixture of water sweetened with sugar or honey. Suspend the feeder from a tree or post.—*P. Casperson*

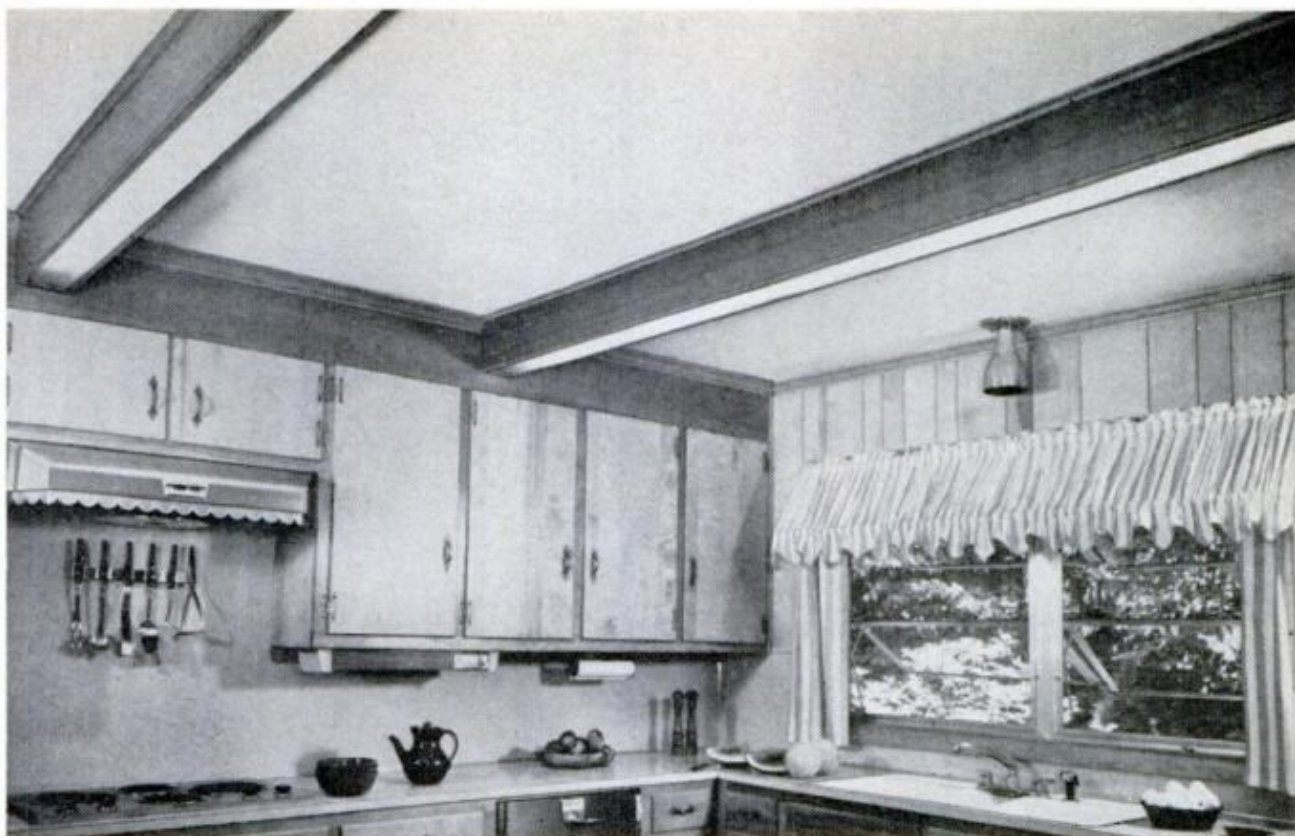


Try Rainbow Eggs This Easter

By mounting the shell of an old brass lamp socket on the spindle of your child's phonograph, you can make a spinning holder for "striping" Easter eggs. Use a regular insulating bushing to make sure of a snug fit. The setscrew will hold it in place and prevent wobbling. Before you begin coloring eggs, cover the turntable with heavy brown wrapping paper to catch any dye which might drip. Then perch an egg upright in the socket and set the phonograph at 33 1/3 r.p.m. By holding a brush moistened with dye against the egg, you can produce a simple striped design. For rainbow effects, load brush slightly heavier with dye and change colors frequently. With practice, you can create a great variety of effects.—*W. C. Wilhite*

NEXT MONTH IN SHOP AND CRAFTS

- ★ **TAKE MOVIES UNDER WATER:** It costs almost nothing to make, but this underwater housing will let you operate an 8-mm movie camera 50 feet below the surface. Made of clear plastic and assembled with adhesives, it's much simpler than commercial units, yet serves the same purpose. Learn how to make it in the May issue of *PM*
- ★ **"NUTCRACKER" KNURLING TOOL:** Like a king-size pliers, the amateur machinist can use it to knurl rods, tubes, and knobs, in a lathe, drillpress or electric drill. Used with a lathe, it needn't be mounted on the carriage. It even knurls stock held stationary in a vise. Complete plans and instruction for this shop accessory will appear in next month's *PM*
- ★ **TO LUBE OR NOT TO LUBE:** It's still a puzzling question for America's car owners. In part I of a two-part series, we'll tell you how to add years to the life of your car while ridding it of squeeks and rattles—all through the proper, thorough use of lubricants. There'll also be a handy file-away chart pin-pointing many lubrication points your mechanic overlooks and you probably never heard of. See it next month in *PM*
- ★ **ROADSIDE CHUCK WAGON:** With this two-wheel vacation trailer, you can tote everything but the kitchen sink. Small enough for a Volkswagen to pull, it still packs (in separate compartments) a two-burner stove, pantry cooler and supply of fresh water—plus a "closet" for clothes on hangers, and an optional built-in speaker for music while you dine



Beams of Light

By Dorothy Swanson

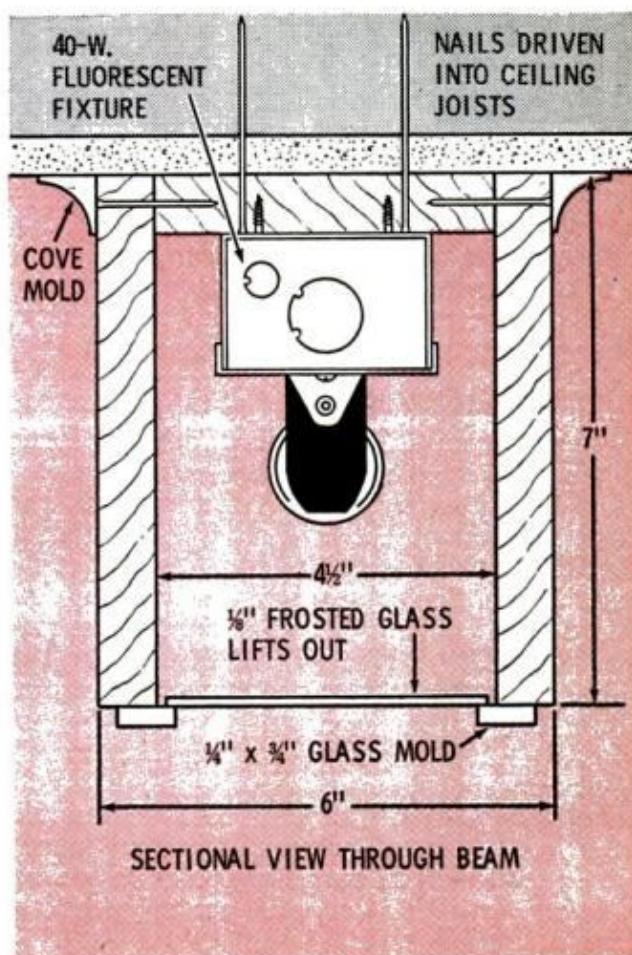
COMBINING THE DECORATIVE effect of an exposed beam ceiling with room-width strip lighting, this ingenious remodeling idea was developed by a building contractor for use in his own kitchen.

H. D. Roach, Reidsville, N.C., worked out the simple plan in an evening. After nailing a mounting board to the ceiling for each "dummy" beam, he mounted three fluorescent fixtures, end to end, onto each board. Sides of the open-bottom beams were stock 1 x 8s from which thin strips had been cut to serve as support molding for the frosted glass. This molding was secured with brads and glue to the bottom edges of the side pieces, offset slightly to form a lip for the glass.

Sides were attached by nailing into the edge grain of the mounting board, after which the nail heads were concealed with cove molding. Finally, three strips of frosted glass were cut to fit loosely inside the bottom of each beam.

To simplify finishing, Roach applied stain and clear varnish to all exposed surfaces before assembling the beams. If your decorating scheme calls for painted beams, the same procedure can be followed, though you may wish to touch up joints and nail and brad heads after installation.

BEAMS BY DAY, lights by night. Clever way in which false ceiling beams can be put to work as kitchen light fixtures. Lift-out glass panels hide fluorescent lamp units



Working Divider Earns Its Space



Here's an entry divider that doesn't just stand there—it creates a handsome front hall and works full time as a storage wall and a hi-fi counter

ONE OF THE PROBLEMS in small modern homes is the lack of a front hall. When the exterior door opens directly into the living room, privacy is nil and you risk winter drafts when you must conduct any sort of transaction at the door while other people are in the room.

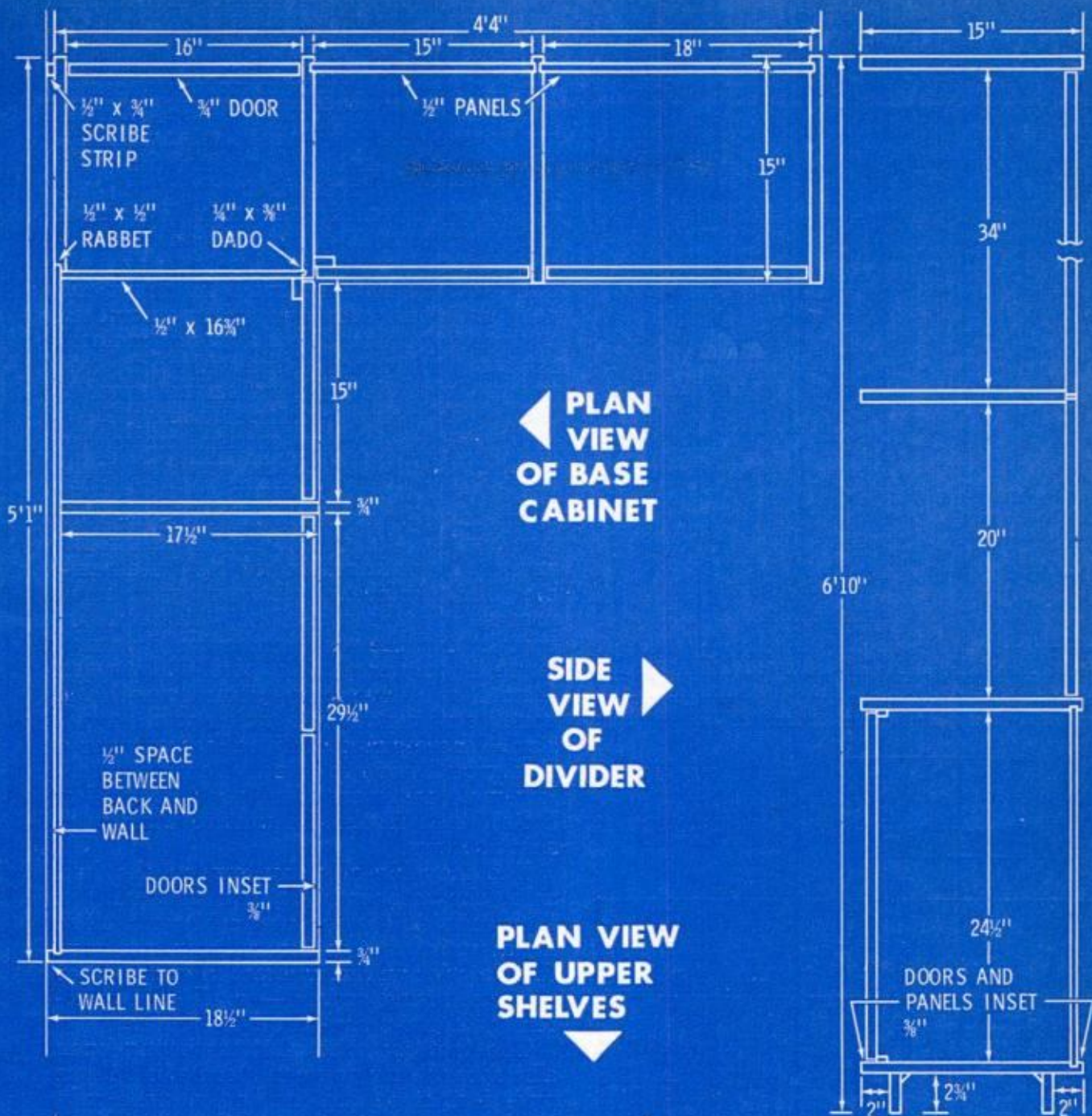
This handsome divider not only shields the living room—it creates a pleasant entry area, and provides generous storage for games and household accessories. A counter-height cabinet, tied into the divider to form an L, serves as a hi-fi center.

The upper shelves of the nearly-seven-foot-tall divider section are cantilevered over the counter L, and must be anchored to the wall through the end panel. Yet the entire unit is built sturdily enough so that it may be detached and moved to a new location, like a piece of furniture. The two shelves within the cantilevered section, and those in the storage cabinets, are adjustable for items of various heights. In the cabinets, this can be accomplished with shelf standards, but for a neater effect in the cantilevered section, tubular inserts are positioned in matching pairs of sockets (holes drilled 2-in. o.c.) to support the loose shelf boards.

The dimensions given in the plan at right are for the unit seen above, as designed by architect Norman E. Abplanalp for a home in Mt. Prospect, Illinois. You can adapt them to fit your own requirements. The original unit, for example, was custom-scaled to accommodate a 20-volume encyclopedia from the wall to a center partition, and a group of tall atlases from the countertop to the only fixed shelf.

The construction is almost entirely of plywood. With judicious layout, you should be able to get all the uprights, shelves and door panels out of two 4x8 panels of $\frac{3}{4}$ -in. double-faced hardwood ply. One panel of "good-one-side-only" $\frac{1}{2}$ -in. hardwood ply is plenty for the stationary panels. Two more $\frac{3}{4}$ -in. 4x8 panels—this time of fir, for economy—will give you your countertop and floor panels. The floors should be stained to match the hardwood veneer, before final assembly. Once the countertop is covered with plastic laminate (black Formica, in the unit shown) and all edges are concealed with veneer tape, the cheaper plywood will be undetectable.

The best treatment for the exposed rear face of the upper stationary panel is to paint it to match the plastic countertop.

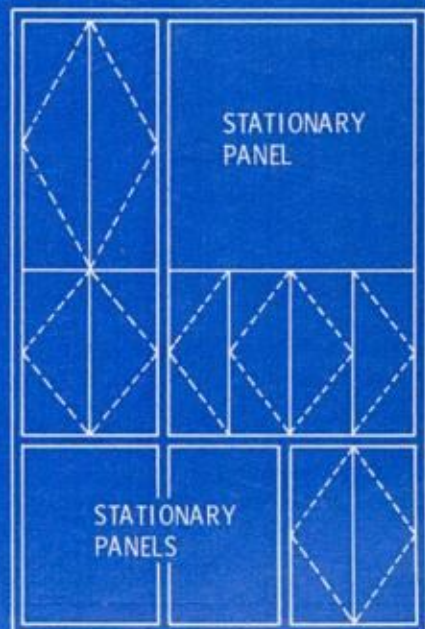


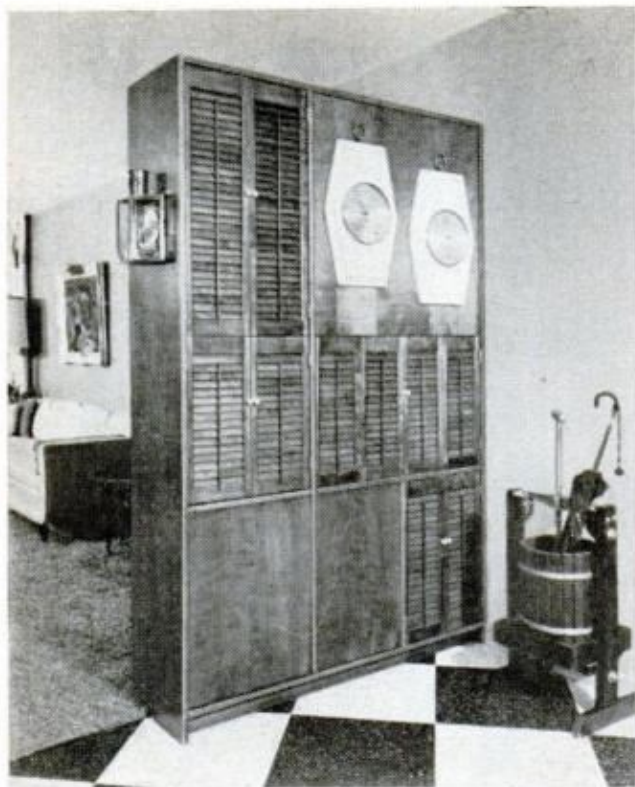
PLAN VIEW OF BASE CABINET

SIDE VIEW OF DIVIDER

PLAN VIEW OF UPPER SHELVES

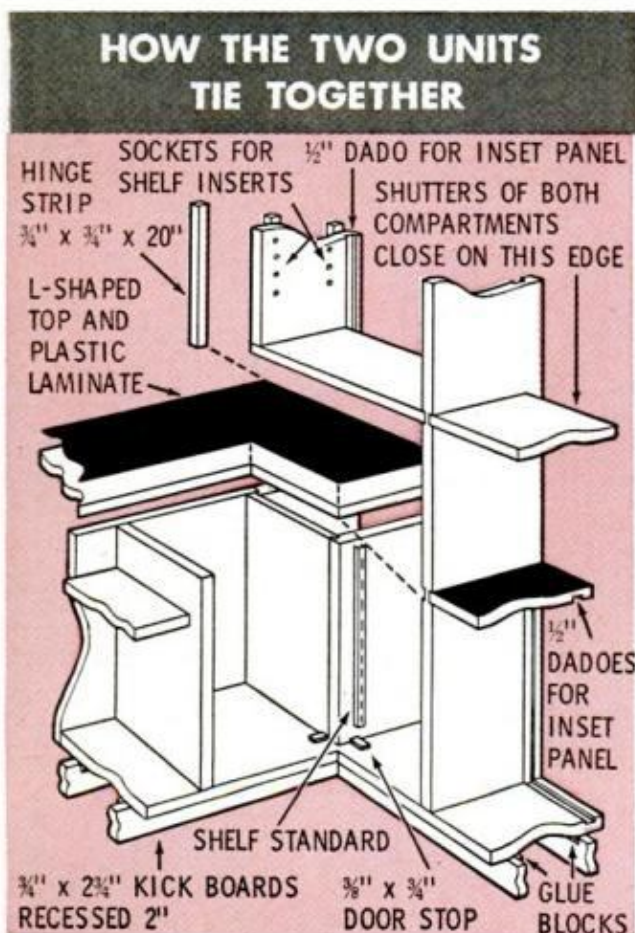
Dimensions can be altered to suit location. The dotted lines on the rear elevation at right indicate how shutter-doors are hinged. Point of each V is toward hinged side. Four doors at right center are hinged into two bi-fold pairs. Though stop blocks are essential for the solid touch-latch doors on opposite side, they're optional for hook-latched shutters, especially where shutters close on shelf edge. The three stationary panels must be glued in $\frac{1}{4} \times \frac{1}{2}$ -in. dados, $\frac{3}{8}$ in. in from edges, during assembly of unit





ENTRY SIDE of divider has ten hinged shutters plus large stationary panel for mounting barometer and clock. Shutters are optional; the only compartment requiring doors for access is one at bottom right

CUT, FOLD, TAPE **ENTRY DIVIDER** **FILE FLAG**



The back panel of the counter section can be cheap $\frac{1}{2}$ -in. plywood, or hardboard—or it could even be omitted.

For a built-in look, the unit should hug the wall as closely as possible. This is easily achieved at the counter end by butting that panel tight against the wall. But few walls, even in new homes, are perfectly plumb. If you cut a dado for a back panel, set it about half an inch inside the end panel's wall edge, then butt this edge against the wall, in about the position it will assume when the assembled counter is in place. With a pencil compass set for the distance of the widest gap between panel and wall, scribe the panel to the wall line and trim it for a snug fit.

Where the divider section meets the wall, however, there's no panel at right angles to the wall, so your filling is done by means of scribe strips. Rip $\frac{3}{4}$ -in.-thick stock into $\frac{1}{2}$ -in. widths and lay them flat against the wall before setting the assembled unit in place. Again, using your compass set to the widest gap between the upright and the wall, scribe the strip and plane it to permit the best fit between them. Now, drive long screws through the panel, scribe-strip and finish wall, into a stud. Where strips can't be located over a stud, you'll have to attach them with hollow-wall fasteners (such as expansion bolts), then fasten the unit to them with short screws.

The movable-slat shutters on the hall side (shown above left) are optional, but they provide a wide range of versatility. By adjusting the center rail you can open the slats for an airier effect in summer; or you can swing several—or all—the shutters wide for a see-through divider.

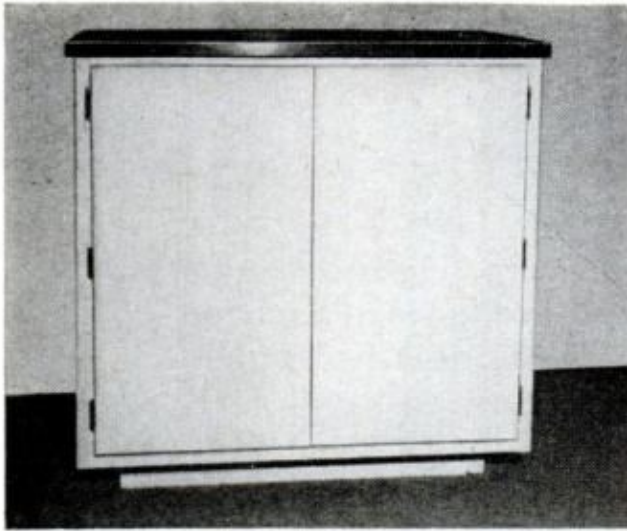
The fact that the shutters swing open also means that you can store small items out-of-sight behind the books, since only the largest books will need the entire shelf width. In fact, if the divider were located between living and dining rooms, you could increase its thickness and provide a center partition of $\frac{3}{8}$ -in. plywood, turning the unit into a true double-faced shelf, with the shuttered side used for storage of glassware and other table service.

The choice of your plywood veneer will, of course, depend on your present decor, and on the nearby furniture to be matched. A deep walnut tone was wanted for the original unit, but since the shutters were available only in birch, and had to be stained, birch plywood was used throughout. All exposed edges were covered with birch-veneer tape before the walnut stain was applied. By running a continuous strip down the rear edge nearest the wall, joints between the top section, hinge strip and base cabinet were concealed. ★★

Can Storage Galore

And you see only half the space, below! The units hinged to that center partition are two-faced, and there are shelves on the rear wall, too. Plans for a shorter version are given on the next two pages





SHORTY VERSION, dimensioned to match height of existing kitchen cabinets, is 25-in. deep by 36-in. wide

shelf space to spare—all well-organized.

The beauty of this storage system is that all shelves are a *single can deep*, so you can tell at a glance just what's on hand, without groping into dark cabinet corners. Every inch of shelving is *working space*, readily accessible.

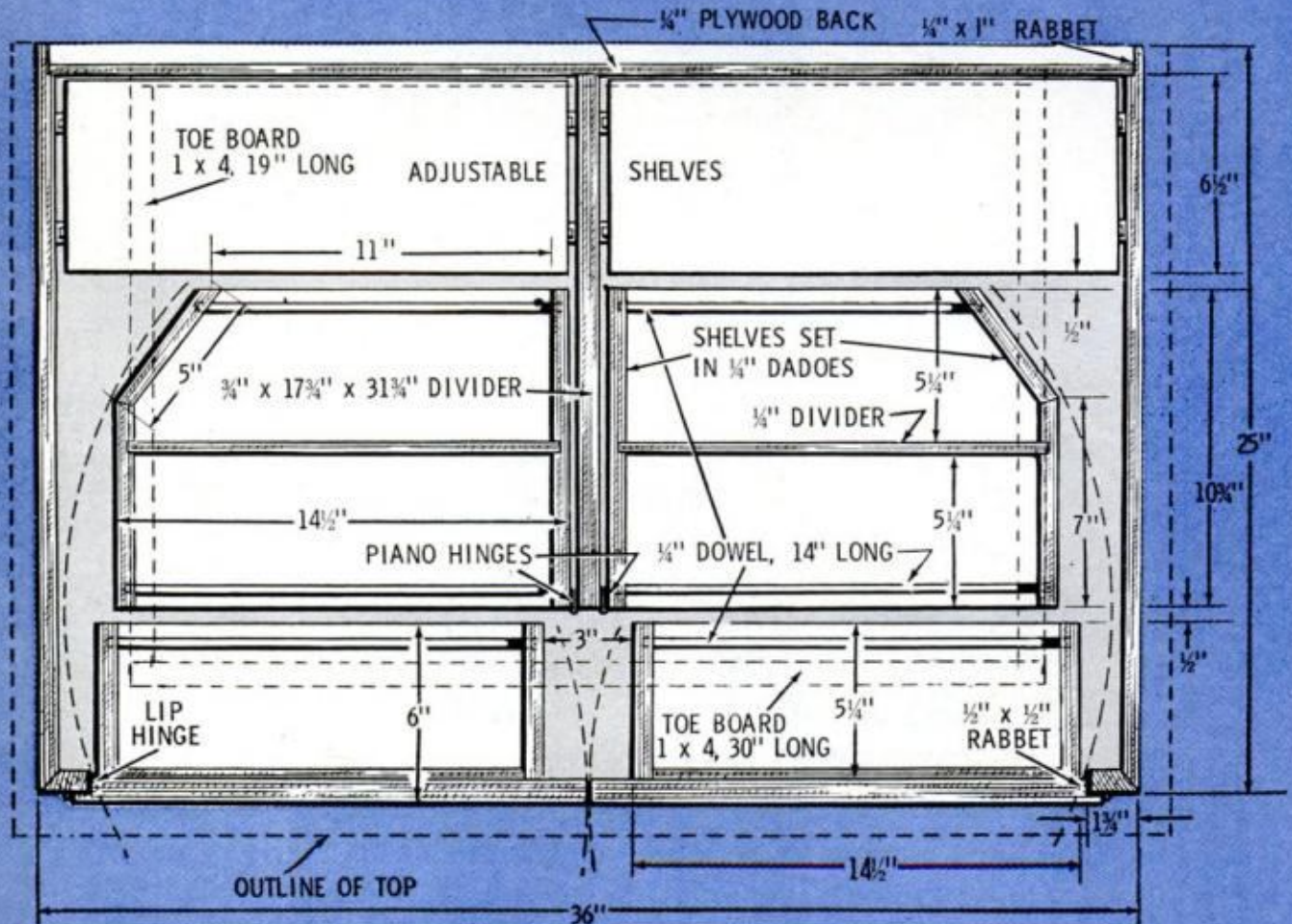
The cabinet can be dimensioned to your family needs, ranging from the six-footer on the previous page to the counter-height version shown here. This shorty still holds up to 100 cans, and can be built into a cabinet counter, or set on casters for use as an island work table.

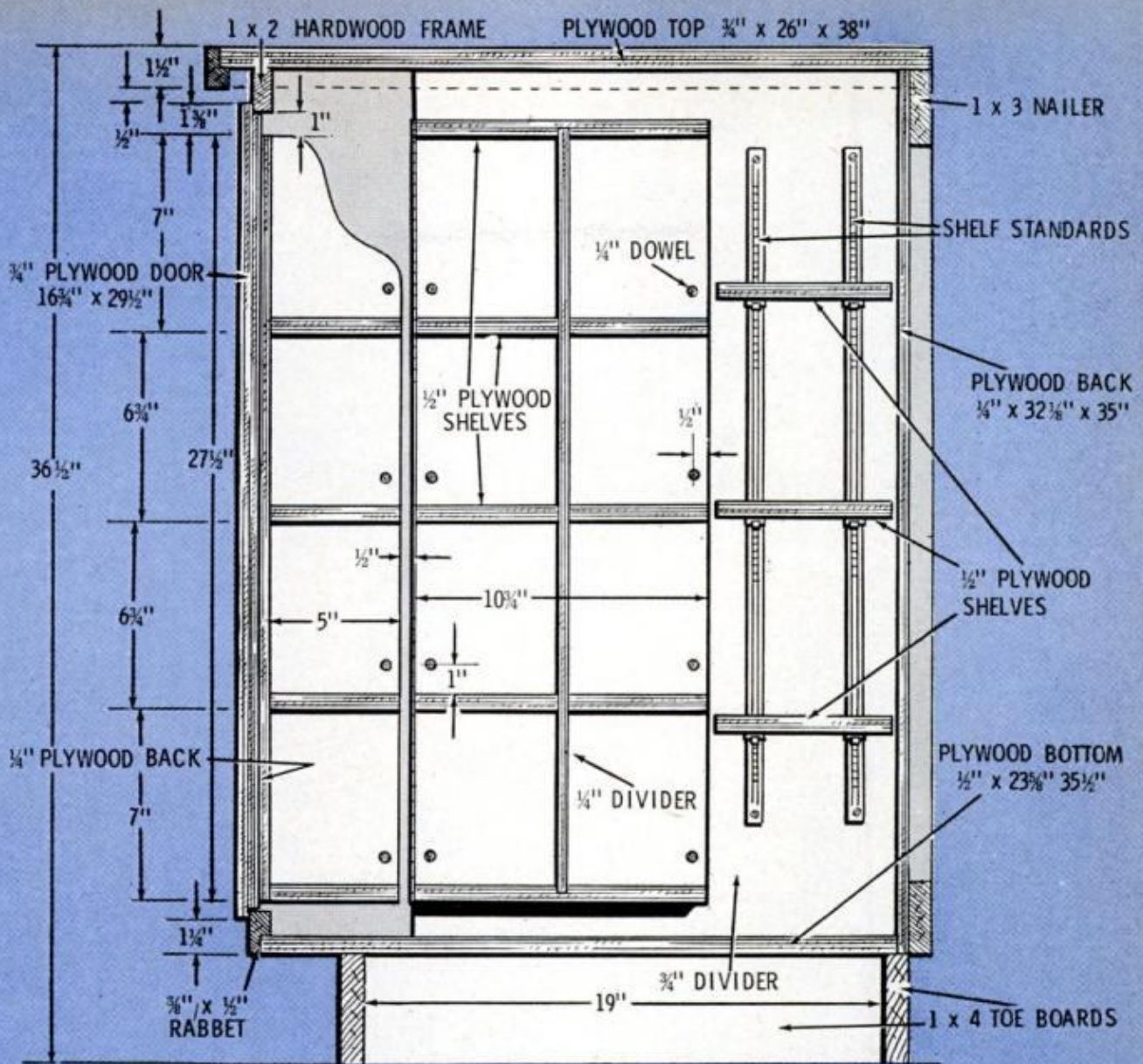
It's constructed of 3 different thicknesses of plywood, 1-in. solid pine (which is actually $\frac{3}{4}$ -in. thick) and dowels, to keep the cans from slipping out of pivoting shelf units. The top, the doors and the center divider from which the double-faced units hang, are all $\frac{3}{4}$ -in. ply; the bottom, sides and all shelves are $\frac{1}{2}$ -in.; and the backs and partitions of the various units are $\frac{1}{4}$ -in. ply. The rear outside corner of both double-faced units is "beveled" to clear the sides when these units are swung outward on their hinges. ★★★

WHETHER YOUR FAMILY is large or small, you can pare down your grocery budget by purchasing in *quantity*. The only problem, in today's pantryless homes, is finding storage space for big supplies of canned and packaged goods. But once you build yourself this ingenious cabinet, designed by the Modern Cabinet Company of Bell, Calif., you'll always have

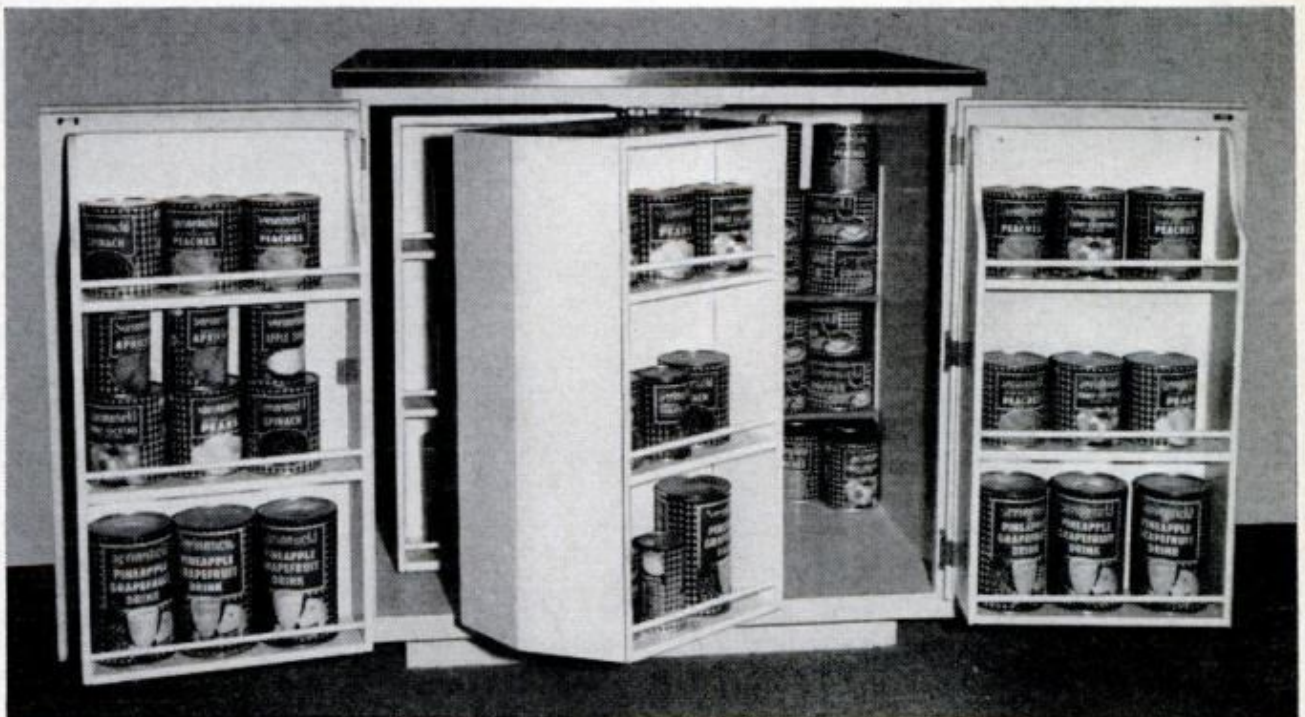
CUT,
FOLD,
TAPE

CAN
STORAGE





THIRTY FEET OF SHELVES—all five inches deep—are interfolded. Here, both door-hung and swing-out units have only three equal-spaced shelves; plans above show four—choice depends on type of can to be stored





Remodel with Drywall

By Steven J. Howard

WITH A LITTLE SKILL, plus a few tricks of the trade, the amateur remodeler can apply drywall almost as well as a contractor.

To get these tricks for you, we recently interviewed a number of pros, then boiled down their information into this two-part article. So here, right from the horse's mouth, is the inside dope on remodeling with drywall.

Since the most common use of drywall—also called gypsum wallboard and plasterboard—is in finishing a new room, let's approach the subject from that angle. You've built a new room on your house, or

are turning an attic into an extra bedroom. The siding and roof are on, the flooring or subfloor is down and the studs are waiting to be covered. Here's how you go about it:

• **Preparatory Steps:** The first thing you do is estimate how many sheets of plasterboard you'll need. To do this intelligently, mull over these facts:

1. Plasterboard for direct nailing to studs is available in four common sizes—4x8, 4x10, 4x12 and 4x14 ft.—and in two thicknesses— $\frac{3}{8}$ and $\frac{1}{2}$ in. The thinner and less expensive $\frac{3}{8}$ -in. plasterboard is perfectly adequate for most rooms. But the sturdier $\frac{1}{2}$ -in. thickness is recommended

for, say, a family room, where junior might drive a wagon or bike into the wall.

2. To estimate how many sheets or panels of plasterboard you'll need, measure the length, width and height of the room. You might be able to estimate in your head, as the pro's do, how many panels you'll need, but if not, make a diagram like the one on page 164. Figure on using the largest-sized panels compatible with the room's dimensions. The smaller sizes may be easier to handle, but the larger ones cover an area more quickly and reduce the number of joints you'll have to cover with cement and tape.

Less Taping with Big Panels

For example, suppose the room measures 16x24 with an 8-ft. ceiling. Most amateurs would cover each 24-ft. wall with six 4x8 panels, and each 16-ft. wall with four 4x8 panels—all applied vertically. However, a pro would save a lot of time by putting four 4x12 panels on each 24-ft. wall—installed horizontally. The reason for this is that the six vertical 4x8s give you five joints (or a total of 40 ft.) to nail and tape, while the four 4x12s give only four (for a total of 32 ft.). On the 16-ft. walls, you'd require four 4x8 panels whether you installed them horizontally or vertically, and would get the same amount of taping either way. However, you should apply them horizontally, to be consistent with the 24-ft. wall.

Now, suppose you have a non-standard ceiling height that won't work with the 4- or 8-ft. modules we've discussed so far because it's 2 or 3 in. greater than 8 ft. You would still use 4- or 8-ft. panels but simply hike them up to the ceiling and fill the space at the bottom with scrap plasterboard before nailing on the baseboard.

3. In estimating, use overall wall dimensions. Deducting windows and doors in the hope of reducing panel requirements won't save you enough to speak of, and you could even find yourself minus half a panel just as you're ready to finish the job. Live with the fact that there's going to be some waste when installing plasterboard on most walls.

4. If ceiling height is greater than 8 ft.-3 in., vertical installation of panels is more practical than horizontal, since a 4x10 panel, for example, can be cut to fit a 9-ft. ceiling height.

The same principles should be considered when determining whether panels on a ceiling should be installed horizontally or vertically in relation to the joists.

• **Start with the Ceiling:** This will permit you, when doing the walls, to work from the top down, with less danger of marring the plasterboard if a hammer should slip.

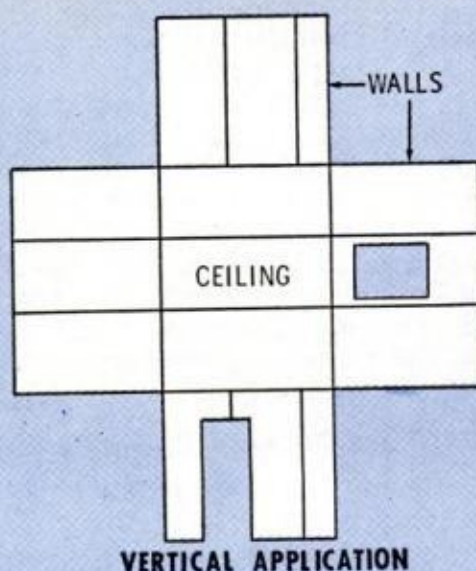
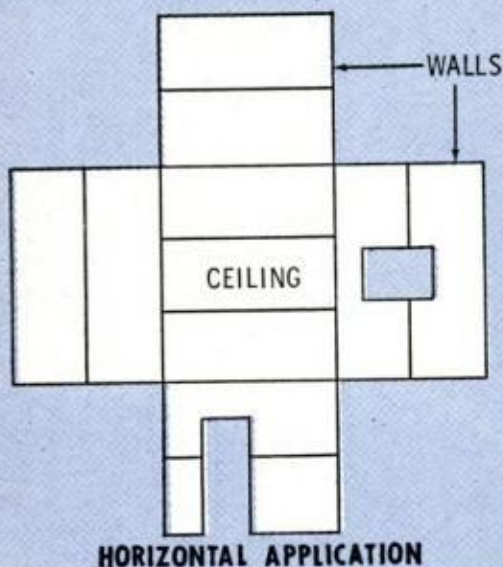


WITH PLASTERBOARD, amateur remodelers can obtain professional results. In room above, wall behind desk was "paneled" with wood-grain plasterboard

VERTICAL APPLICATION of plasterboard (below) is the method most amateurs favor. But in many rooms, horizontal application can save a lot of nailing, taping

National Gypsum photo

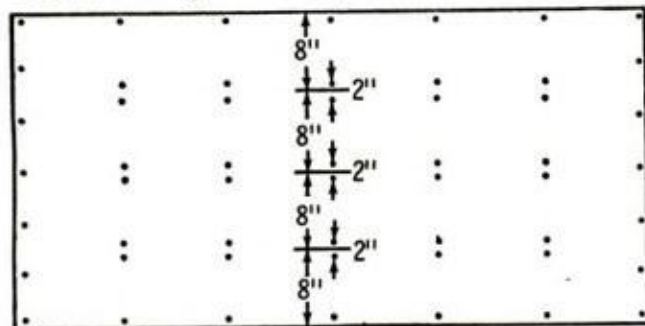




TO ESTIMATE number of panels you'll need, make a scale drawing of room with various sized panels installed horizontally and vertically. In drawings above, more vertical 4x8s are needed than horizontal 4x12s

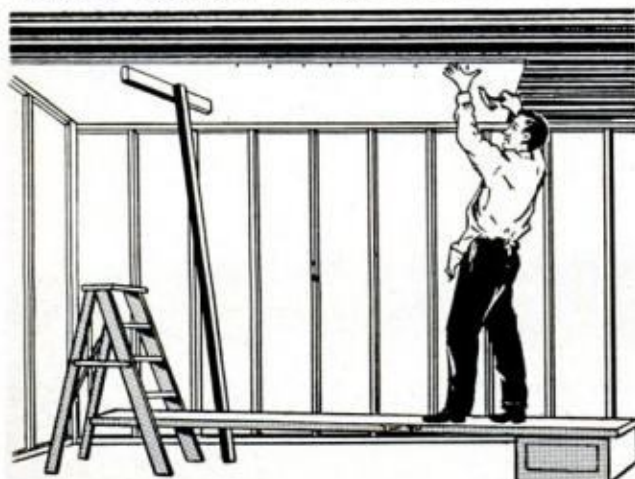
It also permits an easier, better-fitting installation of the panels.

