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Special Midwinter Car Issue: 36 pages of U.S. and foreign cars. The Wood Brothers, Greatest Team in Auto Racing . . . Comparing Those Sporty Small Sedans: Datsun, BMW, Cortina, Saab, Fiat 124 . . . Has the Gasoline Engine Had It? . . . Luxurious New Pickups . . . Why U.S. Cars Look Alike . . . Classic Radiator Ornaments. **Starlight Scope.** The story behind our new see-in-the-dark gunsight.

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She'll never guess
you want a new
Teflon-S* handsaw
by Nicholson.

So tell her.

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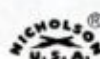
Then offer to drive her to the nearest hardware dealer.

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The Lazy Pipe Tobacco



Bond Street is for the man who gets a lot out of pipe smoking. He likes to stretch out the pleasure with a pipeful that lasts him awhile. Bond Street does, because it's a combination of plugs and flakes, for smooth and steady burning.

Just to give you an idea: you can watch about half of an old Charlie Chan movie on one filling of Bond Street. You'll be quite happy with the good Bond Street flavor (and unless you're alone, someone will surely say something nice about the aroma).



Lights easy—
takes its own
good time about burning.

LETTERS TO THE EDITOR

Wanted: 3-handed troopers

I do not feel that being a "former race-car driver" qualifies a man (law enforcement officer or not) to drive a car "steering with his left hand while with his right he operated the camera's small pistol grip control, swiveling the camera back and forth on its tripod mounting." (*Watch It! You're on Trooper TV*, page 85, Oct. PM.) A police officer driving in expressway traffic at expressway speeds or chasing a reckless, drunk or speeding driver at 94 mph has no business trying to drive a car with one hand while aiming a camera with the other.

KNOXVILLE, TENN. S. F. TROUTMAN JR.

Your article especially interested me since my husband drives close to 100 miles every day to and from his job with the State Highway Dept. He comes across just the kind of dangerous drivers you described in your article. Could the TV be used to make work less hazardous for all such people who must be on busy highways during heavy traffic hours?

RED WING, MINN. MRS. DAVID W. HILL

I wish I had been able to write that article. I, too, am tired of being bullied by a huge truck—or Volkswagen—from behind while going so fast that I fear the police radar over the next hill. I, too, am tired of the lane-switcher who cuts in sharply ahead of me.

I am also tired of trying to repair the smashed faces and jaws of these drivers when they are admitted to the hospital.

DANVILLE, PA. JAMES B. SMITH, DDS, MS

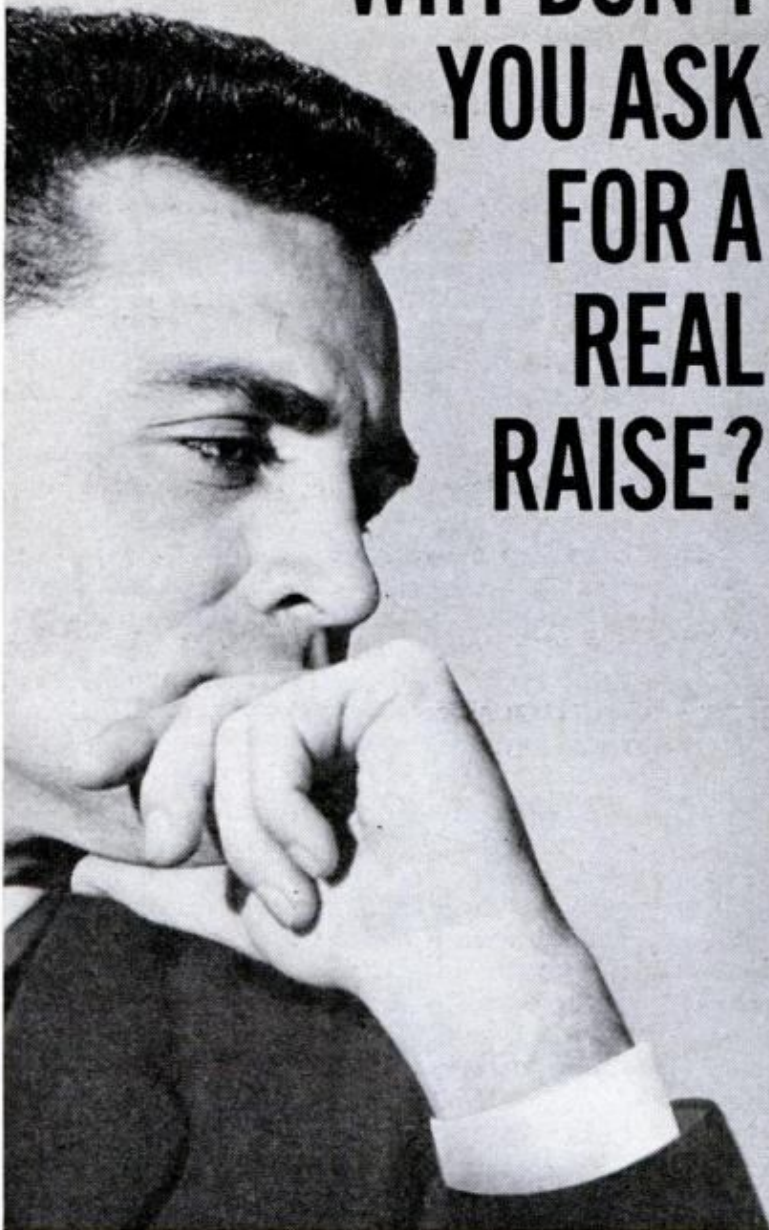
We are stopping them

Since I am serving a voluntary tour in Vietnam with the artillery, I was flabbergasted when I read *How Can We Stop Those VC Rockets?* (page 70, Aug. PM).

There are more defenses for 122-mm rockets than I care to discuss. When I was in Pleiku during the first quarter of '68, I could see the rockets coming in. An officer made rocket locations during that attack with his radar. Aircraft can easily detect rockets, and gun ships can stop them.

The point that prompted this letter was the statement that Charlie could set up his 122, fire, move, set up again and fire before 105 howitzers can shoot. This is

(Please turn to page 8)



WHY DON'T YOU ASK FOR A REAL RAISE?

Think you may be turned down? Here's how ambitious men get important promotions without even having to ask.

If it's been a long time since you've celebrated a raise in salary, ask yourself why. Are you really worth more money? If you're not sure, look again at men who have moved ahead...men so clearly marked for promotion that when it came it was just what everyone expected.

How did they do it? The most usual answer: *through special training*. Special training is the direct way to increase your personal value, your income, your rate of advancement. Soon other employers are likely to seek you out—because *many important positions today are going begging for lack of qualified people to fill them*.

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- Diesel

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- Commercial Art
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- French
- Spanish

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- Piano
- Guitar
- Other: _____

CAREERS FOR WOMEN

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- Dental Assistant
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- Real Estate
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LETTERS

(Continued from page 6)

pure poppycock. The last time Chuck hit Nha Trang this battery had its first round out in 30 seconds. We fired 193 rounds on 21 targets in 8 minutes. These were planned targets in locations that were good launch sites. After our initial firing, the Special Forces made several locations. It takes us no more than two minutes to compute data to a new target and fire. The range of a 122 rocket is 11 kilometers, not 10 miles. Since Chuck usually fires from maximum range, all you do when you see a rocket coming is take an azimuth and cover a couple of grid squares out at 10,500 meters. Since the 105 howitzer has a range of 11,000 meters, this is easy to do.

The weight of a 105 is 4980 pounds, not 3000, but it still can outshoot any Vietcong rocket. I will put any one of my six howitzers up against a rocket.

If Hanoi was as scared of the Air Force as Charlie is of the artillery, the war would be over.

A BATTERY LT. MICHAEL A. FITZ
7TH BATTALION, 13TH ARTILLERY
NHA TRANG, VIETNAM

Author Mort Schultz did not dream up the story. He talked with a number of returned Vietnam veterans, and reported on what they told him. Realizing that no Vietnam duty can be looked on as a picnic, we're glad to learn that things are better than we thought and that artillerymen are coping with rockets in an admirable fashion.

Lots of Christmas plans



I've built and enjoyed PM's Christmas displays from several years back. Do you have later ones?

FERNANDINA BEACH, FLA. J. A. BEARD

Lots of 'em. You can get a complete list in a free booklet from PM's Service Bureau, 575 Lexington Ave., New York 10022.

★★★

Now—from Encyclopaedia Britannica—a new way to help men without a college education

Break the invisible chain that bars you from earning a 5-figure salary in business

Many capable high school graduates working "out on the floor" of a plant, or sent "out in the field" by the sales or service department, have a secret dream of getting a good management job with a private office, personal secretary, and high five-figure salary.

But so often, when there is a good opening as manager, supervisor, or department head, they are simply not considered. Instead the job goes to a college graduate who may not be as experienced but who has a more impressive background.

There seems to be almost an invisible chain barring inadequately educated men from getting a start in management. And for a good reason.

Most companies today want managers and supervisors who are capable of more than just handling their own jobs well. They want and need men who can be moved up, over the years, into positions of greater and greater responsibility. And most men who have merely a high school education simply don't have a broad enough business background for that kind of advancement.

How to Break In

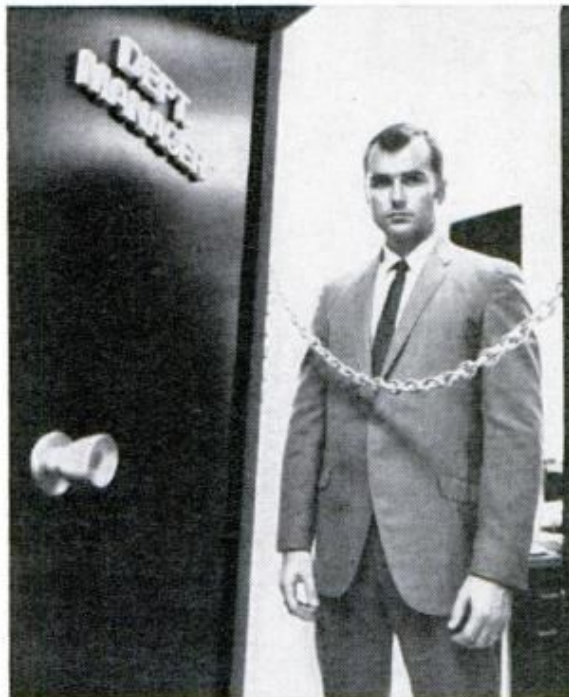
What's the answer, then? Does "an ordinary Joe" who is intelligent, good at his job, and skillful at handling people—but who has only a high school education—simply have no chance at all to break into management?

Not at all—as many self-made men have proven. The key is determination. Those who have the determination can acquire the necessary business background in their spare time. In fact, they can prepare themselves so well that they can actually leapfrog over the college grad in business who makes the mistake of taking success for granted.

This is especially true today, thanks to an important new method of home education in business developed by a new division of Encyclopaedia Britannica, Inc.

How We Help You

The Britannica Institute for Executive Development has been established to help ambitious, capable men—regardless of who they are, where they live, or what



their educational background may be—get the business education they need to compete for top management jobs.

Working with business leaders and specialists in every field, we have created courses in every business subject needed by today's well-rounded executive — including Marketing, Accounting, Business Law, Corporate Finance, Automation, Computers, and Scientific Planning and Decision-Making via the revolutionary new Critical Path Method.

And we have used the latest educational discoveries to make it possible for you to master these subjects in your spare time with surprising ease and rapidity.

Free Executive Success Test

To locate promising men who can benefit most from this new breakthrough in spare-time business education, we have developed an interesting Executive Success Test. This Test, which is given free of charge, will tell you both how much natural executive ability you already have and where your "weak spots" in business know-how are. The coupon below will bring you a copy of the Test, together with free details of our unique training methods. There is no obligation, and no salesman will call.

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Please send me, free and without obligation, your Executive Success Test and a copy of your booklet, "Your Guide to Executive Success."

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0005-005

An out-of-this-world Christmas may be spent by three Apollo astronauts. NASA plans call for a late December flight to the moon and a full day in lunar orbit for astronauts Frank Borman, James A. Lovell Jr. and William A. Anders. Primary objective: to take photos of five possible landing sites. The vehicle, a command module, would circle the moon at an altitude of about 70 miles. Booster for the trip would be the Saturn 5, which has a thrust of 7.5 million pounds.

Fast freezing knocks out warts, reports Dr. Laurance M. Hursh, associate director of the health service at the University of Illinois' Urbana campus. Dr. Hursh uses a homemade "cryopen," a chrome-plated brass rod cooled to below minus 300°F. by liquid nitrogen. Three to six minutes' exposure usually is enough to kill wart-causing viruses. Dr. Hursh reports removing 745 warts on 250 patients. The procedure doesn't cause enough pain to require an anesthetic.

Earth's magnetic field can be seen with the naked eye by means of a technique used by West German scientists. A barium cloud is ejected from a rocket hundreds of miles above the earth. Ultraviolet light from the sun knocks off an electron from some of the barium atoms (ionization), causing them to have a positive electrical charge. They align themselves with the earth's magnetic field and can be seen because they have a pink color, while nonionized atoms appear blue or yellow.

An experimental space suit being built for the Air Force has a tough fiberglass torso section studded with 16 maneuvering jets. Each jet will produce 1.5 pounds of thrust. The 182-pound suit will have arms and legs of flexible nylon and will incorporate a life-support system permitting space walks of up to four hours.

Prescription for preventing blood clots: Eat onions. Something in the pungent vegetable increases the enzyme action needed to split up fibrin, the cause of clotting. So say researchers studying ulcer patients at the University of Newcastle-upon-Tyne, England. Though all patients received the same basic meals, one group topped off breakfast with fried or boiled onions. The anti-clotting enzyme activity in this group was consistently highest among all the patients. The experiment was prompted by information that French farmers feed garlic and onions to horses that develop blood clots in the legs.

You can be brainwashed into learning a language. That was recently demonstrated by a Canadian businessman who learned to speak Spanish in a 61-hour nonstop session during which he neither ate nor slept. The method is based on the theory that when the brain is in a state of fatigue it can be imprinted with a mass of new information through a technique of continuous bombardment. Though the subject spoke no Spanish before the crash course, he was able to converse with Spanish-speaking people after the brainwashing. The experimental technique was developed by the International Synectics Foundation, a new Canadian "think tank."

Nuplexes are in our future—perhaps only two or three decades away. If you've never heard of a nuplex, it's because it is a new word for a new concept. Dr. Glenn T. Seaborg, chairman of the Atomic Energy Commission, says nuplexes are "large nuclear-powered industrial complexes—highly automated, efficient and clean, the nuclei of a nation's major industrial areas, responsible for most of its products and power." Best of all, according to Dr. Seaborg, a nuplex would operate in a "quiet manner, with no forest of chimneys on its horizon to pour harmful pollutants into the atmosphere." ★ ★ ★



An untuned car is winter starting trouble.

**This winter, more cars won't start because
of worn spark plugs than old batteries.**

You can have a perfectly good battery and still be in for starting trouble this winter—if your spark plugs are worn. Here's why.

Cold damp weather reduces your battery's output. When you go to start, there's less voltage available. At the same time, worn spark plugs can require twice the voltage of new plugs. Result—a combination that can be too much for even a brand-new battery.

A seven-year study of 80,000 cars from all over the United States shows the odds are *three times greater* that you'll have starting

trouble if your spark plugs are worn.

To avoid winter starting trouble, get Champion Tune-Up: a new set of Champion spark plugs plus any other basic tune-up items your car may need. Champion spark plugs meet or exceed warranty requirements of all vehicle and engine manufacturers.



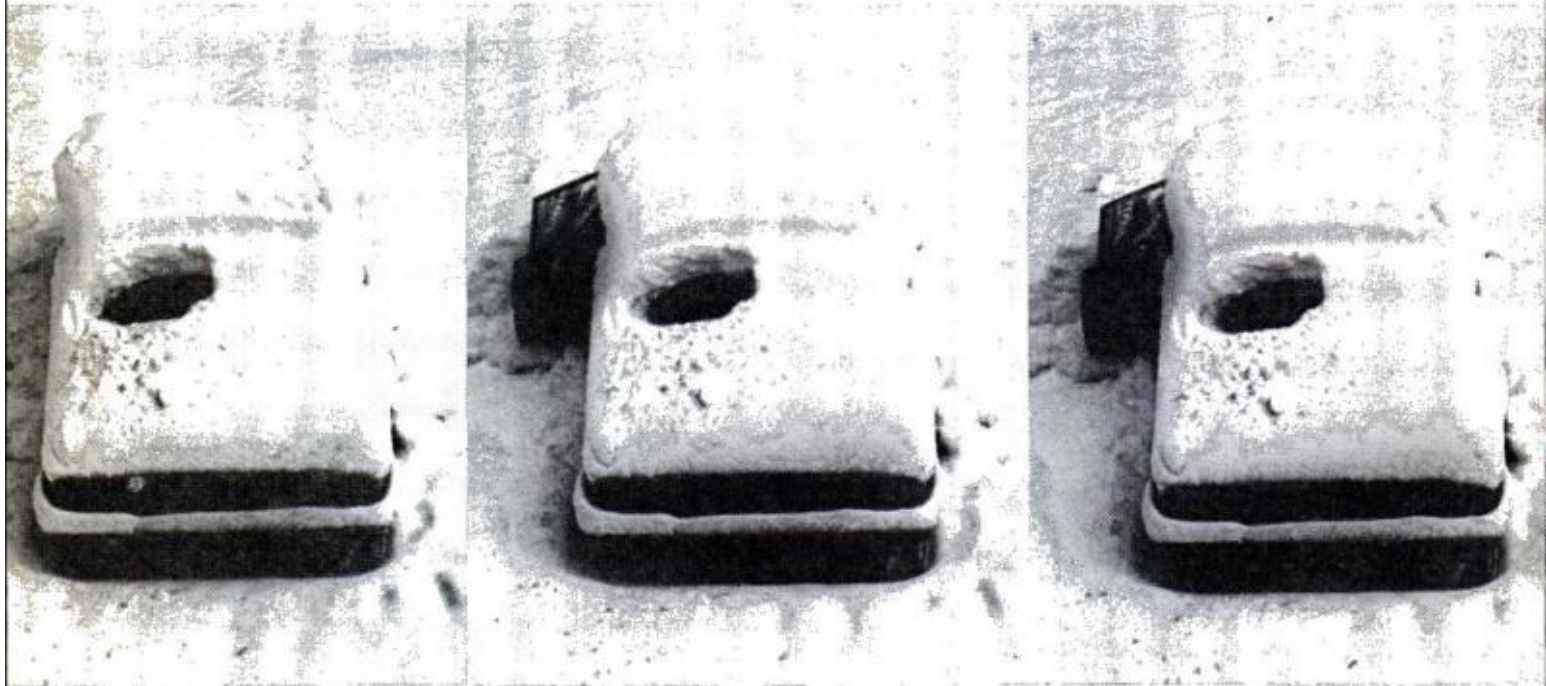
The heart of a tune-up





RRR

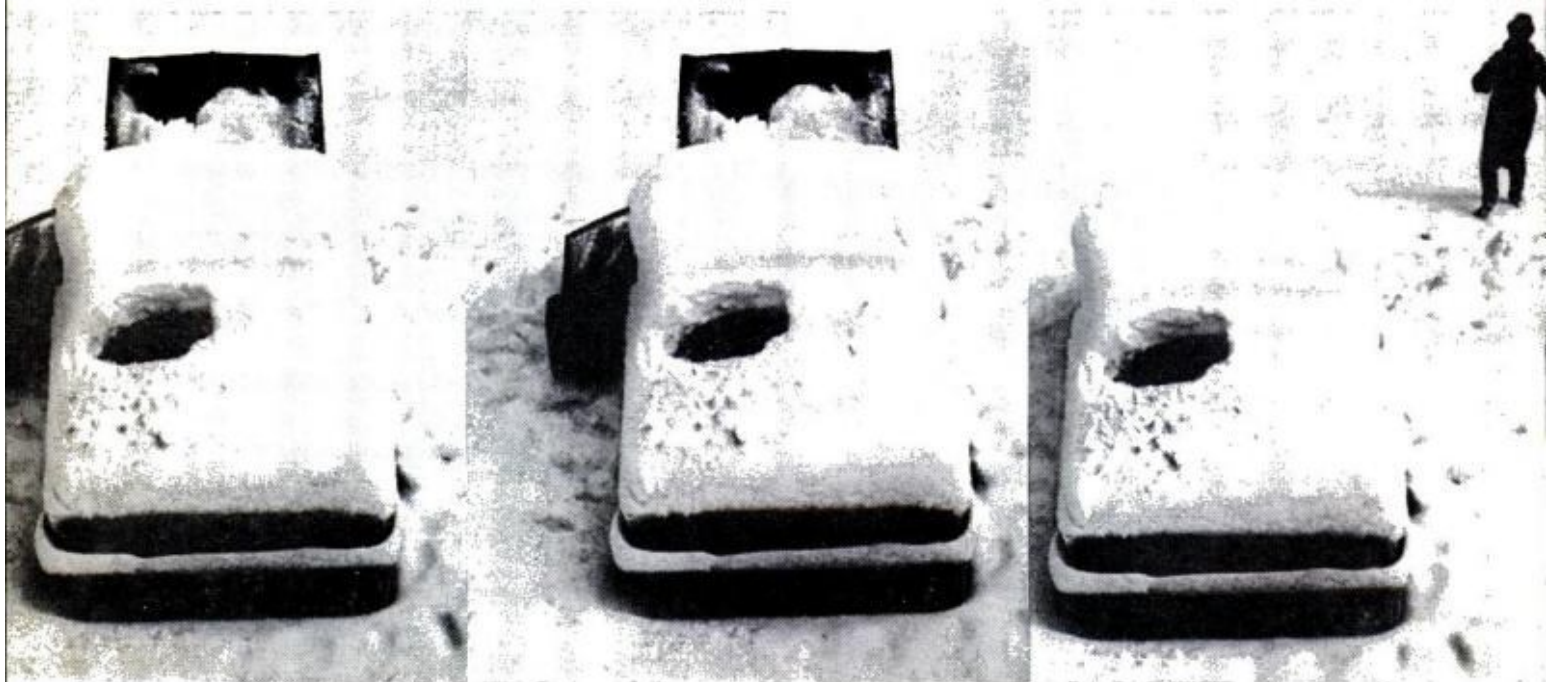
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* (-)

Now don't you wish you had the DieHardTM?

Size for size, it's America's most powerful car battery —by 35%.

"Why this car was completely winterized just a couple of months ago!"

"New plugs, points, heater hose. Put on the snow tires. Put in the anti-freeze and the winter thermostat. Changed to winter weight oil. Even put non-freezing gloop in the windshield squirts."

Now right when he thought he was sitting pretty he's sitting right in the middle of nowhere.

Can you know when your battery's nearing the end? Maybe not always, but here are a few rules of thumb:

- 1) When your headlights dim at idle.
- 2) When your battery has about 25,000 miles on it.
- 3) When your battery's heading into its third winter (statistics show it has only a 50-50 chance of making it to Spring).

If any two of these conditions describe your present battery,



sound preventive maintenance suggests you get the DieHard now.

What makes the DieHard so special? Size for size it's bigger. Not on the outside. On the inside, where it counts. All because of its polypropylene case. With polypropylene, the case can be 50% thinner and still be 6 times stronger than the old rubber battery cases.

In that extra room inside, Sears puts higher, wider plates and more acid. That's what gives the DieHard 35% more usable starting power than any other battery of its size.

You might consider this too. If you buy a DieHard now chances are you'll never need another battery as long as you own your present car.

There are over 2500 places to buy the DieHard. They're all Sears, Roebuck and Co. stores. You can Charge It, of course, on your Sears Revolving Charge.

The Sears 5-year guarantee: "Free replacement within 90 days of purchase if battery proves defective. After 90 days we replace the battery, if defective, and charge you only for the period of ownership, based on the regular price less trade-in at the time of return, prorated over number of months of guarantee."

The DieHard. Sold only at Sears. \$29.95 with trade-in. In Canada, at Simpsons-Sears at slightly higher prices.

Sears

ALLSTATE

You can't do better than Sears.

DieHard batteries now fit 88% of the 12-volt cars on the road. Sears carries a complete line of other fine batteries as well, in a wide range of prices.

The
clean-cut
look
is
here...

with the new
**Solid State
Retractable**
by Schick

**Solid state engineering
creates new breakthrough
in electric shaving!**

Thanks to solid state engineering, the new Schick Retractable is the biggest news since electric shaving first began. The motor is solid state controlled—for the cleanest shaves in Schick history. And—it's the most convenient razor ever built.

With the headguard doors closed, razor is completely self-protected.



Move casing down—headguard doors open, shaving head emerges, razor starts.



**No other razor shaves as
so clean—so easily!**

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Homelite XL chain saws make fast firewood for you. They're easy to handle and loaded with power, cutting through 12-inch logs in mere seconds and felling trees up to four

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DECEMBER 1968

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1. Training Means Money These Days

In today's job market, men with specialized training get the good jobs—and good pay. Trained men get the promotions and pay raises that count. In virtually every field, TRAINING spells the difference between staying where you are—and moving ahead.

Look over the list of fields below. In each, I. C. S. has been training men and women for years. Giving them up-to-date knowledge that will let them advance in their present job... or break into an entirely new field. I. C. S. can do the same for you—starting RIGHT NOW.

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PLUMBING-HEATING—Earn \$4.30 hourly—average for plumbing-heating specialists. I. C. S. course has proven track record. Starts with basics. Mail coupon for FREE Success Kit.

3. Art Talent Sought

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TRANSMISSION SPEC'L'ST—If you now know cars, why not become a specialist? Course covers transmission troubles, testing, repairing, overhauling. Auto., standard.

5. Businessmen Make \$\$\$\$

ACCOUNTANTS—20,000 openings a year in this high-pay field. I. C. S. courses cover the basics plus 10 vital accounting specialties. Get information. Send coupon right NOW.

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STENO-TYPIST—Want to be a secretary? Break into steno-typist work first. Send coupon for facts on I. C. S. training in typing, stenography, business practice—all you'll need to know.

15. Steam, Diesel Power. You're Needed

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PERSONNEL-LABOR RELAT'NS—Enjoy working with people? I. C. S. course can help you crack personnel field—or advance, if you're already in it. Labor relations also covered. Send coupon for FREE Success Kit.

17. Earn Money in Radio-TV

SERVICEMAN—Trained radio-TV servicemen average \$100-\$150 a week. I. C. S. course covers fundamentals of field step by step. Basic electricity, electronics; AM, FM radio; B & W, color TV. Mail coupon NOW.

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DETROIT LISTENING POST

BY BILL KILPATRICK

COMPLAINTS ABOUT REDUCED VISIBILITY thanks to government-required headrests on the new cars are starting to pile up on Detroit's doorstep. Although not mandatory 'til the first of next month, many '69s hit the streets with headrests already installed. According to complaint mail, many new-car buyers like and appreciate the concept, but feel automakers have done an indifferent design job. A lot of the mail includes ideas and sketches as to how Detroit *should* have solved the whiplash problem, most favoring some sort of roof-mounted webbing.

GENERAL MOTORS continues protestations that it's not in racing per se, yet apparently allows at least two of its divisions—Pontiac and Chevrolet—to look more and more like eager bridesmaids. Chevy has entered an agreement with the National Assn. for Stock Car Auto Racing (NASCAR) to provide pace cars for all of NASCAR's 1969 races. Chevy paced the '67 Indianapolis 500, has since made pace cars available for other big races, thus in effect abrogating GM's agreement to not "go racing." The agreement, drawn up a few years back under the auspices of the Automobile Manufacturers Assn., called for carmakers to wash their hands of all racing activity, including the providing of pace cars. Ford and Chrysler have long since repudiated the agreement publicly. GM never has, nevertheless "looks the other way" at Pontiac's drag-racing activities, Chevy's proliferation of pace cars. The theory? A guess, but perhaps *Numero Uno*—secure in its position of industry sales leadership—feels enough of a racing image will rub off via pace cars to keep its hand in with the go-go crowd, while avoiding racing's admittedly high costs.

COLLISION TESTS conducted by UCLA's Institute of Transportation and Traffic Engineering indicate 28 inches as being the best all-'round height for front seatbacks—several inches higher than most are now. For the backs of rear seats the Institute suggests a height increase of about four inches over the present more-or-less-standard 21. The Institute adds that seatback width can be reduced considerably to improve visibility without sacrificing support strength and antiwhiplash protection.

Detroit engineers are hip-deep in the whole safety/seat situation, will probably have all-new seat designs ready for the 1971s. Due for the ax? Presumably bench seats up front.

DODGE WILL ADD AN ALL-NEW TWO-PASSENGER SPORTS COUPE to its 1970 line. Car will be aimed at the market now catered to by the Corvette and the AMX, will be priced roughly in between, or at about \$4000. Car, to be called the Challenger, has a distinct European GT styling flavor, will probably feature an all-new Chrysler Corp. engine in both standard and hot versions.

PRODUCTION OF THE AVANTI II, a much-modified and hand-crafted takeoff on the former Studebaker offering, is approaching 300 units per year. The fiberglass-bodied car, built around Chevy Corvette power and running gear, sells in basic form for just over \$7000. Options can run the cost to over \$9000. Car is the same as the '68 with the exception of a newly designed hood and, after Jan. 1, a new engine—the Corvette 350. Car is built to order, takes six to eight weeks to manufacture and test.

KIND WORDS FOR THE AMERICAN DRIVER! "One of the safest—and smartest—drivers in the world," says New York University Prof. William J. Toth, who bases his eye-popper on a comparison between U.S. highway fatality rates and those of other countries. Our 80 million motorists drive over 700 billion miles per year, Prof.

(Please turn to page 52)

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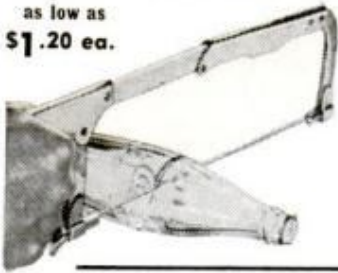
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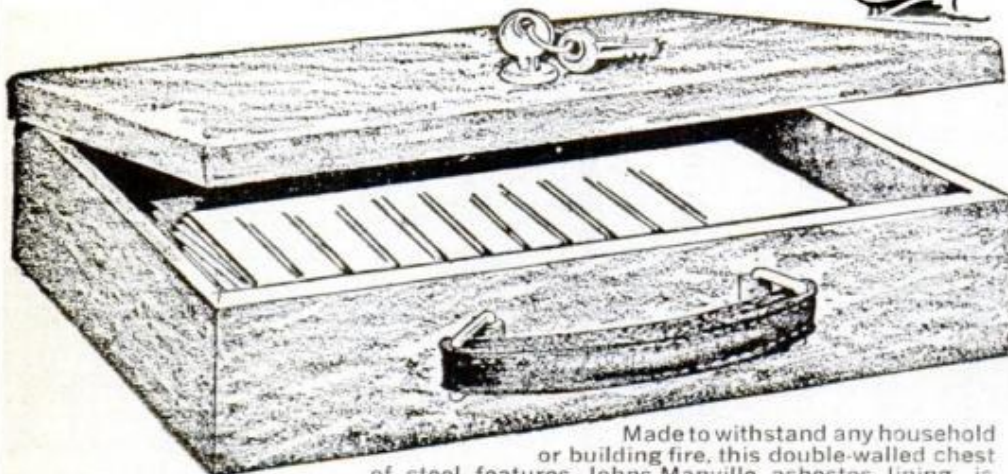
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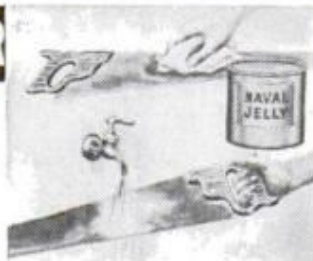


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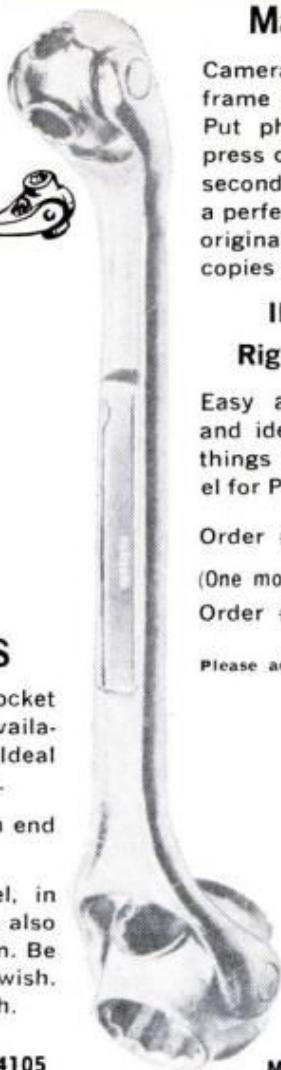
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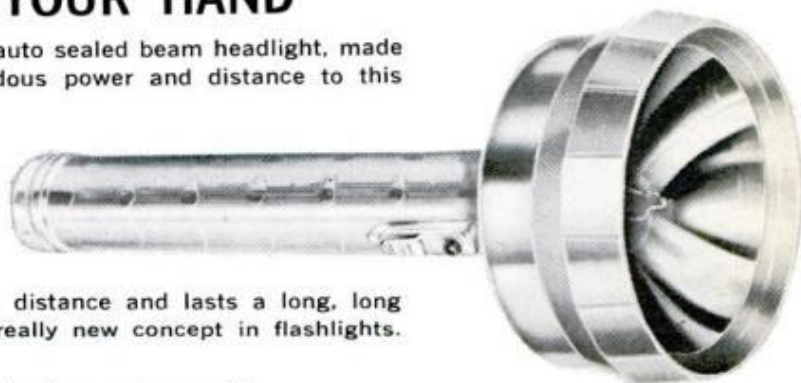
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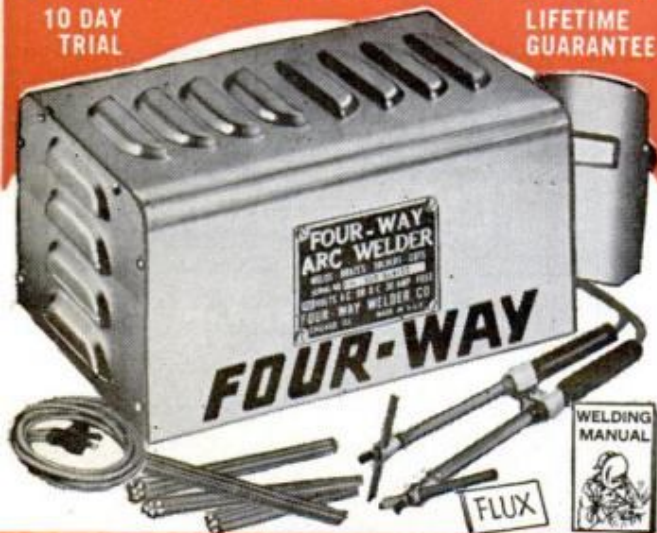
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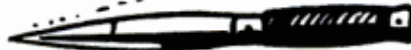
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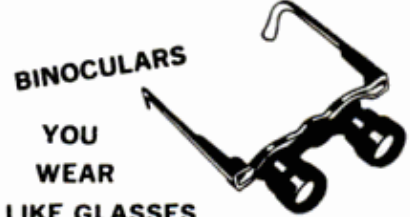
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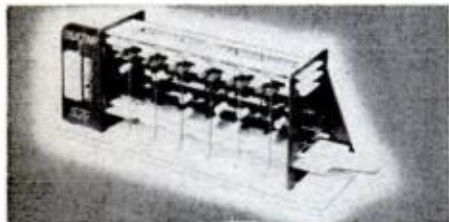
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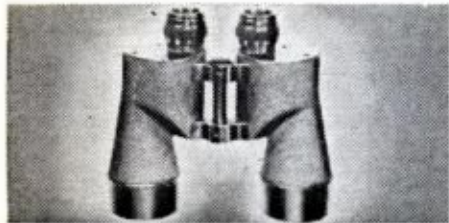
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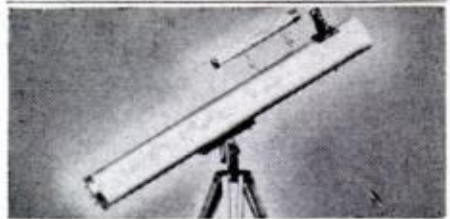
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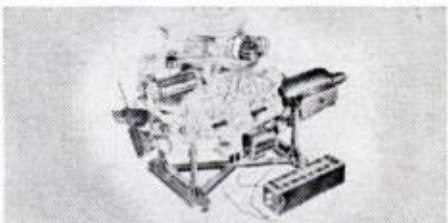
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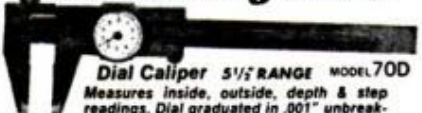
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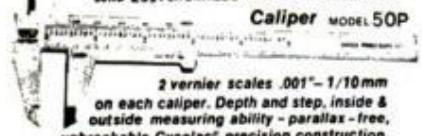


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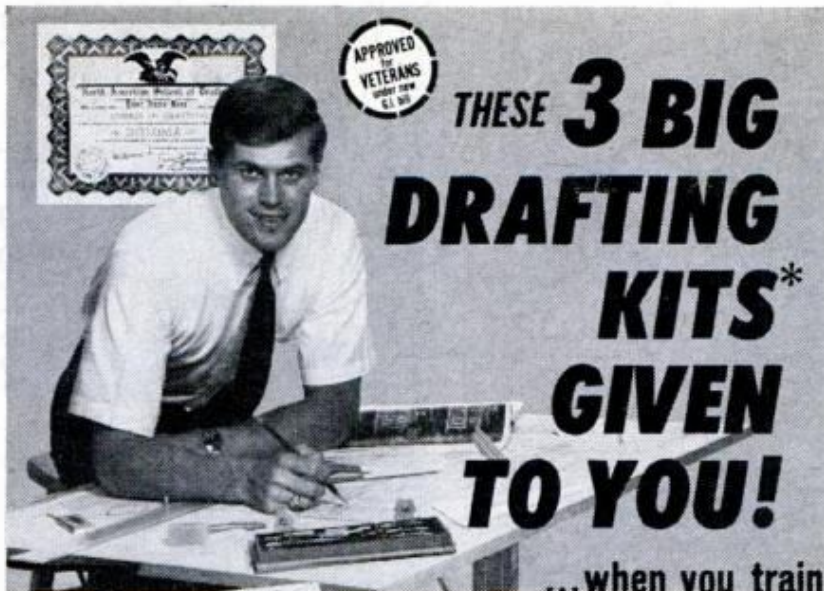
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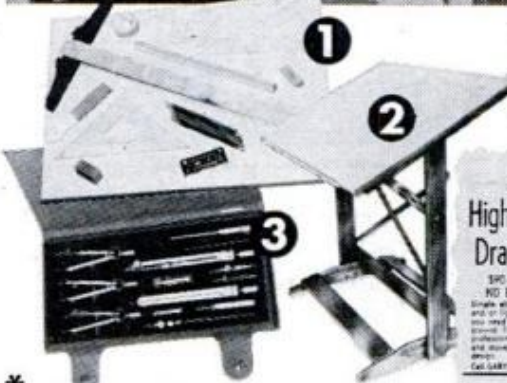
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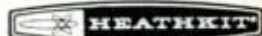
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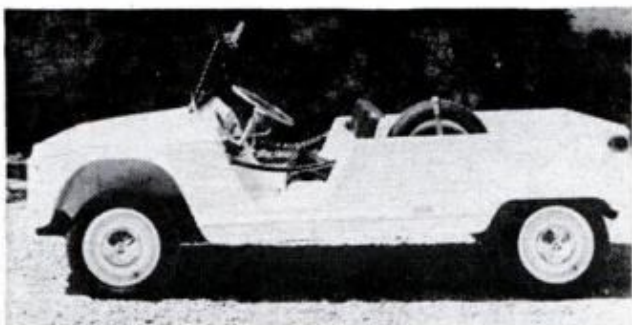
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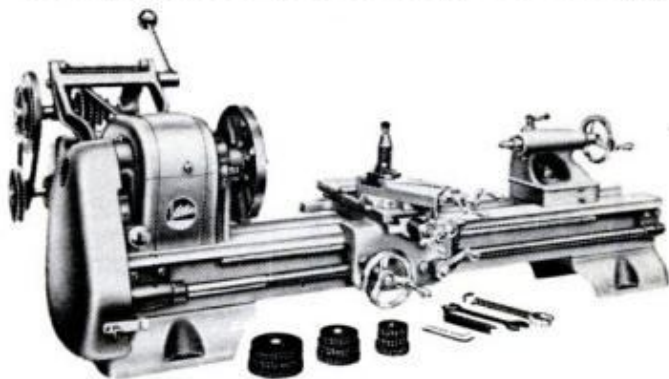
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DETROIT LISTENING POST

(Continued from page 20)

Toth points out, and, with 43 vehicles per 100 population—largest ratio in the world—our death rate per 100,000 registered vehicles is 52.6. Nothing to be smug about, he adds, but far better than, say, the U.K., which has a rate of 76.3 deaths per 100,000 vehicles. Even higher are France (112.9 per 100,000) and Germany (159 per 100,000). The grim booby prize goes to Japan, with 402.2 deaths per 100,000.

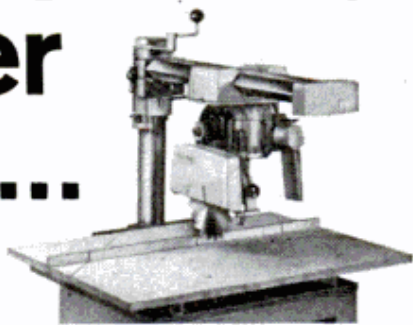
In an effort to reduce the carnage on its highways, Japan next year will introduce a "point" system to keep track of serious traffic offenses and bad drivers. Much like many U.S. state motor vehicle licensing procedures, offending motorists will be slapped with a certain number of points for each violation. A total of 15 points will mean a yanked license. But the Japanese have added a wrinkle: Offenses in a single accident are cumulative; meaning, for example, that a drunk (9 points) hit-and-run (11 points) driver who kills someone (13 points) will run up 33 points, good for a jail term as well as revocation of license.

CARS OF THE NEXT DECADE will not only look far different from cars today,

they'll be built differently, too. Very much under way here are elaborate and hard-nosed plans to link highly sophisticated production machines to computers, a process called by any other name, but spelled **A-U-T-O-M-A-T-I-O-N**. Automakers are currently experimenting with production equipment far more elaborate than anything in use right now, hopefully plan to have it "on line" as the decade of the 1970s opens. Crystal-balling it, the industry sees big gains in production without adding to the work force, a factor that should hold prices down, limit increases to covering higher costs of materials, installation of foreseeable government-required safety equipment.

Also on tap for the '70s is much wider use of so-called "throwaway" components, items that will be pitched out rather than repaired; this, too, a sidelight of increased industry-wide automation. Items that can't be thrown away because of comparatively high costs involved in their manufacture will, in the same vein, be replaced rather than repaired. Entire units will be yanked, new ones installed. Replaced units will be rebuilt for installation farther down the line. These units and "throwaways" should mean less down time for car service, lower costs. ★★

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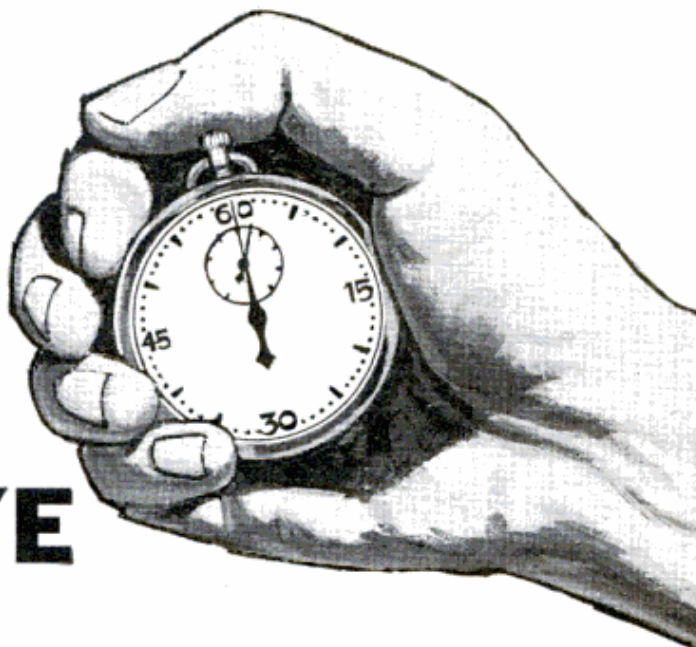
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Drivin' with Dan

Where can I buy a Ford or Ferrari racing car? Why are Eagle race cars different from any others? What engine do you plan to use in next year's Can-Am series? Dan Gurney answers these and other provocative questions

Q. Why is your Eagle different from any other race car?—Derrick Goudy, New Castle, Ind.

A. Well, we have built four types of Eagle cars to date—the first Indy Eagle, the Formula I Eagle, the 1968 Indy Eagle (winner Bobby Unser's car) and the Formula A Eagle. They are all of the current conventional rear-engine design. They differ only in detail and execution. We are concerned with certain refinements involving aerodynamics and materials, with an emphasis on durability and safety as well as on pure performance.

Q. What advantages does a piston-driven car have over a turbine-driven car? What is different about your style of driving and that of A. J. Foyt? —James Segar, Potsdam, N.Y.

A. Right now, piston-driven cars have a faster throttle response, a big help in heavy racing

traffic. A. J.'s style was formed primarily on U.S. dirt and paved ovals, while mine is a product of road racing. The styles are different, just as our fingerprints are different. Under equal racing circumstances, I would say they end up very similar. When you get right down to it, style is dependent upon the potential of the machine. A. J. generally stands on the gas, and he's a tremendous driver. I appreciate being compared with such an all-time great.

Q. I've read that it's going to take a 427-cu.-in. engine to win next season's Can-Am series. What do you think? What engine do you plan to use? —John Garrity, San Bernardino, Calif.

A. I hope that it won't take a 427 to do the job. We plan to use only a 325-cu.-in. version of our 305 Indy Ford. We might have a 377

(Please turn to page 62)

DAN CRANKS OUT a quick one in his new "McLeagle" (McLaren-Eagle), one of two All American Racers entries in the fast and exciting Can-Am race series. Power is a 325-cu.-in. stock-block Ford putting out 530 hp



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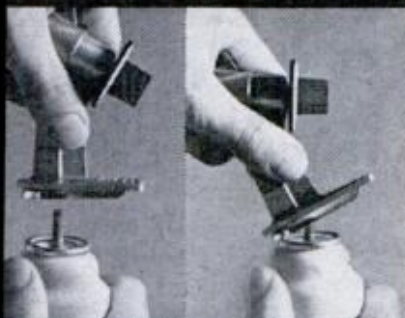
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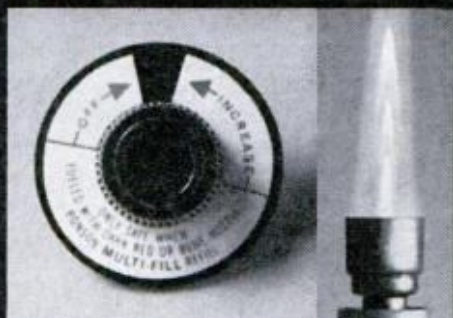
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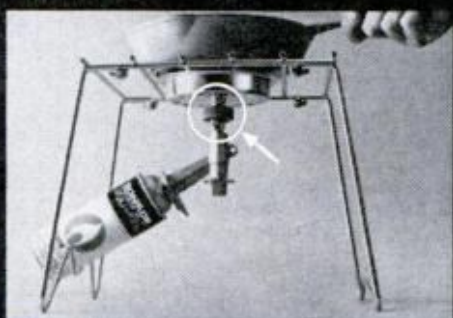
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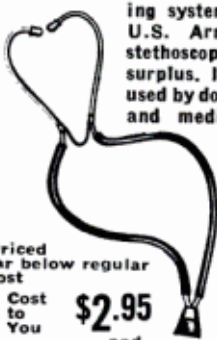
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DRIVIN' WITH DAN

(Continued from page 56)

engine when the series starts. There probably will be at least one Ford entry with an aluminum 427 engine, also a 306, four-cam Ford entry. Durability may be the deciding factor.

Q. What age do you have to be to become a race car driver?—Rod Janacek, Sandy Creek, N.Y.

A. I believe 21 is the usual minimum limit. There have been exceptions. The maturity that comes with age is a vital safety consideration. Judgment is the most important aspect of driving, either on the highway or the racetrack.

Q. Why don't you write a book on how a person should drive in a race?—Armand Bucci, West Berlin, N.J.

A. I hope to find time to do this someday. If I am able to, I want to give it everything I have. Right now I feel that it would require so much time, it will have to wait until I retire from the rigors of active driving.

Q. Where can one buy racing cars, such as a Ford GT or a Ferrari?—Howie Kaye, Brooklyn, N.Y.

A. I suggest contacting Jacque Passino, head of Ford Competition Dept., for a Ford GT. John Wyer, of J.A.W. Automobiles, Slough, England, is actually engaged in selling Ford GT-40s to private customers. As for Ferraris, I suggest contacting Luigi Chinetti, of New York City. Ferrari seldom sells out-and-out competition cars.

Q. In your opinion, does Ford make anything that can beat the 427 Corvette for '68?—G. Cline, Worthington, Ohio.

A. The 427 Ford Mustang and/or the 427 Cougar can do it on occasions, although for the present Ford does not produce a car in the same class.

Q. For someone starting in stock-car racing, which engine would you say delivers more power and speed for its size and weight?—Scott Moore, Dayton, Ohio.

A. This is a fair question, but one that is virtually impossible to answer with any degree
(Please turn to page 64)



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DRIVIN' WITH DAN

(Continued from page 62)

of certainty. The picture changes from race to race. Engine development is such that no engine seems to be able to maintain a sustained advantage.

Q. I want a car with four-on-the-floor, a 350-cu.-in. V8 or higher, for under \$5000. What would you buy?—Arnold Schmidt, Raleigh, N.C.

A. I suggest you make a real project out of it. Visit the various dealers, try all the cars, and make up your own mind. That's the way I would do it.

Q. Craig Breedlove says he's going to break the sound barrier. Will he create a sonic boom? Will the car shatter? How will he be able to stop? Will he be able to get tires to withstand the high speed?—George Meyer, Costa Mesa, Calif.

A. I'm out of my realm here, but here goes. Yes, he certainly will create a sonic boom. It may create severe stability problems. I doubt if the car will shatter, at least from the boom. I think it will require a lot of distance to stop safely. Chutes may help. I'm sure he can get the tires he'll need.

Q. What's your favorite type of racing—F-1, Indy, or Can-Am? Do you think USAC would ever allow an adaptation of F-2 or F-3 prototype cars and engines at Indy?—Jon Kline, Cincinnati.

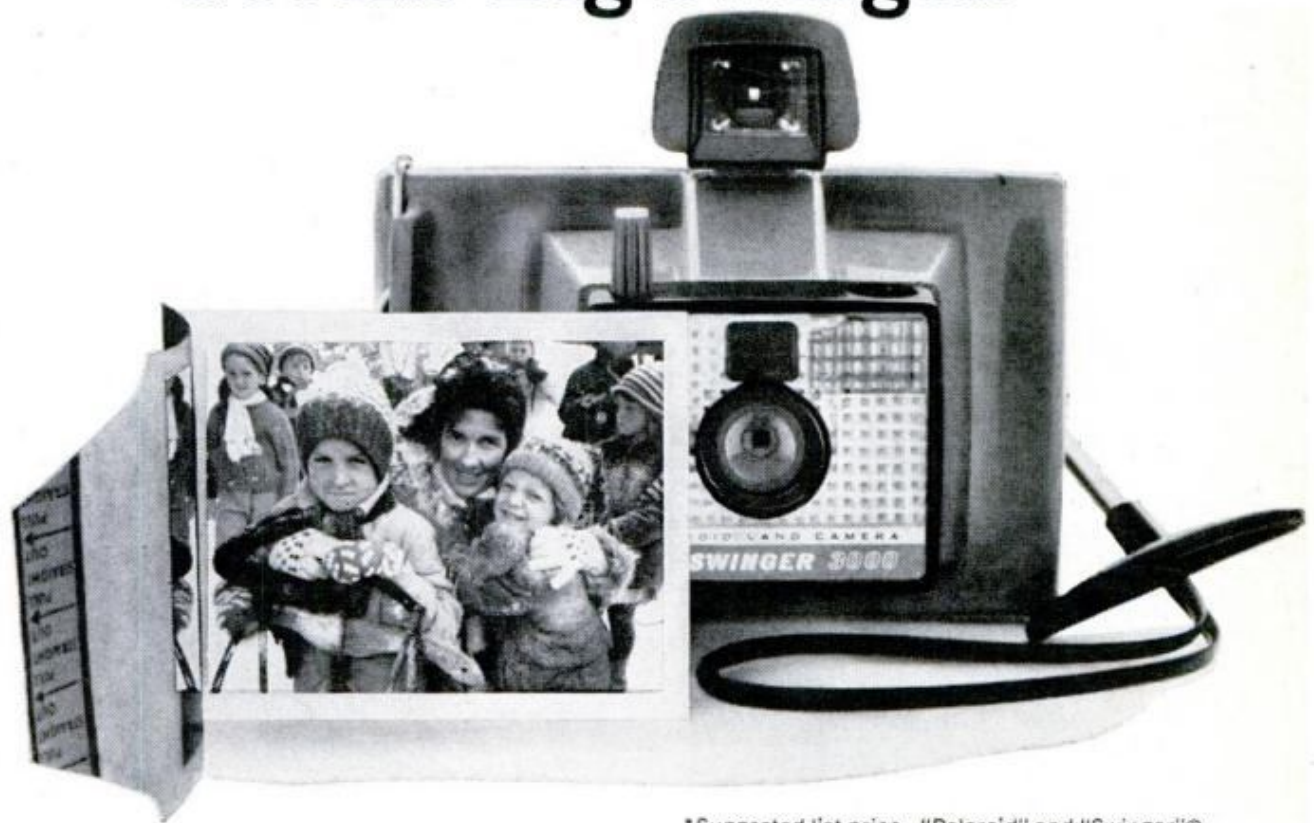
A. I like Indy cars a lot because there are no restrictions on fuel used. Can-Am cars are great because engines are unlimited. F-1 offers international flavor and great tradition. They are all great in their own way. No, F-2 or F-3 cars are too small and weak for Indy.

Q. Are there any cars in the world with over 400 hp?—Ward Smith, New Orleans, La.

A. There are many, many racing cars with 400 and more, of course. As for passenger cars, there are none to my knowledge. ★ ★ ★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 72).

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QUESTIONS ANSWERED

HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

60°F. basement

The temperature in my basement stays at 60°F. all winter, so my workshop is always cold and damp. How can I eliminate this condition? My furnace is in a separate room on a different floor.—F.L., N.Y.

If it is not possible to tap into ducts or pipes to conduct heat into the basement, then the only practical solution remaining is to go to a vented gas heater (which can be suspended from the ceiling or installed between studs in a conventional framed wall). Such heaters are quite efficient and come with a circulating fan for more uniform heat distribution.

For summer months, you might consider the installation of an automatic dehumidifier to keep the moisture content of the air at a given level.

Sticky problem

I want to cover the tops of a chest of drawers and a small table with plastic laminate. Can I do this with contact cement? What's the procedure in preparing the surfaces? Can I cut the laminate with a handsaw? If not, how?—C.U., N.Y.

Yes, contact cement can save you time and clamps. It sticks—but you must work quickly. The surfaces of the table and chest tops should be sanded smooth without any bumps or dents. If edges of the tops are molded you'll have to make sure the laminate is cut to exact size—you can't easily work down an overhang with a file or rasp after the material is in place. Usually it's best to make cardboard patterns of the tops, then take these to your dealer and have him cut the laminate to the patterns. The cutting charge will be nominal and it will save you a lot of time.

Coat the bottom face of the laminate and the tops with the cement, following the application instructions on the container. Let coatings set until very tacky.

Now comes the tricky part: Hold the laminate with both hands and position one edge flush with the edge of the table top. Make sure this edge is correctly positioned, then press the edge into contact with the table and gradually lower the laminate sheet, pressing outward from

(Please turn to page 69)

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HOMEOWNERS' CLINIC

(Continued from page 66)

the center. Once the laminate is in full contact, smooth it quickly in two directions from the center. Remember, you cannot shift the material once it is in contact. If edges of the tops are square, apply strips of matching laminate to these first, smoothing top edges flush with a rasp.

Renewing rush seats

I have two chairs (modern reproductions) with fiber rush seats. The original finish—probably a colored shellac or varnish—is wearing thin, exposing the natural light color. The color of the original matched the maple finish on the chairs quite closely. How can I refinish the seats to match?—R.S., Ga.

I assume the rush seating material is still in good condition—no tears, broken strands or discoloration. Should there be any breaks or other appreciable damage, I'd advise having the chairs resealed with new material, a relatively inexpensive job that should be done by someone who understands how to weave a rush seat.

If it isn't damaged, however, first go over the seat lightly with fine steel wool to remove any loose residues of the old finish or hardened dust. A stiff-bristle scrubbing brush is a good substitute for steel wool. But in either case, do a thorough job and take pains to brush away all loosened debris. Then stain the light, worn areas with artist's color; usually a burnt sienna will match most maple finishes quite closely. Thin the color to a creamy paste with turps, brush on and immediately wipe off until you get just the right depth of color. Allow to dry for at least 72 hours. Then coat the entire seat with a semi-gloss varnish.

Haunted house?

I live in a fairly new ranch home and when the wind blows hard from the northwest, I sometimes hear an alarming buzzing or whistling sound, loud enough to awaken me from a sound sleep. I've traced it to the front door but nothing I've done, even shifting the striker, has stopped it. All windows and doors are weatherstripped so they should be tight. Can you tell what's wrong?—D.W., Iowa.