Pros don't waste time by making supports to brace a panel against ceiling joists. Instead they literally use their heads.



TO ASSURE SECURE NAILING, after you've nailed panel in place, go back and drive an extra nail 2 in. from each initial nail, except at the panel edges

IN WORKING ALONE to apply ceiling panels, make a T-brace of 2x4s to steady panels. Also, a plank "catwalk" will permit freer movement than a ladder



They first set several planks on horses, so as they walk along them, they're able to cover the entire length and width of the panel. The planks are high enough off the floor so workers standing on them can actually brace the panels with their heads while nailing is done.

Ceiling's a Two-Man Job

This method pre-supposes that two workers are on the job. If you're working alone, then some sort of brace has to be fashioned to help support a ceiling panel for nailing. Such braces are commercially available, but the most common method is to make a T-brace from 2 x 4s. This brace is forced against each panel to secure it while it's nailed into place. The danger here, of course, is that a T-brace can slip while you're nailing and throw everything out of kilter.

In driving the nails, use a backhand hammer stroke. This permits you to keep an eye on the nailhead and reduces the chance of damaging the panels with mis-directed blows. Also, work slowly. Plasterboard is not made of steel, and when you don't hit the nail with every stroke, you'll have a lot of extra patching to do later on.

In nailing up the first panel, edge-nail it initially. All other nails are lined up by eye with the edge nails. But if you prefer a more exact guide, draw a line from each outer edge nail, down the joist center, to the opposite edge. You can now nail along these lines.

Nails in ceiling panels should be spaced about 7 in. apart. After each panel is

nailed in place, go back and drive a second nail 2 in. from each nail, except at the panel edges. This double nailing (drawing page 164) resists the loosening forces that work against the nails. These forces are greatest in the center of the panel.

• **Working on Walls.** Before putting up wall panels, go around the room and make an identifying mark on the floor below all fixtures that will require cutouts in the plasterboard, such as heat ducts and electrical outlets. There are two ways in which cutouts can be made, both of which we'll discuss later. For the meantime, mark on the floor, below each fixture, its width, plus the measurements from the floor to the bottom and top of the fixture.

To install a horizontal panel at top of a wall, rest the panel on the floor and against the studs in the exact position it'll be nailed. Drive a few nails in line with the stud centers along the top edge of the panel—not all the way through the panel, but just far enough so they take hold. These are brace nails that will hold the panel in place after it's raised into position so you can complete nailing without having to support the panel with one hand.

Again, if you're not experienced in placing nails over the stud centers by eye, draw guide lines on the panel before raising it into position.

Now, if there are two of you or if you're strong enough to do it by yourself, raise the panel into place so its top edge butts against the ceiling (but don't jam it), and drive the brace nails into place.

If you're working alone and the panel proves too cumbersome, nail a strip of 1x2 across the studs at a height that permits it to support the panel against the ceiling. When you lift the panel, rest its bottom edge on this support, hammer in the bracing nails, and pry off the support strip.

After driving the bracing nails, start your final nailing at the center of the panel, working out toward the edges. This prevents bowing of the panel, which may cause nails to "pop" later on.

When nailing, hold your free hand firmly against the panel to make sure the panel is tight against the studs and the nail goes in the full distance. Carelessness in this step will, again, encourage nail popping in the future.

Place nails about 8 in. apart. After the nails are in place, go back and drive a second nail about 2 in. below each nail, except on the edges, as you did on the ceiling.

Proper Nailing Critical

Never countersink nailheads on either ceiling or walls. Drive them fully home, leaving a slight dimple in the surface of the plasterboard, to be filled later with



IN NAILING CEILING PANELS, a backhand hammer stroke gives a clear view of nail heads. This permits accurate aiming of strokes, lets you line up nails by eye. Workman is supporting panel with his head

ADHESIVE METHOD of applying plasterboard employs beads of adhesive to hold panels in place. Nails are used only at edges of panels. This method reduces nail popping, but can't be used on ceilings



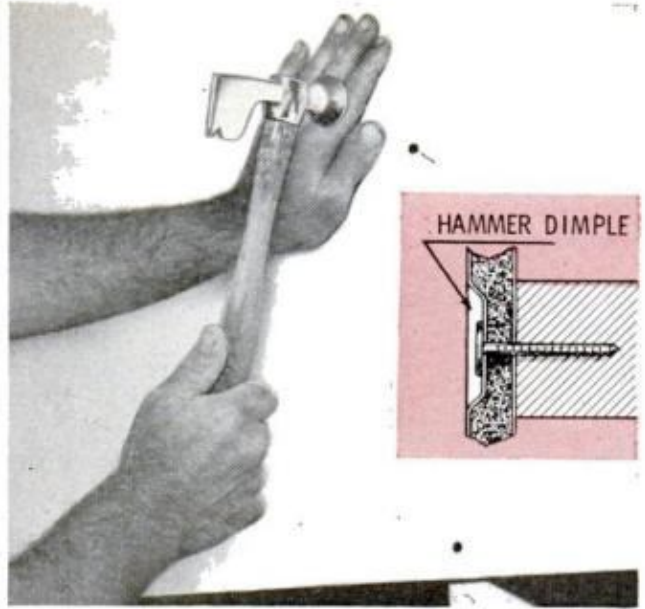
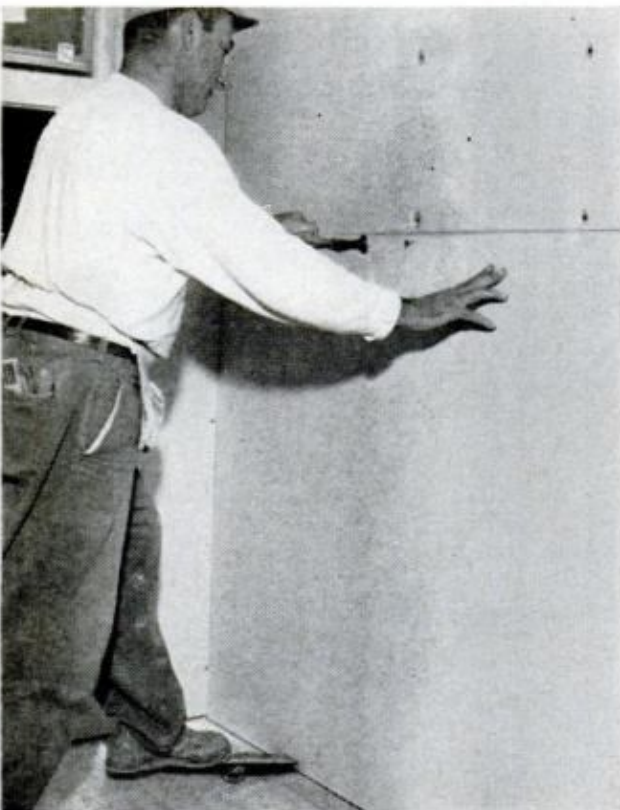


BEFORE LIFTING WALL PANEL into place, lean it against studs, right under its final location. Use stud centers to position nails along top edge of panel

joint cement. But make sure the dimple isn't deep enough to tear the paper surface of the board, or the material inside the board may start to crumble around the nail, weakening the nail's hold.

With top wall panels in place, the bottom row is ready to be installed. Again, there are tricks to this. Prop the bottom panel against the wall, putting in a few nails along its top edge and drawing guide lines for nails, if necessary, as you did

POSITIONING BOTTOM ROW of plasterboard panels can be facilitated with a foot-operated lever made of beveled board and piece of pipe or broomstick



TO CONCEAL NAIL HEADS, drive them slightly below the surface of the plasterboard. This creates a slight dimple, which you will later fill with joint cement

on the panels already installed.

To facilitate positioning of the bottom row of panels, fashion a lever from a piece of lumber by beveling one end. Place it over a piece of broom stick or pipe, bevel side down. Put the beveled end beneath the panel and press down on the lever with your foot to hold the panel while driving the brace nails.

Bottom panels are nailed in the same manner as the top—from the center out to the edges.

• **Some Important Considerations:** Never make joints between plasterboard panels too tight. Proper technique calls for a $\frac{1}{16}$ to $\frac{1}{8}$ -in. gap, for play, between panels. The cement forced into these gaps later on will strengthen the joints.

Furthermore, if a panel is forced too tightly into place, it could bow away from studs and prevent full nailing (drawing, page 167). So, always cut a panel to fit—never use a "shoehorn."

Thus far we've been speaking of nailing panels to the studs. There's another and more modern method which more and more contractors are using—plasterboard contact adhesive. The advantage of this method is that it reduces the number of nails per panel and, consequently, the amount of eventual nail popping. It also cuts installation time. A disadvantage is that adhesive cartridges are expensive. Also, adhesives can't replace nails in ceiling-panel installation.

In this method beads of adhesive are applied to studs with a trigger-action applicator like an ordinary caulking gun. The panels are then put into position, but are nailed only around the edges, the adhesive being sufficiently strong to hold the

plasterboard panels firmly in the center.

• **Cutting and Trim Techniques:** The pros generally use a sharp wallboard knife to cut gypsum board, although a saw is sometimes used.

To cut a panel along its width, brace it against a support and hold a T-square or straight edge firmly along the line to be cut. With heavy enough pressure to score into the gypsum, run the knife down the T-square. Always score on the face side of the panel.

After scoring, snap the waste piece back along the scored line. The waste piece will now be held only by the board's paper backing. From the rear, cut through the crease in the backing to remove the waste piece. Never try to tear it off.

To cut a panel along its length, measure down the amount of waste to be cut off, making sure the panel is firmly braced from the rear. Using your fingers as a guide for the ruler, hold the knife against the tip of the ruler and move ruler and knife along the panel. Use firm pressure to cut into the panel (see photo below). Then, as you did before, snap back the waste piece and cut it off from the rear.

Pre-Cutting Wastes Time

No pro takes time to pre-cut cutouts for heat ducts and electrical fixtures. They use one of two methods.

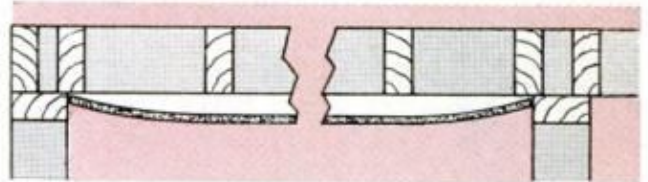
Guided by the measurements that were marked on the floor before the panels were installed, they draw the cutouts on the panel with a pencil and ruler. They then score along the lines with the plasterboard knife, knock out the cutout completely with a hammer and trim the edges for a neat job.

However, there's an even quicker way. Again, using the measurements on the floor, locate the center of the fixture and whack the center with a hammer, making a hole right through the plasterboard. Using a keyhole saw, cut up or to the side until you hit against the fixture. Now, use the fixture's edge as a guide to saw around the opening. Then, knock out waste with a hammer. After cutting, edges are trimmed off with a plasterboard knife or saw to remove loose particles and chips.

The same principle applies to doors and windows—don't take time to pre-cut openings for them. There's a faster and easier method. Just nail panels in place right over the framed opening. After each panel is up, saw upward or downward along the side edge of the opening, using the edge of the frame as a guide. When the sides have been cut, pull out the waste piece slightly to create a bend along the top or bottom edge. Score along the bend with your knife, lining up the knife



TO CUT A STRAIGHT LINE across the width of plasterboard panel (above), use a T-square to guide your knife. Drawing below shows undesirable bowing effect which is result of forcing panel into tight space



STRAIGHT LENGTHWISE CUTTING: Press your knife blade against the end of the ruler. Then, while applying enough pressure to score the plasterboard, guide the ruler along edge of the panel with your finger

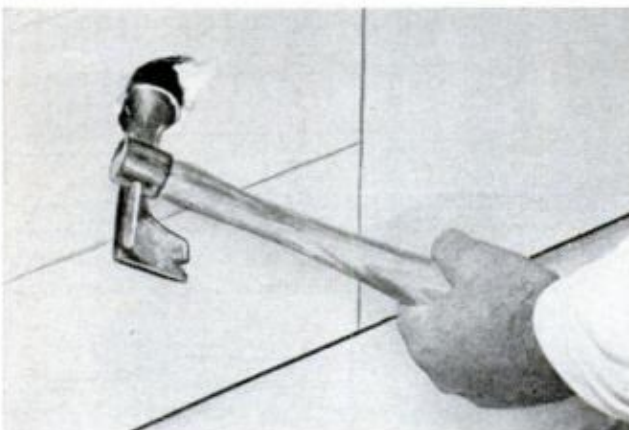


MAKING REGISTER CUTOUTS

1 MARK LOCATION on floor directly under register. Top numeral is distance from floor to bottom of register. Bottom numeral is distance from floor to top of register. Two long lines mark edges of register



2 AFTER PANELS ARE UP, use marks on floor to lay out rough outlines of register on plasterboard. Then knock a hole in the center of the register with hammer. Hole permits insertion of saw blade



by eye with the frame. Now break off the waste piece.

Not only does this method take less time than measuring and pre-cutting, but it also gives a neater looking job since you'll get a perfect, one-piece fit around windows and doors.

Scrap pieces of plasterboard, by the way, can be used where small pieces are needed to cover narrow areas, such as around arches and doorways.

Speaking of arches, you may have one that has to be enclosed. But how is plasterboard going to curve to fit an arch?



3 WITH KEYHOLE SAW, cut straight up and down until you hit edges of register. Next, saw around the entire inside of the register, using the edges to guide saw, then knock out pieces with hammer

4 FINALLY, use your plasterboard knife to trim the cut edges and remove any stray pieces that cling to the paper backing. This operation is not critical, as the flange of the register cover will hide cuts



Easy—just cut the piece to the size you need and score it across the back about every 3 to 4 in., or less, depending on the radius of the required bend. Any creases that may appear when the bent piece is applied can be filled with joint cement.

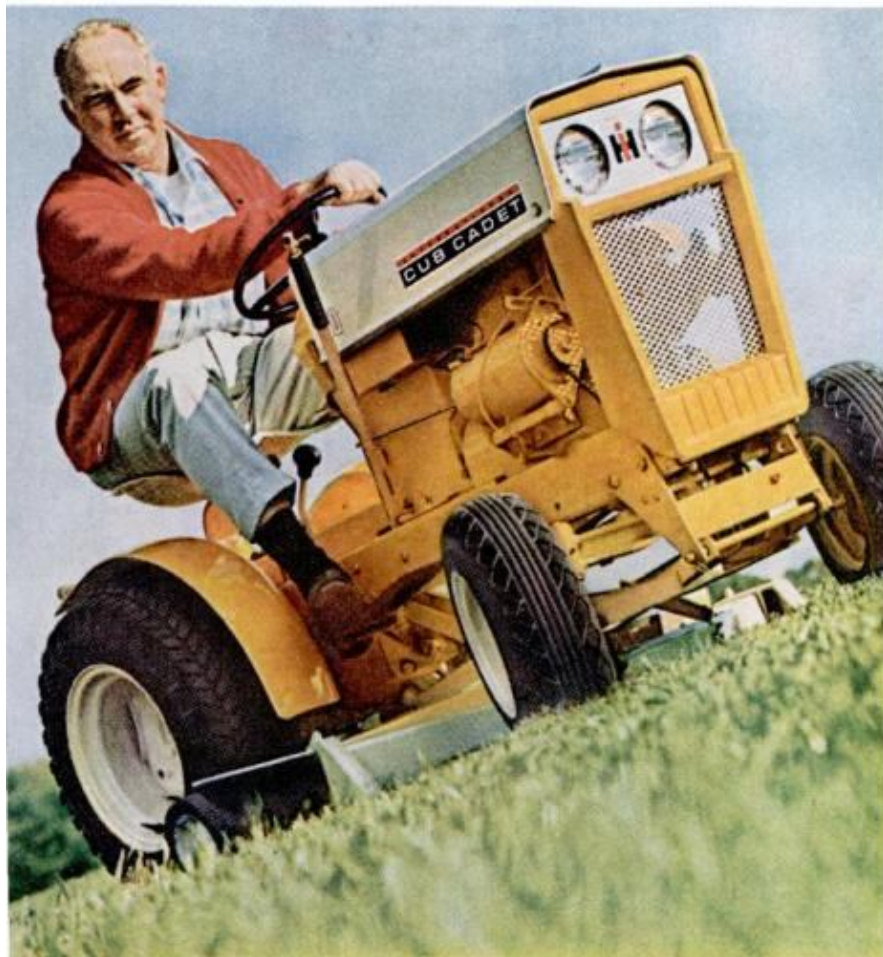
A word, now, about two important items you'll need for applying plasterboard—nails and corner bead.

There are two types of nails—those with smooth shanks and those with ringed shanks (called **annular ring nails**). The pros can't seem to agree on which type to

(Please turn to page 201)

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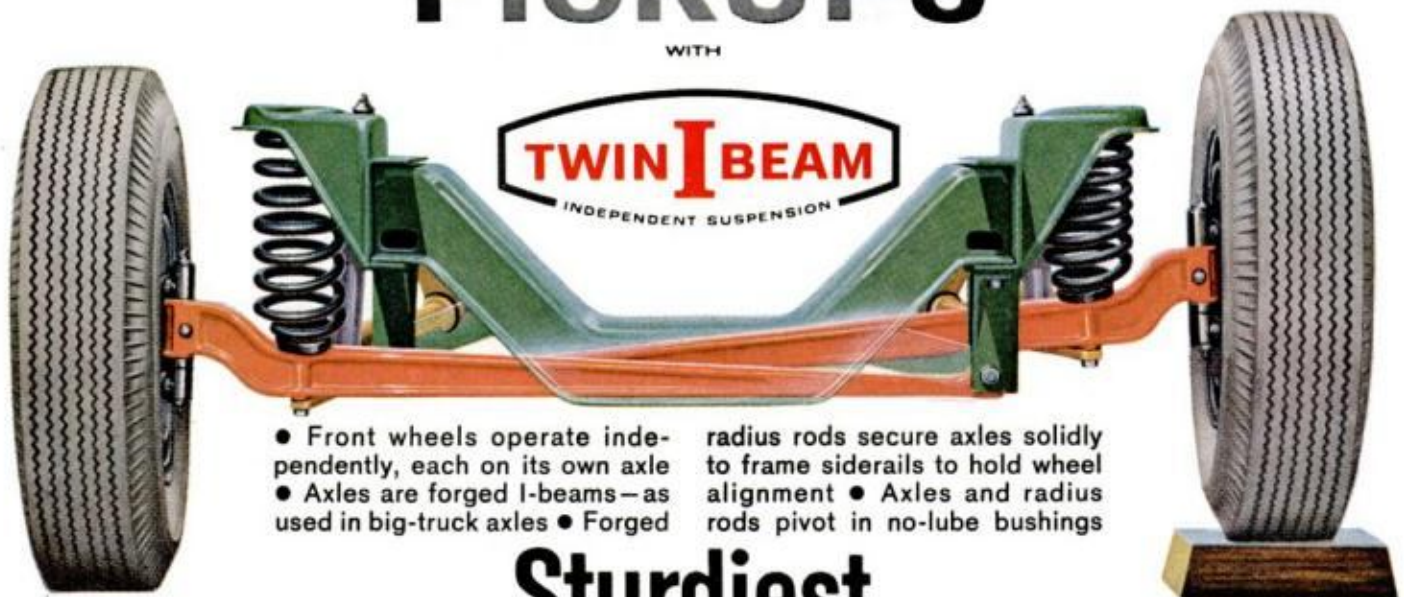


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- Axles are forged I-beams—as used in big-truck axles
- Forged radius rods secure axles solidly to frame siderails to hold wheel alignment
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Smoothest ride you've ever tried!

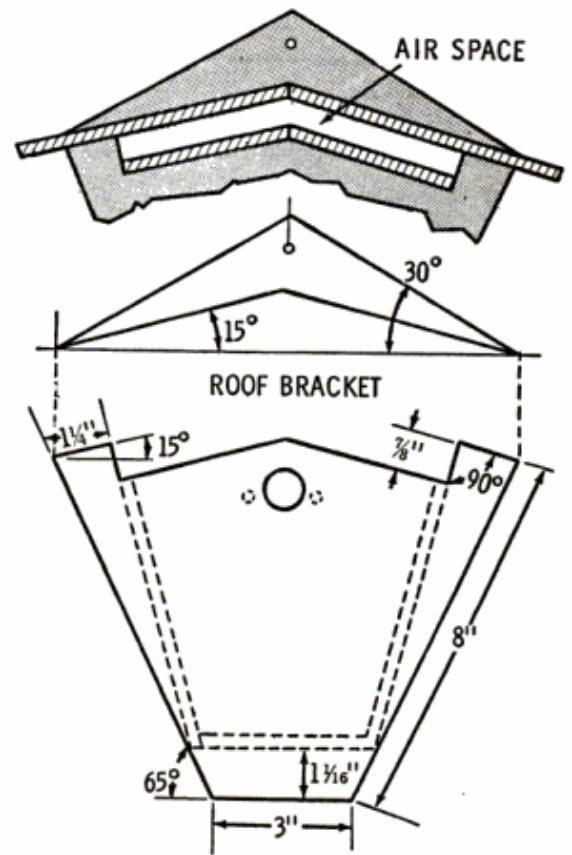
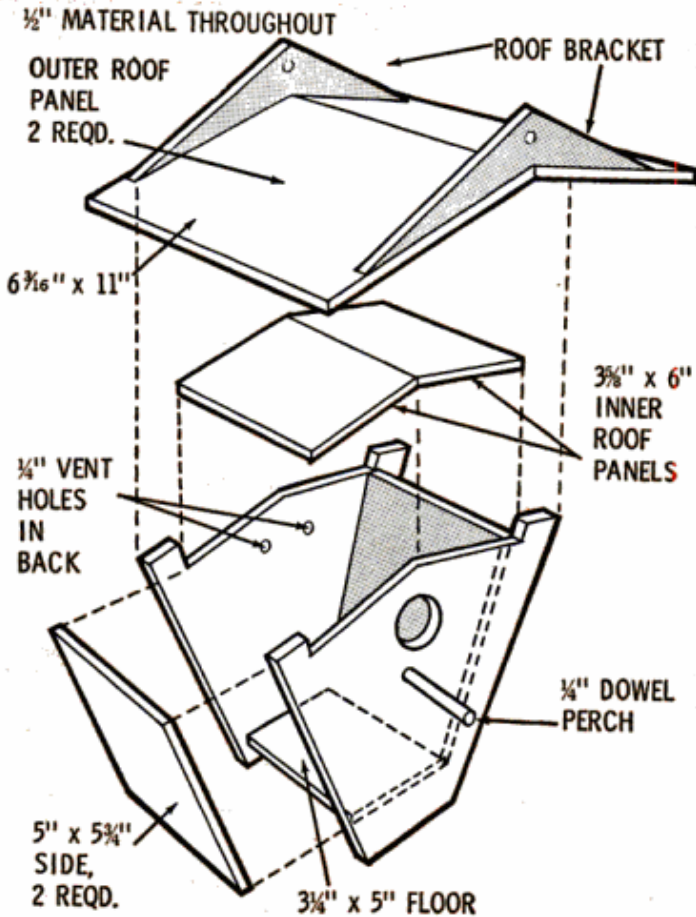
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Insulated Birdhouse Beats the Heat



Even on the sunniest day, the interior of this birdhouse is cool because an insulating air space is built into its double roof. As dimensioned, the house is suitable for wrens and similar birds. Scrap stock can be used to make it, in fact a couple of wooden crates will provide adequate material. Don't forget to paint the inner surfaces of the double roof before assembly. All parts are assembled with nails and waterproof glue, except for the bottom, which is fastened with wood screws so it can be removed for cleaning.

—Gordon Hancock

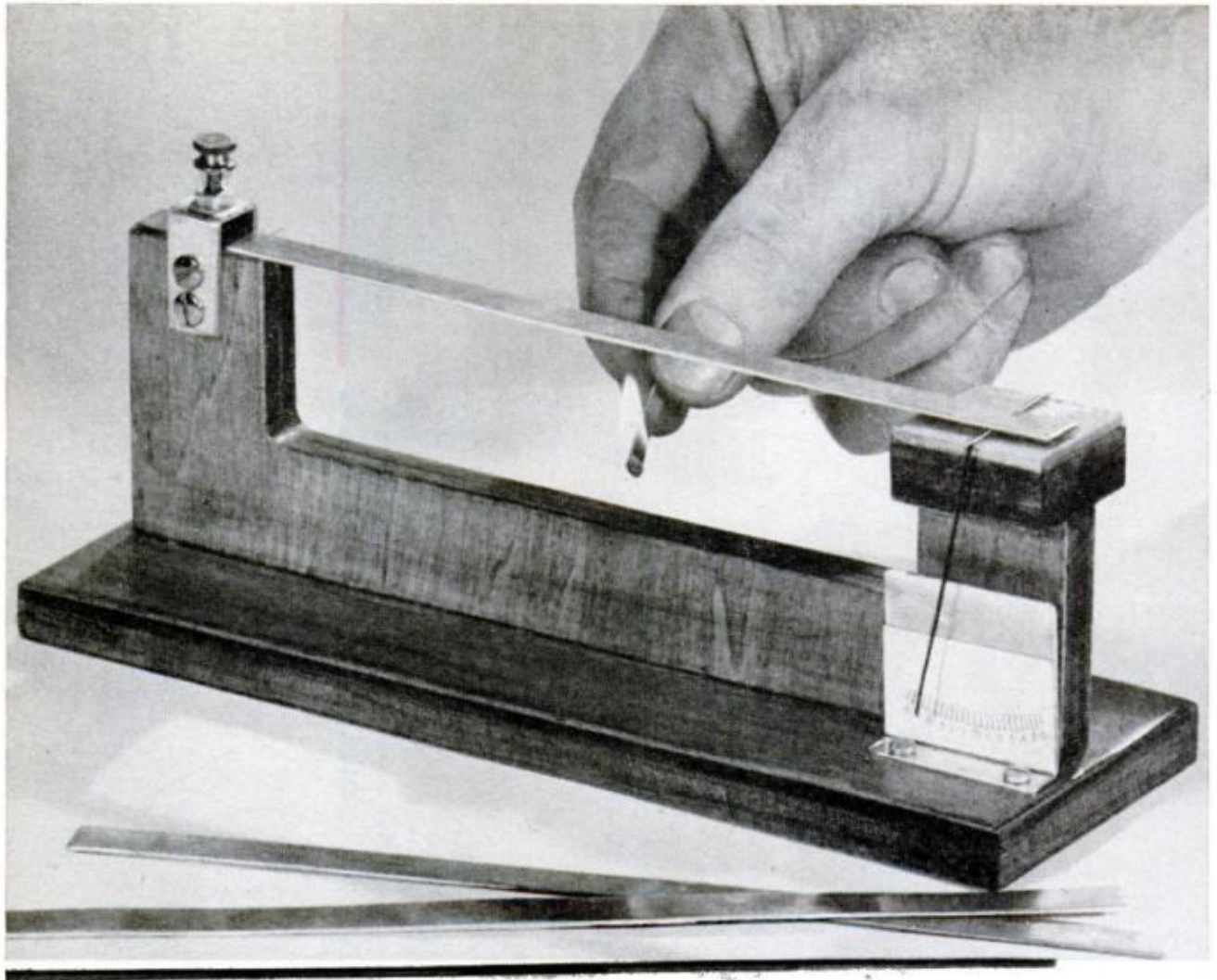
Open Table Does the Trick

Recently I wanted to rule off a number of parallel lines in drawing a poster but I was stymied because my drafting board was too small. Even my dining room table seemed to offer no solution because its circular shape failed to provide a straight edge for a T-square. Or so I thought, until I realized that all I had to do was to open the table. By using the side without pins, I had a straight edge for the T-square.

—James R. McElroy

- To keep a medicine bottle label clean and readable always make sure that the label is on top of the bottle as you pour.





Metal Testing Machine

By Harold P. Strand

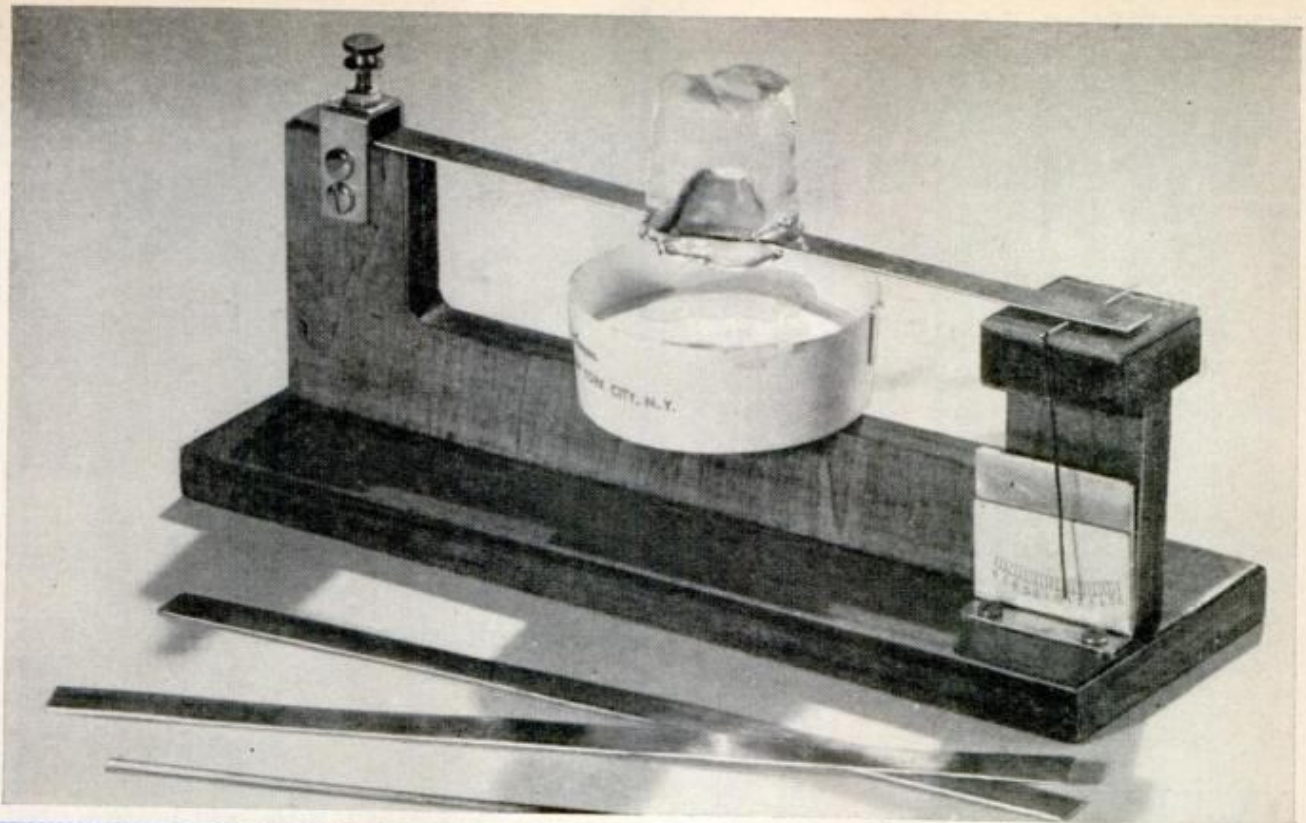
IT'S A WELL-KNOWN fact that metals expand when heated and contract when cooled, but the proportion of change (called the "coefficient of linear expansion") is usually so small that it's difficult to measure. However, this can be an important factor in the design of technical apparatus where allowances have to be made for expansion and contraction. In such cases the metal testing machine shown here can solve many problems.

While no attempt has been made to calibrate the scale accurately, it can be used for comparative measurement nicely. Test strips or small diameter rods of different metals are clamped in the holder and bent down slightly, if necessary, to make firm contact with a sewing needle which rests on a glass surface. A piece of fine wire fitted in the eye of the needle acts as a pointer. Expansion or contraction of the sample will cause the needle to roll slightly, mov-

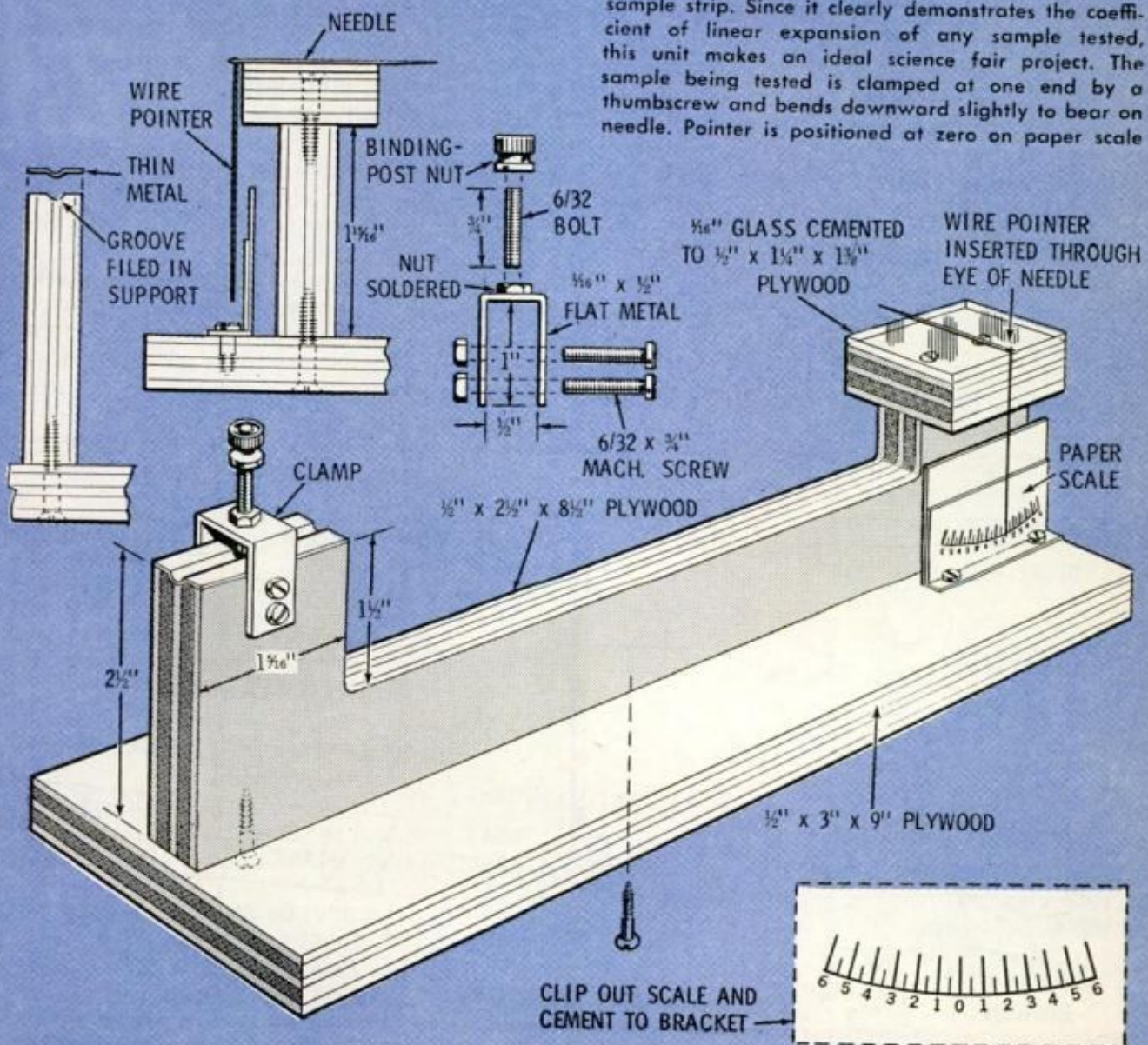
ing the pointer over the scale to indicate the comparative amount of change.

For convenience, the scale has been reproduced on the opposite page so that you can simply clip it out, glue it to the aluminum bracket and attach it to the tester as shown in the plan. A few odds and ends from the shop scrap box are all it takes to make it. By notching the end, a small C-clamp could be substituted for the thumbscrew holddown yoke.

When testing samples of flat stock with heat from a match, make sure that they aren't more than .035 in. thick since the match won't supply enough heat to produce an easily readable change in length. Naturally, thicker samples will require greater heat. With rod stock, samples up to $\frac{3}{32}$ in. in diameter will give good readings with a match. For more prolonged heat, you might try the flame from a cigarette lighter.



TO TEST CONTRACTION, place an ice cube on the sample strip. Since it clearly demonstrates the coefficient of linear expansion of any sample tested, this unit makes an ideal science fair project. The sample being tested is clamped at one end by a thumbscrew and bends downward slightly to bear on needle. Pointer is positioned at zero on paper scale



Permanent Caulking For Your Boat Hull

You can't beat these new synthetics for a strong leak-tight seal. They form a tough bond, remain flexible for life and don't shrink during curing

By Merle E. Dowd

WHILE POLYSULFIDE SEALANTS have turned out to be particularly well suited for caulking jobs around the house (see Part I last month), they have also been used with great success in marine applications, both for bedding frame members and caulking seams.

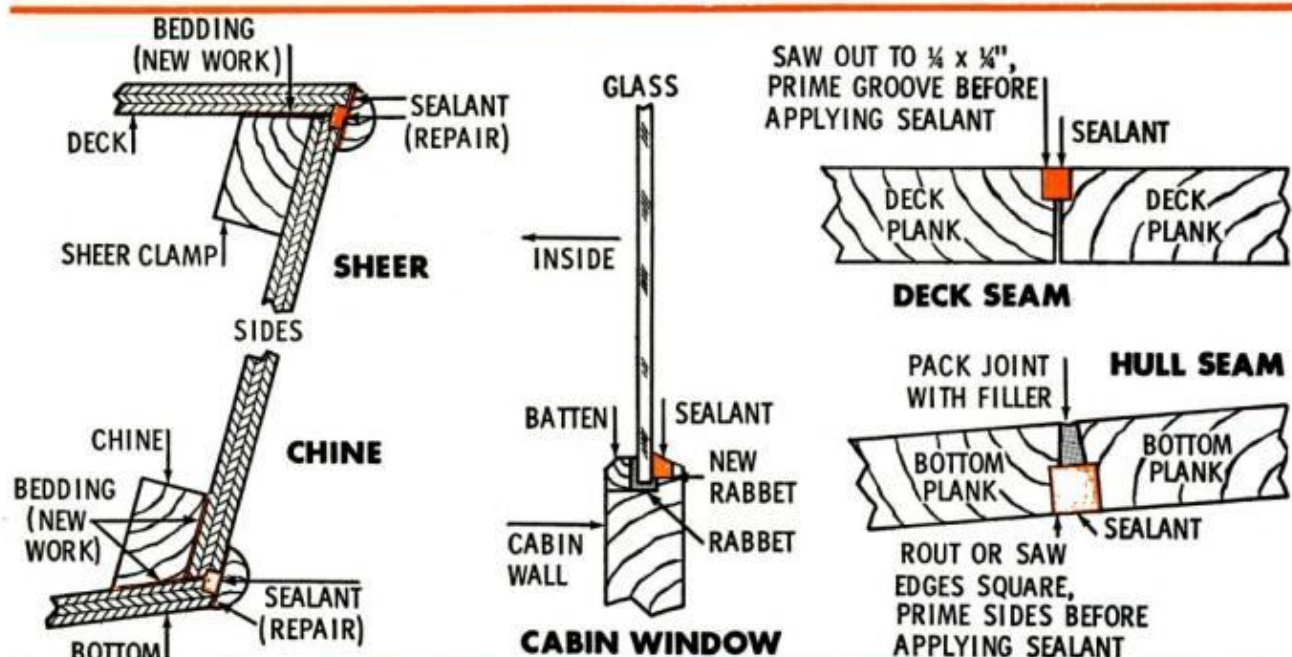
Due to their consistency, these synthetic rubber sealants flow into every void in a bedding joint, filling irregularities that could turn into leaks later. And since there's practically no shrinkage during curing, you can be sure that these voids will stay filled.

In bedding, first assemble the joint dry to check fit, then disassemble the parts and coat both surfaces with primer (see the materials chart, Part I). Once the

primer has dried, apply enough of the compound so that a little will be squeezed out when the joint is assembled.

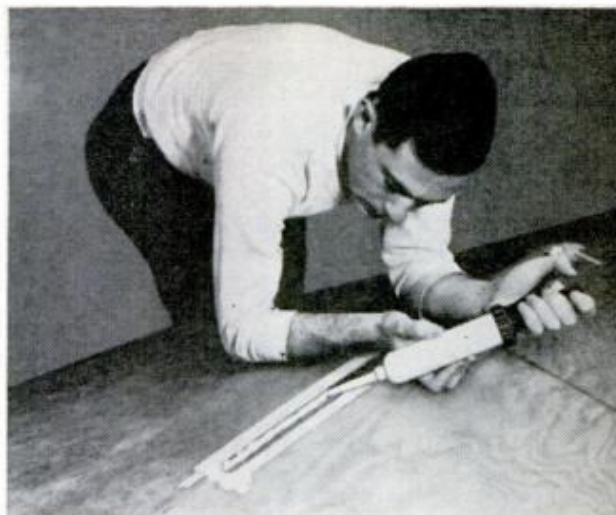
If the joint covers only a small area, you can butter the sealant on with a putty knife, but for large areas it's much easier to achieve even distribution by applying a bead with a caulking gun. Then reassemble the joints and knife away the excess sealant that is squeezed out. It isn't necessary to remove every speck, since any that remains can be sanded flush with the surface after curing.

Wood preservatives won't interfere with bonding, but if penta or copper-bearing preservatives are used, allow time for the mineral spirit solvents to evaporate before applying primer. The joint can be painted





BEFORE CAULKING the joint in this centerboard well the seam was widened with a router, then the edges were masked and primer applied to wall of joint



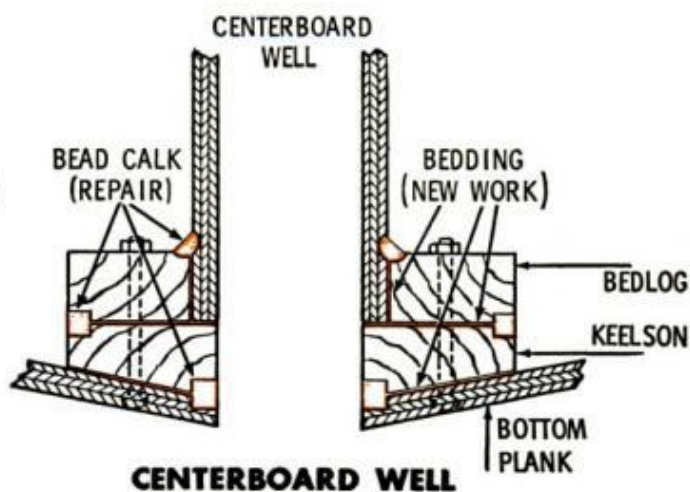
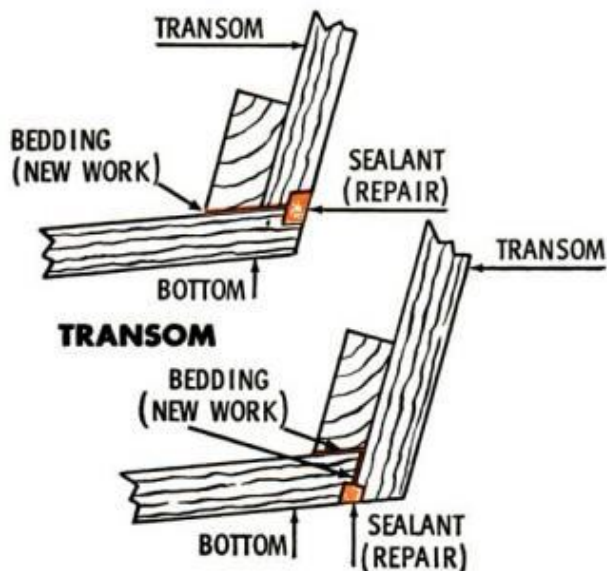
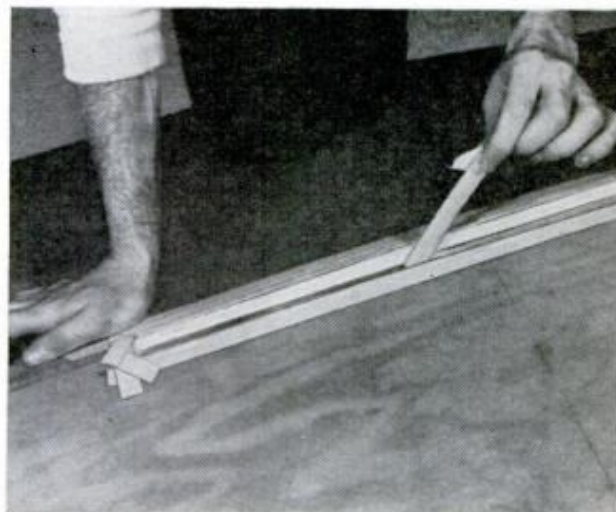
CAULKING GUN loaded with a plastic cartridge containing bulk sealant is perfect for squeezing the sealant into hard-to-reach joints like this one

after curing, but remember that if it works, the sealant will stretch or compress as necessary, and a significant amount of movement may cause paint to flake off the joint where sealant flexes.

When caulking seams, try to keep the sealant-joint cross section approximately square, as described in Part I. Rout out soft or decayed wood and remove all remains of old caulking before applying primer. You can minimize clean-up by masking both sides of the joint.

Horizontal seams can be filled with a flow-type sealant, which has a consistency much like thick paint. This is a two-part formulation requiring that an accelerator be mixed with the base material. The same surface preparation is required. After mixing, simply pour the sealant into the seam. It must be used within two to four hours after mixing. Any not used within this time should be discarded. ★★★

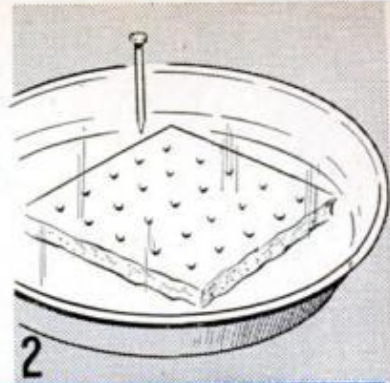
FINISHED JOINT required almost no clean-up. After filling the joint with sealant, a putty knife was used to level it and then the masking tape could be removed. Because of location, no paint was used



1 TRY STORING spackling, patching putty and other powdered material in a covered syrup pitcher. When mixing with water, you can pour desired amount through spout

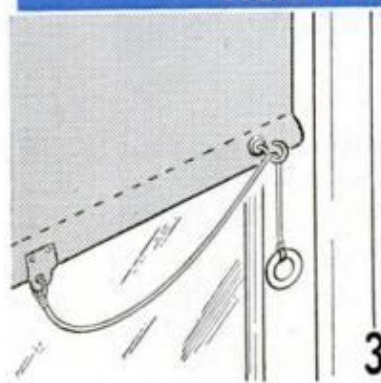


2 GERMINATION percentage of seeds saved from last season can be tested before planting by inserting them in holes punched in insulation board which is kept moistened

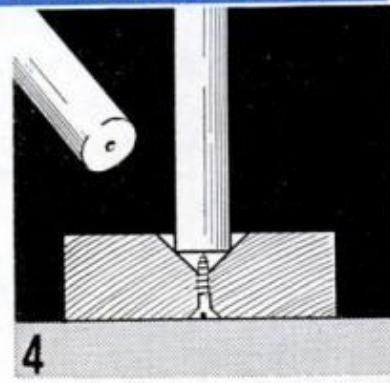


HELPFUL HINTS FOR HOME

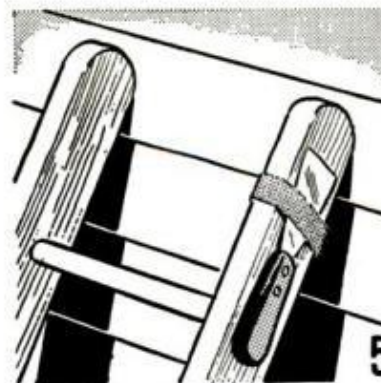
3 ONE WAY TO stop toddlers from playing with a window shade is to keep the pull cord out of reach. Simply drive a cup hook into shade slat and loop cord over this



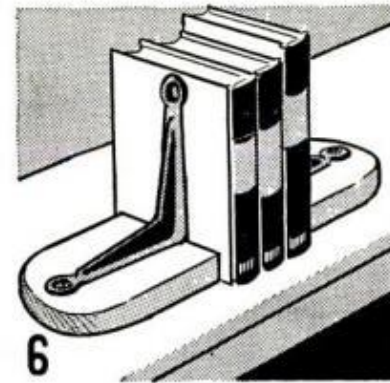
4 SIMPLE JIG for center-marking ends of dowels can be made by drilling through a block of hard wood, counter-sinking the hole and driving a screw up into countersink



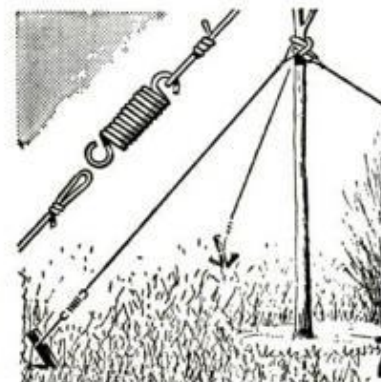
5 TOOL HOLDER for use at the top of a ladder is just a stout rubber band stretched over one of the rails. Screwdriver, putty knife or other light tool slips underneath



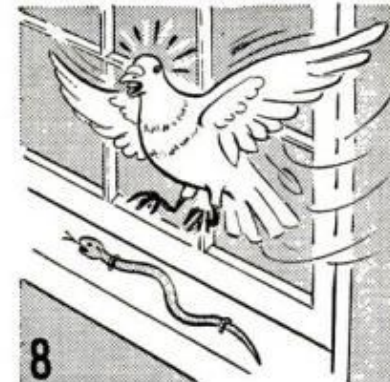
6 SHOP BOOKENDS to hold those operator's manuals, magazines and reference books are just a pair of shelf brackets mounted on wooden bases salvaged from scrap box



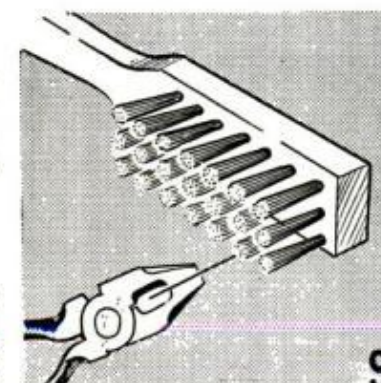
7 DETACHABLE guy wires offer firm support for a newly planted tree yet can be unhooked to simplify mowing. Make loops in the wires and connect them with coil springs



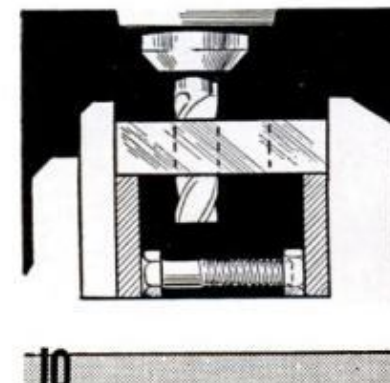
8 SIMPLE TRICK which frightens pigeons away from cornices, window sills and other favorite roosting spots involves fastening a realistic rubber snake to the surface

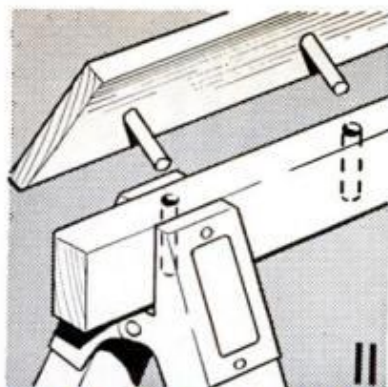


9 WHEN YOU NEED a fine stiff wire for cleaning a paint sprayer or welding tip, pull a bristle out of your wire brush with pair of pliers. It's fine enough to fit most jets



10 USE BOLTS as spreaders when milling templates supported on hardened parallels in a vise. They'll hold the parallels apart so the endmill won't touch hardened stock

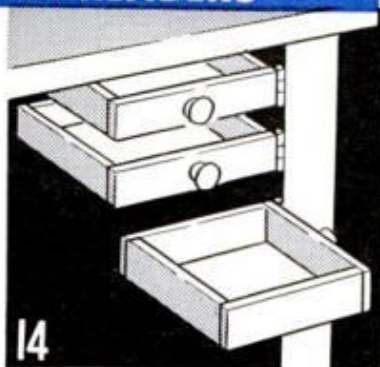
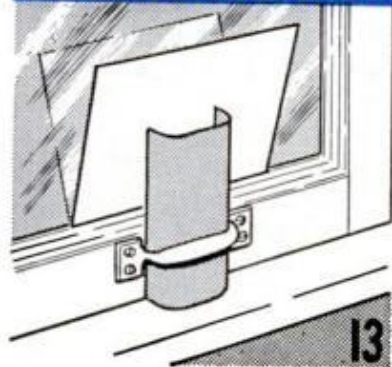




11 SAWHORSE makes a fine table for sawing wide boards if you cut a lift-off top from wide stock and drill blind holes for pegs to fit corresponding holes in sawhorse

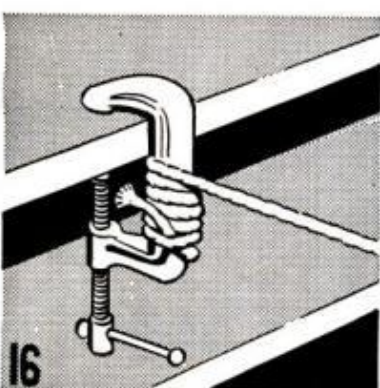
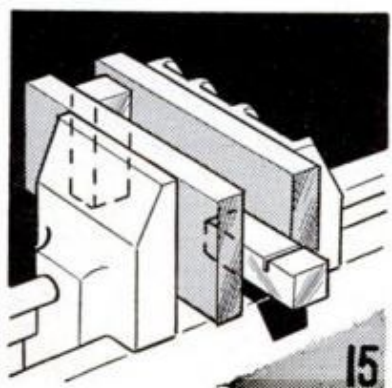
12 THROWAWAY applicator for spreading glue is a low-cost plastic picnic fork. The spades between tines hold a surprising amount, and tines distribute it evenly

AND SHOP FROM PM READERS



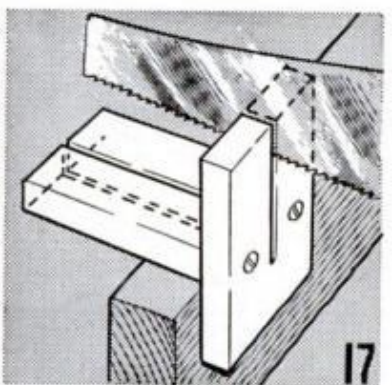
13 TO SUPPORT a "For Rent" sign or other card-type notice in a window, roll a strip of light cardboard to fit inside sash lift and insert card between this and pane

14 SWING-OUT drawers mounted on the leg of your workbench provide easy-access storage for small parts. Mount with loose-pin hinges so drawer can be removed



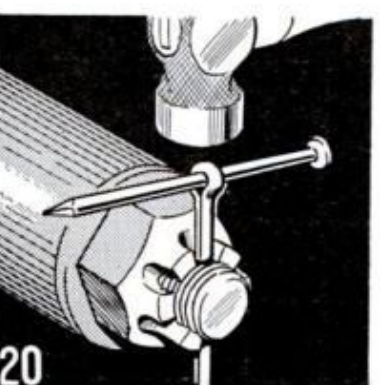
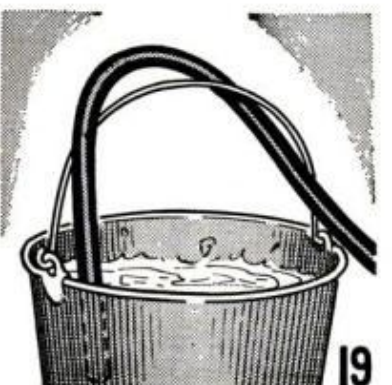
15 WHEN CUTTING bar stock which is too small to hold in the regular vise, hold it between two pieces of heavy bar stock. Brace heavy stock with piece the same size

16 IMPROVISED hook for mounting a temporary clothesline can be made from a small C-clamp. If the clamp is to be used on a finished surface, protect with pad



17 USEFUL FOR making short cuts and starting the saw square with the work is the simple "quick square jig" shown at left. It's made from two pieces of hard wood

18 BALL BEARING will assure smooth cuts with an acetylene cutting torch. Just fit torch tip into inner race and clamp angle iron on work to form guide for bearing



19 EASY WAY to hold the end of a garden hose in a pail while filling it is to wrap hose around the bail so that end is braced in position while pointing downward

20 TO AVOID crushing the eye of a cotter pin when driving it into a hole where the fit is snug, slip a nail through the eye. This also prevents it from folding together



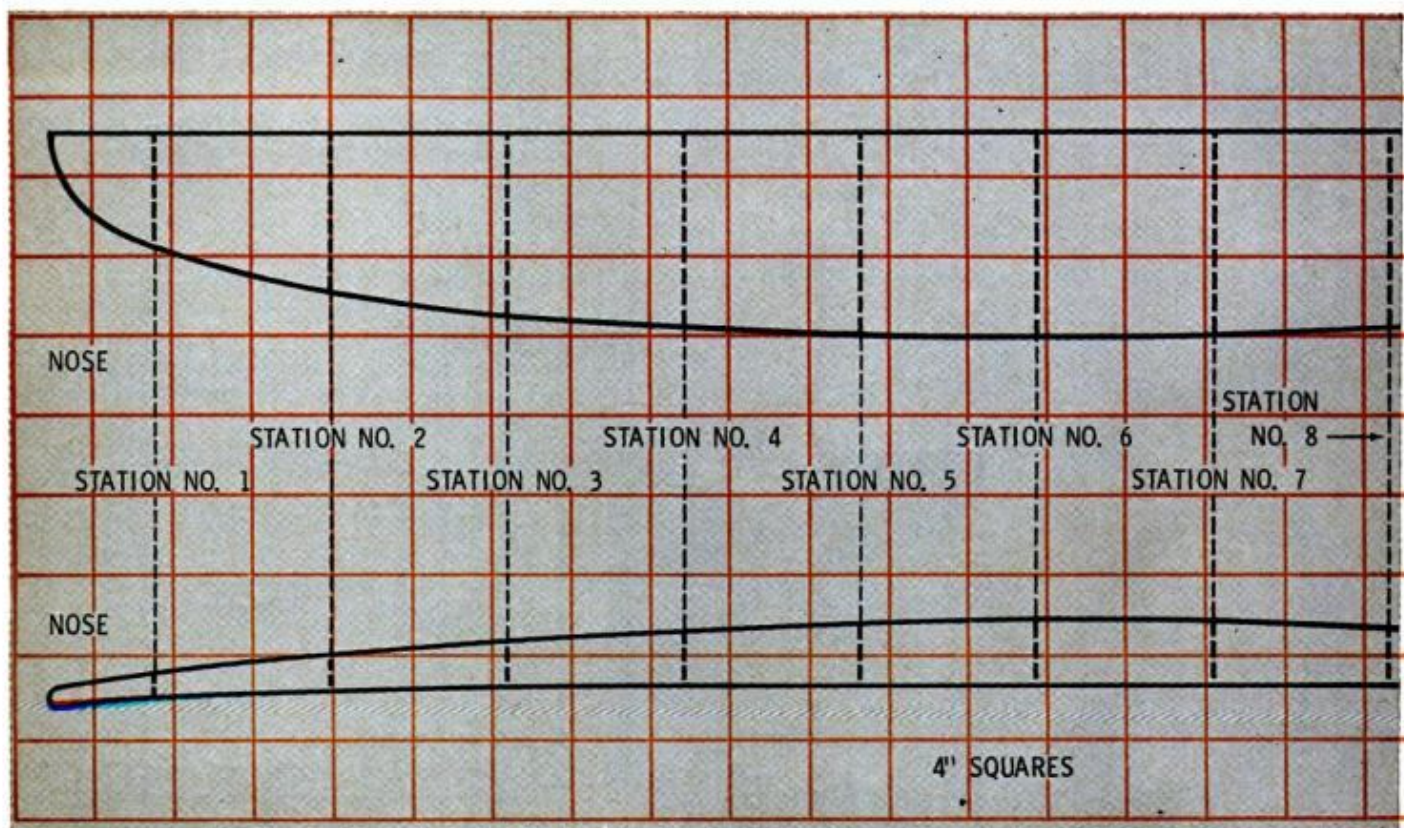
Surfboard

IF YOU'VE wanted to try surfing but have been scared off by the fancy price tag on a commercially-built board, or if you thought that surfing was out of the question because you didn't live anywhere near the ocean, here's some good news: you can build the board shown and save about 20 percent of the cost of a commercial model, and thanks to a new technique, boat surfing, your local lake can offer all the thrills of Makaha. Boat surfing isn't complicated. You lie on your surfboard and hang onto a 20-ft. towline as your skipper eases up to maximum wake speed. Then you rise to your knees and stand up. Suddenly, you'll feel the line slacken, though you'll still be zipping along in the wake. Finally you toss the towline away and enjoy the ride until the boat runs out of gas—or you "wipe-out."

—Steve Ellingson

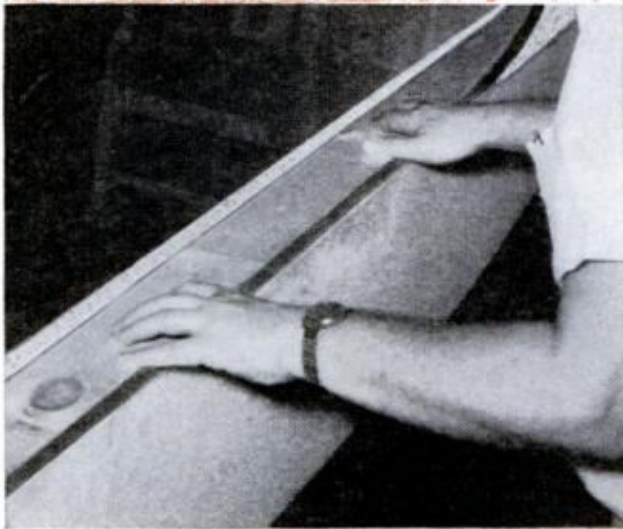
MATERIALS LIST

- 1 pc. $\frac{3}{4}$ " x 4" x 9' pine, cedar or balsa for spine
- 1 slab 4" x 22" x $8\frac{1}{2}$ ' 4 lb. polyurethane foam
- 1 gal. polyester laminating resin
- 2 qts. polyester coating resin for finishing
- 4 oz. polyester hardener
- $3\frac{1}{2}$ yds. 50" wide, 13 oz. weight fiberglass cloth
- 18" fiberglass rope, $\frac{1}{4}$ " dia. for skeg fillet
- 1 skeg (available at marine supply stores)
- 1 4-in. paintbrush, bristles set in epoxy
- 50-grit sandpaper, 400-grit wet paper



PLANS AVAILABLE

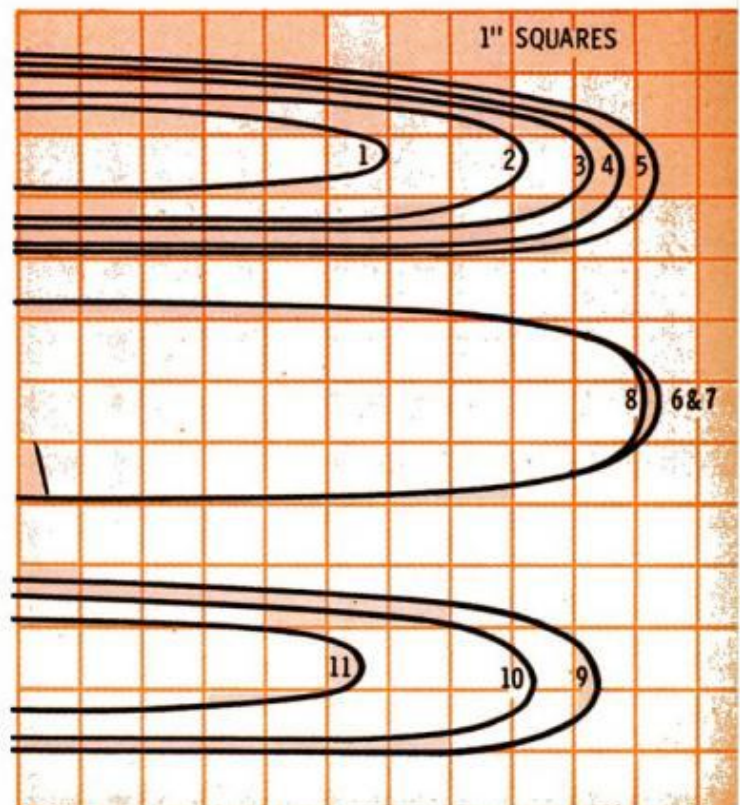
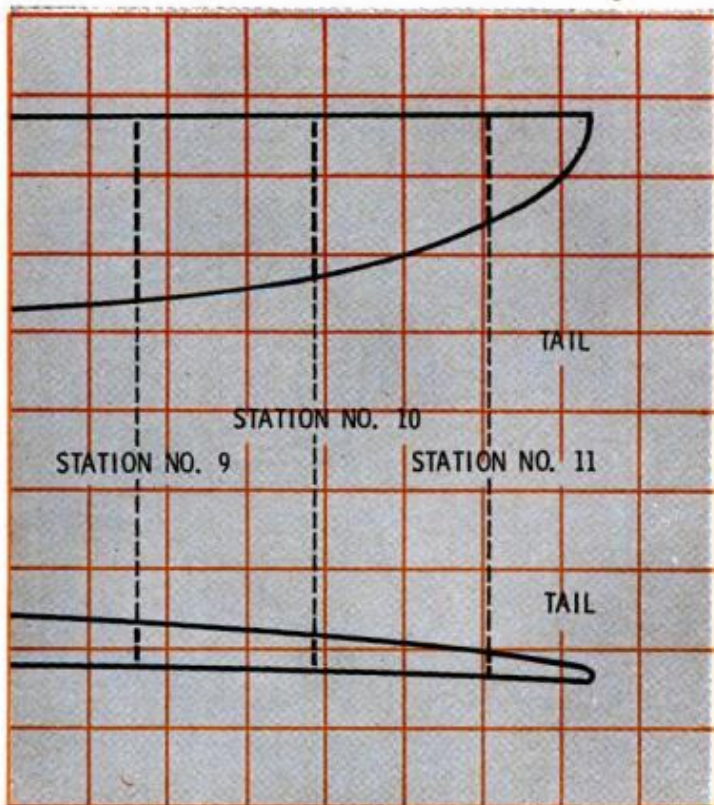
If you would prefer to work from a full-size pattern, send \$1.00 to Steve Ellingson, Popular Mechanics Pattern Dept. Box 2383, Van Nuys, Calif. 91409. Please specify pattern number 351. The pattern includes additional photographs and drawings.

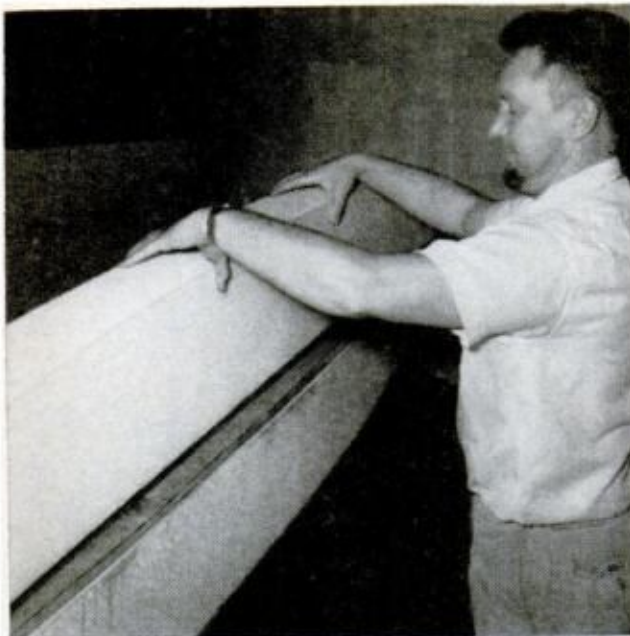


STEP 1. After bandsawing the foam lengthwise to produce two slabs measuring 4 x 11 in., 8½ ft. long, attach paper pattern to each piece with masking tape, outline with crayon and saw to shape. Double check to make sure that side of foam facing spine is perfectly flat, then use polyester laminating resin to bond spine to slab. After carefully positioning spine on foam, allow at least one hour's time for the resin to cure. It is important to follow the manufacturer's instructions when using polyesters.



STEP 2. Mix one pint of laminating resin with two teaspoonsful of hardener. Using a squeegee, apply the mixture liberally along the spine so that when the second slab of polyfoam is applied a strong bond will result. If you are allergic to resins or other chemicals, it is advisable to wear either rubber or polyethylene gloves when mixing or applying the laminating resin. Even if gloves are worn, it is a worthwhile precaution to wash hands thoroughly immediately after the work is completed.





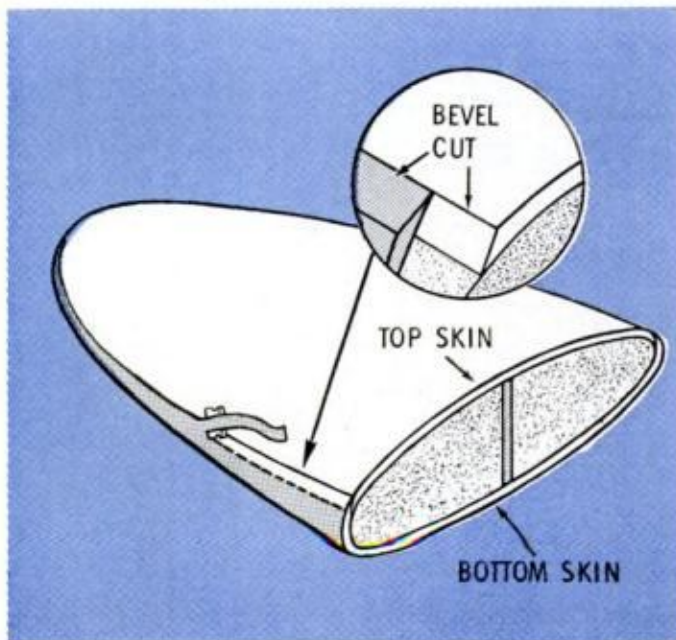
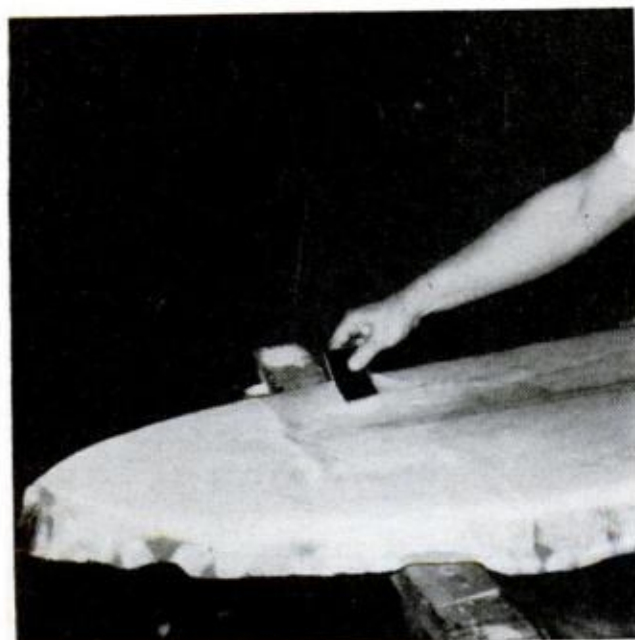
STEP 3. After applying the laminating resin, carefully position the second slab of foam. As before, allow an hour for the adhesive to cure. Resins work best when applied at a temperature of about 70 degrees; try to work in a well ventilated place away from the direct rays of the sun. For safety, make certain that the laminating resin is not stored near any open flame. While the resin cures, cut out a set of templates.



STEP 4. A crosscut saw is used to cut away excess foam. Be careful to hold the saw parallel to the surface of the slab, following the spine as a guide in making the cut. After you've finished this step, the board in side view will closely resemble the finished product. Though the operation is being performed here without the aid of a helper, you may find it easier if you enlist a friend to hold the board as you saw.

STEP 7. Fold the fiberglass cloth lengthwise and cut into two 25 x 126 in. pieces. Place the cloth over the blank so that 3 in. extends over the nose, then trim the excess cloth from the tail end, again leaving a 3-in. extension. After that, mix 1½ quarts of laminating resin with three teaspoonsful of hardener, stir thoroughly and pour a generous bead down the center of the cloth. Use the squeegee as shown to spread the resin, working with a moderate pressure

from the center toward the nose, tail and rails (edges). Work resin into the cloth at the rails. If any resin gets on the board, wipe off immediately with acetone. Before the top skin (cloth) hardens completely, turn the board over and trim with a razor blade. A critical step after the top skin has set is to bevel the trimmed edge with file or sandpaper. Without beveling, a ridge will form when the bottom skin is applied and a weak spot will result after sanding.





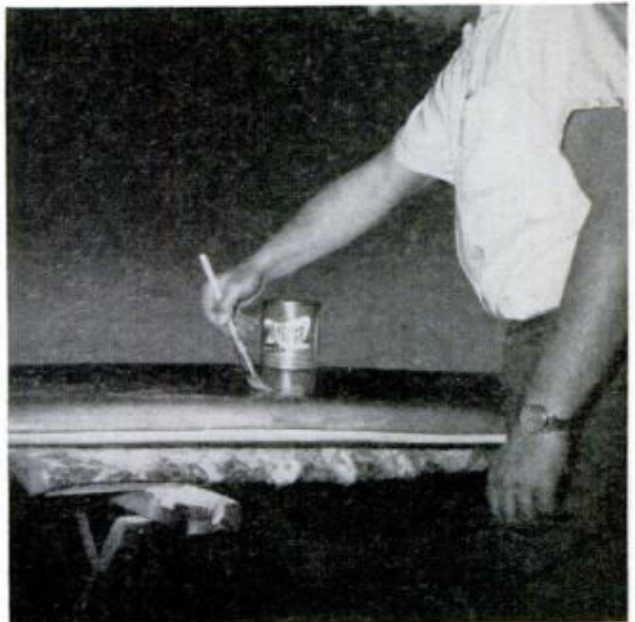
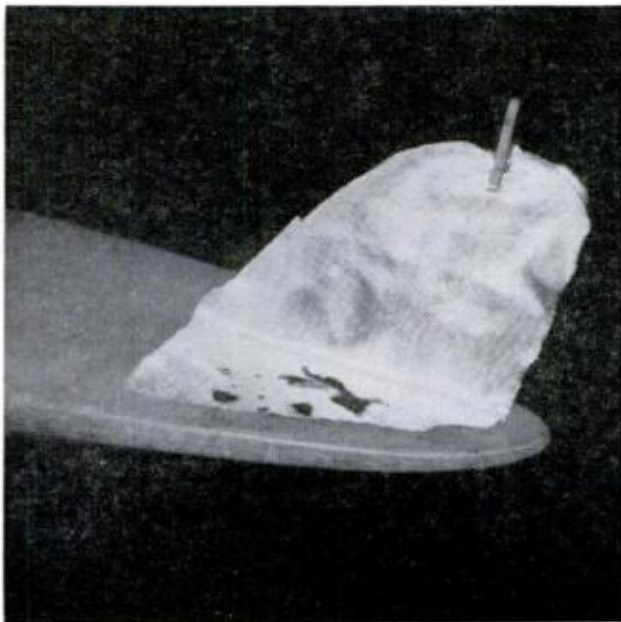
STEP 5. Patience is the watchword when you are roughing out the shape of the surfboard. Errors are difficult to repair so don't try for any speed records at this stage. A coarse rasp or a Stanley Surform file should be used; fine-toothed files are not suitable for this purpose because they tend to clog. To avoid taking off too much material at any one spot, work with even strokes along the entire edge of the board.



STEP 6. As you progress with the shaping, stop frequently to check contour with the appropriate template at each numbered station. The best material for the templates is $\frac{1}{8}$ -in. plywood, which is rigid enough to assure accuracy. In a pinch though, you can cut the templates from $\frac{1}{8}$ -in. non-corrugated cardboard. There are ten templates in the complete set; one template is used for checking stations six and seven.

STEP 8. Having sanded the bevel of the bottom skin, attach skeg 2-in. from the tail, using 3 oz. of resin and 20 drops of hardener. Hold skeg at a 90 deg. angle with masking tape until resin sets. Form fillet at the base of the skeg with resin soaked strands of fiberglass rope. Allow to harden, then lay cloth from rail to fillet and up the side of the skeg, apply resin and repeat on other side of skeg. The fiberglass cloth should extend $\frac{3}{4}$ -in. around skeg edges.

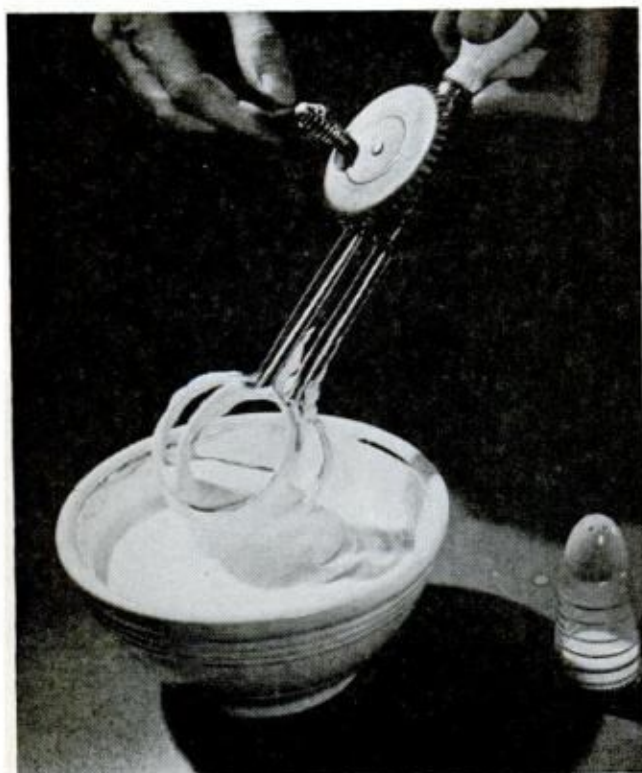
STEP 9. Before applying the finish coat make certain that the board is thoroughly clean. Masking tape should be placed around the rails, then a mixture of one pint coating resin and three teaspoonsful of hardener is brushed over the entire board. The tape is removed before the resin sets. After the resin hardens, turn the board over and repeat the process. Be careful to position the masking tape so that each finish coat overlaps about $\frac{1}{8}$ -in.