It's probably the weatherstripping, likely at some point just above or below the lock. Drive a few extra nails at both of these points and you'll no doubt sleep more soundly. ★ ★ ★

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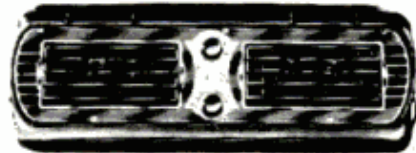
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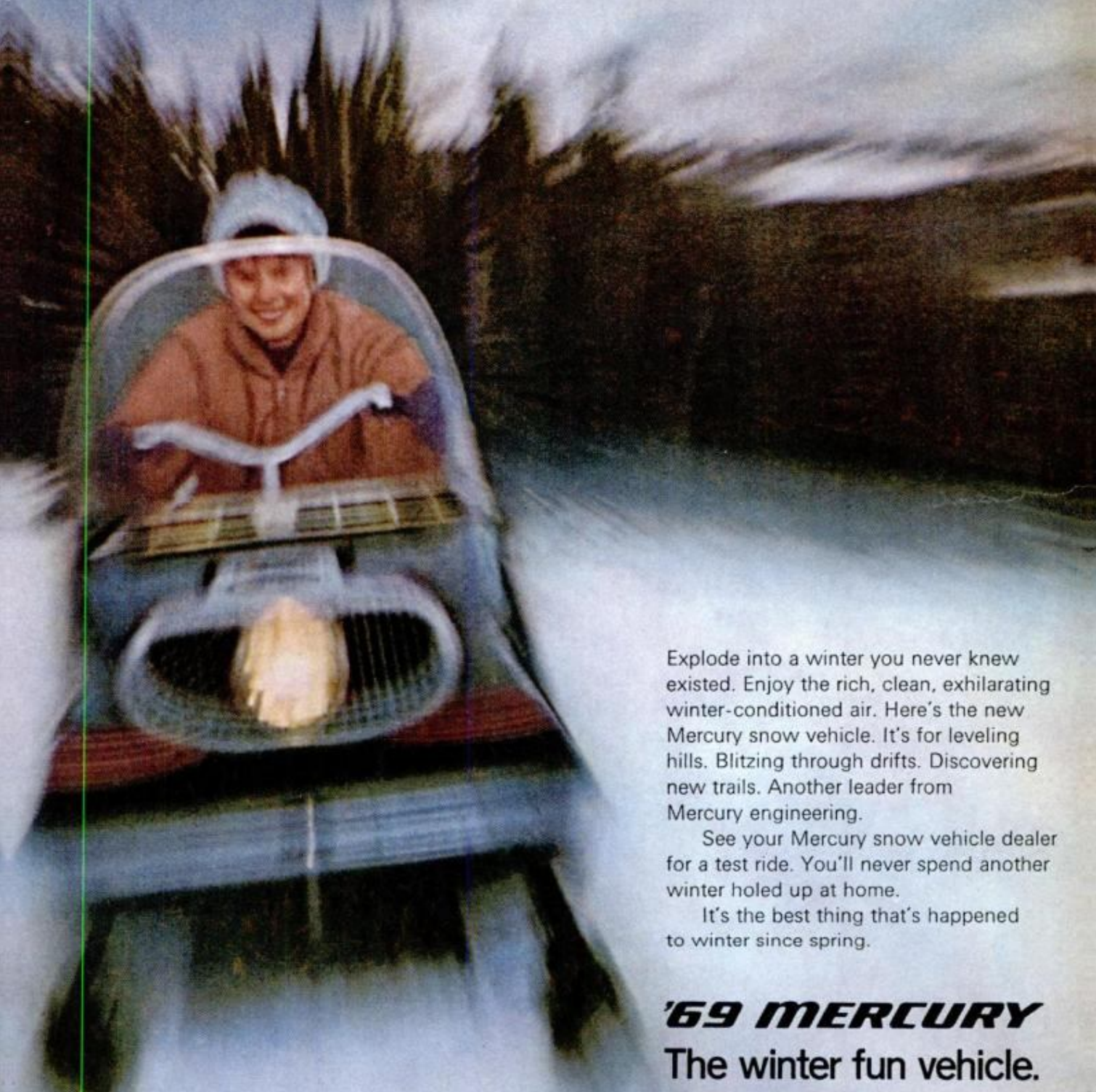
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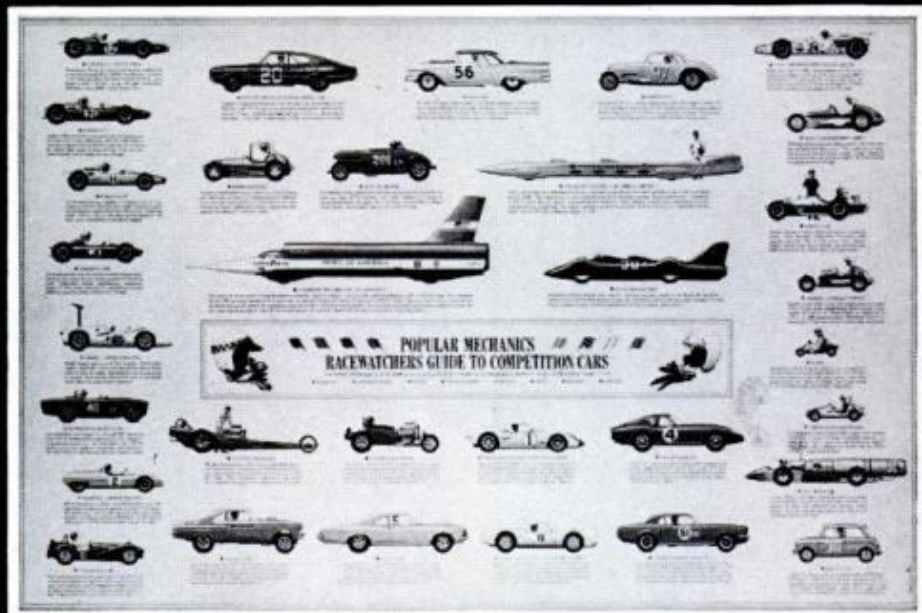
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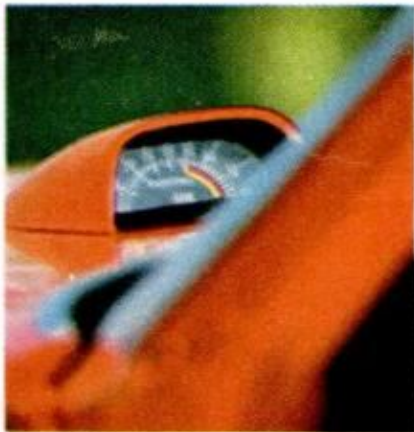
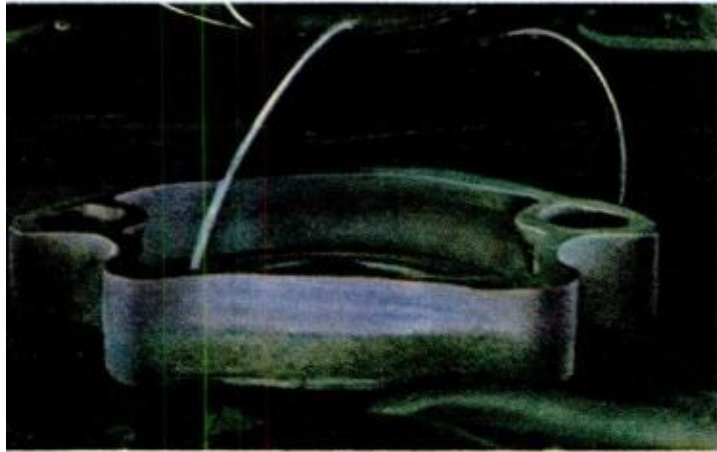
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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Heavy-duty clutch

I'm unable to keep a clutch in my 1964 Grand Prix longer than 90 days. I have had to adjust it every week for free play. Still, it gets chewed up. I'm not a hot rodder and I don't ride the clutch. Any solution?—Charles H. Kallies, Milwaukee, Wis.

Here are two. First, it's possible that you have a misalignment condition between the clutch housing and engine. When checking this, if you find alignment to be okay, I suggest that the standard clutch for this car isn't heavy enough to withstand the use you're giving it. Switch to a heavy-duty clutch and pressure plate of the type used in police cars and cabs. A Pontiac dealer can provide the right one.

No explanation

Why, after only 7700 miles, did the shock absorbers of my new Chevelle fail? The dealer replaced them without question or cost to me, but couldn't explain the reason.—W.J. Mulligan, Meadville, Pa.

For the same reason that anything mechanical is susceptible to a breakdown anytime after it leaves the factory.

Nervous speedometer

My problem with a 1967 Olds Cutlass (standard transmission) is that the speedometer needle jumps around and doesn't give a true reading. At times, it doesn't register at all. Mechanics have checked out the speedometer cable and find nothing wrong. Do you have a cure?—Kenton L. Pate, Mobile, Ala.

An interested mechanic would check the speedometer head if he found nothing wrong with the cable. The fact that occasionally the speedometer doesn't register suggests that the nylon bushings in the head may be too tight. It's also possible that the speedometer cable is too short and is slipping out of its socket at the back end of the speedometer.

High-flying jets

I have a 1968 Toyota Corona that is operated most often at an altitude of 5200

to 6000 feet. I get an average of 24 miles to the gallon. Yet, when I drive in Phoenix, Ariz. (altitude of 1300 feet), I get a consistent 28 miles to the gallon. I'm thinking of changing the primary jets in the carburetor to a smaller size to improve gas mileage at the higher altitude. Is this advisable?—Jack L. Keith, Farmington, N.M.

No, and for two reasons. First, you won't be able to get a smaller jet for your carburetor. The carburetor is made in Japan, and they don't make variable jet sizes for it. Even if you could get smaller jets, I wouldn't switch. If you did, when you do drop down to visit us folks at the lower altitude, your engine will have to run on a leaner fuel mixture, and there's a good chance you'll start burning valves.

Not enough torque

I get a crunch or squeak when I turn into my driveway or when driving over a dippy road. Is it the ball joints? The car's a 1964 Olds F-85.—Harry L. Jennings, Los Angeles, Calif.

Could be, but it's also possible that the lower control arm bushing bolts are insufficiently torqued. Before going through the expense of replacing ball joints, torque those bolts to 85 ft.-lb. with the weight of the car resting on its wheels. Also try lubricating the control arm stops.

Bumming for a smoke

I have a 1966 Chevelle with a 396-cu.-in. engine that suddenly developed a tapping noise which sounds like a frozen or stuck lifter. Investigation has proved that it's not a lifter. The engine runs fine—doesn't miss. A mechanic tells me the only way to get rid of the noise is to replace the block, which doesn't sound logical. Can you help?—Richard J. Shulz, FPO, New York.

Sounds kind of kooky to me, too, that you should have to replace an engine for making a noise. A good possibility, since it's been happening with these engines, is that carbon deposits have built up on top of the pistons, causing the noise. Go to a Chevy dealer and buy some engine
(Please turn to page 76)



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Dirty spark plugs are a major cause of power loss and poor gasoline mileage.

Dirt and deposits are built up during short trip, stop-and-go driving. They can bleed off so much current that the spark plugs misfire.

The new ACNITER Spark Plug features an exclusive hot tip design. The thin, recessed insulator heats up fast enough



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to help burn away deposits.

The firing tip stays cleaner, longer, to give you better engine performance on the roughest trips you make—short or long.

Multiple firing edges

ACNITER's knurled center electrode provides multiple firing edges. So you get better ignition at all speeds, under all driving conditions.



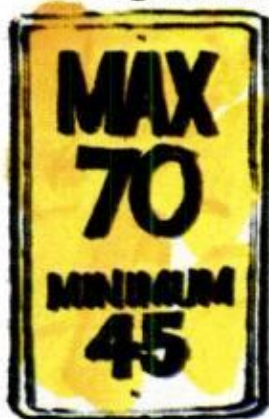
Better highway performance

ACNITER's clean tip helps your car run better on the highway, too.

Dirty spark plugs are more likely to misfire at high speeds and during rapid acceleration.

The ACNITER thin tip gives you another important benefit at highway speeds: it guards against engine-damaging pre-ignition.

Pre-ignition occurs when the insulator tip doesn't cool off in time for the next fuel charge. Instead of burning at the proper time, the gas and air mixture pre-ignites. It could cost you an engine.



AC KEEPS YOUR CAR IN



TION

AC's insulator tip cools quickly for full power at highway speeds while guarding against damaging pre-ignition.

Improves radio reception

Anytime an electrical spark is produced, radio signals are also produced. These signals cause static interference, a major problem for modern communications.



ACNITER's built-in resistor screens out a large portion of the static caused by electrical sparks. This improves reception on AM, FM, and FM-stereo car radios.

But the most important benefit is that widespread use of new ACNITER Spark Plugs will help clear up valuable radio frequencies which are vital for space age communications.

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AC ACNITER Spark Plugs will be original equipment on 1969 General Motors cars: Chevrolet, Pontiac, Oldsmobile, Buick, and Cadillac.

Next time you tune your car, get new AC ACNITER Spark Plugs. They give you more go when you really want to go!

For Safety's Sake, Check Your Lights—Replace with AC Guide Lamps.

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AUTOMOBILE CLINIC

(Continued from page 72)

cleaner. Use it as directed. Then get the car on a highway and step it up to try and blow the deposits out the exhaust. I wouldn't stake my life on it helping, but I'll bet a good cigar it does the trick.

Eternal light

What makes my battery die so often? I have been assured that the electrical system is in good condition. Yet, every couple of days following charging of the battery, the thing fizzles out. The car's a 1964 Olds F-85.—Jack Felt, Richmond, Va.

If generator and regulator are doing their job, then the cause has to be a current draw from somewhere—probably in a place that's not readily visible. Take, for example, the trunk lamp, which is supposed to turn off when the lid is closed. The feed to this lamp in your car is "hot" at all times, giving rise to the possibility that the lamp's staying on. I don't suggest you climb into the trunk and close the lid behind you to check on this (but it is the easy way). Otherwise connect an ammeter in the circuit. It will tell you if current's being drawn with the trunk lid closed. If this is the case, remove the lamp cap and bend the lamp mounting flange so the light goes out *before* the lid reaches the fully closed position. If you can't repair the switching assembly, replace it.

Paint problem

My trouble is with the dark blue finish on my 1963 Pontiac. It's discolored to a chalky white in some spots, and there are fine hairline cracks over the entire finish. None of the known reputable shops in this area will tackle the job of repainting the car. They tell me it's been their experience that the same thing will only recur. Is there any solution to my trouble?—J. Pierino Bevivino, Mount Carmel, Pa.

I don't know, because you do have a most unique paint problem. The solution might be to sand the car down to bare metal, apply a sealer, and prime and paint it. This, of course, would be quite expensive. My advice, therefore, is to get one of the paint shops to call in a field representative of a leading automotive paint

company, such as DuPont. These people can usually come up with a solution to a tough paint problem such as yours.

Radial runaround

I plan to purchase a new car, and I'd like to get different tires put on. But I'm getting the runaround from the dealer when I ask about radials. He tells me the tire companies are taking them off the market, because they don't last as long as standard two-ply tires. This is contrary to the reports I've read. What's the scoop?—Stuart C. Hoffman, Perrysburg, Ohio.

The scoop is that some tire companies aren't "pushing" radial ply tires because their production set-up isn't geared for high volume yet. They will last a long time and, as for your dealer's contention that the tires are being taken off the market, that's not true.

Service Tips

● **1968 Lincoln exhaust system noise** could be caused by a leak at the resonator inlet and outlet flange. You can fix the problem by replacing the single resonator flange gasket with two new gaskets. Authorization for your dealer to do the work is provided by service bulletin 31 (5/13/68).

● **The Rubber Manufacturers Assn.** warns us not to have flat tires repaired with a rubber plug inserted from outside the tire as so many service stations do. The safe way is with a combination vulcanized plug and patch repair applied from inside the tire.

● **Chrysler owners** have often complained about brake problems, particularly squealing. The company has issued a long, detailed service bulletin that covers all Chrysler brake problems. It appears to be the answer we've been looking for. It's service bulletin 68-5-1 (5/23/68).

● **Oldsmobile** tells us that a deep "squawk" coming from the rear shock absorbers when the car's first moved in the morning could be the result of dry shock-absorber shafts. The annoying noise can be cured by supporting the car at its lift points to let the rear shocks extend themselves, and then to lubricate the shafts and seals with silicone lubricant. ★★ ★

GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Letters cannot be answered individually, but problems of general interest will be published in the column.

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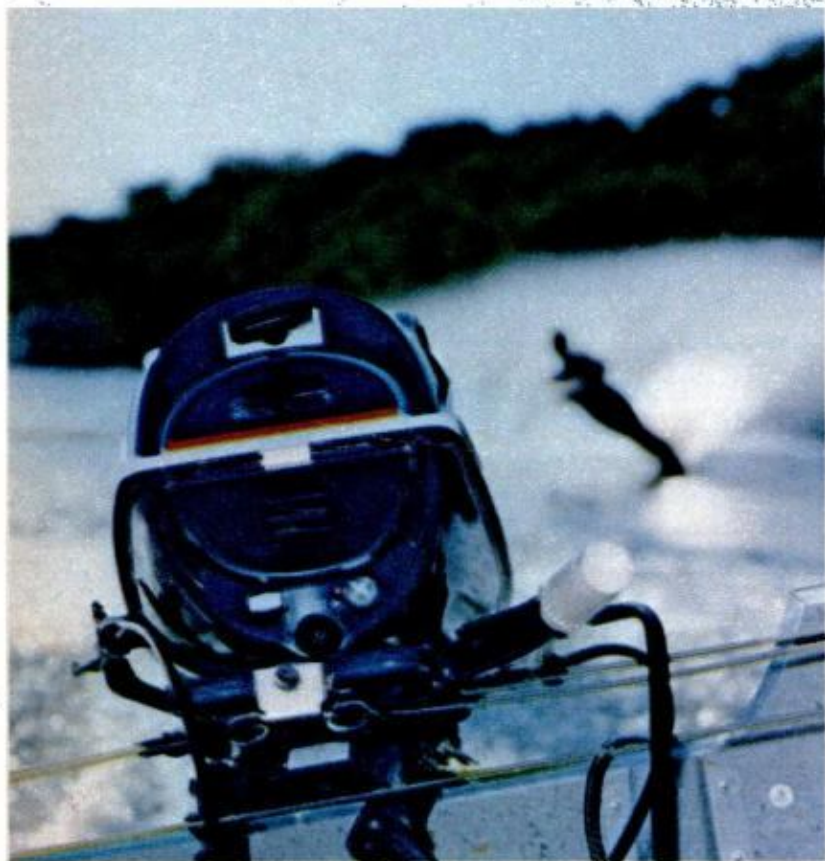
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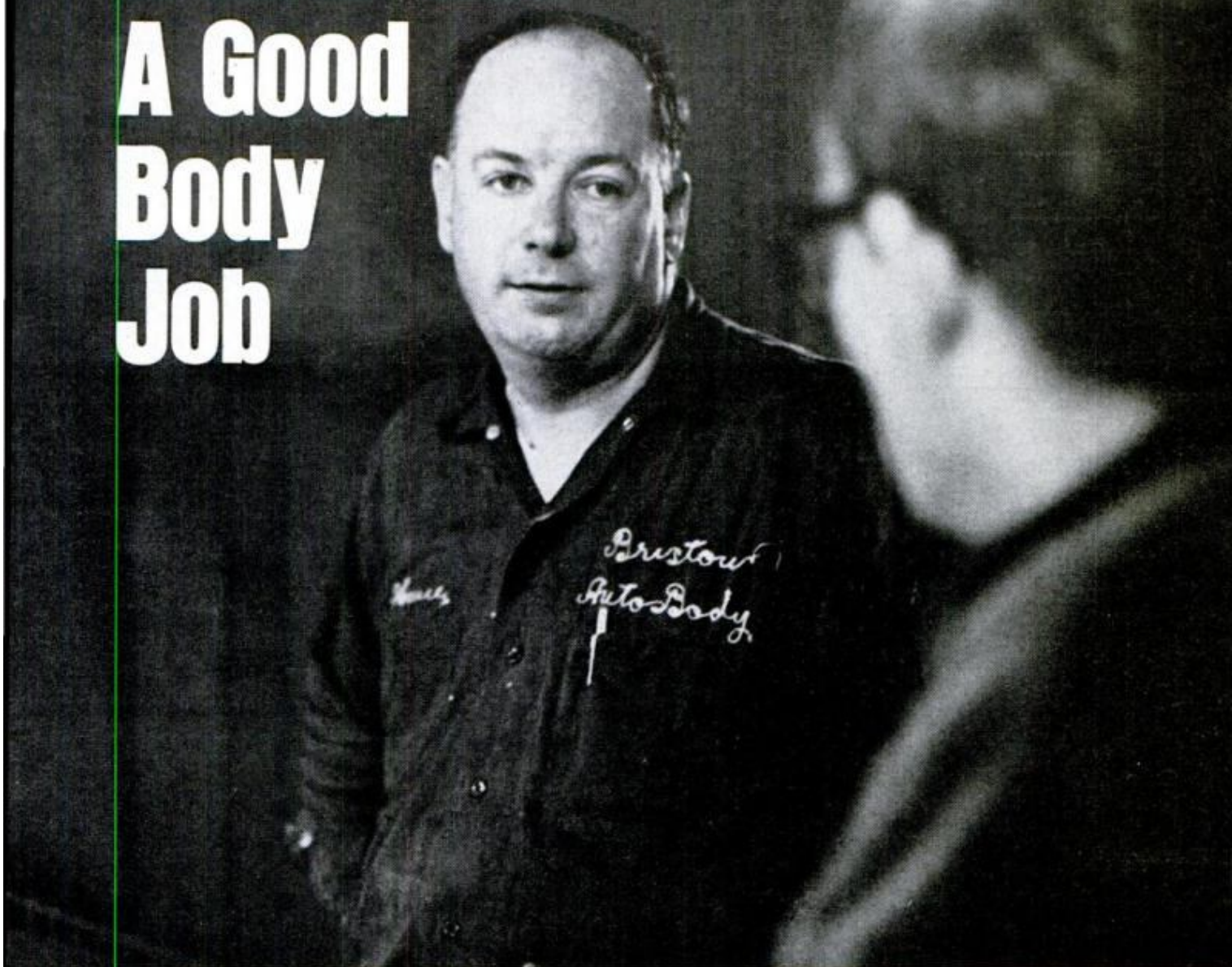
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How to Get A Good Body Job



The thing to remember is that looks are only skin-deep; it's what's underneath that counts

By **BILL KILPATRICK**, Auto Editor

Photos by *Stanley Rosenthal*

THE MAN on the right above could be anybody, someone getting the bad news as to what it's going to cost to repair his smacked-up automobile. He could also be a petty chiseler trying to get something for nothing.

The man on the left could be a legitimate businessman or a bandit out to take everybody for every dime he can by cutting vital corners and doing the

cheapest possible job for the most money.

The only element missing in this scene—one repeated thousands of times daily throughout the United States—is a representative of an insurance company, often a man also interested only in the cheapest possible job.

But the man on the left is far from a bandit. He's Howard Bristow, proprietor of a Paterson, N.J., auto body shop

and a leading force in a nationwide effort to bring about reforms in today's auto body repair business. And Bristow's the first to tell you the business needs reforming.

"Something has to be done," he says with the fervor of a crusader. "Everybody—you, me, the insurance companies—we've all got a big stake in shedding a little light on this business before we all go down the tube."

To illustrate his point as to how the present situation affects the average motorist, Bristow tells of a man who brought in a car that had just been repaired at another body shop. Seems the fellow had second thoughts as to whether or not he had received a good job. Bristow immediately noticed that one of the fenders was set back about half an inch; it was supposed to be flush with the front of the hood.

"Whoever did the job didn't bother to straighten the frame," Bristow says. "It wasn't off much, so the guy probably figured to hell with it and just slapped on another fender. But a frame out of whack can mean excessive tire wear, bad handling and possible structural and component failure. It's a good example of a 'public be damned' attitude that a few rotten apples in the body repair business have."

Bristow says that when he showed the fender to the man who had brought the car in, the fellow said the guy at the body shop told him Ford made fenders in three lengths—long, medium, short—and the only ones he had in stock were short.

"For a few days there the guy actually believed him," Bristow says, shaking his head in amazement.

"Some of the insurance companies don't help much either," he adds. "One of our main gripes with them is this flat rate business. One big company, for example, figures its jobs at the rate of a dollar less an hour than the average. That may be gravy for a body shop in East Nowhere, but it's murder on me. I pay my help top dollar and I'm supposed to pay all my costs of doing busi-

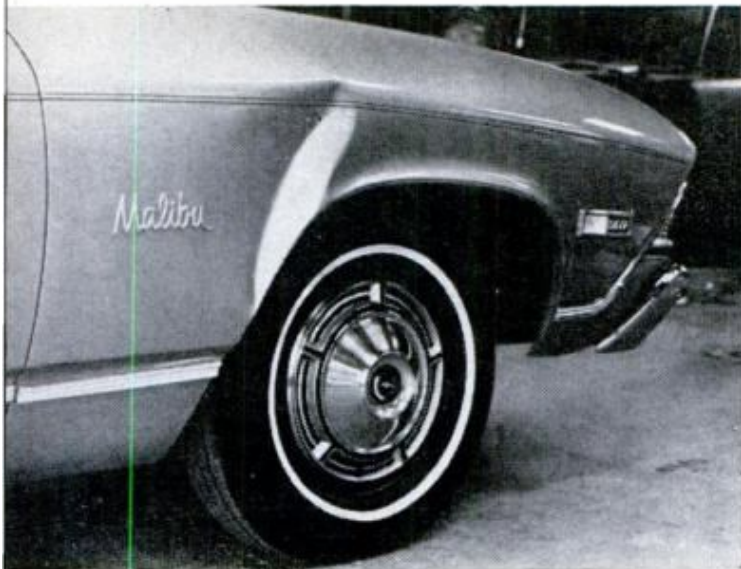


A SKILLED ESTIMATOR is an important man in any body repair work. He determines what needs doing, what parts need replacing. How thorough, accurate he is helps determine how good a body job you get

ness plus making a profit for a dollar less. It can't be done, and that's why a lot of us refuse work insured by this particular company."

Someone else with whom Bristow doesn't have much patience is the customer who tries to chisel.

"He just smacked a front fender and his insurance company told him to get a couple of estimates. But it turns out that six months ago, say, his wife put a little scratch and dent in a door and he says to me, 'Say, while you're at it, and

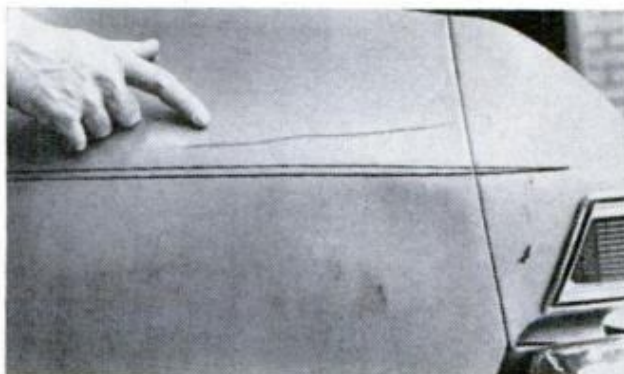


LOOKS LIKE a crunched fender, period, but frame is bent downward, will need extensive straightening

seeing as how the insurance company is paying for it, how about fixing that door?" This is the kind of guy who wants me to kite my price and kick back the money he has to pay under the terms of his \$50 or \$100 deductible policy. You'd be amazed at some of the stuff a lot of people try and pull. I tell them to get lost."

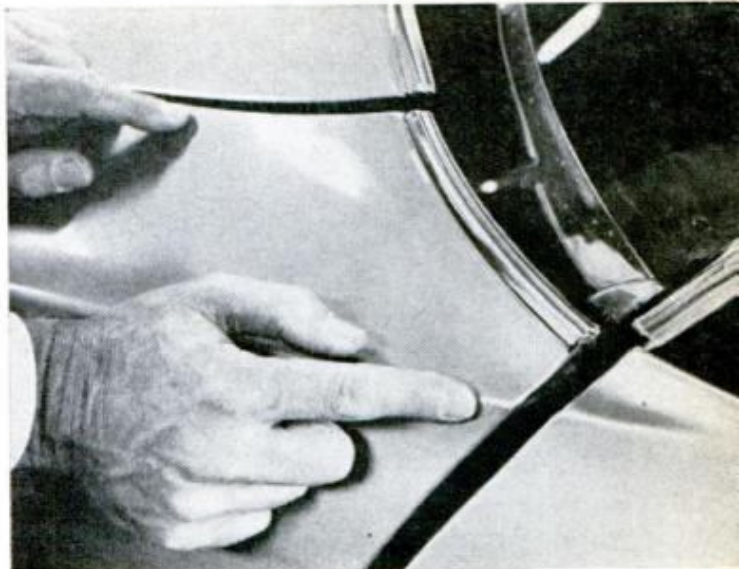
Bristow says that far too many body jobs wind up with all parties involved—the shop, the customer, the insurance company—thinking they've put one over on the other guy. The result, he says, is that all are getting the short end of the stick.

"The body man's problem is compounded by several things," points out George Threlfall, secretary of the Auto Body Assn. of America, and also proprietor of a New Jersey body shop. "One, for example, is that we pay more for parts than dealers. To stay compet-



TYPICAL CHISELING CUSTOMER wants to add cost of fixing old scratch to insurance company's bill

DECEMBER 1968



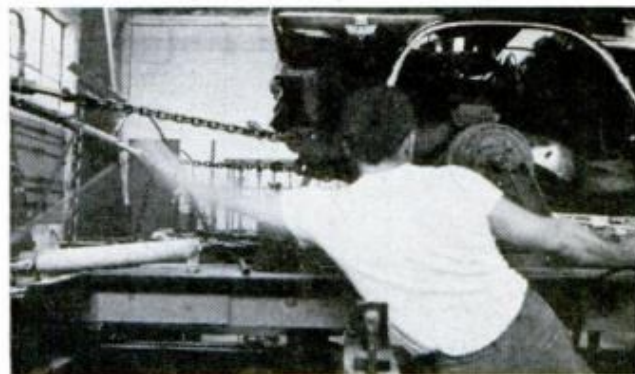
CLUE to extent of damage to car in left photo is indicated by rupture of body panels at windshield

itive we can't charge more, so we're in a squeeze.

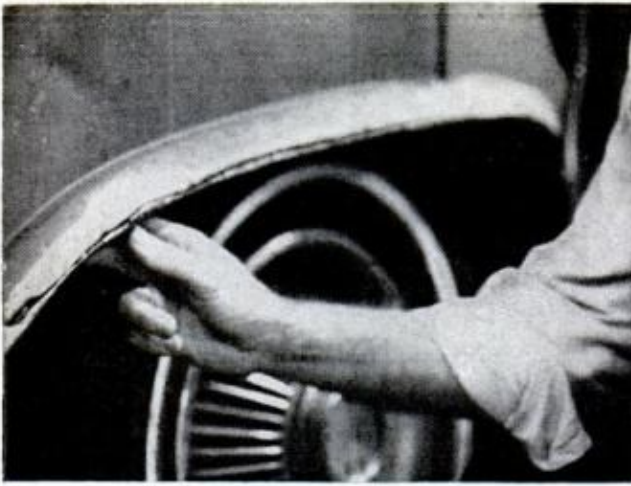
"Then there's a big shortage of skilled help. There just aren't enough good men to go around, which means we're bidding in a tight labor market, something else that puts the squeeze on us. So a lot of guys in this business feel they have to cut corners on a job to make ends meet. This means the customer comes out short, the insurance company doesn't get its nickel's worth, and the body shop gets a lousy reputation. Nobody wins."

So is there anything a straightforward customer can do to be sure he'll get a good body job? Lots, say both Bristow and Threlfall.

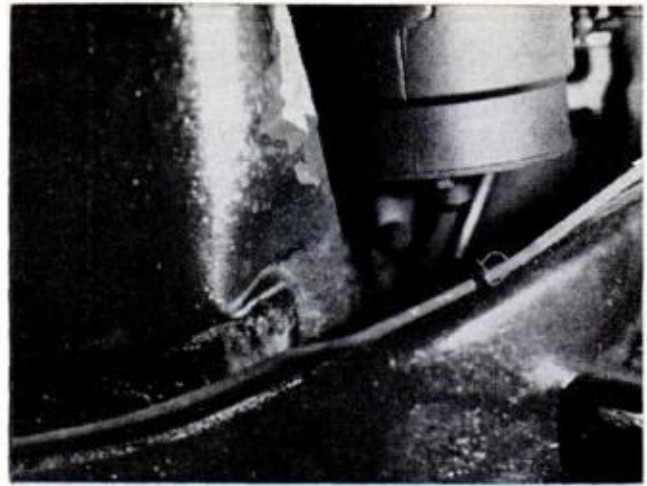
"When a shop estimates a job, for example," says Bristow, "it prepares an itemized list of exactly what it proposes to do to repair the car. Based on that list and the price quoted, the shop



UP-TO-DATE EQUIPMENT, skilled help can provide a clue as to the quality of work done by a body shop



GOOD SHOP will also repair damage done to under panels, approach individual jobs from the inside out



CHECK UNDERNEATH to see that work was done. Here frame cross member and pan were realigned

and the insurance company agree on a certain amount. Now most people don't realize it, but they can ask for a copy of that list so when they go to pick up the car they can check it against the work performed. An honest shop will be glad—even proud—to show a customer the extent and quality of its work. The customer, on the other hand, has to be realistic and reasonable; he can't expect something for nothing.

"A customer can be his own inspector, too," continues Bristow. "He doesn't

have to be an expert to see whether or not body panels fit properly, molding lines up, paint matches and is smooth. Walk around the car and look at it from all angles. There shouldn't be any ripples or waves. Open and close all the doors. Same with the hood and trunk lid.

"Look inside the engine compartment, particularly on a nose job. Everything should be straightened out and lined up like new. Check front and rear

(Please turn to page 214)

PAINT FLECKS (right) are sure sign of "quick and dirty" job. Good shop will carefully blend new paint to old, will rub down and smooth out all imperfections. Properly finished job should look as good as new



AMAZING NEW MOWBOT: It really mows your lawn—by itself!



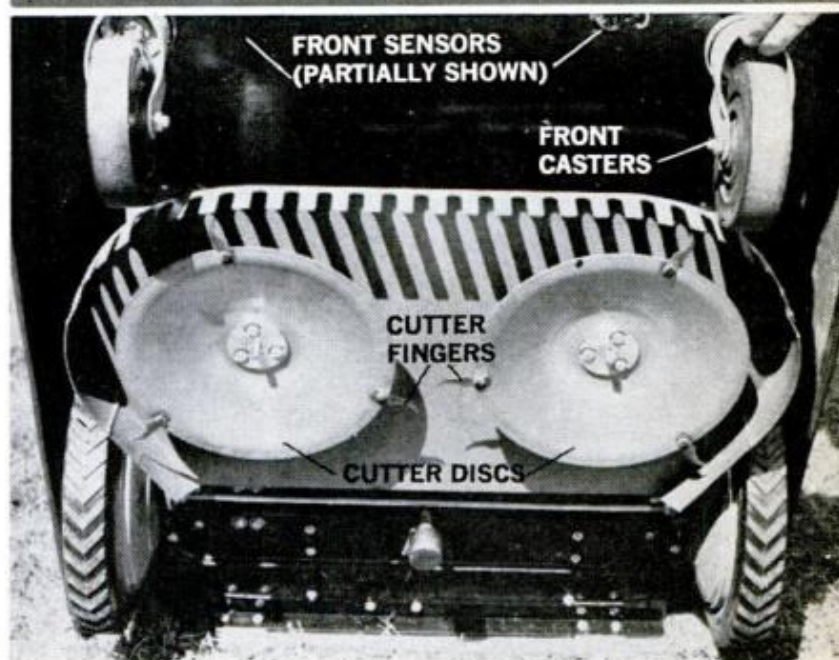
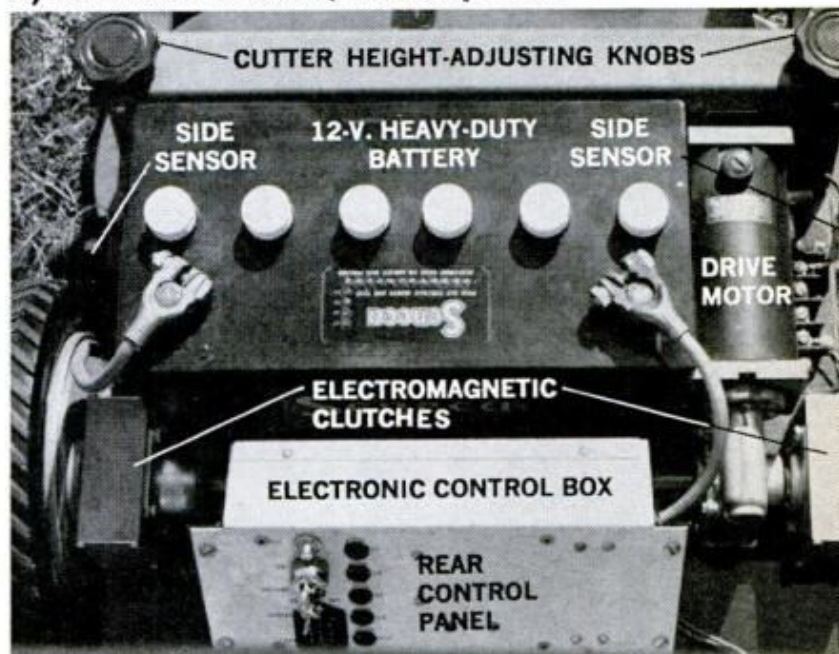
IN OPERATION, it's one of the strangest mechanical devices ever. Without straining, smoking or noisemaking, it glides along at an even pace, first in one direction, then another, whirring slightly as it slices and mulches its merry way through the grass.

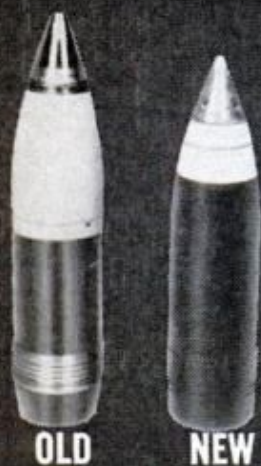
It's called Mowbot, and in a recent demonstration, it performed faultlessly and safely, without power cords, radio control or other control system.

How? Sensors on the front and sides of the unit determine when it's about to reach a tone-carrying wire buried an inch or two beneath the ground, and then they signal one of the electromagnetic clutches to disengage. Thus, Mowbot will approach a boundary marked by the wire, sense it and then turn off in another direction. Should someone step in its way, a safety shutoff switch built into the front edge turns it off. Safe, too, are the cutter fingers—they're held out by centrifugal force, so if they hit a rock, they simply back off. There is one catch—Mowbot costs \$795 from Mowbot, Inc., 232 Zimmerman St., N. Tonawanda, N.Y. ★★★

DECEMBER 1968

By LEONARD E. SABAL, Workshop Editor



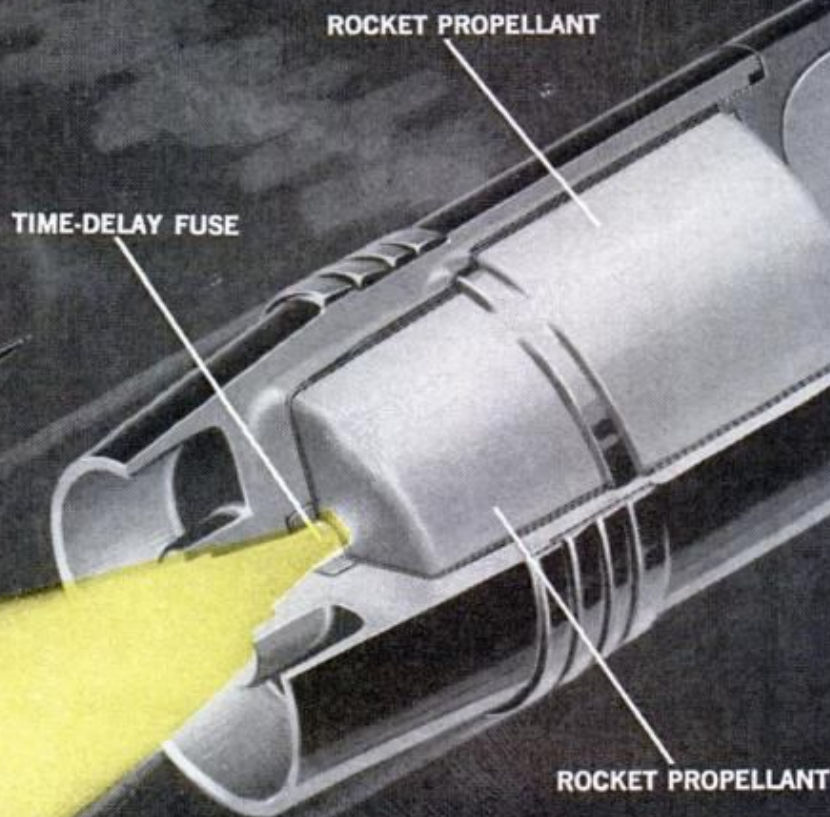


RAP: AN OLD NAVAL WITH A NEW KICK

Rocket-Assisted Projectiles convert ordinary naval shells into deadly rockets, increasing their range by as much as 50 percent

By MORT SCHULTZ

Technical art concept by Dale Gustafson



SHELL

SOMEWHERE IN VIETNAM, troops of a Vietcong regiment dig in as shells rain down on them at a murderous rate of 108 per minute.

This is a rest camp and supposedly outside the range of land artillery and offshore naval guns. Still the shells come. From where?

The answer will surprise the VC and amaze veteran Navy men. The shells are indeed coming from the sea, delivered by six five-inch guns of a destroyer in the Gulf of Tonkin, 18 miles away.

"But that's impossible," some might say. "A five-inch gun can lob a shell only 12 miles."

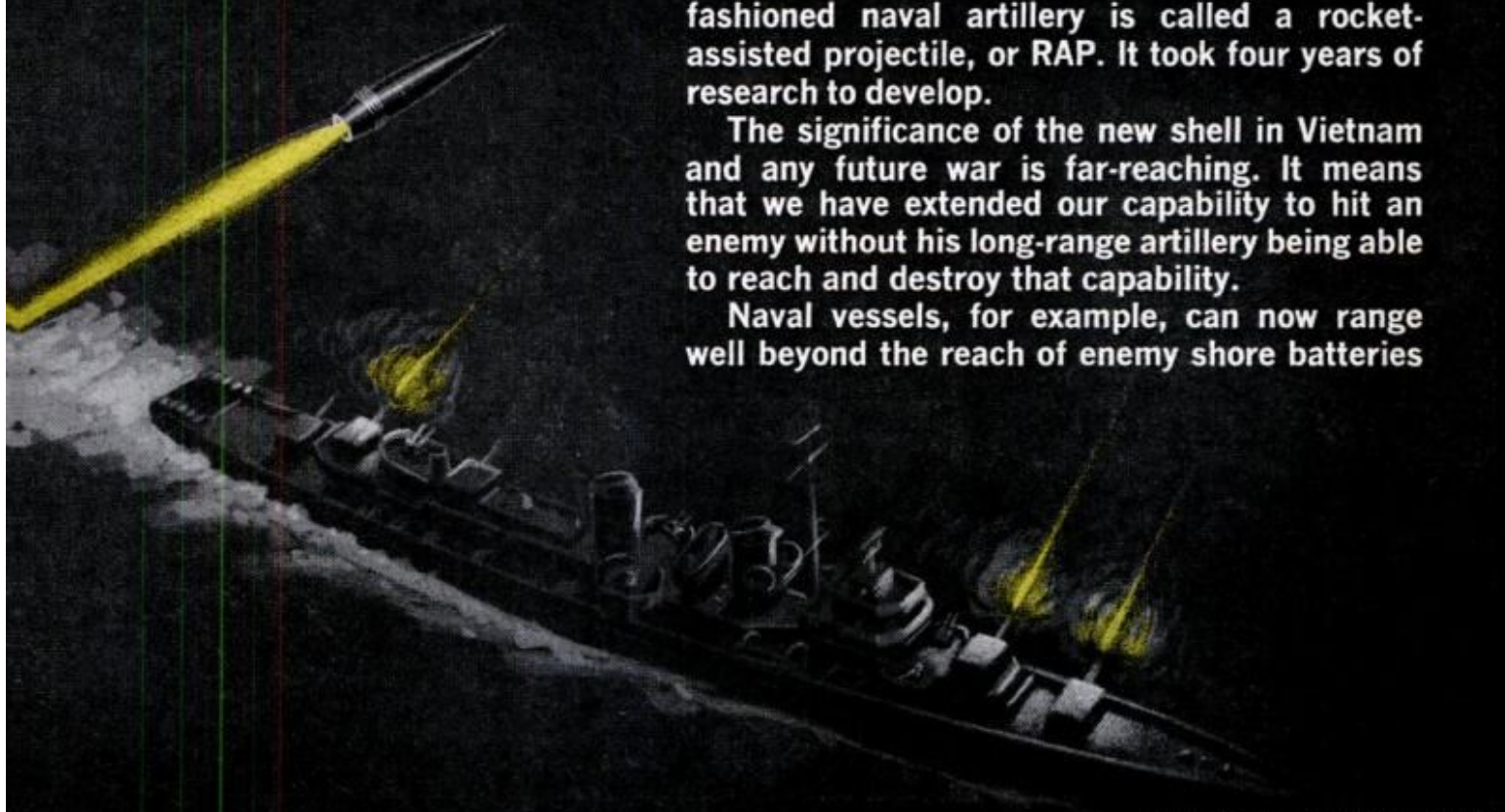
Nonetheless, guns of destroyers now on duty off Vietnam have extended their range by almost 50 percent, to equal the range of eight-inch guns carried by American heavy cruisers.

The secret lies not with the guns, but with the shells. Tucked behind the warhead is a new and still-secret rocket propellant that gives each round a fantastic boost in range. Yet, side by side, you could hardly tell the difference between the old and the new. They're of almost the same size and configuration.

This mating of modern rocketry and old-fashioned naval artillery is called a rocket-assisted projectile, or RAP. It took four years of research to develop.

The significance of the new shell in Vietnam and any future war is far-reaching. It means that we have extended our capability to hit an enemy without his long-range artillery being able to reach and destroy that capability.

Naval vessels, for example, can now range well beyond the reach of enemy shore batteries



and support amphibious landings or bombard installations.

How is the United States able to take a conventional artillery shell and convert it into a rocket that's fired not from a rocket launcher, but from unmodified guns which have been in service for years? Rear Adm. Arthur R. Gralla, commander of the Naval Ordnance Systems Command, told me.

"RAP is comparable to a two-stage rocket," he explains. "The first stage is the conventional gunpowder exploded in the round's cartridge case when the gun is fired. The second stage is the rocket propellant, which is ignited in flight."

According to Adm. Gralla, engineers had two major problems to solve. One was to ignite the rocket propellant at just the right time. The other was to develop a propellant that wouldn't collapse when subjected to extreme gas pressure in the gun barrel and fizzle out on ignition.

The solution to the first problem is a time-delay fuse filled with a pyrotechnic. It lies in RAP's base, behind the propellant. When the shell is fired in the gun, gas pressure discharges an

ordinary percussion cap. This, in turn, ignites the delay fuse.

The fuse burns 23 seconds while the round is in flight. After that much time in flight a conventional 5-inch shell would be falling to earth. Not RAP.

The burning delay fuse reaches the rocket propellant. Ignition of up to two seconds takes place in RAP's base. The projectile now takes on the full characteristics of a rocket.

Gases generated by the burning propellant stream from the orifice. These escaping gases remultiply the round's velocity. A tremendous surge of thrust gives the round its additional range.

The biggest headache in the development of RAP was to find a solid propellant that would withstand the 18,000-G force generated in the gun barrel.

Another force that had to be dealt with was the one generated by the round's spiraling down the gun tube and through space—12,000 Gs.

No solid propellant used in the U. S. missile or space programs met the requirements. A new propellant had to be formulated. It uses plastic materials to bind the composition together.

"This propellant is a high-density

Range Comparison of Standard 5 inch Projectile and 5 inch Rocket Assist Projectile

SCALE
1 MILE

Rocket Assist Ignites

Burns 1.5 Seconds

0 1 2 3 4 5 6 7 8

impulse compound that is extruded," according to Gene H. Lewis of the Naval Ordnance Command in Indian Head, Md. He's one of the project engineers for RAP. "It gives us more energy from the same volume of propellant than other solid fuels now in existence."

Where does RAP stand now and what of the future?

As mentioned, the 5-inch, 38-cal. guns of U. S. destroyers off Vietnam are presently being outfitted with the new rounds in both 38 and 54 caliber. The six 38-cal. gun tubes of older destroyers use 62-pound shells. They are able to fire 18 rounds per minute each.

Since the advantage to RAP lies in its lethal effect against "soft" targets, particularly troop concentrations, destroyers also carry conventional 5-inch shells for use against enemy naval vessels and other "hard" targets. These have a better penetrating capability.

Although the Navy is considering manufacturing RAPs for the 8-inch guns of cruisers, which might stretch their range from 17 to approximately 25 miles, no plans are being formulated for outfitting the 16-inch guns of battleships. The only battlewagon in com-

mission is the *New Jersey*, which now is shelling targets in Vietnam.

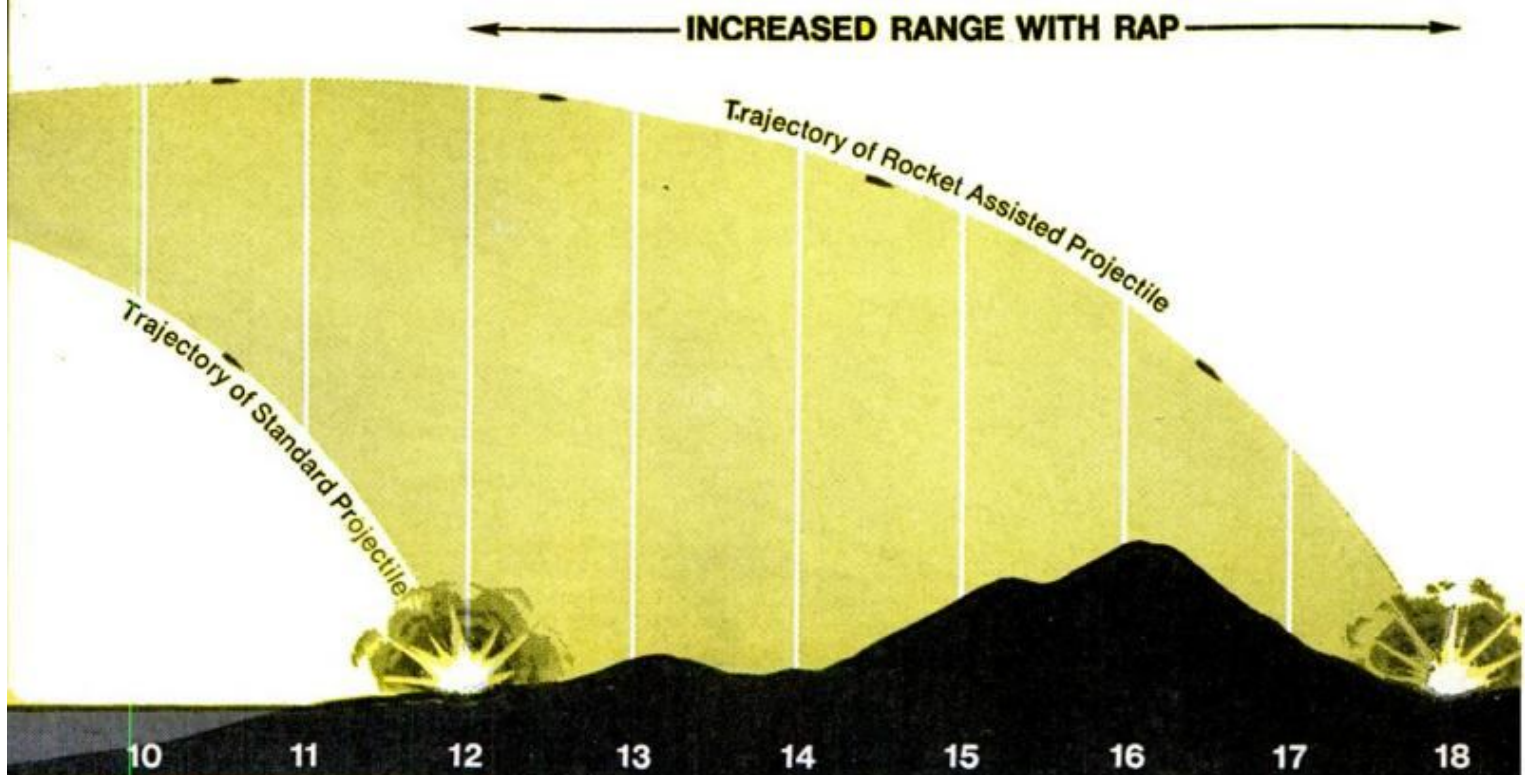
"I can't foresee that we would go into production to make RAPs for this ship, which carries only nine 16-inch tubes," Adm. Gralla says. Without RAP, the *New Jersey* is able to fire its 2500-pound projectiles some 20-odd miles anyway.

According to Adm. Gralla, future developments of RAP may include equipping the round with some guidance.

"It is not outside the realm of possibility to devise a means by which we can guide the round by radio signal," he explains. "We would be able to have the option of using the rocket capability or not using it. We would also be able to correct the course of the projectile in flight."

The Army RAP program, according to those at Combat Systems Command in Fort Belvoir, Va., is in the draft proposal stage. They see no action on it until late 1969 or early 1970.

"However," a spokesman told me, "development of RAP for Army artillery pieces, like the 105-mm howitzer, is well within the state of the art. All we need is the go-ahead." ★★★



The Biggest, Fastest

It's 212 feet long and displaces 300 tons, but when it goes up on "stilts" it skims across the water — even heavy seas — at better than 40 knots. It's the Navy's latest in a new breed of hydrofoils.

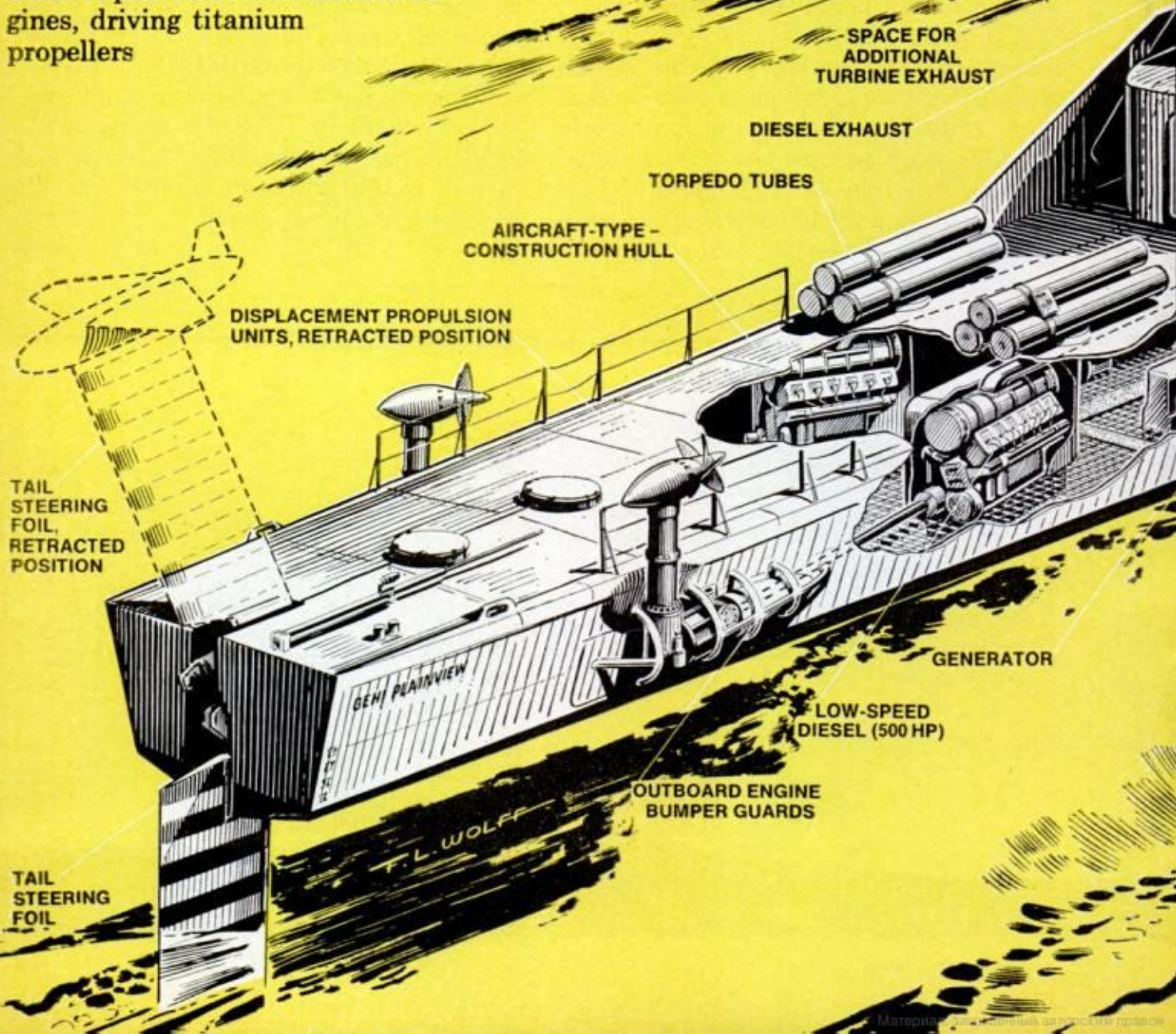
By BOB ZIMMERMAN

Technical Art Concept by Fred Wolff

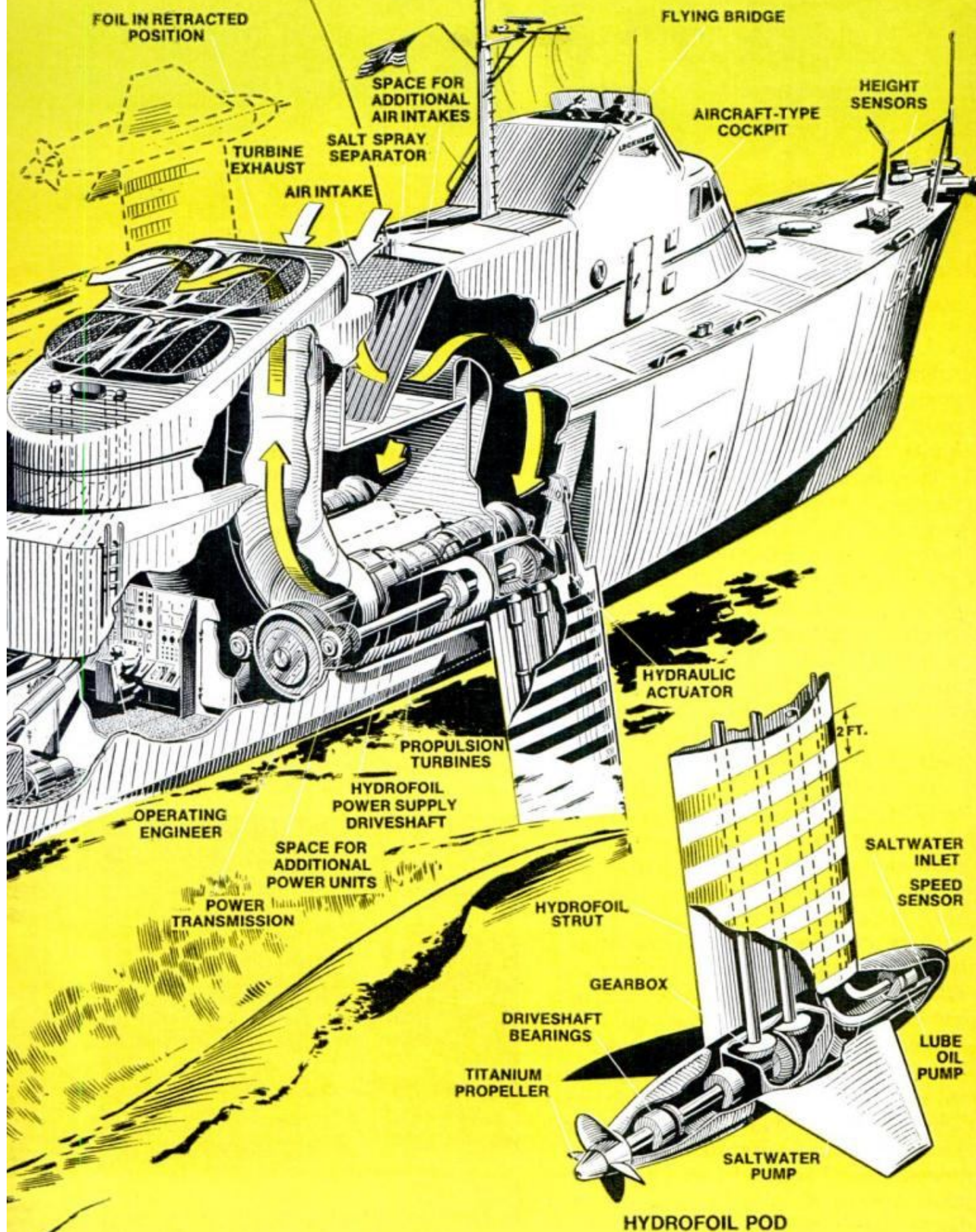
PICTURE A DESTROYER bristling with guns and torpedo launchers skimming at 50 knots or more over the surface of a stormy sea. You can see daylight under the hull. The ship is flying — literally. Its wings are hydrofoils, knifing through the water on struts.

An admiral's pipe dream? Not quite. The new USS *Plainview*, just beginning a test program with the Navy, may be the forerunner of a fleet of such high-flying sub-chasers.

The *Plainview* — 212 feet long and displacing 300 tons — is the largest hydrofoil ship ever built. A pair of aircraft turbine engines, driving titanium propellers



'Flying' Boat Yet!





PLAINVIEW'S COCKPIT looks like jetliner's, and men in charge are known as "pilot" and "co-pilot"

submerged along with its foils, can push the ship to what the Navy modestly says is a speed "in excess of 40 knots."

How much in excess is classified. But smaller hydrofoil craft have already proved that speed possibilities on the high seas are greater than mariners ever imagined. Hydrofoil boats can hit 65 mph before their foils begin "cavitating" (creating an air cavity in the water behind the foil), a limit of performance similar to the sound barrier met by conventional airplanes. A craft with experimental "supercavitating" foils has been clocked at 80!

The *Plainview*, made by the Lockheed Aircraft Corp., is the most ambitious effort yet to put oceangoing vessels into such speed ranges and free them of the bucking and buffeting of choppy seas. It will be a test bed for the Navy to find out how such a hydrofoil ship will handle in all weather and sea conditions and how it would meet demands put on an active modern warship.