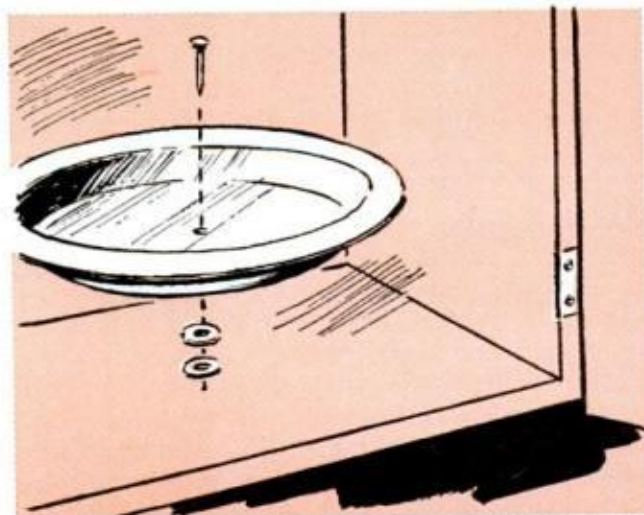
PORTABLE leaf burner that offers the ultimate in lawn protection is a wire trash burner placed in a wheelbarrow. The wheelbarrow catches all of the ashes and does away with those ugly burned areas

LABOR SAVER to pass along to your wife saves time when whipping cream. A pinch of salt added to the cream before whipping will strengthen the fat cells and make them more elastic so cream stiffens quicker

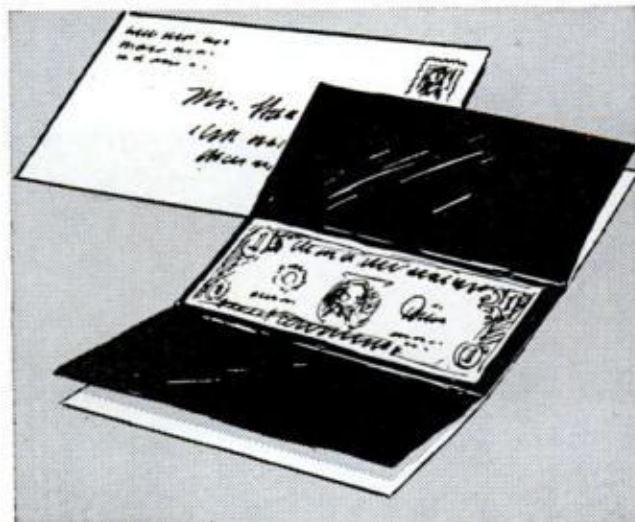


Solving Home Problems

LAZY SUSAN for your wife's spice cans holds them all neatly in one place, spins at the touch of a finger. It's just a tin plate with a nail through the center and two washers underneath for easy spinning



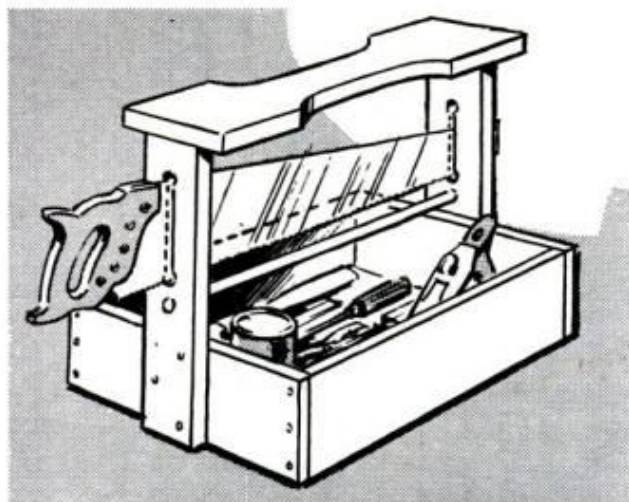
FOLDING MONEY—or a check—shouldn't be mailed if it will show when the envelope is held to the light. Always fold it in carbon paper (a used sheet will do) placed face down on lightweight backing paper



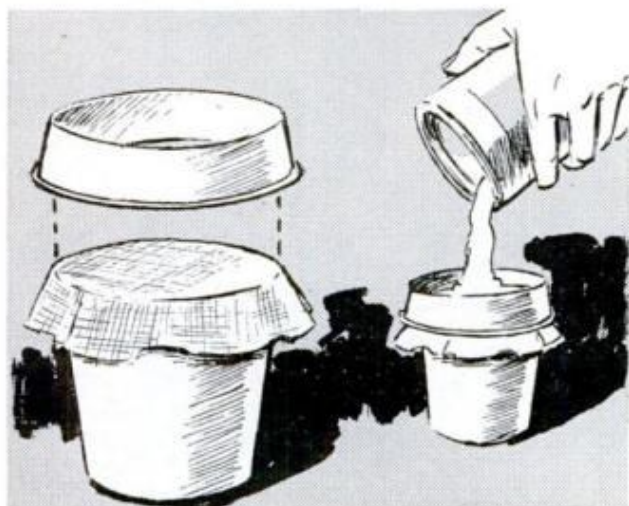


WHEN STORING a wet paintbrush temporarily in a plastic bag, it will remain flexible longer if you force the air out of the bag. To do this immerse the lower part of bag in water, then tie it tightly

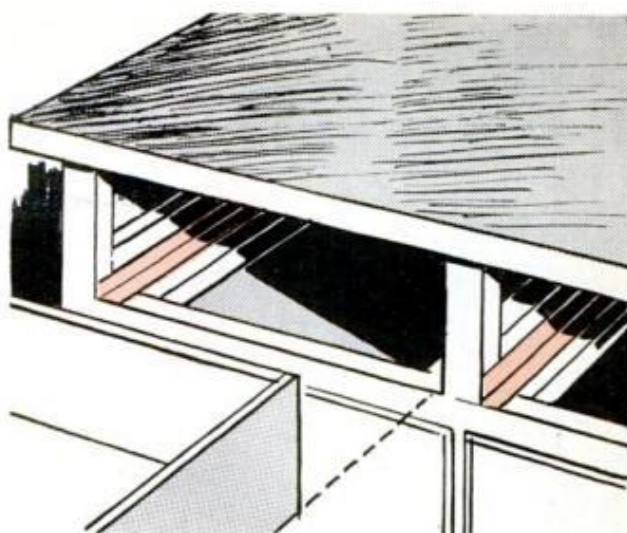
COMBINATION tool kit and on-the-job sawhorse has a wide board top instead of narrow handle. Slots in the vertical standards will hold a small handsaw, while dowel guard below protects against hand injury



SIMPLE STRAINER for paint can be made by cutting off the top 1½ in. of a cottage cheese container and inverting it over a one-quart paint can or juice can to clamp cheese cloth or nylon stocking in place



APRIL 1965



SLICK SLIDES for drawers can be made from scraps of plastic laminate countertopping. When installed as shown and rubbed with a paraffin block, they make drawers slide as though mounted on bearings

ADJUSTABLE support for a tall house plant grows right along with the plant. Actually, it's only a small brass extension curtain rod which can be pulled out as required to provide support at any height



181

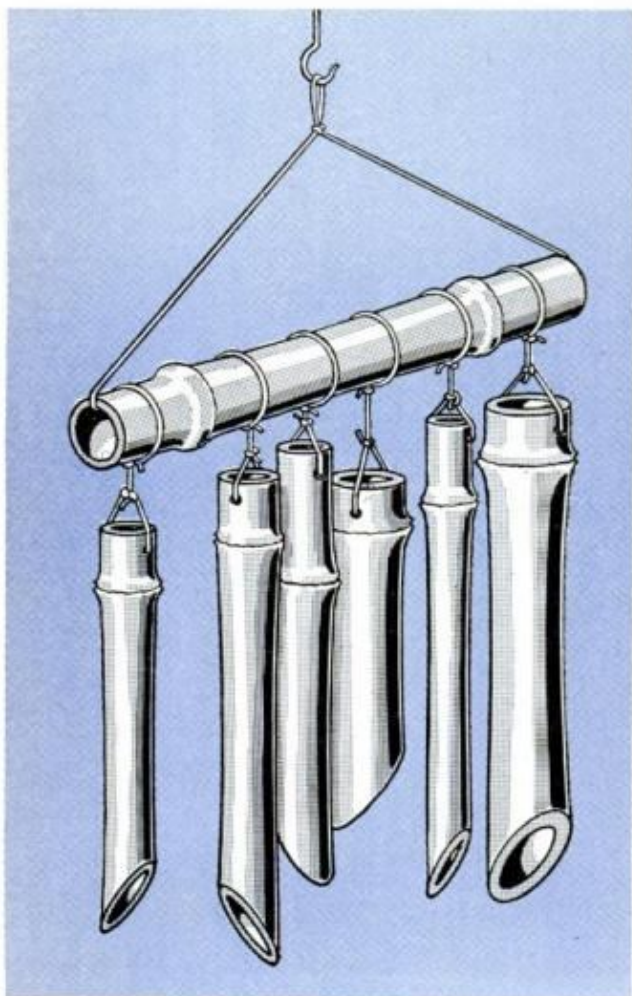
For the Boy Craftsman

By Frank N. Stephany

◀ Bamboo Wind Harp

STIRRED BY A BREEZE, these random-sized pieces of bamboo strike and brush one another to produce a musical sound. Vary the lengths from 6 to 10 in., sawing the ends at 45-degree angles in a miter box. Clamp each section for cross-drilling a hole $\frac{1}{4}$ in. from the top end. Pass twine through and hang the pieces (about $\frac{1}{4}$ in. apart) from a horizontal section, adjusting the relationships of short to long to create the best sounds.

When you try to feed a cord through the horizontal section, for hanging, you'll doubtless find free passage blocked by a web across each section-joint. If you have no facilities for end-drilling this long a piece, you can make yourself a needle by bending a tight eye at one end of a heavy wire. Sharpen and heat the other end so it will char its way through the webs.

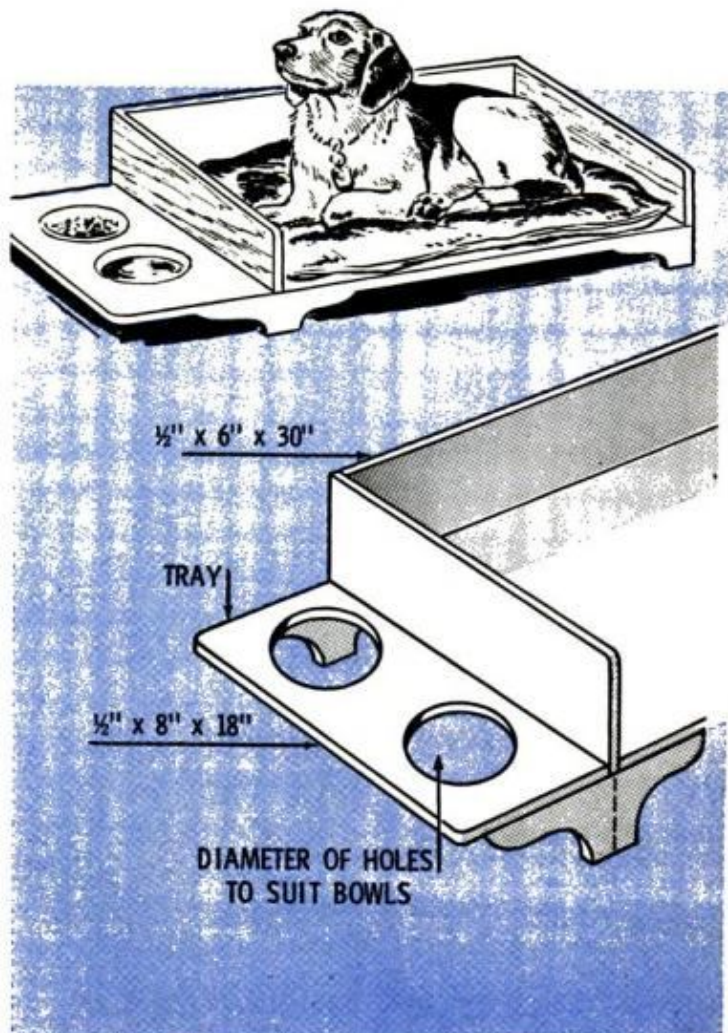


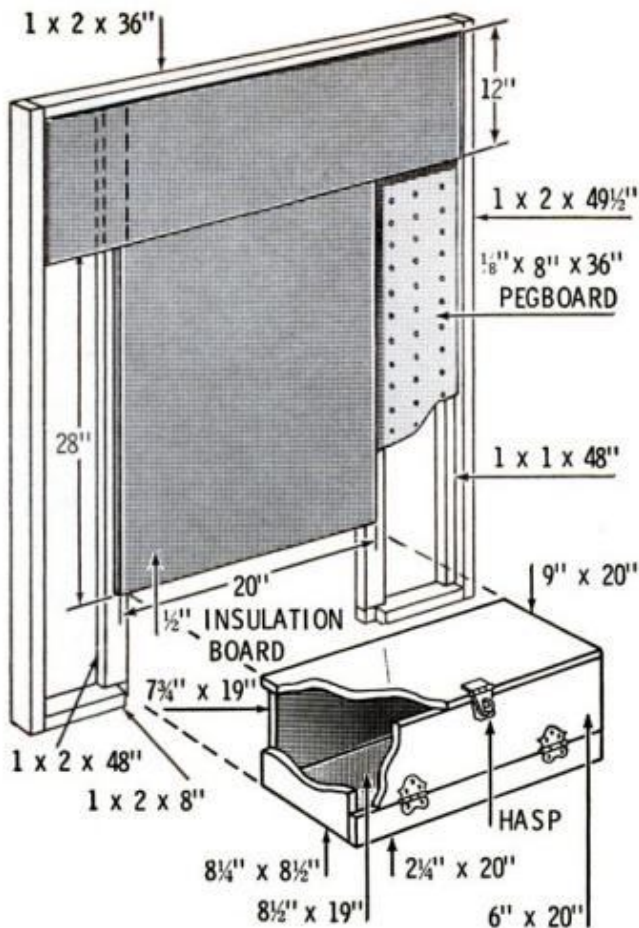
▶ Dog Bed and Feeder

EVEN IF YOUR POOCH has the run of the house, he'll appreciate a place of his own. This snug bed keeps him up off drafty floors; the attached tray makes his water bowl tip-proof and anchors his food dish so he won't have to chase it as he eats.

Make the unit from $\frac{1}{2}$ -in. plywood. If an 18x30-in.-size sleeping platform is too cramped for your dog (measure the area he needs when he's lying on the floor), add a few inches to both dimensions. You can adapt the width of the tray to the size of your dog's bowls. These should be the type with a flanged or turned edge.

Once you've laid out the right end, you can use it as a pattern for the left end, cutting the latter off at the dotted line. Except for the attached legs on the right end, the leg pattern is used to cut separate members (it's doubled at the left) which are glued and screwed flush with the long edges of the bed and tray panels.





CHEST MADE OF 1/2" PLYWOOD

CHEST TOP is nailed to back and ends to form stationary shelf. Top part of front panel drops down

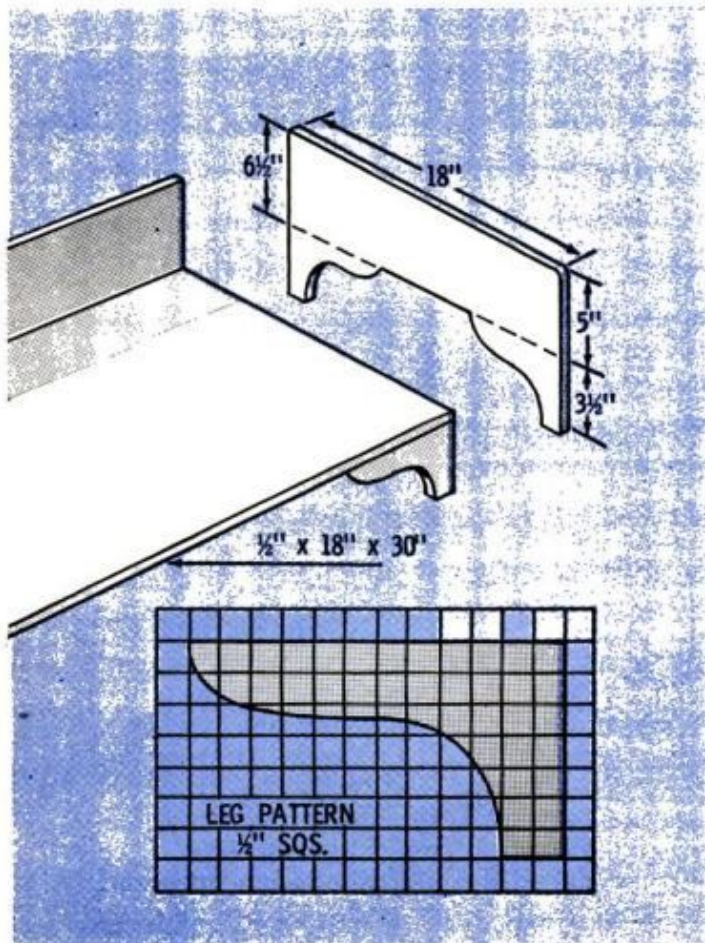


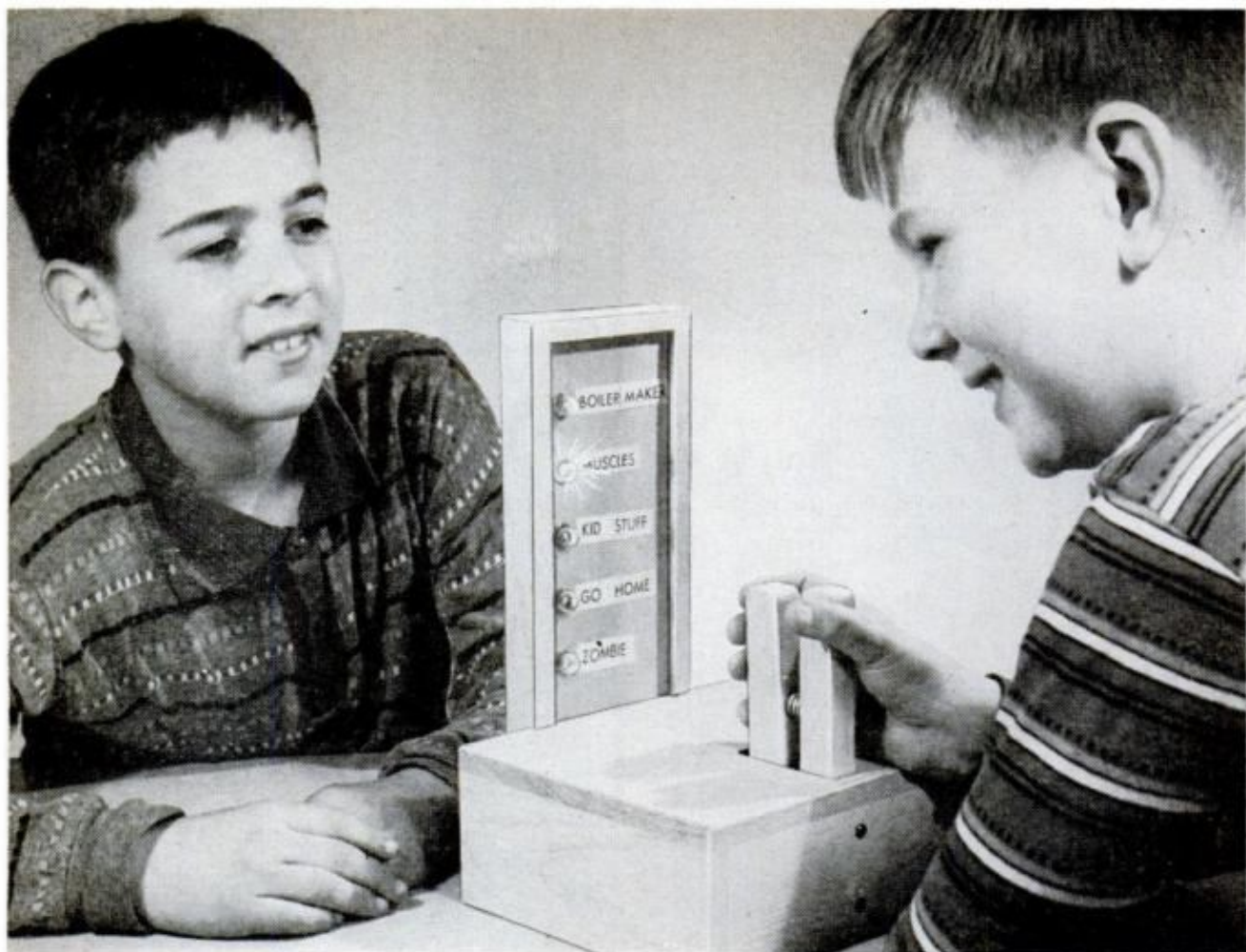
Treasure-Board Strongbox

GIVE YOUR BEDROOM an individual stamp with this combination wall rack (for sports equipment), bulletin board, trophy shelf and strongbox. By mounting a selection of items that represent your interests, you'll personalize your room in a way that announces: "Private! Don't disturb without owner's permission." And nailed right into the frame (so nobody can walk off with it) is a lockable chest for cash and treasured items you can't leave around loose.

To make the frame, assemble the 1x2s flat on a floor, using glue and finishing nails. Set the five outer pieces on edge, but not the two in the center that back up the meeting edges of the three vertical panels. Form a rabbet to support the outer edges of the pegboard by tacking 1x1 strips on the inner faces of the side members.

Cut up a sheet of insulation board (the kind with a prefinished face is best) into two panels and glue these to the backing strips. After nailing the pegboard to the frame, you can provide a finishing touch by butting a molding strip along the exposed edges of the center insulation board panel and on down the sides of the box.

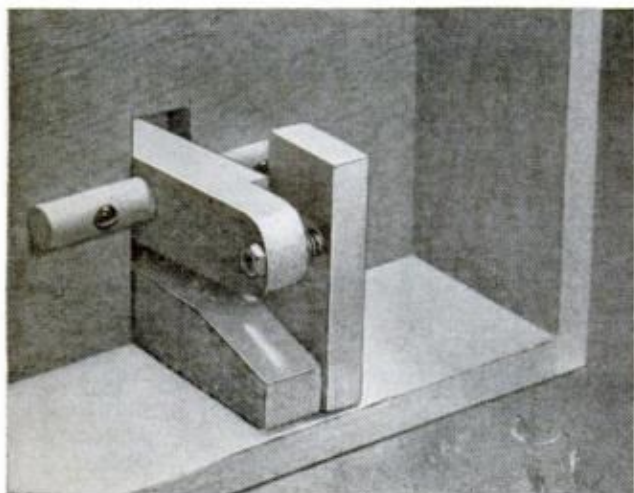




WATCHING LIGHTS run up the ladder as levers are compressed keeps kids amused (and builds muscles)

Grip Gauge Rings the Bell

INSIDE VIEW of the hand grips shows how movable one pivots on dowel screwed to underside of box

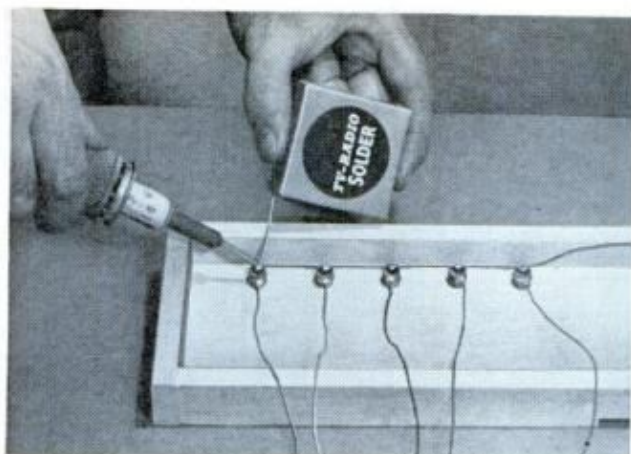


YOUR YOUNG MUSCLE MAN will get a big kick out of this grip tester made along the same lines as those found in amusement arcades. Easy to build, the device consists of five flashlight bulbs, a 6-v. lantern cell, a doorbell and a simple switching arrangement.

The lower end of the movable hand grip connects to one terminal of the battery so as to close the circuit to the various lamps as it makes contact with the stationary lugs. A compression spring holds the hand grips apart until the spring is overcome by squeezing, causing the different bulbs to light. When the top bulb lights, the bell rings to add to the fun.

The toy consists of a slotted-top box which houses the doorbell, battery and levers, and an electric scoreboard which is labeled (bottom to top) with such appropriate words as ZOMBIE, GO HOME, KID STUFF, MUSCLES and BOILER MAKER. The terminal lugs are spaced on the leg of the fixed lever as sketched on next page, and secured with screws.

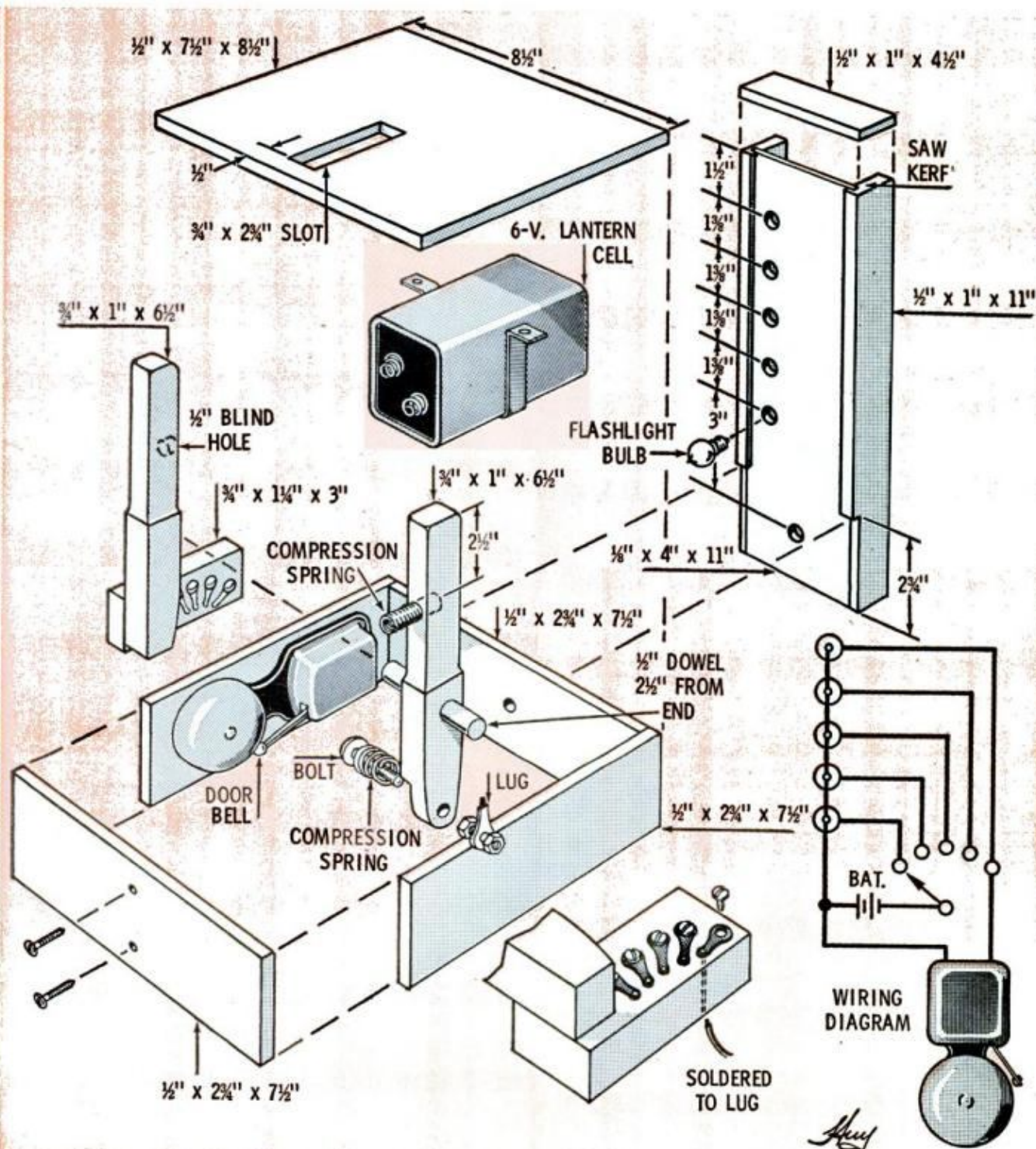
The five bulbs are merely pressed in undersize holes drilled in the $\frac{1}{8}$ -in. panel—no sockets are used. They are wired together following the diagram, one wire being soldered to the side of each bulb and the other to the very end.—C. Sinapi

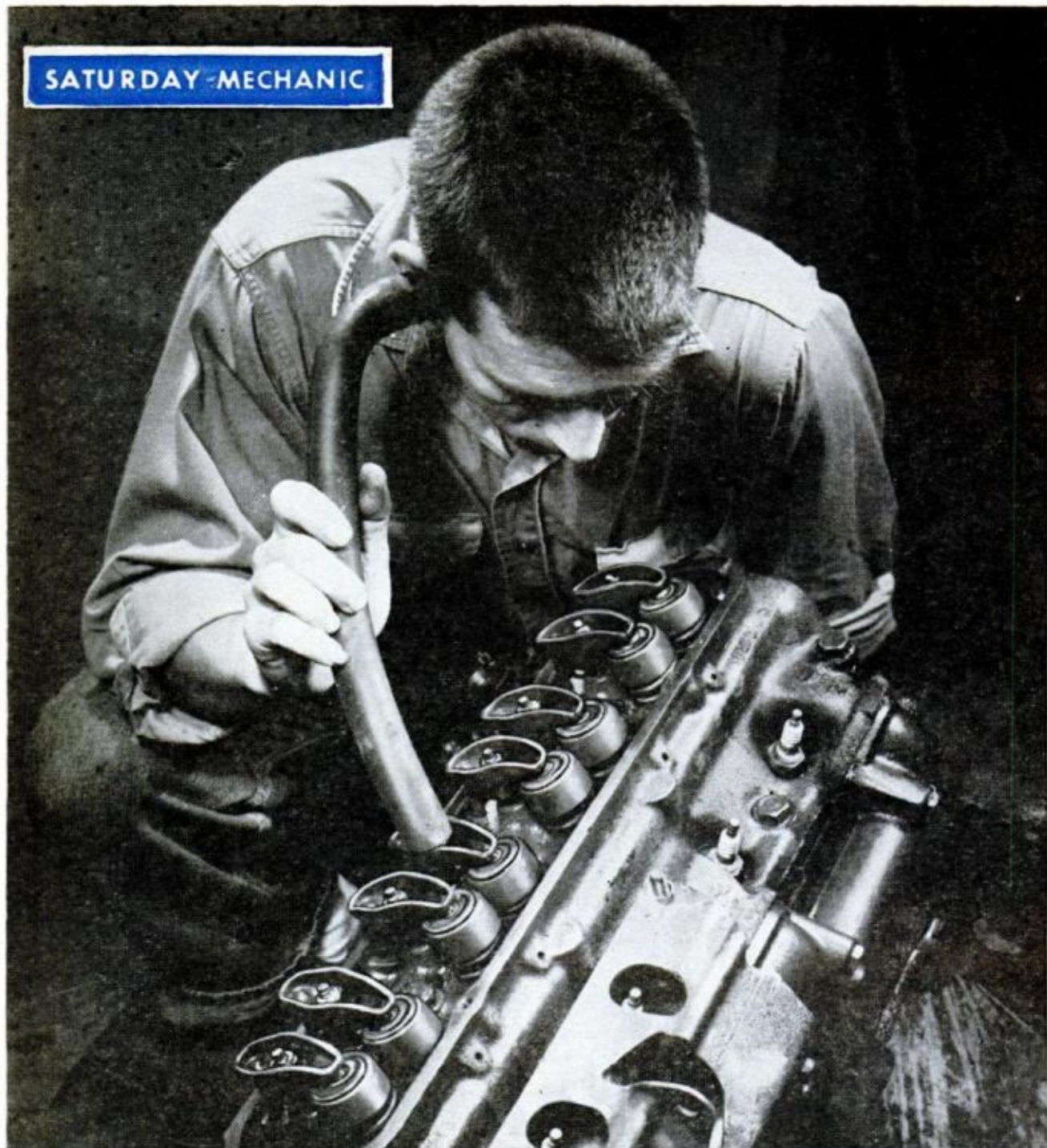


PANEL LIGHTS are flashlight bulbs pressed in under-size holes. Connect bases to the wires by soldering



UNDERSIDE VIEW of toy shows how components fit inside base. Scoreboard wiring enters hole in back





CLICKING VALVE—the first sign of lifter trouble—can be pinpointed with improvised “stethoscope” which is actually a short length of hose. Here the mechanic is working on demonstration engine. Yours can stay in car

Hydraulic Lifters

By Morton
J. Schultz

They're so simple many people don't give them a second thought. But ignoring them can lead to burnt valves, lost power and other troubles

THAT CLICKING NOISE in your engine seems harmless enough. It's not loud enough to bother anyone, and the engine seems to run okay. Don't even worry about it unless it becomes objectionably loud.

Essentially, that casual approach to the first signs of trouble in one or more of a car's hydraulic lifters is typical of many motorists. Since a car will continue to run with damaged lifters, many tell themselves, "I'll have it checked next time I get a

tuneup," But, as so often happens when we sidestep a problem, this easy going approach often leads to various forms of serious trouble, such as damage to other valve-train components and loss of compression. Obviously, signs of hydraulic lifter trouble cannot safely be ignored.

The hydraulic valve lifter is a take-up device which automatically adjusts the clearance between valve train components as they expand and contract with changes in engine temperature and as parts wear. It is, in short, a device to control valve lash.

Valve lash is the clearance between valve train components when the lifter (sometimes called follower or tappet) is on the base side of the cam. (See drawing at right.) This lash is required to permit the valve to seat fully when valve-train components are expanded in length by engine heat. In cars equipped with solid lifters, this lash can only be controlled manually by adjusting screws, which must be re-set every few thousand miles to compensate for wear.

Basically, all hydraulic lifters work on the same principle. The lifter itself is hollow and is filled with oil (hence the term *hydraulic*). The oil, under pressure, is forced into the lifter body (see drawing, page 188) from the engine lubrication system when the valve which the lifter serves is closed. The oil pushes up against the lifter plunger. The plunger, in turn, pushes up all other valve-train components by its action against the push rod, thus eliminating the clearance (or lash) between them.

As the cam lobe moves around under the lifter and starts to raise it, a ball check valve closes, sealing the oil inside the lifter. In this position, the valve is open, and the lifter is acting as any one-piece solid lifter would.

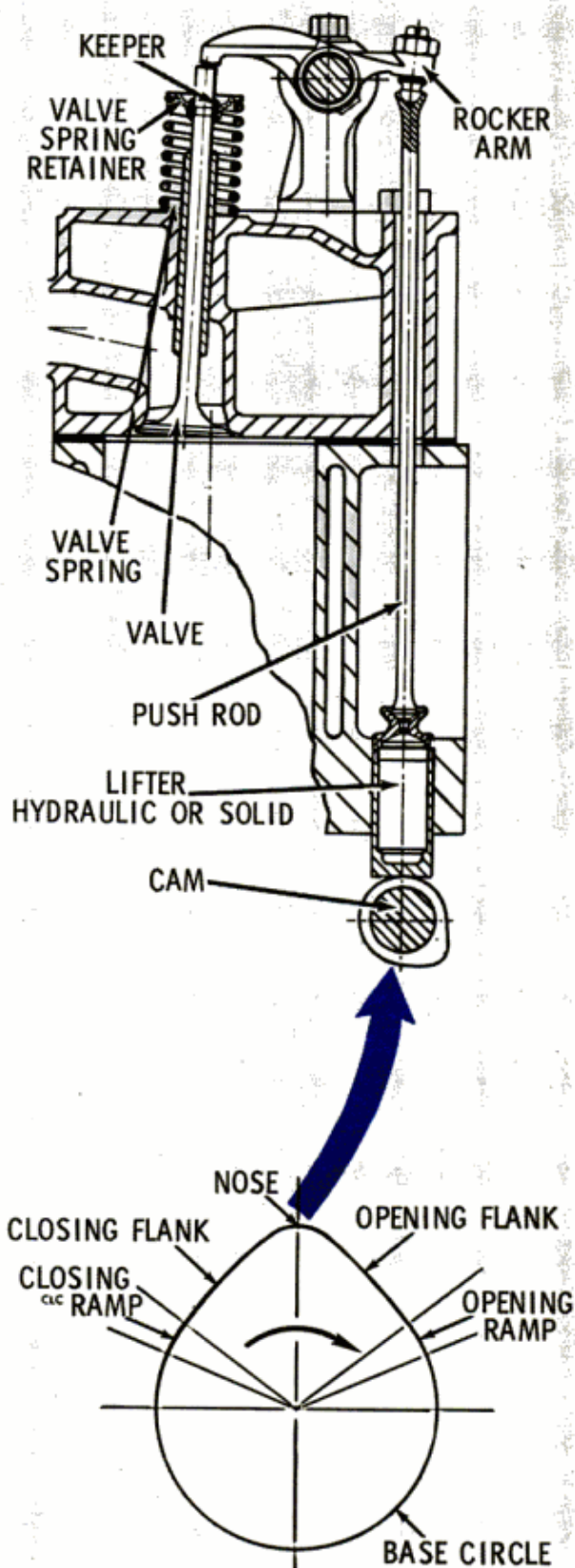
As the cam lobe moves out from under the lifter (and the valve starts to close again), pressure in the lifter is relieved. There is, in fact, a slight loss of oil, permitting the valve to close. This oil loss, though, is not great enough (unless there's a malfunction) to permit any lash. The ball check valve opens and the lost oil is replaced by oil from the engine lubrication system when the valve reseats itself.

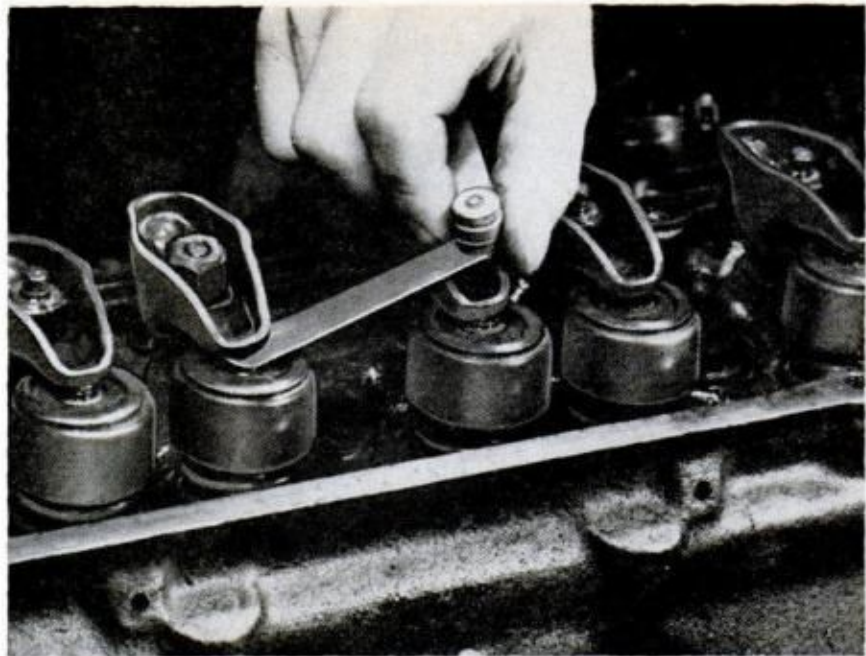
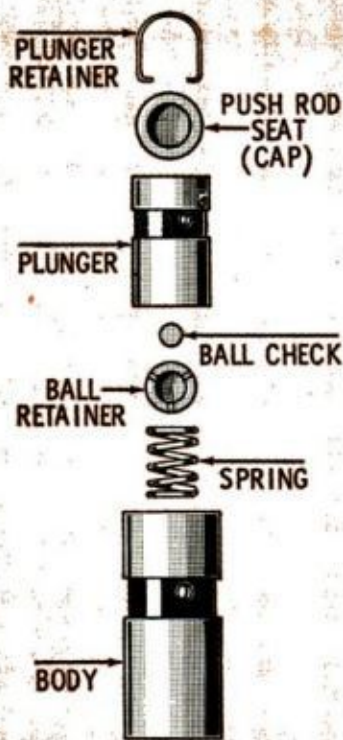
Each intake and exhaust valve in your car is served by a valve lifter. Thus, an eight-cylinder car has 16 lifters and a six-cylinder has 12 lifters.

Despite general belief, when a hydraulic lifter fails to operate properly, it does not become noisy. The noise which is generally attributed to the hydraulic lifter actually results from the valve pounding on the valve seat, which is why it's so tough to isolate the trouble.