This aluminum-hulled wonder is only one blossom on a suddenly fruitful vine of Navy hydrofoil development. Two new hydrofoil gunboats, named *Tucumcari* and *Flagstaff*, have just joined the Pacific Fleet. While the *Plainview* is still experimental, the gunboats are full-fledged combatants. They are scheduled for combat trials to



RESTING PLAINVIEW gives some indication of its size (note crewmen amidships). Three hydrofoils, two

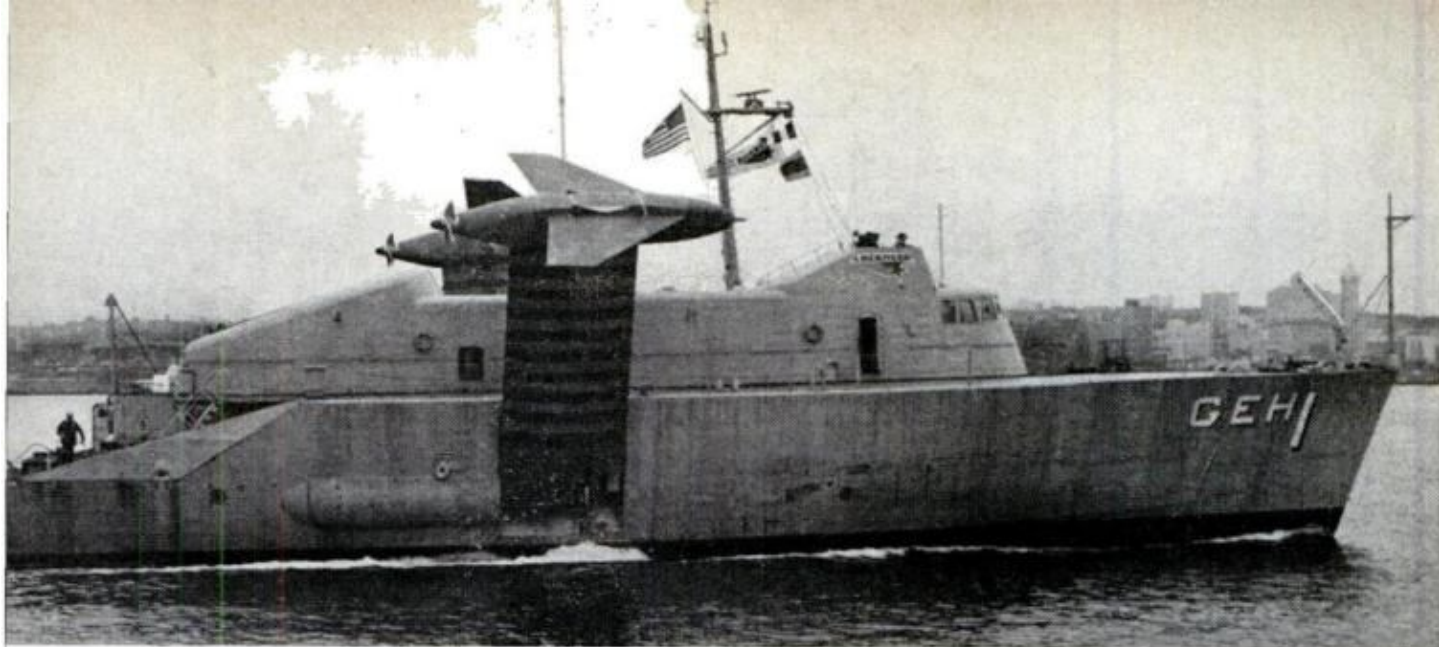
take place off the coast of California.

The principle of hydrofoils is simple enough: They use the water as a medium of flight the same way airplanes use the air. Hydrofoils are winglike surfaces mounted on struts under the hull of a boat or ship. They look like airplane wings and have the same cross section—a curved upper surface and a flat lower surface. Water flowing over and under the hydrofoil produces lift the same way an air current does.

Arrival of the huge *Plainview* on the scene means hydrofoil technology is

GUNBOAT TUCUMCARI, built by Boeing, features canard configuration, with one foil forward, two aft





forward and one aft, are in retracted position, displaying their winglike construction. *Plainview*, the largest hydrofoil ever built, is 212 feet long, displaces 300 tons and is intended to perform the duties of a destroyer

well out of the nursery and into long pants.

The world inhabited by the *Plainview* crewmen—it takes 20 to run the ship—is a strange blend of forecastle and flight line. The ship's wheelhouse, if that's the word, looks more like the cockpit of a jet airliner. The "pilot" and "co-pilot" are surrounded by instrument panels—overhead, in front and between seats. In the engine room are two marine-type J-79 jet engines, the same kind used in the supersonic F-104 Starfighter.

GUNBOAT FLAGSTAFF, built by Grumman, has conventional configuration, two foils forward, one aft



DECEMBER 1968

Actually, the *Plainview* has two powerplants. To taxi away from a pier through a crowded harbor, with foils retracted, it is driven by two 600-hp General Motors diesels. Power goes to two outboard propellers mounted on swivels on either side of the hull about 50 feet from the stern. Propeller pods can be turned left and right to steer the ship.

In this configuration, the *Plainview* is a slow, gawky, flightless bird, its forward struts and foils raised out of the water like clipped wings, its stern strut and foil sticking up like a tail.

For flying, the struts go into the water and the diesel propeller units lift out. Then the *Plainview* can run up its turbines, preparing for takeoff.

Power from the turbines is transmitted through an intricate system of gears and shafts to the four-bladed, 62-inch titanium propellers submerged at the tip of the two forward struts. These same struts carry the ship's main foils, each with a "wingspan" of 26 feet.

Takeoff speed is about 30 knots. "If you're down in the hull," says a hydrofoil crewman, "you hear a gurgling sound, and in 20 or 30 seconds you're foilborne."

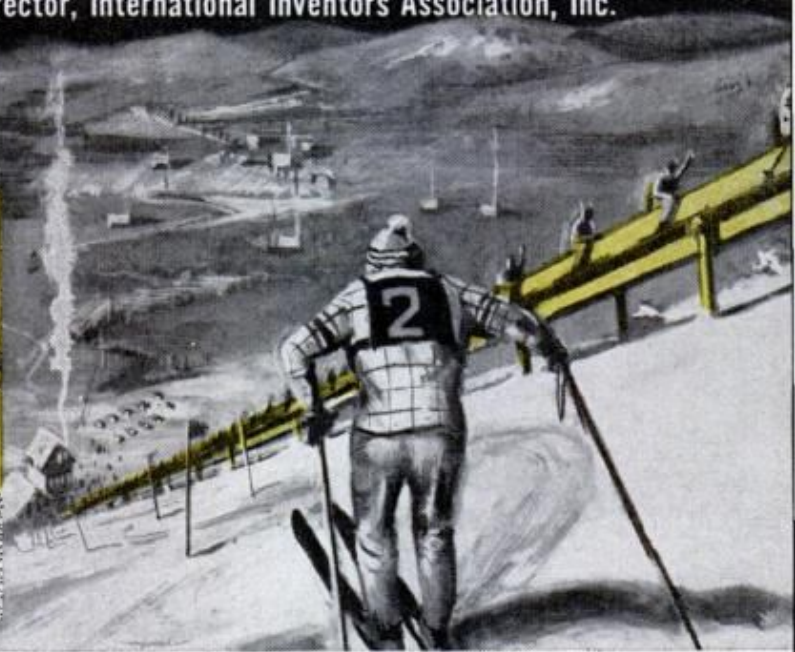
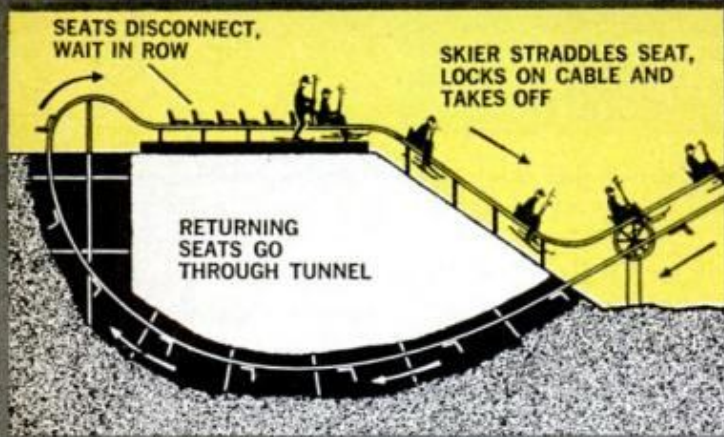
As if at the command of a magician the *Plainview's* 300 tons rise gently

(Please turn to page 210)

Just patented

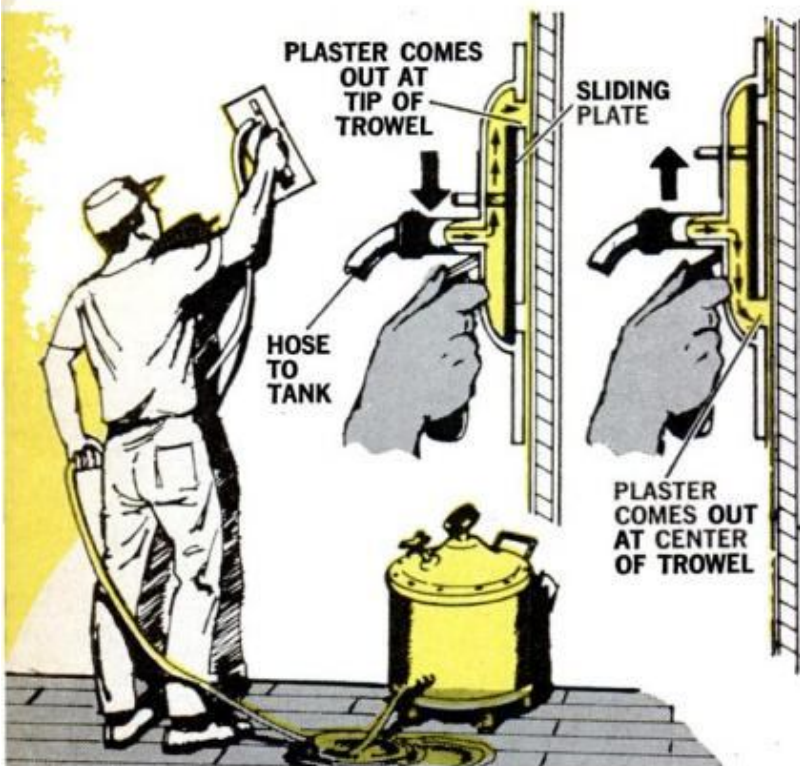
PM'S PICK OF THE NEW INVENTIONS

Prepared in cooperation with Roger S. Shashoua, Director, International Inventors Association, Inc.

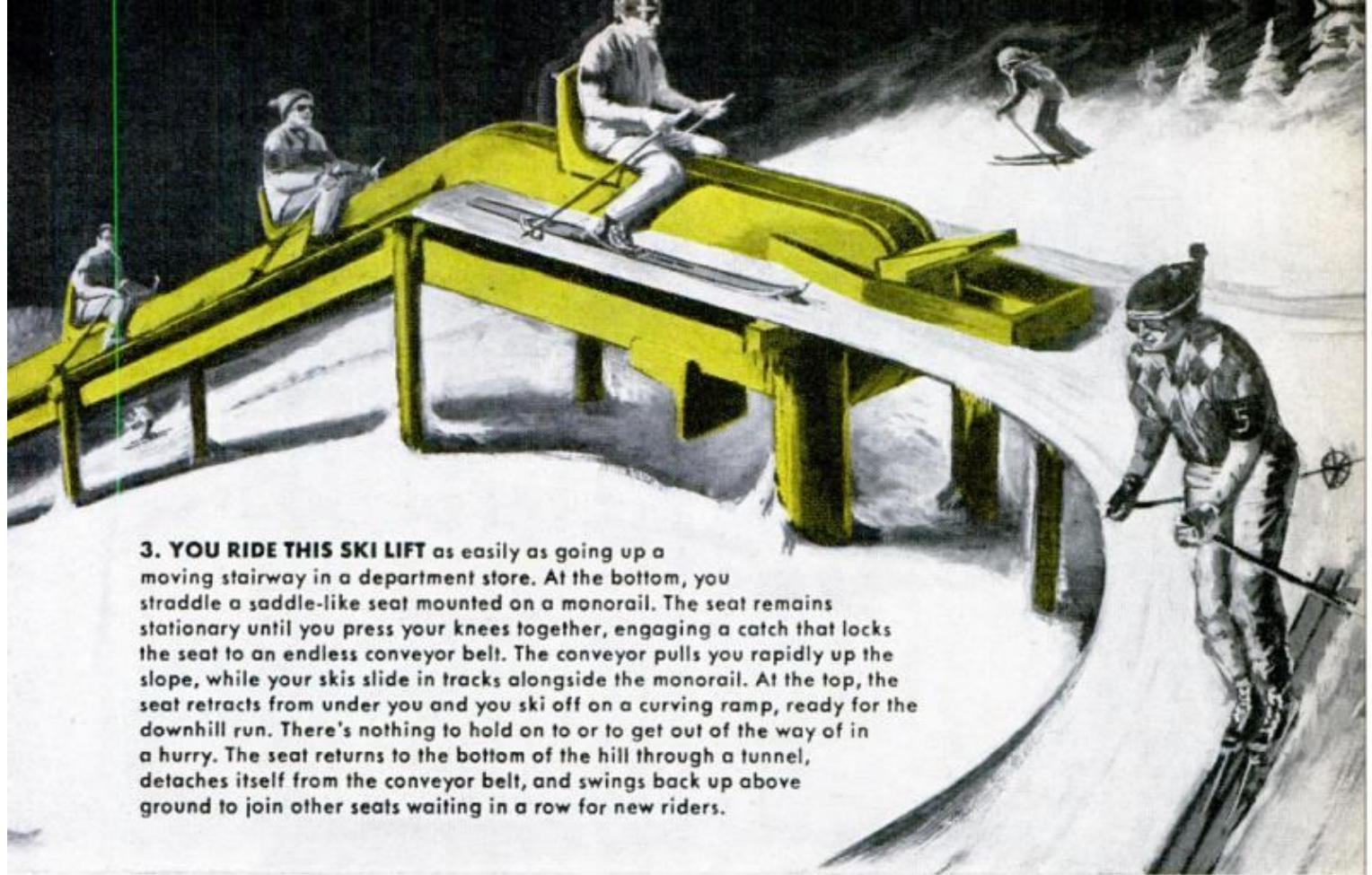


1. **DISPENSING ITS OWN PLASTER**, this ingenious trowel makes it easy to cover large areas quickly without your having to stop every few minutes to load the blade with a fresh supply. The hollow blade is fed premixed plaster through a hose from a pressurized container, eliminating the need for on-the-job mixing. A sliding valve inside the trowel gives the plasterer a choice of two openings—one near the tip for corner work and one near the center for open areas

2. **NO ONE CAN STEAL** your parking place with the lockable post below. For those who have a private parking stall where they live or work, the post is designed to block the opening and keep other cars from using it when the owner's car is away. Turning a key retracts a cross pin, which allows the hinged post to be swung down flat out of the way



Inventors of the items shown on these pages are as follows: 1. Edgar E. Edens Jr., Lapuente, Calif. (No. 3,368,234); 2. LeBas Tube Co., London, England; 3. David R. Pender, Columbia, S.C. (No. 3,349,720); 4. Top Secret Ltd., London, England; 5. Lal B. Roy, New Delhi, India (No. 3,346,884). Anyone interested in bringing



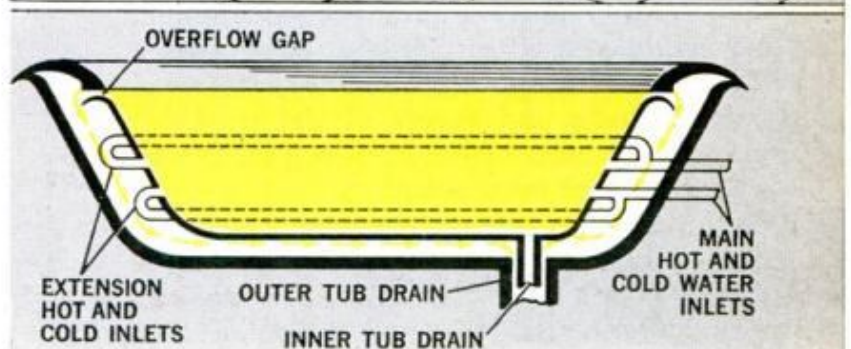
3. YOU RIDE THIS SKI LIFT as easily as going up a moving stairway in a department store. At the bottom, you straddle a saddle-like seat mounted on a monorail. The seat remains stationary until you press your knees together, engaging a catch that locks the seat to an endless conveyor belt. The conveyor pulls you rapidly up the slope, while your skis slide in tracks alongside the monorail. At the top, the seat retracts from under you and you ski off on a curving ramp, ready for the downhill run. There's nothing to hold on to or to get out of the way of in a hurry. The seat returns to the bottom of the hill through a tunnel, detaches itself from the conveyor belt, and swings back up above ground to join other seats waiting in a row for new riders.

4. SELF-ADJUSTING BOOK RACK automatically changes its length to suit the number of books you want to put in it. Made of springy coiled plastic, it unrolls to vary the opening from 2 to 22 inches. Besides books, the rack will hold up to 12 telephone directories, 240 phonograph records and 32 reels of recording tape

NO DIRTY RING can form around this self-cleaning bathtub. Where the ring would normally be there's an overflow lip running around the tub's edge like a skimmer trough in a swimming pool. Water spilling over the lip carries dirt and soapsuds with it into a drain under the tub. The faucets are set so a small amount of water constantly overflows the lip, making the cleaning action automatic. Filling the tub at both ends simultaneously keeps water temperature uniform as well



new inventions to the attention of Roger Shashoua can reach him at the International Inventors Assn., 680 Fifth Ave., New York 10019.



How to Save Money

No matter how good a deal you make on the purchase price, you can toss it all away if you pay too much for a loan

By MERLE E. DOWD

From the book *How to Save Money When You Buy and Drive Your Car*
© 1967 by Merle E. Dowd. Parker Publishing Co., West Nyack, N.Y. \$5.95.

IF YOU ARE the one car buyer out of three who pays cash for your car, you can skip this. You're already saving an average of 1.8 cents per mile over the guy who pays a little down and borrows the rest. If you do finance a car purchase, learn to shop for money as carefully as you shop for the car itself. According to a survey, only one out of five car buyers shopped for credit outside the car dealer's showroom. That one buyer saved an average of \$148 if he purchased a new car, \$74 on a used one. The four others could have saved from \$8 to \$439 each—if they had shopped around for credit on a new car—or as much as \$200 on a used car.

Some other interesting facts were turned up in the survey.

- True interest rates paid by 50 families buying new cars ranged from 4.9 to 26.5 percent. One-half of the 50 families were paying 12.4 percent or more true interest. Three families paying lowest rates, around 5 percent, had contracts that called for big "balloon" payments during the 12th month.

When buying used cars, 48 families were found to be paying from 7.7 to 110 percent interest. Half of these buyers were paying 23.6 percent or more and the mean rate was 24.9 percent.

There seemed to be no relationship between interest rate and the occupation, salary, age, or education of the borrowers. Little relationship existed either between interest rate and terms of the contract, such as amount of down payment, length of contract, or unpaid balance.

- Interest rates for financing used cars varied closely with the age of the car—higher rates for older cars. The median rate of interest paid for financing cars

five or more years old was 25.9 percent compared to 15.3 percent for cars less than five years old.

- Few of the families questioned knew the true interest rate they were paying. Those who thought they knew said they were paying 5 or 6 percent. Actually, they were paying from 12 to 32.5 percent. The only man who knew his exact interest rate was an automobile salesman.

The truth is you can save real money by shopping for financing with the same energy you shop for a car.

How the Cost of Financing Affects Your Car Costs

Money is a commodity. It reacts to supply and demand like other commodities. Interest rates are high now, because the demand for money exceeds the supply. The actual dollar cost of borrowing money varies according, to how much you borrow, how long you keep it, and the rate of interest. Whether interest is figured on an installment, discount, or simple annual basis also affects your dollar cost of credit. Let's examine some of these variables.

Effect of Interest Rate on Dollar Cost of Credit—Suppose you select a car that costs \$3200; we'll use round numbers to simplify calculations. The dealer allows you \$700 for your old car. This leaves you owing \$2500. You decide to finance the \$2500 and sign a contract calling for monthly payments of \$81.94 over three years. The dealer quotes a 6 percent rate for your loan. So—

$$\begin{aligned} & \$2500 \times 6\% \times 3 \text{ years} = \$450 \text{ interest} \\ & \$2500 + \$450 = \$2950 \\ & \frac{\$2950}{36 \text{ months}} = \$81.94 \text{ per month} \end{aligned}$$

When You Finance a Car

If you drive 10,000 miles a year, \$150 interest per year increases your cost by 1.5 cents per mile.

The gimmick most often overlooked in this transaction is that the 6 percent interest rate is figured on the *total* amount for the *total* time. That is, \$2500 at 6 percent for the full three years.

Since you pay back part of the money with each monthly payment you are borrowing only about half the money for the full term. Roughly figuring the simple annual interest rate on half the money for that period pushes the rate to about 12 percent. Actually, it figures out 11.7 percent. Formula A shows how to figure the true or simple interest rate. The tables on page 96 list the financing costs at different rates and for different lengths of time. Remember, if you pay back part of the loan each month, these are not *true* interest rates. Two financing costs are important to you:

- **Dollar Cost**—the actual number of dollars you pay in interest for the privilege of borrowing the money. In the previous example, \$450 is the total dollar cost of credit. Over the three-year period, as we have seen, you actually pay the dealer \$2950 instead of \$2500.

- **Simple Annual Interest Rate**—the so-called “bank interest rate,” or “true” interest rate. For example, suppose you borrow \$100 for a year at 6 percent interest. At the end of one full year, you would pay back \$106. Note that you have kept the full \$100 for the entire year and paid back the interest at the end of the period. For the car-financing example earlier, you would have paid 6 percent simple annual interest *only* if you had kept the \$2500 for the full three years and paid the \$2950 in a lump sum. The formula shown for calculating simple annual interest allows you to figure all financing contracts back to the one best standard for comparison of interest rates.

Some lenders discount interest *at the beginning* of the loan period. You'll remember that simple annual interest is

FORMULA A— HOW TO CALCULATE DOLLAR COST AND SIMPLE ANNUAL INTEREST RATE FOR FINANCE CHARGES

The formula most often used to find the simple annual interest rate on installment credit is:

$$SI = \frac{2 \times C \times M}{P \times (N + 1)}$$

where SI = Simple annual true interest rate
 C = Total credit or finance charges in dollars (dollar cost of credit)
 M = Number of payments per year
 P = Principal amount borrowed
 N = Number of installment payments to be made

Consider the example in the text—\$2500 to be financed over 36 months at 6 per cent installment credit rate, monthly payments at \$81.94 per month. in detailed step-by-step form:

A. Cash price \$2500 (Remaining to be financed after down payment)

B. Determine credit price \$2500 + (\$2500 x .06 x 3) = \$2950 credit price

C. Find dollar cost of credit

Credit price	\$2950
Cash price	<u>2500</u>
	\$450 Dollar cost of credit

So: C = \$450
 M = 12 payments per year
 P = \$2500 (principal amount borrowed)
 N = 36 (Number of installment payments)

Step 1: Multiply 2 times dollar cost of credit
 $2 \times \$450 = \900

Step 2: Multiply this by the number of payments in a year (12)

$$\$900 \times 12 = \$10,800$$

Step 3: Multiply the amount of credit needed by the number of payments plus one.

$$\$2500 \times (36 + 1) = \$92,500$$

Step 4: Divide the results from Step 2 by the results from Step 3. The answer is the true interest rate.

$$\frac{\text{Step 2}}{\text{Step 3}} = \frac{\$10,800}{\$92,500} = .1167 \text{ or } 11.7\%$$

paid back at the end of the period. For example, if you were to borrow \$100 at 6 percent *discounted*, the lending institution would deduct the \$6 interest immediately and give you \$94—not the \$100 you requested. If you actually wanted to get \$100, you would have to borrow \$106.38, of which \$6.38 is discounted immediately.

Using the same example, on a \$2500 loan, the \$450 in interest would be discounted immediately. So, to receive \$2500 for three years at 6 percent (18 percent for 3 years), you must borrow a higher amount, calculated as follows:

$$x = \frac{82 \times \$2500}{100 - 82} = \$3048.78$$

Discounting adds \$98.78 to the cost of the loan over three years. Compared to \$450, \$548.78 comes to 7.317 percent annually—not 6 percent. Simple or true

interest amounts to 14.3 percent using the formula on page 95.

Don't be misled by such terms as "bank rates," "low-low 5 percent financing," and "easy credit." The credit so generously offered may be the most expensive difference in what your car finally costs you. Instead, figure out the rates yourself from Table 1 (below).

How to Reduce Finance Charges

In addition to shopping around for credit, you can save considerable money by changing contract terms. Follow these tips to whittle dollars off your financing costs:

- **Make a Big Down Payment**—paying as much down as possible reduces the amount you borrow and, consequently, the dollars you pay for credit. Paying cash, of course, eliminates all financing costs. Even

TABLE 1—FINANCING COSTS AND REPLACEMENT AMOUNTS

12 MONTHS

Installment Interest Rate	8%			6%			5%			4½%		
	Total Dollars Borrowed	Interest Paid	Total Dollars to be Repaid	Monthly Payments	Interest Paid	Total Dollars to be Repaid	Monthly Payments	Interest Paid	Total Dollars to be Repaid	Monthly Payments	Interest Paid	Total Dollars to be Repaid	Monthly Payments
\$1000	\$80	\$1080	\$90.00	\$60	\$1060	\$88.33	\$50	\$1050	\$87.50	\$45	\$1045	\$87.08
1600	128	1728	144.00	96	1696	141.33	80	1680	140.00	72	1672	139.33
2000	160	2160	180.00	120	2120	176.67	100	2100	175.00	90	2090	174.17
3200	256	3456	288.00	192	3392	282.67	160	3360	280.00	144	3344	278.67

24 MONTHS

Installment Interest Rate	8%			6%			5%			4½%		
	Total Dollars Borrowed	Interest Paid	Total Dollars to be Repaid	Monthly Payments	Interest Paid	Total Dollars to be Repaid	Monthly Payments	Interest Paid	Total Dollars to be Repaid	Monthly Payments	Interest Paid	Total Dollars to be Repaid	Monthly Payments
\$1000	\$160	\$1160	\$48.33	\$120	\$1120	\$46.67	\$100	\$1100	\$45.83	\$90	\$1090	\$45.42
1600	256	1856	77.33	192	1792	74.67	160	1760	73.33	144	1744	72.67
2000	320	2320	96.67	240	2240	93.33	200	2200	91.67	180	2180	90.83
3200	512	3712	154.67	384	3584	149.33	320	3520	146.67	288	3488	145.33

36 MONTHS

Installment Interest Rate	8%			6%			5%			4½%		
	Total Dollars Borrowed	Interest Paid	Total Dollars to be Repaid	Monthly Payments	Interest Paid	Total Dollars to be Repaid	Monthly Payments	Interest Paid	Total Dollars to be Repaid	Monthly Payments	Interest Paid	Total Dollars to be Repaid	Monthly Payments
\$1000	\$240	\$1240	\$34.44	\$180	\$1180	\$32.78	\$150	\$1150	\$31.94	\$135	\$1135	\$31.52
1600	384	1984	55.11	288	1888	52.44	240	1840	51.11	216	1816	50.44
2000	480	2480	68.88	360	2360	65.56	300	2300	63.89	270	2270	63.06
3200	768	3968	110.22	576	3776	104.89	480	3680	102.22	432	3632	100.89

if you can't pay *all* cash, you may want to pay more down, once you understand what it will save you.

Using the same example, suppose you paid \$1950 down, instead of only \$700, leaving a balance to finance of \$1250, or half the original balance of \$2500. Finance charges over the three-year period would drop to only \$225 instead of \$450. Also, monthly payments would drop to only \$40.97 instead of \$81.94. By financing \$2500 of the purchase price over three years, your car actually cost \$3650—not the bargained-for price of \$3200. By paying the \$1950 down, the same car costs \$3425.

● *Pay Off the Loan Quickly*—Since one of the elements that affect the dollar cost of credit is how long you keep the money, you can save by planning to pay off the loan as quickly as possible. Again, using the same example, suppose you paid off the \$1250 in one year instead of three years. The dollar cost of financing \$1250 for one year at 6 percent amounts to only \$75 instead of \$225, but monthly payments increase to \$110.41. Your new car then costs \$3275 total.

● *Bargain for Your Interest*—Depending on your credit rating and your shopping ability, you can finance cars as low as 4½ percent—possibly even 4 percent, although the tight money market has dried up many low-cost sources. Figure a 4 percent loan and you'll find that financing charges drop to only \$50 for the \$1250 loan. Monthly payments over one year would be \$108.34. You can save still more if you can arrange a simple-interest loan. Normally, banks will make such loans only when they're secured by some sort of readily convertible (quick) collateral, such as a savings-account pass book or negotiable stocks. You might also consider borrowing against the cash value of your life insurance, either directly or indirectly. A *direct* loan can be negotiated with the insurance company at a rate of interest specified in the policy. A frequently used simple interest rate is 5 percent. An *indirect* loan pledges the cash value of the insurance policy, but the money actually comes from a bank or other lending institution at an interest rate you negotiate. For convenience in figuring, suppose you negotiate a simple 6 percent loan for the \$1250 example. Interest would amount to \$39.28 if regular monthly payments of \$107.44 are made over a year. You have

another advantage with a simple-interest loan: You can prepay as much as you wish before due date and save, because interest is based on the amount still owed.

Just by choosing a shorter time, paying more down, and shopping for the best break on interest, you could save \$509.50 in interest. Your car would actually cost only \$3239.28 instead of \$3748.78. Monthly payments would vary according to Table 3. Although savings on interest can be considerable, you will need enough cash to make a good down payment.

Let's take the analysis one step further. Suppose you decide to finance the purchase of the \$3200 car in advance: that is, save the total price before buying. During the time your old car is depreciating to its \$700 trade-in value, you regularly stick \$85 in the bank each month at 5 percent interest compounded semi-annually. This is about the same monthly amount you would have to pay over a three-year period if you financed \$2500 at 6 percent. When you are ready to buy at the end of the three years, you will have \$3339.19 in the bank. After you pay out \$2500 (plus your \$700 trade-in) for your new \$3200 car, your bank balance will still show \$839.19, enough to take a long trip in your new car. As you can see from the last line of Table 3, your \$3200 car would have cost you only \$2360.81!

Not All Financing Costs Are for Credit—Before signing any conditional sales

TABLE 2—FINANCING COST CHART

	Bank (name)	Credit Union	Dealer	Other
Interest rate and time				
Cost of car (include all extras)				
Trade-in				
Subtotal				
Cash down payment				
Remaining balance				
Monthly payment				
Total payments (payments number)				
Credit investigation				
Other charges				
Total contract				
Principal (total financed)				
Finance charges				
Insurance coverage				
Insurance cost Financed				
Cash				
Insurance finance cost				

contract calling for monthly payments, look for extra charges hidden in the small print. Not all of the difference between the car's sale price and the total of your payments is interest. You may also be charged for a credit investigation, credit life insurance, a "finders' fee," chattel mortgage registration fee, legal fee, or other extras. Use the Financing Cost Chart (Table 2) to get a clear, itemized statement of exactly what you are paying for. Used-car dealers are particularly prone to use the "finance pack" to add all kinds of lump-sum amounts under the total bill for financing. Buyers of used cars have occasionally been known to pay off contracts that more than doubled the price of the car.

How and Where to Shop For a Loan

Dealers make it so easy to complete a sale and wrap up the whole deal in one package that few buyers actually compare loan costs. According to the previously cited survey, four out of five did not even check any source of credit besides the dealer. The ones who did check another source paid a median rate of 12 percent true interest for used cars, compared to 22.9 percent for those who didn't shop. So, to get the best deal, compare finance costs from several sources of credit in terms of total dollars, extra items included besides interest, and the *true* interest rate.

Remember, money is a commodity with a price that varies in response to demand and how shrewdly you shop. You are better prepared to shop for a car if you have a source of financing arranged for *ahead*

of time, so you should check loan costs at:

- **Local Banks**—Ask for the consumer-credit manager at your own bank. Auto-installment loan interest is figured on the entire amount for the total time. The principal plus interest is then divided by the number of months the loan is to run. Ask specifically if the loan is discounted. Refer to Table 3 for a reminder of how discounting increases true interest rate. If you can put up quick collateral, you may be able to arrange a simple-interest loan. Note these costs on your Financing Cost Chart.

- **Credit Union**—Many companies subsidize the operation of a credit union to make it easy for employees to purchase goods, particularly autos, on favorable terms. Frequently, because payments are deducted directly from your pay with a minimum of expense and risk, rates may be less than for a comparable bank loan.

- **Insurance Company**—As noted earlier, low-cost credit may be available through the cash value of your life-insurance policy. Most old-line or permanent-value policies include provisions for borrowing up to the cash value of the policy. The interest rate is spelled out in the policy. All you need do is write directly to the company or enlist the aid of your local agent. Since the money is already "on deposit" on the books of the company, there is no question about qualifying for a loan. If you should die before you pay it back, the unpaid balance is simply deducted from the proceeds of your insurance.

There is, however, one problem in borrowing against your insurance policy. That is, insurance companies seldom make

(Please turn to page 216)

TABLE 3—COMPARISONS OF FINANCING COSTS AND MONTHLY PAYMENTS

(Example is for a car that would cost \$3200 cash.)

Down Payment	Rate of Interest	Simple Annual Interest Rate	Dollar Cost of Credit	Number of Payments	Amount of Payments	Total Cost of Car
\$700	6%*	14.3%	\$548.78	36	\$84.69	\$3748.78
700	6%**	11.7%	450.00	36	81.94	3650.00
1950	6%**	11.7%	225.00	36	40.97	3425.00
1950	6%**	11.1%	75.00	12	110.41	3275.00
1950	4%**	7.4%	50.00	12	108.34	3250.00
1950	6%***	6.0%	39.28	12	107.44	3239.28
700	None†	—	None†	None†	None†	2360.81

*Installment interest discounted.

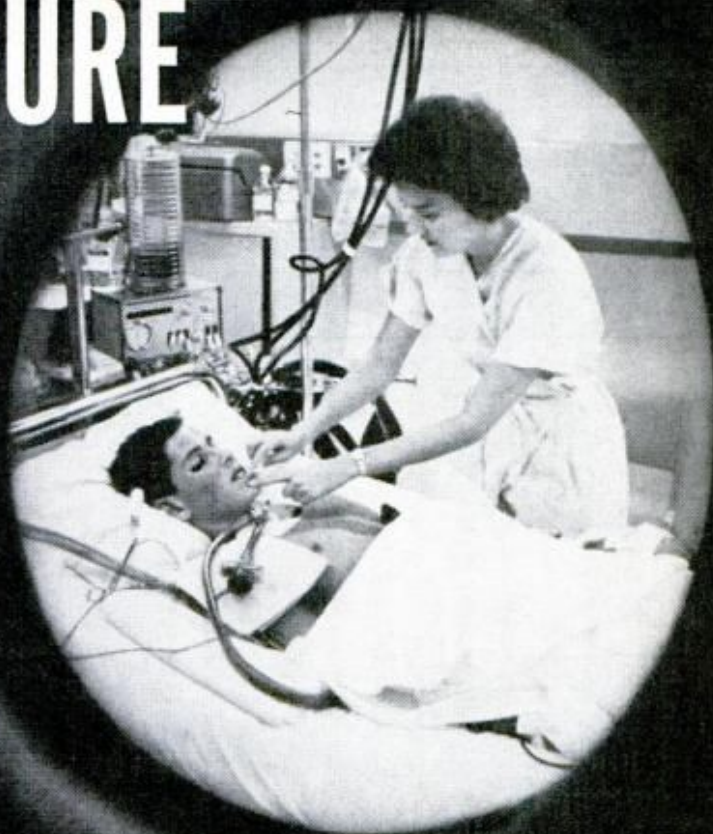
**Installment interest.

***Simple annual interest.

†Saving at \$85 per month for 36 months @ 5% interest on savings compounded semiannually.

HIGH-PRESSURE MEDICINE

Forcing large amounts of life-giving oxygen into a patient's blood-stream in the new hyperbaric chambers has worked medical miracles on everything from gangrene to cancer



By JAMES R. BERRY

THE NAVY RESCUE HELICOPTER, its four blades wildly chopping the air, briefly hovered over a clear spot in New York's Central Park. Then, receiving an "all clear" from waiting policemen, it darted down to a quick landing a few hundred yards from Mount Sinai Hospital. A cluster of white-coated attendants burst forward, and—before the copter's blades had stopped whirling—began moving a 13-year-old boy onto a stretcher.

The boy, Bruce Taylor of Annapolis, Md., had punctured his left calf with a rusty nail three days earlier. Somehow, gas gangrene—a rare but vicious disease that thrives in the absence of oxygen—had taken hold. By now, Bruce's temperature had soared to 104°. His leg was swollen up to his thigh and the skin had turned a dull green color, was spongy and crackled to the touch. Antibiotics had done little more than slow the infection's rampage.

Normally, the youngster would have lost his leg. Probably his life. But in this instance, doctors rushed him toward one of medicine's latest and most startling weapons—hyperbaric oxygenation (HBO).

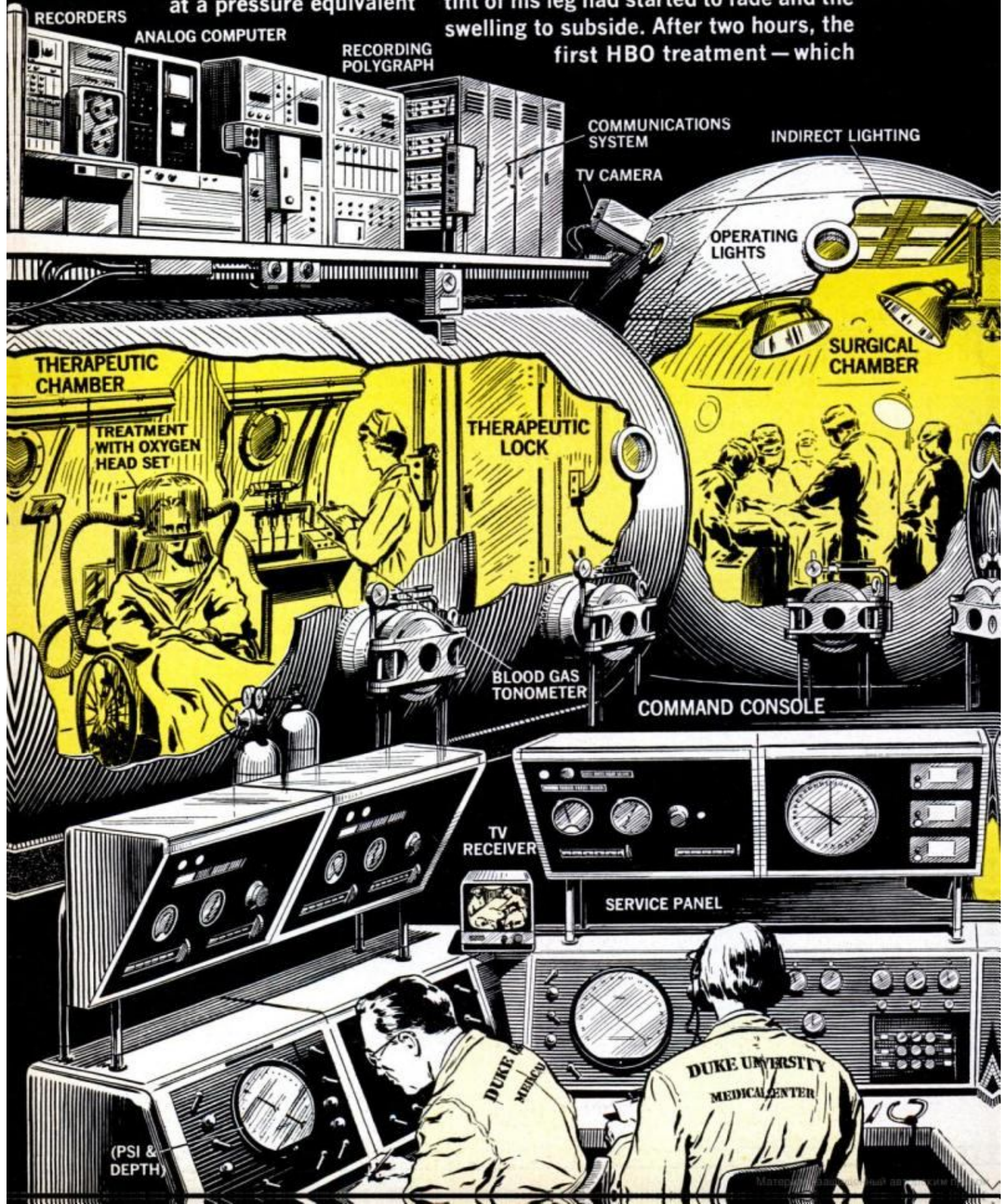
After a quick examination at Mount Sinai, Bruce was hurried onto a bed inside a 12-foot diameter, 45-foot-long steel cylinder that looked like a huge boiler dotted with portholes. A giant door at one end clanged shut and instantly the high-pitched hiss of compressed air echoed hollowly through the chamber. Medical personnel in the chamber yawned vigorously to equalize the mounting pressure. Bruce was awake, but if he had been unconscious a doctor would have

made tiny punctures in his eardrums to prevent their rupturing. Through a mask over his face, the youngster received pure oxygen. The other occupants breathed the tank's air.

When the pressure reached 45 pounds per square inch, triple that of the atmosphere, the hiss slowed and died. Now— at a pressure equivalent

to 66 feet below sea level—almost 20 times more oxygen than normal was being squeezed into the boy's blood, drenching it and the tissues it reached, with the life-giving gas. The youngster's response was dramatic.

Within 12 hours his temperature dropped to normal. Soon after, the green tint of his leg had started to fade and the swelling to subside. After two hours, the first HBO treatment—which

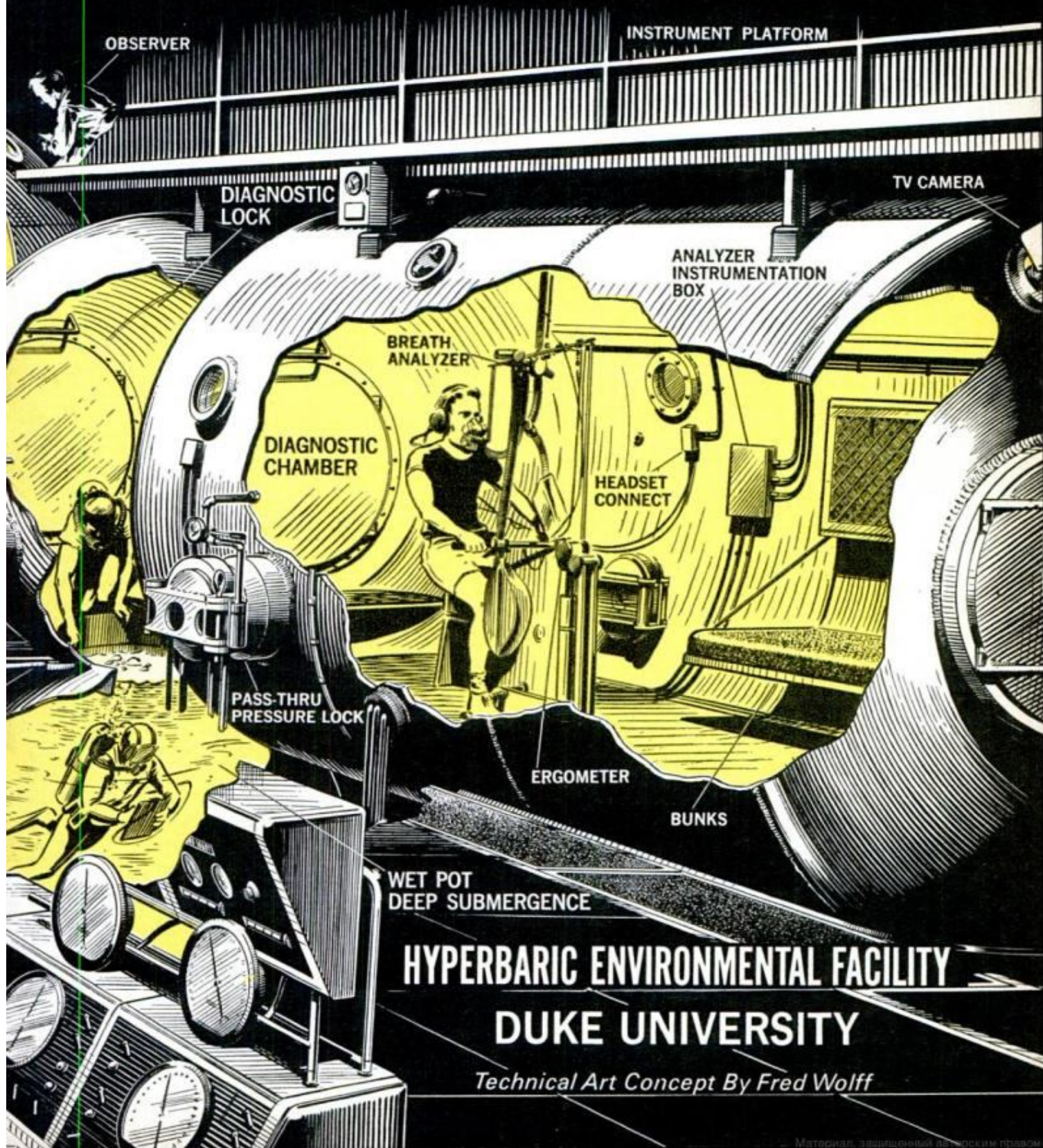


had to end to avoid oxygen poisoning and subsequent convulsions — had checked the infection. Other treatments, given at regular intervals over the next three days, wiped it out completely. Twenty-two days after entering the hospital, Bruce, fully recovered, left for his Maryland home.

Curing gas gangrene is only one of the jobs HBO is performing today. Researchers, still smarting from the rash of exaggerations claimed for the specialty

when it was introduced five years ago, hesitate to cite applications. But, when pressed, they admit that HBO is now an important medical tool in such diversified uses as skin grafting, heart surgery, treatment of carbon-monoxide poisoning and shock, and storage of human organs for transplantation.

To probe more fully these, and many other medical uses of HBO — and to study effects of high pressure on human





HYPERBARIC CHAMBERS are usually cramped, with most equipment outside, just patient and personnel inside

beings—Duke University recently added two mammoth chambers to its small pilot tank. Not long ago, Bill Greenman, engineer in charge of Duke's chambers and an ex-Navy diver, gave me a tour of the installation.

These chambers are so huge—each about the size of a large mobile home—that they were first laid on a foundation, *then* the building was put up around them. Angled together like a V, their ends meet at a 20-foot-diameter steel globe that houses one of the most sophisticated operating rooms in the country. The installation, which began operations early this year, is divided into six interconnected compartments, including a diagnostic-and-treatment section that can hold eight patients at a time. Any one of the six compartments can be pressurized to the equivalent of 1000 feet below sea level or 445 pounds per square inch.

Two air locks allow quick entry to the chambers, or slow exiting. "People in HBO tanks risk the same dangers as undersea divers," explained Greenman, a husky, quiet man with a crew cut. "If they left the chamber suddenly, the nitrogen absorbed in their blood would bubble out, and they'd get the bends. We use the locks to decompress them slowly." Smaller, two-foot-diameter

locks stud the chambers' sides; through these, technicians pass medical supplies and even snacks.

Next, Greenman led me to the installation's sleek control console, which is stationed between the two chambers. The console's three panels bristle with levers, dials, gauges, flickering signal lights and pushbuttons. Somehow, I felt I was looking at the control station of a modern submarine. From this nerve center a single operator can control the communications, pressure, humidity, temperature and other environmental factors in the five compartments, singly or in any combination. Medical instruments, such as an electrocardiogram machine and blood-pressure readers, are on a platform built atop the two giant cylinders.

A novel feature of Duke's new hyperbaric setup is a six-foot-diameter steel sphere underneath one of the huge chambers. Called the wet pot, this compartment can be filled with water, then pressurized, simulating deep-water dives. "Seals can plunge to 800 or 900 feet, stay there for 20 minutes, then surface without getting the bends," Greenman told me. "We plan to send seals on 1000-foot dives in the wet pot while we record their physiological reactions. What we find could show us

how men could do the same thing. That's just one of dozens of projects for this chamber."

At the Duke installation, as in all HBO chambers, certain precautions are taken to protect both patients and personnel. Since quick exiting causes bends, fire is the most dreaded calamity. All HBO chambers have sprinkler systems, and instruments that might spark—EEG machine, scintillation counter and the like—are located outside the chambers. Wires connect them with the patients inside. Electrical outlets are specially designed to be spark-proof, and light bulbs are shatterproof. One other safety measure: All glassware has to be self-venting. A stoppered bottle could implode when pressure mounts, or explode during decompression. HBO chambers are important in many kinds of surgery. In one study at Mount Sinai Hospital, doctors measured the oxygen level in a patient's brain after clamping off the carotid, or main head, artery for repair. They found that the oxygenated blood brought *more* oxygen to the brain through small, supplementary vessels than the carotid artery did normally. Because of this fact, surgeons can perform delicate time-consuming carotid surgery without worry over brain damage from oxygen deprivation.

Research is uncovering still more uses of the specialty. After a serious head injury, a pinched-off blood supply can cause the brain to swell, often resulting in death or brain damage. "It looks as though a bad head injury causes anoxia, a lack of oxygen, under the blow. This means swelling, which causes further anoxia, and you have a vicious cycle," explains Dr. Julius Jacobson of Mount Sinai. "In recent experiments on animals, we found that HBO treatments often break this cycle."

It wasn't long before this discovery was put to work. In an auto accident last winter, the skull of a New York teen-ager was dented by the crash. A day later his brain had puffed up so much that surgeons had to remove part

of his skull to allow for expansion. To avoid more swelling, doctors brought him to Mount Sinai's HBO chamber. The expansion stopped. More important, within half an hour after the HBO treatment began his brain had *shrunk* two inches in diameter. "This use of the hyperbaric chamber could be particularly important because of so many head injuries in auto accidents," states Dr. Jacobson.

Other applications of HBO now under trial focus on major killers. Super-oxygenated blood renders certain cancers particularly vulnerable to X-rays. Often, just a single X-ray treatment in an HBO chamber is equivalent to five outside; some hospitals even use small, portable HBO chambers in which cancer patients are brought to the institution's X-ray apparatus. And, many spe-

Within half an hour after the HBO treatment began his brain had shrunk two inches in diameter.

cialists claim that rushing victims of heart attacks to an HBO chamber greatly increases chances of recovery.

Yet other respected authorities quarrel with these uses of HBO, claiming that results don't justify shunting so much money and time away from perfecting present therapy. All specialists agree that only additional research will decide the issues.

"The effects of high pressure on humans are only beginning to be explored," states Dr. Herbert Saltzman, director of the Duke University HBO program. Saltzman, a large-boned man whose animated facial expressions continually punctuate his carefully worded sentences, clasped his hands behind his neck. His office chair creaked as he leaned back. "At Duke we're probing medical uses for HBO. We're also looking at how men react to alien environments. What our research finds may help man live at high pressure under the sea. Or, perhaps even under low pressure on other planets." ★★ ★

The Traffic Cop of the Sky

He may never see the aircraft he directs, but the air-traffic controller must know them all, know exactly where they are, keep them comfortably spaced and bring them down safely

By CREIGHTON PEET

Photos by Jim Pickerell

THE ROOM is low-ceilinged, dark and small, not much larger than an average office with 10 or so men in it. Yet these men, young men mostly in their early 30s, control the destinies of thousands.

They are radar controllers. Hunched over greenish scopes with a mish-mash of marks no layman could decipher, they speak softly but with authority into headsets, each directing at one time as many as eight huge jetliners around the sky, keeping them safely separated, bringing them down one by one to lower altitudes, then ordering them in for landings — all without ever seeing the planes they control. Each plane is represented by two fuzzy slashes that crawl across the scope amidst all the other garish symbols. If just one of these sets of slashes is lost, disaster could result.

It's the job of these traffic cops of the sky to prevent disaster, and they have to prevent it daily, hourly, minute-by-minute.

ULCER TERRITORY. Jim Knoetgen sorts out takeoffs and landings from tower at Kennedy Airport



Jim Knoetgen is one of these traffic cops—air-traffic controllers—and fairly typical. And the room he works in is the new Common Instrument Flight Rules Room (CIFRR) at Kennedy International Airport, which directs traffic at New York's three major airports.

Knoetgen (pronounced NOTE-gen) is 31, about average for this fantastically responsible job. And for this slender, boyish-looking man, the job is the triumph of a lifelong ambition.

Born in New York City, he grew up in nearby Islip, Long Island, hardly 50 miles as the jet flies from the Kennedy tower. When he was 15, and a Civil Air Patrol cadet, he wrote to the forerunner of the Federal Aviation Administration in Washington, asking how he could learn to be an aircraft controller. He was the youngest ever to make such a request. Told that the only training available was that offered by the military services, he enlisted in the Air Force the day after graduating from high school.

He got his training. Then, after his discharge, he joined the FAA, working in various air-traffic capacities in various parts of the country, until he worked his way up to his present job.

Basically, an air-traffic controller's duties fall into four categories:

Air-Route Traffic Control, which controls planes en route from one point to another—say, from New York to Chicago—is done by radar. Controllers never see the planes they direct.

Approach Control, also controlled "blind" by radar, places planes intending to land in neat "stacks" above fixed points near an airport until they can be brought down safely one by one.

Departure Control controls, by radar, planes after they take off to guide them to an air-route controller.

Actual takeoffs and landings, of course, are controlled visually by the controllers in the airport tower, assisted by supplementary radar at night or in poor weather.

Knoetgen, who has handled all four jobs during his career, is now exclu-



JIM KNOETGEN'S BIG LUXURY is '64 Cadillac, which he drives to work at Kennedy International Airport

sively in approach control. He normally controls two stacks at a time, talking to pilots in as many as eight planes, sometimes ten. The planes, all headed for Kennedy, are divided into two stacks because of the difference in speeds; the jets in one stack, the prop-driven planes in another. Within each stack, as they circle over their fixed points, the planes are separated by 1000 feet of altitude, and the fixed points are separated by enough geography so the circling stacks do not overlap one



RADAR SCREEN'S MISHMASH of marks represents multimillion-dollar planes with hundreds of passengers

another. The stacks are further separated by keeping the top plane in the prop stack at 8000 feet or below, and the bottom plane in the jet stack at 9000 feet or above.

It's Knoetgen's job to "peel" the bottom plane off each stack at the right time and send it in toward the airport, passing it on to the tower controller, then dropping all the other planes down 1000 feet, one at a time.

Meanwhile, during peak periods, more planes are flying onto the top of the stacks, passed on by the air-route traffic controllers, and still more planes are taking off from the nearby airport and flying close to his stacks.

Knoetgen has to keep his eye on all of them, and this endless cycle can go on for hours. No controller can keep this up for more than two or three hours at a time. It's too nerve-wracking.

"And my eyeballs start to fall out of their sockets," Knoetgen says, closing them. He gets shifted around to change his routine, or takes coffee breaks.

Kennedy handles planes from more

than 42 different airlines, including, now, one from Russia. Last year Kennedy had more than 380,000 operations, which averages out to 1200 a day, 1400 a day during the peak summer season.

As Knoetgen explains the routine, when a plane bound for Kennedy reaches the New York area, it is first handled by an air-route controller at the New York Center, located farther out on Long Island at MacArthur Airport. The New York Center, one of 21 in the United States, controls en-route traffic in an area between the Boston and Washington, D.C., centers.

Then, when the timing is right, one of the air-route controllers "gives a hand-off" to the radar room at Kennedy, passing the plane on. An approach controller writes out the basic facts about it on an 8 by 1-inch yellow card called a "strip." From now on this strip represents the plane. It's filed on a rack with other aircraft headed for Kennedy.

"Then," said Knoetgen, "we begin to watch for it on our scopes. When it appears, the first man responsible for it

RADAR ROOM at Kennedy, where Knoetgen works, controls all approach traffic to New York area airports





CONTROLLERS' DILEMMA: Too many airplanes, especially at peak periods, and too few qualified controllers

calls the plane's captain, 'I have radar contact.'

As the plane comes nearer and lower, its strip is handed from one man to another until, if traffic permits, it can go on in for a landing, or it is placed on top of one of the stacks.

The information on the strip includes the name of the airline, the number of the flight, the model of the plane, its altitude and airspeed. Surprisingly, the key fact is the model of the plane.

"We have to know the characteristics of every plane we handle," Jim said. "Some planes make sharp turns, others wide sweeps. We can't tell a pilot to make a turn if it's going to put him dangerously near other aircraft. And if we put a plane which will normally do 180 knots on final approach behind one which can't do more than 140, the three or four miles we are supposed to keep between planes would soon be used up."

Sitting beside Knoetgen, and listening as he exchanged talk with incoming pilots, I heard this:

"... American 530, turn right, maintain 5000 ... Thank you ... United 1910, what is your altitude? ... 4000 ... Thank you ... Descend to 3000 ... TWA ... What is your airspeed? ... 350 ... Reduce to 250 and turn right

... Thank you ... National 343, descend to 2500 ... United 231, what is your airspeed? ... 250 ... Reduce to 200 ... You are now on final approach ..."

As a plane passed out of his control area, Jim handed its strip holder back over his shoulder without even looking around. A supervisor snatched it away and passed it to another controller who immediately located it on his scope.

"When the planes are in stacks, you can tell the pilots to 'expect approach clearance in X number of minutes.' If the delays increase, the pilot may say his fuel is low and he hasn't much beyond 'what I need to make my alternate,' meaning his alternate airport, such as Boston or Montreal."

Is all this responsibility, fast thinking and experienced judgment wearying? Jim says it certainly is.

"You can't think about all those lives or all that expensive equipment you're guiding through the air. You'd go crazy. You have to keep calm, make sure you do everything exactly right. Sometimes we make small mistakes but we correct them in seconds. Some people talk about unwinding at the end of the day. For me it's no joke. It's the truth.

"When I get home at night I can't

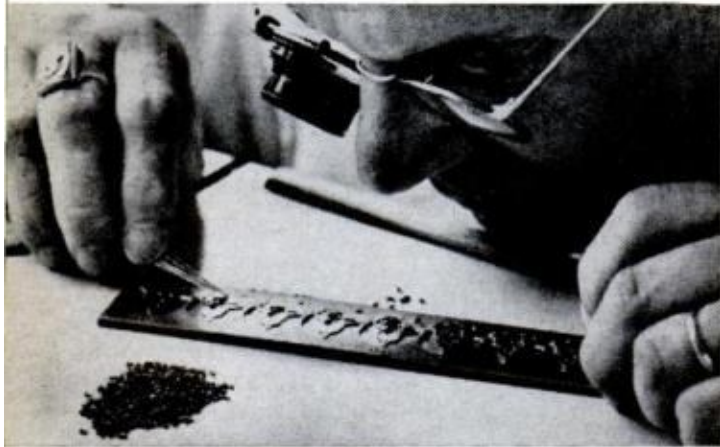
(Please turn to page 218)

The little mechanical wonder that gives you

THE TIME OF YOUR LIFE

That tiny timepiece on your wrist ticks 432,000 times a day, never stops, and comprises more machinery than the engine in your car—yet you take it for granted. Coming for the future: New watch designs that are wilder still

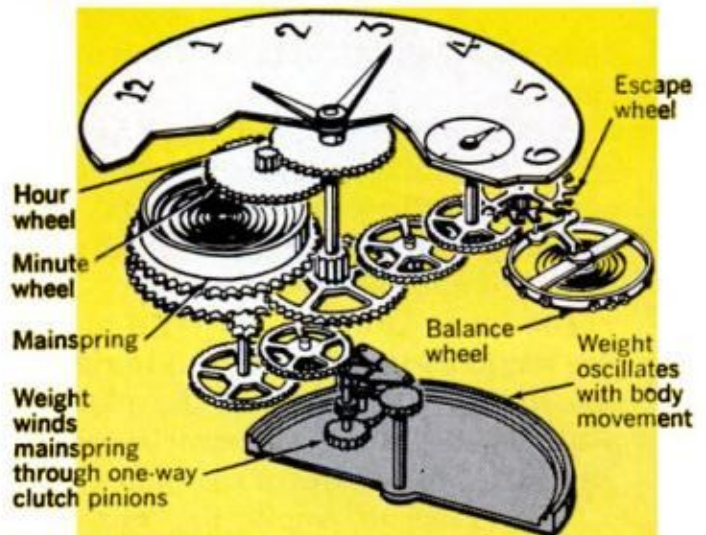
By ARTHUR S. FREESE *Technical Art by Associated Technical Services, Ltd.*



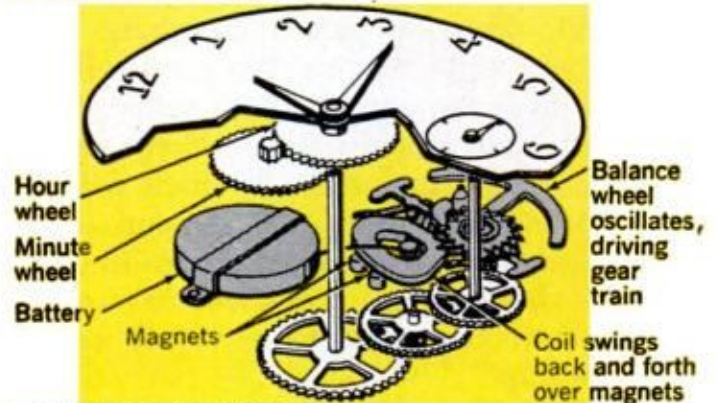
TRICKY WORK: A Swiss watchmaker painstakingly assembles a row of Eterna watches held in a shallow tray above. Below, a technician wears gloves while adjusting a Bulova Accutron to keep the parts clean



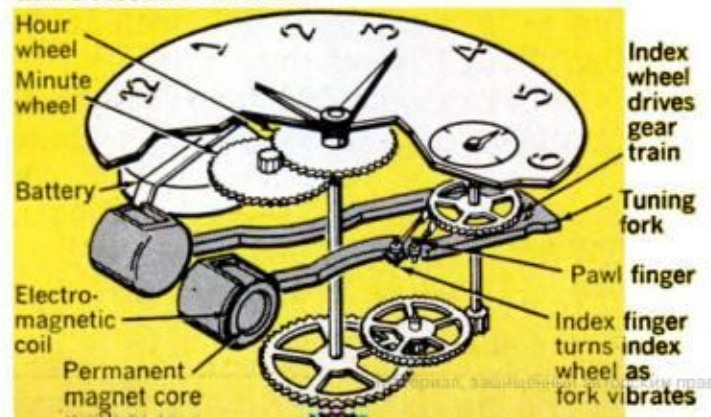
SELF-WINDING WATCH



ELECTRIC WATCH



ELECTRONIC WATCH



IT'S A MACHINE that develops 0.0000001 horsepower. It's built in as many as 3500 separate operations to tolerances as fine as 0.001 millimeter—1/50th the thickness of a human hair. Its moving parts travel 90,000 miles in a quarter of a century.

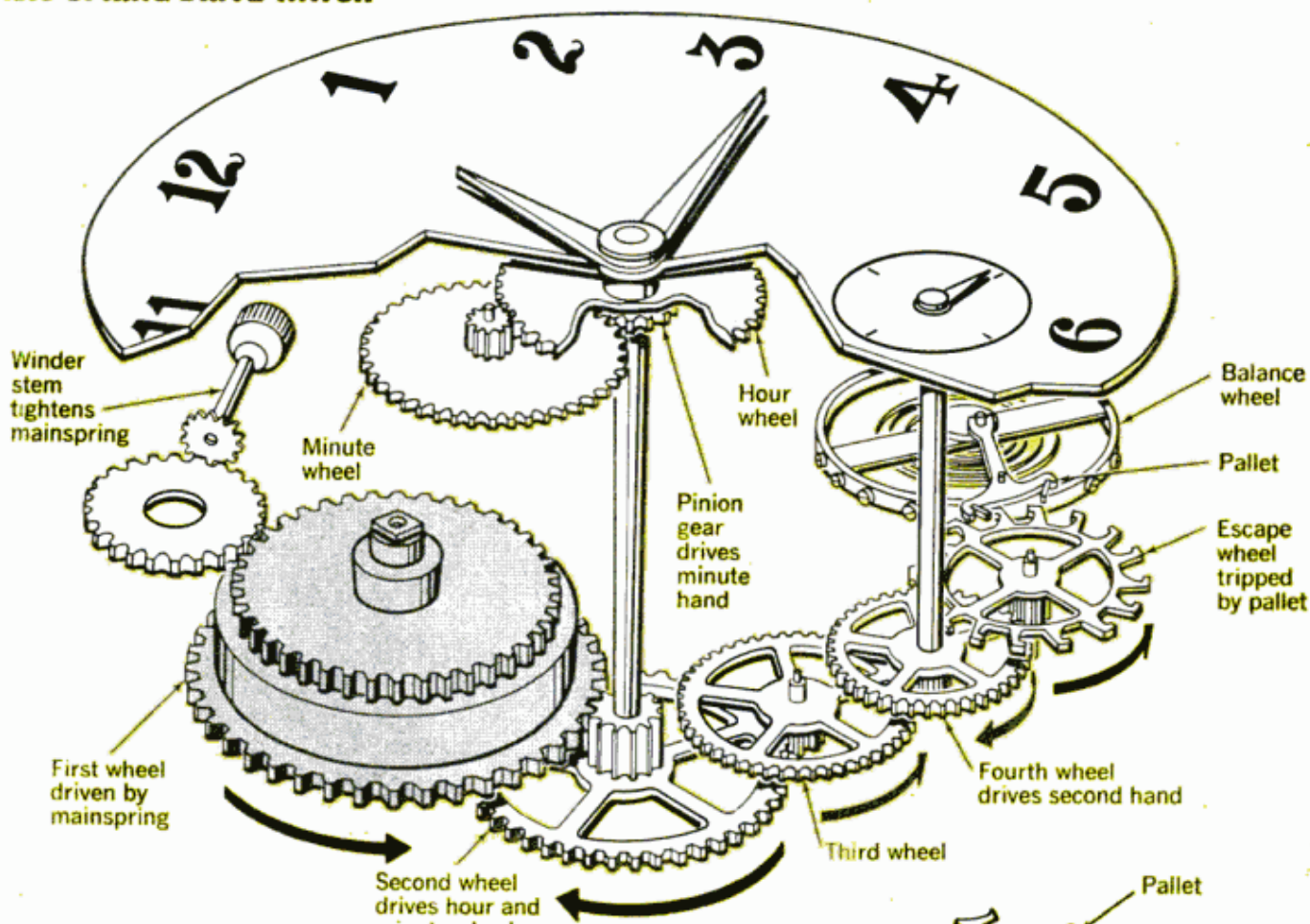
This is the amazing little mechanism that is your watch. More than 35 million are sold every year. You can pay from \$25 to \$2500 for what is essentially the same basic works, with or without a varying amount of exotic refinements.

The first portable clocks turned up about 500 years ago in Europe. At that

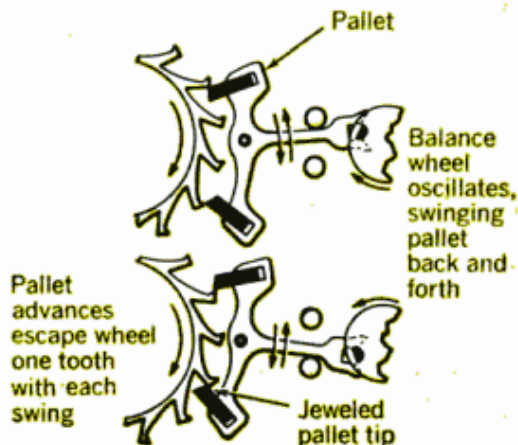
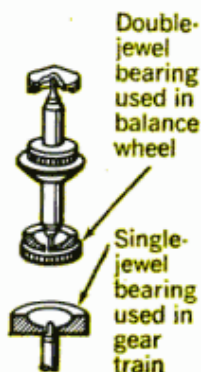
time, they were either carried in a pocket or worn around the neck on a chain. In the 16th century, Queen Elizabeth attached one to her wrist and thus created what is believed to be the first wristwatch. The idea did not catch on, however, because the practice was considered effeminate.

In World War I, necessity changed the course of watch history. Officers preparing to launch infantry attacks found they couldn't easily pull a bulky pocket watch out from under layers of gear while scrambling out of a muddy trench at the same time. They began to strap their watches to their wrists—

BASIC SPRING-DRIVE WATCH



DIFFERENT WATCH DRIVES are basically similar except for power source. In conventional type, unwinding spring turns gears while escape mechanism regulates the speed. Self-winding watch uses oscillating weight to keep spring wound. In electric and electronic types, the escapement becomes, in effect, the drive mechanism itself instead of just a speed regulator. Electric is powered by a battery and moving coil. In electronic, vibrations of a tiny tuning fork drive gears and keep speed constant at the same time





PARKING-METER WATCH keeps tabs on how much time you have left so you won't get a ticket. You can set it for 30, 60, 90 or 120 minutes. At the end of the period, an alarm sounds, warning you to return to your car. The watch also shows date in a window



BRILLE WATCH, made for the blind, has raised numerals that can be "read" by the touch of a finger. The crystal flips open, allowing the wearer to feel the exact time. Both wrist and pocket watch styles are available

The Many Faces



LOW-COST STOPWATCH introduced by the Japanese functions as a regular wristwatch but has a sweep second hand controlled by a pushbutton for timing races and other sports events. Made by Seiko, it has a rotating outer ring to show elapsed time in minutes up to one hour, sells for about \$24



WORLD TRAVELERS can tell what time it is anywhere on the face of the earth with this global watch. A revolving disc with 12 pointers is coordinated with 12 pairs of major cities around the world, each pair 12 hours apart on opposite sides of the globe. The pointers on the Vantage watch thus show the time simultaneously in 24 locations



SLIDE-RULE WATCH, handy for engineers and architects, has an outer dial you turn to make mathematical calculations. You can multiply, divide, find cube roots and do other operations. A button-controlled sweep hand provides the function of a stopwatch as well, and several small inner dials register elapsed time



DIVER'S WATCH has a novel sweep hand that shows minutes instead of seconds—more important in keeping track of underwater time. This \$220 Breitling also has an outer ring that records elapsed time



◀ **PILOT'S CHRONOGRAPH** has a button-controlled sweep second hand for help in navigating. A rotating outer ring, divided into 24-hour day, can be set to show elapsed time, estimated time of arrival or times in other time zones. Small inner dials on this Heuer model indicate elapsed time



▲ **WATCHLIKE GAUGE** for scuba diving shows how far down you are at a glance. Pointer indicates depths up to 350 feet in five-foot divisions. The Swiss-made Aquastar measures changes in pressure of water against a diaphragm to tell depth

Watches Wear

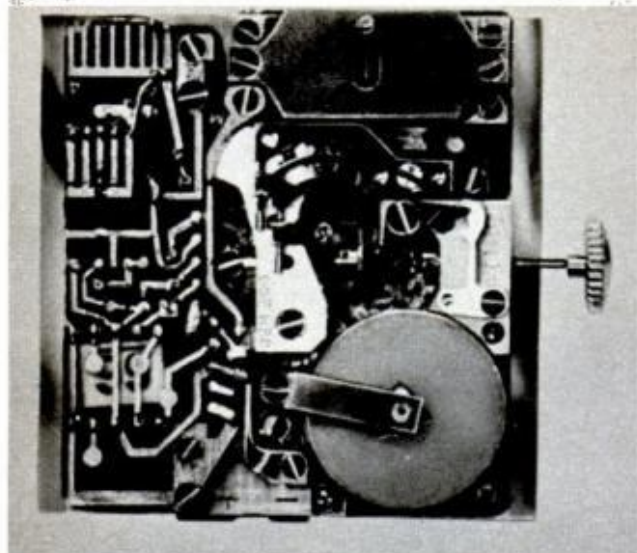
▶ **A DISTINCTIVE** conversation piece, the watch mechanism at right is built—believe it or not—into an authentic \$20 gold coin. Corum makes the exotic goldpiece watches in styles for both men and women. Their price: about \$1000



▲ **CALENDAR WATCH** shows day and month in windows. Also self-powered, this Japanese design runs for years without attention. Note unconventional location of stem, needed only to permit occasional resetting of the hands

▶ **ELECTRONIC WATCH**, Bulova's Accutron, has unusual see-through face, showing off miniature tuning fork mechanism inside. Tiny transistor, resistor and capacitor, part of electronic circuit, can be seen along right side





A PREVIEW OF THINGS TO COME, this superaccurate electronic wristwatch uses the precise resonating frequency of a quartz crystal to keep it on the beam. Designed by Swiss experts, it's accurate to within 1/100th of a second a day. Instead of gears, its innards consist of a printed-circuit board, as at left

and that did it. Since no one could call an infantryman a sissy, the new watch style gained a quick popularity.

In a relatively few short years, the wristwatch has progressed from a cumbersome, clanking oddity to a fine, precision piece of machinery so small and slim that one manufacturer hides the works inside a gold coin. There are over 125 parts in a modern wristwatch, the smallest being a threaded and highly polished screw 0.004 inches in diameter, so tiny that 50,000 would fit into a thimble.

PILLAR PLATES, shown here being checked, form the main foundation for mounting other watch parts

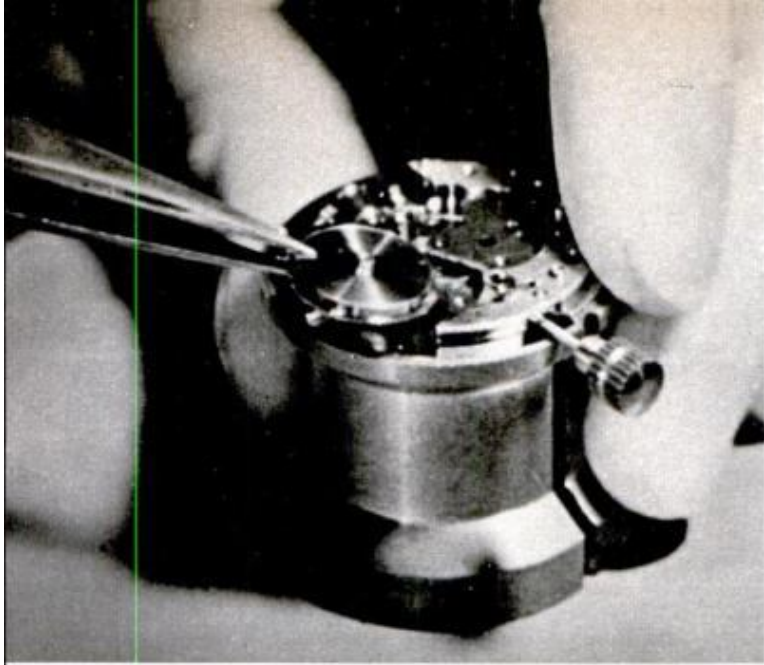


The basic watch movement consists of three mechanisms. The first is the mainspring or motor. The second is the "train of wheels"—a series of gears that step down the fast speed needed for the second hand to the slower speeds needed for the minute and hour hands. The third is the escapement, a control mechanism that transmits the power of the mainspring through the gear train at a precise rate.

Without the escapement mechanism, the wheels and hands would spin around until the mainspring quickly ran down. This control consists of the escape wheel, escape lever or pallet, balance wheel, and hairspring. The two tiny fingers of the escape lever, a wish-bone-shaped part that rocks back and forth, let the escape wheel move forward one tooth with each swing of the balance wheel. This is the "tick" of your watch.

The balance wheel oscillates five times a second—432,000 times a day, 157,680,000 times a year. The escape wheel passes the mainspring pressure on to the escape lever. This pushes the balance wheel, tightening the hairspring, which then swings the balance wheel back again, five times a second.

What do jewels in a wristwatch mean? Originally, natural jewels alone were available, and only the most ex-



ASSEMBLING A WATCH is like putting a miniature jigsaw puzzle together with tweezers. A weighted stand holds watch firmly in position during the job

pensive watches could use them. But now synthetic rubies and sapphires are available for pennies. The chief cause of a watch's inaccuracy is frictional wear. The hardness of jewels makes them ideal for use as bearings at the points of greatest wear—the pivots where the wheels turn.

How many jewels should a watch have? The number commonly used varies from seven to about 23. For good wear protection, the conventional wristwatch should have at least 17 jewels—10 for the five main gear wheels,

two for the tiny fingers of the escape lever, and the remainder in other parts of the escapement. Watches having only seven jewels use them in the escapement—the most critical mechanism—and omit them from the gear train. In addition to the basic 17, some watches have double jewels consisting of extra cap jewels over the bearings to keep oil in and dirt out.

Beyond 22 or 23 jewels, adding more serves no purpose except in some special watches. In the past, some watchmakers stuck in extra nonfunctional jewels just to make the count sound higher. American and Swiss laws now prohibit this, permitting only the actual number of functional jewels to be advertised.

Not all watchmakers agree on the need for jewels. Timex, the world's largest producer of nonjeweled watches with many happy customers to its credit, argues that good design is more important in determining how long a timepiece will last than the use of jewels alone. Also, a watch that costs \$25 and runs reliably for 5 or 10 years doesn't have to last a lifetime to have earned its keep. It can be a fine investment for what you pay.

The whole question of how much you

(Please turn to page 192)

WORKING UNDER A SPECIAL SHIELD, a Bulova technician coils mainsprings into storage rings. The shield keeps dust particles from settling on the tiny parts and possibly fouling the delicate movements later



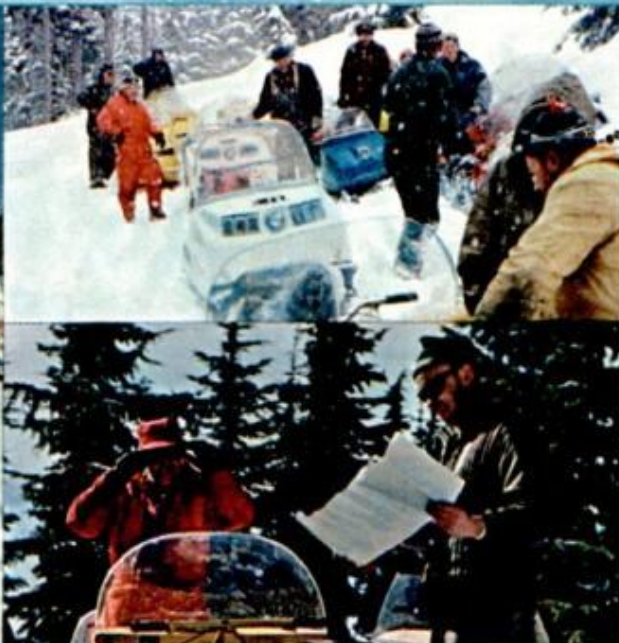
ACROSS THE BITTERROOTS WITH LEWIS AND CLARK —BY SNOWMOBILE

Want adventure? It's now yours for the taking on trails like this that almost defeated the famous explorers.

By JAMES M. LISTON, Executive Editor

A SNOWMOBILE can make you an explorer. With it you can venture where four-wheel drives can't make it: into wilderness areas few men have seen; into awesome stands of towering pine that yield only to the 44-inch width of your dependable little mount; across snowfields on the windswept ridges of mountains where the view stretches as far as you can see.

You can cross Idaho's Bitterroot Range on Lewis and Clark's own trail, camp where they camped, see what they saw. Best of all, you can see it as they saw it—in winter, with its wild, sudden snow squalls yielding to ice-blue skies, with rugged canyons yawning below as you travel the ridges. You feel the sharp bite of the wind as the sky turns blood red in the twilight and you wend your way into a canyon to camp for the night—you see it pretty much as the explorers left it over 150



SUPPLIES, parts and fuel were carried on sleds (above). Our party set a fast pace (far left) when the going was good; covered 60 miles the first day. After a long, hard stretch of side-hilling, we pause for a "breather" (left) and are hit by a snow-storm where snows delayed Lewis and Clark. U.S. Ranger John Leasure (below) studies map of Lolo Trail. On trip he surveyed the route that will be open to snowmobilers this year.

years ago. Until about a year ago, the Idaho wilderness area had been penetrated only by dedicated hikers, pack trips, arduous four-wheel-drive safaris and hairy float trips on the wild rivers. When winter came, the wilderness kept its secrets. But local snow-catters soon discovered that snow meant they could scoot where pack animals scramble for footing and they could race where Jeeps and pick-ups groan in low gear. On weekend trips they ranged far into the mountains and began planning a 100-mile run across the top of the Bitterroots following Lewis and Clark's eastward return on the Lolo Trail.

Last winter when *Popular Mechanics* learned that a hardy bunch of experienced snow-catters at Kooskia, Idaho, was planning the trip, I joined them to report its possibilities as a snowmobile adventure—and to see if a tenderfoot could survive it. I had all the qualifications: a personal interest in survival and all of 15 minutes' time on a snowmobile the previous season.

The day before we set out, I met the leaders of this expedition: big, genial Jim Jackson, Polaris dealer, and Orville Shelgren, his good friend and competitor, the Ski-doo dealer. Jackson and his 19-year-old son, Bob, would alternate as trail busters; Orville would bring up the rear of the column with a supply of spare parts, tools and gas. The week before, Jim and Orville had



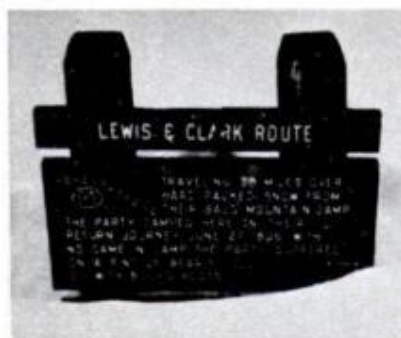
REPAIRS ON TRAIL were no problem; we called the dealer. Machines stood pounding very well. Total repairs: set of bogie wheels, two belts, two springs

catted up from the highway to the trail at three points roughly 25 miles apart and cached 50-gallon drums of gas.

There would be 16 men on 16 single- and double-track Polaris and Ski-doo snowmobiles, with sleds (carrying gas, bedrolls and supplies) attached to nine of them. John Leasure, chief ranger at the Lochsa Ranger Station and Frank Fowler, from the Powell Ranger Station—our final objective—would be along to survey the trail's possibilities as a regular skimobile route. The Forest Service wants to improve access to remote areas of the Lewis and Clark expedition. The snowmobile offers an ideal solution because

Photos by Roscoe LeGresley

LEWIS AND CLARK ROUTE is 100 miles along highest ridges of Bitterroot Mountains. Forest Service markers were usually under drifts



Start:
March 7,
7:30 A.M.
Dollar Creek

Snowmobiles bog down in heavy stand of pine

Fuel cache
Deep Saddle

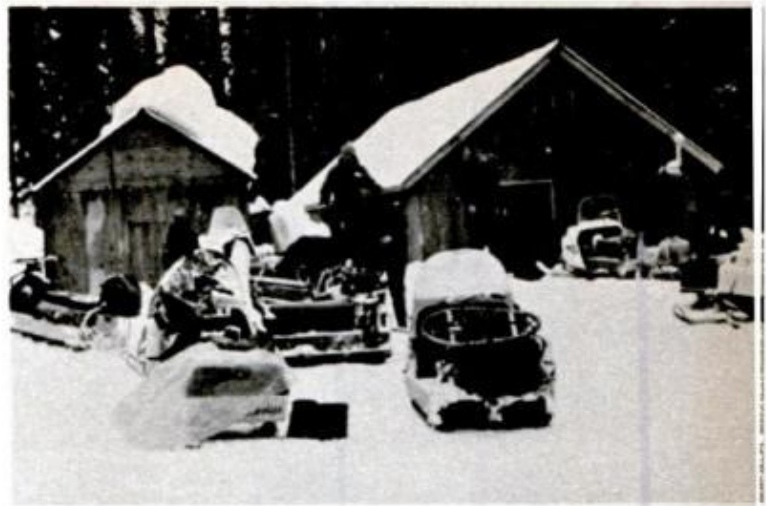
KOOSKIA



LOCHSA RIVER



ORVILLE SHELGREN climbs out from under his overturned machine after losing control of it on steep, icy slope. We had many spills, but no injuries



DESERTED LOGGING CAMP was our overnight stop. After breakfast in the cook shack, our men are packing their gear for the second day on the trail

it doesn't scar the wilderness with new roads.

The rest of the party was made up of local snow-catters, all outdoorsmen and glad to trade a couple of days from their jobs as loggers, mechanics and truckers for a crack at this adventure.

With our cats loaded onto pickups we pulled out of Kooskia at 5:00 a.m. and labored for two hours up a Forest Service road to Dollar Creek where the road intercepts Lewis and Clark's eastward route of 1806, and the real snow began for them—and for us.

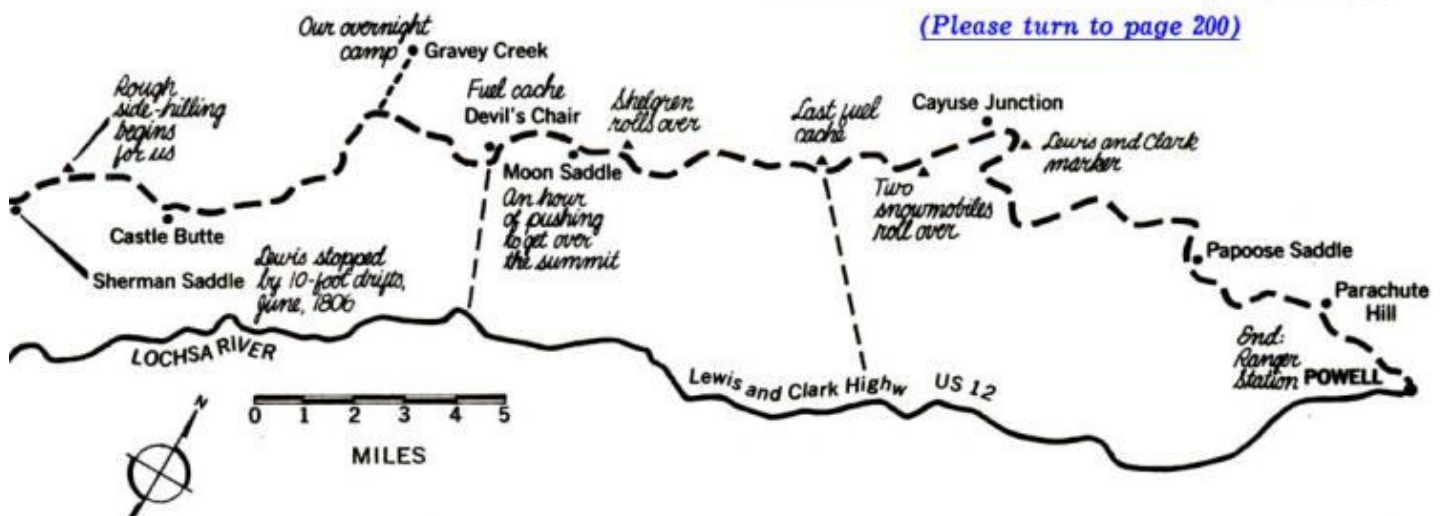
We gassed up, secured our gear, and started our engines. Up ahead, Jim Jackson waved his arm in a circle and we were underway at 7:30 on what felt exactly like a fine spring morning with

the temperature hovering over the 50s.

I settled into the saddle, getting the feel of the machine, getting used to the steady bark of the engine. Jackson set a fast pace and we were soon strung out in a long column. We were climbing steadily on the Lolo Motorway, a grandiose name for a narrow Forest Service "road" built in 1935 that roughly follows the route taken by Lewis and Clark. If it were like this all the way, it would be a breeze. (I was a babe in the woods, as green as the giant firs that towered above us.)

The air was like champagne, heady stuff that made it easy to see Captain Meriwether Lewis and Captain William Clark laboring up this grade on horseback on their homeward trek across these mountains. They had twice

(Please turn to page 200)



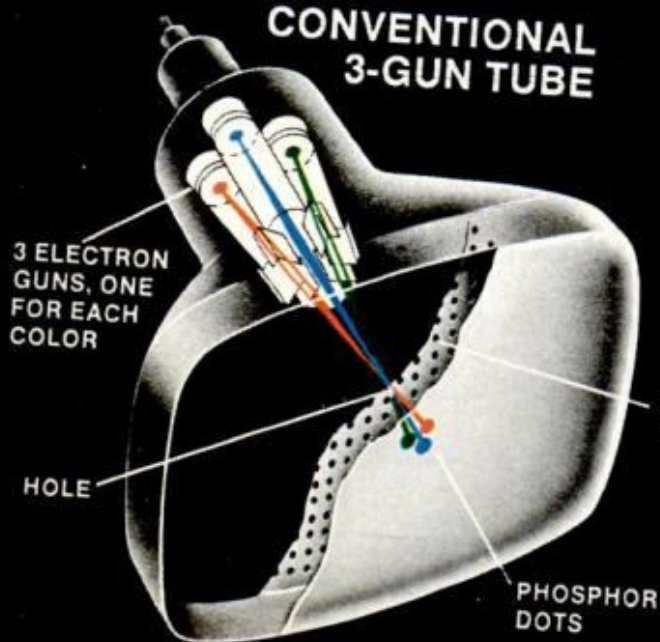
THE LOLO TRAIL is five miles north and high above the new Lewis & Clark Highway, U.S. 12. We started at Dollar Creek, where Lewis began his return journey, and ended at Powell Ranger Station, where the trail descends to Lochsa River. Trips on Lolo can start from Kooskia or Powell, where the Lochsa Lodge accommodates skimobilers

World's Smallest Color TV

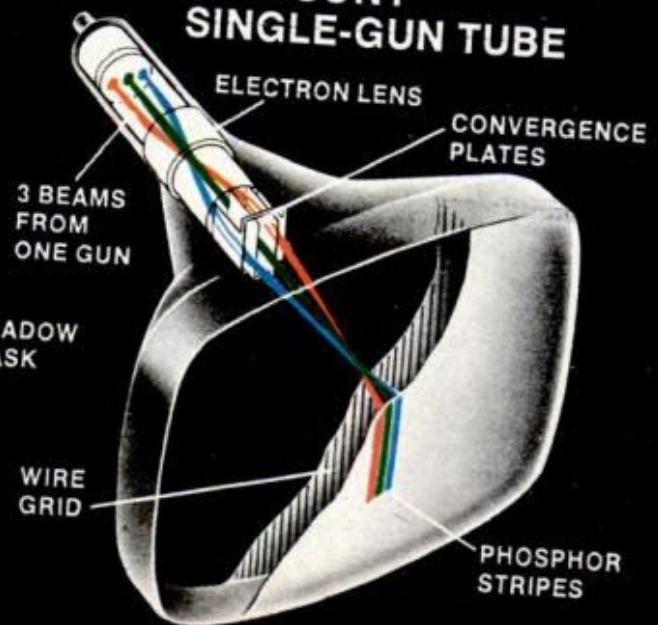
By LEN BUCKWALTER



CONVENTIONAL 3-GUN TUBE



NEW SONY SINGLE-GUN TUBE



Shoehorn engineering and a radical new picture tube design make this 18-pound portable one of the hottest advances in home entertainment

A PORTABLE COLOR TV small enough to carry from room to room, even take outdoors on the patio, is here at last. After eluding manufacturers for more than a decade, mid-gut color sets are finally becoming a reality.

Proof that the technical problems of color "tinyvision" have been licked is appearing on dealers' shelves now. It's a compact portable weighing only 18 pounds with a seven-inch screen (measured diagonally). It can pull in signals on a built-in whip antenna or be connected to a rooftop antenna in fringe areas. While it trails a power cord, it fulfills one of the most important requirements for TV portability—it produces a bright, vivid picture that you can view in a lighted room or even in daylight outdoors. That's a tall order for a color receiver.

The new set, called the "Micro Color TV," is produced by Sony. With this model, the Japanese manufacturer wins the race to market the first all-transistor compact color receiver. Until now, only one color set could boast full transistorization, and that one comes only in a big-screen console. The smallest color set you could buy before was a 10-inch model that contained mostly vacuum tubes.

But going to solid-state construction is only half the story. Sony has startled the TV industry by introducing a completely new picture tube in the compact set. It had to, to achieve the small size. Conventional color sets all use a color tube known as the "shadow mask" type. Although capable of producing good color, the shadow mask tube doesn't lend itself to very small screen sizes. Its picture is fashioned from small dots that blend together in the eye at normal viewing distances

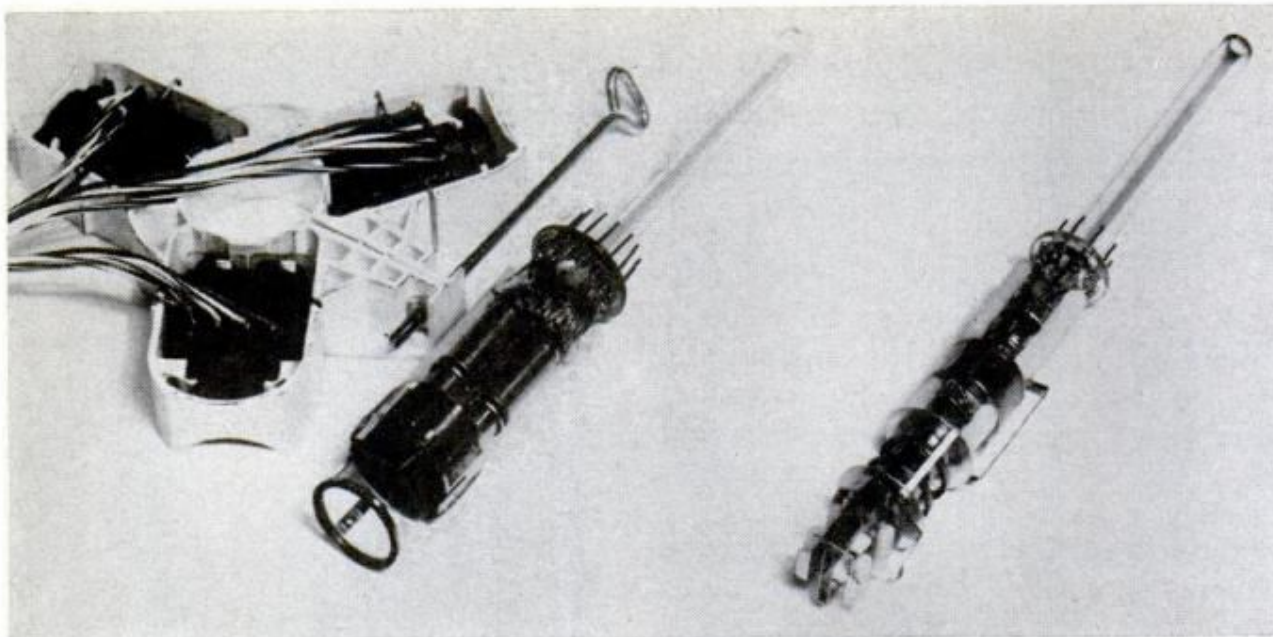


WEIGHING ONLY 18 POUNDS, the 7-in. set can be toted anywhere line cord will reach, even outdoors

of five feet or more. But small screens are viewed at shorter distances—and that was the problem. At close range, the dot structure tends to make the picture appear coarse and grainy.

The new Sony tube has no dots. Its screen is built from rows of vertical stripes. The spacing is narrow enough so the screen can be viewed comfortably at very close range. A major feature of the screen is that it operates at very high color brightness—about double that of a regular shadow mask tube. It has a grid of fine wires that gives the tube high "transparency." The conventional shadow mask blocks more of the scanning beam that produces the picture.

The Sony tube will almost certainly capture the tinyvision market, leaving the big screens to the shadow mask. Whether the Sony tube can be made

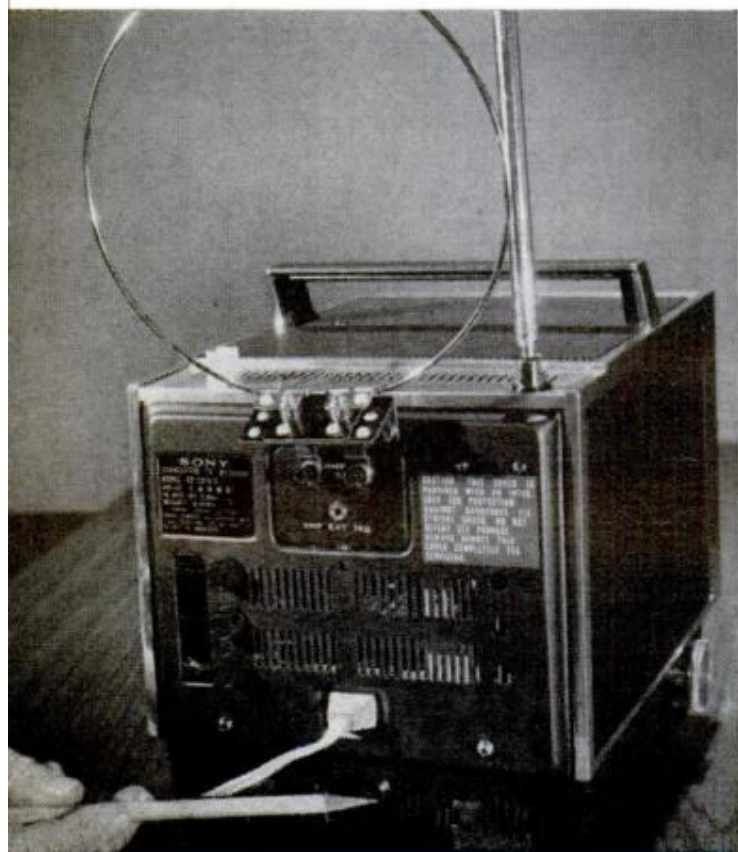


SMALLER AND SIMPLER, Sony's new Trinitron electron gun is shown at right compared with bulkier conventional gun at left. Gun makes possible narrower tube and thus a more compact arrangement of parts in set

for large-screen sets is still to be determined.

Another major departure in the Sony tube is in its electron gun, the assembly located in the neck of the picture tube. In the shadow mask tube, there are three identical electron guns for firing three separate electron beams

CONVERGENCE CONTROL on back lets set owner make own adjustment without calling a serviceman



at the screen. Each beam, striking chemical phosphors on the screen, causes three primary colors—red, blue and green—to glow. The beams must fly across the screen in tight, precision formation to form the color image.

Although the beams maintain a reasonably close relationship as they arrive at the center of the screen, they tend to fan out in other areas of the picture. The result is "misconvergence"—seen by the viewer as fringes of false color around objects or people in the picture. To cure the problem, the beams are given an electronic twist by convergence coils mounted around the tube's neck.

There are no convergence coils on the Sony tube—it doesn't need any. Instead of using three separate electron guns to originate three beams, the Sony tube splits the beam from one gun into three sections. An advantage is that three beams produced this way can be focused through one large, efficient electronic lens. In a three-gun tube, there's a relatively small lens for each gun. Engineers claim there's less focusing efficiency and more chance for the beams to spread and misconverge in a three-gun arrangement.

A dramatic consequence of the one-gun tube is its smaller size, made pos-

sible by the elimination of bulky convergence coils. This allows extra space in the cabinet and makes for easier miniaturization. Another key feature is that the number of convergence adjustments is vastly reduced from about a dozen to just two. One convergence control, in fact, is brought out at the back of the set so that the owner himself can make the adjustments. Called "color uniformity," it allows you to adjust the screen until color fringes disappear from the black-and-white picture—a far cry from the elaborate convergence procedure done by a serviceman on conventional color sets.

First time you see the Micro Color set in action, you'll probably spot its

outstanding characteristics. Its color glows with extraordinary brightness. You can, of course turn up color and brightness on a conventional set, but the result won't be the same.

If you apply excessive brightness, then the conventional color image will become too pale. If you pour on excessive color, then the hues will quickly assume an unpleasant "saturated" or smeary appearance.

These conditions, however, are not particularly troublesome in the normal viewing situation; for example, in a living room where the light is easily reduced. But the Sony tube will continue to deliver impressive color when lighting

(Please turn to page 222)

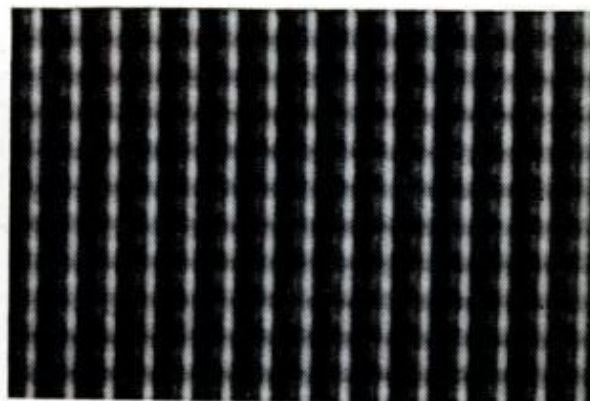
CONVENTIONAL TUBE



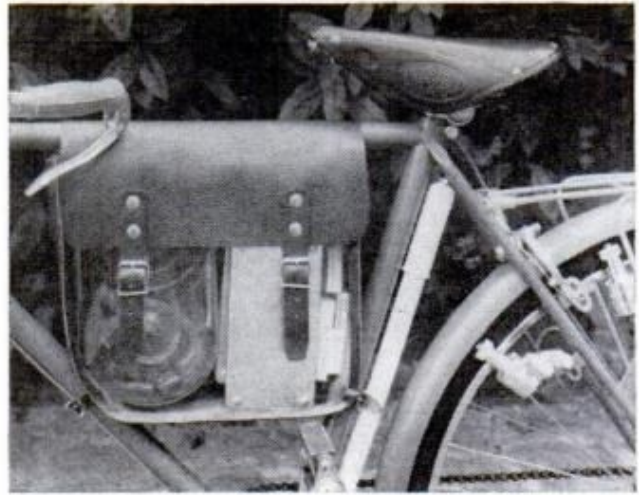
NEW SONY TUBE



SLIM-NECKED SONY TUBE, seen alongside conventional color tube above, shows space gained by single-gun design. Both tubes have deflection yokes containing electromagnets that swing the scanning beams across the screen to create



the picture, but single-gun type requires no external convergence coils to focus the beams. Enlarged photos above show how regular screen is made up of little groups of dots, while Sony's consists of vertical lines, made by a wire grid



Bikes for Hanoi

A French firm has shipped 1000 specially equipped bicycles to Hanoi for the use of traveling medical personnel there. Each bike is outfitted with a set of surgical instruments (left) in a bag slung over the frame of the bicycle (above). Each vehicle also has two generators which provide electricity for the headlamp while the bike is being pedaled. With the rear wheel raised off the ground on a special stand (photo, upper left), the bike can be pedaled in place to produce light for night work in the field. The special bicycles were designed by two French doctors who studied the needs of the Vietcong.



Swimmer's speed mask

Long distance swimmer Calvin Gongwer wears this prow-shaped "speed mask" to cut down face-mask drag in the water. It has a built-in snorkel and a bracket for a compass.



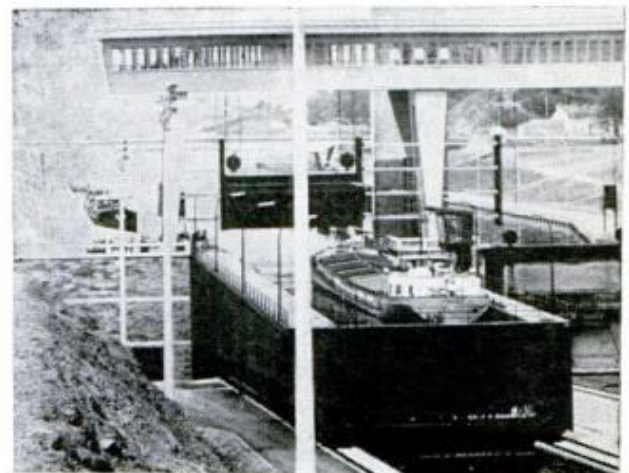
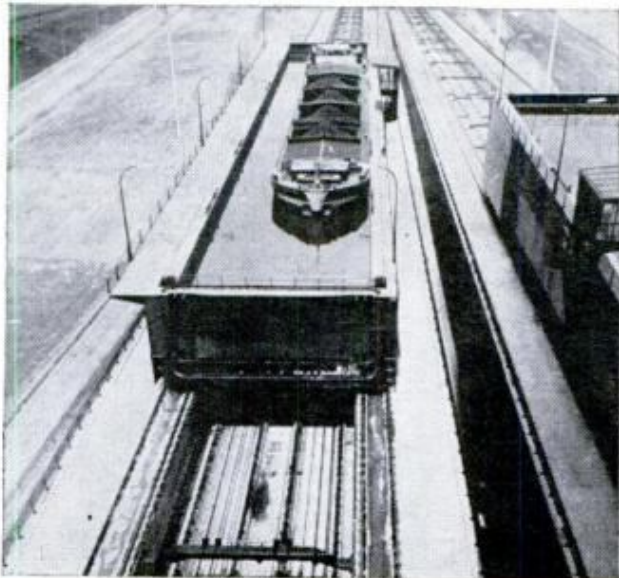
New funnel for Hamburg

From this low-angle view, the new funnel on the passenger ship *Hamburg* looks like a giant umbrella. The funnel was designed by engineers of Berlin Technical University to disperse smoke and soot so that the airborne dirt wouldn't fall on passengers below.



Multipurpose nightstick for the police

The "Buddy Stick," invented by Raymond Finn of the New York Correction Dept., serves several police needs. It's a flashlight, billy, gunstock for a policeman's revolver (gun and stick lock together, as at left), and it contains 100 feet of nylon line coiled inside.



Ships travel on wheels in Belgian canal

Large ships and barges, traveling the canal between Charleroi and Brussels, Belgium, are lifted 223 feet in huge "bathtubs" that travel on rails and are pulled by cables. The rail system takes the place of locks, which would have been too expensive to build and maintain. Each of the two giant containers is almost 300 feet long and 40 feet wide, and each can carry a 1350-ton ship up or down the track in 25 minutes. At upper left is a view of the entire installation, and at upper right is a technician at the controls in one of the towers. The two lower photos show a barge being carried (left) and discharged (right).



A MARQUE REVIVED. Some say Borgward looks—and rides—like a Mercedes, others say it's like a Nash

***Caramba!* A Mexican Borgward?**

The easy way to get into automaking is to buy a working factory. The hard way is to begin from scratch and build a plant. Then, of course, there's the Mexican way—do both!

By LEONARD E. SABAL

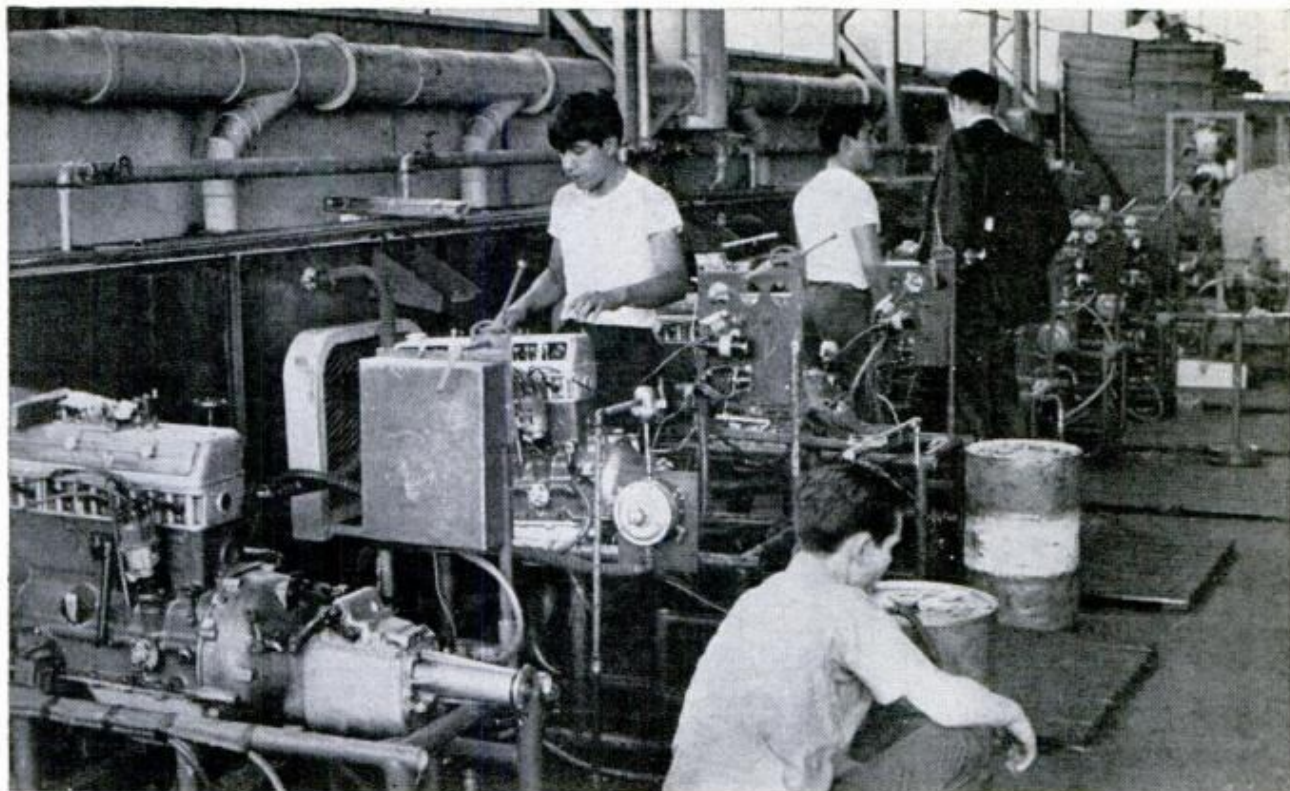
Photos by the Author

I COULDN'T HELP SMILING as I realized I was driving a very new, but very old, automobile, and sitting next to the Irish-English-Mexican export manager of the new Mexican but old German plant that wasn't exporting the classic made using French, Swiss, German and English machinery.

It was almost as confusing as the time I was stopped for speeding around Rome's *Piazza da Popolo*—the *polizia* were understandably bewildered by a young American from Denmark with a Japanese driver's license and a noisy, modified sports car that looked like a Ferrari but was really a Triumph and had English license plates to prove it.

As did Rome's finest, I asked "Why?" only I got an answer from my Mexican host. In fact, as the first writer ever permitted to visit the new auto factory in Monterrey, I also learned of the problems associated with the purchase of the Borgward plant in Bremen—and those of Mexico's auto industry.

For example, can you imagine cataloging (much less moving) 96,000 pounds of blueprints, 34,000 engineering drawings, or 16 million pounds of machinery, tools, jigs and furniture? Yet that, plus patents in 72 countries, is what cost eight Mexican financiers 100 million pesos—or \$12 million—when they bought Borgward in 1962.



THOROUGH TESTING PROGRAM requires mating of engine to gearbox, tuning during three-hour break-in run

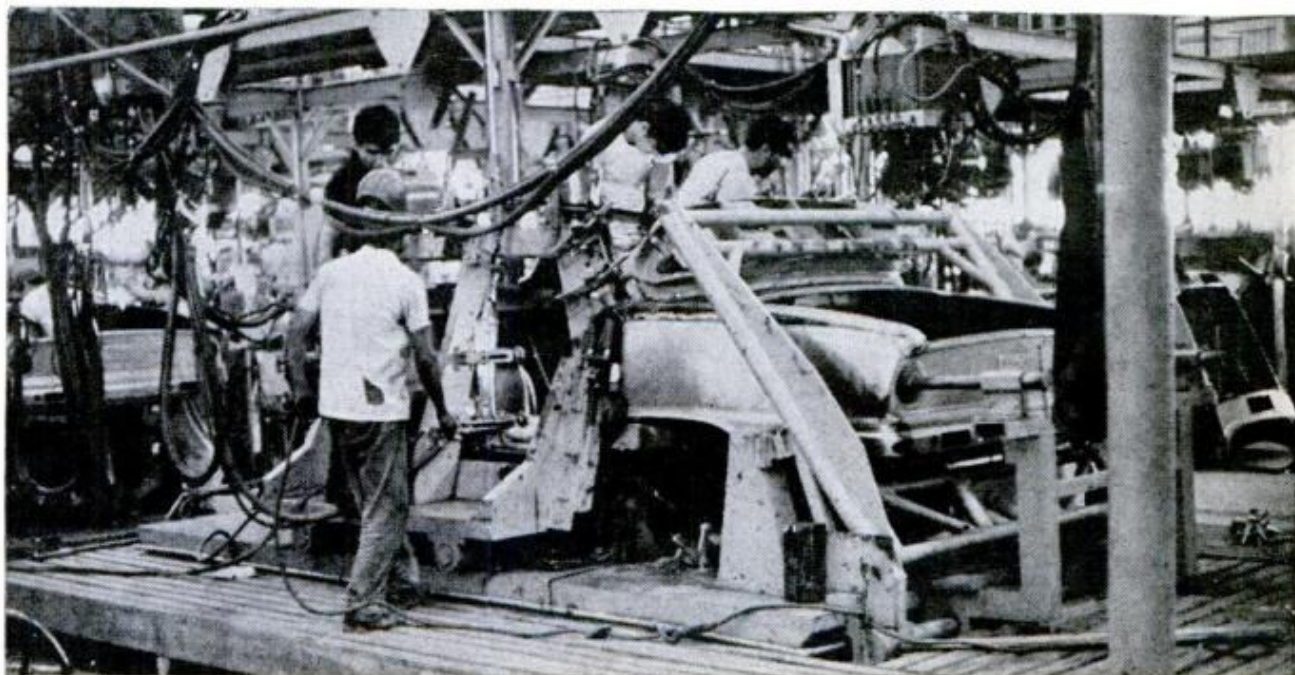
Not one of the group had any experience managing, producing or selling automobiles, nor had they decided on the site or the labor and power sources for their new plant. In addition, their acquisition of Dr. Carl Borgward's factory created waves in Mexico's bureaucratic and industrial circles since it marked the birth of Mexico's auto manufacturing industry. Previous plants in Mexico simply had been assembly lines

for imported components and parts.

Confusing? The best is yet to come.

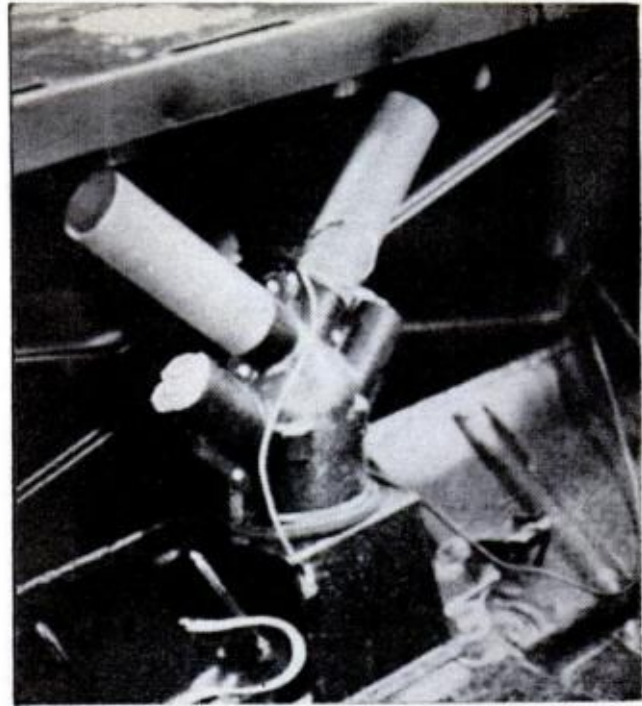
In 1962, the Mexican government prohibited the importation of engines and assembled mechanical components for automobiles or trucks. It also required that manufacturers use Mexican-made parts to represent not less than 60 percent of the direct cost of new vehicles. But in promoting a new industry, Mexican officials overlooked

ORIGINAL JIGS SHIPPED FROM GERMANY are used in making the reborn Teuton. Only changes are in trim





HAND WORKMANSHIP by trained youngsters assures minimum of defects. New plant employs 860 workers



STANDARD EQUIPMENT for Borgward models is an electrical defroster/defogger for the rear window

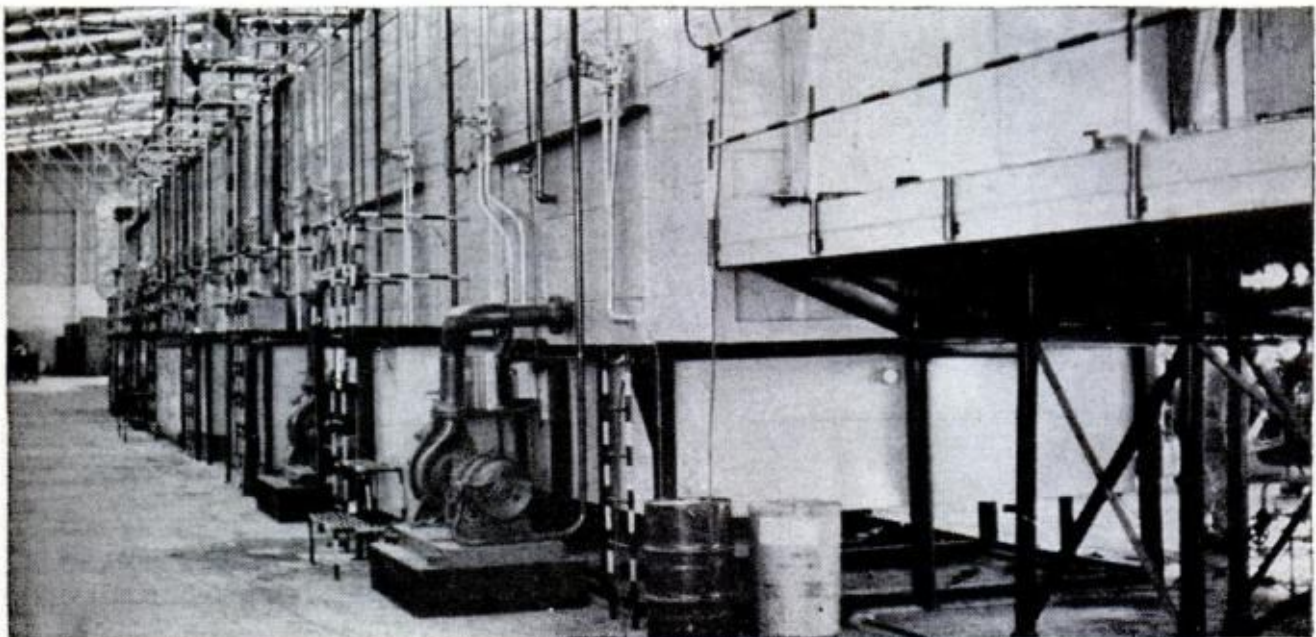
the need for laws governing the future exportation of the vehicles. (Thus, as I watched the 900th Borgward 230 roll off the line earlier this year, the export manager lamented he *couldn't* export vehicles, even if he had any to export.)

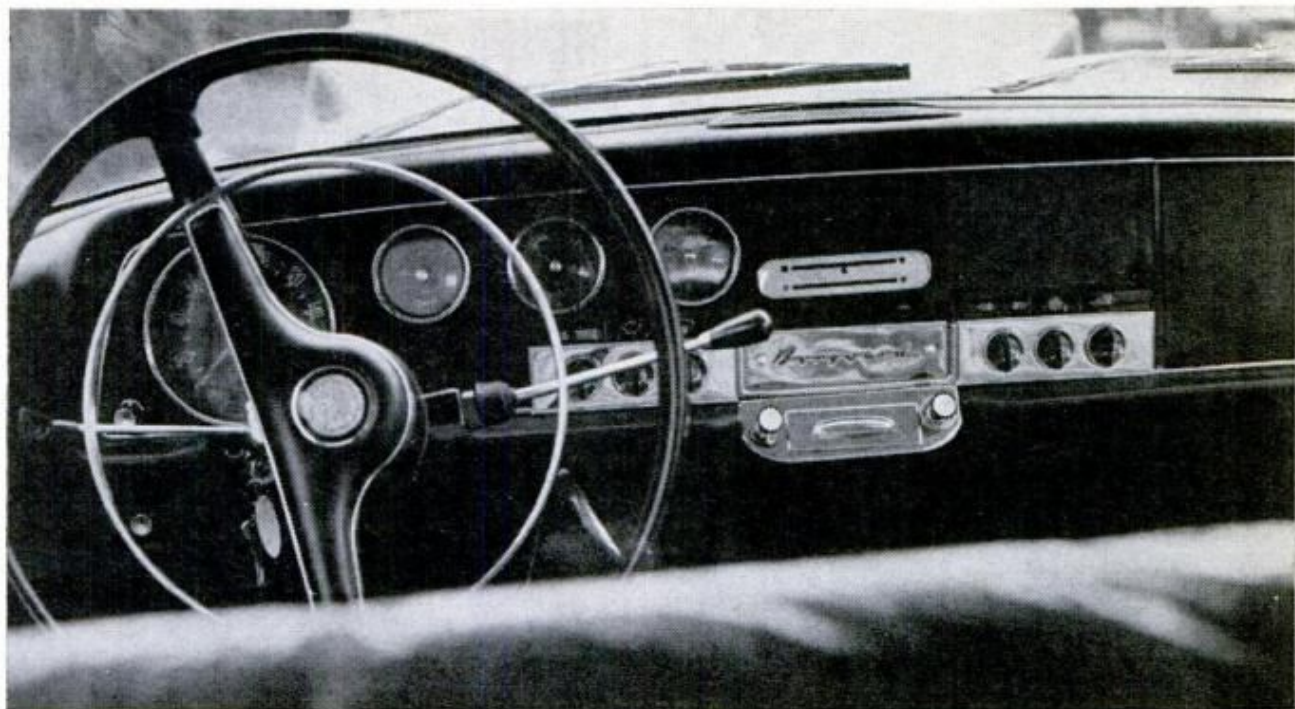
During this hectic period, the group, then known as Impulsora Mexicana Automotriz, shrouded their activities as a protective screen against cynics and competitors. Later, they reorganized and brought trucking giant Sr. Gregorio Ramirez into the fold as president of

the new company, Fabrica Nacional de Automoviles, S. A. (FANASA).

Meanwhile, all machinery at the Bremen plant had been examined and overhauled by technical representatives of the old Borgward company. Simultaneously, site preparations were being made at Monterrey, Mexico's second largest city and an industrial center offering access via railroad and two highways, natural gas, high-voltage power, diverse engineering and manufacturing facilities—and competent labor.

FOUR SUCH PAINT OVENS are from Bremen plant. For size comparison, note the 50-gal. drum in foreground





DASH IS WELL-APPOINTED, with conveniently located gauges and controls—more important, they all work

In 1963, everything but the old Borgward building arrived by ship and rail. By late '65, with the help of German technicians from the Bremen plant, the installations were complete and a two-year program of training young men initiated. Late last year, the first Mexican-made Borgward rolled off the line, followed by 75 the next month and 100 the next, until production was at 180 vehicles per month last May. Company officials then estimated it would reach 400 to 450 per month by January. This means there may be vehicles to export next year, since the estimated market for Borgwards in Mexico is only 5000 cars per year, and General Manager Jose Santos De La Garza calculates that plant capacity is 1500 vehicles *per month*.

On the assembly lines during my visit were three automobiles—the basic 230, the plush 230 GL (shown on page 124) and the special-order luxury limousine that has unofficially become the official car of Mexican executives.

The 230 and the 230 GL are mechanically identical, with an in-line, six-cylinder, 136.5-cu.-in. engine that develops 110 hp at 5200 rpm. Wheelbase is 104.3 in., length, 185.6 in., and width, 68.4 in. Dry weight is 2890 pounds.