HOW VALVE TRAIN OPERATES

AS THE NOSE (or lobe) of the cam comes under the lifter, it forces lifter upward. This action is transmitted to the rocker arm by the push rod, which acts as a lever to force valve downward into the open position. As cam nose moves away from lifter, the valve spring closes the valve. The rocker arm and push rod transmit valve's closing action to the lifter, maintaining contact between the lifter and cam





IF VALVE CLICK is caused by a faulty lifter, the noise will continue when you insert a feeler gauge between the rocker arm and the valve stem. However, if noise is caused by wear in one or more of valve train's other parts, noise will stop. Drawing at left shows parts of lifter

Noise of this sort could also be coming (and often does come) from other parts of the valve train. For this reason, you must troubleshoot to pinpoint the exact trouble before indiscriminately replacing lifters, which cost about \$3 a piece and take a great deal of time and effort to remove from the engine.

First, though, be aware of one important fact. A clicking sound of short duration when you start a cold engine equipped with hydraulic lifters is normal. Oil in some of the lifters is bound to leak down as the car stands idle, since these are held under pressure by the valves that remain in the open position. The time it takes to rebuild the lifter oil pressure varies with temperature and oil viscosity. During this

time, a distinct click, caused by lash in the valve train, is often heard, but it's nothing to worry

**CUT,
FOLD,
TAPE** **VALVE
LIFTERS**

about, in most cases.

Nothing to worry about, that is, if it stops. If, though, the clicking sound lasts longer than a minute or two or the sound doesn't stop at all, you have cause for some concern.

Make no mistake about one thing. The chief cause of hydraulic valve-lifter troubles and, indeed, valve troubles in general, is dirty oil. Sludge, varnish and carbon carried in the oil and left on parts can plug up the hollow valve lifter faster than **anything else**. Therefore, many experts feel that the best way to keep hydraulic lifters functioning as they should and, for

that matter, to keep the rest of the engine in good shape, is to change the oil and oil filter every 2000 miles. (A strong case is being made for the extended oil-change periods advocated by some manufacturers, but the oil and automotive industries still disagree on this matter.)

Now, let's suppose your engine has a clicking noise that doesn't stop soon after you start the car. If the trouble is indeed the lifters, you might be able to loosen up the sludge and varnish surrounding them by pouring a can of top engine oil into the crankcase. If this fails to solve the problem, things have gone too far, and you have no choice but to take off the rocker-arm covers, determine if the noise is in the valve train or hydraulic lifter, and fix the trouble.

How to Pinpoint Trouble

To determine whether the trouble is a lifter or another part, you must first find out exactly where the noise is coming from. The easiest way to do this is to get a piece of garden or heater hose about three-feet long. Place one end near the rocker arm of each valve and the other end to your ear, as in the photo on page 186. This test can be performed with the engine in the car.

You'll know when you've reached the noisy valve or valves, but you'll still want to make sure the trouble is caused by a lifter. To do this, insert a feeler gauge between the rocker arm and the valve stem, photo, above.

If the noise is eliminated or lessened, the trouble is *not* with the hydraulic lifter,

but with one of the other valve-train parts, which is worn. If the noise persists, then it's lifter problems. Try several different-sized feeler gauges, to make sure.

There are three primary reasons for hydraulic valve-lifter troubles:

- The ball check valve is damaged and off its seat, permitting too much oil to leak out of the lifter during operation. This is determined by conducting the leakdown test, which is explained later.

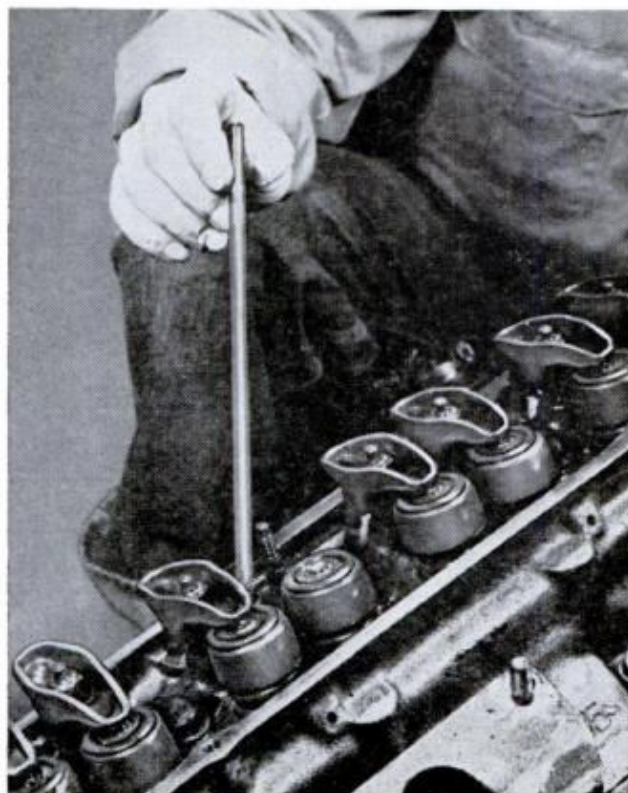
- Sludge and varnish are gumming up the works, causing lifter parts to stick.

- The lifter or one of its parts has been scored, pitted or scratched by dirt or metal chips.

The photos on page 190 show the procedure for removing valve-train parts to get at the lifter. The procedure will vary somewhat from one type of engine to another, but in general the procedure is the same in all cases. The rocker arm has to be disconnected, and the push rod and lifter taken from their seats.

In some engines, you can get the lifter out by inserting a special tool down into the push rod hole. This tool attaches directly to the lifter, which is then taken out. In other engines, you have to remove the manifold and unbolt a cover plate, revealing all lifters. The lifter can then be pried out with a pair of pliers or by hand. This technique can also be used as an alternate method with engines for which a special push-rod tool is made.

TO REMOVE THE LIFTER from the engine, first remove the rocker arm. This will reveal the push rod (above) which you then pull out, revealing top of the lifter



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If, when you remove the lifter from the engine, you find it is scored or pitted on the outside—especially where it touches the cam—replace the lifter with a new one.

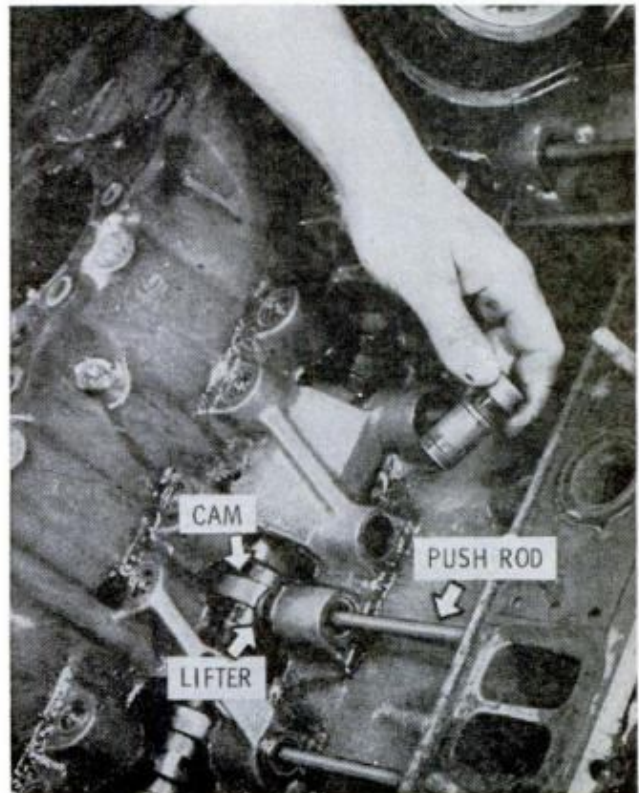
Taking things in logical order, it's best to check the leakdown of the lifter next, since checking for other problems requires disassembly of the lifter.

In a professional garage, the leakdown test is made with one of two special devices, one of which resembles a pair of pliers, the other an arbor press. However, a dull-ended drift pin will do quite well. To assure accuracy, perform the test immediately after removing the lifter from the engine, when it's filled with oil.

After cleaning the outside of the lifter with kerosene, or other parts cleaning solvent, hold it in an upright position, place it in the tester and apply pressure. If no tester is available, place the lifter on a flat surface and press down hard on the lifter cap with the drift pin mentioned above.

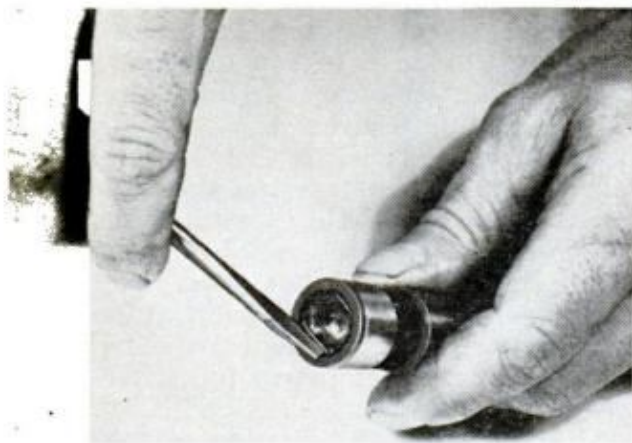
The lifter should maintain a strong tension against the downward pressure for at least 15 seconds without dropping more than $\frac{1}{8}$ inch. If the plunger collapses almost instantly, there's no doubt. The leakdown condition is drastic and the lifter must be replaced. If the plunger gives way more slowly, disassemble and clean it thoroughly. Then, reassemble and test again. A small piece of dirt under the ball check valve can be causing the gradual leakdown condition.

WITH SOME ENGINES—like this cutaway demonstration model—removing the intake manifold and lifter cover plate reveals lifters and push rods for removal



189

DISASSEMBLY OF LIFTERS

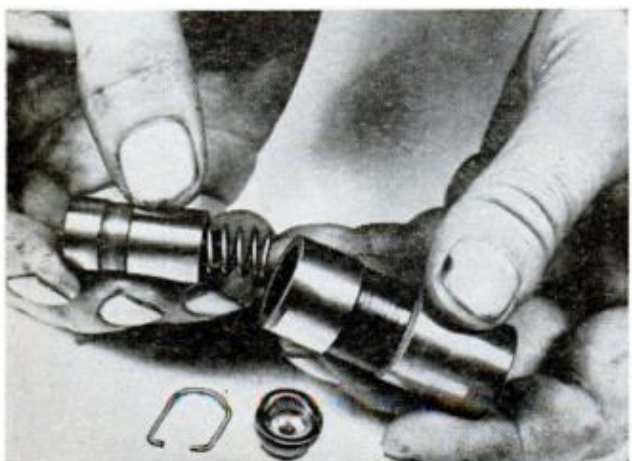


FORTUNATELY, THE HYDRAULIC LIFTER is easy to disassemble. First step, as shown above, is to pry out the plunger retainer with tip of a screwdriver



WITH THE PLUNGER RETAINER OUT, you can remove the push rod seat, or lifter cap, with a pair of pliers. Or, slap the lifter smartly in the palm of your hand

PLUNGER ASSEMBLY can now be removed. Insert your little finger into the end of the plunger and lift it out. The plunger assembly can then be broken down by lifting the plunger spring from the plunger, permitting the ball check valve and ball retainer to come out. Parts can now be cleaned and inspected



To re-test a lifter that's been cleaned and, thus, emptied of oil, you must refill it. To do this, keep the cap off and place the lifter in a *clean* can filled with *clean* kerosene. Submerge the lifter until it becomes filled with the kerosene. Now, replace the cap and repeat the test. If the plunger still gives way too fast, replace the lifter.

Now, if the leakdown test didn't reveal the trouble, disassemble the lifter as shown at the left. Then, clean all parts in a solvent and examine the plunger, push-rod seat, and other parts carefully. If you see score marks, pits, scratches or any other surface damage, replace the lifter. Finally, check the inside of the lifter body by feeling inside it with a *clean* finger. Again, any nicks, scratches, scores or pits mean you need a new lifter.

If everything checks out to this point, then you know that varnish and sludge were gumming up the works. Since your cleaning will have remedied this situation, the problem is solved and you can reassemble the lifter and return it to service. But there's one more consideration.

Gumshoeing the Gum Problem

If this one lifter was gummed up, then others in the engine are probably nearing the same condition and might start that rapping noise again in a few hundred miles. As long as you have the rocker covers off, you might as well remove all the lifters and clean them thoroughly. The time and effort will be worth it.

In putting the lifters back in the engine, or putting in a new lifter, two cautions must be observed:

1. In most engines equipped with hydraulic lifters, valve trains are set to zero lash by tightening down on the rocker arm until there's no play in the rockers. Some valve trains, though, have to be tightened down even more. Some Chevies, for example, require an additional $\frac{3}{4}$ of a turn tighter than zero lash to set the plunger midway in the hydraulic lifter. Since this adjustment varies from car to car, and from year to year in any one car, it's best to check with the service department of your dealer to determine the proper adjustment.

2. To prevent damage to the valve mechanism, the engine should never be run faster than idle for several minutes after the lifters have been removed and replaced. This will permit them to fill with oil, purge the kerosene or solvent with which they were cleaned, and become quiet. The small amount of kerosene or solvent will burn away, so there's no danger in letting them enter the engine lubricating system. ★ ★ ★

Auto Clinic

Q Intermittent no-start is my problem on a 1960 Rambler V8. I push the starter button and get only a click. I've replaced the starter relay and vacuum neutral switch, cleaned the starter, and put on two new starter solenoids. I can't figure out what else to do.—D.C.T., Fla.

A If you've done all this and still the trouble exists, then the only other spot to check is the starter itself. If just one small segment of the commutator is bad, you'll get intermittent starting problems if the bad segment is in position when you go to start the car. You say nothing of testing the starter, so this is the only remaining course you can follow. But to test it properly, you should remove the unit from the car and have the armature checked separately on a bench with an armature testing instrument. If this trouble does exist, you must replace the starter.

Q I'm getting water leaks in the trunk and around the windshield of my 1963 Valiant. Can't seem to stop them. Any ideas?—A.J.F., Ala.

A In most cases, leaks in this car originate with water coming in through the body holes drilled to pass the bolts that hold moldings to the body—not between the molding-body joint. It's a time-consuming job, but you should remove all bolts and cover the holes with a layer of dum-dum body filler, which you can buy in an auto body shop. Reinsert and tighten the bolts. The dum-dum has been known to block off the water effectively.

POSTSCRIPT ON GAS MILEAGE

Since our "open letter" on gas-mileage complaints in the November, 1964, Auto Clinic, we've received many letters asking: "Is there any way to tell whether the mileage I'm getting approaches some general standard?" There is, but you should keep in mind that engine size and added equipment aren't the only things that affect gas consumption. The reason you and a friend might get different mileage from the same model and make car could be the way you drive (heavy on the gas pedal, lots of braking) and under what conditions (city or turnpike).

Anyway, a standard mileage figure for a six-cylinder car with stick shift

Monthly Service Tips

★ If you have an early-production 1965 Chevrolet or Chevelle equipped with a rear radio speaker and are experiencing occasional static or no play, you may have one of the cars that escaped with an incomplete electrical contact in the harness connector. Take the car back to the dealer and remind him of the fix procedure outlined in his Chevrolet Service News, dated Oct. 1964.

★ Does your 1965 Mercury stall when you apply the brakes quickly? This is due to absence of a dashpot on the carburetor of all models except those with air conditioning. The newly designed cable accelerator linkage eliminates need for a dashpot for most drivers. However, if quick stops (and stalling) are part of your driving habits, your dealer is authorized to install a dashpot under the provisions of Service Bulletin 7 (Oct. 2, 1964). No reason to have it put on, though, unless it's needed.

★ Cases of automatic transmission governor failure have been reported for the 1964 Tempest. The defective units torn into by Pontiac have revealed either a stripped or worn nylon gear, or a feed port opening that's too small (it should be .019 inch). Pontiac has instructed its shops (Pontiac Service News, Aug. '64) to replace the bad gears with a new governor-driven gear replacement kit (part no. 1396569 or 1396570, depending on type of governor).

has been estimated as about 17 miles to the gallon. But suppose you have an eight-cylinder station wagon with automatic transmission and air conditioning. Those extra two cylinders and automatic box are costing you about two miles to the gallon. Knock off about another mile to the gallon for air conditioning and an additional mile for the station wagon, and you can see that bigger equipment costs you a total of four miles to the gallon. But, please, don't take it as gospel that if you have the car we've just described (a station-wagon 8, with automatic transmission and air conditioning) you're going to get 13 miles to the gallon. You could get a mile or two less. Figures quoted here are only comparative standards.

PM Reports on

Epoxy Paints



EPOXY PAINTS are ideal for beautifying and sealing porous brick and concrete walls, producing a glazed coating which simulates the finish on ceramic tile

EXCELLENT FOR FLOORS too, intermixed coating is thinned up to 10 percent for ease of roller and brush application. Primer coat is thinned even more



LOOKING FOR a concrete paint that defies teenage wear? Sounds like a large order but maybe you haven't heard of the new epoxy paints. They're now made to order for rugged wear areas.

Unlike conventional paints, epoxy coatings cure (through catalyzing action) with a "chemical graft" which produces a tenacious bond to practically any surface. They resist alkali and acids better than other hard coatings. It takes a lot to chip and peel them and they take a beating when it comes to abrasion. They go on like any paint, produce a finish that looks like glazed tile and come in a host of decorator colors.

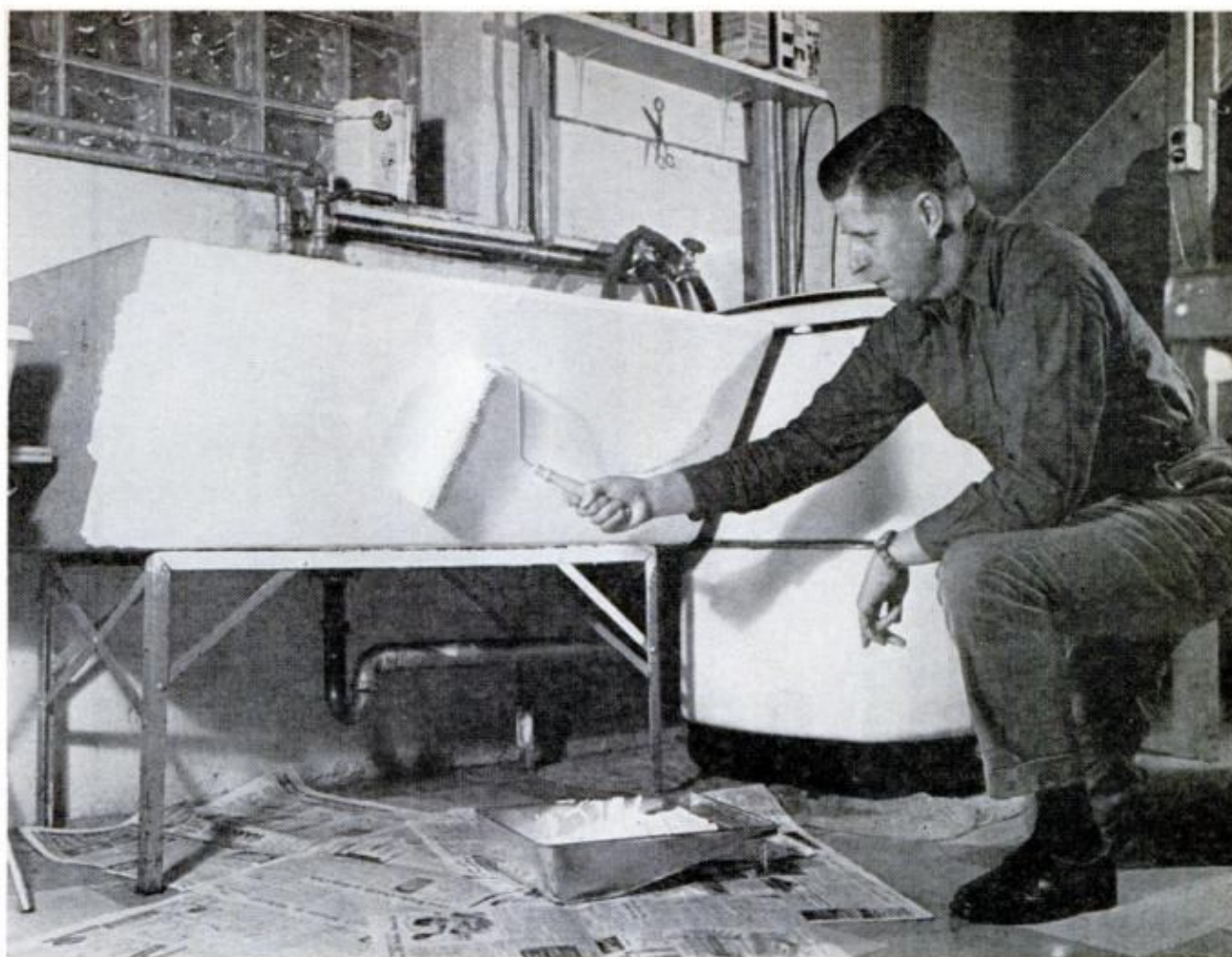
Where can one use these miracle paints? Almost anywhere. You can redo an old ceramic-tile kitchen or bath in a whole new color. You can use them to add a tough wearing surface to a basement or garage floor. Their water-resistance properties make them ideal for painting laundry tubs, basement walls and swimming pools. You can use them to give a lasting coating to boat hulls of all kinds.

Epoxies are a two-component coating, consisting of a pigmented base and a hardener, which are intermixed and allowed to stand for 60 min. before applying. However, since the pot life is only 8 hours, leftovers cannot be saved and reused. You mix only what you think you'll need for each coat, making sure you'll have enough, yet not be left with too much to throw away. You can apply the mix with brush, roller or spray gun. Nylon brushes are recommended, as are short-nap mohair rollers, and cleaning and thinning are done with a special epoxy solvent. For fairly small jobs, such as refinishing kitchen appliances, you can now buy epoxy enamel in convenient spray cans, ready to use direct from the can.

You can only apply epoxies at temperatures above 60 deg. F., and it is essential that such temperatures be maintained for a period of at least 72 hours after application. This means that paint jobs in unheated areas must be done during warm weather and at a time of year when there is little likelihood of an overnight drop in temperature.

While epoxies dry dust-free in one hour and may be recoated the next day, the final coat requires a much longer curing time than conventional paints. It is recommended that you allow one full week for maximum cure at 70 deg. F. before "moving in" on a floor and giving it hard wear.

In making a test application of a brand called Mira-Plate, *PM* chose an unpainted garage floor mainly because of its poor, porous condition and because we wanted to see for ourselves the resistance of the



BOTH INSIDE AND OUT of concrete laundry tub takes on "porcelain" finish when coated with epoxy paint

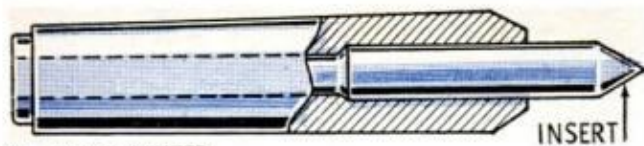
coating to oil and grease and salt drippings from a car. We applied three coats (with a roller) in three successive days, thinning the first with an equal amount of thinner as recommended to assure deep penetration of the porous concrete. The work was done late last fall and we experienced an overnight drop in the temperature after applying the third coat. This retarded the curing and caused the coating to remain slightly tacky under foot for several days. However, it made clear the importance of avoiding low temperatures during and immediately after application.

In making performance tests of the finished floor, we found that oil, grease and road salt wiped up without a trace and that the coating did a fine job of sealing the concrete, making it waterproof.

Aside from the long wait for epoxies to cure, which could prove inconvenient in some instances, our main beef was their potent, lingering odor. In closed areas, it is most essential that forced-air ventilation be used to speed the evaporation of the strong solvents. As for a tile-like finish: our test paint produced a glass-smooth surface which bridged the pores and voids with a continuous film and added decorative beauty to an otherwise drab concrete floor. ★ ★ ★

THE PAINT is a two-component mixture, the epoxy color being added to a hardener (below), then mixed thoroughly and left to stand 60 min. before application. When intermixing colors for special shades, thorough mixing of the colors themselves is just as important as the final mixing of the colors with hardener. Haphazard mixing can result in uneven overall color when paint is applied and completely cured





1 LATHE CENTER



2 HALF CENTER



3 FEMALE CENTER

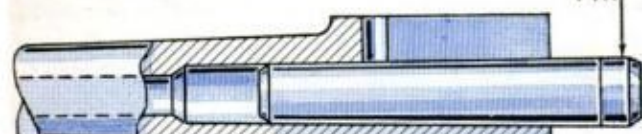


Lathe Accessories From Taper Shanks

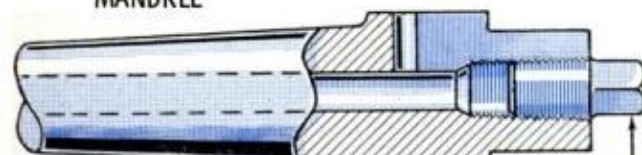


4 SMALL EXPANDING MANDREL

TAPER
PIN



5 LARGE EXPANDING
MANDREL



6 SCREW-TYPE EXPANDING
MANDREL

PIPE PLUG



7 LARGE FEMALE CENTER



8 CUP CENTER FOR WOOD

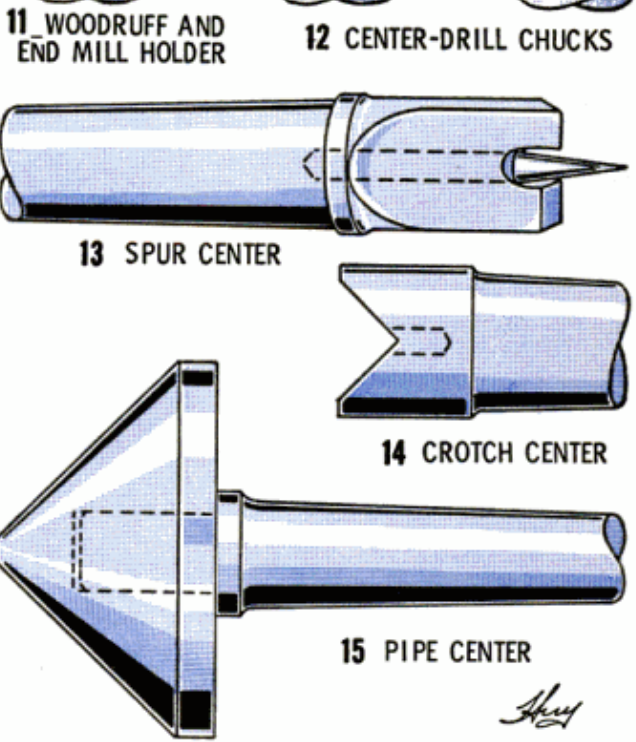
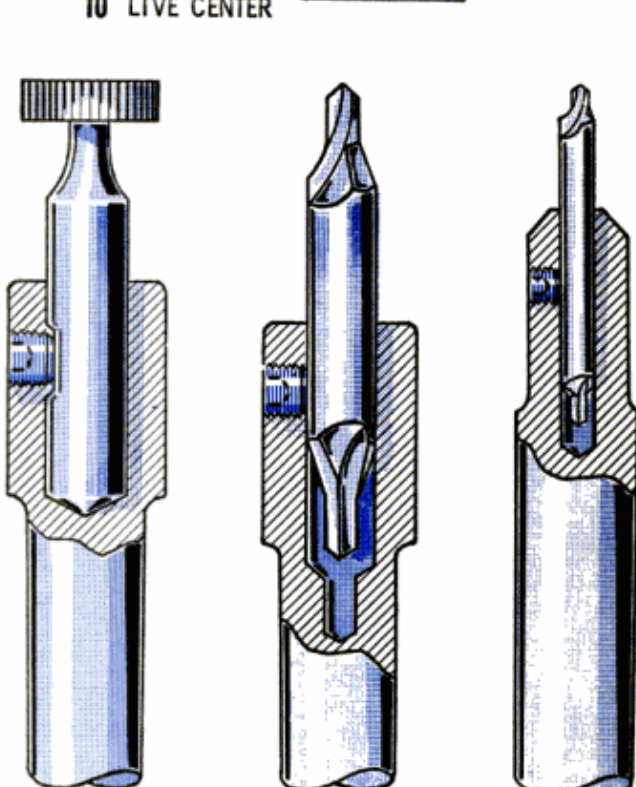
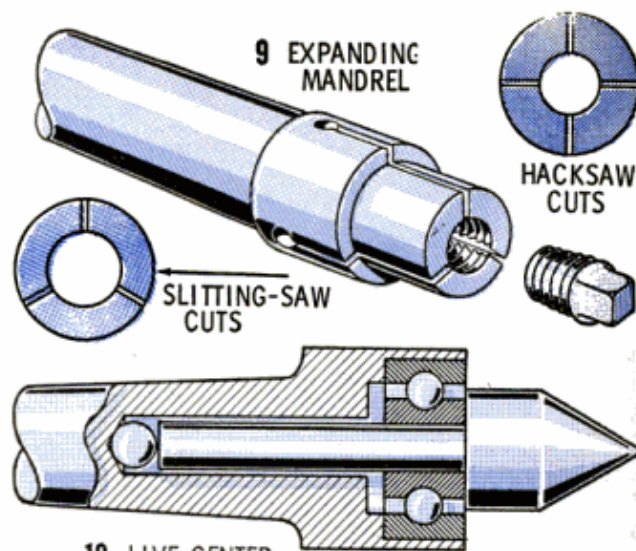
DON'T TOSS OUT the Morse taper shanks of worn-out twist drills. You can convert these discards into useful accessories for your metal lathe—such as the three centers and the small expanding mandrel sketched at the left.

The larger mandrels, the crotch center and the live center require bigger heads, so are best made from blank centers or semi-machined chuck arbors. You can buy these with No. 2 or No. 3 Morse tapers, and heads of various sizes that are soft enough to machine to any shape.

Taper-shank twist drills and reamers aren't usually hardened as far back as the shank, so the old tool can be cut off with a hacksaw or parting tool by inserting the shank directly into your lathe's headstock spindle. The projecting end can then be turned to shape and end-drilled as required. The mill holder (11) and drill chucks (12) are cross-drilled by using the tailstock's crotch center for support.

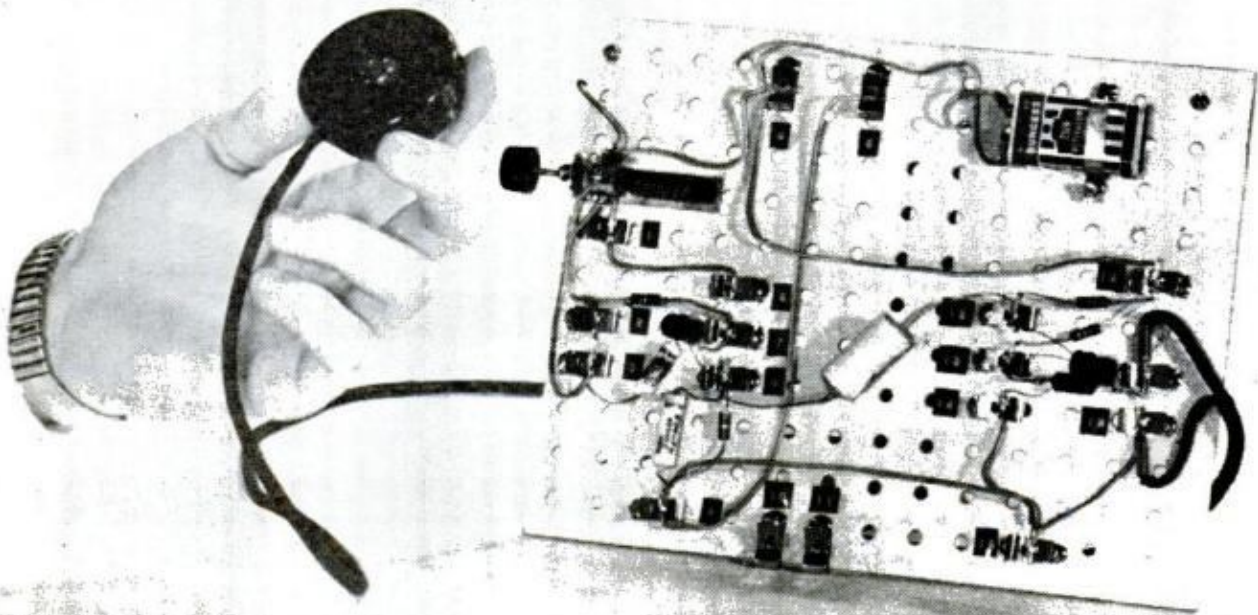
The outer diameter of the mandrels should be turned to an easy press fit in the center hole of the work to be mounted. After drilling for the taper pin or plug, cut the expansion slots last. Driving in the pin or turning plug expands the mandrel to center the work.—C. W. Woodson

- 1 LATHE CENTER**—light precision work. High-speed steel insert is driven in place. Harden center point and grind to 60-deg. included angle shown
- 2 HALF CENTER**—milled to provide tool clearance for facing end of work or external grinding of small diameters. Point is hardened and ground
- 3 FEMALE CENTER**—head hardened for small diameter or pointed work, after turning it to 60-deg. included angle and center-drilling to same angle
- 4 EXPANDING MANDREL**—for small diameter work. Drill and ream for standard taper pin. Three saw cuts allow expansion (see sketch of item 9)
- 5 EXPANDING MANDREL**—turned from blank center. Drill and ream for Morse taper. Again, saw cuts into radially-drilled holes allow expansion
- 6 EXPANDING MANDREL**—turned from blank center. End-drilled and tapped for tapered plug. End is sectioned for expansion with slitting saw
- 7 LARGE FEMALE CENTER**—drilled and bored to 60-deg. incl. angle. Hardened to support armature shafts and other centerless work in tailstock
- 8 CUP CENTER**—for wood turning. Turn cup to shape and end-drill to take replaceable steel point. Both cup and point are hardened after assembly
- 9 PERSPECTIVE VIEW** of item 6 with cutting details for expandability. If slitting saw is not available, use hacksaw to quarter with diameter cuts
- 10 LIVE CENTER**—head bored for firm press fit of ball bearing. Turn center point to 60-deg. incl. angle, harden and grind. Drop ball in shank hole
- 11 WOODRUFF CHUCK**—for mounting cutters with 1/2-in. shanks. Head cross-drilled and tapped for set-screw to lock cutter or end mill firmly in place
- 12 CENTER-DRILL CHUCKS**—make three sizes to permanently convert most-used center drills for quick-mounting in lathe headstock or tailstock
- 13 SPUR CENTER**—milled to shape in milling attachment, and end-drilled for replaceable hardened center. Driver tips beveled, hardened, ground
- 14 CROTCH CENTER**—for accurately centering round work to be cross-drilled in tailstock. Mill groove to 60-deg. included angle, end-drill 1/4-in. relief
- 15 PIPE CENTER**—for mounting tubular work between centers. Turn 90-deg. cone from steel and bore it to spin without shake on tailstock-mounted straight shank. Cone takes 3/8 to 3-in. diameter



Five-Way

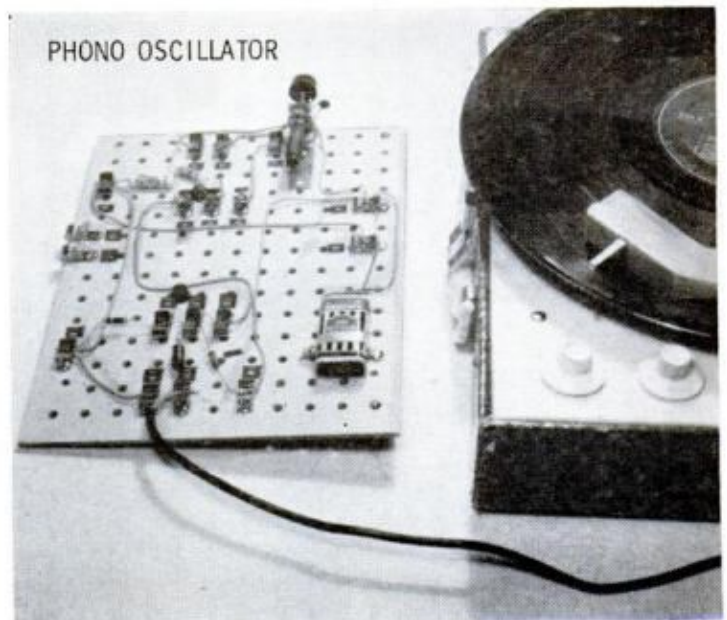
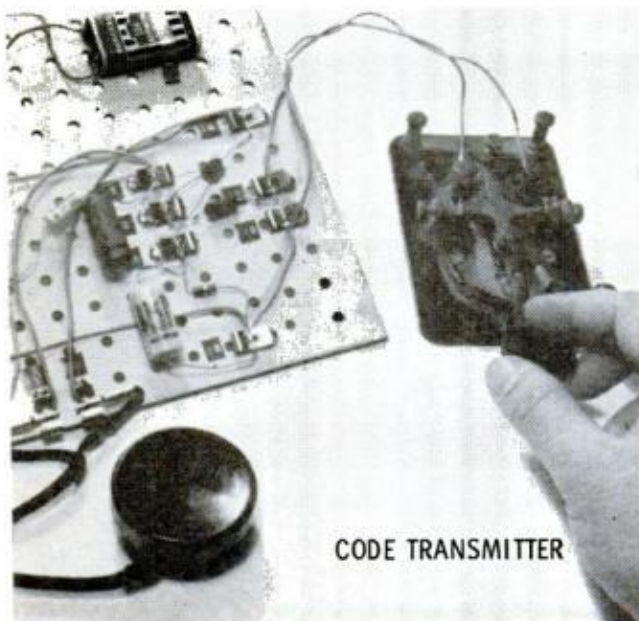
WIRELESS MIKE



EARPIECE BECOMES DYNAMIC MIKE when using the breadboard as a voice broadcaster. This setup is the basic wiring arrangement illustrated in Fig. 1. Add an antenna to clip 1 to increase the transmitter's range

ADD A KEY, make a few minor circuit changes and you can practice Morse code either listening in with the earphone or on a nearby AM table radio

CONNECT A PHONOGRAPH to the breadboard and you've got a small wireless transmitter that will broadcast recorded music to any AM radio receiver



Radio Breadboard

Parts costing \$6 turn into three different kinds of transmitters, a touch alarm and a radio receiver

By Len Buckwalter

HERE ARE FIVE electronic projects for the price of one. The secret's in the breadboard. Fitted with spring clips, it lets you shift parts around, create new circuits in minutes or restore old ones. Total cost of all components is about \$6. The only other item required is an AM radio—tabletop or portable. It's needed in several experiments to pick up transmitted signals.

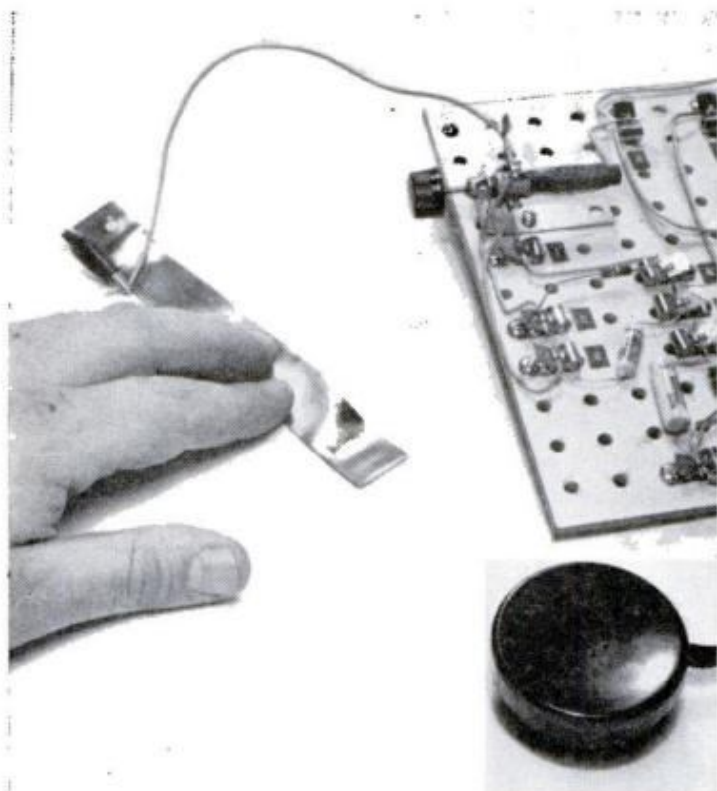
Preparing the board begins with mounting all clips. Their positions remain the same for all projects. Since connections are wired "by the numbers," label each clip, as shown. Next, mount the tuning coil (L1). Its three lugs must be soldered and connected to the correct clips as shown in the schematic diagram. While attaching these leads, also solder capacitor C1 into place from lug 1 to lug 2. These coils come with a variety of control knobs. If yours has a metal knob replace it with a plastic one or tuning will be touchy.

The battery is held in place by a strip of sheet metal bolted to the board. Two leads are soldered to its terminals. When you do this be sure to observe polarity carefully or none of the experiments described here will work. One battery lead, the positive one going to lug 5, serves as the on-off switch. Whenever the board is being rewired or is not in use, disconnect this lead to prevent shorts or unnecessary battery drain.

When wiring up the experimental circuits, you'll find that using the clips is much easier if you press them open with the tip of a screwdriver, rather than with your fingers. Slide the transistors into place after doublechecking the connections for their three leads.

Voice Broadcaster

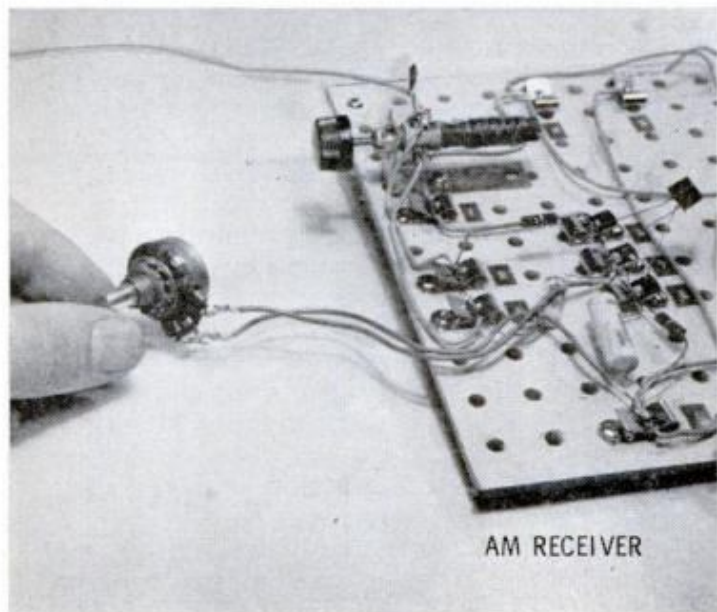
Set up the board following the wiring in Fig. 1. After all connections have been checked, apply power by sliding the positive battery lead into clip 5. Then turn on your AM radio and tune it to a clear spot on the dial. Set the volume control for a normal listening level. (Place the radio a



TOUCH ALARM

WITH TOUCH ALARM assembly a light touch of a finger on the metal trigger plate sets off an audio tone, which is heard from the earphone

WANT A TWO-TRANSISTOR AM regenerative radio set? Just make a few more wiring changes and there you have it. Add a 30-foot antenna for best reception



AM RECEIVER

few feet from the board at this time.) Now pick up the earphone (it is used as a microphone here) and holding it close to your mouth, speak into it. As you talk, rotate the tuning knob on coil L1 completely through its range. You will hear signals at several tuning points but only one of these is correct. It is readily identified as it is the only one that produces the voice, *loud and clear*, in the radio speaker.

It's possible to switch your transmission to any desired portion of the broadcast band. Simply screw in the tuning knob to lower the broadcast frequency and retune the radio receiver to pick it up.

The range of the little broadcaster is several feet. This can be increased by adding a short length of hookup wire to coil terminal 1. Do not add an antenna that is more than five feet long or the transmitted signal will violate FCC rules on such low power broadcasts.

Phono Oscillator

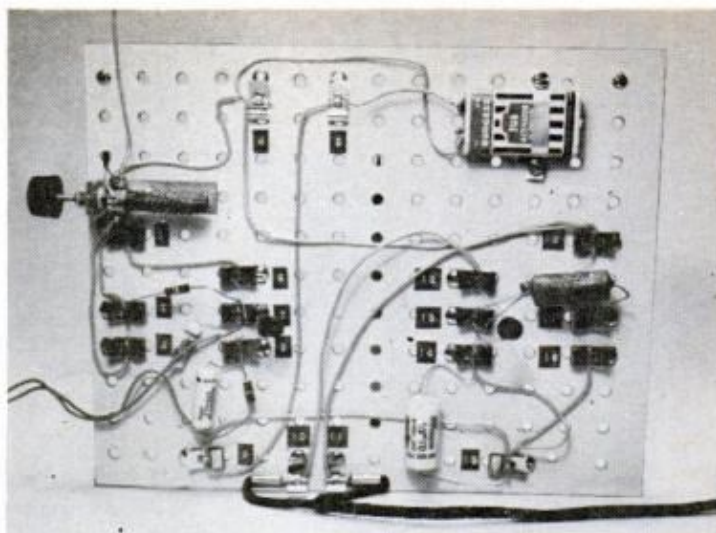
A simple conversion adapts the voice broadcaster for transmitting music from a phonograph to the radio. Remove the earphone from clips 17 and 18. Then connect a shielded cable from the phono cartridge in the pickup arm to these terminals as shown in Fig. 3. For best results use a crystal type phono cartridge to insure a strong signal.

Code Transmitter

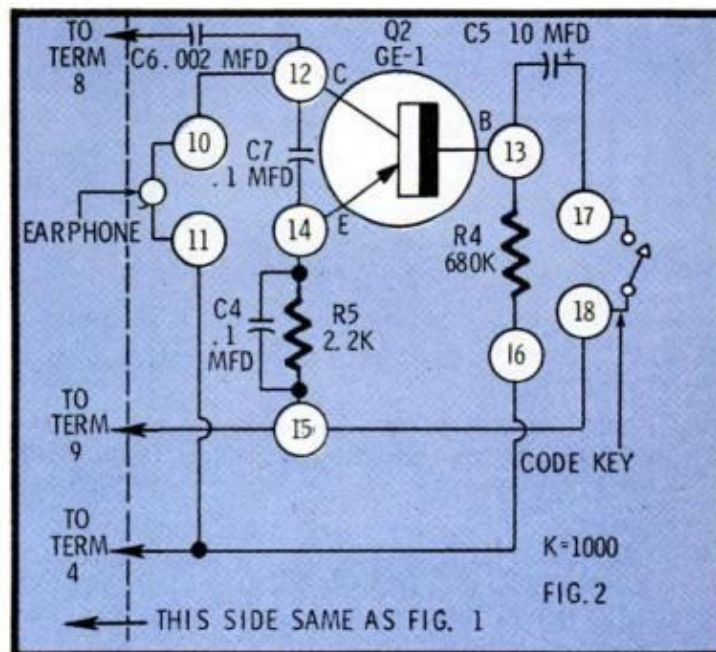
Unlike most code transmitters, the one shown in Fig. 2 produces an audible tone in an ordinary AM radio without the specialized circuits of a communications receiver. Instead, the transmitter generates an audio tone which is then applied to a radio-frequency carrier for transmission. If used for code practice, the receiver may be in another room listening to signals on the radio as the sender operates the key. The sender needs no radio since he hears the identical tone in his earphone.

Much of the earlier circuit (Fig. 1) surrounding transistor Q1 remains the same,

Parts List	
R1	—270,000 ohms, 1/2-watt resistor
R2	—4,700 ohms, 1/2-watt resistor
R3	—10,000 ohms, 1/2-watt resistor
R4	—680,000 ohms, 1/2-watt resistor
R5	—2,200 ohms, 1/2-watt resistor
R6	—200 ohms, 1/2-watt resistor
R7	—100,000 ohms, carbon potentiometer
C1	—330 PFD, 600 volts, ceramic disc capacitor
C2	—.001 MFD, 200 volts, paper capacitor
C3	—.01 MFD, 200 volts, paper capacitor
C4, C7	—.1 MFD, 200 volts, paper capacitor
C5	—10 MFD, 15-volts, electrolytic capacitor
C6	—.002 MFD, 200 volts, paper capacitor
Q1, Q2	—GE-1 transistors
L1	—Tapped transistor coil (Superex VLT-240)
BATT	—9 volts (Burgess 2U6 or equivalent)
Earphone	—1,000 ohms, PM type
Miscellaneous	perforated hardboard 7 x 9 inches;
	18 Fahnestock clips (H. H. Smith 553); 6-32 x 1/4" machine screws and nuts; No. 20 hookup wire



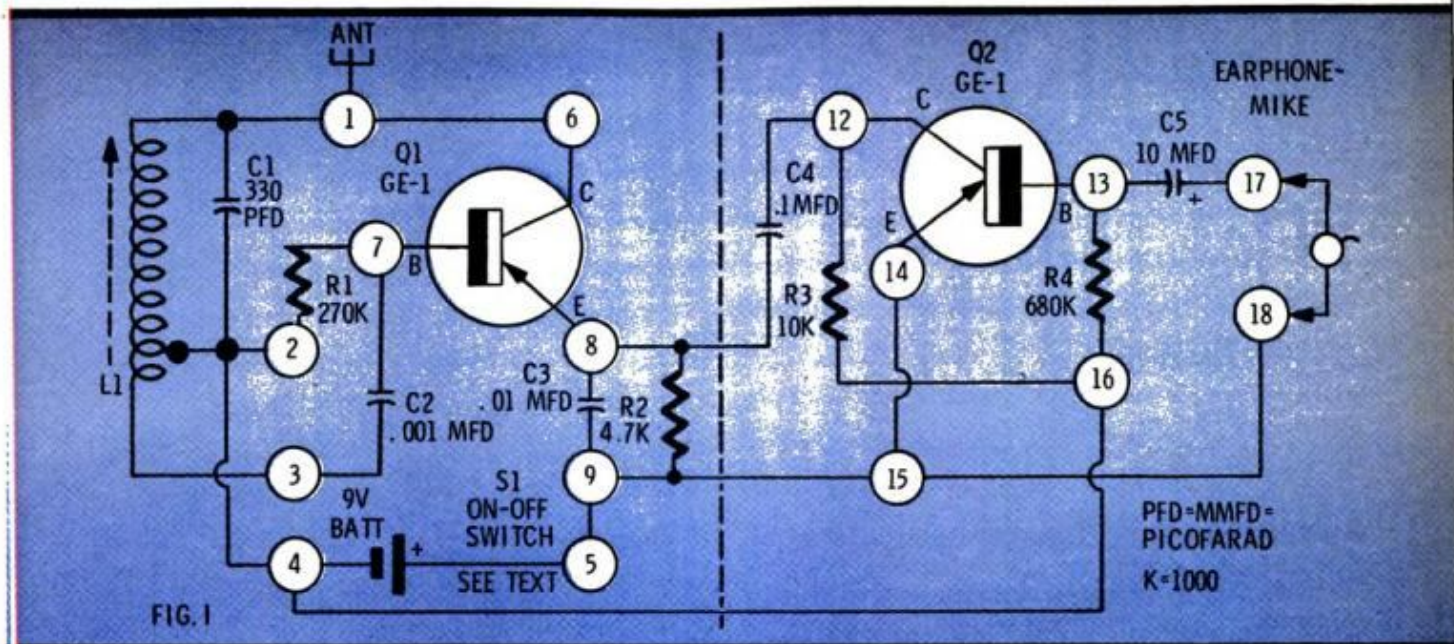
FIVE-WAY CIRCUIT BOARD set up for use. Earphone doubles as a microphone. Minor changes in wiring convert the circuit to perform its other varied duties



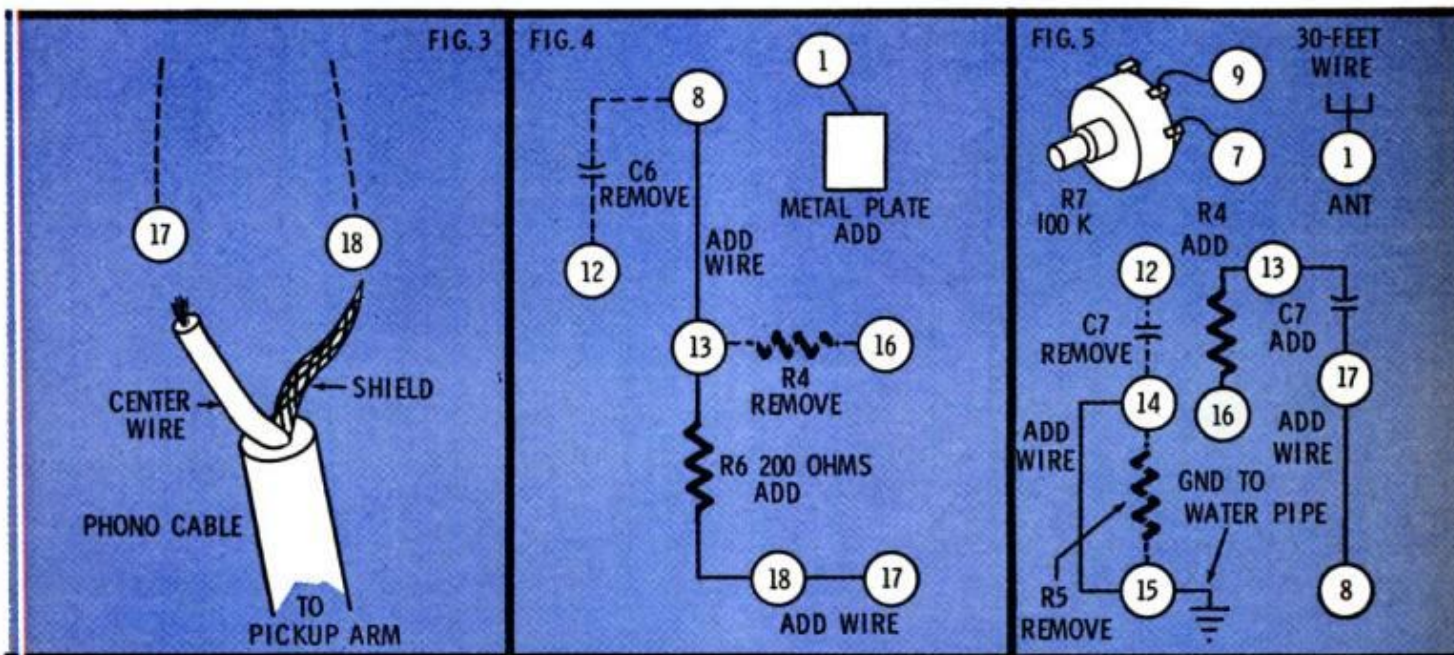
WHEN YOU CHANGE the wireless mike to a code transmitter you'll have to rewire the second transistor stage. This diagram shows the new wiring setup

but the second stage around Q2 is rewired as shown in Fig. 2. Just compare Fig. 1 to Fig. 2 to determine the new connections. When testing the completed circuit and tuning it to the radio receiver frequency follow the same procedure as for the voice broadcaster. Use a screwdriver to short terminals 17 and 18 during this adjustment. Shorting these terminals produces a steady transmitted tone. After you are set up, connect a key at this position and you're ready for wireless code practice.

In this circuit, the touch of a hand on a metallic object triggers an alarm tone. Although it doesn't use the AM radio, it



HERE'S THE START. When your breadboard is set up following this wiring arrangement, you have a wireless mike (a voice transmitter). All the other circuits derive from this one, so refer back to this in making other changes



SHIELDED CABLE is used to connect a phono cartridge to the input of the transmitter circuit

TOUCH ALARM is set up by making circuit changes detailed here. Dashed circuitry shows parts to be removed

LITTLE 2-TRANSISTOR receiver also calls for wiring changes. Follow this sketch and text

relies on radio waves for its operation. The audio tone is heard in the earphone. In operation, radio-frequency oscillator (Q1) is disabled by the electrical disturbance introduced by the hand. Voltages on the transistor change and "unlock" the audio oscillator formed by Q2.

A complete circuit for the alarm is not shown since it is set up merely by making the following modifications to the code transmitter in Fig. 2. Details of these changes are shown in Fig. 4.

Starting with the code transmitter, remove R4 from clips 13 and 16. Next, remove C6 from clips 8 and 12. Now install

R6 (200 ohms) between clips 13 and 18 and add a wire from 17 to 18. Also attach a metal plate or other metal object to a short lead connected to terminal 1. A tone will be heard as soon as the plate is touched, triggering the alarm. Sometimes sensitivity can be improved by connecting an additional wire from clip 9 to a nearby ground (like a cold water pipe). If the tone does not cut off when the plate is not touched increase the value of resistor R6 until it does.

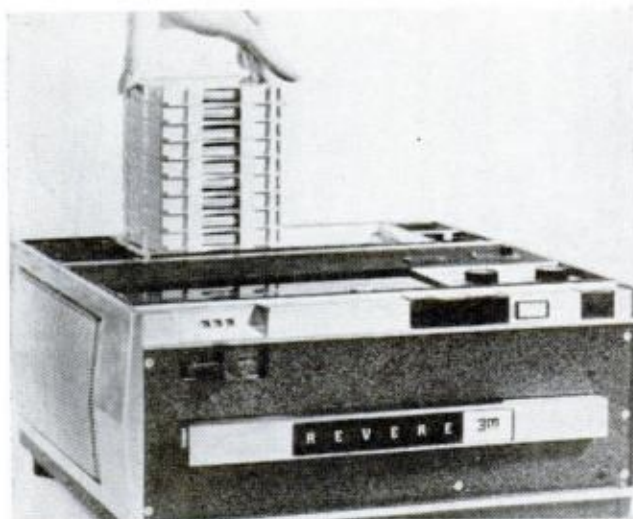
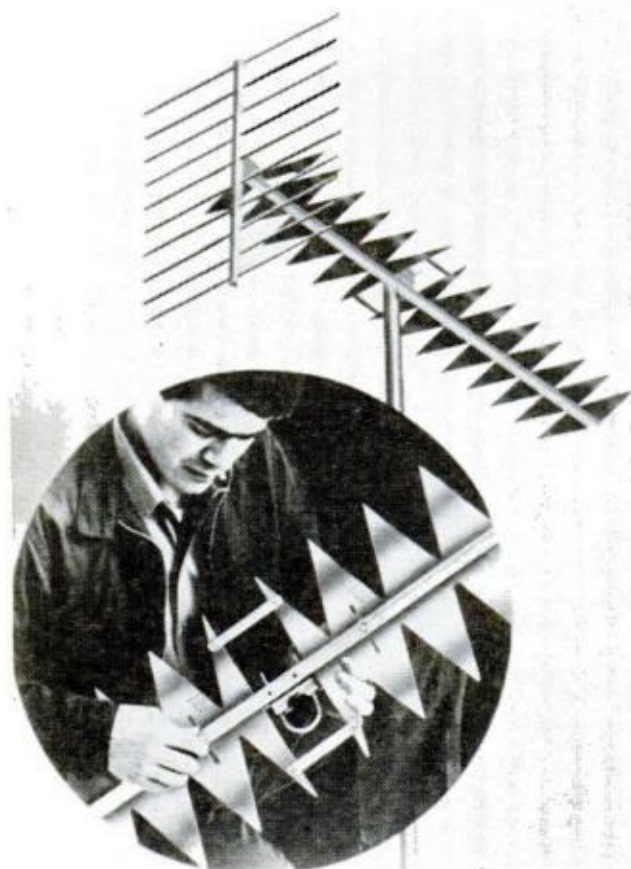
Adding one component and making a few modifications to the touch alarm con-

(Please turn to page 210)

New in Electronics

POCKET TRANSMITTER no larger than pack of cigarettes keeps modern executive in constant touch with switchboard or his secretary no matter where he is in the factory. The Multitone Talk Back weighs only 2½ ounces and has a range of about two miles

HI-FI THAT HANGS ON THE WALL lends itself to the decoration of the most crowded livingroom. Package is made up of two speaker cabinets, record player, all-transistor stereo amplifier and AM-FM-stereo tuner. The Phonola Solar System is priced at \$399.95



STEREO TAPE CARTRIDGE RECORDER can automatically play stereophonic music for as long as 15 hours. Just stack up the cartridges to be played in the desired order and the Revere M-2 does the rest. The automatic tape changer system sells for \$399

ADJUSTABLE UHF TV ANTENNA is the first of its kind. When being installed the technician sets the Band-saw for the portion of the UHF spectrum local UHF stations are using. The 13-element Channel Master antenna is \$15.95. A 22-element version is \$19.95

Remodel with Drywall

(Continued from page 168)



BENDING PLASTERBOARD to fit inside an arch is similar to bending plywood. Score the plasterboard across the back every few inches, depending on radius of bend. When board is nailed up, any angles that show on face can be smoothed with joint cement

use. The straight shanked nail does a good job. The annular ring nail, with its greater holding power, is designed to cut down on nail popping. However, either type will pop if the drywall is not properly applied.

The other product, corner bead, is nailed to outcorners after panels are up to trim off and protect the corners. Again, there are two general types. One is all metal; the other has a metal center with perforated tape along both sides.

Which one do you use? Again, it's a matter of preference. We feel if there are children in the home who seem to take delight in knocking into corners, the all-metal will provide maximum protection. It's slightly more expensive than the metal-tape combination.

Cover Taping Next Month

Next month we will discuss the taping and cementing of all joints and corners. Also included is a summary roundup of the new remodeling types of plasterboard panels now available and what special techniques are needed when working with them. As a bonus, we'll tell you what to do should those newly installed panels (or your old walls) become damaged. This will include the latest information about how to combat that chief nemesis of plasterboard—popping nails. ★★★

APRIL 1965



nuts & bolts

Jig saws, abrasive bands, auto parts, skilled mechanics... anything? Just let your fingers do the walking. Action-People do.

NEW TUFF CASTING RESIN



CLEAR THING

*for creating decorative
panels and embedding
art objects!*



New TUFF Clear Casting Resin opens a whole new dimension in creative craftsmanship. Now you can cast crystal clear decorative panels and blocks on your first try. Embed butterflies, leaves, flowers, treasured photos, coins, jewelry, even junior's baby teeth, in clear TUFF resin to create beautiful wall plaques, mosaic table tops and trays, dividers, desk sets, identification tags . . . your imagination is the limit. TUFF preserves objects permanently. And it's easy and fun to cast. TUFF hardens chemically . . . quickly. Ask for TUFF at your hardware store or hobby shop. If they don't have it, write to GLASS PLASTICS CORPORATION, 1261 West Elizabeth Avenue, Linden, New Jersey.

Ask for your free copy of our new idea-packed booklet: *Creating with Clear Casting Resin.*



CLEAR CASTING RESIN

GLASS PLASTICS CORPORATION, LINDEN, NEW JERSEY

Five-Way Radio Breadboard

(Continued from page 199)

verts the board to a 2-transistor AM receiver. It is a regenerative circuit and has reasonably good sensitivity. Transistor Q1 becomes an oscillating detector while Q2 serves as an earphone amplifier.

Radio Receiver Changes

Assuming that the board is set up for the code transmitter, follow this sequence of circuit changes. Fig. 5 also acts as a guide. Remove C7 from 12 and 14. Remove R5 from 14 and 15. Remove key from 17 and 18. Install R4 between 13 and 16. Install wire from 14 to 15. Install C7 from 13 to 17. Install wire between 17 and 8. Solder two wires to the middle and one end lug of R7 (110K potentiometer) and hook these wires to 7 and 9. You'll also need a long antenna, about 20 or 30 feet of wire connected to terminal 1. Run a ground wire from 15 to a cold water pipe.

While listening to the earphone, start turning the coil knob through its range. As this is done vary the setting of the potentiometer. This is the regeneration control. If it is set too high there will be an annoying whistle behind each station tuned. With a little practice you'll be able to find the correct setting for each station.

There you have your five radio circuits. You may find some of them so interesting that you'll want to set up that particular circuit permanently. If so wire it up on a perforated phenolic board without the connecting clips. ★★★

Pesticides Contaminate Sea

The seas around Britain and the north-west European countries are substantially contaminated by "organo-chlorine" pesticides which are washed off farmland and carried down by rivers.

Eggs of 52 species of seabirds, all feeding on fish, marine mollusks or plankton, were collected from four sites hundreds of miles apart. Upon examination, all eggs were found to contain residues of poisons varying from 0.2 to 8.9 parts per million. This shows "an astonishing and widespread contamination of the sea and its fauna," according to a recent report of the British Government's Nature Conservancy for 1964.

Studies are currently being conducted by the Nature Conservancy to determine the extent of insecticide contamination. Bengalese finches are being bred to study the sublethal effects of residues on reproduction and behavior, and wild house sparrows are being caught and used for toxicological tests.

NEW HARLEY-DAVIDSON M-50...



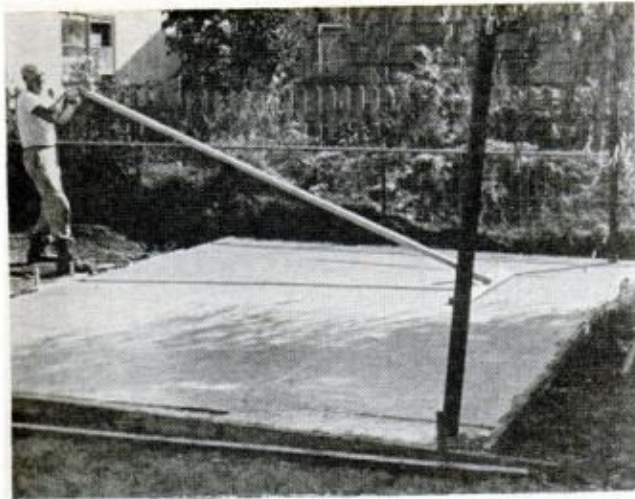
Has a natural instinct for fun:

Fun is born into an M-50. Whether you're high-tailing it to the local drive-in to soak-up the action, or neatly threading your way through traffic, you'll find the M-50 has an uncanny knack for stirring up fun and excitement — over any kind of road. Looking for kicks? Like to be scot-free? Want to come and go as you please without asking for the "family wheels"? Stop at your Harley-Davidson dealer — take a friend along — and ask for a "go" with the new M-50. More than 700 franchised dealers selling, servicing and stocking genuine Harley-Davidson parts throughout the U.S. Low-cost insurance easily available.

ONLY
\$225
plus low delivery
charge

*M-50, a new way to put
fun in your freedom,
naturally.*





AFTER JITTERBUGGING, smooth concrete with home-made bull float—a 2x6 nailed across end of long 2x4 to let you work wet concrete from outside the form

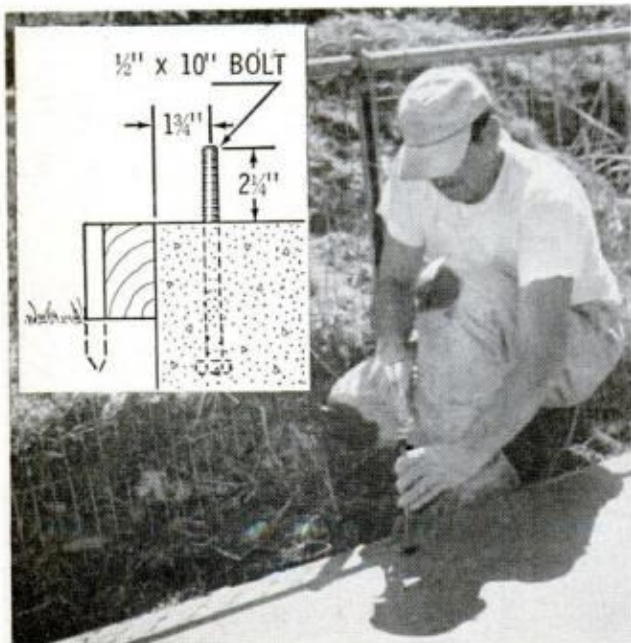
PM's Patio Garage

(Continued from page 145)

brief, the "lucky-seven" steps toward professional slab work are: (1) pour and spread the concrete; (2) rod off to level the pour; (3) consolidate the mix by "jitterbugging"; (4) smooth with the bull float. Then, when the concrete has set sufficiently to bear a man's weight on knee and toe boards, the finishing steps begin: (5) go over entire surface with a wooden float; (6) after considerably more setting up, smooth and equalize the surface with a rectangular steel trowel; (7) a considerable time later, when the concrete is firm enough not to erode away, go over the surface with a rubber float (sponge rubber on the bottom of a wood float—a

(Please turn to page 214)

ONCE SLAB HAS SET UP and has been finished with hand floats, tap foundation bolts into place to anchor privacy screen along rear edge of the patio



BILL OF MATERIALS

The following is the builder's list of all materials required to construct the garage as shown in the photographs on page 136. This includes such optional details as the bench and planter boxes, and redwood-stained board-and-batten siding. The list is offered here for guidance in estimating your local costs, and in ordering lumber and supplies. For PM's garage, the lumber was supplied by Western Wood Products Association (formerly, Western Pine Assn.) and was all Douglas fir, except where otherwise specified; all grades were Construction or Standard, except where noted.

LUMBER

50	2x4 x 16'	(Studs)
1100 lineal	2x4	(Framing)
70 lineal	2x6, pressure-treated	(Mud sill)
34	2x6 x 14'	(Rafters)
2	2x6 x 8'	} clear (Garage door framing)
1	2x6 x 18'	
6	2x6 x 10'	clear (Frieze boards)
2	2x6 x 16'	clear (Swept-back facing rafters)
16	2x10 x 20'	Ceiling Joists; Door headers in patio wall)
2	2x10 x 12'	(Headers over windows)
2	2x12 x 18'	(Lintel beam)
2	2x8 x 18'	(Ridge board)
6	1x8 x 18'	(Fascia board, cabinet work, door jambs, etc.)
130 lineal	4x4	(Framing for privacy screen)
1200 bd. ft.	1x8 shiplap	(Roof, attic deck)
50 lineal	1x5, clear	(Patio wall, doorways, etc.)
216 lineal	1 x 12	(Shelving)
12	1x2 x 8, clear	(Slats for bench seat)
14 lineal	2x12, clear	(Bench back and legs)
1	4x4 x 6', clear	(Bench feet)
32 lineal	2x12, pressure-treated	(Planter boxes)
1	2x4 x 10', pressure-treated	(Box feet)
1	1x24 x 6'	Laminated pine (Sink cabinet top)
110	1x8 x 8'	1&g pine paneling (Wall cover for storage and sink compartments, garage entry, closet)
6	1x4 x 12'	} Sway braces, etc.
6	1x4 x 14'	
1600 lineal	1x12, rough-cut, tight knot	Western Red Cedar (Siding, Patio-wall doors, fences, battens)

NAILS

50 lbs.,	16d Box
25 lbs.,	8d Box
16 lbs.,	16d Box, Galvanized
10 lbs.,	8d finishing
3 lbs.,	8d finishing, Galvanized
1 lb.,	6d Box, Galvanized
1/4 lb.	2" Concrete Nails

ROOFING

9 squares	Asphalt Shingles
1	Starter Roll
3	Rolls 15-lb. Building Paper
30'	Special Metal Edging (Overhang end of roof)
30'	1 1/2" Sheet Metal Angle Roof Edging (Other gable)
10#	7/8" Roofing Nails
	Gutters and Downspouts

FINISHING

Redwood Stain, 9 gallons

PLUMBING

16"x20"	Plain Sink with Fittings
5/8" o.d.	Copper Tubing Water Line, as required, for
1 1/2"	Pipe for Drain, as required

ELECTRIC WIRING

12-2	Underground Cable w/ground, as required, for lighting system, wall outlets
12-2 and 10-2	Indoor Cable with ground, as required, for wiring inside garage
	Two post lamps
	Two porch lights
	Boxes, lighting equipment, switches, duplex outlets, etc.



A special Chevrolet we'll practically custom tailor for you

There are nearly 200 custom touches you can have us add to make this Impala Super Sport as unique and personal as you like.

There's an AM-FM Stereo radio you can add. Black vinyl roof cover. Tinted glass. Four-Season air conditioning. Seven-position Comfortilt steering wheel. Tachometer.

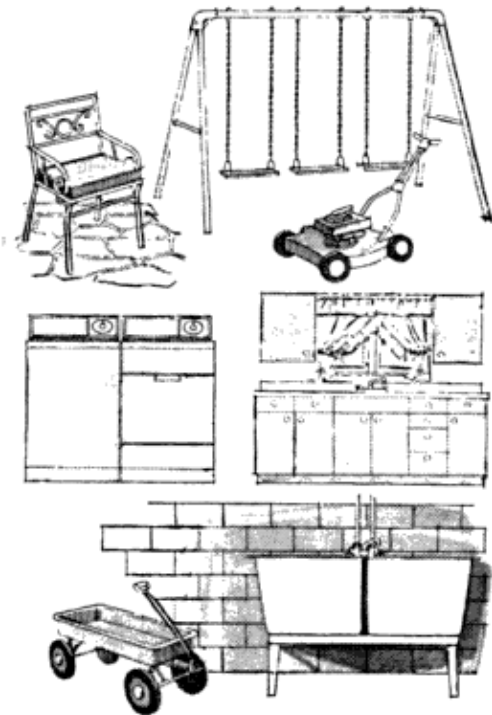
You combine all this with a Super Sport's front bucket seats, center console, all-vinyl interior and wall-to-wall deep-twist carpeting, and that's about as special as a car can be.

Your Chevrolet dealer has a book listing everything this Impala comes with and all the special touches you can add. He'll be glad to show it to you.

And remember, this is a custom-tailored *Chevrolet* we're talking about. So it's like ordering a suit from a wonderful little old tailor who hasn't heard what those shops with the fancy names are charging for the same thing. . . . Chevrolet Division of General Motors, Detroit, Michigan.



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PM's Patio Garage

(Continued from page 212)

special finishing tool) to roughen the surface so you won't slip on it in rainy weather. To assure a neat corner on the two outside edges, your final finishing step is to run an edger between the not-yet-set-up pour and these form boards.

You'll note that we poured my slab directly on the ground, without reinforcing of any kind. Where frost-heaving is likely, you'll probably want to lay welded wire fabric in the pour to prevent cracking.

As soon as you've laid the patio slab, pour the garage footings in the trenches to a depth of 6 in. (previously driven stakes mark this depth) and jitterbug to smooth and level them out.

A clean-working mix—which we used throughout—is 1:3:4; one part cement, three of sand and 4 of gravel. The proportions may vary in other localities, owing to climatic conditions. Consult your ready-mix concrete supplier.

Be sure to insert foundation bolts along the rear edge of the patio slab for tying down the privacy screen. Also locate a hook-bolt for the tie-down under the eave-beam post at the front corner of the garage. The dimensions of this welded tie-down unit (to be detailed later) require that the bolt be positioned 1¾ in. from the front edge and 42½ in. from the garage edge of the patio. To safeguard against the patio cracking under the support beam, I dug a 12x12x12-in. hole here, before pouring the patio, so that the concrete, flowing into it, would create a footing. The hook bolt is then embedded in this footing.

To assure proper curing, hose the concrete off for several days after it's set.

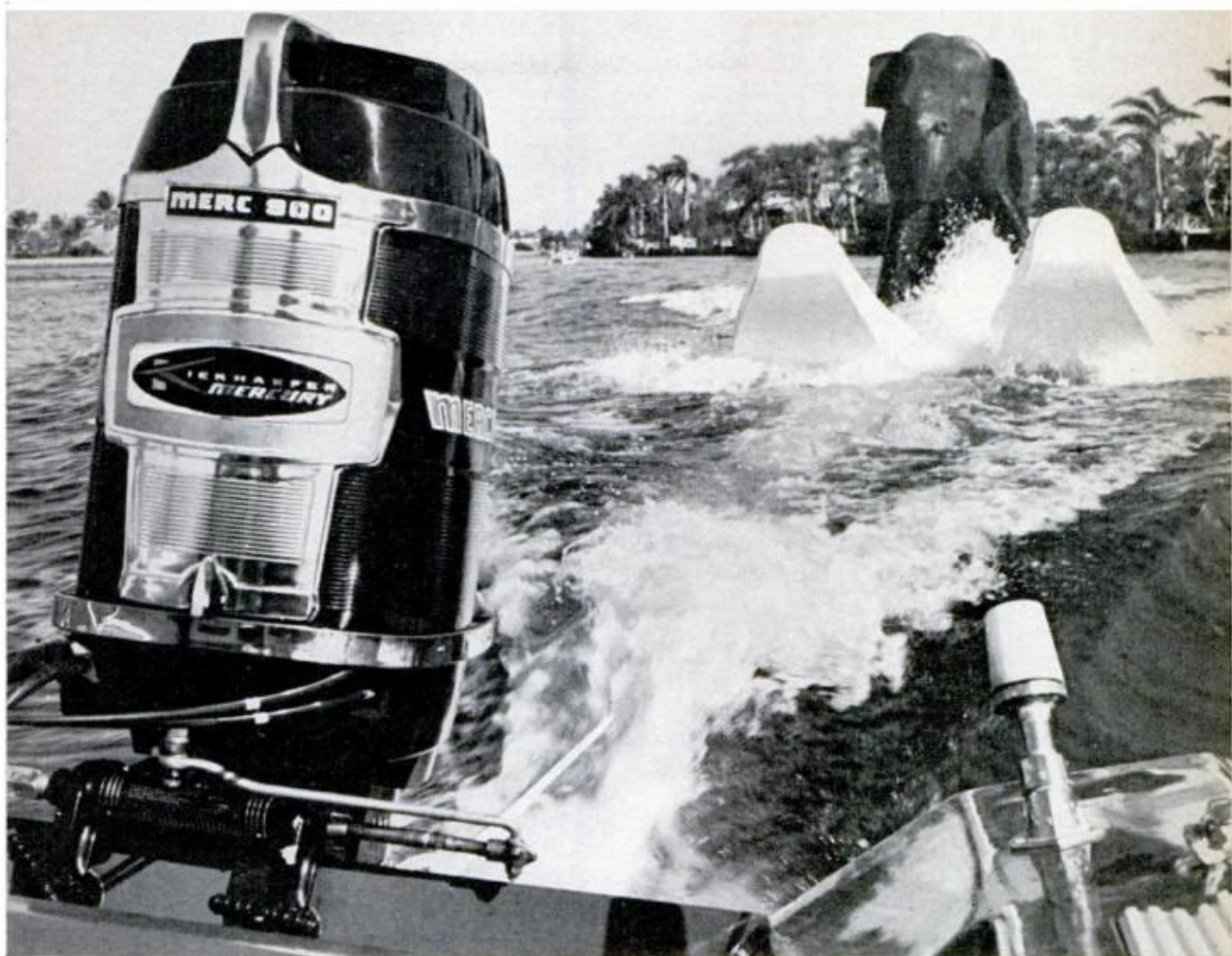
(Continued next month)

Even Birds Get Fat

Swallows, warblers and other long-distance travelers may have as much as 50 percent of their body weight stored in fat reserves when they are ready to fly on long migrations in the spring. This fat provides energy to the winged voyagers during long flights, across the oceans or at night, when they cannot or do not stop for food, report Drs. James R. King and D. S. Farmer of Washington State University, Pullman, Wash.

Yet at other times of the year, these same birds, when molting or reproducing, can grow exceedingly thin. During these lean times of the year, the fat reserves are only 5 percent of the body weight.

Even captive birds, kept outside in cages, show the same cyclic variations in their fat reserves as wild birds.



Pulls an elephant... runs on peanuts

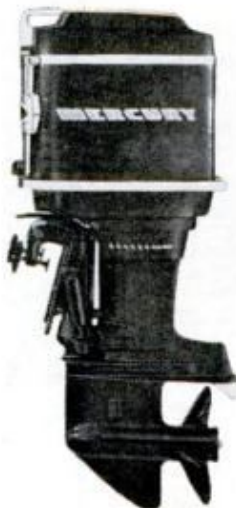
The new 90 hp Merc 900 can pull an elephant yet it uses less fuel than 75 hp outboards. The elephant and skis weighed as much as 28 skiers and, although we doubt that you will ever want to pull an elephant (or 28 skiers), we know you want *real* performance plus fuel economy for your boat.

With a Merc 900 on your transom, you can outrun and outpull any other 90 hp outboard . . . and do it on far less fuel. Some of the reasons for this kind of performance are: Power-Dome combustion chambers that squeeze more energy from every ounce of fuel; new internal reed valves, and improved carburetion techniques. Mercury's propellers are more efficient . . . they are low rpm and large diameter for less slippage and cavi-

tion drag. Mercury's new dry exhaust system reduces back-pressure, improves engine breathing, and boosts power at the prop.

50% Quieter. This new exhaust system also helps make the new Mercs 50% quieter. Silencing was accomplished by using new principles of sound engineering . . . not by adding fat, sound-and-gasoline absorbent padding.

Ask your dealer for a demonstration ride . . . you'll be able to see *and hear* why Mercury gives you more RUN for your money . . . 100, 90, 65, 50, 35, 20, 9.8, 6 and 3.9 horsepower.



MERCURY 

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The Terrible Twisters

(Continued from page 105)

cloud on the set. He wanted me to cancel the warning, but I didn't. Within an hour he picked up a storm echo. Within another hour he was tracking the tornado."

Tornadoes show themselves as characteristic "hooks" on the radar scope. Once formed, they can readily be tracked. People in their paths can then be precisely warned.

The weather bureau also tries to keep track of twisters through eye witnesses. The Kansas City office each February activates a network of observers spaced one per five square miles. Police, fire and civil defense officials report via a special "hot line" phone.