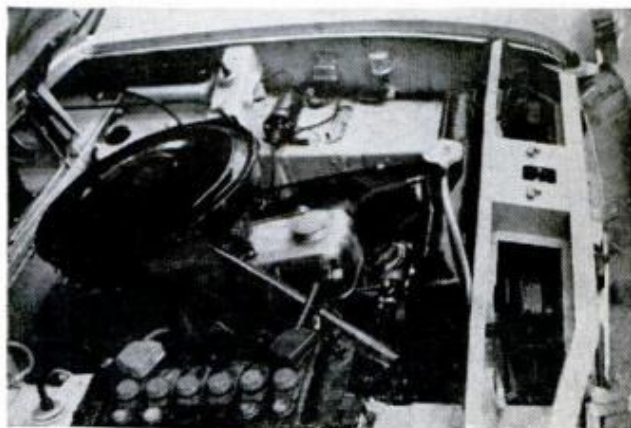
Both feature optional air suspension,

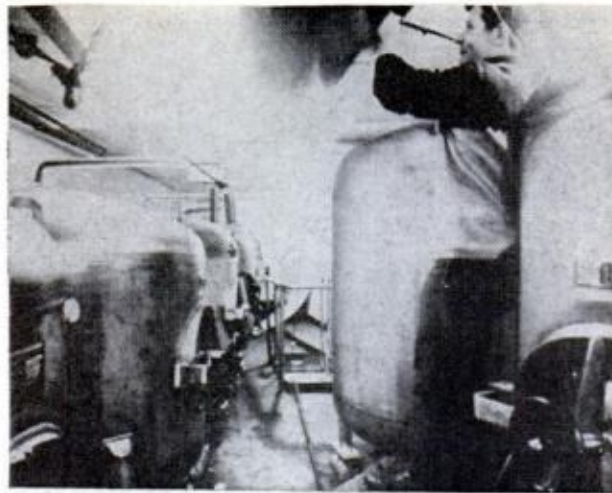
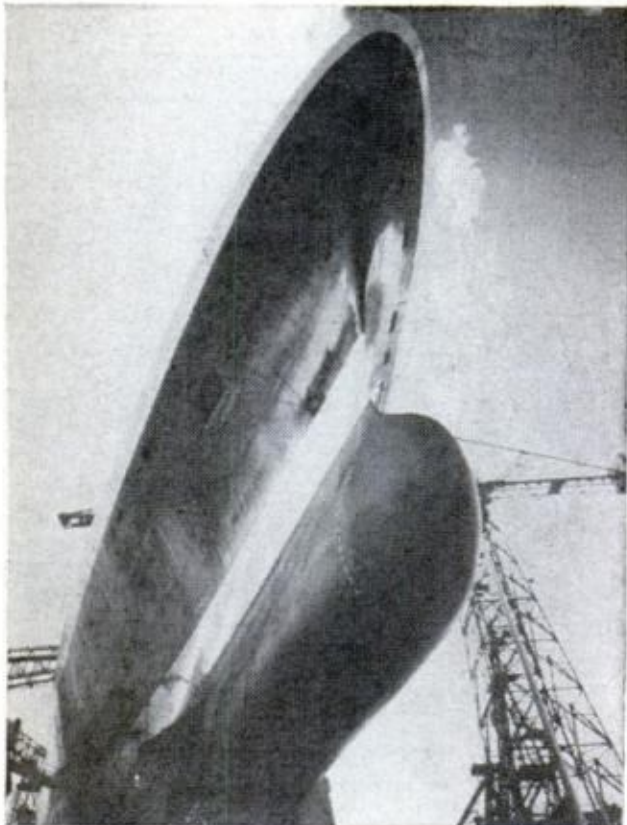
hydraulic brake drums with a swept area of 129.5 sq. in., and a final drive ratio of 3.9 to 1. The four-speed stick shift is column mounted.

Production of the well-known Isabella is scheduled to begin this spring with a two door sedan, then the combi (or station wagon) and eventually the two-seater Sports Coupe. The 91.5-cu.-in., four-cylinder engine will be standard in the Isabella line, with the Six optional in the Sports Coupe (a choice not available in Germany).

Mexican prices for the 230 GL are about \$4000, while the two-door Isabella will cost about \$2700. In a land where a basic Ford Galaxie costs \$6100 and a Spartan Mustang \$5000, I'd say FANASA has a winner. ★ ★ ★

IN-LINE SIX fits neatly under hood, can be serviced at any of the 30 authorized centers in Mexico





Bow is full of beer

Cunard's new *Queen Elizabeth II* has a bulbous bow (left) that adds stability and speed to the vessel. The builders of the new ship figured that there's no use wasting the space inside, so they put the ship's beer supply in the protrusion. There are some 13,000 gallons of draft beer carried in 27 vats (above). The new *Queen* is scheduled to go into service in January. (See *Successor to the Queens*, page 106, Sept. '67 PM).



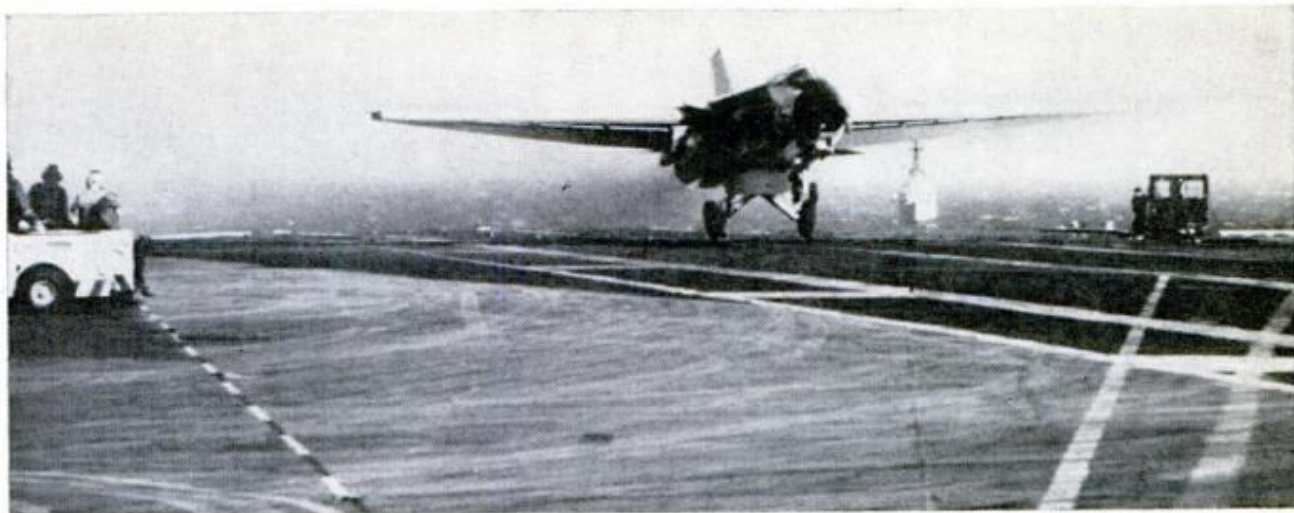
High-rise parking space

One Vert-A-Park tower, taking just 20 by 23 feet of ground space, can hold 21 cars. Users operate it by coin or by key.



Volkswagen 411

The new VW 411, shown recently in Wolfsburg, has a 4-cylinder, 68-hp engine with two carburetors. Price in Germany: \$2000.



Navy tests the F-111B on a carrier

Although the Navy won't use the F-111, the plane was tested on a carrier to gain information about variable-wing performance. The Navy is developing its own swing-wing interceptor.



Renault's open-air car

Renault is now making a doorless, canopied vacation car called the Renault 4 *Plein Air*. It has an 850-cc. engine. The car, shown with its top down, carries four passengers.



British lifeboat

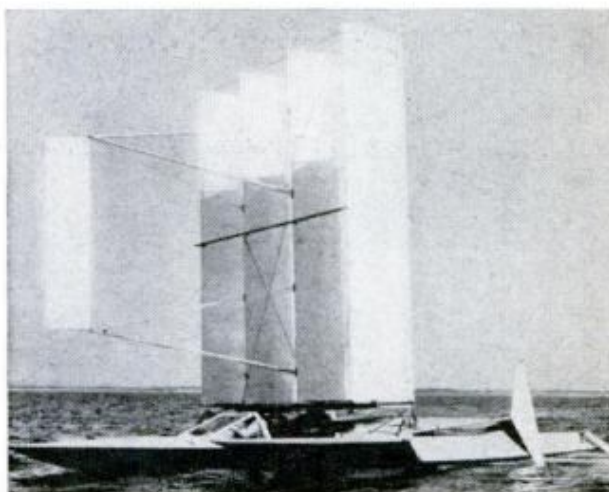
A crew of two puts a new British lifeboat through its paces off Southampton. The boat is the Royal National Lifeboat Institute's first fiberglass craft. It will be put into service at Eastney near Portsmouth.



Front seats are best

The first 12 riders on this 20-passenger bicycle just go along for the ride; it's the last eight who do the pedaling. The bike, which is 35 feet, 4 inches long, was built in Milton, England. Fully loaded, it weighs two tons. (If you count heads, there are 21; the mayor came along for the inaugural run.)

DECEMBER 1968



Trimaran with rigid sails

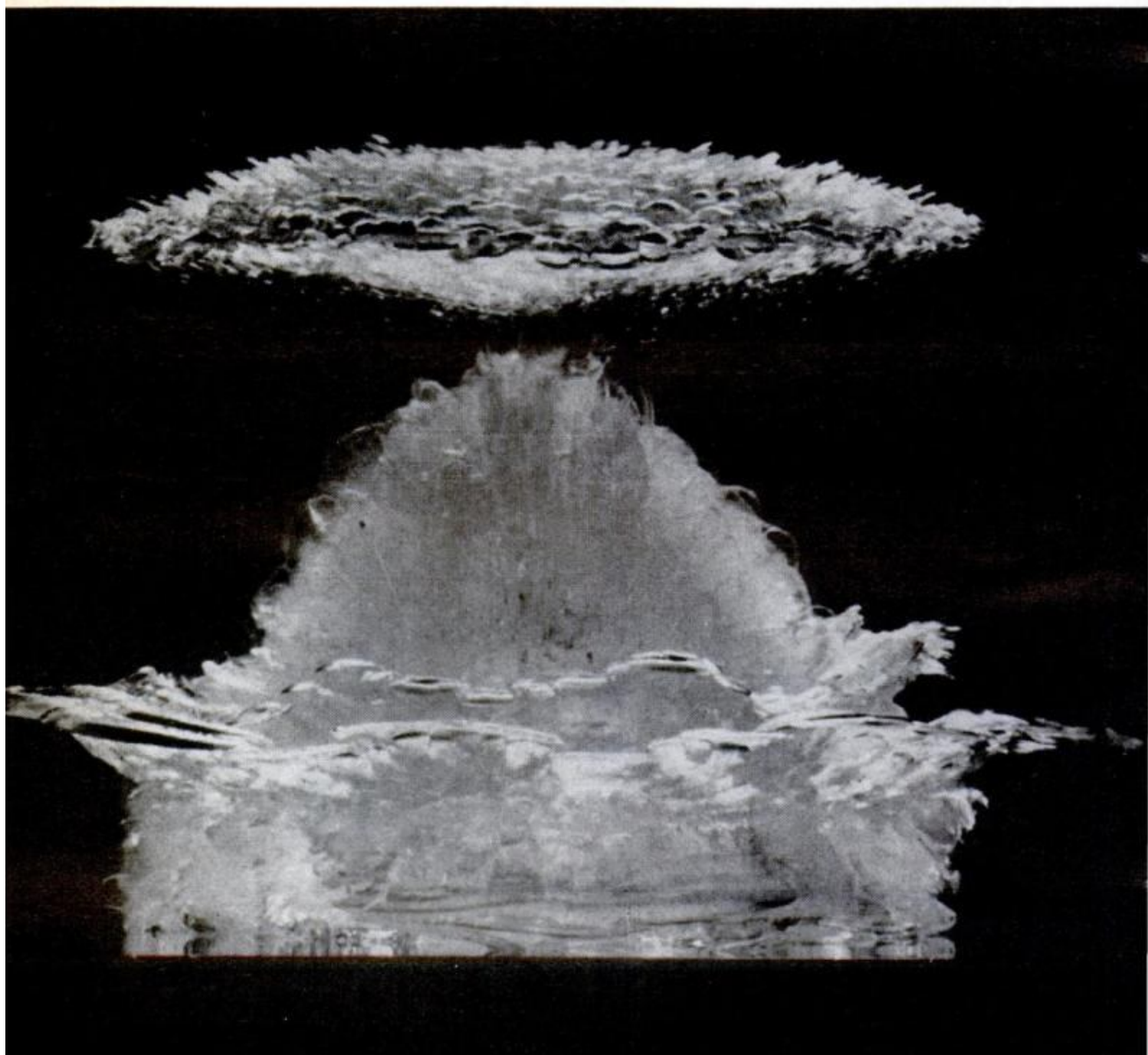
Shown during sea trials in the harbor at Chichester, England, is the *Planesail I*, a rigid-sail yacht. Designed by John Walker, the *Planesail* has sails molded of fiberglass reinforced with polyester resin. V-foils below the trimaran hull aid control and stability.

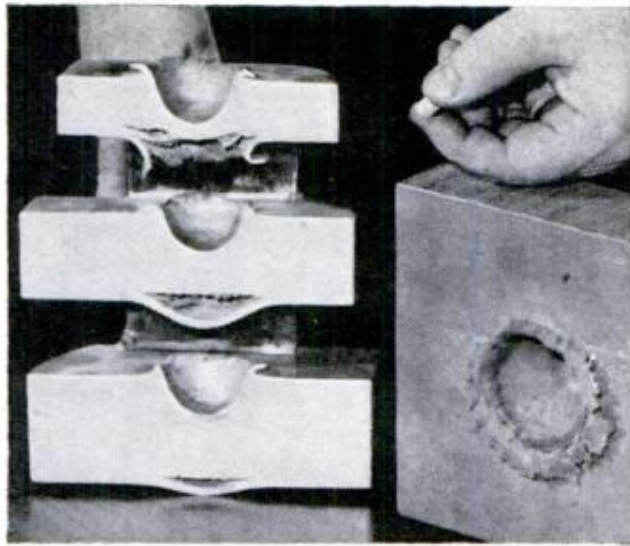
FASTER THAN A SPEEDING BULLET!

Tests that send tiny pellets crashing into metal at speeds up to 30,000 feet per second may help protect our spacecraft if they collide with runaway meteoroids

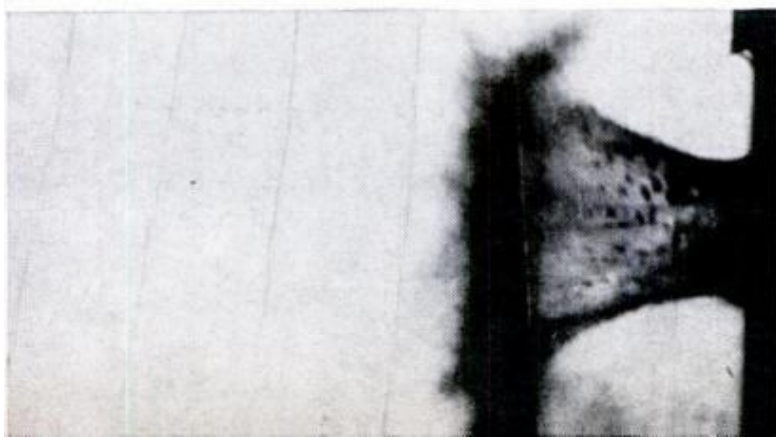
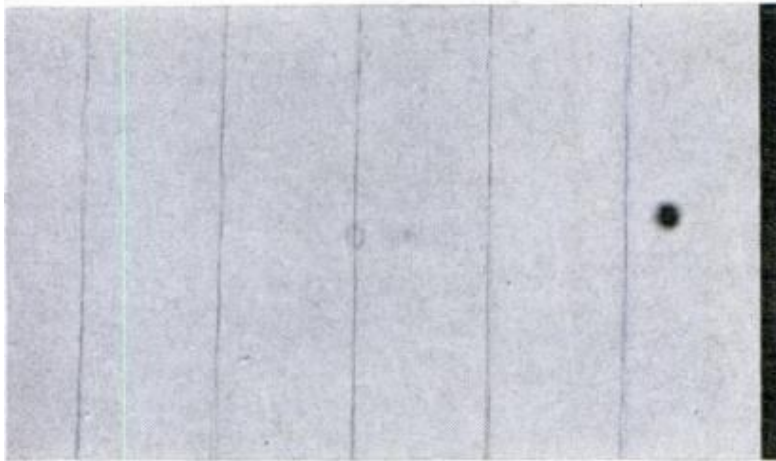
By DOUGLAS NORMAN

MUSHROOMLIKE CLOUD is deceiving. Microcosmic in size, it was actually caused by tiny pellet fired in hypervelocity test at metal target, liquidizing some of target and generating additional shock waves





TINY PELLETS, similar in size to one shown, caused these craters in various thicknesses of solid metal. Stop-action, high-speed photography (below) shows sequence of hypervelocity impact. These tests may help determine construction of future spacecraft to protect them from hyperspeed collision with meteoroids



IN SPITE OF OUR SUCCESSES in space, one of the original fears still remains: the possibility of a collision of a spacecraft with an infinitesimal piece of metallic cosmic debris.

Though minute in size—no larger than a pellet from a shotgun shell—a meteoroid's fantastic speed could smash it through a spacecraft's wall, causing dangerous damage or destruction.

Scientists estimate that up to 200 million visible meteoroids enter Earth's atmosphere every day. They compare deep space to a huge gravel pit which has no gravity to hold these pellets in place, and they race in at speeds of about 250,000 feet per second.

Normally, these pellets burn up when they enter the atmosphere, but what happens if they meet a solid spacecraft first? Not much is known about this new field of hypervelocity, but studies at Tennessee Technological University in Cookeville are seeking answers.

Using a two-stage, light-gas gun, engineers propel tiny pellets into plastic and metal targets. An explosive charge drives a piston within the gun, compressing either helium or hydrogen. The gas expands, propelling the pellet. Although the velocities are only 30,000 feet per second, much lower than those of meteoroids, the pellets often tear completely through blocks of inch-thick aluminum, and gouge deep craters in aluminum targets two and three inches thick. Shock waves generated by the impact bulge and fracture metal walls on the opposite sides of targets.

The point of impact seems to explode and a rapidly expanding crater is formed. Part of the target turns to liquid and flows along the crater wall before being ejected backward at high speeds. A shock wave generated around the crater races through the target.

Thus far, the research suggests future spacecraft may look like prunes with wrinkled skins. The outer shield will be thin, light metal, with the space between it and the main hull filled with foam—a sandwich construction to protect the ship.

★★★

PM BOAT TEST:

Chrysler's 'Sport Fury' Takes to the Water



**Chrysler's all-new
line of cathedral-hull
boats is topped off by this
'dragon slayer'**

**By DAN FALES, Boating and Outdoors Editor
Photos by Ralph Poole**

FROM THE AIR, Lake of the Ozarks looks like a dragon. But this Midwest dragon is tame when you ride it saddled in a brand-new 16-foot "Sport Fury."

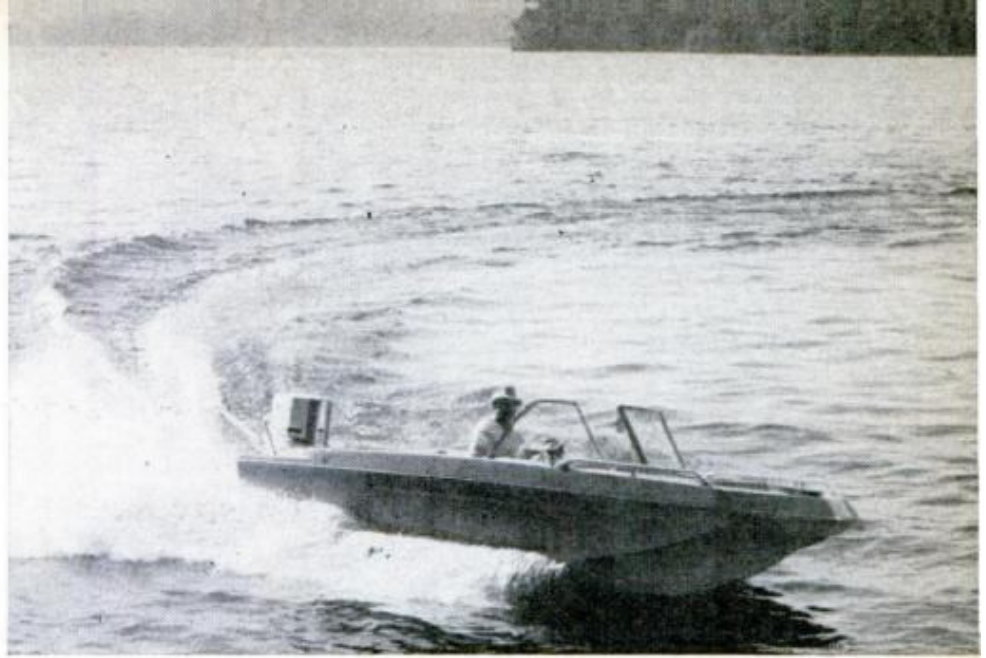
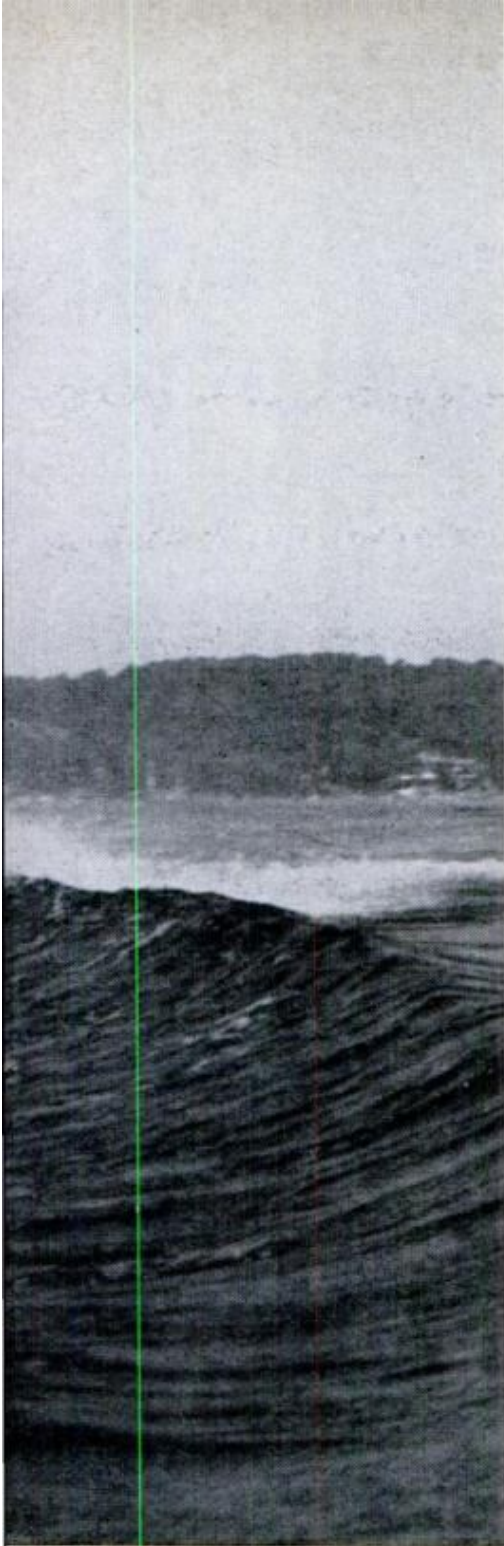
In fact, the long resort lake is a perfect place to test a boat. And this is what I did during Chrysler Marine's press show at the Inn of the Four Seasons.

Chrysler was announcing its 1969 line of motors and boats. I wanted to try out the Sport Fury, one of Chrysler's new cathedral-hull boats.

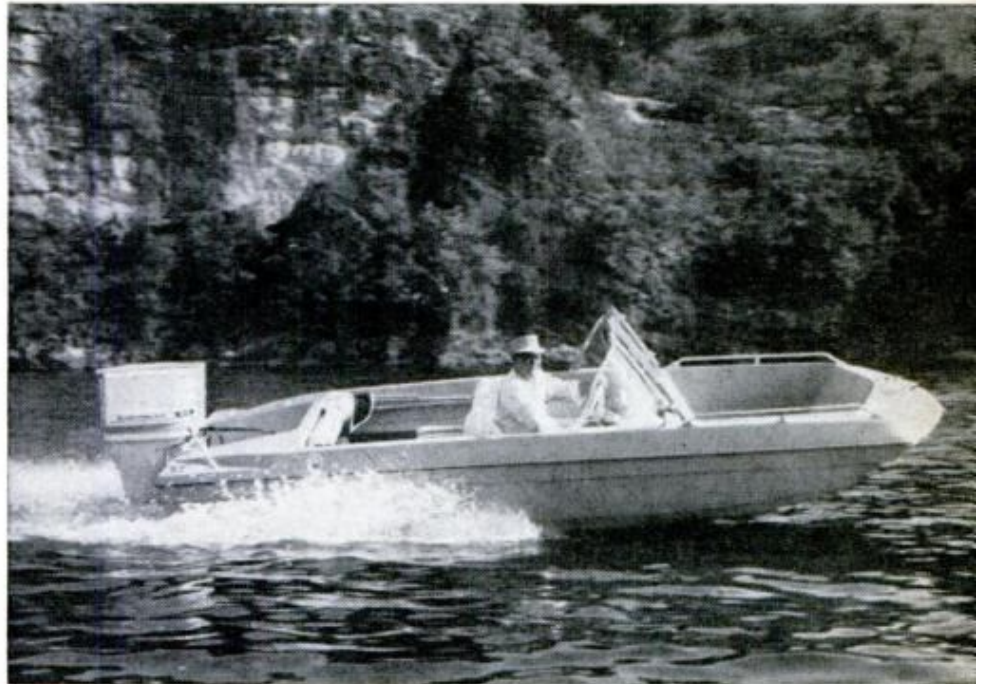
I didn't have any trouble picking Sport Fury from among the many boats dockside. Its smooth lines with rounded gunwales and wide-open appearance made it easy to spot. It rode easily and level in its slip.

The 35-inch freeboard is one feature of this boat that tells you it's been designed with care.

Designer Jack Gampel has put a lot of thought into the Sport Fury. The appearance of a slight reverse sheer from the beam to bow gives the boat a speedy look even while it's sitting at



WAKE JUMPING (left) shows off the configuration of the boat's cathedral hull. A port turn (above) demonstrates the Sport Fury's ability to deflect water down and away from the hull, making it a very dry boat. Large splash well, high transom and canopy (strapped in travel position) can be seen below



the dock. Under way, this illusion makes the boat look as if it's flying.

As I stepped into the cockpit, I was impressed with the roominess. I even double checked to make sure this was a 16-foot boat. I was also impressed with stability. Sport Fury is not a tender boat. Its 76-inch beam and cathedral hull give the fiberglass boat a sturdy feeling.

Even with extra-large splash well in the stern, the Sport Fury still feels like an 18 or 20-footer. The splash well, by the way, is the full size recommended

by the Boating Industry Assn. for boats carrying motors over 50 hp.

I'm all for this safety feature. Though many boats have acceptable wells, not all are up to the letter of BIA standards.

The well butts up against what is considered a "high" transom. Again Gampel has designed a good feature. Though Sport Fury requires a long-shaft outboard motor, the advantages of such a high transom far outweigh the slight additional cost for such a motor. This is especially true when the boat is



I TALKED with this float-plane pilot to get more information about Lake of the Ozarks. He flies sight-seers over 129-mile lake and 1375 miles of shoreline

traveling in a following sea or making quick stops.

The motor on this boat was Chrysler's new 85-hp outboard. Though the boat is rated for 105 hp, the three-cylinder 85 moved her in fine fashion.

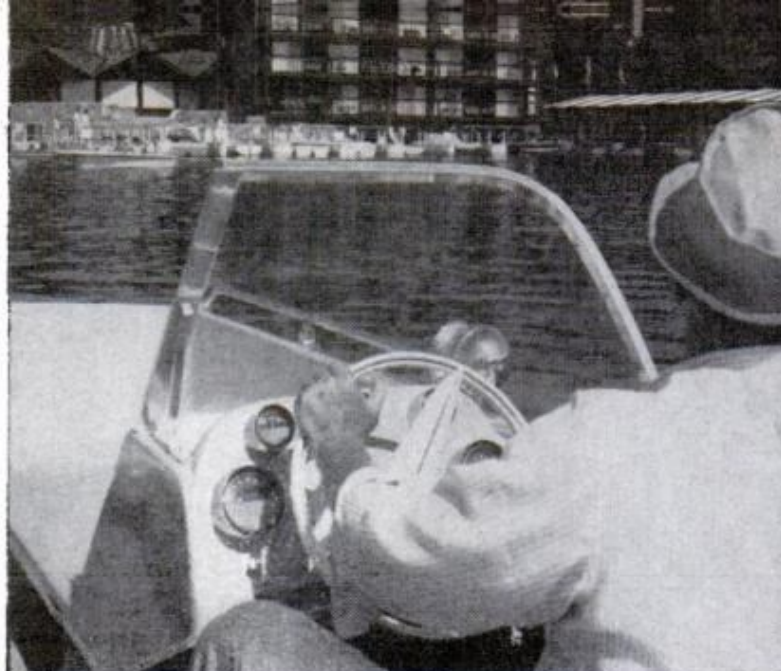
When I socked the power to the boat out on the lake, I felt a quick, sure response. It took only a few seconds to go from standstill to a flat-out plane. The bow-rise when getting up on the step was slight. At no time did I lose sight of the water just in front of the boat.

With the 85 hp, I found I was doing about 34 mph at 5000 rpm.

With the cathedral hull, Sport Fury rode smoothly, easily, quickly in all kinds of choppy water. Because of Chrysler's Foam-Pac construction the sound of water rushing past the hull was barely audible. This system of construction with flotation foam makes the boat "virtually unsinkable," according to Chrysler experts.

But the best feature of this particular hull is dryness. Sport Fury is one of the driest boats I've ever handled. There was no way I could get water or even spray in the boat. And I tried.

I put her in tight port and starboard turns. She didn't "catch." She didn't slip. She didn't want to spill. Chrysler experts say the boat is designed with



TAN-TAR-A, a famous resort halfway up the lake, is my goal here. Note position of my left knee near lower edge of console. I was careful not to bump it

"non-trip chines." And I believe it. There is also a deep short keel for directional stability.

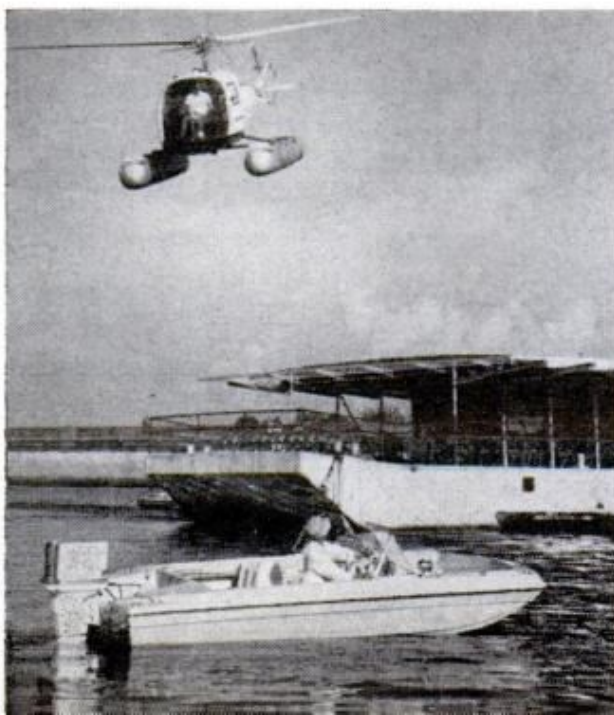
While running at top speed, I never felt I was losing control when she came down after flying off a high wake.

I handled her at high and low speed. She handled equally well at either.

On plane, I let her run free with my hands just off the helm. She kept her course. There was no evidence of bad balance. However I did find two problems that might be corrected.

The first is knee space under the

ANOTHER WAY to see the lake is by helicopter. The chopper pilot comes in close to view the Sport Fury and study such features as its big bow-riding section





BOAT-IN-RESTAURANT is popular on the lake. You just float in, tie up and give your order to the gal. At times, boats are waiting in line for slips



STATE PARKS all along lake offer excellent facilities for launching. This view shows off the sleek lines of the Sport Fury and its 35 inches of freeboard

pilot's console. There's plenty of foot room for the helmsman in this area. But sure as shootin', someone's going to bark his knees on the lower edge of the console panel. This is especially true of the left knee.

The second problem is a flimsy-feeling wheel. I had the thought that if I tugged just a little harder the wheel might well break off or pull out of the console. I know the wheel is made of sturdy stuff and won't break off under stress, but I just had that feeling.

SPORT FURY SPECS

L.O.A.: 16' 2"	Max hp: 105
Beam: 76"	Shaft: long
Max. depth: 30½"	Load: 2083 lbs.
Weight without motor: 680 lbs.	Cubic footage: 178
	Price: \$1355

A very minor complaint is fuel capacity. I think an extra gas tank might be in order. Or a larger tank. The standard 12-gal. tank now on the boat is adequate for use with lower horsepower motors. But when you are using one of the big brutes, you might want more fuel on tap.

The reason this is a minor point is that extra tanks are optional, and there is space for them under the splash well.

Workmanship on the Sport Fury is good. Care has been taken to mount the walk-through windshield securely. The latch on the "swing window-door" holds the door firmly open through all operating conditions.

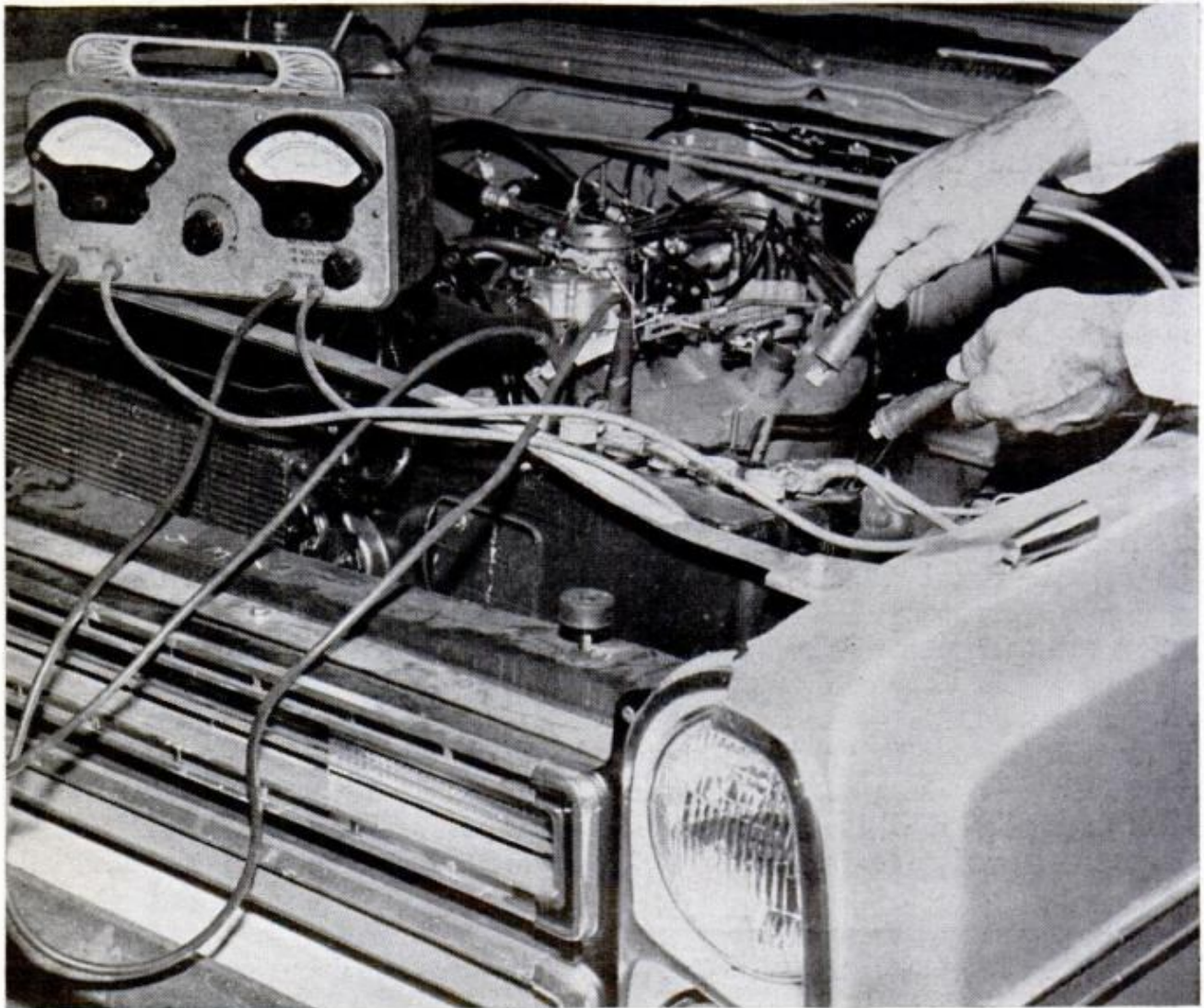
The bow riding section is spacious and deep. You don't get the feeling while riding up front that you might be thrown out when bouncing over a steep wave. With the bow seats running along port and starboard, there's plenty of room between them to stand and cast in quiet fishing waters with the boat still.

The two fore-and-aft seats in the main cockpit open up into lounges. There's a canopy available, too, that can be conveniently strapped in the stern of the cockpit when not in use. Though I had trouble keeping the canopy snap in place during high-speed, bouncy operation; I'm sure I didn't fold it right.

This Sport Fury has a sister of the same size called Fury. The Fury is a front-decked version of the more luxurious Sport Fury. Both these boats are also available with inboard/outboard motors.

I think Chrysler Marine has come up with a good line of cathedral-hull boats. This type hull gives a stable, dry, easy ride. The Sport Fury, in particular, should be popular. ★★★

PREPARE YOUR CAR



If you don't get a chance to coldproof your car before the big snows, you're gambling with the statistics which show that battery, starter, ignition and fuel problems will stop one of three cars dead in its tracks this winter

THE CHIEF REASONS why cars fail to start in winter are battery, starter and ignition breakdowns, according to the American Automobile Assn. In 1967, these left 31 million of 80 million cars registered in the United States stranded by the roadside. Two million others suffered fuel-system problems.

This, I feel, is reason enough for taking an hour or so before cold weather sets in to make sure things are in shape. Among other things, testing and maintenance now

can save you a case of frozen toes later as you stand beside your lifeless car awaiting a service truck.

The battery's the place to start. One that's borderline will surely fail in the cold. By taking a battery capacity test with a volt-ammeter, you can tell whether your battery will be able to meet the demands of cold weather.

If you've ever tested your car's electrical system, you no doubt have a volt-ammeter. If not, you can buy one from

TO BEAT THE COLD



BATTERY CAPACITY is tested with volt-ammeter as shown on facing page or with the cell tester at top. In both cases, the battery is tested under load, which tells more about its condition than a mere state of charge, as with a hydrometer. Coating the cables and posts with petroleum jelly will prevent corrosion

IGNITION COMPONENTS—coil, plugs, distributor, ballast resistor and insulation—should be checked thoroughly. Test insulation with a screwdriver probe connected to ground. With engine running, probe sparkplug and high-tension leads for leaks in the insulation using a technique discussed in the text

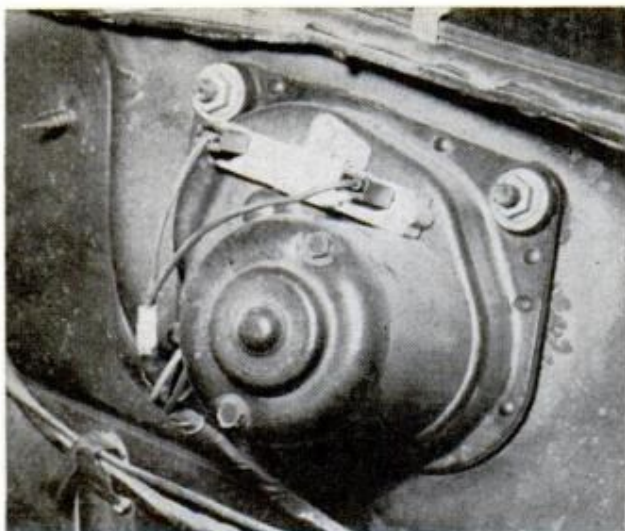
your supplier for about \$35. It's a great tool, but get a combination unit with a built-in shunt that allows you to control the amount of current for greater testing accuracy.

Also make sure the ammeter can take the flow of current provided by the starter draw test (discussed below). Get one capable of recording up to 400 amps. However, you'd better check the *maximum* starter draw specs for your starter (see the manual) before buying the meter to

make sure the meter can handle the flow.

Keep the shunt control knob off and connect the voltmeter's ground lead (that's the black one) to the ground side of the battery. Hook the meter's "hot" lead (the colored one) to the battery starter cable. Keep battery cables hooked to the battery when testing.

Now, connect the ammeter leads in the same way—ground lead to battery ground and "hot" lead to the battery's starter side. Make absolutely certain that your



BALLAST RESISTOR in ignition primary circuit should be examined. Remove leads to clean terminals

connections are right. A wrong hookup can damage the alternator.

Turn the shunt control knob slowly toward "increase" until the ammeter reads three times the ampere/hour rating of the battery (stamped into the battery case). For instance, if you have a 12-v. battery rated at 50 amp./hrs., as most 12-v. batteries are, turn the shunt control until the ammeter reads 150 amps.; that is, 3×50 .

Wait 15 seconds and read the voltmeter. It should show 9.0 v. or more for a 12-v. battery and 4.5 v. or more for a 6-v. unit. Insufficient voltage output signifies that the battery should be charged and retested. If it fails to meet these requirements after charging, get a new one before winter.

Before leaving the battery, wash it down with a mixture of one part baking soda to one part water, flushing thoroughly with clear water. Keep the baking soda mixture away from vented battery caps so that it can't leak accidentally into cells and dilute electrolyte. Clean corrosion from battery posts and cable terminals.

You should apply a light coating of petroleum jelly to battery terminals to prevent corrosion. However, if lubricant gets between posts and terminals, the flow of current will be restricted, hampering battery output. So apply it only after cables are tightly connected to posts.

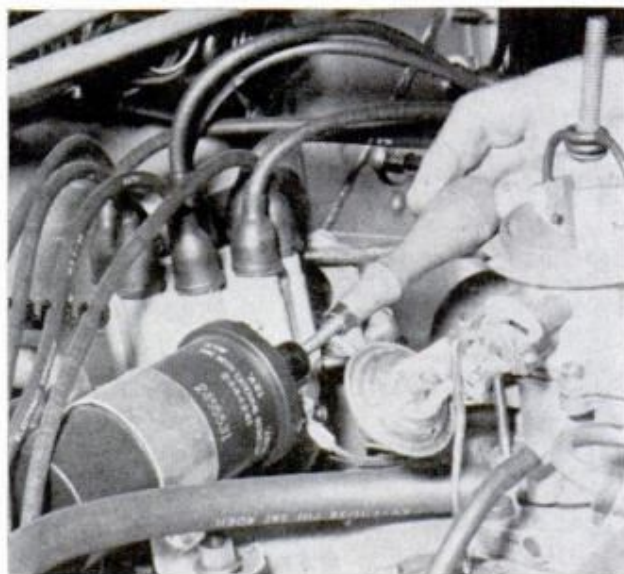
Make sure the starter circuit is ready to handle the extra load winter will put on it. Hook the voltmeter's ground lead to ground and colored lead to the starter motor body. Connect a jumper wire between the distributor primary terminal and ground to keep the engine from start-

ing. Then crank the engine for no longer than 15 seconds. The voltmeter should record 5 v. or more for a 6-v. electrical system, at least 10 v. for a 12-v. system. If not, you have a failure in the battery cables, the starter solenoid or the starter itself.

Check the battery cables. Look for cracks in insulation and damage at the terminal endings. Replace the cables if necessary.

If you have an ohmmeter available, check to see if cables are damaged internally and are building up excessive resistance in the starter circuit. The meter should read no more than $\frac{1}{2}$ ohm as the engine is being cranked.

To test the starter, you will need your



IGNITION COIL tower should be removed and the seat cleaned of possible power-robbing corrosion

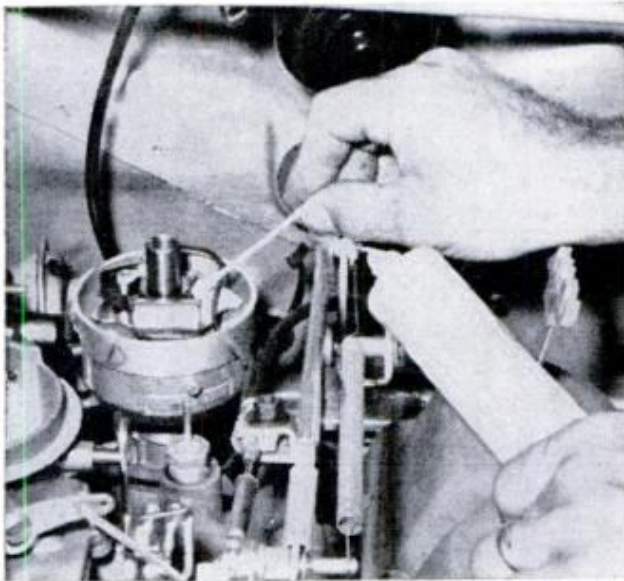
starter's current draw specifications, which are different from other starters. Consult the manual.

Turn off the shunt control of your volt-ammeter and hook up the meter as you did for the battery capacity test. Leave the jumper wire in position on the distributor primary. Crank the engine and note the exact voltmeter reading. Now, turn the shunt control to the "increase" side until the voltmeter shows the exact reading you just got. Crank the engine and read the ammeter. This is the current draw of the starter. If not to specification, the starter has to come off for repair or replacement. If the reading's okay, but the starter circuit reading was not to spec, replace the starter solenoid.

Here's an important tip. If your engine fails to start sometime this winter despite preventive precautions and you have to

use a booster battery, be sure its capacity matches that of the car's battery. Over-matching batteries—for example, use of an 18 or 24-v. booster source to start a car with a 12-v. battery—can severely damage electrical components. Distributor breaker points can burn, and the ignition coil can be overstressed and damaged. If your car's equipped with transistorized equipment, such as ignition, alternator and even a transistorized radio, the sudden jolt of excess voltage can knock out the transistors and diodes immediately.

There are no shortcuts in getting the ignition system ready for cold weather. The one thing you forget to do or disregard might be the trouble spot which



DISTRIBUTOR CAM should be lubricated lightly to keep lobes from wearing and affecting point gap

fails when cold weather makes maximum demands.

We've discussed how to tune up ignition many times. In this report, you'll be reminded of things every Saturday mechanic knows (such as checking distributor point gap and dwell), but we'll concentrate on factors less well known and which can affect ignition system operation in cold weather as much as bad sparkplugs.

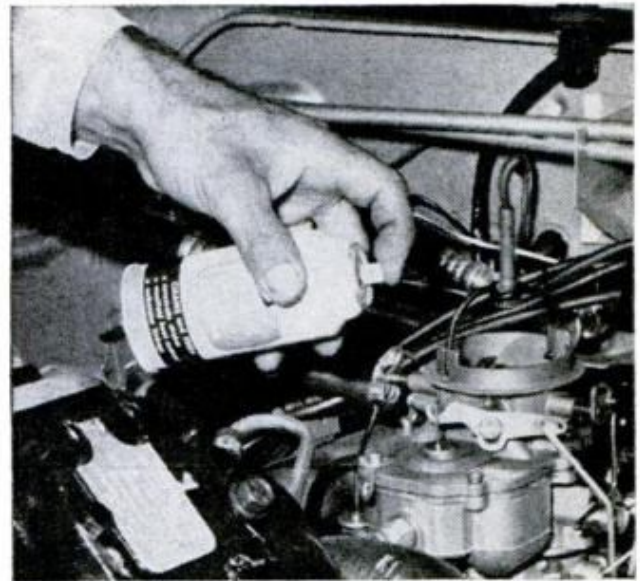
For instance, clean and tight connections are vital in preventing voltage drop at a time when the ignition system needs every bit of voltage it can muster. Inspect all primary and secondary wiring connections to make sure they are clean and tight.

Also check out the ignition system wiring and boots to find "leakers." There's a simple way. You'll need a jumper wire

with a clip on each end and a screwdriver. Hook one clip to the shank of the screwdriver—the other to ground. This serves as a probe.

Start the engine and remove one cable from a sparkplug. With the engine running, probe around the high-tension lead which extends from coil to distributor and the leads's boots. If sparks jump from the boot or lead, it's a sure sign the cable and boot need replacing.

Keep the engine running and probe around the disconnected cable and boot. If you see sparks, replace the cable and boot. Then reconnect the cable and check the other cables in the same way. If you find one defective cable, chances are good



AUTOMATIC CHOKE clogged with dirt can keep you from starting. Clean it with spray of choke cleaner

that others will soon give you trouble, so it might be wise to replace all.

The following is a checklist of things to do in getting the rest of your ignition system ready for winter:

Ballast resistor—Corrosion and bent prongs can affect operation of this unit which has the job of reducing primary circuit current at low-speed engine operation, thereby prolonging the life of distributor points. Pull the resistor wiring from the resistor—it's usually located on the firewall—and check terminals. Clean them carefully with lightweight sandpaper if corrosion is present. If prongs are bent, straighten them with your fingertip.

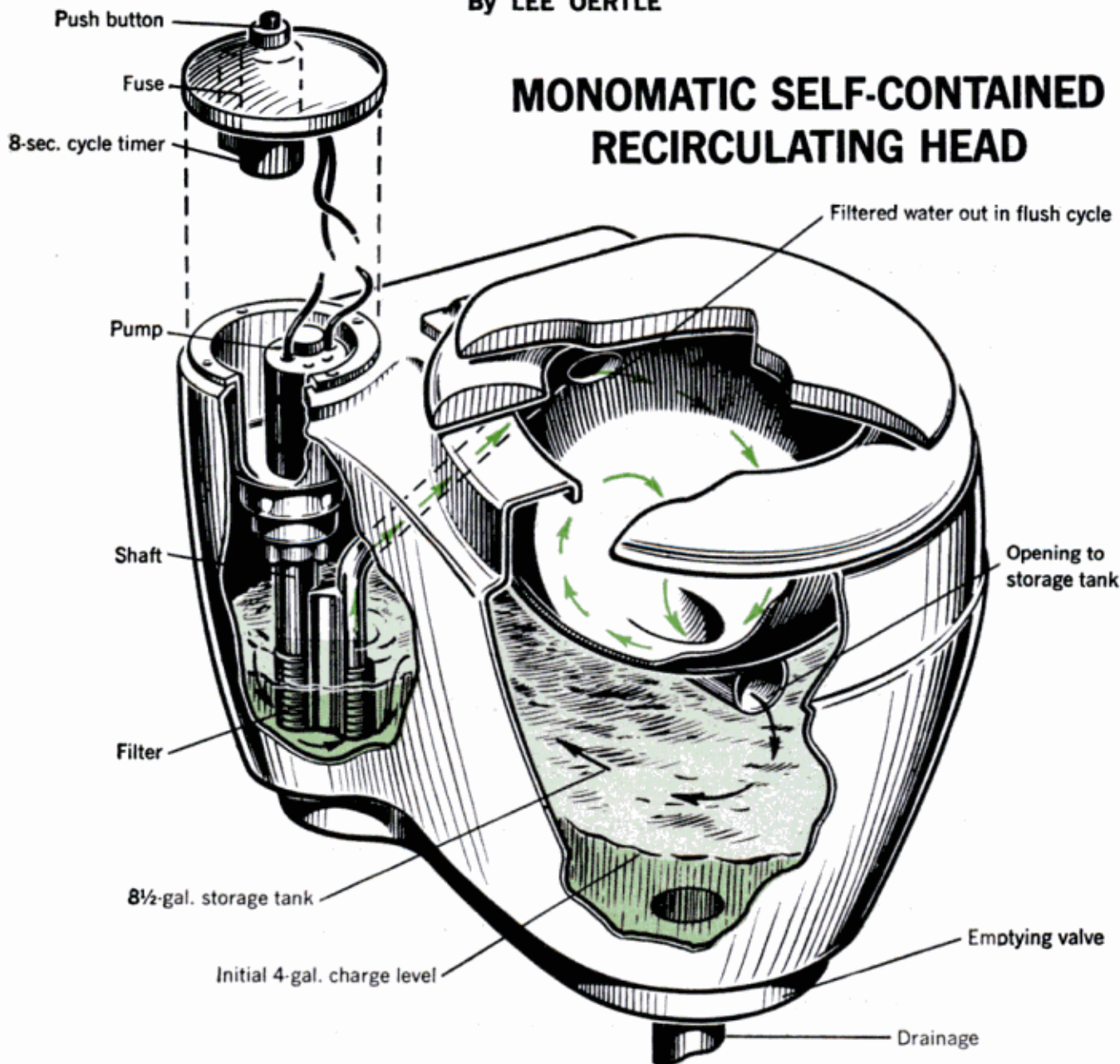
Coil—Wipe the coil with a damp cloth and check it for cracks. Replace a damaged coil. Check for corrosion in the high-tension tower. Use a small tower cleaning

(Please turn to page 226)

Plan a Head

New boat laws may force you to change your marine toilet. Here's a rundown on the four basic sanitation systems now available

By LEE OERTLE



MONOMATIC SELF-CONTAINED RECIRCULATING HEAD

WITH WATER POLLUTION getting more attention from various government agencies, you may find yourself faced with laws that require changes in your present marine sanitation system.

If new laws do affect you, or you're planning to install a head in your boat for the first time, you'll want to know what's currently available. There are four basic systems for small boats:

1. Treatment devices that mechanically reduce and chemically treat waste.

They're called "macerator-chlorinators."

2. Recirculating systems, in which the original charge of water is used over and over again, up to built-in limits.

3. Combustion-type toilets, which literally cook away waste matter.

4. Holding tanks, in which wastes are trapped and held for dockside discharge.

There are several variations of this equipment, combining one or more types. For example, a recirculating system might be connected to a discharge pump or to a



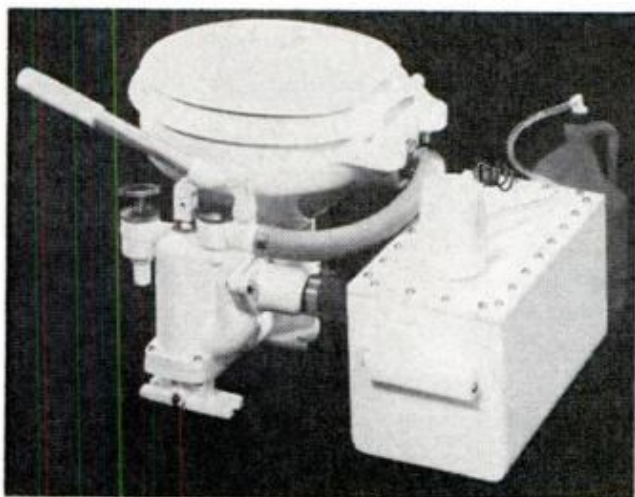
CORLON COMMANDER is brand-new recirculating unit with 9-gal. capacity, built-in discharge pump

holding tank. A macerator-chlorinator might be connected to a holding tank. The type for you depends on your own situation. Your home port may have one law, your boating area a few miles away, another. This is true on Long Island Sound and the Great Lakes.

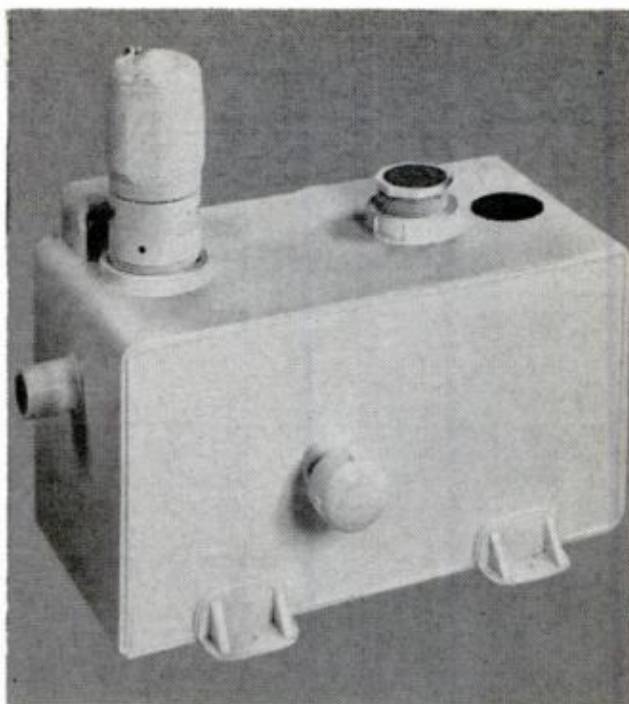
Holding tanks

Sanitary waste is trapped inside a tank under or adjacent to the toilet. Later, the waste may be discharged at dockside into a septic tank. Result: No direct water pollution. The boat owner buys a separate tank and reroutes the toilet into it. If space permits, it's a simple job.

However, I should point out that holding tanks collect untreated sewage for



RARITAN regular flush unit connected to an electrochemical chlorinator which discharges overboard



KOEHLER-DAYTON unit macerates, chlorinates, then discharges overboard. Unit attaches to regular head

discharge at the marina. If the marina is not equipped with a discharge pump, it's up to the boat owner to find another way to empty the tank.

Macerator-chlorinators

In this system, the marine toilet is connected to a small tank in which a powerful grinder literally chews up solid matter, breaking it down into tiny particles. Chlorine is added. Then the whole chemically treated load is discharged through a hull fitting. Many macerator-chlorinators require the addition of chlorine regularly. But one more advanced model (Apollco) adds the chlorine automatically.

The waste matter is flushed into the macerating chamber. Whirling at 10,000 rpm, the chamber breaks down the solids. A chlorinating agent is injected into the chamber. The chlorine container rests on a spring-loaded switch that breaks the motor circuit when the chlorine bottle is empty. The unit will not operate unless this container holds enough liquid to depress the switch. Such a system is said to be "Fail safe"—it cannot be operated without chlorine. That would seem to satisfy some experts who make the complaint that the whole system depends on the habits of the users. (In some other models, chlorine must be added manually at regular intervals.)

Those companies manufacturing macerator-chlorinators claim that discharging

COMPARISON CHART

TYPE OF SYSTEM	METHOD OF OPERATION	POWER SOURCE
Treatment devices (Macerator —chlorinators)	Sewage is mechanically broken up, chlorine added, then dumped overboard as "treated waste."	6-v. d.c. 12-v. d.c. 24-v. d.c. 32-v. d.c. 115-v. a.c. d.c.
Recirculating systems	Closed system uses 3 to 4 gallons of water integral reservoir. Filters remove and trap solids, but same water used over and over again for flushing.	12-v. d.c. 115-v. a.c.
Holding-tank system	Toilet waste is simply flushed into a separate tank which traps and "holds" the sewage for later discharge at dockside.	
Combustion-type	Sewage is actually incinerated with high-speed burners. The ash residue is removed monthly.	12-v. d.c. or 115-v. a.c. with propane or natural gas for burners.
Direct overboard discharge system	Sewage is simply flushed out through the hull into the water. No mechanical breakup or treatment is given to the waste.	Manual pump

treated sanitary waste back into the water is better than simply carting raw sewage back to the marina (in a holding tank) for them to release into the water. These experts claim that the material discharged out of their macerator-chlorinators is of a higher quality than most sewage treated by municipalities.

Research institutions spend millions

every year studying water pollution, and some of their experts say that *all forms* of pollution must be stopped if we are to clean up our lakes and rivers. They say *treated* waste is still sewage in a slightly altered chemical form.

The people who make macerator-chlorinators counter by saying that sewage from small boats should be compared to



RARITAN CROWN HEAD grinds waste, galley garbage, adds chlorine from tank, discharges overboard



DESTROILET is a self-contained, incinerating-combustion unit operating on LP-gas and electricity

MARINE SANITATION SYSTEMS

ADVANTAGES	DRAWBACKS	PRICE RANGE
Treats sewage as it occurs. No space needed for holding tank. Does not depend on dockside sewage treatment. Can be used with existing toilet.	Waste disposal and treatment may depend on user's habits in some cases. Not allowed in some states.	\$110-\$300
Traps and re-uses all waste fluids. Solids never leave system until pumped out at dockside. No plumbing required	Limited capacity. Must be emptied every few days. Existing toilet cannot be used.	\$184-\$300
Can be used with existing toilet. No waste ever dumped into water from boat. No treatment required. Tank is pumped out at dock into septic tank.	Plumbing and holding tank required. Must be emptied when full or system becomes inoperative.	\$85-\$150
No plumbing, holding tank or waste-holding problems. Ash is emptied once monthly. No water required for operation.	Existing toilet cannot be used. Must have butane available. Recycle time 14 minutes. Limited capacity.	\$350-\$360
State and Federal laws prohibit direct discharge into water in most areas.	Raw sewage pollutes waters.	

existing municipal systems—not to standards which even cities and towns cannot match. Evaluated on that basis, they add, the chlorinator does an excellent job.