Some Are Unseen

Even so, not all tornadoes that occur are seen. Darkness, low clouds, or both, often hide funnels from view. That's why the tornado forecasters feel they really do better than the score shows.

The tornado that they most frequently miss is the isolated one that strikes from a lone, suddenly violent cloud.

Tornado forecasting is about as good as it's going to get with existing techniques. That's what makes storm research so important.

New techniques are sometimes based on discoveries made by accident. That's how the U-2 got into the picture. One day in 1961, a pilot from Edwards Air Force Base, Calif., was steering his long-winged plane back home. At 60,000 feet, he passed over an anvil top. He was amazed at what he saw. It was, he explained on landing, like looking down into Los Angeles Coliseum. There was a gigantic hole near the center of that monstrous thunderstorm.

Since then, systematic U-2 flights have been made as part of the National Severe Storms Project. The characteristic "doughnut hole" was found and photographed on the first such flight. It was in a thunderstorm that was part of a squall line that flipped out tornadoes six minutes later into Oklahoma. Photographs show that the giant vortex had been hidden just 12 minutes before by a thin ice layer.

Three and a half miles across and twice as deep as the Grand Canyon, the thunderstorm vortex is an awesome sight. It's a supersized whirlpool that looks like a drain to the center of the earth.

Dr. Donald R. Fitzgerald, an Air Force Cambridge Research Laboratories meteorologist who analyzed the U-2 photos, calculates that these vortexes spin at 100 mph at the top and 300 mph deep inside. And it seems certain, he says, that they

extend all the way down through the thundercloud and provide the torque to drive tornadoes, which are much smaller. (Eye witnesses have, over the years, told how they looked up when a twister passed overhead and could see all the way up to the clear blue sky.)

Thunderstorm vortexes could well be another factor to be added to everyday tornado forecasting. A weather satellite's cameras could easily pick them out.

While the U-2s flew over tornado storms during the Oklahoma project, F-100 and T-33 jets flew into them, and instrument-laden C-130s flew around them.

The daredevil pilots radioed back some harrowing experiences inside the monster storms. They were tossed aloft on unbelievably powerful updrafts. Lightning sizzled all around them as they tried to ease back down. Shuddering gusts slapped the big craft around like pieces of tissue paper. The wings curled and slapped up and down. Fuselages twisted like torsion bars.

The grueling test battered men and planes. Here's the damage done to one aircraft, mainly by rain and hail: hammered radome, with complete puncture in one spot; left cooling door torn loose; extremely damaged jet inlet ducts, one with five holes punched through; bent wing fillets; badly dented wingtip tanks; hammered, flattened, and punctured vertical fin; and dented horizontal stabilizer.

At the same time, sensitive instruments aboard a C-130 recorded some interesting things. When the storm cloud reached tornado ferocity, its electrical character changed. Lightning discharges became more frequent and less intense.

With the lightning came unique "sferic" patterns. Sferics are the crackling static on your radio caused by thunderstorms. Directional antennas show that clouds produce the most radio noise (at 500 kc) both at early formative stages and at late severe stages. More than 20 discharges a second indicate a tornado-producing cloud.

Confirmed by Tornado Viewers

People who have been close to tornadoes confirm what the electronic instruments record. The lightning that accompanies twisters is strange and almost continuous.

Such eyewitness reports inspired Dr. Bernard Vonnegut of Arthur D. Little Co., Cambridge, Mass., to form an electrical theory of tornadoes.

People have written to him from all over the country to tell him of strange glows and electrical discharges in and around tornadoes:

An Oklahoma woman saw a ball of fire that flashed when a twister hit her storm

(Please turn to page 218)



Front runner

Gravelly attachments are out-front for greater maneuverability, safety, performance.

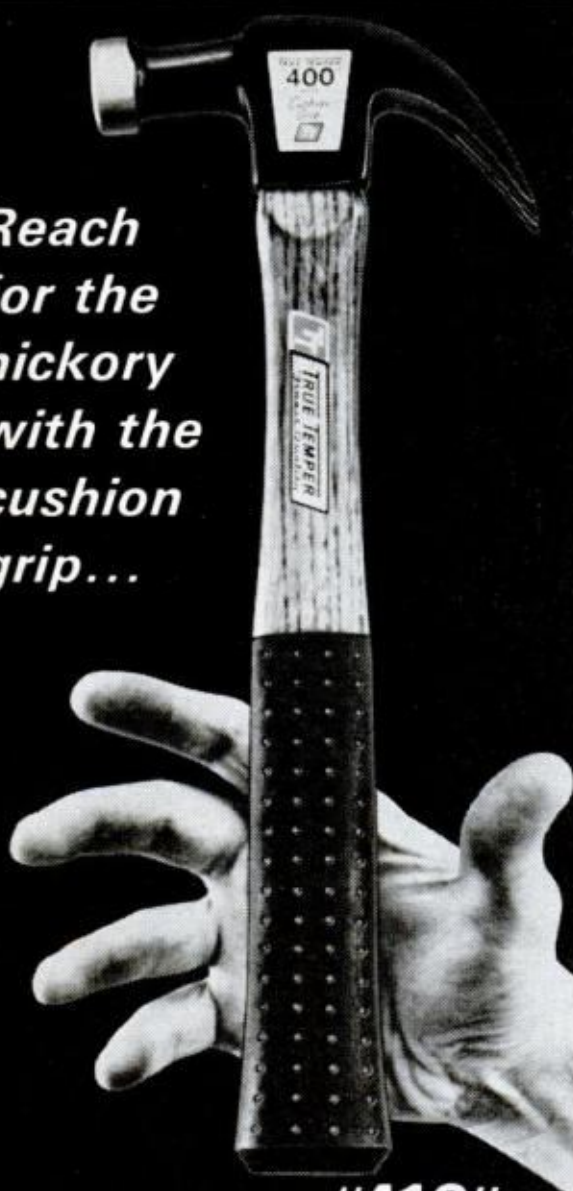
The Gravelly charges into lawn and garden chores head first. It has a nose for new ways of getting tough jobs done faster, easier, better. With safer out-front attachments working for you, you can see what you're doing all the time. And you'll like what you see. Mowing is just a walk (or ride, if you're sitting on a sulky), plowing a garden is a quick caper, and scooping or blowing snow is a snap. With 31 attachments, Gravelly has the fixtures and features you deserve. Give the Gravelly a go at your local dealer's now. Or give the Gravelly a look in our new, free catalog. Write now; it's a whiz . . . and so is the Gravelly. **Get your Front runner on our budget plan.**

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*Reach
for the
hickory
with the
cushion
grip...*



TRUE TEMPER "416"

Here's real hammering comfort and confidence. Solid hickory handle—Fire-Hardened®—with the famous Rocket® shock-absorbing cushion grip. Securely bonded to the wood. Won't slip, even if your hand is wet or has a glove on it. The "416" is professionally shaped, professionally balanced—yet popularly priced. And check these extra quality features: hard drive head heat-treated three ways, resilient claws, extra-strong socket.

No. 416 16-oz. nail hammer **\$366***

"400" series with cushion grip also in 7, 13 and 20-oz. nail hammers; 16 and 20-oz. rippers; and hatchet.

**Manufacturer's suggested retail price. Available throughout the United States and Canada.*

TRUE TEMPER®

The Terrible Twisters

(Continued from page 216)

cellar. A Connecticut housewife saw "a bright flash like brilliant lightning right down in the base." A Kansas pilot reported that the center of a funnel was "luminous with yellow-green." A Florida scientist said of a tornado that hit Miami: "Its lower extremity was continuously illuminated with a blue-green light flashing like an electric welding torch."

Idea from Boston Storm

Dr. Vonnegut holds that there are scientific reasons for the strange lightning. In fact, the electricity that produces the fireworks also produces the twister.

He started investigating electricity in tornadoes, and in storms in general, 12 years ago, after he saw a severe storm that hit Boston. One of his first laboratory experiments showed how a tight air vortex can compress an electric arc, which probably explains the glowing of funnels.

The severe storm also impressed him when he realized that it was producing electricity at a faster rate than could all of the country's electrical power stations combined! Some of this power is discharged by repeated lightning strokes that flash through the same path to the ground. This heats a column of air to far above the boiling point of water. This superheated air then explodes up into the cloud. And this, says Dr. Vonnegut, is the "sink" that starts the upside-down drain that is the tornado.

What Gives Twisters Power?

He points out that electricity is just one way to provide a sink for a whirlwind. The heat of the sun causes those familiar dust devils that spiral upward in open fields. Huge bonfires trigger off small twisters, while large conflagrations, such as Tokyo and Hamburg experienced after World War II bombings, produce full scale tornadoes.

A French scientist, Dr. Henri Dessens, has photographed small twisters that accompanied an intense gas well fire in the Sahara Desert. And twisters and water spouts whirl from the clouds of smoke and steam spit out by an underseas volcano that formed Surtsey Island off Iceland a year and a half ago.

If Dr. Vonnegut is right, he has answered a question that has long troubled tornado probers: Where do twisters get their tremendous energy to move so much air so rapidly?

Because his theories involve thunderstorms in general, they might help in future predictions of tornadoes. He sees

(Please turn to page 222)



1965 Ford speedometer gear

You've heard a lot about the quietness of the Ford ride!

This small gear is one of the reasons

This nylon speedometer gear is only one small part but does an important job.

There are eleven different speedometer gears available in the '65s from Ford. You only get one—but, it's the right one! The right one to match your choice of transmission, rear axle ratio, and tire size. This choice, enabling you to get just the right car for your driving

needs, also gives you the proper speedometer gearing.

Nylon speedometer gears are quieter running than steel gears. Rubber body-to-frame mounts—placed where they'll do the most good in making a car quiet—make the level of quiet in the 1965 Ford almost unbelievable. The nylon speedometer gear helps just that little bit more.

Nylon speedometer gears are just one more element in the total quietness story. See your Ford Dealer today!

*Best year yet to go Ford!
Test Drive Total Performance '65*

FORD

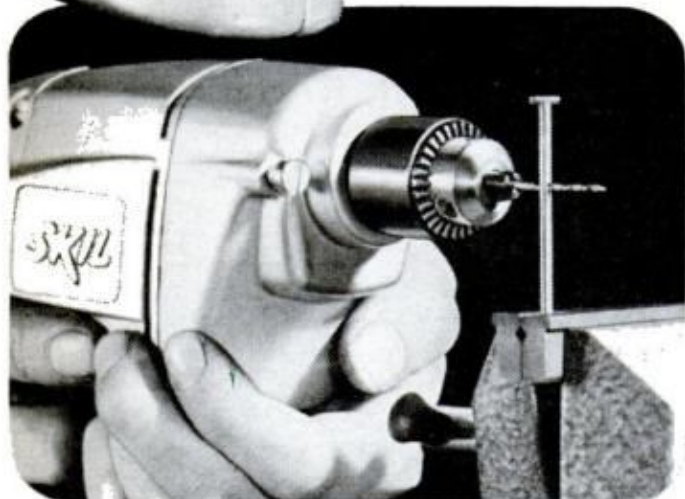
MUSTANG • FALCON • FAIRLANE
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A PRODUCT OF  MOTOR COMPANY



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Exclusive! New! Skil



HOLE IN NAIL DEMONSTRATES THE AMAZING CONTROL OF NEW SKIL DRILL. We did it with the 1/4" Skil Trigger Speed Control (TSC) Drill. TSC drills also available in 3/8" and 1/2" sizes.



A PRECISION DRIVER, TOO! With the versatile Skil Trigger Speed Control Drill the variable speed feature lets you start screw at low speed, run it down at high speed, set it by slowing to a stop.

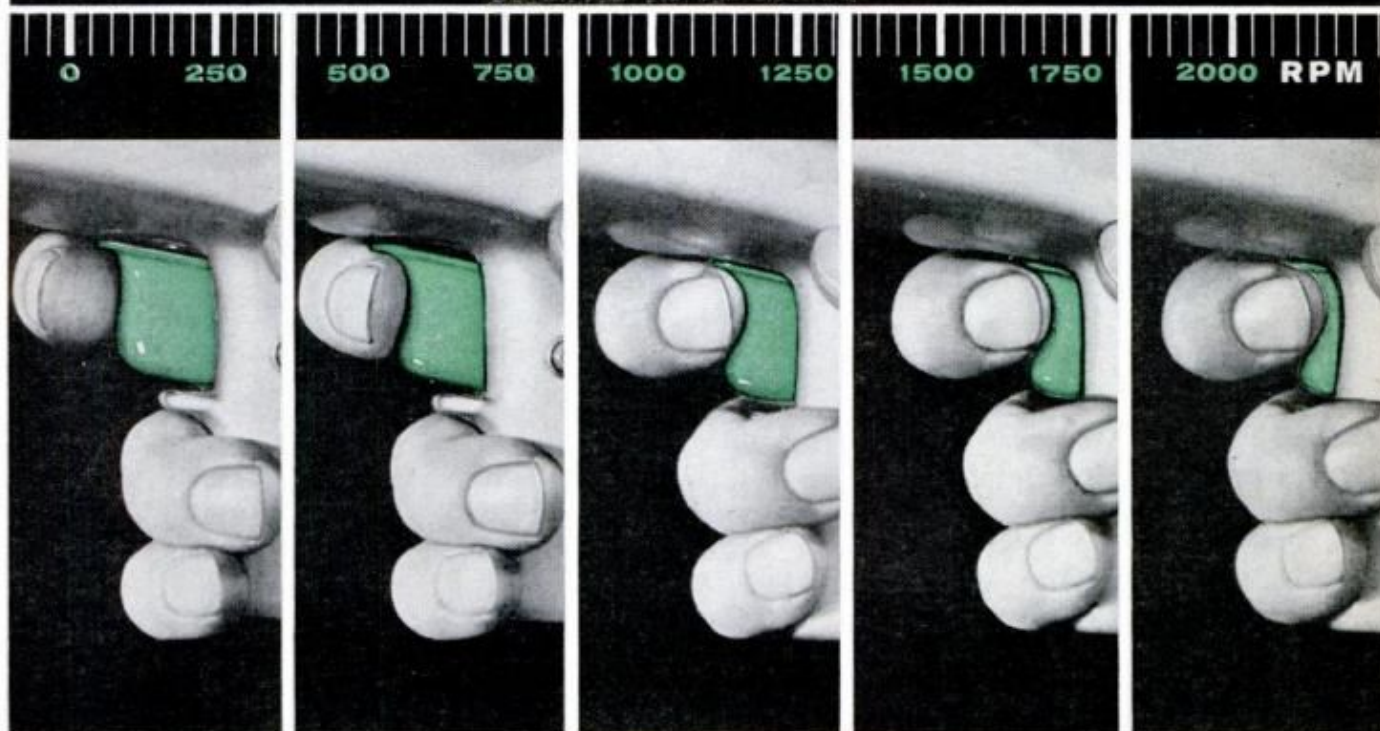
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Skil Corporation, 5033 Elston Ave., Chicago, Illinois 60630

SQUEEZE THE DRILL SPEED YOU NEED

With Trigger Speed Control you actually sense the correct speed with your trigger finger—much as you sense your car's speed with your foot on the accelerator.



Trigger Speed Control Drill

For the first time, you regulate speeds, from 0 to 2,000 rpm's, with your trigger finger

TO MATCH THE MATERIAL

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TO DRILL HOLES IN METAL WITHOUT CENTER PUNCHING

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SEE NEW SKIL TSC DRILLS AT BETTER DEPARTMENT, HARDWARE AND LUMBER STORES EVERYWHERE



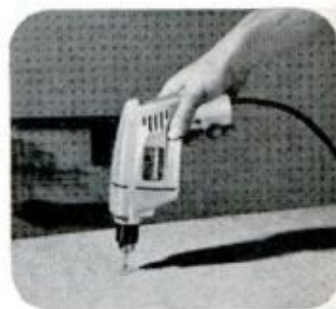
AUTOMOTIVE



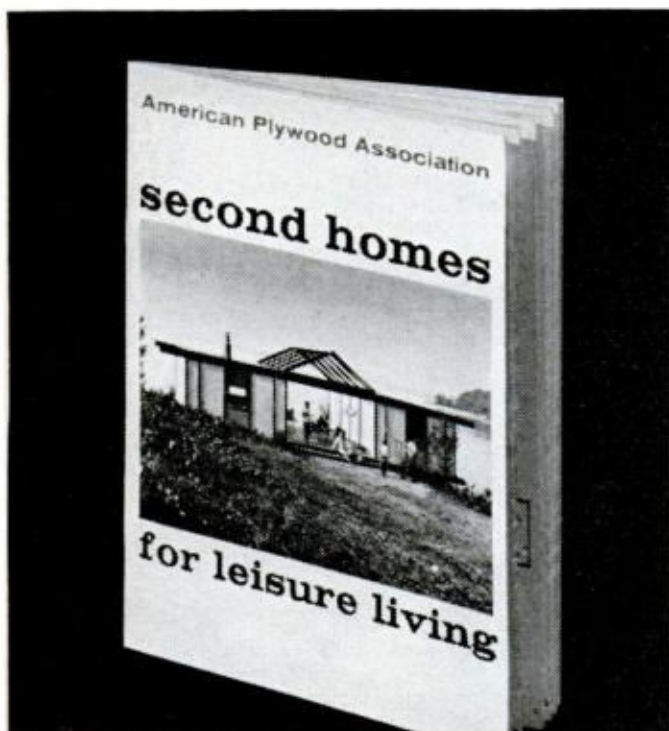
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MAINTENANCE



WORKSHOP



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The Terrible Twisters

(Continued from page 218)

thunderstorms as giant static electricity generators. Updrafts pick up electrical charges from the air and separate them into cells. When a cell's charge is high enough, it discharges its electricity in the form of lightning—to other cells in the cloud, to nearby clouds, or to the ground.

As a lightning bolt flashes, it gives its charge to the microscopic water droplets of which clouds are made. These charges—and not ice crystals—make millions of these droplets combine to make each raindrop, he says.

"Lightning is an exceedingly efficient way to make rain," Dr. Vonnegut adds.

He can show you in his laboratory how water droplets—even those from the tap—pick up electrical charges. And when some outside electrical influence, like a rubbed hair comb, is introduced, the droplets come together to form a bigger blob.

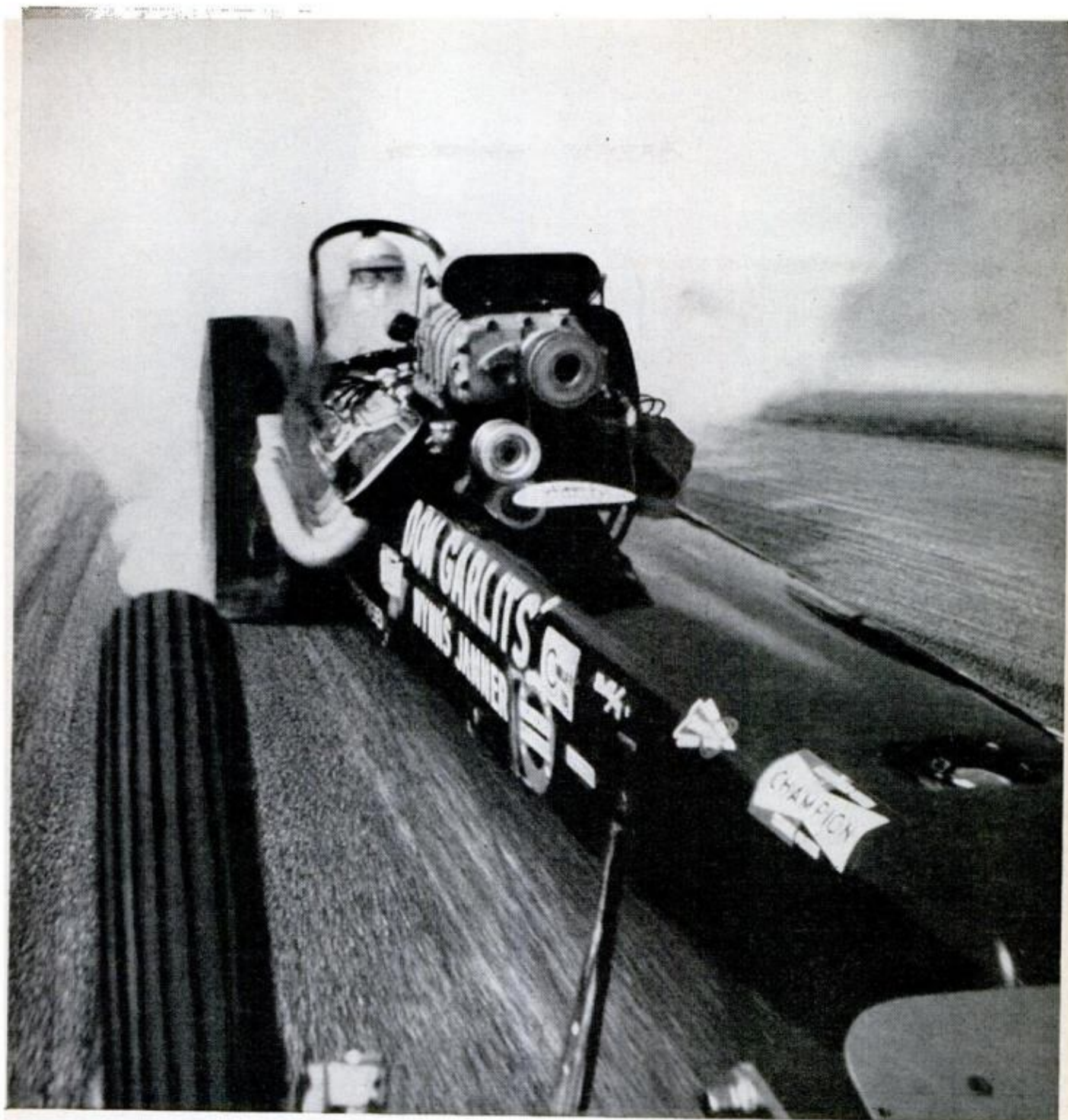
Control the Twisters?

Thus electricity might someday be used to fight tornadoes. A network of wires set up above the ground in Tornado Alley could be used to generate static electricity to neutralize that of a storm cloud.

But that's a possibility for the future. Back in the everyday forecasting world, Kansas City's Dr. Donald House says the next improvements in information gathering will be more powerful WSR64 radar units and the weather satellite planned to replace Tiros. Like the Nimbus satellite, it will be in a polar orbit and will almost instantly provide pictures of 500-mile swaths of the U.S. as it passes over. Further off in the future is the use of cloud-probing light radar.

However, getting information is only part of the problem. "We get data faster than we know what to do with it," says Dr. House. He wants newer and bigger computers that can instantly swallow each day's mountain of statistics, chew it up, and produce meaningful answers to forecasters like Joe Galway. For it's he and his fellow forecasters who offer us the only existing protection against the awesome twisters of the plains—time to get under cover. ★★★

Party poops. If your guests start yawning, check the barometer before deciding they're bored. Experiments carried out on Navy aviation cadets show that in some people the pattern of electrical activity of the brain changes with high or low barometric pressure. It becomes much like the brain pattern of approaching sleep.



Champions use Champions!

Don Garlits was NHRA Top Eliminator in a Dodge-powered AA fuel dragster, sparked by silvery-plated Champions. The overwhelming majority of race winners choose Champion spark plugs – regardless of make of engine. Why settle for less in your car?

To feel new power, instantly, install new Champions now and every 10,000 miles



Make Remodeling Easy

(Continued from page 132)

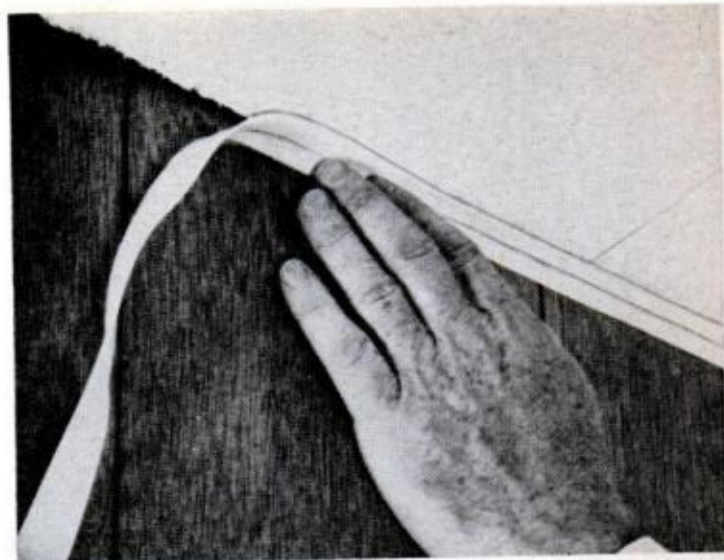
that grip the Ts firmly. The panels used in this system come in four-foot widths and lengths up to 16 feet. They are made in 2- and 3-inch thicknesses that are said to provide both acoustical and thermal insulation. The white prefinished surfaces require no paint, but can be painted, if desired, to match any color scheme.

If you want a distinctive roofing material, Johns-Manville's Colorbestos Slates (page 133) should interest you. They are mineral fiber shingles that look like natural slate, are nailed in place like slate roofing, but weigh only 540 pounds per square—about half the weight of slate. This light weight makes them suitable for use on many roofs that were originally designed for asphalt. The shingles carry a 25-year guarantee and cost \$80 to \$100 per square, installed. According to the manufacturer, their colors weather very much like those of natural slate.

Sampling Tomorrow's Products

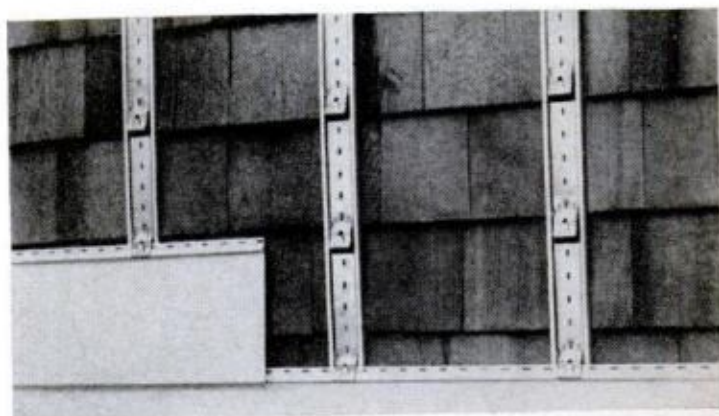
So much for the present; what about the future? A new process for overlaying wood with a 5-mil film of vulcanized cellulose fibers promises to make ordinary brush-on exterior paints rival the factory-applied coatings used on low-maintenance sidings. The film, called Forbon, will be applied at the factory to sidings, trim lumber, etc. What it does is greatly reduce the effect of the expansion and contraction that causes paint to crack, peel, and admit moisture to the wood. Result: expected paint life of about 10 years. As of this writing, Potlatch Forests Inc. plans to market Forbon treated bevel siding, fascia, frieze boards and shelving in June, or thereabouts. Other manufacturers seem likely to follow. A study by Georgia Tech indicates additional cost of the treated wood should be at least \$50 a thousand board feet. The overlay process was developed by National Starch and Chemical and National Vulcanized Fibre Co.

Finally, there's an atomic age wood. By impregnating wood with pigment and plastic resin, then curing the resin with radiation, Lockheed-Georgia has, for example, given Southern pine twice the hardness of flooring oak. While no irradiated-wood products are ready for the market, Lockheed-Georgia is well along on an experimental flooring. This material, aside from its outstanding hardness, is highly resistant to liquids and abrasion and, if marred or worn, can be restored by merely sanding and finishing. No finish or stain is required. (See *Irradiated Miracles*, page 85, March PM). ★★★

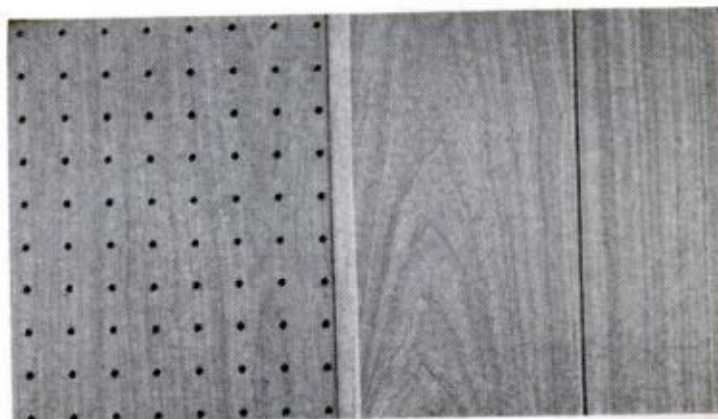


MOLDING COMES IN A ROLL: Ceiling 'n Wall Cove can save you the job of cutting, mitering, nailing and finishing wood moldings. It's a flexible plastic adhesive tape which you press over the joint between ceiling and wall. Ideal for acoustical ceilings, but can also be used over plaster, drywall, paint, etc.

CLIP-ON ALUMINUM SIDING is applied by nailing stringers, called Lok-On strips, to the house, then putting siding strips into the stringers. This method, says the manufacturer, gives a wave-free surface because the siding is free to expand and contract. Flexalum siding costs \$75 to \$100 a square

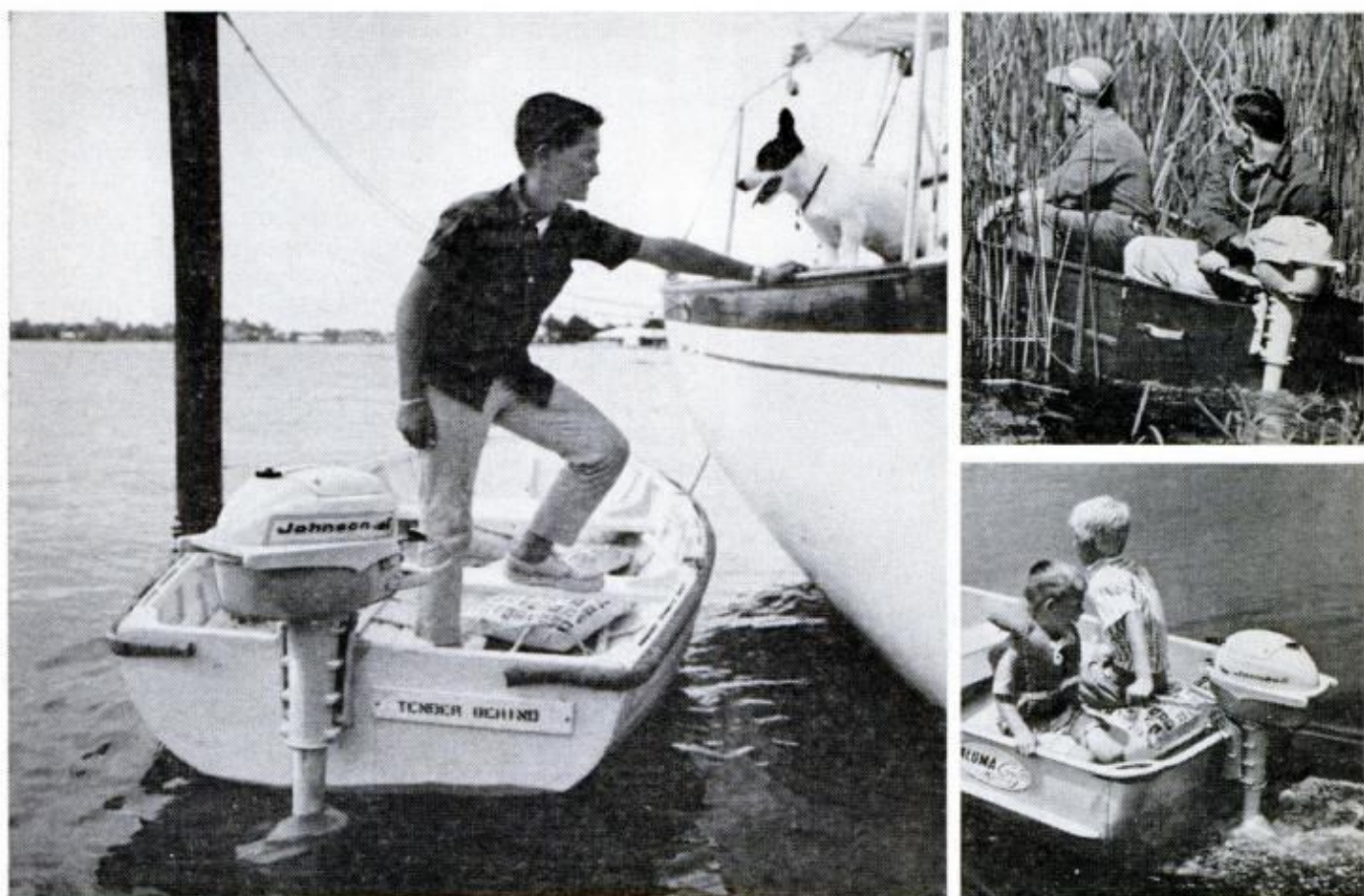


WOOD GRAINED PEG-BOARD is a perforated 1/8-inch Masonite hardboard that can blend with walnut paneling or furniture. In three tones—Glacier, Tawny and Sable. The 4x8-foot panels can be installed over almost any surface. About 23¢ a square foot



Looking for a little outboard that's not afraid of work or weeds or salt water, one that's surprisingly strong and with a warranty surprisingly long?

**Solution:
the carefree, new 3 (a Sea-Horse, of course!)**



Actually there are two new Johnson 3's. One is the High Thrust 3—a new right angle drive plus a 3-bladed prop allow it to deliver 24% more static thrust. (As an accessory, an additional 15" lower unit extension is available.) The other is the Angle-Matic 3—with its weedless prop and sloping skeg it knifes through weeds that would stop an ordinary outboard.

One hour's cruising costs about 15¢. Either Sea-Horse 3 burns less than 3 pints of fuel per hour! What kind of fuel? Nothing exotic. Regular grade gasoline and oil. Fact is all 17 new Johnsons do, from the 3 hp to the 90 hp Golden Meteor.

And any one of them will halve your oil costs because each now uses a new 50 to 1 gas-oil mix. **Complete corrosion protection.** No Johnson needs flushing after salt water use. All are quiet as the night and dependable as sunrise. All are backed by a 2-year warranty* on parts and labor. For the right engine to fit your needs, see your Johnson dealer. He's listed in the Yellow Pages. Johnson Motors, 1941 Pershing Rd., Waukegan, Illinois. Division Outboard Marine Corporation. In Canada: Johnson Motors, Peterborough, Ontario.

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

Another carefree *Johnson* ... first in dependability 

Skilled Fly-Casting

(Continued from page 123)

close quarters, and you could fish almost any stream and catch fish using only this one method.

The overhead cast is almost entirely a matter of timing, and you can learn it in a few minutes.

What you are attempting to do is pick the fly off the water, swing it back over your head, and then shoot it out over the water, letting it drop like a live insect touching down on the surface.

Slack line can be a problem in the overhead cast because it is line that is not under control. Learn to avoid this in the beginning and it will not become a problem as you gain in casting proficiency. Instead of yanking the fly into the air from wherever it and the line might be, lower the rod tip and take up the slack in loose coils with the left hand until the rod tip and line are as near as possible in a straight line toward the fly. Then slowly pull the fly toward you by lifting the rod tip to the proper position—angled slightly above the horizontal.

The Overhead Cast

Now try the overhead cast. The right foot is advanced. The rod is slightly above the horizontal (Fig. A, page 123). About two rod lengths of line are out before you. There is no slack in the line.

The following movements will seem exaggerated, but they are Newman's method, designed to teach control from the very beginning.

Press the right elbow tightly against the side, the upper arm perpendicular from shoulder to waist. Bend slightly forward from the waist (Fig. B). The forearm and wrist are kept rigid. There is no bending of the wrist.

Count, "One!" Shout it aloud. Snap your body erect, throwing your head back. This will automatically bring the rod up, concentrating any movement in the elbow. Stop the rod in the position that would have the tip pointing to the numeral 11 on the face of a clock. (Fig. C).

Freeze in that position!

The line is in the air and traveling back over your head.

Shout, "And!" This gives the line a full second to get fully straightened out behind you (Fig. D).

Shout, "Two," and snap your body forward, bending slightly at the waist, the elbow still tight against your side. The rod automatically returns to the position, angling slightly above the horizontal (Fig. E). The line descends to the water, the fly following it to land like a bug from the blue.

The timing is everything. "One—And—Two." If the line is snapped back before it has fully straightened, the result will be like cracking a whip. The line will not go out and the fly could snap off. If you wait too long the line drops behind you.

Run through the overhead cast until you get the feel of the timing. You can do this by making false casts. Before the line and fly hit the water bring it back up again, counting aloud, keeping the line in the air and working up a rhythm. "One—And—Two—And—One—And—Two."

When you have this down to your satisfaction, take a few loops of line in the left hand. Repeat the overhead cast, keeping the fly in the air, but now let out a little more line from the left hand on each false cast. As the length of line increases so must the length of the pause that allows it to straighten out. When all the slack is in the air, send it out and let it hit the water. This is the whole reason for the overhead cast, working the line out to the desired length that will place the fly where you want it to land.

Don't try to put out too much line. A fly line is 90 feet long, but most stream fishing is done within a distance of 50 feet.

When you have the feel of the timing you can stop the exaggerated body movements and cast with just the arm. But remember: *no wrist movement!* The arm, from shoulder to hand, must be used like two rods with a hinge at the elbow.

Gentleness Is an Art


A principle of fly casting is to lay the line on the water as gently as possible so as not to frighten the fish. This is where you are getting into the "art" of fly casting, and it comes from practice.

You will also want to put the fly on target. This is the part that makes fly casting more pleasurable than other types of fishing. Catching fish becomes secondary to the fun of learning to put the fly where you want it. You can practice this on the lawn or rooftop, with a teacup as target.

In one hour you'll be able to fish with a fly. After that there is no limit to how skillful you may become—by practicing.

Ellis Newman can put out the full 90 feet of line without a rod, using only his bare hands. He can cast with two rods in one hand. I've watched him cast simultaneously with a rod in each hand, and then alternate the rods so that he's in the back cast with one and the forward cast with the other.

This is the epitome of the art, but Newman is the first to admit that it doesn't impress a fish. Dropping a fly in the current so it looks like a free lunch is the important thing—and the easiest. ★★★

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Born for action | Racy, new '65
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Help stamp out dull driving! This newest, sportiest edition of the World's 100,000-Mile Durability Champion has excitement built right in. In every Cyclone: bucket seats...console...tachometer...special wheel covers and grille...4-barrel

Cyclone Super 289 V-8. Also, your choice of custom options like a four-on-the-floor or Multi-Drive Merc-O-Matic...competi-

tion elapsed-time clock and vacuum gauge...black or white vinyl-covered roof. Get into a hot, new '65 Comet. Go lively.



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the world's 100,000-mile durability champion



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

Finding a Bargain Outboard

(Continued from page 119)

and stop when you hit the graph curve. If you fall between readings, always take the one to the right—the higher one. For example, if you compute the horsepower to be 31, 32 or 33, the maximum safe horsepower for your boat is 35.

You're always safer buying a used engine from a dealer, preferably one who is franchised by the manufacturer to sell the make of engine you want. Private party sales are risky, unless you know the party and know the engine's been cared for. This doesn't mean you can't get as good and many times, a better deal by buying from a private owner—it just means you're safer with a franchised dealer.

Most dealers when taking a used engine in trade will recondition it from prop to cowl if required. Assuredly, this jacks up the selling price, but at least you'll get a package that's as mechanically sound and trouble-free as possible.

It costs a dealer about \$50, depending on engine size and parts replacement, to do a thorough overhaul. If you bought an engine that needed this work and then brought it to a shop, it would cost you about \$100 to have the work done.

This doesn't mean, of course, that there aren't some dealers who won't try to get away with just polishing up the outside of the engine and putting it on the rack. As you'll see, however, if an engine's in bad enough shape to require complete dismantling, a careful inspection (especially important when buying from private parties) will usually reveal it.

There's one other important factor to consider in this dealer versus private party question.

New engines are warranted for long periods, so it stands to reason that a dealer will warrant a used engine for some period, if he has any confidence in the motor. And most do, with the average warranty ranging from 30 to 60 days. If a dealer refuses to warrant an engine, stay away from it.

Another thing to keep in mind about warranties: They're not worth the paper they're written on if the engine's going to sit on the shelf during the warranty period.

So, if you buy an engine now but don't intend to use it for a while, put a deposit on it and have the dealer hold it in his shop until you're ready to put it into the water. And make sure the effective starting date of the warranty is the day you take delivery.

New from Rockwell, the world's

Let the Porter-Cable Green Line make your yard work easier!

Don't be fooled by their good looks, these tools are tough. Each one is: **SHOCKPROOF**—constructed of non-conductive miracle material, double insulated against electrical shock from product malfunction.