Such arguments have been raging for years and appear no closer to settlement. At the moment, several states allow macerator-chlorinators on certain waterways.

Recirculating toilets

One of the most recent developments is the recirculating toilet. A fairly complicated task is performed through an extremely simple-looking device. The complete toilet, water tank and waste reservoir are all contained in one housing.

They are essentially *electric* toilets (12-volt). The user pushes a button which flushes the toilet. Waste matter drops into the reservoir, where chemical additives color and deodorize it. At the next flushing, fluid is drawn from the reservoir and forced through a filter which removes solids, thence into the toilet tank to handle the flushing job. It may sound awkward, but the system has worked efficiently in airliners for many years. And for several seasons, recirculating toilets have worked well in campers and trailers.

To set one in motion, the user simply pours in three to four gallons of water (called charging the unit). Add a small,

REPRESENTATIVE MARINE SANITATION SYSTEMS

TYPE	UNIT	SIZE*	PRICE RANGE
Rec	Monomatic	18x20x18	\$195-\$300
Rec	Corlon	18x19x19	\$184-\$270
M/C	Apollo	17x19x16	\$307
M/C	Koehler-Dayton Carlson Mark IV	20x15x15	\$190
M/C	Groco	15x10x15	\$150
M/C	Raritan	23x12x13	\$110-300
M/C	Wilcox- Crittendon	18x11x11	\$120
CT	Destroilet	15x24x20	\$350-\$450
CT	Incinolet	18x21x21	\$650

Holding tanks: \$85-\$150 10 to 30 gallons 32x12x12 (Mono-Marine)

*Note: Dimensions in inches given above are approximate. In most cases, toilets are actually smaller than shown here. Clearances for installing the unit are allowed.

Rec—recirculating. M/C—macerator-chlorinator. CT—combustion type.

specified amount of chemical sanitizers, and it's ready to go. Depending on the actual size of the base reservoir, capacity can range from 40 to 90 flushes. If the recirculating toilet is connected to a large holding tank (occasionally done) the capacity increases dramatically up to 500 or 600 flushes before emptying is required. Normally, though, a recirculating toilet will need to be emptied and recharged with clean water about every five days of constant usage (depending on family size). When the tank is finally full, the unit will not operate. To empty it, there are these choices: (a) Use an electric discharge pump to empty into a dockside septic tank. (b) Discharge overboard through the hull, where laws and conditions allow it. (c) Manually remove the toilet and empty it where it's legal and convenient.

Personally, I feel that at present the recirculating toilet is the best choice to replace an outmoded direct-discharge unit. Why? Because the user has complete freedom of choice of discharge methods.

Another advantage of the recirculating toilet is that it can be used in a boat then removed and transported to a beach cabin, or shoved into a closet of a camping coach and used with equal efficiency and convenience. It is completely self-sustaining, up to the limits of storage capacity.

The newest class of recirculating toilet (by Corlon and Monomatic) features not only the reservoir and filter, but also a built-in grinder and discharge pump. When the user reaches a dockside septic tank, he pushes a button on the toilet which starts the grinder and sets the discharge pump into motion. The advantage is that the boat owner can discharge the waste into dockside tanks even where the marina operator does not have sewage suction pumps. A garden-hose connection on the top of the Corlon allows the user to discharge the toilet anywhere there is an indoor toilet—right into the bowl. It'll lift about 6 feet and move it about 25 feet. That means at home, in a resort, or in a gas station rest room.

On most new boats large enough to carry toilets the matter of placement will be settled by the designers. On older boats where replacements or conversions are required, it's up to you. The accompanying chart gives some average measurements for different types of units, which are intended only as a general guide. You can't install a 20-inch toilet in

a 20-inch space, for example. Expansion and contraction, inlet and outlet flanges, and irregularities in the tanks, molds, or lines might interfere with making precise fittings. However, the figures I have used allow about one-half-inch tolerance for fitting purposes. (Consult manufacturer for precise diagrams.)

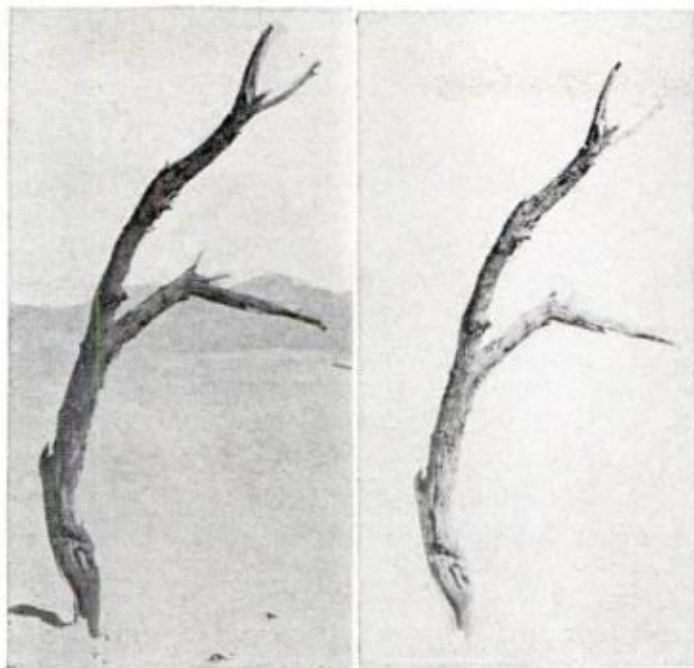
Basic things to remember about all toilet systems on small boats:

- Privacy must be provided.
- Install any sanitary system so that servicing is handy. Drain outlets, water-recharge lines and chlorine dispensers should be easy to reach.
- On models featuring overboard pump-out at dockside, it is desirable to keep the outlet port in a location easily reached.
- Try not to upset the balance of the craft. If an old toilet is being replaced, the new unit should be installed as close to that location as possible to avoid a change in hull efficiency. On a new installation consult a marine architect or the maker.

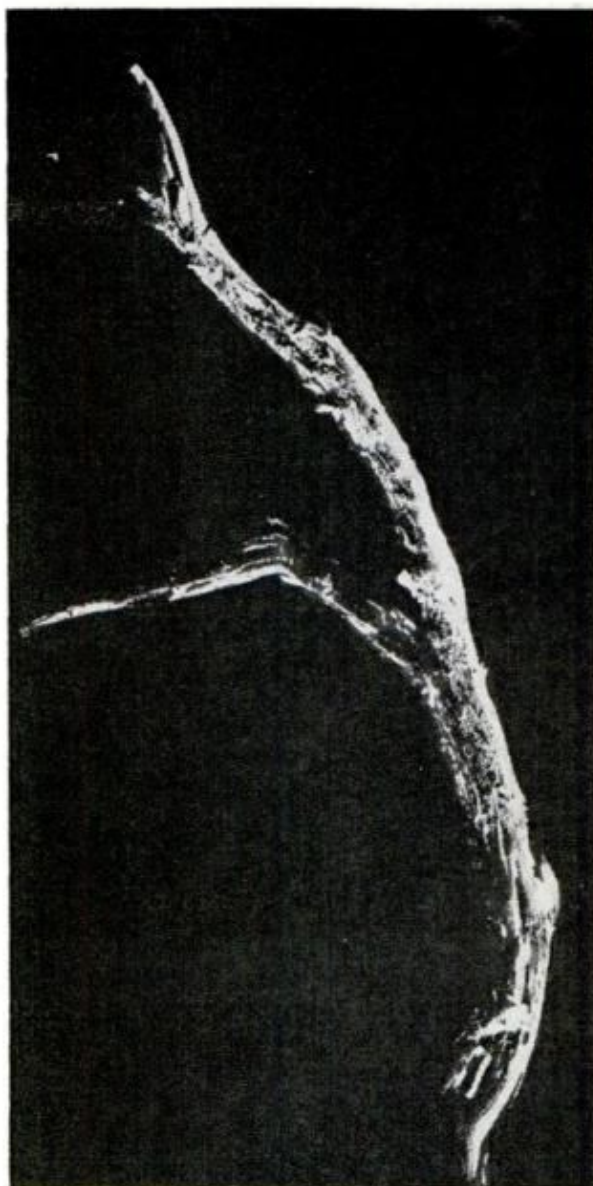
Keep these things in mind when installing a new toilet system:

- Recirculating toilets: It is possible to get two types of drain outlets: bottom outlet and top outlet. Using a top-mounted outlet solves many problems. For example, there are no through-hull fittings to contend with. The unit is emptied through a regular $\frac{3}{4}$ -inch hose outlet (by means of a pump). Place the toilet so that recharging the reservoir with water and getting at the drain-hose outlet is not difficult. Make sure that overhead clearance allows the toilet seat to be raised! One great advantage of recirculating toilets is that the installation requires nothing more than the basic unit and a 12-volt power source.
- Holding tanks: Because a holding tank is adaptable to an existing flush-type toilet, the problem is usually one of finding sufficient space for it. Dimensions of holding tanks vary quite a bit. One popular tank is 32 inches long, 12 inches in width, 12 inches in height. It holds about 20 gallons, according to the maker. (You can figure about 7 gallons per cubic foot of tank space.) Keeping the holding tank close to the toilet will prevent extra plumbing lines, but that may not always be possible. Make sure that the tank is securely bolted.
- Macerator-chlorinators: Such systems are compact in nature, but remember to install an M/C unit so that you can get at the chlorine dispenser easily. ★★ ★

Photo Hints

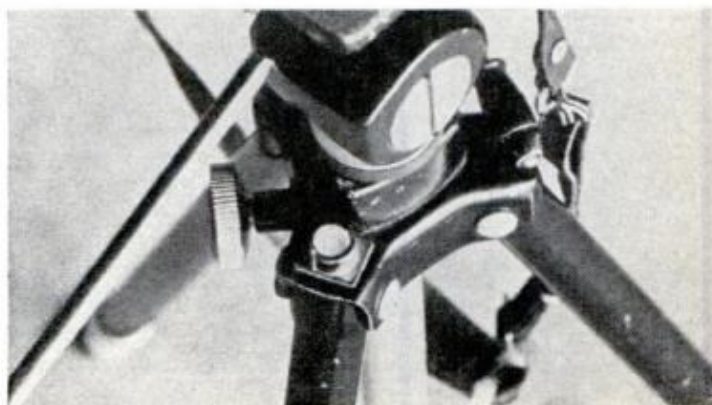


TRICKS IN PRINTING often add interest to an otherwise routine picture. The old, dead sagebrush at left, above, was printed "correctly," but is flat, dull and lacks appeal. When you print the same negative on No. 6 high-contrast paper, the background drops out and the bush takes on an attractive texture, as in the center photo. For an even more dramatic effect, you can make a negative print, as at right. This is done by using the first high-contrast print as a negative and placing it against another sheet of high-contrast paper. A contact printer or beam from an enlarger serves as the light source. The background goes black and the bush suggests a pen-and-ink sketch.—Ward Fanning



NEED FILTERS for an odd-size or little-used lens? If you have a set of Polycontrast enlarging filters, you can save the cost of buying regular filters by using these as a substitute. They will work well on all black-and-white films shot outdoors. The No. 1 filter gives about the same effect as a conventional sky-darkening medium-yellow K2 filter. The No. 3½ approximates the results of a 25A red filter. As with their counterparts, the No. 1 will require an exposure increase of one stop and the No. 3½ of approximately four stops to compensate for the light that's held back by the colored filter material.—Bob Corley

A TRIPOD LEVEL is a handy aid. Some tripods come already equipped with one, but on those that don't it's easy to add your own level. Small, round, chrome-trimmed levels can be purchased at most camera stores for about a dollar (you'll also find them sold in hi-fi shops and electronics-supply houses for use in leveling record changers and turntables). Find a flat place on the tripod, such as on top of the leg platform as shown at right, and attach the level with a little dab of epoxy cement. Now you'll be able to set your tripod plumb in both directions at a quick glance and with no guesswork.—Rod Moon



How Much to

By JIM LISTON, Executive Editor



LIGHTWEIGHT TORO SNOW PUP uses paddles, fins, costs \$100; 21-in. Pup or electric model: \$120



AMF HUSKY, JUNIOR cuts 14-in. swath, has polyethylene rotor. Gas-powered, it sells for \$100

WHAT DOES IT TAKE to trade your snow shovel for power? For some men it takes a bad back or a heart attack. Others make the switch earlier—and cheaper—for as little as \$80. For that kind of money you won't be cutting a three-foot swath or throwing a 30-foot plume. But you'll discover that clearing snow can be fun.

Not long ago, if you had a short driveway, you were stymied. You couldn't justify investing in a big snow thrower, yet you had to shovel every time it snowed. But no more. The new gas or electric lightweight thrower (no heavier than a vacuum cleaner) is the tool to fit the job. Lightweights are popular in areas where snowfalls are medium, but they're also used in big snow country for clearing porches and short driveways.

People who live in heavy-snow country with long drives to clear buy 4 to 7-hp machines that range from \$250 to \$400. The big throwers have four-cycle engines and price is governed by the width of the swath cleared, horsepower of the engine, the total weight, and whether the machine



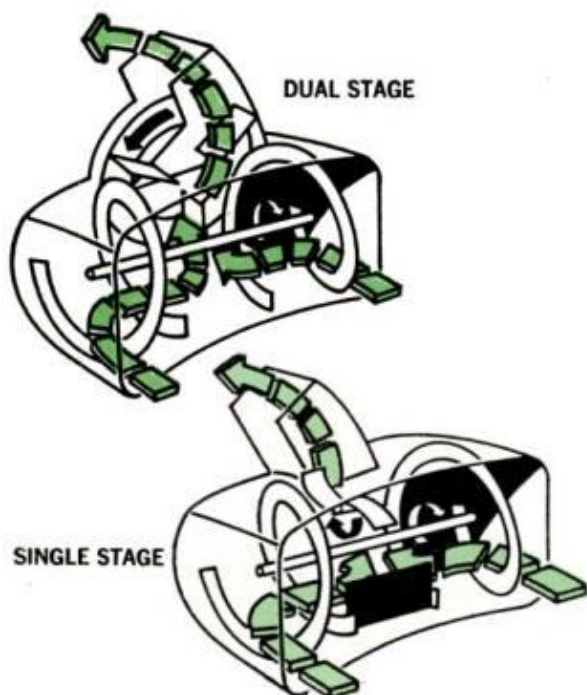
JACOBSEN SNOW BLITZ 17-IN. has discharge chute that rotates 180°. Gas model: \$100; electric: \$120

Throw Snow?

is a single or a dual-stage thrower.

A single-stage uses an auger to feed the snow to the discharge chute and release it with a throwing action that hurls it out the chute. A dual-stage machine has, in addition to the auger, an impeller fan at the base of the discharge chute. The impeller turns at high speed and *blows* rather than throws the snow fed to it by the auger. That's why a two-stage machine is more accurately called a snow *blower*; a single-stage a snow *thrower*, though the terms are used interchangeably. A three-stage unit has chain-driven teeth mounted above the auger that chew into the tops of drifts and drop snow into the auger.

Should you buy a single or dual-stage machine? That depends on where you live and the distance you'd like to throw to do the job effectively. In some parts of the country, most snows are handled without any trouble with single-stage machines. In others, buyers swear by dual-stage. In still others, it's a tossup. Heavy slush or icy granules are hardest to throw and cause most chute clogging. *Tip:* Ask those who clear parking lots in your town what type they've found best for most snows in your area. Dual-stage machines cost



AUGER of single-stage throws snow out chute. In dual-stage, auger feeds snow to fan to be blown out

DECEMBER 1968



SNOW BLADE is economical, efficient for walking and riding tractors. The 48-in. Gravely is \$60



DUAL-STAGE WHEELHORSE 26-in., 7 hp (\$360) shows advantage of blowing: Snow can be lofted over bank



GILSON'S DUAL-STAGE 7-hp model costs \$375. Under ideal conditions, it throws snow up to 40 feet

SNOWTHROWERS AT A GLANCE

Make and Model	Type	Stages	Swath Width (in.)	Discharge Chute		Auger Rotor			Engine			Ship. Wt. (lbs.)	Sugg. Retail
				Distance (ft.)	Rotation (degrees)	Opening (in.)	Blades	Dia. (in.)	Make	Cycle	Hp		
AMF Western Tool, Inc.													
1360	SP	2	26	3-30	180	6	4	15	Tecumseh	4	4	242	\$300
1361	SP	3	26	3-30	180	6	4	15	Tecumseh	4	6	275	\$390
1362	SP	3	26	3-30	180	6	4	15	Tecumseh	4	7	275	\$400
1365 (A,F)	Push	1	14	1-20	...	14	0	...	Tecumseh	2	2.5	27	\$110
Allis-Chalmers													
SB-2524	SP	2	24	30	220	6	2	15 1/2	Tecumseh	6	5	...	\$330
SB-2728	SP	2	28	35	220	6	2	15 1/2	Tecumseh	4	7	...	\$380
Ariens Co.													
2299 Snow Thro	SP	2	24	25	240	6	4	14	Tecumseh	4	4	250	\$230
10965 Snow Thro	SP	2	24	30	240	6	4	16	Tecumseh	4	5	262	\$300
10970 Snow Thro	SP	2	24	30	240	6	4	16	Tecumseh	4	6	262	\$350
10962 Snow Thro	SP	2	24	30	240	6	4	16	Tecumseh	4	7	267	\$370
10957 Snow Thro	SP	2	32	30	240	6	4	16	Tecumseh	4	7	267	\$390
Atlas Tool and Mfg. Co.													
SN420A	SP	1	20	15-20	180	5	4	10	B&S	4	4	120	\$170
Bolens Div., FMC Corp.													
537 Arctic 70	SP	2	26	30	200	..	4	16	Tecumseh	4	7	280	\$370
Gilson Bros. Co.													
832SS	SP	1	26	10-30	180	7	4	12	B&S	4	5	205	\$270
833SS	SP	1	26	10-30	180	7	4	12	B&S	4	7	230	\$314
834DS	SP	2	26	20-40	180	7	4	16	Lauson	4	5	290	\$325
835DS	SP	2	26	20-40	180	7	4	16	B&S	4	7	316	\$375
Hahn-Eclipse Co.													
CH-520-4	SP	1	20	20	180	6	4	10 1/2	Tecumseh	4	4	246	\$190
CH-584-5	SP	2	24	40	180	7	4	15 1/2	Tecumseh	4	5	257	\$300
CH-584-6	SP	2	24	40	180	7	4	15 1/2	Tecumseh	4	6	272	\$350
CH-588-7	SP	2	28	40	180	7	4	15 1/2	Tecumseh	4	7	281	\$380
CH-E584-5 (ES)	SP	2	24	40	180	7	4	15 1/2	Tecumseh	4	5	278	\$390
Hunter Industries													
62-54-1 Sno Wonder	SP	2	24	3-60	180	6	4	11 3/4	Lauson	4	5	295	\$300
62-64-1 Sno Wonder	SP	2	26	3-60	180	6	4	11 3/4	Lauson	4	6	315	\$365
62-78-1 Sno Wonder	SP	2	28	3-60	180	6	4	11 3/4	Lauson	4	7	325	\$400
Jacobsen Mfg. Co.													
51603 Sno-Blitz (P)	Push	1	17	10-20	180	16	4	9	Tecumseh	2	..	34	\$100
51613 Sno-Blitz (P)	Push	1	17	10-20	180	16	4	9	B&D (elec.)	..	..	40	\$120
52003 Snow Jet	SP	1	20	10-20	180	22	4	14	Jacobsen	2	3.5	164	\$220
52601 Imperial	SP	2	26	15-30	180	28	4	16	Tecumseh	4	6	264	\$335
Lambert Inc.													
SS-4	SP	1	20	3-20	180	4 1/2	4	10 1/2	B&S	4	4	127	\$190
SS-5	SP	1	22	3-20	180	4 1/2	4	10 1/2	Lauson	4	5	135	\$230
HS-54-1	SP	2	26	3-60	180	6	4	11 3/4	Lauson	4	5	295	\$300
HS-64-F-1	SP	2	28	3-60	180	6	4	11 3/4	Lauson	4	6	315	\$365
HS-78-1	SP	2	32	3-60	180	6	4	11 3/4	Lauson	4	7	325	\$400
Lazy Boy Lawn Mower Co., Inc.													
RE 69	Push	1	19	40	180	4 1/2	4	10 1/2	B&S	4	3	88	\$130
DLB-68	SP	1	20	40	180	4 1/2	4	10 1/2	B&S	4	4	134	\$190
Montgomery Ward													
481	Push	1	18	15	L & R	4	2	10	B&S	4	3	83	\$120
484	SP	1	22	30	180	7	2	12	B&S	4	4	215	\$230
489	SP	2	22	40	180	7	4	16	B&S	4	5	280	\$300
477	SP	2	26	40	180	7	4	16	B&S	4	7	310	\$360
478 (ES)	SP	2	26	40	180	7	4	16	B&S	4	7	315	\$420
Power Equipment, Inc.													
88183 Viking	Push	1	18	15	200	6	4	10	B&S	4	3	80	\$100
88183SP Viking	SP	1	18	15	200	6	4	10	B&S	4	3	85	\$160
88204SP Viking	SP	1	20	20	200	6	4	10	B&S	4	4	100	\$180
Sears													
81929	SP	1	20	15	180	6	4	10	Craftsman	4	3.5	90	\$180
82542	SP	1	18	20	160	6	4	18	Craftsman	4	3.5	151	\$200
82552	SP	1	24	30	160	6	4	11 1/2	Craftsman	4	6	220	\$300
82562	SP	3	26	35	180	6	4	15	Craftsman	4	6	280	\$400
Simplicity Mfg. Co.													
482 Sno-Away	SP	1	23	4-30	180	6 1/2	4	12	B&S	4	4	205	\$265
483 Sno-Away	SP	1	26	4-30	180	6 1/2	4	12	B&S	4	6	244	\$334
430 Sno-Away	SP	2	26	4-30	180	5 1/4	4	12	B&S	4	7	285	\$385
Sunbeam Corp.													
LD16 (Electric)	Push	1	16	12-15	180	5	2	9	Electric	..	...	42	\$ 80
DSA (Electric)	Push	1	16	12-15	180	5	2	9	Electric	..	...	50	\$100
CD18 (Electric)	Push	1	18	12-15	180	5	2	9	Electric	..	...	56	\$150
ST200 (Electric)	Push	1	18	12-15	180	5	2	9	Electric	..	...	66 1/2	\$170
ST050 (Electric)	Push	1	16	12-15	180	5	2	9	Electric	..	...	52	\$120
Yoro Mfg. Co.													
31411 Snow Pup(P)	Push	1	14	15	180	14	2	8 1/2	Tecumseh	2	2	22	\$100

Make and Model	Type	Stages	Swath Width (in.)	Discharge Chute		Auger Rotor			Engine			Ship. Wt. (lbs.)	Sugg. Retail
				Distance (ft.)	Rotation (degrees)	Opening (in.)	Blades	Dia. (in.)	Make	Cycle	Hp		
31451 Snow Pup(P)	Push	1	14	15	180	14	2	8½	Howard	(elec.)	3	30	\$120
31501 Snow Pup(P)	Push	1	21	15	180	21	4	8½	Tecumseh	2	2½	26	\$120
31301 Snow Hound	SP	1	20	15	240	5	4	9¾	Tecumseh	4	3½	105	\$180
Wheel Horse Products, Inc.													
4-2633 Trailblazer	SP	2	26	35	190	6	4	16	Tecumseh	4	7	269	\$360
4-2634 Trailblazer	SP	2	26	35	190	6	4	16	Tecumseh	4	5	265	\$299
Wisconsin Marine Co.													
820 Bob-Cat	SP	2	20	30	180	5½	2	14	B&S	4	5	235	\$299
1824 Bob-Cat	SP	2	24	30	180	5½	2	14	B&S	4	7	270	\$367
Yard-Man, Inc.													
7000-1 Snow-Bird	SP	2	22	20	180	5	4	15	Tecumseh	4	4	190	\$250
7040-0 Snow-Bird	SP	2	22	30	240	5	4	15	Tecumseh	4	5	225	\$290
7010-1 Snow-Bird	SP	2	24	30	240	5	4	15	Tecumseh	4	6	235	\$330
7020-1 Snow-Bird	SP	2	26	40	240	6½	4	17	Tecumseh	4	7	300	\$390

(P): Paddle; (A,F): Auger and Fan; (ES): Electric Start; SP: Self-Propelled.

SNOW-THROWER ATTACHMENTS FOR COMPACT AND TWO-WHEEL TRACTORS

Tractor manufacturers match thrower capacity to the power of their tractor, so the tractor owner should buy the thrower made for his machine. Single-stage thrower attachments range in width from 32 in. to 48 in. and in price from \$150 to \$265. Dual-stage thrower attachments range from \$245 to \$380.

more than single-stage of the same size.

The maximum discharge distance claimed for a machine always represents what it will do with light fluffy stuff. So if you have a driveway hemmed in by retaining walls or shrubbery and expect to loft the plume over these, figure on days when maximum throw will be reduced by one-half or one-third. If the discharge distance (see chart at left) for a machine is, for example 3-30, the smaller figure means that the throw can be kept to 3 feet. This can be important if you clear between buildings. For example, a neighbor won't appreciate having the snow from your drive added to his.

Hard starting used to plague throwers. Engines with compression release valves and electric starters have licked that. Some throwers have optional starters that operate on house current and eliminate the need for a battery. These add about \$60 to the price of the machine but are well worth it on cold mornings.

Self-propelled units have several forward speeds, but be sure you get reverse on a big machine; you'll need it. For safety, a self-propelled machine should be able to move with the rotor stopped. Otherwise, you must stop the engine, push the unit and restart the engine. Rather than do this, you'll take chances. Not good.

Homeowners with compact tractors can use either a plow or a snow-thrower attachment. (At least 6 hp is needed for a thrower.) A "lawn tractor" (one that does not operate ground-engaging—tilling—attachments) can take a small plow, but don't expect it to handle big snows.

Most tractor owners buy plows (for under \$100) rather than thrower attachments because of the price difference. A plow can clear up to a 12-inch fall faster than a thrower. But drifts and heavy wet stuff can stop a plow. A thrower just bores in until the job is done. Here again the choice depends on what winter dumps in your area. ★★★



TORO'S NEW 7-HP HYDROSTATIC tractor can handle a 32-in. thrower attachment that sells for \$210



JOHN DEERE THROWER (\$195) for 8 and 10-hp tractors clears 38 in.; a 46-incher for 12 hp costs \$265

We Put It All On Our Living Room Wall



Without sacrificing good design, we were able to include everything from a stereo system to a concealed typewriter desk in this handsome bookcase wall.

TELEVISION IS CONCEALED behind sliding doors in the center of base cabinet. Space on either side of it is devoted to storage

By **MARJORIE JOHNSON**

A 14-FOOT BLANK WALL turned out to be the key to solving our storage problems. Using the full height and width, we were able to design a built-in entertainment wall that would not only hold books, but also include a concealed typing desk and a surprising amount of general storage space. Best of all, by doing the work ourselves, we were able to save \$500 from the estimate given us by a professional cabinetmaker.

The countertop and lower unit rest on a 2x4 base which forms a recessed toe-board. The top extends 21 in. out from the wall for most of its length. At the desk end, however, it increases to 33 in. This deeper portion holds the typewriter shelf which can be slid out and raised to counter height.

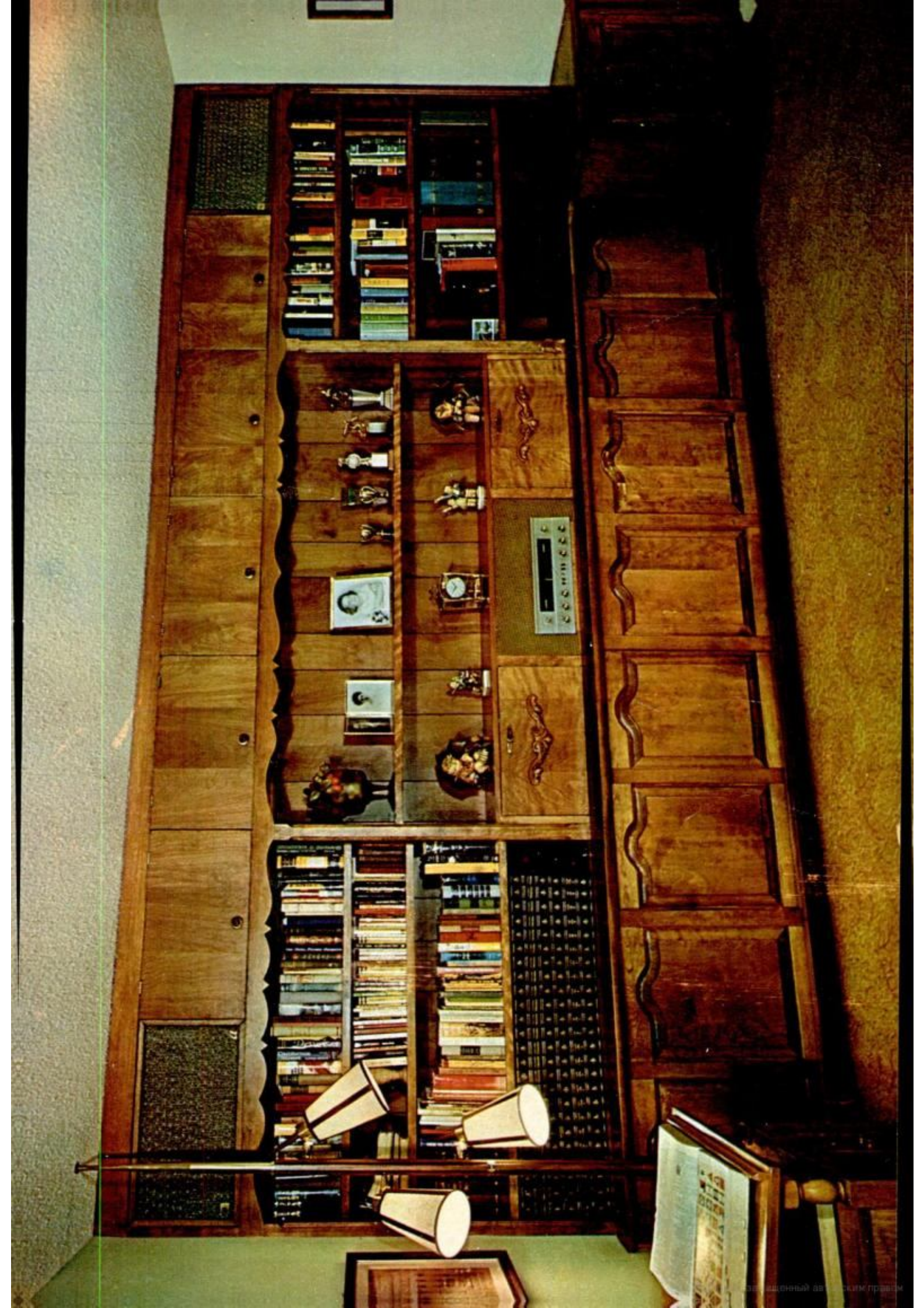
Our 27-in. TV is located in the center of the base unit. Space on either side is devoted to general storage. We installed

Technical Art by Associated Technical Services, Ltd.

shelves in the side cabinets, but these could be omitted if you plan to use the space for bulky items. Sliding doors in aluminum tracks conceal all these storage cabinets and the TV.

Above the counter, the space is divided into three open sections—a wide 6-ft. section in the middle to hold the stereo equipment and provide display shelves, and two 4-ft. bookshelf sections on the ends. All three sections are equipped with adjustable shelf brackets, so the height of the shelves can be changed to suit your books or art objects.

The bottom portion of the middle section is a permanent enclosure in which the stereo equipment is mounted. Our tuner/amplifier is located in the center, directly above the TV. To provide a decorative touch, the area around it is covered with gold mesh screening backed with acoustical cloth. The doors on either side



conceal the tape deck and turntable. Centered on each of these doors is an ornamental leaf molding stained to match the rest of the wood and glued to the face.

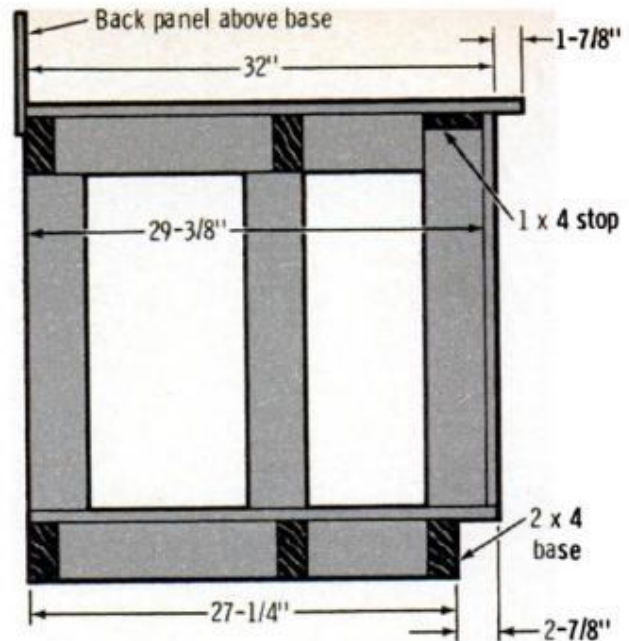
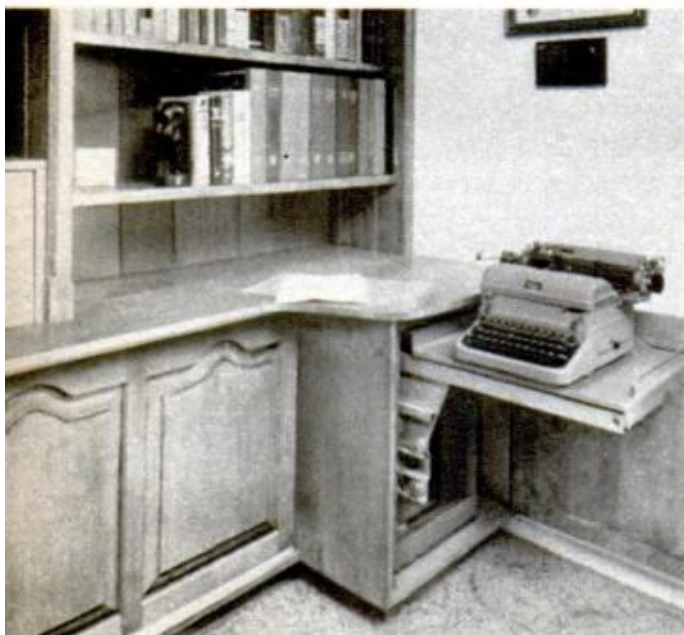
We chose standard 1 1/8-in. bookshelf stock for all of the upper shelves because it's thick enough not to require center supports. It measures 12 in. deep.

The top 2 ft. of the unit holds a pair of stereo speaker enclosures, one at either end. Five 2-ft. doors give access to the long space between these speakers, which we use to store seldom needed games and other recreational gear. The doors are hinged at the top and equipped with folding brackets to lock them open.

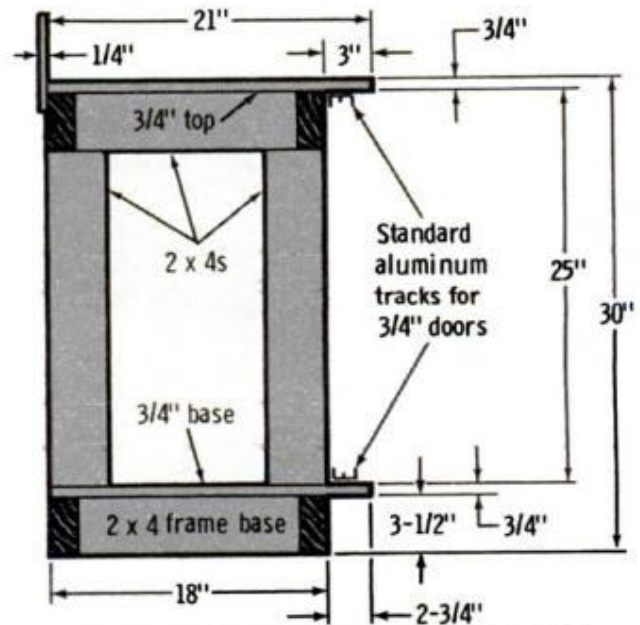
All the exposed surfaces are birch. Although the unit is fastened to the wall, we backed the shelf sections with prefinished, random-width birch plywood to give it a cabinet look rather than leave the wall exposed. We colored the unfinished parts of the unit with a mix of equal parts of fruitwood and maple stains, followed by a coat of clear varnish and two coats of satin varnish. All surfaces were rubbed with fine steel wool between coats.

If the fancy, beveled panel inserts in the sliding doors are too difficult for you to copy, forget the curved top part and substitute a plain beveled insert. This is easily made by tilting the blade on a bench saw and running the work through on edge, after first making the raised shoulder cuts. We had ours made by a local cabinetmaker who had the special shaper cutter needed to bevel curved tops. ★ ★ ★

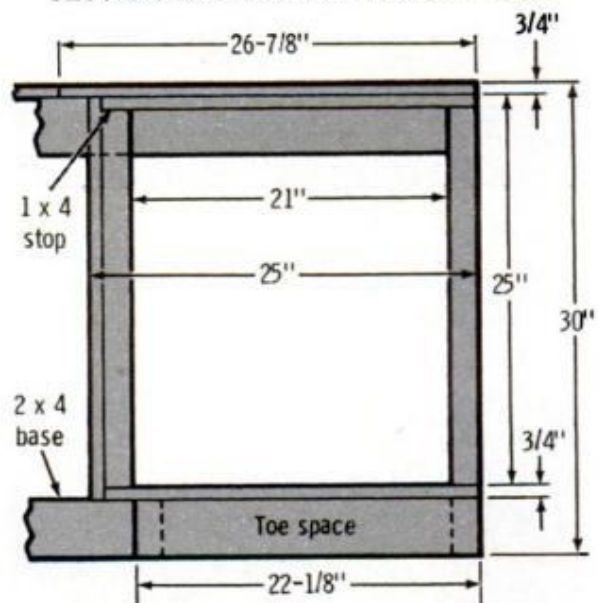
TYPEWRITER DESK built into one end holds typewriter shelf, installed with standard desk hardware



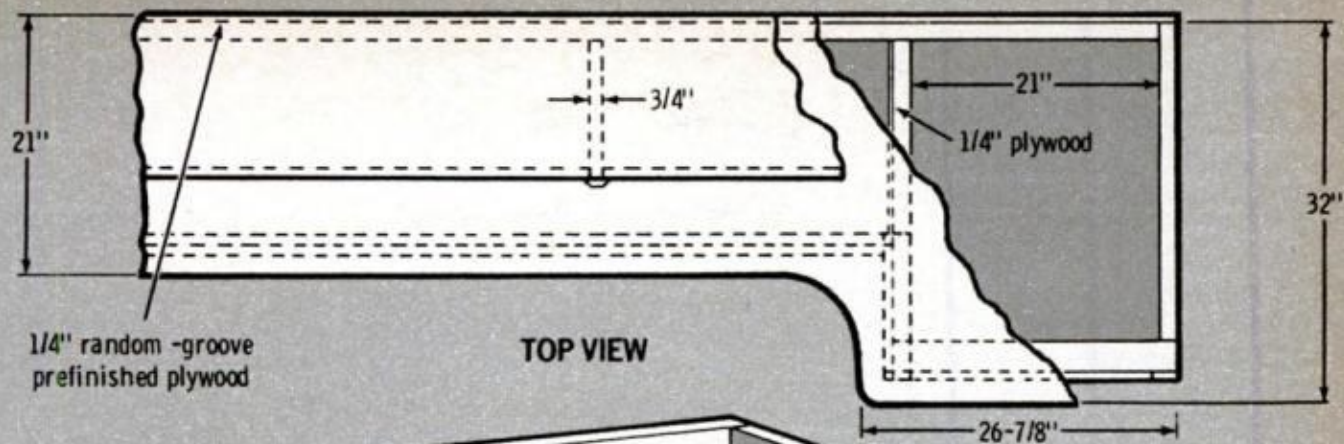
SECTION SHOWING LEFT END OF TYPING UNIT



SECTION SHOWING LEFT END OF BASE

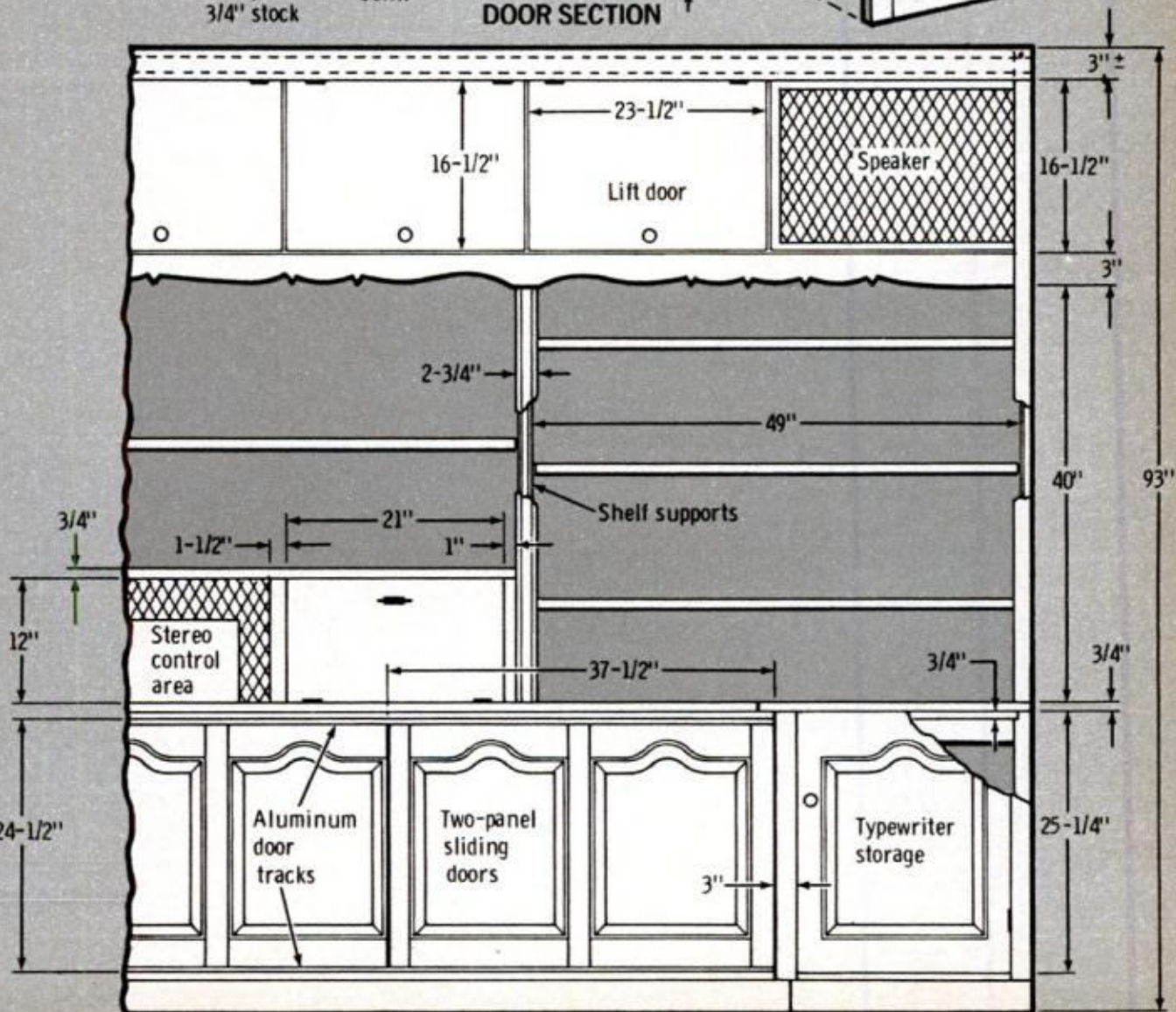
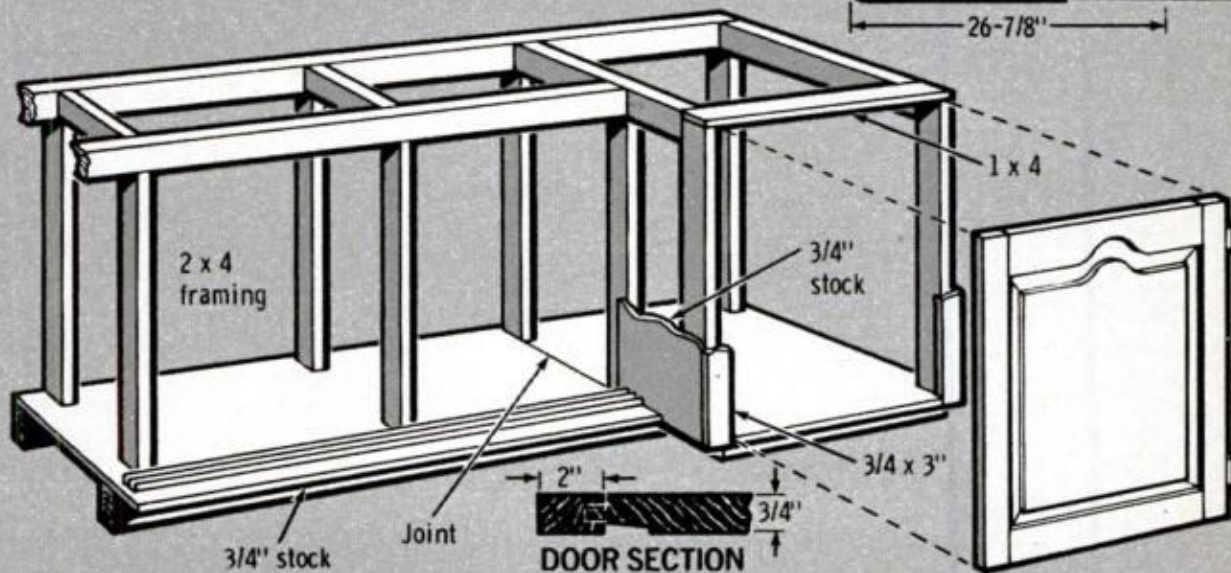


FRONT VIEW SECTION OF TYPING UNIT



1/4" random-groove prefinished plywood

TOP VIEW



FRONT VIEW



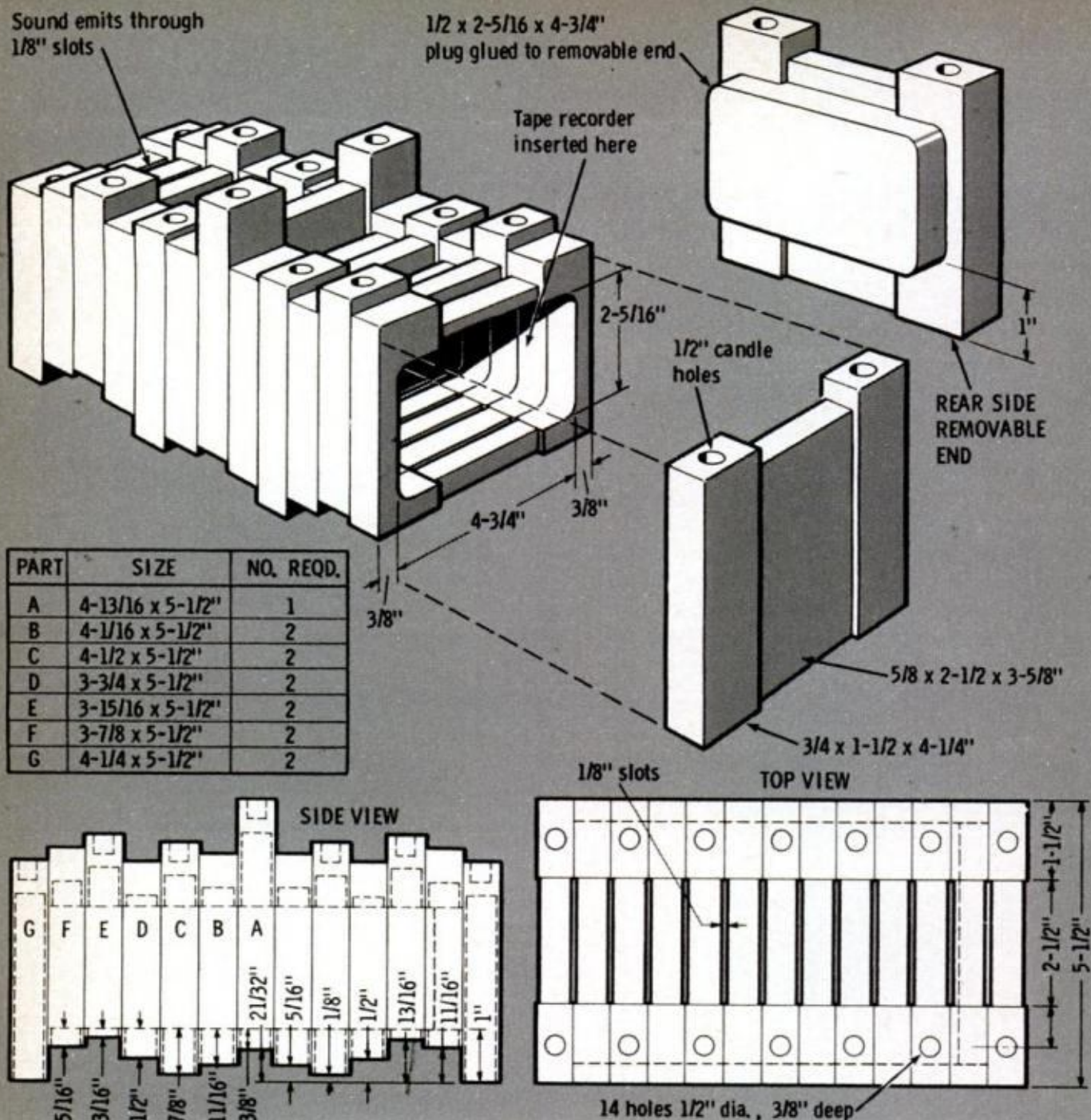
Build These Musical Centerpieces

IF YOU DON'T HAVE a cassette tape recorder, perhaps you should. You can make this Christmas a truly musical one by using it to provide personalized "built-in" sound in your table centerpieces.

The three examples shown are designed so that any cassette recorder may be slipped in place from the side or bottom. Cassette-type recorders can be set to play up to 60 minutes and, since you can make your own tapes, you can be as original and personal as you like. For example, the sound coming from the tree base can be the voices of your own family singing Christmas carols. Music emerging from

Color Photos by Robert Borst





the table candelabra can be a recording of Johnny or Susan playing *Silent Night*, *Holy Night* on the family organ. It can be Dad making out like jolly ol' St. Nick himself to keep tiny Jim believing in Santa. The tunnel-like candelabra detailed above consists of 13 layers which stand like slices of bread. Except for the center layer, there are two each of identical overall size and shape. Both ends are alike also, except that the removable one has a centering plug glued to its back.

Since two pairs of each layer are alike, the U-shaped sides are bandsawed four at a time. This is done by first stacking the 3/4 x 1 1/2-in. pieces (all cut to proper length) in a block and holding them to-

gether with masking tape. As there is only one "A" layer, only two pieces would be stacked for cutting.

The U-shaped pieces are joined together at top and bottom with identical-length cross pieces. All are 5/8-in. wide so that when they are glued to the 3/4-in. side pieces, 1/8-in. slots remain between the individual layers,

When all layers are completed they're glued together and clamped into a single block, taking care to keep all even at the sides. "Stringing" them on a scrap board will help to keep them aligned.

The Styrofoam tree has a base made up of five plywood discs, the bottom one being removable for placing a recorder

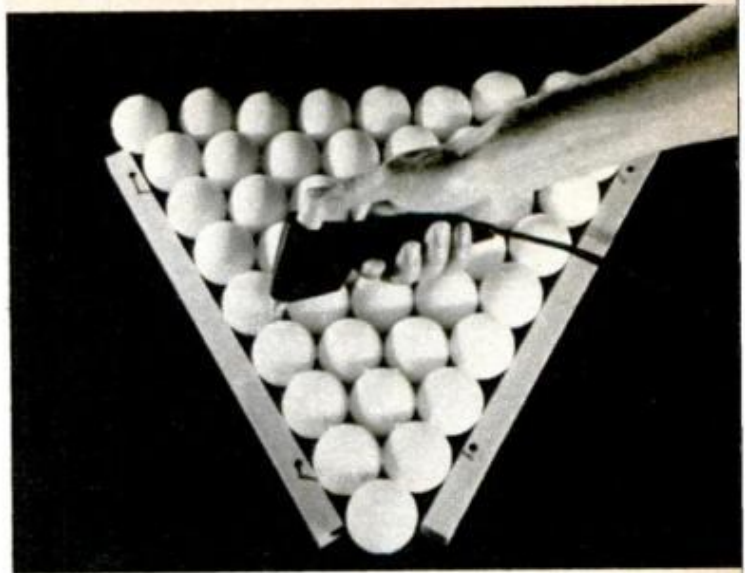
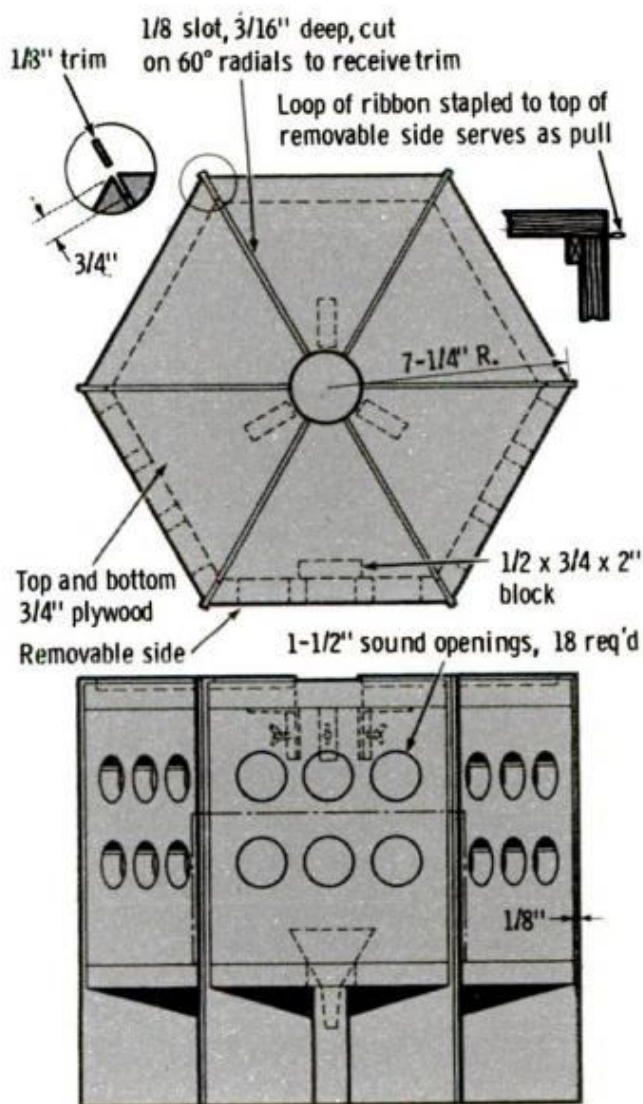
Technical Art by Graphic Presentations

inside. Sound comes out through a perforated metal band wrapped around two discs that are made slightly smaller in diameter than the top and bottom ones to which they are glued. The different size creates rabbets for the metal band. The base is completed by gluing and nailing $\frac{1}{4}$ -in. thick wooden fins completely around the circumference.

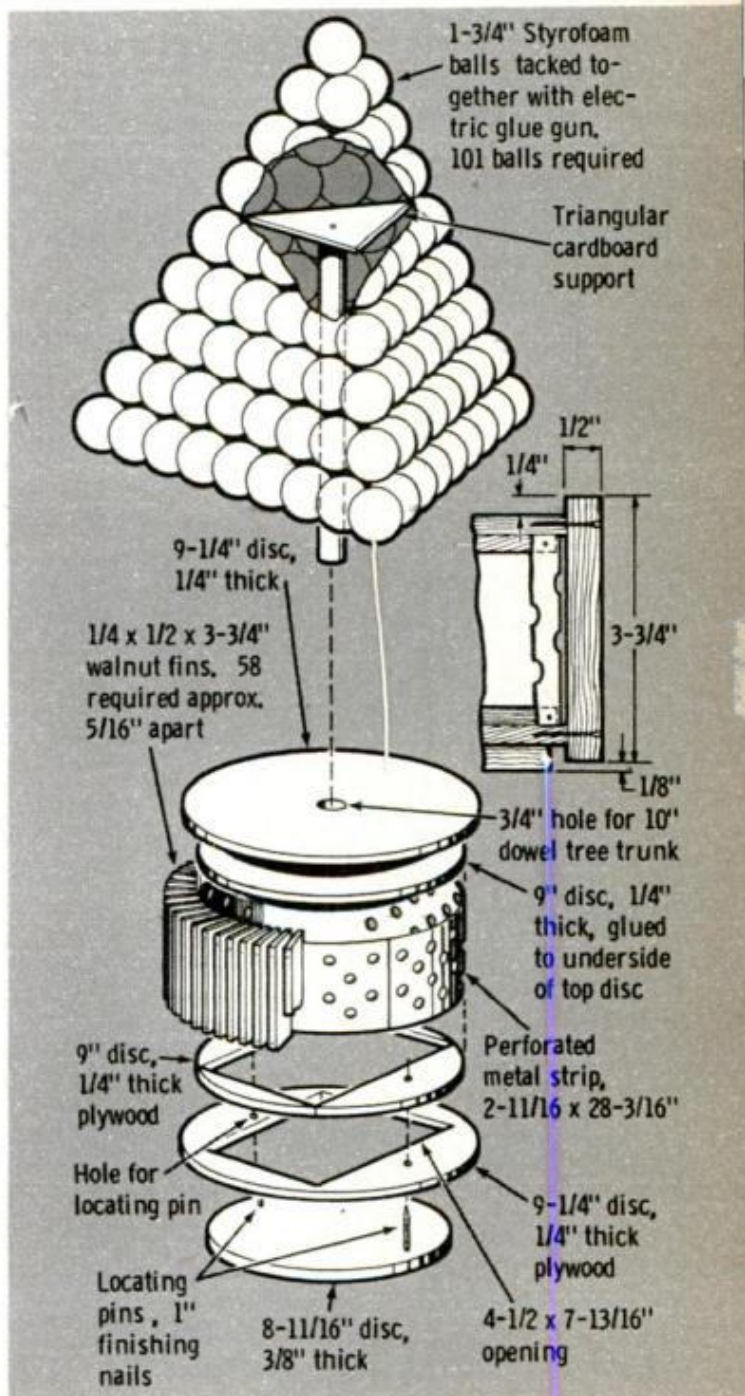
The tree itself is formed in a triangular hollow pyramid from 101 Styrofoam balls tack-glued together with an electric glue gun. Building them up is tricky but can be done with help by assembling each side flat on a table and then tacking the three sides together on the inside with glue. The completed tree should measure nine balls on a side, nine balls high.

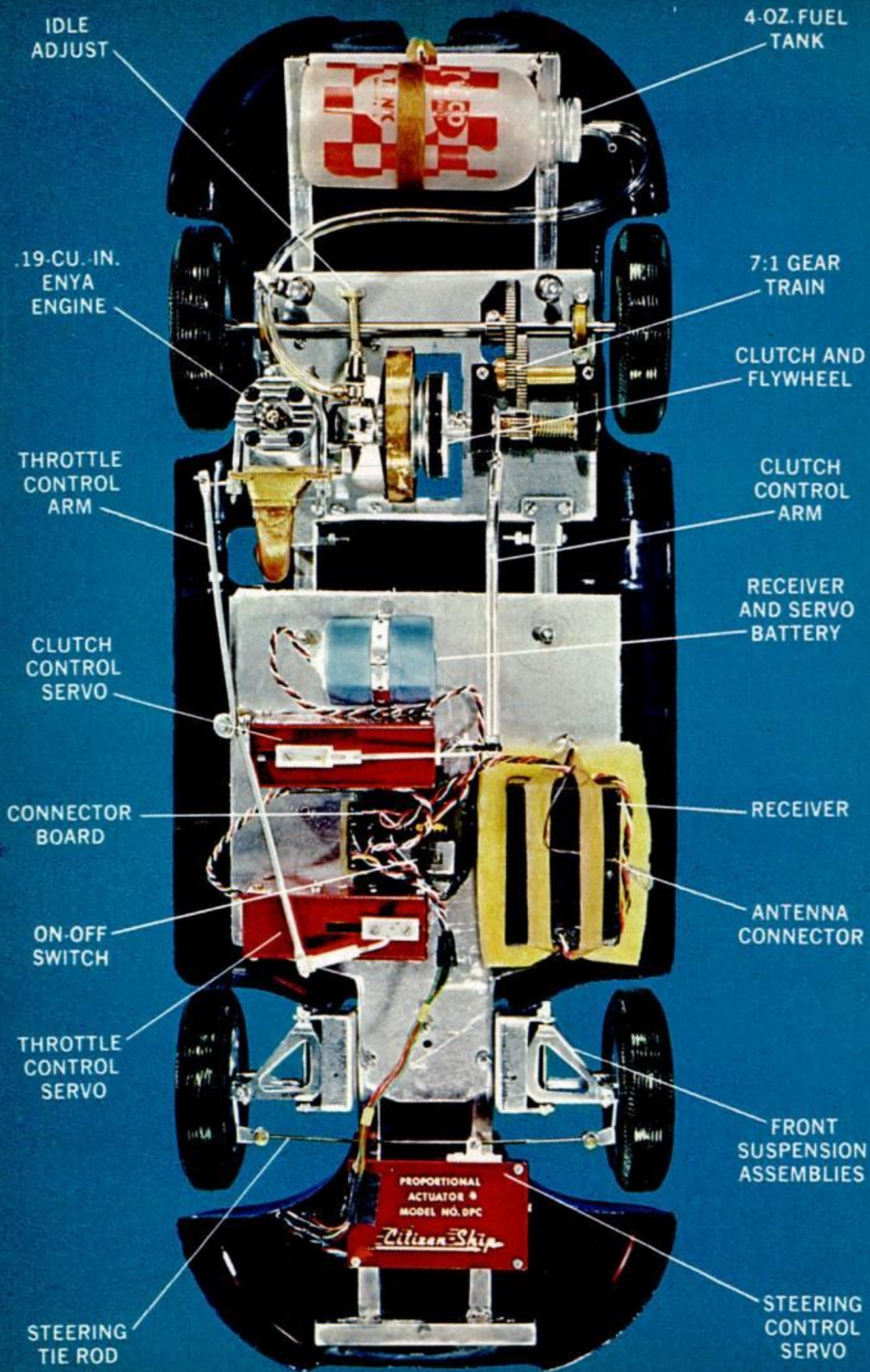
The modern tree stand shown on page 154 has an access door on one side. The details on pages 157 and 228 show how it's made of two six-sided discs cut from $\frac{3}{4}$ -in. wood and then joined with five beveled side members to form a hexagonal

(Please turn to page 228)



HANDIEST WAY to assemble the Styrofoam balls is to tack-glue them with a Thermogrip electric glue gun





IDLE
ADJUST

4-OZ. FUEL
TANK

19-CU.-IN.
ENYA
ENGINE

7:1 GEAR
TRAIN

CLUTCH AND
FLYWHEEL

THROTTLE
CONTROL
ARM

CLUTCH
CONTROL
ARM

CLUTCH
CONTROL
SERVO

RECEIVER
AND SERVO
BATTERY

CONNECTOR
BOARD

RECEIVER

ON-OFF
SWITCH

ANTENNA
CONNECTOR

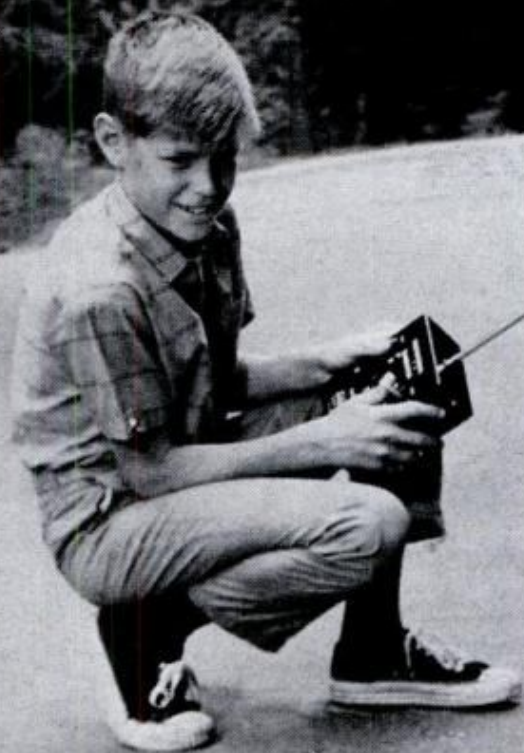
THROTTLE
CONTROL
SERVO

FRONT
SUSPENSION
ASSEMBLIES

STEERING
TIE ROD

PROPORTIONAL
ACTUATOR
MODEL NO. 9PC
Citizen-Ship

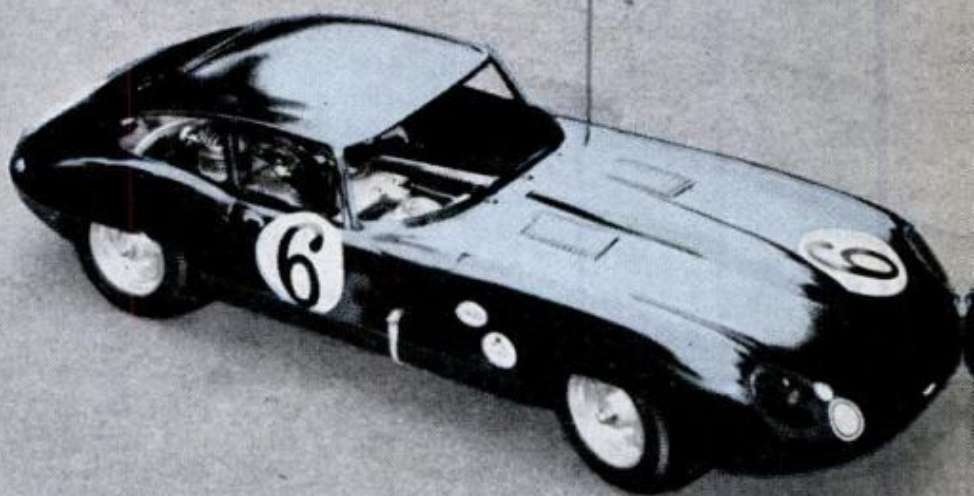
STEERING
CONTROL
SERVO



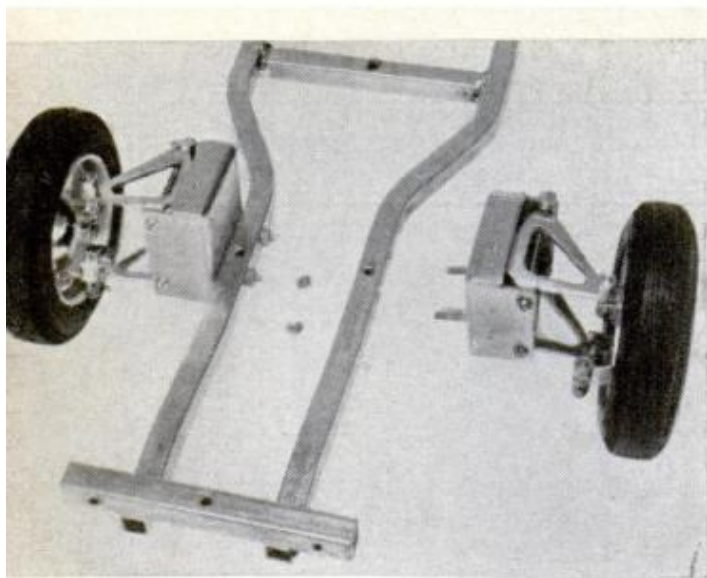
Build This R/C GASSER

By LEONARD E. SABAL

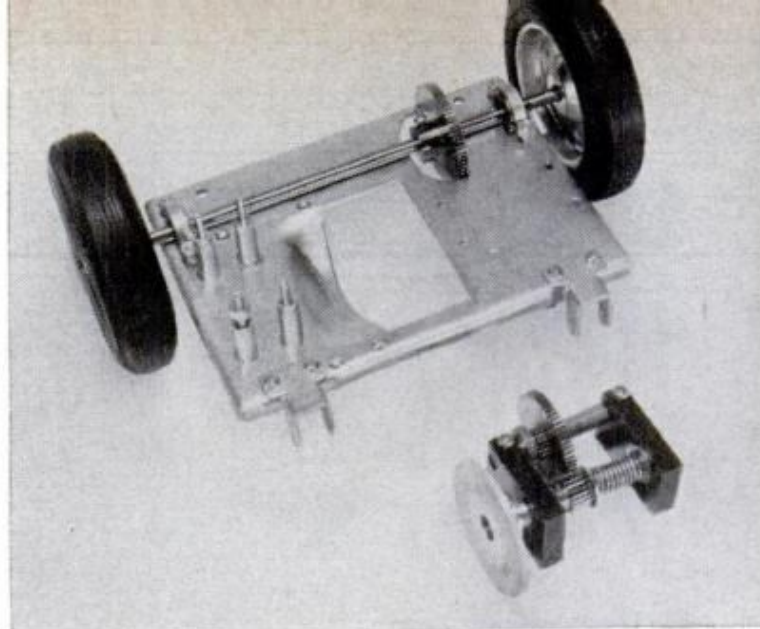
IT'S NOT AN ELECTRIC TOY, but a $\frac{1}{8}$ th-scale, gas-powered racing car, featuring throttle control, clutch, fully proportional steering and dynamic braking. With the gear train provided, it will do almost 20 mph, at the time and place of your choosing—and if that seems slow, just remember that it's equal to 160-mph scale speed to fully tax your driving



R/C
SPECIAL
SECTION



ALL HOLES IN TUBULAR CHASSIS are predrilled by maker of kit. Suspension assemblies really work



ALSO PREDRILLED TO PREVENT MISTAKES, rear platform will hold motor, drive train and rear axle

skills, reflexes and responses. In fact, it likely will take four or five runs at *idle speed* before you can increase the speed and control the car with confidence.

Once this familiarity is gained, it's easy enough to change the drive ratio to increase the maximum speed to 30 or 35 mph. It's even possible that the manufacturer of this car kit may soon make available an accessory gear train with a 4-to-1 or 5-to-1 ratio.

Yes, you read correctly—it's a car *kit* designed to be operated by radio-control. What's more, I put it together in less than two hours. Of course, the kit does not include the R/C gear, for the simple reason that many hobbyists already have a suitable radio-control system.

Installation of the R/C components took another two hours, and final tuning and linkage adjustments required one-half to one hour. All told, then, start-to-finish assembly is possible within five hours.

The kit package

When you open the coffin-like cardboard carton, you'll find a two-piece transparent fiberglass body, an Enya .19-cu.-in. engine, plastic-wrapped mechanical components, tires, and the sturdy, welded tubular chassis.

Open each of the plastic bags and set the contents in separate boxes so they won't get mixed. Then find the small tie-rod connectors and loosely fit them to the one-piece front suspension assemblies, along with the tires. Note that the front wheels are secured to the threaded axles with capped nuts so the wheels will spin

freely. Then bolt both suspension assemblies to the frame and install the thin wire tie-rod and steering take-off connector, making sure that the wheels are properly aligned.

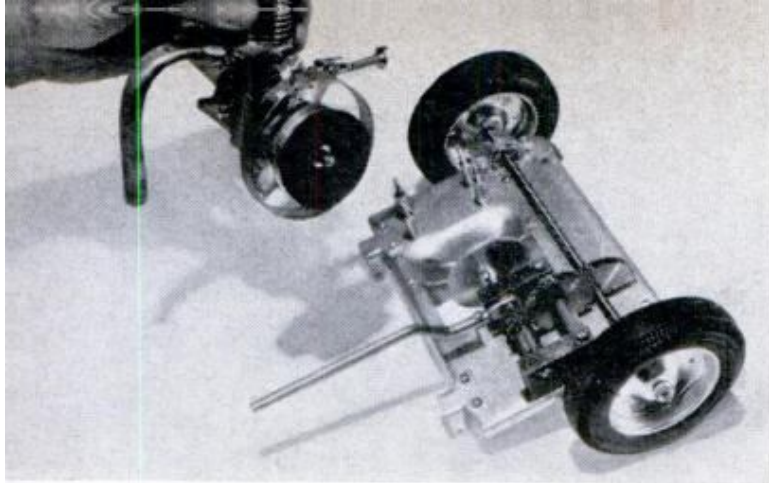
Driveline assembly

The rear platform holding the motor and drive components looks complicated at first glance, but is quite simple and goes together in only a few minutes. First fit the rear-axle assembly (consisting of axle, drive gear, ball-bearing mounts and wheels) on the platform; followed by the gear train, engine spacers and right-angle pivot fittings.

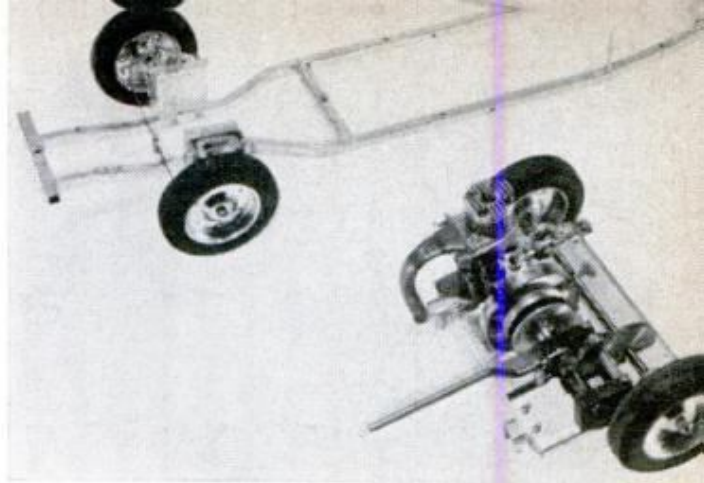
Secure both the muffler and the fan-flywheel unit to the engine and install this in place. After fitting the clutch actuating arm on the platform, pull it toward the engine so it disengages the clutch, and slowly turn the fan-flywheel to check the spacing between the mating faces. If necessary, install shims under the proper engine supports to bring the clutch faces into perfect alignment.

Tighten the two long screws through the rear of the chassis, but before fitting the platform to the chassis, drill out the two rear holes in the platform to $\frac{3}{16}$ or $\frac{1}{4}$ in. This will enable the entire assembly to absorb any shocks at the rear wheels by pivoting upward against the spring-loaded screws. (Of course, the screws holding the right-angle pivots to the frame should not be so tight as to restrict this movement.)

Next, trim the aluminum plate and the asbestos sheet provided to the pattern



MOTOR COMES OFF IN A FEW MINUTES for bench testing. Muffler reduces noise level considerably



ENTIRE REAR PLATFORM pivots on forward elbows, works against springs placed over long rear screws

included in the kit, and mount the long screw and throttle control arm. Although this completes assembly of the mechanical components of the kit, don't fret over the dozen or so pieces that you haven't used—these are mainly spare screws and control rods you might find handy with certain types of radio-control equipment.

R/C installation

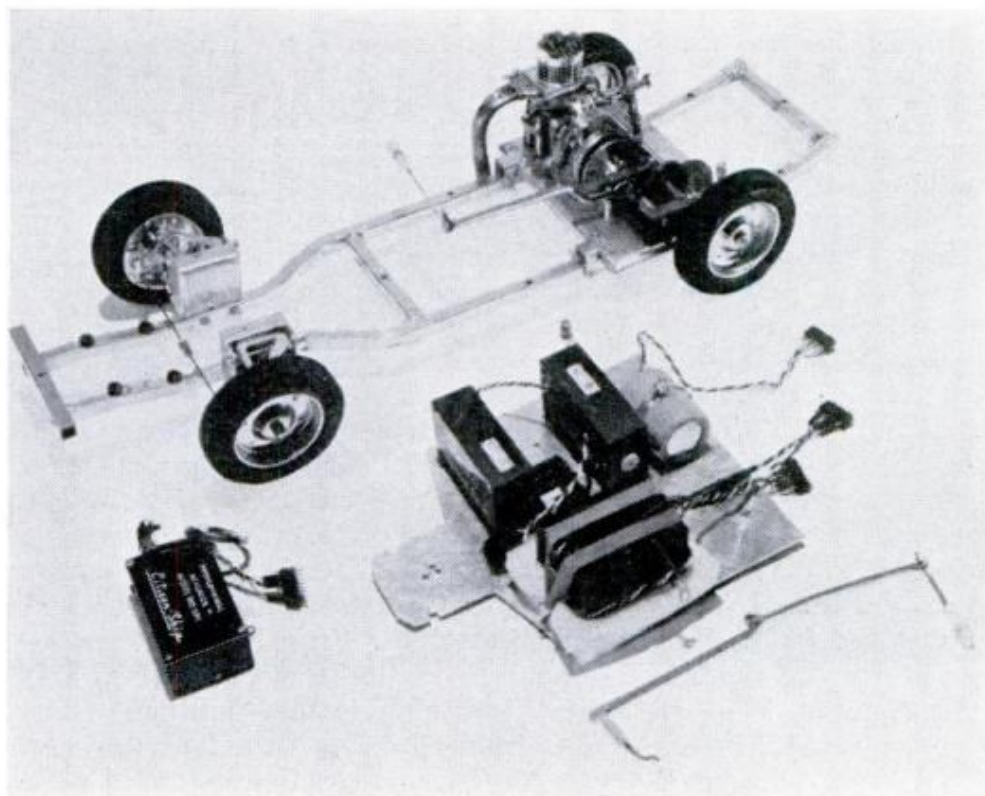
The Citizen-Ship system shown is a three-channel digital proportional outfit (for a definition, see *Basic Radio-Control Systems* on page 163) that comes ready-to-use with battery pack, wiring connector and built-in charger for both transmitter and receiver/servo batteries. The compact servos produce four pounds thrust, more than enough of a kick to

actuate any of the controls in the "gasser."

When installing radio-control equipment, it's important that metal-to-metal contact be avoided as much as possible to prevent "noise" from interfering with smooth servo operation. Thus, all servos are fastened with screws and rubber grommets to isolate metal surfaces, and nylon or plastic clevis connectors are used at the ends of linkages.

Similarly, most receivers must be insulated from other components and ground, and also must be mounted in foam-rubber to prevent damage from shock. As shown in the photo directly below, thick rubber bands are fastened to simple wire hooks through the aluminum plate and pass

(Text continues on page 230; Radio-Control Section continues on next page)

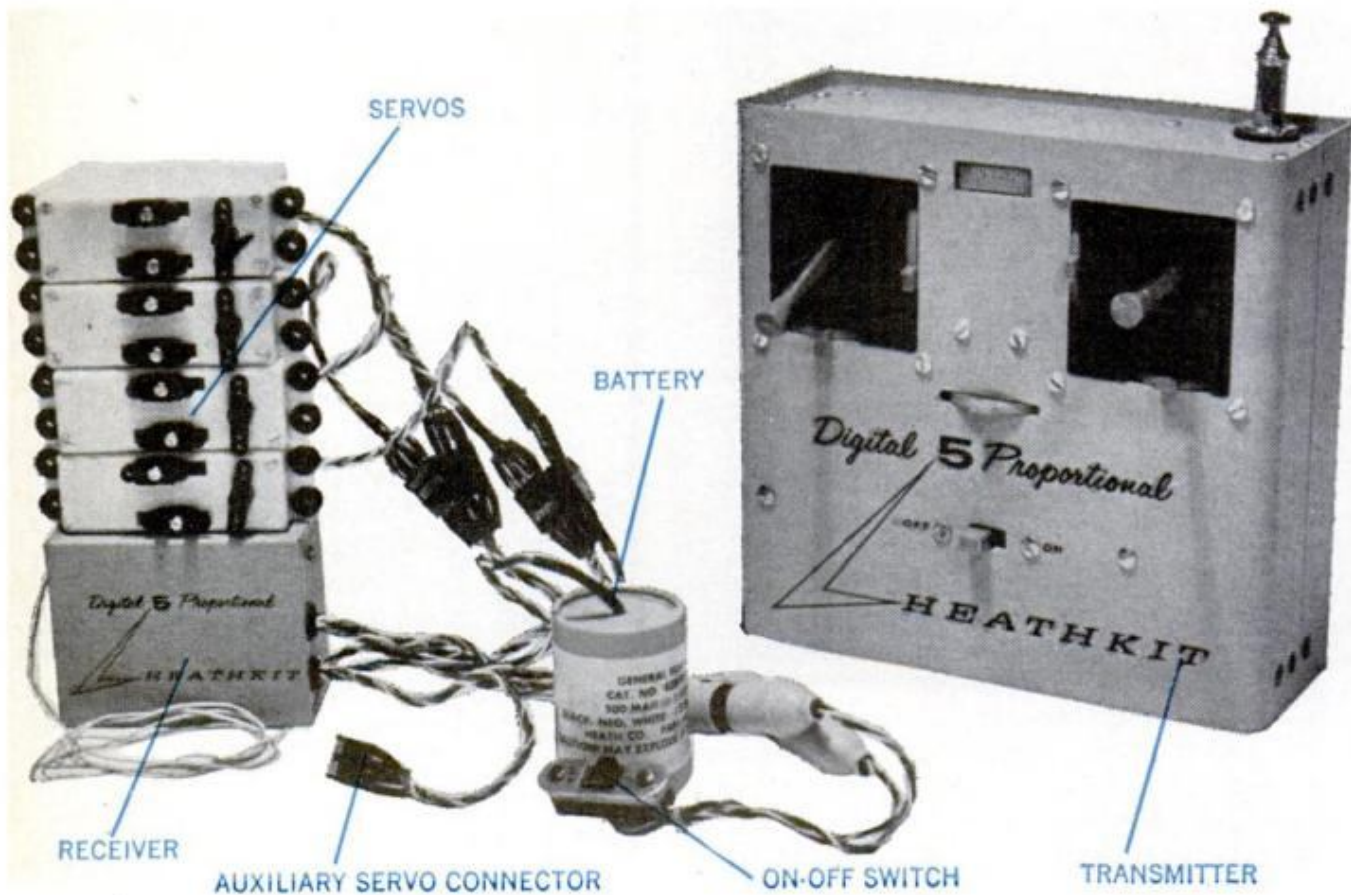


ALUMINUM PLATE holds all but steering R/C components. Under this plate, install the asbestos sheet to reduce vibration and prevent R/C gear from becoming soaked with fuel from exhaust. Linkages, body will complete gasser

R/C
SPECIAL SECTION

R/C
SPECIAL
SECTION

Control your gasser, plane or boat with this 'FULL HOUSE' KIT



IN R/C TERMINOLOGY, a "full-house" is a 5-channel system, or a radio-control rig with 5 separately controlled servos. This means that in a sophisticated model sailboat, for example, you could control the tiller, set the mainsheet, set the jib, raise and lower the mainsail and even control a reversible auxiliary motor—from a mile away!

The fifth servo, however, would be useful only with such highly complex and exotic models; thus, Heath's GD-47 kit, like most commercial "full-house" systems, includes only four servos, with a built-in auxiliary channel that can be used with a fifth servo (\$21.50) if needed.

As with all Heath kits, the GD-47 works faultlessly if instructions are followed to the letter. Working carefully and double-checking component placement, you can easily complete the entire system in less than 25 hours. In fact, I know a 15-year-

old who never used a soldering iron before, yet completed his father's kit in 14 hours—and made only one mistake.

The single biggest feature of the GD-47 is in the design of the servos, where the feedback element (or balancing circuit that controls the amount and direction of mechanical movement) is a variable capacitor instead of a conventional potentiometer. The moving wiper of a potentiometer in time can wear away the resistance element, producing noisy, erratic and eventually, a complete failure of operation. A capacitor element eliminates this by bypassing the wear due to friction—feedback instead is dependent upon the intermeshing action of two plates insulated from each other by a polyethylene film. Heath's price of \$219.95 may seem high to the uninitiated, but to R/C buffs, it's less than half the cost of comparable systems.—Leonard E. Sabal

Basic R/C Systems

ALTHOUGH there are six types of radio-control equipment, there are only two classes—inexpensive and expensive.

The inexpensive systems use the simple units that most people still think of when radio-control is mentioned. These include the escapement, the step servo and the "multi." The escapement-type actuator is usually a rotating mechanism that's "loaded" by turning it against a rubber band. A pawl connected to a relay releases the gear-like mechanism each time the transmitter button is depressed. Simple enough, but to give a "right" signal, it's necessary first to go through "neutral" and "left."

The stepped or three-position servo does away with the rotating mechanism, but still gives only full right, full left and neutral positions.

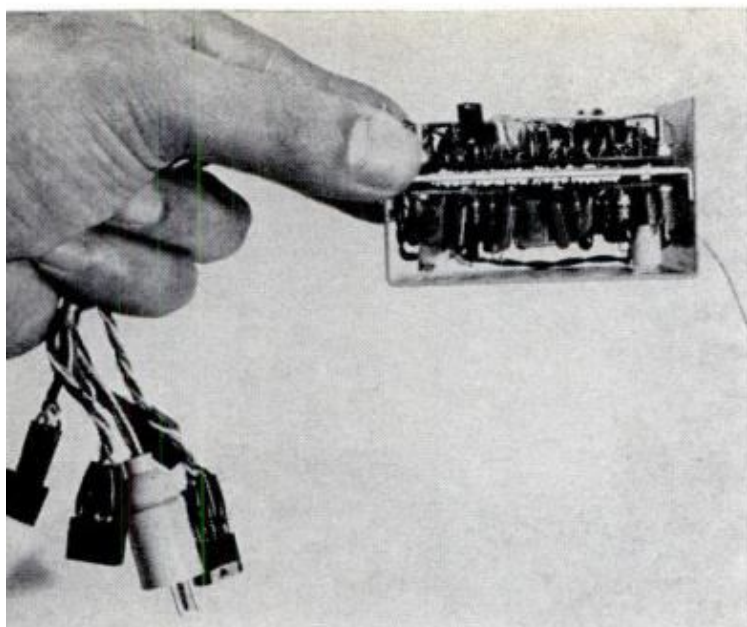
The "multi" system is the most popular of the inexpensive systems, since it can control more than one function. It does so by transmitting different tones that actuate reed relays tuned to a specific tone or frequency. When the relay resonates it signals the servo. But here again, you can only control it with full left or right movements of the servos.

The newer, expensive systems overcome these disadvantages in different ways, but all provide proportional control; that is, if you move the control stick 20 percent to the right, the servo will also move 20 percent to the right. Signal 100 percent movement, and the servo moves accordingly.

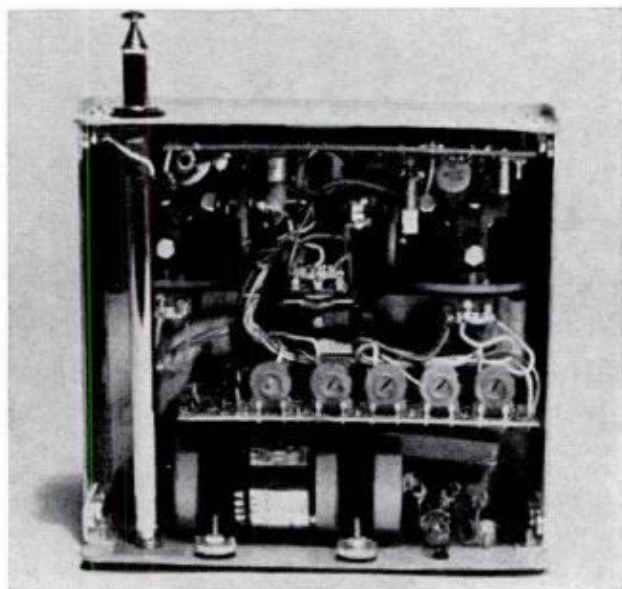
The three types of proportional control systems are the pulse, analog and digital. The pulse type operates basically by taking an on-off pulse (like that used for the inexpensive units) and switching it on-and-off according to the position of the control stick; that is, 50-on and 50-off pulses mean neutral servo position, while 60-on and 40-off pulses move the servo proportionately.

Analog systems vary the tones (according to the position of the control stick) at the transmitter, then compare the tones at the receiver and pass the difference (or the stick position) to the proper closed-loop feedback servos.

Digital systems operate by sending pulses of different durations sequentially. The receiver and decoder network sorts out the sequential pulses and applies them to the proper closed-loop feedback servo. Is it any wonder that proportional R/C is expensive? ★★

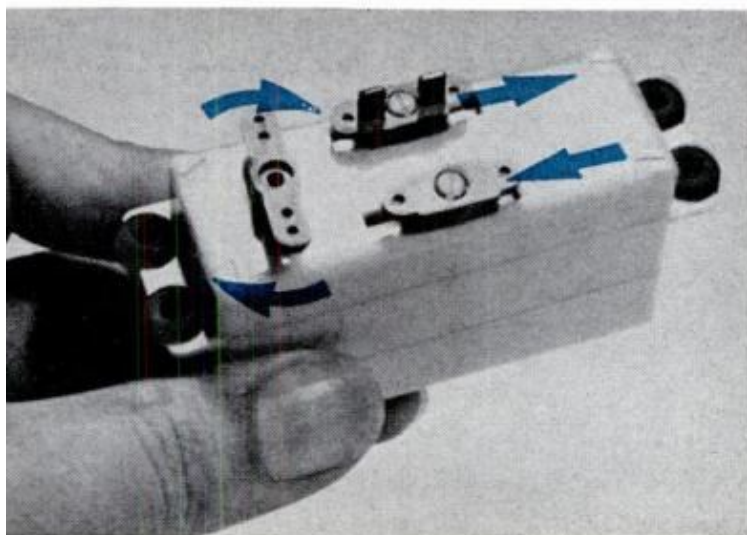


RECEIVER consists of two circuit boards, one for receiver components, the other for the decoder circuit




TRANSMITTER has two separate boards for encoder and transmitting circuits. Latter comes preassembled

SERVOS feature three takeoffs that operate simultaneously, but in different directions as shown below



Complete Guide to Weatherstripping



Modern materials
make it easy to
stop those drafts.

By ARTHUR MIKESELL

NEW MATERIALS, NEW SHAPES, all sorts of special-purpose hardware—weatherstripping has come a long way from the days when a strip of felt was the standard means of stopping drafts.

To get an expert's opinion on today's weatherstripping materials, I contacted Paul Floyd, vice-president of the Macklanburg-Duncan Co., one of the largest companies in the business. Floyd has been around the weatherstripping field for over 30 years, and since M-D makes almost all types of weatherstripping, he has no special axes to grind. Here's what he said:

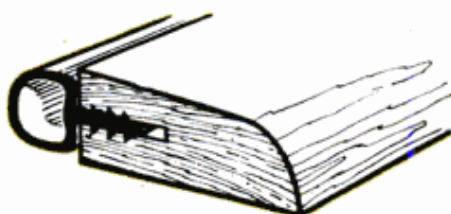
Vinyl—"It's an excellent material for weatherstripping, because it's tough, flexible and has a long life. M-D's NuKoil, for instance, is hemmed with flexible aluminum and will last indefinitely in any climate."

Foam—"The type with an adhesive backing is relatively inexpensive and simple to apply. It has almost 100 percent compressibility, so it makes a very efficient weatherstripping. However, it tears more easily than other materials, and you have to be careful when painting around it because the foam loses its resilience if coated with paint. This type of weatherstripping is usually installed with the idea of getting the job done quickly at the least possible cost. It's a stopgap solution (literally) designed to last through one winter, though under ideal conditions it may hold up for as long as three years. Incidentally, one unusual problem with foam that we keep hearing about has to do with small children. When doors are left open during good weather, a toddler will discover the foam and have a fine time tearing it into little pieces."

Vinyl-covered foam—"This is a very fine weatherstrip. It has splendid recovery in cold weather and is almost impervious to all deteriorating weather conditions—ozone, sunlight, salt and anything causing corrosion. Thus, it's a wonderful utility strip for use almost anywhere, even on trailers or boats."

Felt—"Shop for all-wool, preshrunk felt and you'll get a fine weatherstrip. Inexpensive hair felts, on the other hand, are poor substitutes for quality felt. Good felt has excellent resiliency and fine wearing qualities. It's been used in door-bottom strips for 40 years or more. For many years, it was also used in large commercial windows, though other materials

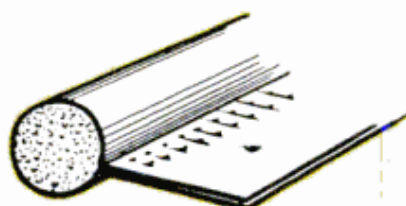
UTILITY STRIPS



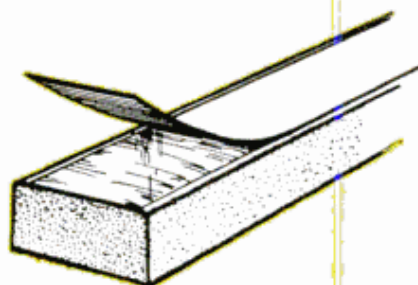
WOOD-BACKED VINYL



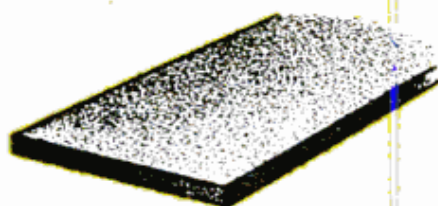
ALUMINUM-HEMMED VINYL



VINYL-COATED FOAM



ADHESIVE-BACKED FOAM



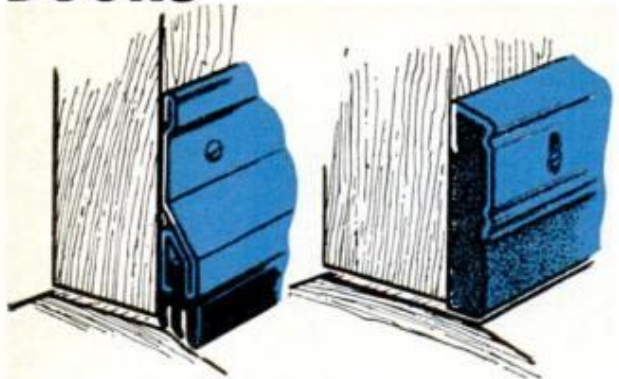
FELT



ALUMINUM-HEMMED FELT

MOST POPULAR TYPES of weatherstripping are those that can be used almost anywhere. In many cases, however, you'll get better performance from some other product designed specifically for one kind of application, such as sealing around doors or windows

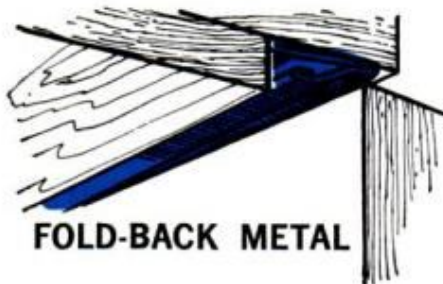
DOORS



TRIPLE-EDGE VINYL **FELT STRIP**



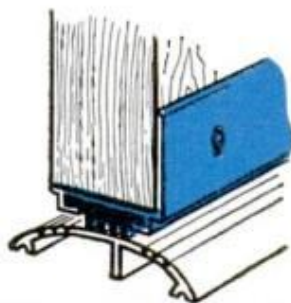
VINYL BULB



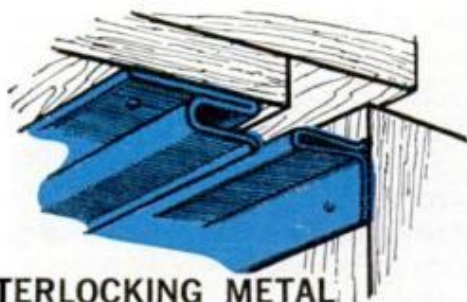
FOLD-BACK METAL



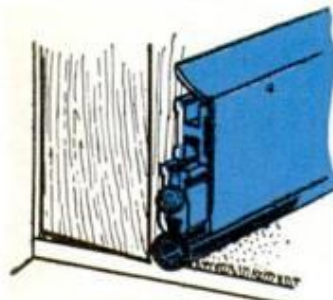
VINYL BULB



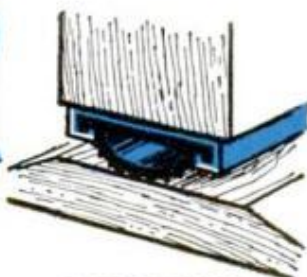
VINYL AIR-BAFFLE



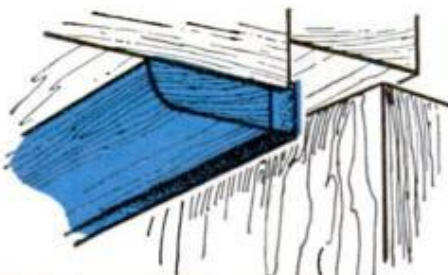
INTERLOCKING METAL



AUTOMATIC



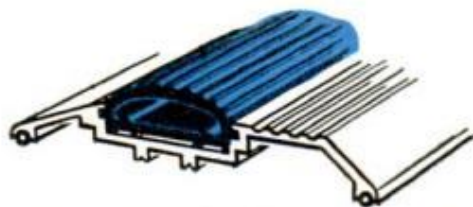
CONCEALED



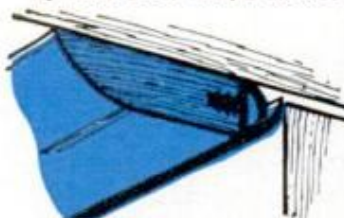
WOOD-BACKED FOAM

DOOR BOTTOMS come in an endless variety of shapes and materials. Most are designed for mounting on the outside of the door and feature some sort of flexible contact material which presses against the threshold when the door is closed. Others locate the gasketing material under the bottom edge of the door. Macklanburg-Duncan's automatic model raises when the door is open to clear the carpet inside

DOOR STRIPS are either mounted on the stop or on the frame where they are concealed when the door is closed. General-purpose strips could also be mounted on the stop, but the more rugged construction of special door strips makes them better suited to job



SNAP-IN VINYL INSERT



WOOD-BACKED VINYL FLAP/BULB



VINYL FLAP



PLAIN METAL

DOOR STOPS, like these M-D and Portaseal products, replace the regular wood stops and include some type of built-in sealing strip. While most people probably would choose to use one of the standard door strips with the old stop, rather than replacing it with a weatherstripping stop, these products should be kept in mind if you plan any remodeling which might involve relocating doors. They offer concealed weatherstripping protection in one neat package

THRESHOLDS may be used for weatherstripping if you're rebuilding a door frame or adding a new door. Some have vinyl strips; others are metal which works well with door bottoms, won't warp or wear

have since replaced felt in such installations. The type hemmed with flexible aluminum, designed primarily for use around doors and windows, can be installed easily by almost anyone. As with foam, however, you have to be careful to avoid getting paint on the felt."

So much for the basic materials—how about prices? With weatherstripping, as with most home maintenance materials, you get just about what you pay for. However, the difference in cost between quality weatherstripping and less expensive types is actually very small. Permanent metal weatherstripping is priced little higher than stick-on foam, yet will last many years instead of a single winter. The big difference is in installation time.

With the metal, you have to spend an hour or so driving nails or screws. To a somewhat lesser extent, the same thing holds true for simple tack-down and rope-type strips having a tacking flange.

Obviously, the best approach is to spend a few cents more and take the time to install permanent weatherstripping. If you can't take the time, or would prefer to put off the job until spring, stick-on foam will do an excellent job of sealing out that cold air for at least a year and can be installed in a matter of minutes. If pos-



GARAGE-DOOR BOTTOM nailed along the lower edge of door not only plugs leaks but acts as cushion

DECEMBER 1968

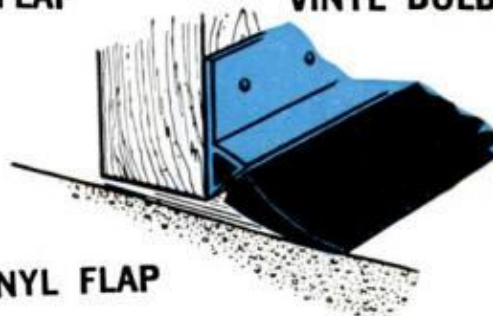
GARAGE DOORS



DOUBLE VINYL FLAP



VINYL BULB



VINYL FLAP

BOTTOM STRIPS not only seal out drafts but make an efficient barrier against dirt. In varying degrees, they also act as cushions to absorb the impact when the door is closed. Vinyl is the most popular material here, though the mounting systems differ greatly



VINYL BULB



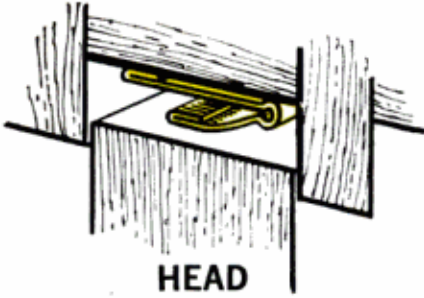
VINYL FLAP

EDGE STRIPS often have same configuration as bottom strips, but are generally somewhat lighter in construction. They offer a tight positive seal along the sides and top of any kind of garage door

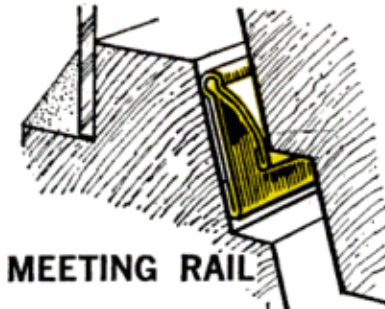
sible, though, wait for a warm day before installing the foam. The glue begins to lose its tackiness in freezing weather.

There are two basic types of weatherstripping installations—those that are concealed when the door or window is closed and those that remain visible at all times. The latter project slightly, cutting down on both the height and width of the opening. In doors, especially, they are often

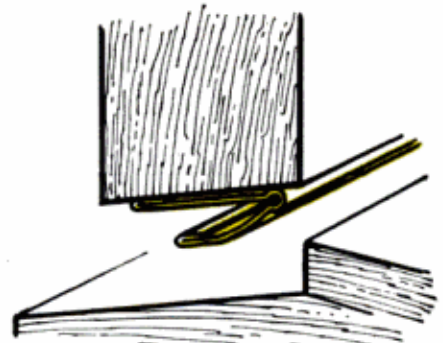
WINDOWS



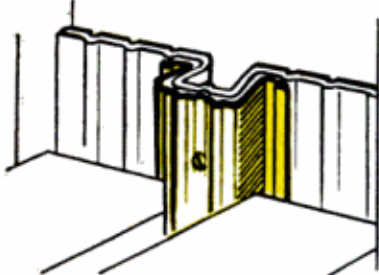
HEAD



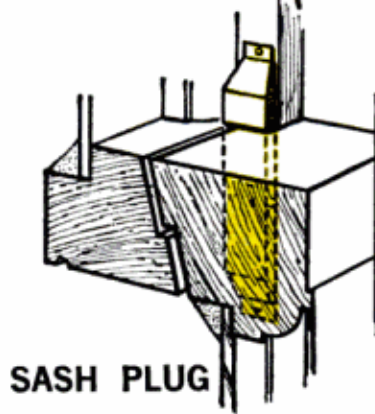
MEETING RAIL



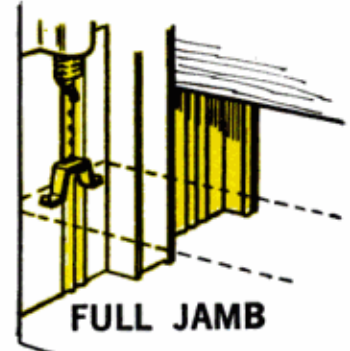
SILL



SASH SEALER



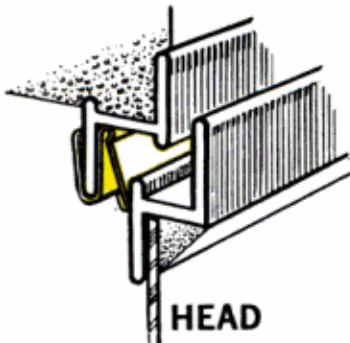
SASH PLUG



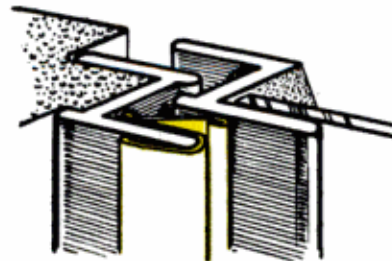
FULL JAMB

DOUBLE-SASH WINDOWS are best sealed with concealed metal weatherstripping. Use spring-type metal strips on the horizontal joints and a double-spring-type strip over the parting strip to block any air leaks along the sides. Felt-backed sash plugs complete

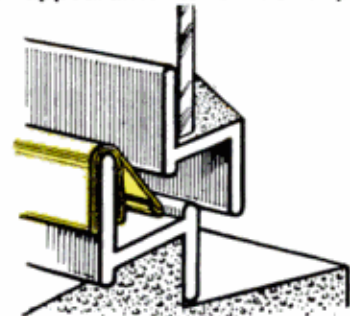
the job by closing any small openings on either end of the meeting rail. Of course, general purpose strips could be used to seal all of these joints, but they would be suitable only in utility installations where the appearance is of no importance



HEAD



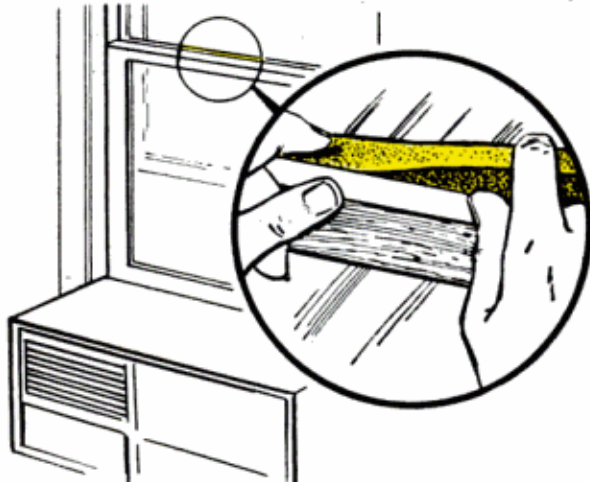
EDGE



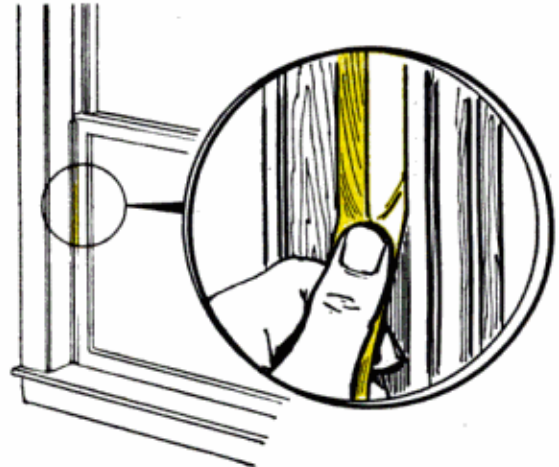
SILL

CASEMENT WINDOWS can be weatherstripped easily with clamp-type strips which slip over the edges. Just mount strips on the head, swinging edge, hinge side and sill. For best results, miter all weatherstrip-

ping corners. At least one type of metal casement-window weatherstripping is soft enough to be cut to length with scissors. As with other installations, felt or foam could be used, but wouldn't work as well



FOAM PLUG



TRANSPARENT TAPE

AIRCONDITIONERS designed for window mounting make it necessary to leave the lower sash in a raised position, leaving a gap between the top of this sash and the panes of the upper sash. Sears Roebuck's simple solution to this is a 1¼-in.-sq. strip of foam designed to be wedged down between the two sashes

TRANSPARENT TAPE sold by Mortell is a tough poly formula designed specifically for weatherstripping. Use it to cover cracks around airconditioners, or as a one-winter seal for leaks around loose sash. This comes the closest to caulking, because it doesn't allow for movement between the surfaces



AUTOMATIC DOOR BOTTOM raises when door is open to provide clearance between door and rug

damaged by furniture being carried into the house. The concealed types are completely protected by the door when it's closed, and partly protected by the door stop when the door is open.

The best time to shop for weatherstripping is in the fall or early winter. Since it's a seasonal product, dealers hate to give weatherstripping precious shelf space during the spring and summer months when people forget about drafts. You can find the various types of general-purpose stripping even in June or July, but the less common products are more likely to be in stock in the fall.

Though weatherstripping is still considered a seasonal product from the dealer's point of view, its year-round benefits are now being recognized with the growth of airconditioning. The same gap that lets in cold air in December will allow cool air to escape in June. Sears Roebuck even has a special weatherstripping product for use with airconditioners—a long block of foam to wedge between the upper edge of the lower sash and panes of the upper sash. It does a fine job of plugging a leak most people don't ever notice.

Check the accompanying drawings for the various types of special weatherstripping available today. This is only a small sampling of the many different kinds now on the market. If your dealer doesn't have the one you want, chances are he sells something very similar that will work just about as well. ★★★

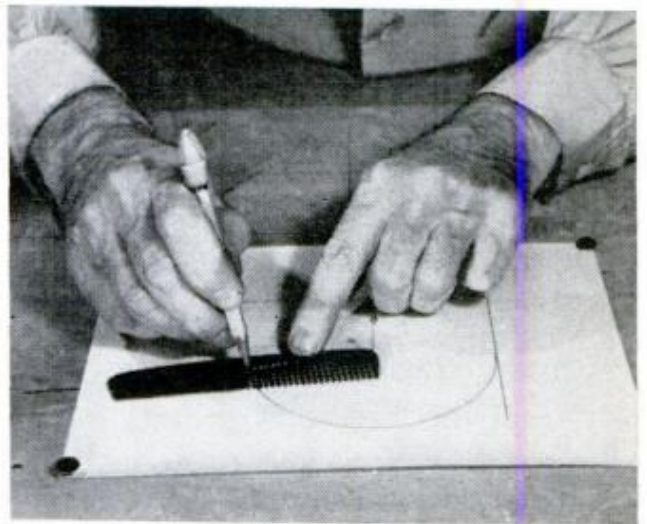
DECEMBER 1968

HINTS FROM READERS



Use saw to tear sandpaper

One of the quickest ways to dull a knife or scissors is to use either one for cutting coarse sandpaper. A safer approach is to press a straightedge over the sandpaper along the cutting line and tear instead of cut. Even better, use the toothed side of a dull handsaw. The serrated edge makes a neat tear every time.



Comb makes emergency compass

Lacking a regular compass, you can make a very practical substitute from a pocket comb. Drill a small hole in one end of the comb and insert a thumbtack or pin to serve as a pivot. Then place a pencil between the teeth of the comb at a distance equal to the desired radius and draw the circle.

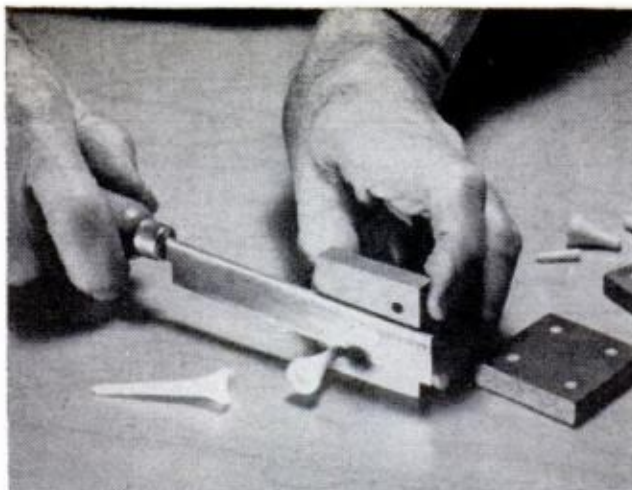
169

HINTS FROM READERS

Plastic golf tees make inlays

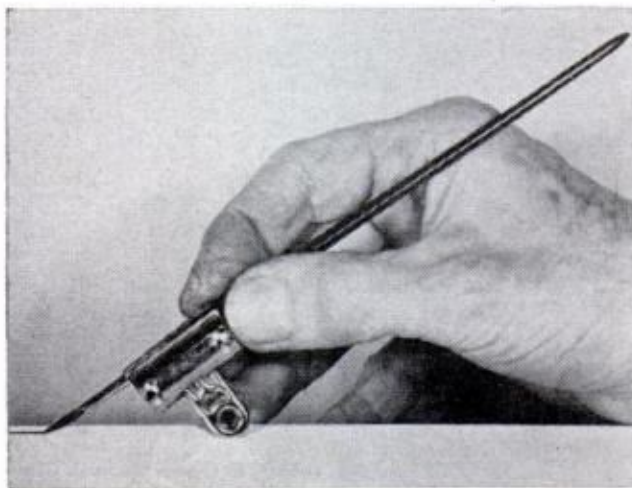
Expensive ivory inlays can be simulated for pennies with plastic golf tees. Roughen a tee stem with sandpaper and drill a hole slightly smaller than the top of the tee. Apply glue to both the stem and hole, drive tee into the hole, cut off the projecting portion near the surface. Use a file and fine-grit paper for final smoothing.

—Henry Dykes



Guide steadies striping brush

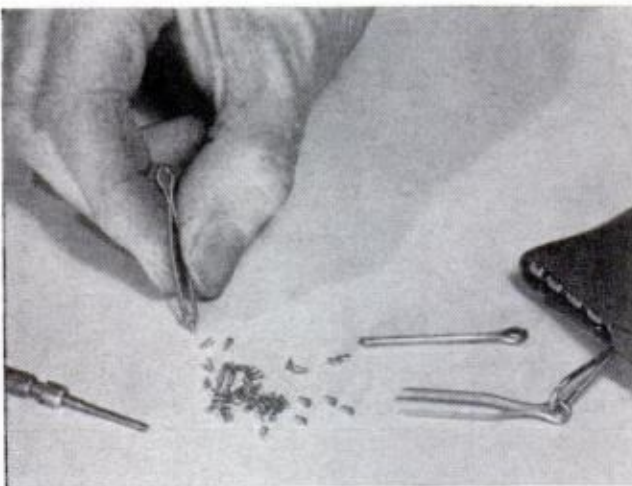
A good striping job requires a keen eye and a steady hand. If your artistic talents are a bit below professional level, simplify the whole operation by clamping the brush in a small clamp-type paper clip. In use, the handles slide along the edge of the work and straddle the pattern line, also form a moving pivot for the brush, making it much easier for you to maintain the proper angle between brush and surface for a stroke of desired width. Practice before you tackle the real thing.



Tiny tweezers from a cotter pin

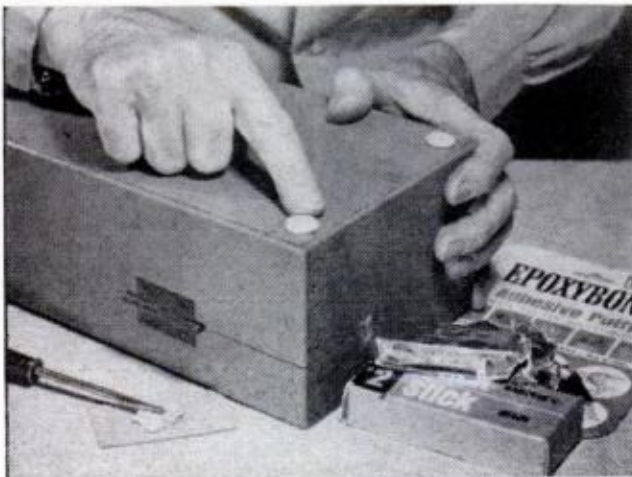
It only takes a couple of minutes to turn a cotter pin into a miniature pair of tweezers. First, file the ends even. Next, file the tips to the desired configuration, either a flat spade end or a blunt point. Finally, bend the ends of the legs approximately $\frac{1}{4}$ in. apart, making sure the loop remains almost completely closed so you can slip it over a key ring or other holder. A slight opening in the loop will make the tweezers easier to use.

—Walter E. Burton

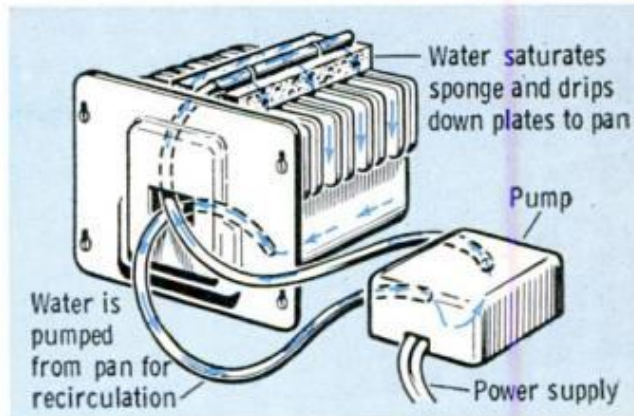
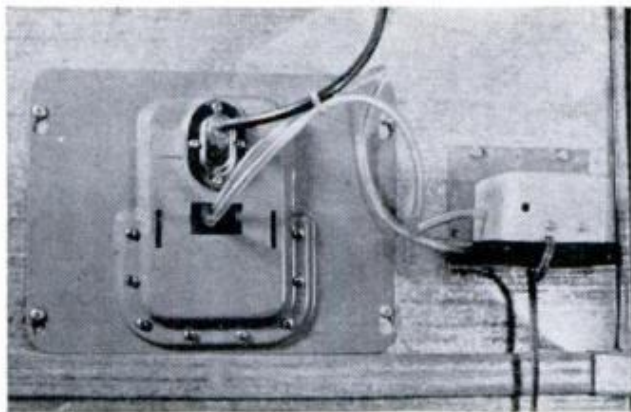


Putty feet for tabletop cabinets

Epoxy adhesive putty can be used to make button-type glides for index boxes, small cabinets and other objects which normally sit on a table or workbench. Simply mold a ball of the putty to shape with your fingers and press it into position on the bottom of the cabinet. Allow plenty of time for it to harden before turning the cabinet upright. With wood cabinets, you can add extra holding power by first driving tacks into the bottom and compacting the putty around the heads.



Pump Makes Plate-Type Humidifier More Efficient



This simple modification for your warm-air furnace humidifier will not only yield a tremendous boost in efficiency but stretch the useful life of those humidifier plates by many months.

Essentially, it consists of adding a small recirculating pump to the humidifier to pull the water out of the pan and pump it up along the top of the plates. From here, it drains down over the plates, keeping them saturated at all times, and is collected in the pan for recirculation.

The pump used was originally designed to pump air into an aquarium. It normally sells for under \$3. To use it for pumping water, you'll have to drill a hole in the housing for the water intake and install a

new gasket which can be cut from an inner tube.

Plastic tubing supplied with the pump is cut into two pieces. One leads from the pan back to the water inlet on the pump. The other is heat-sealed on one end with a soldering iron, then perforated along one side for a distance equal to the length of the humidifier pan. This perforated portion of the tubing is then attached to a piece of cellulose sponge about 1 in. wide and slightly shorter than the pan.

Since it's unnecessary for the water to be recirculated when the blower isn't operating, the pump is wired into the limit control so it will run only when the blower is operating.—C. W. Gaston

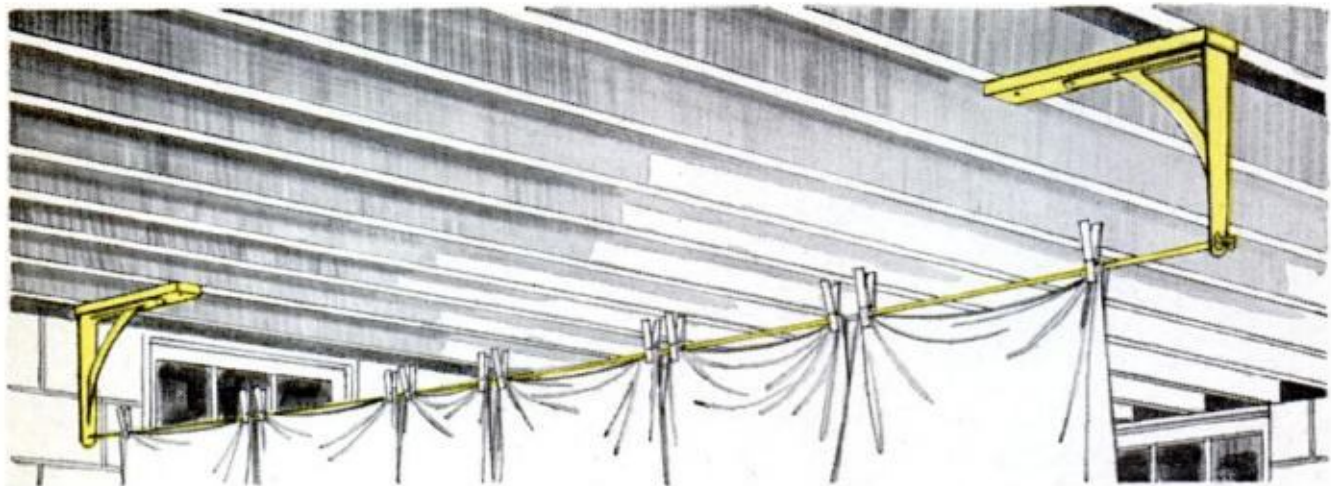
Bike-Basket Sling Cushions Load Against Bumps

Any bicycling enthusiast knows that if you carry your lunch in a bike basket over 20 miles or so of rough road, it's bound to be an unappetizing mess by the time you reach that noon rest stop. One easy way to solve this problem is to install a shock-absorbing sling in the basket.