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Clip this coupon. Send for **FREE** folder and name of nearest dealer.

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Please send more information on these new tools to:

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Edger-Trimmer. Special introductory price—\$36.88. Head turns to 45° and 90° for trenching and edging.



Grass Shear. Special introductory price—\$26.88. Also trims and shapes shrubs, hedges, etc. Available with extension handle and wheels.



I've yet to run across a private party who gives a *written* warranty. If you find a good engine and can wangle a written contract out of the owner, great. If not, you're taking a chance.

But even though the price is fine and the seller looks like an honest man, the vital insurance lies in checking an engine's mechanical condition.

How Sound Is the Motor?

Break your mechanical tests into three groups: (1) a general overall inspection; (2) a detailed inspection of individual areas; (3) a water test.

If you know what to look for, a good general inspection can tip you off to a rough engine that was polished up to make a sale. Just so much sludge, oil, and corrosion can be wiped away, so check every nook and cranny for signs of this. Take a look at the prop, too, especially if you're buying from a private party. Someone who won't replace a bent or nicked prop may let other parts of the motor deteriorate as well.

While you're checking the condition of the prop, grab it and try to work it up and down while looking for oil seepage. Too much up-and-down play or seepage around the prop shaft seal indicates a

worn bushing.

The remote fuel tank is usually sold as part of the outboard package, and it, too, can indicate the way an engine has been treated. Check the inside of the tank in particular. If the bottom's rusted there's a good chance that flakes of rust have gotten through fuel lines and into the carburetor.

While you're at it, prime the line and check around the fuel hose at both ends to make sure that there are no leaks.

The big thing to watch for when buying a used motor is excessive rust, a hint that the engine might have been dunked. Larger engines bolt to the transom and seldom get dunked unless the boat is swamped or sunk.

Corrosion on engine parts is a warning that the engine might have been submerged and not cleaned out immediately afterwards. Buying an engine like this is taking a big chance.

Detailed inspection comes next, and a good detailed check for carburetion, ignition and compression was presented in last month's *PM*. This is summarized in the table.

The last important check before buying the engine is to get it running. Insist upon [\(Please turn to page 231\)](#)

safest lawn and garden tools



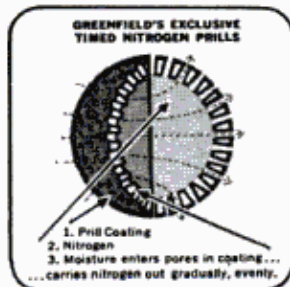
The new tools are Rockwell-built
... safer for you

Hedge Trimmer. Special introductory price — \$26.88. Standard equipment includes exclusive pruning saw attachment and side handle.

How to grow an all-grass lawn



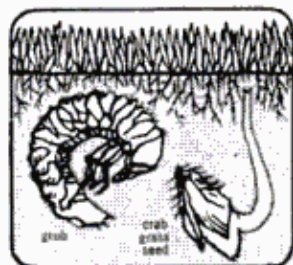
(20% nitrogen, 10% phosphorus, 5% potassium) feeds grass evenly and continuously for many weeks because part



of the nitrogen is in tiny prills coated for slow release. Greenfield® Measured-Release Lawn Food feeds more evenly over a longer period of time than conventional fertilizers.

Stop weeds before they start

Even the best lawns sometimes have their problems with weeds. Don't take a chance with crab grass and other grassy weeds. Apply a pre-emergence killer in early spring and you'll keep these pests out all season.



Use Greenfield® Springtime Triple Action to kill crab grass and other grassy weeds as they sprout from seed. At the same time, it kills harmful soil insects and gives the grass a much-needed spring fertilizing. Three jobs in one! For the budget-minded homeowner, Greenfield® Pre-Emergence Crab Grass Killer provides season-long crab grass control at an attractive price.

Declare war on dandelions

Broadleaf weeds—dandelions, plantain, thistles—pop up later in the spring and summer. You can clean them out with any of a variety of Greenfield weed killers—in dry, liquid or aerosol form.

Your main summer lawn chores are mowing and watering. Don't mow too short. When it gets hot, set your mower blade a little higher than normal. Water only when the grass needs it; water deeply, soaking the soil to a depth of 6 inches.

Rebuild in the fall

In late summer and fall, rebuild and prepare for winter. Fertilize again, and reseed if necessary. Then, at the last mowing cut the grass short to go into winter.

For help with specific problems and for the products that will turn your best efforts into a lawn you can be proud of, see your Greenfield dealer.

Some new ideas and products to help you grow... and keep a healthier, thicker lawn

Early in the spring, mow the grass fairly short and rake up old leaves and clippings. Rake and reseed bare spots. Use any of three excellent new Greenfield grass seed mixtures... Premium, Quality, or Multi-Purpose. Be sure to keep newly seeded areas damp until the seedlings are 1-2 inches high.

Take the guesswork out of fertilizing

Be sure to fertilize in early and late spring and fall. This will develop a thick, vigorous lawn that will help crowd out weeds. Greenfield® Measured-Release Lawn Food takes the guesswork out of lawn feeding. This unique, balanced fertilizer



Greenfield®
the people who know how to make things grow

Finding a Bargain Outboard

(Continued from page 229)

it on your boat and trying it in the water is best. If this isn't possible, though, a tank test will serve the purpose.

Let the engine idle and listen. A good engine "rolls." If you're not sure what one sounds like, have the dealer run up a new engine of the same make and horsepower and listen to that.

Any engine that has a rapping sound at idle, or as you rev it up, could indicate a broken piston or bad bearings, which call for a big overhaul job.

As you rev up the engine, check the operation of the shift lever and throttle control lever for immediate response. Other parts that you can go over are ignition wiring to make sure insulation is tight and not cracked; ignition and the generator drive belt, if there is one, to make sure it's in good shape and not slipping; and the stern bracket screws to determine if the engine bolts strongly in place or if threads are crossed or broken.

While the engine's in the tank, check the functioning of the water pump as explained last month. This is most important, because if the pump is not operating, the lower unit will have to be ripped apart, and that's big money.

Finally, be critical about the way the motor sits on the transom. Is it vibrating and shuddering excessively? If so, the shock absorber mounts may be broken.

If the engine passes all these tests, and you're satisfied with the deal, buy it. You've probably got a bargain. ★★★

Light Cast on Comets

The sun's system of nine planets also contains some two million comets, although very few of them ever get bright enough to be seen by the naked eye. And more than one out of five comets eventually will leave the solar system, according to the calculations of Dr. R. A. Lyttleton of St. John's College, Cambridge University.

Dr. Lyttleton told the Royal Astronomical Society in London that most comets return close to the sun only every thousand years or longer, and his theory takes into account the energy changes comets undergo at each return. His theory shows that no more than one in 20 comets has a lifetime as long as ten million years, and less than one in 1000 is four billion years old, which is about the age of the solar system itself. Dr. Lyttleton therefore concludes that comets were not born at the same time as the planets, as has been suggested.

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AND DIRECTION

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Wheel Horse

SIGN OF THE LEADER IN LAWN/GARDEN POWER EQUIPMENT

Zero Gravity

(Continued from page 89)

duces heart size, because it doesn't need to pump as much blood with each stroke. When more blood is needed, for increased work load, it must pump much more rapidly, increasing the heart rate. Inactivity also decreases the formation of red blood cells and the plasma which supports the cells. With less plasma there is less blood volume. Exercise destroys red blood cells so, if the man becomes too active after a space flight, the red cells—already depleted from inactivity—can be reduced even more, leading to anemia.

There are other factors, but these are enough to highlight the major attention the cardiovascular system of our astronauts will get. Dr. Lawrence Lamb, chief of SAM's clinical sciences division, has supervised several tests that proved the deteriorating effects of inactivity and, more significantly, that they can be overcome.

Four Weeks' Bed Rest

In one set of tests, subjects were confined to bed for up to four weeks. They never left the horizontal position. Susceptibility to fainting—when they were finally allowed to stand—went up as much as 15 times over what their tolerance was when they started. In a corollary test, in which subjects were strapped immobile in chairs for four days, similar symptoms appeared even though the subjects were not horizontal. And in a third test, in a MOL simulator, subjects were confined for up to 30 days, neither horizontal nor strapped down. The same symptoms appeared, proving that simply confinement in small quarters can produce the deteriorating effects of inactivity.

More significantly, however, some of these subjects were treated specially. They were carried horizontal from bed rest and put in a home-made negative-pressure box, in which the lower half of their bodies were in a partial vacuum. The pressure was reduced inside, simulating gravity by intermittently sucking the blood down to the lower extremities and thus "exercising" the lower limbs without the subject working—that is, remaining "weightless." The theory is that something similar to a negative-pressure box could be put in space-capsules to keep an astronaut's lower blood vessels in shape.

Also, some test groups put on G-suits (similar to those worn by jet pilots to keep blood from pooling in their legs during violent maneuvers) for their "fainting" tests after bed rest and, almost without exception, they stayed conscious.

So, either by exercising the limbs in

space or by wearing G-suits when re-entering the field of gravity, the astronauts can avoid most of the hazards of cardiovascular deterioration.

"The significance of the tests," Dr. Lamb summed it up, "is that the blood-system and its reflexes will deteriorate with inactivity, but they can be retrained to function properly—even if we have to treat returning astronauts like bed patients, making them sit up first and so on.

"However, it's more likely they will exercise in space to stay in shape or wear G-suits when they come back."

In related tests at SAM, subjects are submerged in water for periods of up to 12 hours to simulate the floating sensation of weightlessness. After submersion, they are placed in a centrifuge (carried there on a stretcher, so they won't have to stand) and a re-entry mission is run to see how they stand up to going from zero-G to the 8-to-10 Gs of re-entry.

There are two significant findings so far, that it only takes about eight hours of water submersion to start the deconditioning process in the body (so how much deconditioning is there after seven days in space?), and even after deconditioning—and this includes those who stayed in bed four weeks—the body can still withstand all the Gs necessary to return from a Gemini mission, although it might need some gradual reconditioning.

Muscles and Bones Suffer

Another major area that suffers from inactivity is the musculoskeletal system—the muscles and bones. Athletes know that you have to use a muscle to keep it in shape, and doctors know that the bones, too, depend on exercise for proper condition. Muscles grow soft from disuse, even waste away, but the bones lose calcium becoming brittle and fracture-prone.

The bones, in fact, are losing calcium the time. It's only proper diet—vitamin calcium and protein—plus exercise that keeps them in condition. If any of these are missing, the bones tear down faster.

Tests at Wilford Hall, under the direction of Major Charles Rockwood, assistant chief of the department of orthopedic surgery, are trying to pinpoint just what kind and how much exercise is enough for an astronaut's muscles and bones.

Dr. Rockwood said that preliminary tests indicate that isometric exercises—which just pit muscle against muscle and don't depend on gravity—may be enough to counter the muscle-and-bone deterioration of weightless inactivity. Additional, and more exotic, tests are scheduled this summer. Subjects will be placed in full-

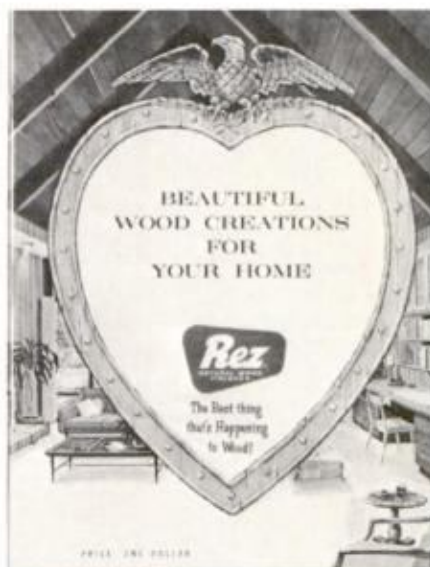
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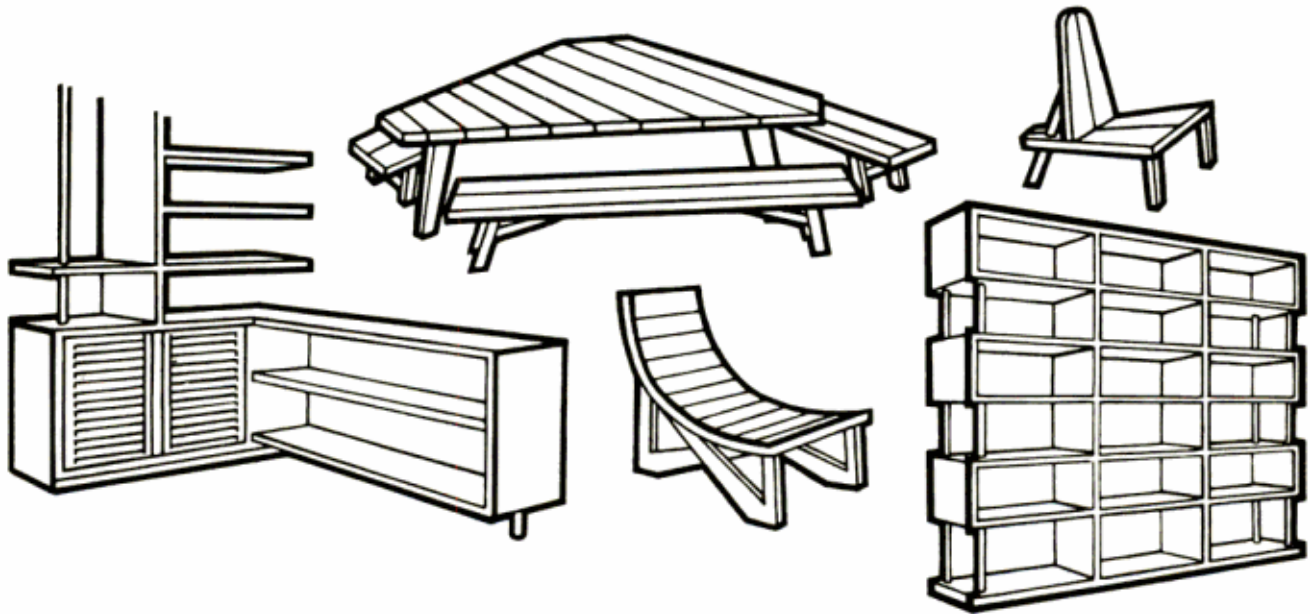
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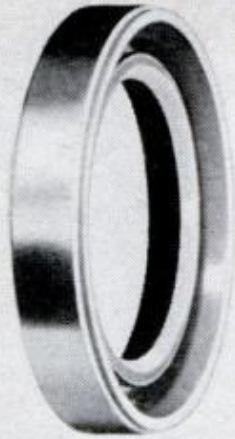
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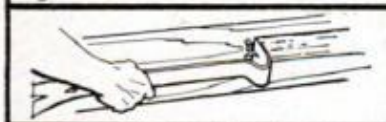
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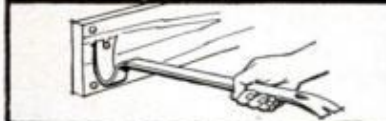
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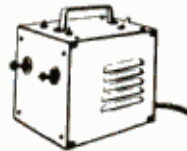


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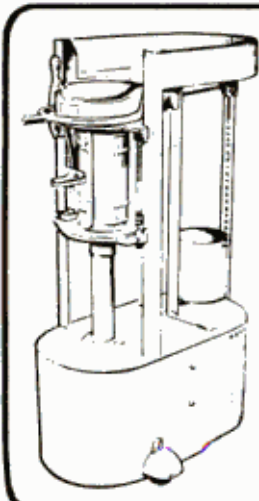
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Zero Gravity

(Continued from page 232)

length casts, completely immobilizing them from toes to armpits. They will be fed a calcium-free diet, with just one gram of calcium added per day. Knowing just how much calcium goes in, they'll know just how much goes out. (Calcium is lost through urine). Half the subjects will remain immobile throughout, the other half will have their casts removed for daily exercise. Then a comparison can be made.

Ergometer Does the Job

Isometrics, however, if sufficient for the muscles and bones, may not be enough for the whole body. More Wilford Hall tests, directed by Major Kenneth Cooper, a specialist in aviation medicine, study ways to build up the body's endurance, the kind enjoyed by long-distance runners. One exercise may do the whole job.

His group of bed-rest subjects, who never leave the horizontal position, are carried several times daily to a horizontal bicycle called an ergometer—pedals which pump a huge metal wheel controlled by magnets. A work load is fed to the magnets which impose a resistance on the wheel. The subject then pedals against this resistance.

The most significant result from this test is that, even though the subjects had been lying on their backs for up to four weeks—and their bodies should have been deteriorating—they actually built up their endurance, in some cases above that of a well-conditioned athlete.

Cooper measures endurance by the amount of oxygen consumed. An average well-conditioned man will use from 40 to 60 units (cubic centimeters of oxygen per kilogram of body weight per minute). A poorly conditioned man uses 35 or below, and a supremely conditioned one, like the long-distance runner, above 60. Some of Cooper's test subjects, starting below 40 units, ended up above 60—without ever leaving the horizontal position.

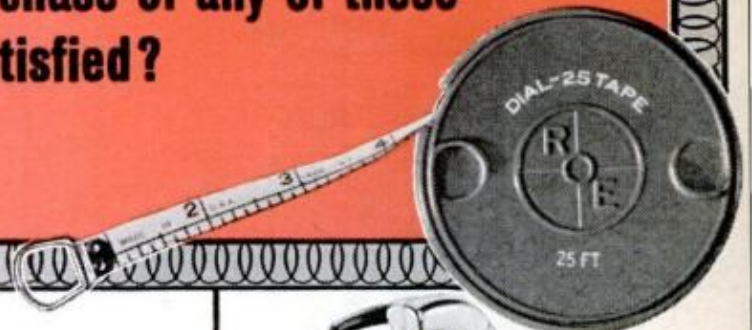
The ergometer has many advantages. It does not depend on gravity. The astronaut can be strapped in place, and his feet strapped to the pedals. It not only builds up endurance, but exercises the largest muscle mass in the body (hips and legs) and conditions the cardiovascular system against the ravages of weightlessness. If more oxygen is being consumed, the blood system must keep in shape to deliver it.

Conceivably, an ergometer, plus a few supplementary isometric exercises to keep the muscles and bones of the arms and chest in shape, could keep an astronaut

(Please turn to page 238)

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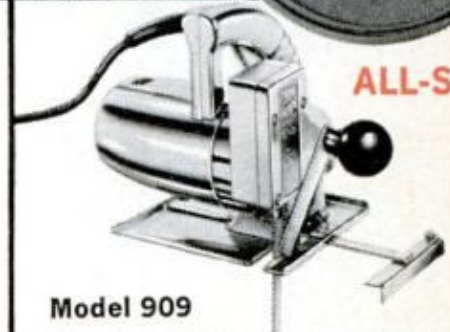
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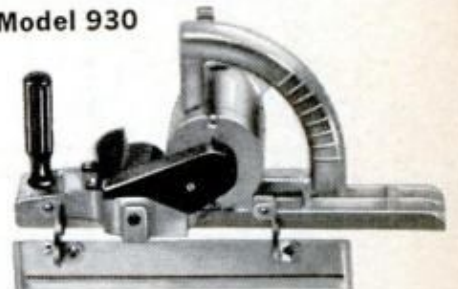
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Zero Gravity

(Continued from page 236)

in condition in space indefinitely.

Cooper emphasizes that the astronauts would receive a considerable amount of preconditioning. A well-conditioned man takes longer to decondition from inactivity—one drawback to sending bookworm-type scientists aloft.

So far we haven't mentioned the inner ear. It probably got more publicity in relation to weightlessness than any other organ, and it brings up an interesting side-light. The worrywarts, concerned about John Glenn's ear injury, overlooked Scott Carpenter's broken wrist, suffered in an accident last year. As indicated, there is considerable evidence that weightlessness deconditions some parts of the body, including the bones, but none at all to show it bothers the inner ear. In fact, the parts of the ear that control balance seem to adapt readily to zero gravity, with no known after effects.

It is the unknown about the inner ear that bothers scientists, and most of the unknown has nothing to do with space. No one really knows its entire function.

Skinful of Balance

Also ignored in the attention given the inner ear is the fact that the body has other mechanisms to control balance, namely the peripheral sense organs contained in the skin and muscles. These are independent of gravity.

Dr. Hubertus Strughold, chief scientific advisor at Brooks, proved in 1928 that pilots actually do fly airplanes "by the seat of their pants." He deadened his posterior with novocaine and became disoriented in flight because he couldn't "feel" anything with his seat. The three Russian cosmonauts, as recently as the Voskhod flight, proved it again when, becoming momentarily disoriented in their huge spacecraft, found they could re-orient themselves by pressing down in their chairs.

The pressure on the skin, especially the palms and soles, are great aids to orienting the body, and, just as in walking when we keep one arm out in front of the other, the muscles also have a sense of balance. What it all means is that, even if the astronauts' inner ear becomes momentarily disoriented, there are other sensory mechanisms to relate him to his environment.

Among the other bodily functions that are independent of gravity—sight and hearing are two—is one that most laymen would name as the first to be affected by weightlessness, the digestive system. The fact is that it can work *against* gravity

(Please turn to page 240)

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Zero Gravity

(Continued from page 238)

Major Gerald Parker, a gastrointestinal task scientist at Wilford Hall, proved this once by standing on his head in front of a fluoroscope and drinking a special solution. The screen showed the esophagus muscles snake the solution *upwards* and literally throw it into the stomach. Dr. Parker pointed out that any nausea suffered by a spaceman, such as by Titov, is more likely due to motion sickness, emotional or nervous tension, rather than weightlessness. The digestive system itself is completely independent of gravity.

An interesting sidelight was brought up in our interview with Dr. Parker. It seems likely that astronauts in long space voyages may be put on a completely liquid diet. It has several advantages. It can be created to specified standards—remember the need for proteins, vitamins and calcium?—and it can eliminate solid bowel movements, thus reducing or eliminating waste-disposal problems. Urine can be recycled and used again.

In summary, weightlessness, while it creates some problems, is not the great big bogeyman it's been pictured. And its problems all have solutions.

The concern was best dispelled by Colonel Harold Ellingson, commanding officer of SAM, "We worried about the sound barrier before it was broken, and now it's being broken daily. Weightlessness is just one more barrier, and we'll break it, too."

Because it seems likely that the human body, if it's in good condition before it leaves for space and is kept in good condition while it stays in space, seems quite capable of operating and surviving in a world without weight. ★★★

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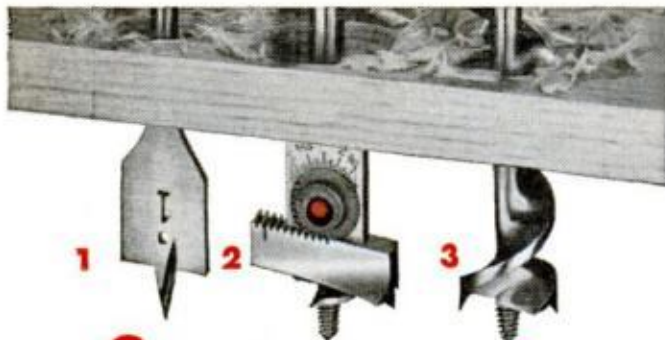
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DAP DAP INC., Dayton 31, Ohio
SUBSIDIARY OF Plough, Inc.

Owner's Report—Falcon

(Continued from page 98)

Kansas materials tester.

"I had a leak in the transmission connections."—New Jersey nurse.

"Glove compartment is made of cheap cardboard-like material."—New York engineer.

"Glove compartment not big enough."—Massachusetts manager.

"I like to keep items locked up in glove compartment."—Indiana foreman.

The factory got heavy handed with the economy axe here—and owners resent it: no size, no strength, no lock.

"My car came from the factory with small parts missing, loose parts, including the trunk lid. Lots of little aggravations."—Ohio secretary.

"The chrome was put on loose, especially around the windshield."—Georgia mechanic.

"There are many little things wrong: the handle of the door comes off, heater blower doesn't work, gear shift handle comes off, floor clutch sticks, door windows rattle terribly."—Florida attorney.

"Seats don't have enough foam; they're very thin."—Tennessee security officer.

"Low gear should be synchronized."—California driver's license examiner.

Ford has an all-synchro box. It should be used on the Falcon.

"Shifting into first after coming to a stop is difficult. Sometimes it is necessary to shift in reverse first."—California teacher.

There's more to say on the bright side, too. From comfortable ride to parking ease, here are the second group of five praises by Falcon owners:

"The ride in a '65 is much better than it was in any previous year, including my '63 Falcon which was a good riding car."—New York secretary.

The ride in the test car was taut, yet completely comfortable.

"I like the size of the car the most. It is convenient for parking and I can tell exactly where it is on the road."—California Marine officer.

It stays put on the road, too, without a tendency to wander.

"I can reach out of either window without sliding across the seat."—Minnesota mailman.

"Green dash lights are easier on the eyes."—Pennsylvania utility engineer.

A sensible color choice that others would do well to adopt.

"The padded dash looks anything but

(Please turn to page 244)

\$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.

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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 enough supplies come with it to return far more than your investment. Many earn the cost of the detergent in a week or two.



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

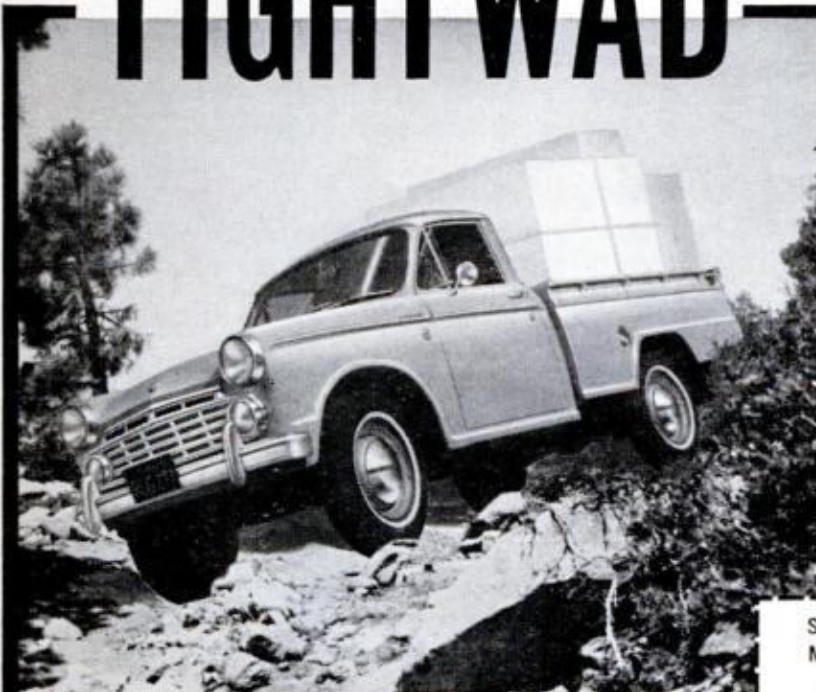
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NEW powerful 4 cylinder engine

NEW economy - saves up to 50% on operating costs!

NEW big 6' x 4'8" bed carries up to 2000 lbs.

There's nothing on the market like the DATSUN Pickup for Performance, Economy, and rugged Dependability. Delivers with WSW Tires, Heater, Vinyl Interior, Torsion-Bar Suspension for only \$1596 plus lic., tax, D & H, and local freight, if any. **TEST IT AT YOUR DEALER NOW!**

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send information on DATSUN Pickup

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ATTENTION CAR DEALERS—Add DATSUN to your present line, inquire on a DATSUN Dealer Franchise!

New All-Purpose Heavy-Duty SWINGLINE STAPLE GUN



Model
#800

\$7.95

ONLY

(Suggested retail price)

- Shoots 5 staple sizes up to 9/16"
- Snap-open load.
- Built-in extractor.
- "Power Dot" for super drive.
- New LOKTILE Staples. Special coating binds ceiling tile securely.

For ceiling tile, fencing, and all the jobs around the house! The first and only all-purpose staple gun ever sold at this low, low price. Does all those time-consuming, hard-to-do chores quickly and easily both inside and outside your home.

- (A) Upholstering furniture (B) Attaching TV antenna (C) Insulating (D) Valances (E) Window shades (F) Weatherstripping (G) Recovering card table and chairs (H) Installing carpeting

#101 Hi-Compression Staple Gun \$4.95
Shoots 1/4" & 5/16" Staples. ONLY 4

Swingline® INC.
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World's Largest Manufacturer of Staplers for Home and Office
See Hardware Week specials at your hardware store.

Owner's Report—Falcon

(Continued from page 242)

cheap."—Illinois air force mechanic.

"The dash is not too congested."—Illinois supervisor.

It isn't congested with gages, either; just simple idiot lights.

"I got 23 miles per gallon on a trip through the mountains and would probably do better on a flat surface."—Colorado air force management analyst.

"I drive mostly to the hospital and college, only a few miles per day. Gas is \$3.00 per month."—California nurse.

Quit smoking and you'll save twice that and gas up for nothing.

"Extremely easy to park between two cars."—Connecticut export sales manager.

Rattles and squeaks in the Falcon fell to sixth place on the brickbat list. Here are representative owner comments from numbers six through ten of that list:

"It rattles all over."—Florida secretary.

"My only complaint is the sloppy way they put these new cars together."—Texas insurance salesman.

We didn't have that trouble. And fewer owners than usual complained of rattles.

"Doors don't shut even after they've been fixed."—Illionis bench man.

"No light to show what gear you are shifting to."—Ohio mailman.

"No light under gear shift."—Pennsylvania sweeper operator.

This omission is silly. A quadrant light isn't even optional.

"The small gas tank filler pipe continually runs over. I get a gas bath with every fill."—Illinois factory foreman.

The sharp turns are to minimize filler pipe intrusion on trunk space—but there should be a better way to achieve it.

"You can hear the gasoline slosh when you come to a stop."—New Jersey broker.

From the bindery worker in New York to the New Mexico mechanic, here are comments illustrating the last group of features owners like:

"I can easily seat five persons, even six if need be."—Indiana army officer.

"There's more room than other compacts in the same price range."—Michigan insurance supervisor.

Add up critical inside dimensions; you'll find Falcon's roominess index slightly higher than Dart, Valiant, Corvair, and Mustang.

"Easy to get in and out."—New York bindery worker.

"We have just taken one long trip—450

(Please turn to page 248)

DISSTON

New 125th Anniversary Hand Saw

has an edge on them all

Pressure welded, 9-ply, marine laminated, hardwood handle.

5 rugged, tarnishproof, nickel-plated, solid steel screws (one a medallion) join handle and blade.

High quality tempered steel blade, full taper ground to prevent binding.

Blades polished and polymerized.

26-inch blade.



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125 years of craftsmanship in every saw.

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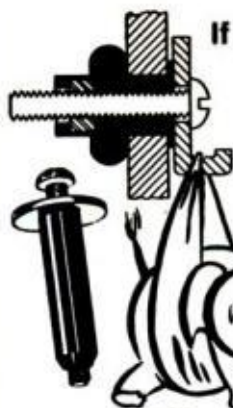
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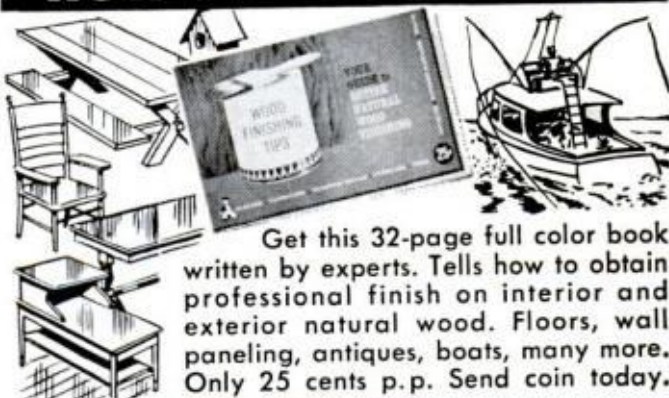


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CASS CITY MICHIGAN
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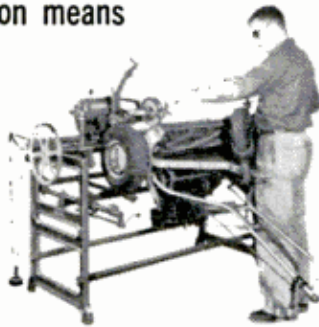
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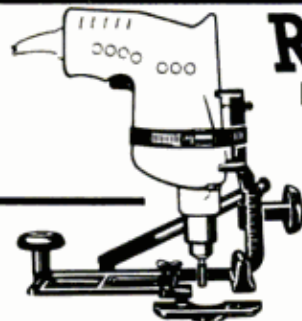
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Clamp this amazing tool to your electric drill and route, mortise, trim, shape, mitre and tenon like a professional cabinet maker. Even inlays become easy.

Handles any job better by letting you take the tool to the work. Routermatic is precision made, sturdy, lightweight. Use it once and you'll wonder how you ever got along without it. Only \$6.95 including \$1.50 router bit. No C.O.D.'s. Can't be sold thru stores at this low price. Descriptive folder on request.

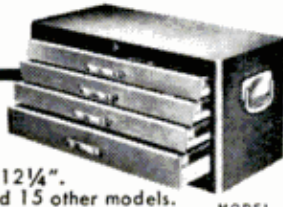
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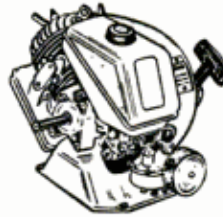
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2 for . . . \$59.50
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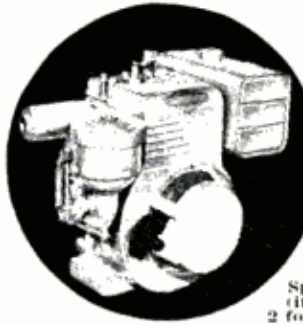


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5 3/4 hp.
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Briggs & Stratton 5 3/4 hp. Md. 143302. Recoil start. Std. 1" shaft w. keyway, and adjustable governor—a rugged big engine ready to tackle any job. Regular price . . . \$92.60

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Model 400, rugged 4 cycle model. Alum. Block, castiron cylinder Rope start—5/8" std. shaft.

Item 1107 . . . 34.95
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A big engine with big power. Model 406, 4 cycle, rope start. 3/4" std. shaft.

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Send postcard today for complete facts.

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Owner's Report—Falcon

(Continued from page 244)

miles—and it was very comfortable."—Pennsylvania housewife.

"Seats are more comfortable than Mustang or Corvair."—California attorney.

Seats are nicely shaped, but padding is sparse—you'll have to grow your own.

"It's dependable—starts instantly in below zero weather."—Michigan teacher.

"Starts briskly these cold mornings of 10° below after sitting out in the cold all day."—Iowa secretary.

This is a tribute that rarely shows up in numbers large enough to be significant. Score another for the Falcon.

"Visibility is better than in my previous Falcon where I felt that the left window-frame often created a blind spot."—Pennsylvania housewife."

"Good view from front and rear windows. I can see where we're going."—Ohio housewife.

She can see where she's headed, even if she's going backward.

"The most durable paint I have ever seen. This is my third Falcon."—California engineer.

"Paint job has unusual luster."—New Mexico mechanic.

Wrapping up owners protests, here are the last five. They're listed, as the others are, in the order of their frequency.

"Carburetor was bad. A new one is being ordered."—Connecticut factory worker.

"The windshield has always leaked. It has been fixed twice."—Ohio musician.

"The doors are not tight. Snow creeps in after a snowfall."—Connecticut secretary.

The body was the only part to get much change this year, and the bugs aren't yet out. Complaints are scarcer than usual, however.

"The headlights are inadequate; I'm almost blinded by oncoming cars."—California machinist.

"Dual lights would enhance the styling."—New Jersey garage operator.

"There is not enough room to swing your feet into and out of the car unless the seat is back."—Florida engineer.

One owner who had this complaint admitted he had big feet.

"The whole car shakes like crazy at low speed in high."—Alabama insurance agent.

"There's a body noise of vibration type at lower speed around 20 mph."—New York manufacturing project coordinator.

The cure: Downshift briskly before speed falls this low.

That's it—the report based on 810,000-plus miles of day to day driving. ★ ★ ★

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DIAL TELEPHONE

● Item #716. Same type used on all phone systems. Use as extension to main phone and on private systems. Directions furnished. Wt. 8 lbs. Cost \$25.00. SALE \$7.95



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● Item #204. New Gov't units. Fine for boat pumping, sump pump, etc. Timken bearings. 1 1/2" intake and discharge ports. 3/4" shaft. Size 12" x 10" x 8". Wt. 32 lbs. Cost \$97.50. SALE \$27.95



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● Item #311. Powerful, fully reversible, ball bearing, gear reduction winch. Capacity 2000 lbs. on 12-volts. Will hold 50 ft. of 1/4" cable. Use on trucks, boats, docks, etc. 18" x 9" x 7". Wt. 65 lbs. Gov't Cost \$280. SALE \$49.95



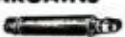
12-V. BATTERY GEAR MOTOR

● Item #564. Powerful, high torque, ball bearing, 1 1/2 h.p., 350 r.p.m., reversible, 24 to 1 gear ratio. Build winches, cars, hoists, etc. Size 17" x 6". Wt. 36 lbs. Gov't Cost \$295.00. SALE \$18.95



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● Great savings. Build loaders, diggers, presses, etc.
● \$95. Pump, 1000 lb. 16 gpm \$41.90
● \$175. 12-v. Battery Hyd. Pump. \$18.49
● \$39. Cyl. 2-way, 3" x 8" \$19.95
● Hyd. Valve, 2-way, 1000 p.s.i. \$19.00



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● Item #829. Famous make unit ideal for farmers, contractors, etc. Focus down to 3 1/2 ft. enables use inside buildings, excavations, etc. 8-power, accurate. Complete with tripod, plumb bob, instructions. Wt. 9 lbs. List \$48.50. SPECIAL .. \$27.95



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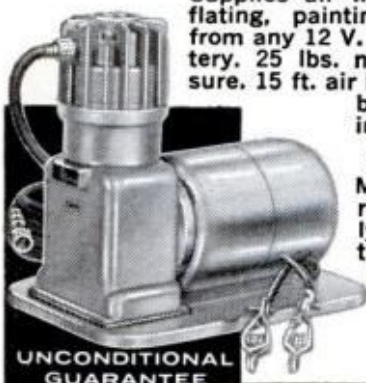
● Item #1810. Fine unit for homeowner, farmer, etc. Sprays weed killers, oil solutions, insecticides, concrete sealers, etc. Consists of 5-gal. tank with capillary tube, 60 lb. pressure gauge, filler valve, liquid port, 4 ft. spray hose, nozzle, valves, etc. Pressurize with air compressor, hand pump, etc. 10" x 26". Wt. 18 lbs. Cost Gov't \$38. Catalog Sale \$11.79
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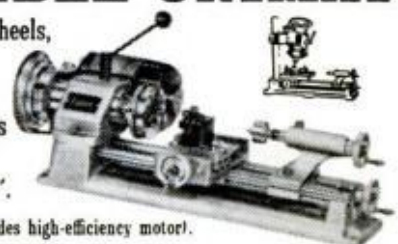
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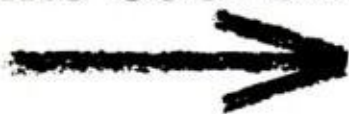
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Include Standard Rip Fence #354 at \$3.50

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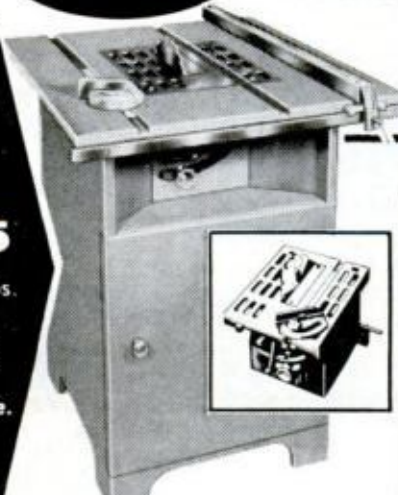
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f.o.b. factory. Wt. 25 lbs.

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



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3-FT. LATHE**

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f.o.b. factory
Optional Faceplate for turning bowls, trays, lamp bases, rosettes, etc. \$2.50

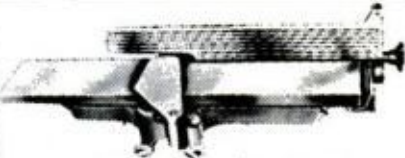


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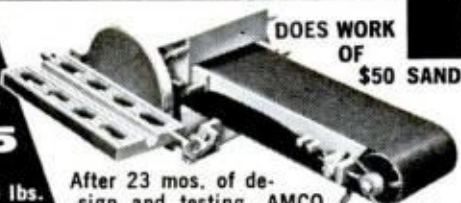
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