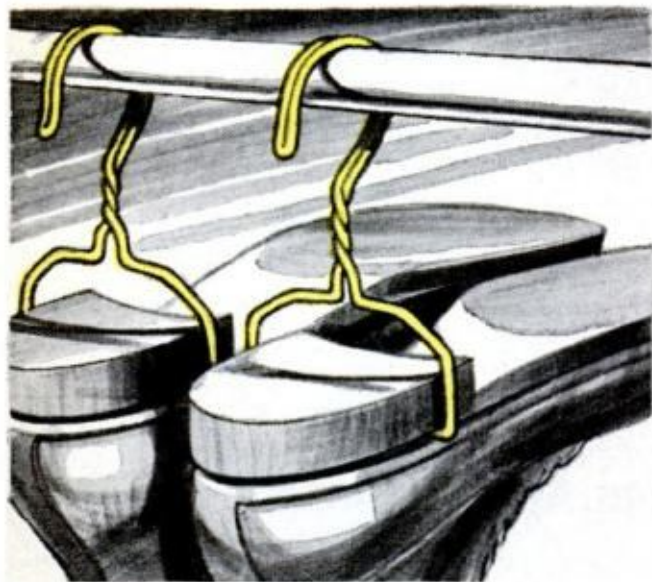
Just cut four strips of rubber from an old inner tube, making them somewhat longer than the width of the basket. Attach three of these to the upper rim of the basket. The fourth strip should be stretched over the top of the load to act as a hold-down.—John Hendry, Jr.



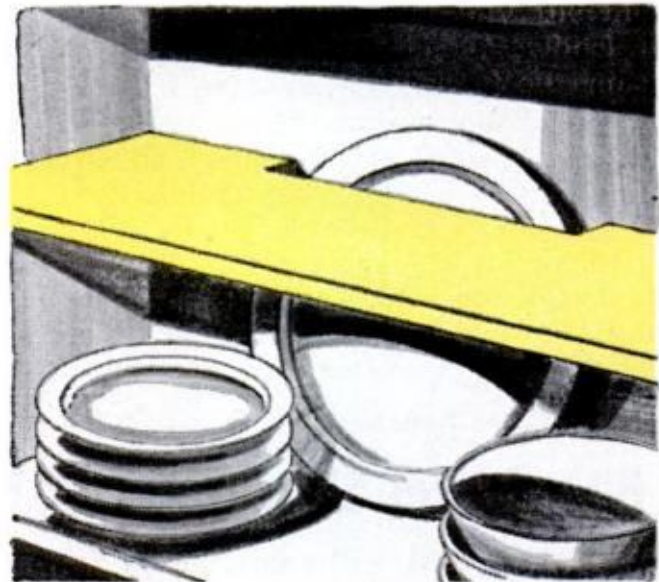
Solving Home Problems



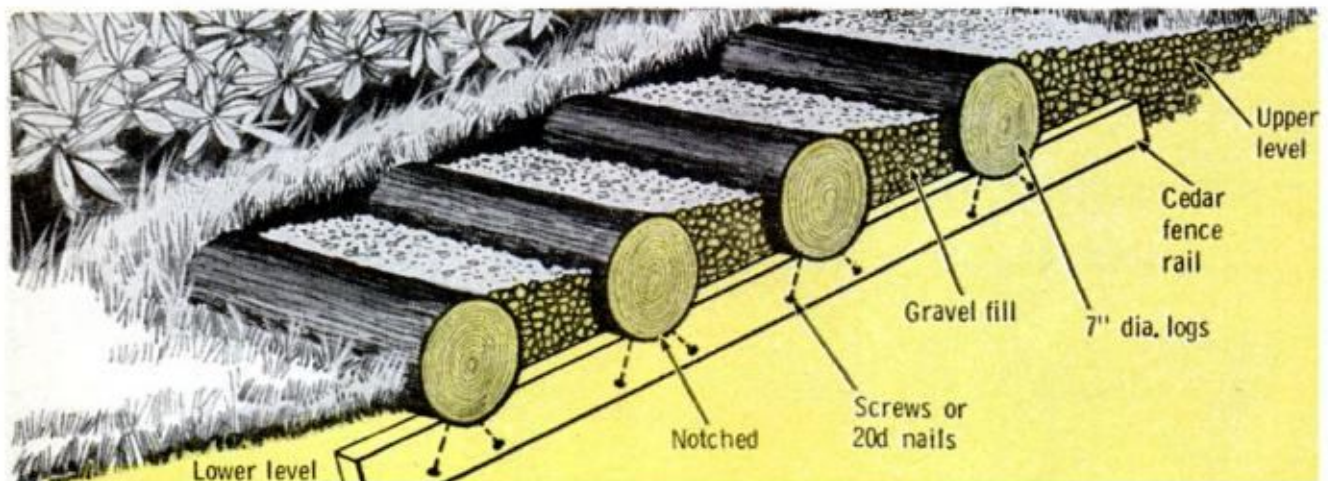
METAL SHELF BRACKETS make fine standoff anchors for mounting a clothesline in the basement. If the line is to run at right angles to joists, screw the brackets to 1x2 cleats spanning two pairs of joists, as shown



BOOT HANGERS are ideal for drying hunting boots or waders, also let you store such footgear off the floor out of way. Make them by cutting down clothes hangers and bending ends to clamp against heels



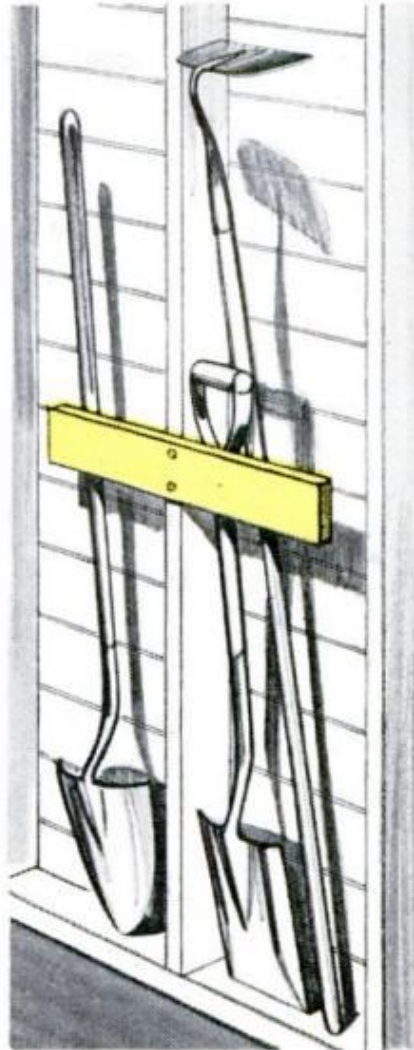
PLATTER NOTCH cut in the rear edge of a low shelf will provide the necessary clearance to store large, seldom-used platter in the back of shelf underneath. Brace bottom edge of the platter with a thumbtack



RUSTIC STEPS for a steep embankment can be made by nailing short logs to a pair of cedar stringers (use fence rails), then burying the stringers in the slope and filling the space behind each riser with fine gravel



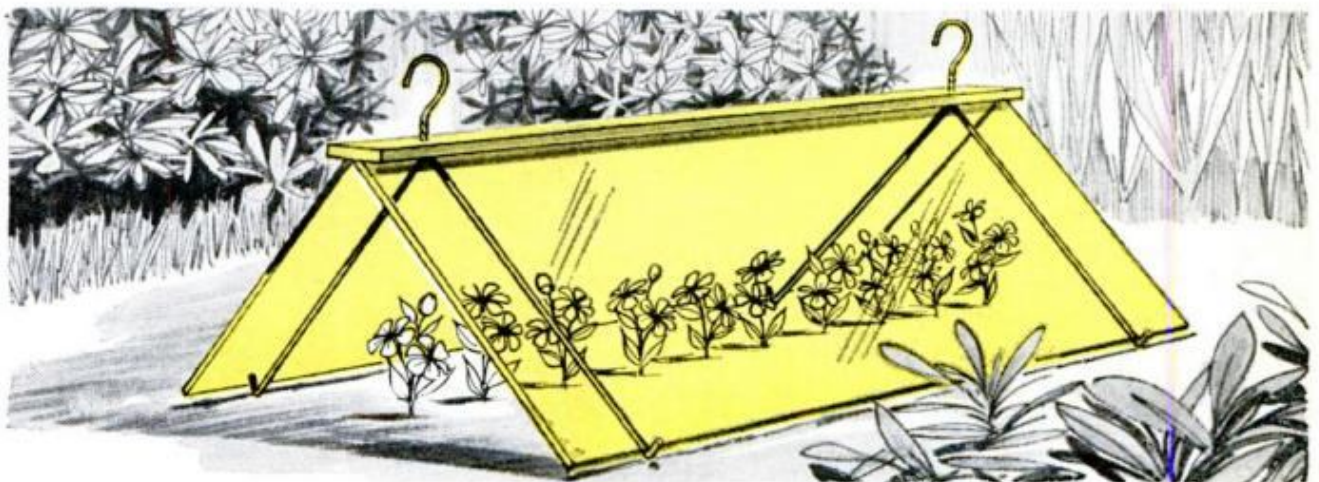
SAWHORSE SHOES will protect highly polished tile or hardwood floors during remodeling work. Just cut narrow slots in front panels of four cardboard milk cartons and slip these on feet of sawhorse. Angled tops act as runners to ride over any irregularities



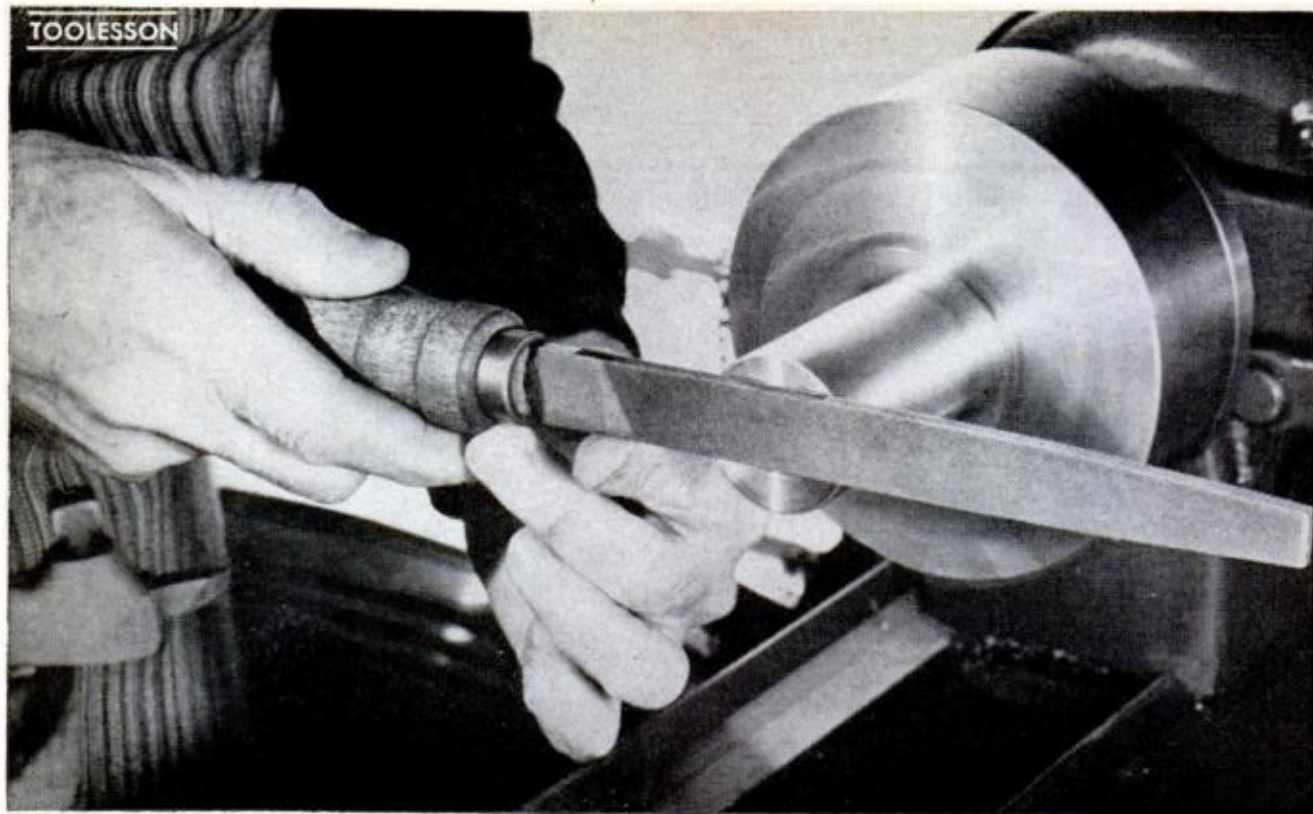
OPEN-END RACK in your garage wall holds long-handled tools between studs, requires no floor space. Nail short length of 1x3 stock to a stud, leaving openings between the ends of board and adjacent studs to permit removal of tools without lifting them out



TRASH BIN swings out from under your workbench, pivoting on a 1-in. supporting dowel which passes through box at the bottom. Ends of dowel rest in notched blocks anchored to floor, permitting bin to be lifted out easily for emptying when it becomes full



PROTECT YOUNG PLANTS with a portable garden frame made from a pair of modified coathangers and two panes of glass. A batten with holes drilled through it slips over hangers to brace them and hold glass



For a truly fine finish, try **FILING ON A LATHE**

By **WALTER E. BURTON**

A FILE IS MORE than just a useful lathe tool. True, it will produce a fine finish—smoother, in fact, than that made by the turning tool. But it can also reduce a diameter by the merest fraction of an inch or millimeter—or it can rapidly cut down a shaft for a drive fit in a pulley or a running fit in a bearing.

In seconds, it can whack off the center tip left by a cutoff tool as shown in the above photo. It can make and smooth round, vee, or other odd-shaped grooves and fillets on turned work. A file can also serve as a miniature taper attachment for such operations as converting rod sections into taper pins, and it can quickly produce a neat point on punches and scribes. A pair of files can be manipulated to smooth and size simultaneously a small-diameter rod that's too limber for regular machining.

In fact, almost any type of file could be used in some form or other for lathe work. A common, single-cut, mill file can do a good job of smoothing turned work

such as a shaft. Conventional three-square or triangular files are handy for touch-up work on small shoulders and grooves. For very fine finishes, or delicate shaping and sizing, Swiss-pattern files are often used. Even a conventional ignition file is handy



AS YOUR LATHE FILING NEEDS INCREASE, you'll find your selection of lathe files growing to this size

where a thicker one would not do the job.

Thus, the lathe owner will indeed find it worthwhile to obtain one or more "lathe files." These are similar to conventional mill files, but their tooth angle is steeper, so that they cut with a more pronounced shearing action. This results in less clogging, smoother cutting, less chatter, more freedom from drag and faster cutting action—but they tend to crawl sidewise a bit more readily than a conventional file. On a sample mill file, the tooth angle (measured with respect to file length) was approximately 65° ; tooth angles on similar lathe files are 45° .

The files you'll need

Perhaps you can handle most of your routine lathe filing with as few as two files: a 10 or 12-in. lathe file for rapid, rough work, and an 8-in. lathe file for finishing. For greater all-around filing

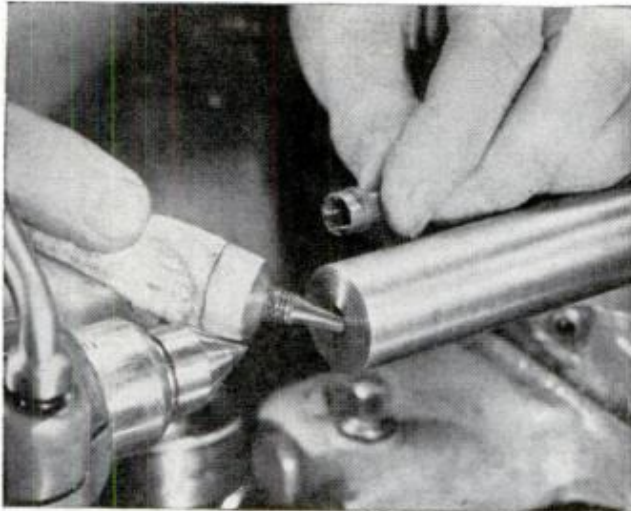
flexibility, however, you may want to supplement these with other files.

As a start, the Nicholson File Co. suggests: a 12 or 14-in.-long-angle lathe file for operations where a considerable amount of stock is to be removed rapidly (as when sizing a shaft for a drive fit in a pulley); a smooth-cut mill file for producing a smooth finish (as on a shaft where it is to run in a bearing) and a Swiss-pattern, hand or pillar file in No. 4 or No. 6 cut, for a very fine, smooth finish.

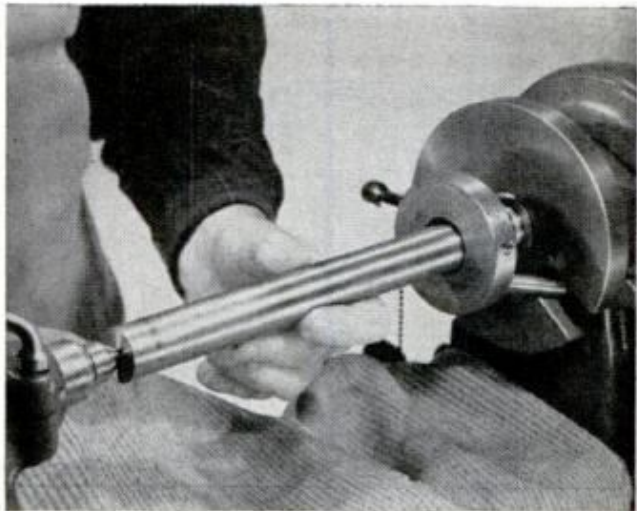
For a fine, *polished* finish, consider making an "abrasive file"—it's simply a strip of fine-grit or well-worn aluminum-oxide or silicon-carbide sheet abrasive. Tack or glue it to a flat wooden stick, or to a stick shaped for polishing contours.

Mounting the work

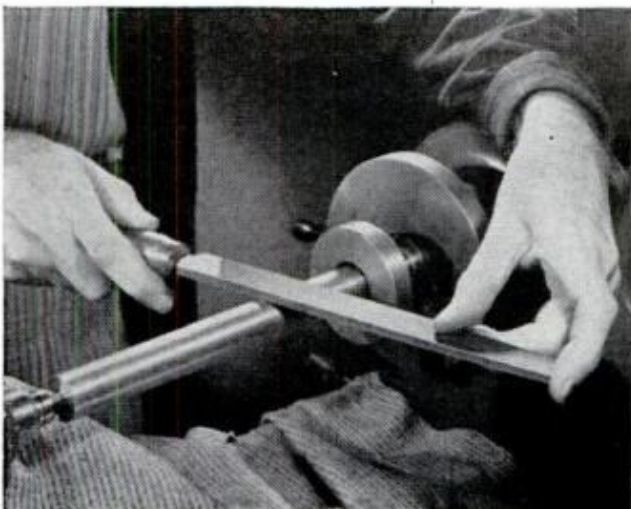
Procedures for filing work in a lathe are not very complicated. The workpiece



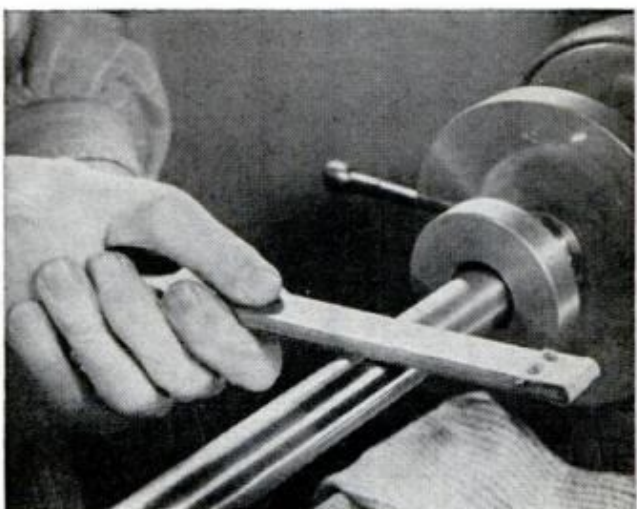
SINCE FRICTION will heat the work and cause it to expand lengthwise, centers must be well lubricated



LATHE CENTERS should not be tight, but should have enough play to allow a slight workpiece movement



A COARSE, FAST-CUTTING FILE can be used in first stage of filing, keeping it at right angle to work



FOR A FINELY POLISHED SURFACE, an abrasive file can be made of a stick and strip of abrasive cloth

can be mounted in a chuck or collet, or between centers. If between centers, remember that filing friction can cause the workpiece to heat-expand lengthwise and bind on the centers. To prevent this, put a little oil on the headstock center, and liberally lubricate the tailstock center. Then adjust center clearance so the workpiece can move freely.

Stop the lathe occasionally during prolonged filing and check for possible binding. If any squealing develops where the workpiece revolves on the tailstock center, stop the lathe immediately, loosen and relubricate.

Speed selection

For finish filing, run the lathe at a high speed—especially for any small-diameter work. But for simply filing off a sharp edge or tip, normal turning speed will do.

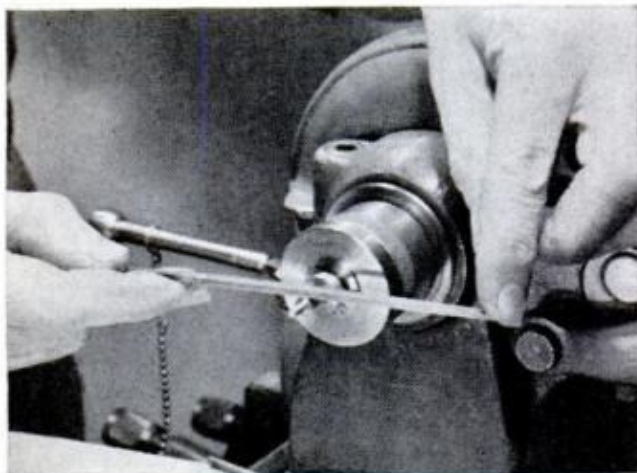
With smooth, even and medium-pressure strokes, keep the file moving across

the revolving work. Normally you should hold the file square with the work axis, or nearly so. You may find, however, that a smoother overall finish results if you move the file in a slightly diagonal path.

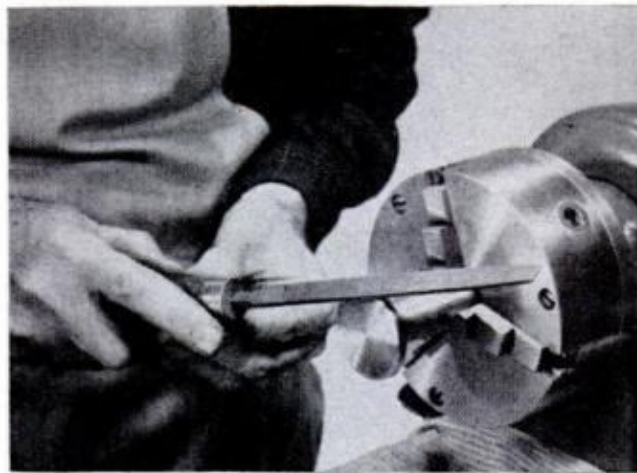
If the file begins to lose its bite, or if it tends to skip or cause streaks on the work, clean the teeth with a file card or small wire-bristle, suede-shoe brush.

Use oil judiciously

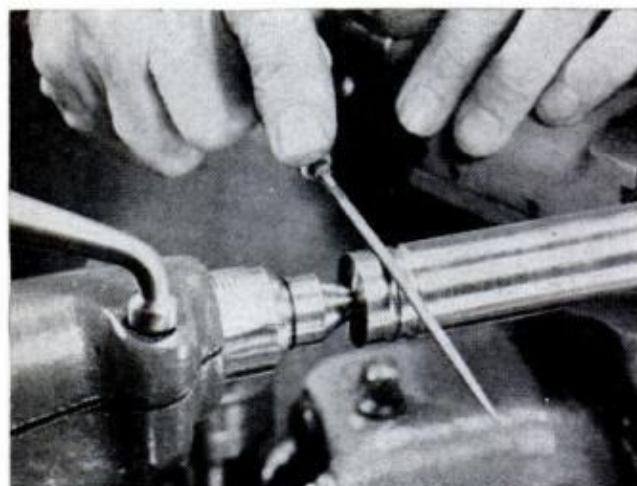
Although file technicians suggest that the surface be oil-free, you may find that a sulphurized cutting oil or similar fluid can be helpful. When filing a rusty shaft, a dash of cutting oil will minimize nose-irritating dust and also reduce the depositing of filings on the lathe bed and carriage. A sulphurized cutting oil I used on various occasions seemed not to decrease the files' efficiency, and perhaps it tended to reduce tooth wear. But because the oil does hold filings in the teeth, the



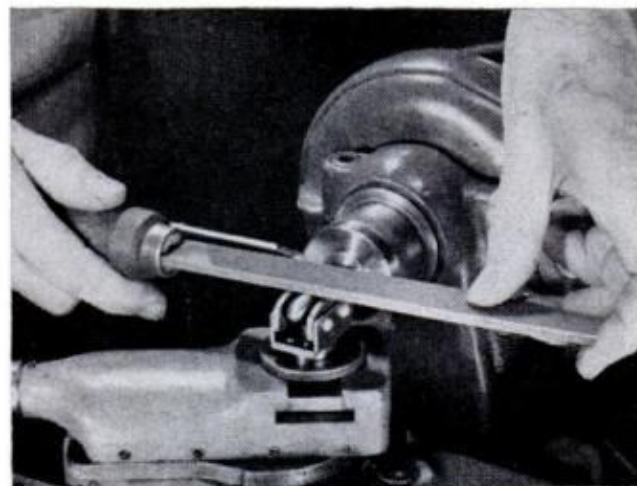
SMALL SWISS-PATTERN FILES are handy for shaping, smoothing small parts, such as this dimpling punch



DISC-SHAPED SECTIONS where a precise radius is not required can be both shaped and finished with files



GROOVED SECTIONS can be made or smoothed by using an appropriately shaped Swiss-pattern file



EASY-TO-MAKE GUIDE helps control the depth or degree of filing to produce bullet or dome shapes

accumulations had to be wiped off after just several strokes of the file.

Regular lathe files have "safe" edges—that is, the edges are smooth, without teeth. The file thus can be used close to a chuck or other part without tending to bite into it. If you use conventional files lacking such safe edges, be careful that the edge doesn't touch any moving surface. One practice is to grind toothed edges smooth before attempting to do lathe filing.

Safety first

When filing work that is revolving in a lathe, use sensible safety precautions. Hold the file firmly, and be careful that it does not catch on the workpiece to be tossed your way, or become entangled with a chuck.

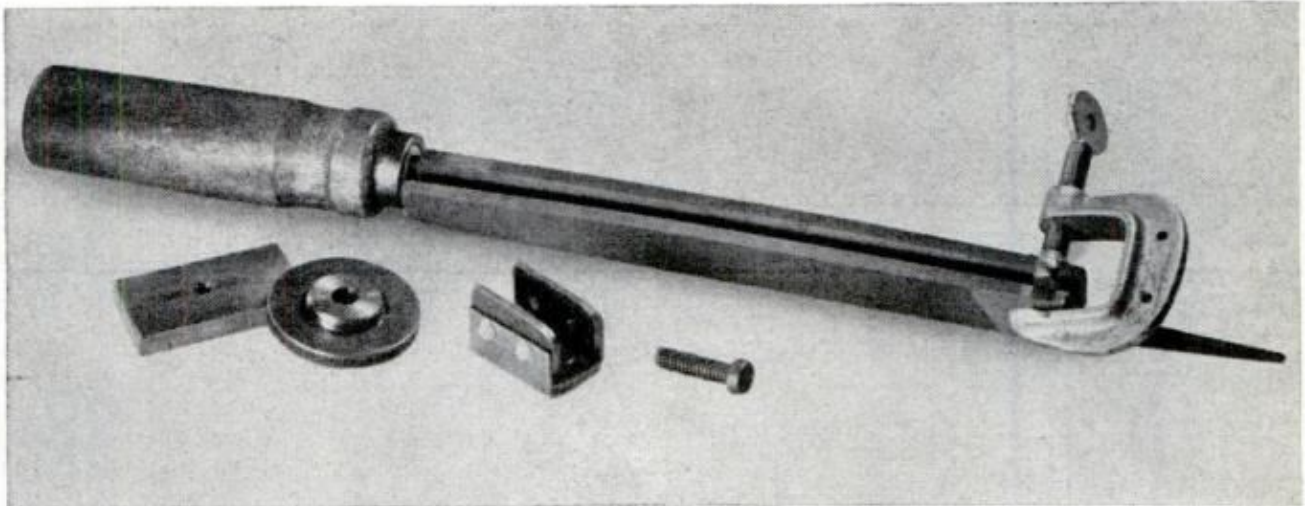
It's always a good idea not to stand directly in line with the file handle. When you reach over the lathe to grasp the

outer end of the file, be careful not to be grabbed by the chuck or dog. On your forearms, wear tight-fitting sleeves or, better yet, none at all.

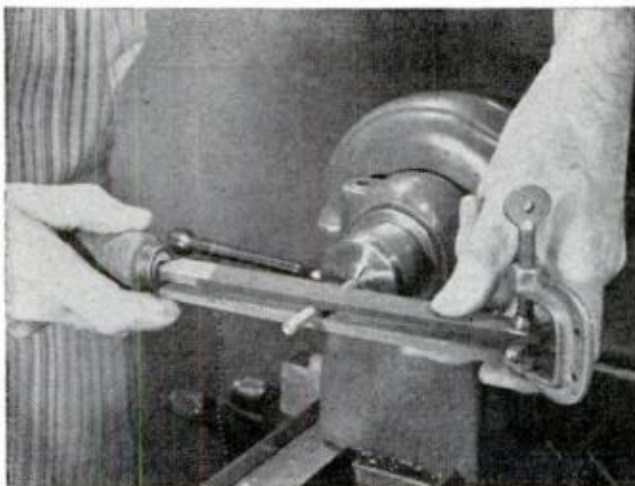
Taking care of files

The life of a lathe file can be greatly reduced by improper care or carelessness. Never throw a file into a drawer or toolbox—also avoid stacking them on top of one another. Instead, always keep them separate by hanging them in a rack placed out of the way so they won't be knocked off accidentally and damaged.

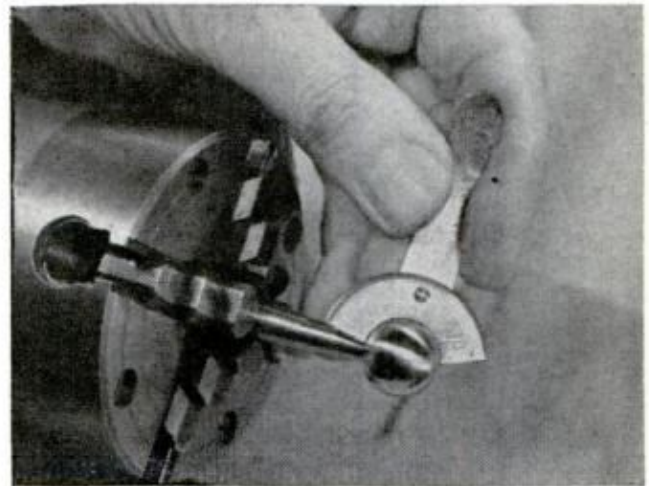
Before storing the file, however, make certain that all chips have been brushed out of the file ridges. If oil or grease is left on the file, it can be removed by wiping with a soft clean cloth, then rubbing chalk into the file teeth. A soft iron "pick" should also be kept on hand for removing troublesome filings that may become imbedded in the teeth. ★★★



FILING ATTACHMENTS and accessories include filing guide and two-file assembly for thin, limber rods



DOUBLE-FILE ASSEMBLY should be used at high speed. Cutting pressure is set by squeezing open end

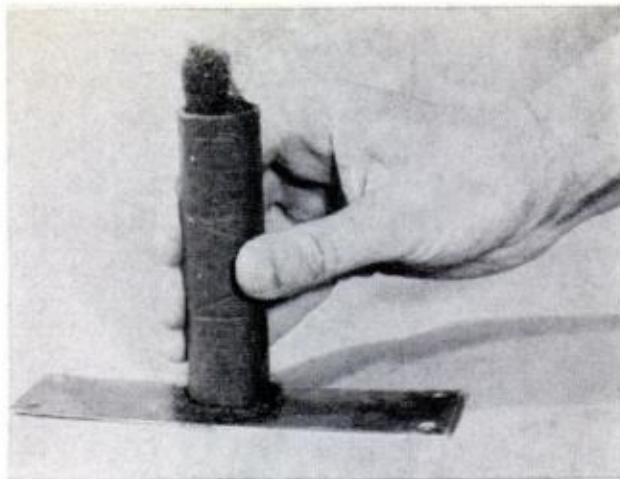


SIMPLE BALL-TURNING GAUGE can be formed from suitable washer, then used to check ball diameter

HINTS FROM READERS

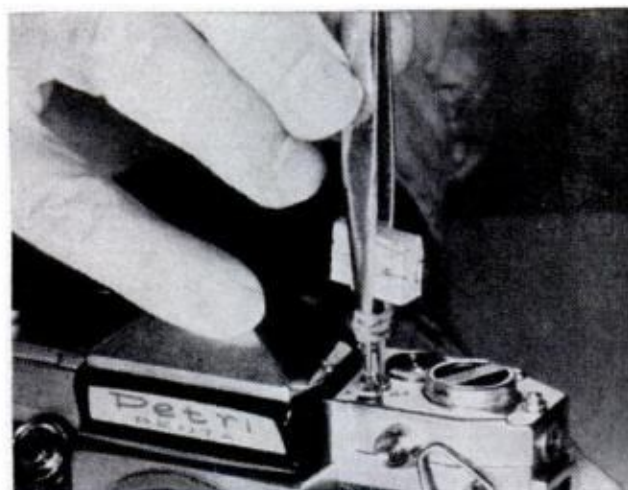
Safe holder for steel wool

Where it is not convenient to wear a glove when working with steel wool, a short cardboard tube makes a dandy holder to safeguard your fingers from metal particles. The wool is simply placed in the tube so it protrudes a bit from the end. A fresh supply is instantly available. Just push the wool out the end a bit and snip off the used portion.—*Ken Patterson*



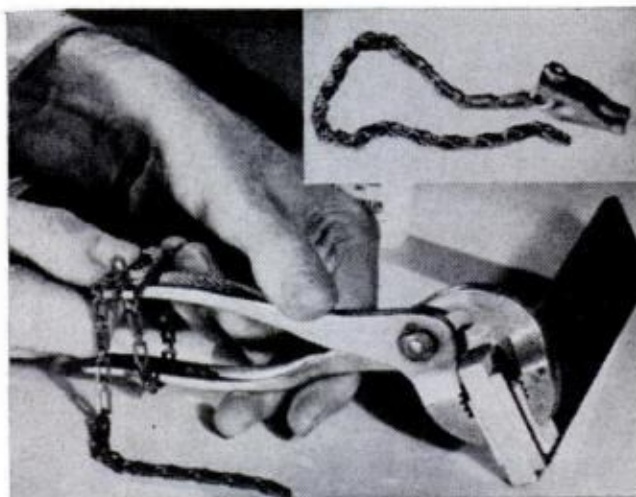
Tweezers to the rescue

Tweezers can be one of the handiest tools in your shop—they can even be used as a wrench. I found this out recently when I had to back off a tiny capscrew flush with the surface. I was stymied until I thought of tweezers. First I wrapped a rubber band several times around the legs to hold the ends tightly together. Then with a small block wedged between the legs, I pressed it downward until the tweezers opened just enough to span the screwhead.—*Walter E. Burton*



Pliers pinch hit as clamp

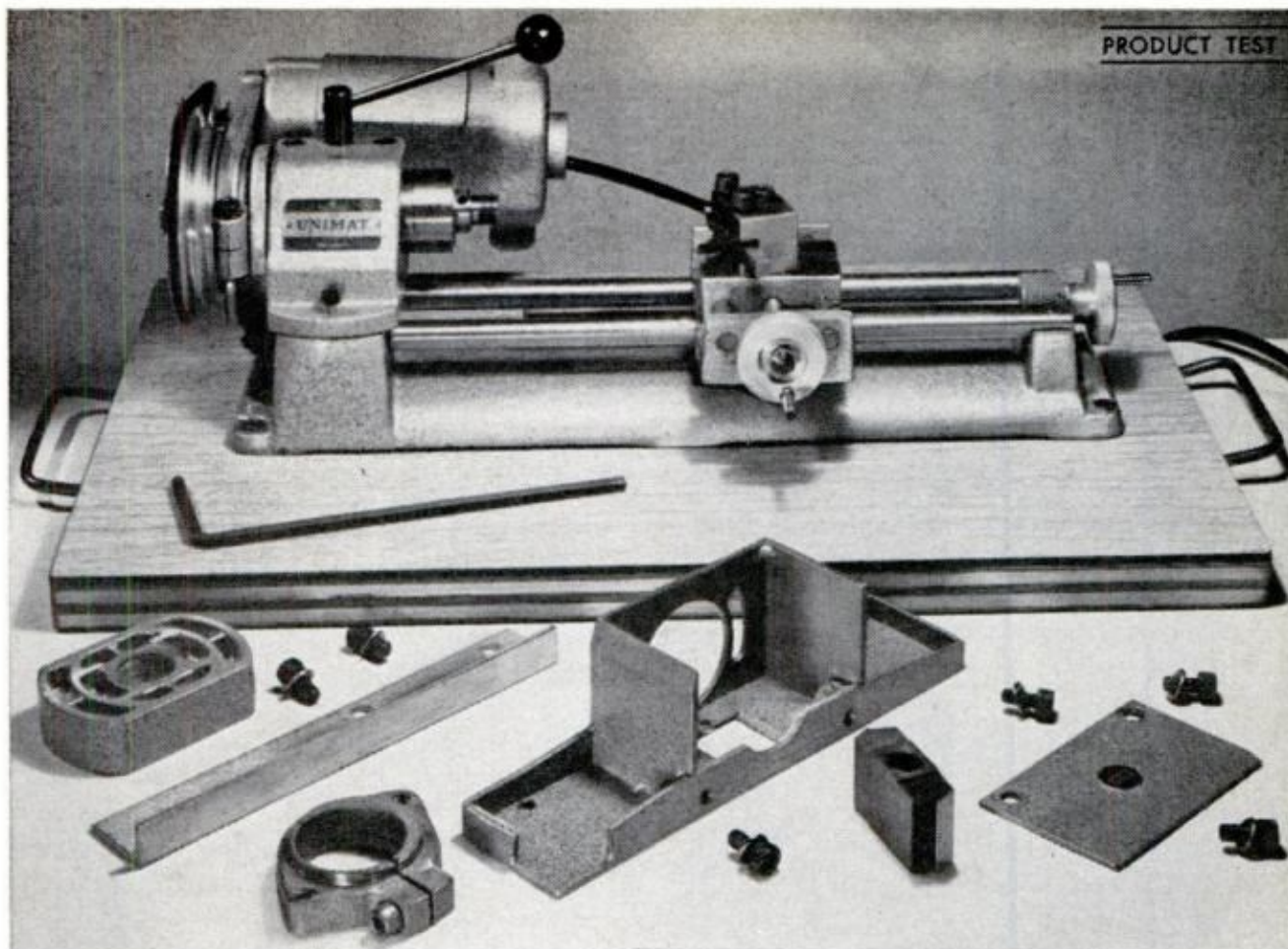
Your slip-joint pliers can be made extra useful by a notched steel block attached to a short chain; it can serve as a glue clamp. In use, the jaws are closed against the work and the chain is then looped around the narrow part of the handles and hooked in the notch. To tighten the grip you slide the chain toward the wider part of the handles. The original block measures $\frac{1}{8} \times \frac{1}{2} \times 1$ in. and is attached to the chain by a swiveling screw eye secured to the chain by a peened nut.



Oil preserves tool handles

When the wooden handles on your garden tools take on that weathered look, linseed oil will prove an effective tonic. First smooth down the rough handle with sandpaper and follow by swabbing the wood with a half-and-half mixture of boiled linseed oil and turpentine. Let stand a few days, then apply a second coating of linseed oil only. After an hour wipe off the excess and polish briskly with a cloth. You'll have a true "oil finish" to preserve the wood.—*Walter E. Burton.*





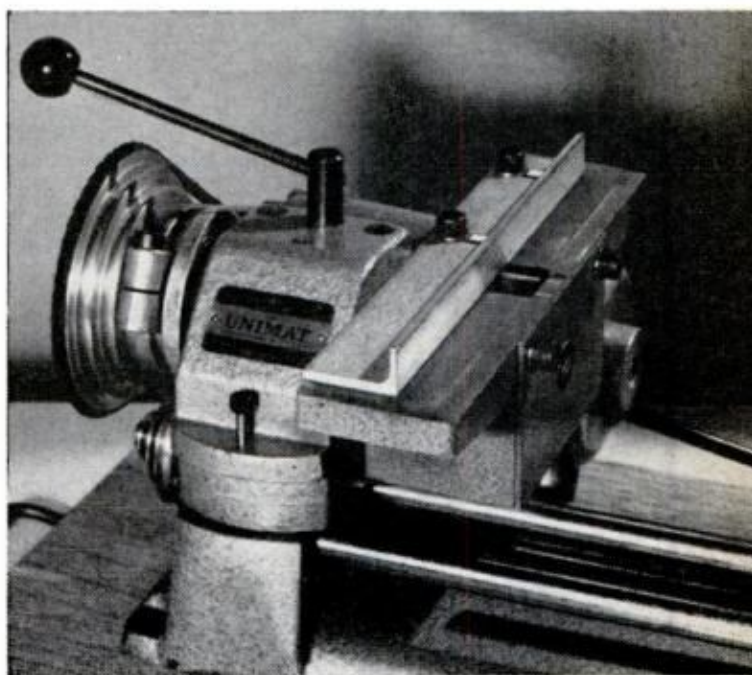
New Wood Planer Attachment For Your Unimat Lathe

By WALTER E. BURTON

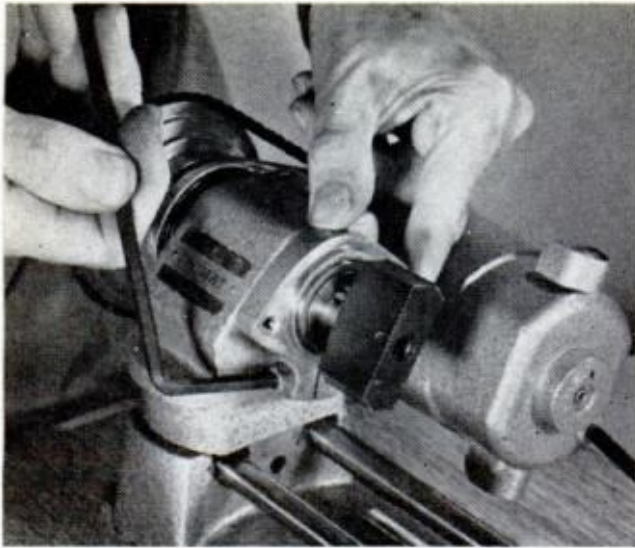
NOW YOU CAN EXPAND your 5-in-1 Unimat into a 6-in-1 machine. The trick is to fit it with Emco's new jointer unit capable of producing almost glass-smooth surfaces on wood and hardboard. Its 26-mm cutter will plane up to a generous 1-in. width in a single pass. By making more than one pass, wider areas can be smoothed.

The cutter is mounted on the Unimat spindle and can be operated over a range of 11 speeds, but the higher speeds are desirable for planing. I found that although a shaving cut of almost negligible depth can be made when the cutter is sharp, a somewhat heftier bite usually is desirable in wood and hardboard. However, too deep a cut can slow or stall the motor, especially if the work is fed too rapidly or with too much pressure.

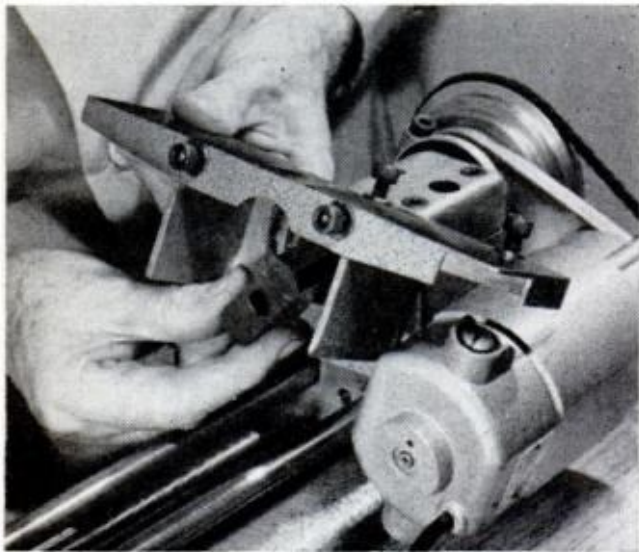
To provide clearance for the back end



ELEVATING BLOCK inserted between headstock and lathe bed provides clearance between table, motor



INSTALL CLAMP on spindle housing but don't screw cutter tightly on spindle until table is in position



PLACE TABLE in position, but do not bolt in place. Then tighten cutter block on the nose of the spindle

of the planer table, the Unimat motor is swung downward and a headstock-raising block (provided with the planer) is inserted between headstock and lathe bed to increase spindle height by $25/32$ in.

The SL Model Unimat has a two-hole headstock-clamping bolt that permits the head to be anchored to the bed either with or without a raising block. Older models have a short, one-hole clamping bolt that cannot be used with a raising block, so it will be necessary to replace this with a longer bolt (for about \$2).

The cutter is a steel block measuring approximately $5/8 \times 1 \times 1 7/8$ in. that screws onto the Unimat spindle nose. The ends of this block have "differential" bevels flanking the cutting edges. Keenness can be restored by honing, but extensive re-sharpening would require more precise grinding.

The guide fence is a 7-in. strip of angle steel secured by two-hex-head capscrews passing through slots that permit lateral adjustment over a range of about $1/2$ in. It also can be adjusted to position narrow work at different points on the cutter for uniform edge wear.

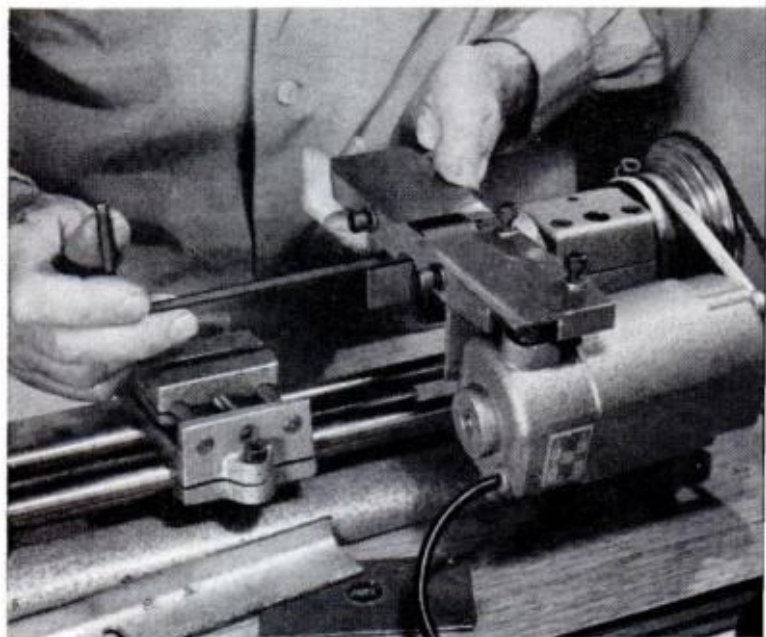
The mounting clamp is a split-ring arrangement that slips over the Unimat spindle housing and over which, in turn, slides the round opening in the side of the table body. The clamp shoulder engaging the table-body opening is eccentric with respect to the spindle-housing hole.

Two capscrews passing through curved slots in the table side engage holes in the clamp. If these, and the clamp screw, are loosened, the table can be elevated by holding it horizontal with one hand and turning the split-ring clamp counterclockwise (facing threaded end of spindle).

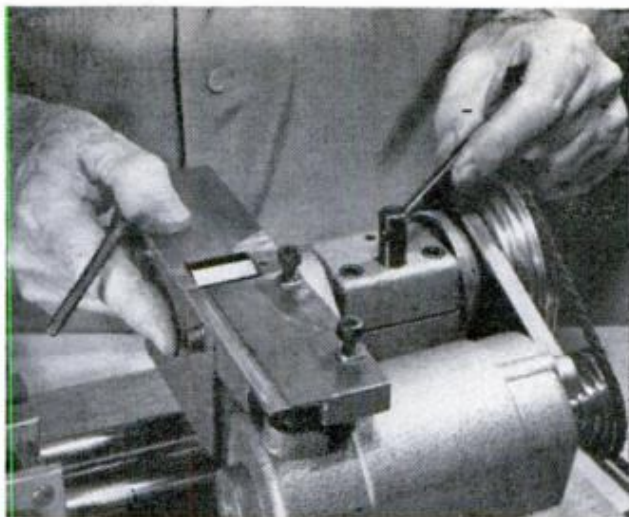
The guard plate is simply a rectangular metal plate held by two capscrews over the open side of the table body to protect the operator's fingers and also help direct chips downward.

During your first attempt to install the planer on the Unimat, you might be inclined to think that somebody goofed in shaping the parts. But after a little practice, setting-up takes just a few minutes.

My first attempts to screw the cutter block on the spindle (after the table had been firmly clamped to the spindle housing) resulted in jamming the spindle nose in the cutter hole—with the prospect of damaging threads when trying to loosen



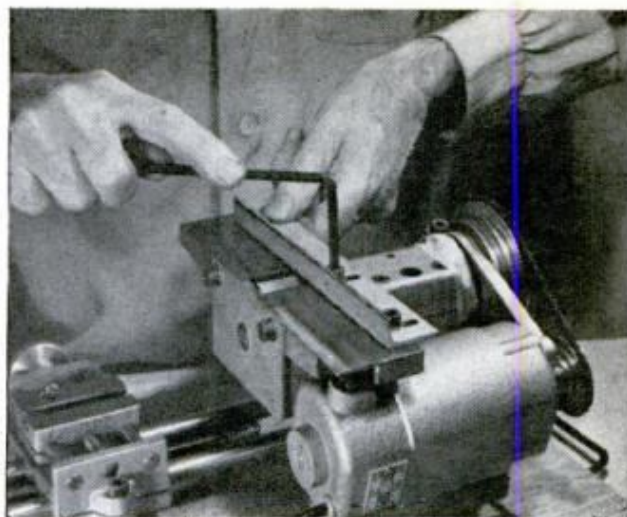
TIGHTEN THE TWO CAPSCREWS holding planer table to the spindle-housing clamp, using wrench provided



TO CENTER CUTTER, loosen clamp and two screws near feed lever, then shift entire spindle with lever

the cutter. There was too little clearance between the cutter and the flange along the outer edge of the table to permit proper manipulation. The cutter was unjammed by loosening the two capscrews anchoring the table assembly to the spindle-housing clamp. Then I found that by removing these screws entirely and supporting the table with one hand, the cutter could be screwed easily on the spindle. The screws then were replaced and the table adjusted for depth of cut.

Because this table adjustment involves inserting a wrench to loosen two capscrews (while the guard plate is off), plus loosening the split-ring clamp, it may seem that depth-of-cut adjusting is forbiddingly complicated and time-consuming. Actually, after the blade has been set for a satisfactory cut, it seldom should be necessary to change it. Since this planer is adapted primarily to relatively light, precision smoothing of wood, a single all-



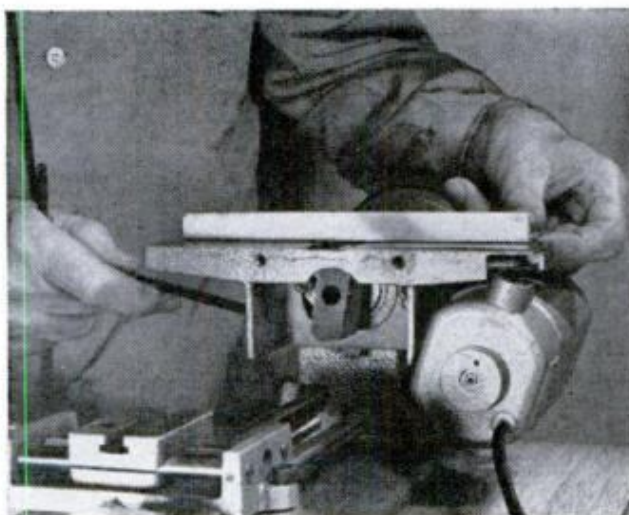
MOUNT THE GUIDE FENCE on table. Slots in guide permit lateral adjustment of approximately $\frac{1}{2}$ in.

around setting usually proves sufficient.

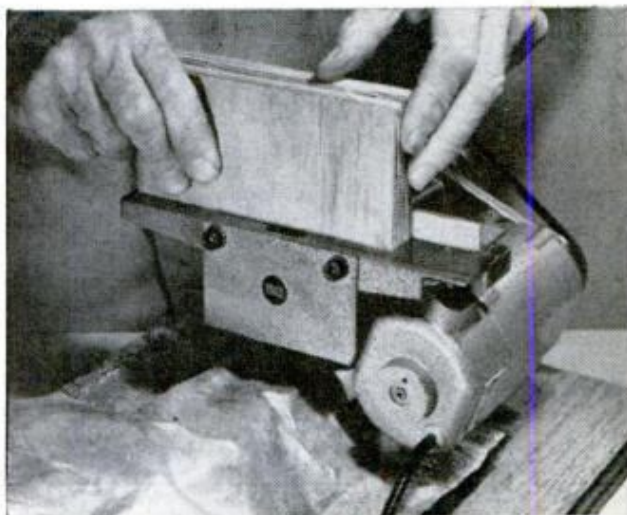
When installing or removing the planer, it's best to remove the tailstock entirely and to position the carriage where it will not interfere with the wrench used with the table-clamping screws. It's also a good idea to cover the carriage, ways and carriage-feed screw with cloth, plastic or foil to prevent them from being buried in chips and dust. If the hand-feed lever is placed in its hole and angled to act as a guard over the headstock pulley, no dirt can get into that hole.

To some craftsmen, this planer may seem like a left-handed jointer. Because of its small size, it is easily used by feeding the workpieces with either hand—though the user should be careful not to get his clothing entangled in the headstock pulley and belt.

The planer attachment is available for \$19.95, from American Edelstaal, Inc., 350 Broadway, New York, N.Y. 10013. ★★★

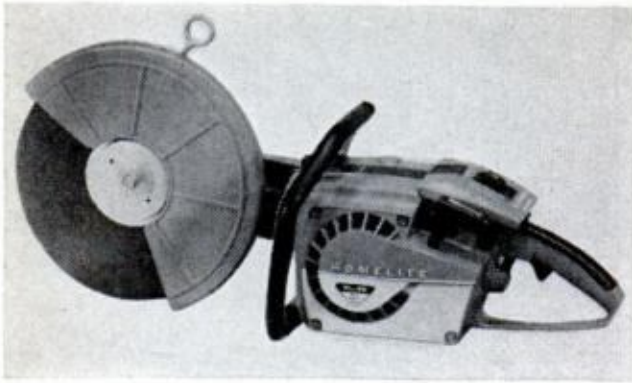


TO VARY DEPTH OF CUT, loosen clamp and bolts in table, rotate clamp to increase or decrease depth



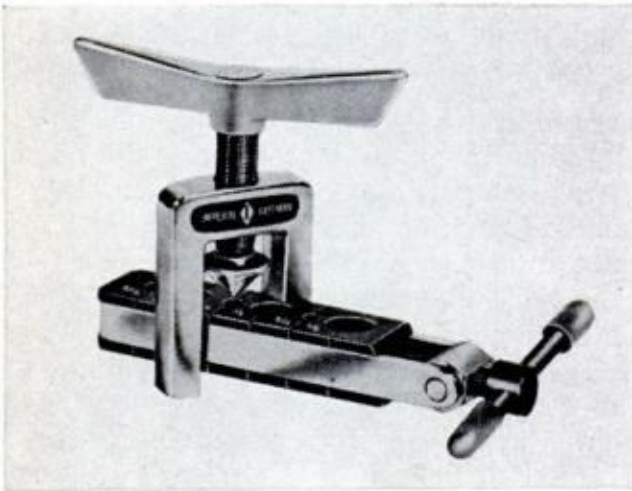
UNLIKE TYPICAL JOINTERS, this imported planer is left-handed; that is, fence is on left of workpiece

New Tools You Should Know About



Multipurpose saw

Designed for construction and demolition work, Homelite's new Model XL-88 saw cuts any material from steel to stone, and has a breakerless ignition system to eliminate maintenance and replacement of points. Featuring an engine governor to prevent runaway blade or wheel speeds, it sells for \$335 (f.o.b. Homelite branches) with a general-purpose blade. Kit with special blade selection, extra belt and metal case is priced at \$125.



Flaring tool for tight quarters

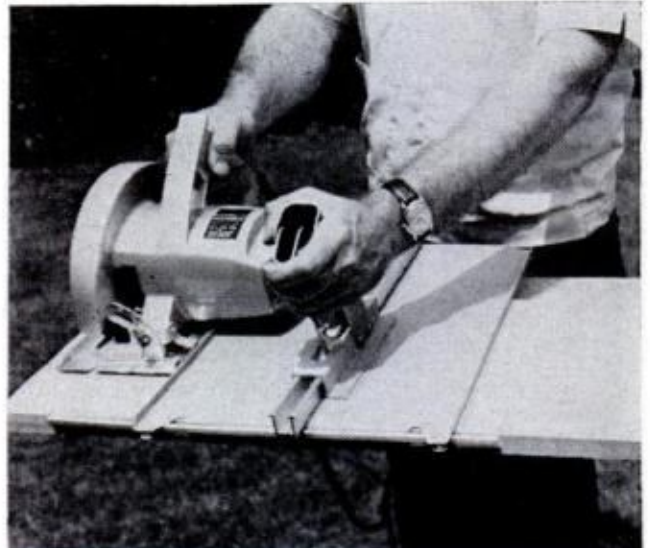
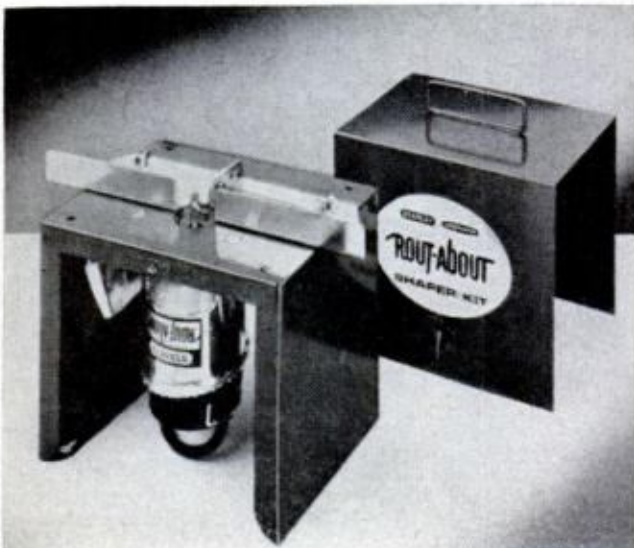
A new 45° flaring tool with a yoke which slips over the die bar top, requires only minimum space for tool manipulation. The yoke's "twist-lock" design allows the flare nut to be positioned tight against the die bar during tool operation. The slip-on feature offers more rapid engagement and release from the die bar assembly. Feed-screw threads are coarser than normal for better mating and less frictional loss. The bottom portion of the legs gauge the proper tube height above the die block. Model 500 FA, priced at \$11.90, is made by Imperial-Eastman Corp., 6300 W. Howard St., Chicago, Ill. 60648.

Kit turns router into shaper

A compact kit converts Stanley's "Rout-About" 1/4-hp router into an inexpensive shaper. When the router is locked upside down into the base of its steel carrying case, the base becomes a 6x8-in. shaper table. When screwed or clamped to the workbench, it can handle slot-making, rabbeting, grooving, molding cuts, edge planing and other shaper operations. The kit includes a 25,000-rpm router with straight and circular guide, adjustable fence and a straight bit. The "Rout-About" kit sells for \$44.95.

Quick-clamping saw guide

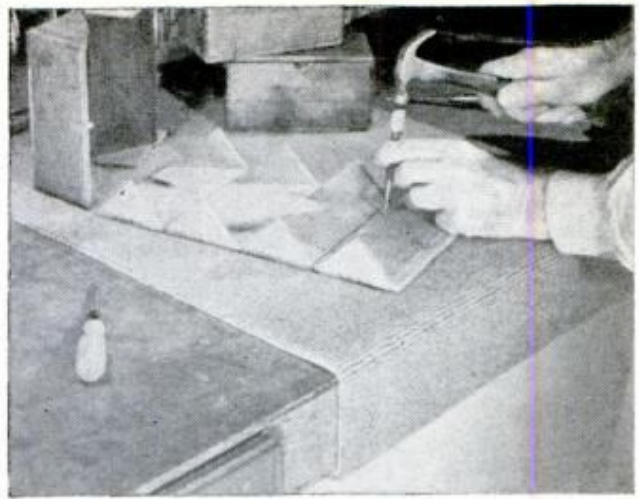
Lightweight and portable, the new Sure Square saw guide prevents creeping under vibration by using squeeze-grip handles which multiply the gripping force more than four times. Made of aluminum it accepts any stock up to 12 in. wide for cutoff and dado operations with a portable saw or router. A setup positioning pointer eliminates the need to draw a cutting line across the full width of the board. The price is \$13.50 postpaid from Independence Specialties, Box 2987, Philadelphia, Pa. 19126.



HINTS FROM READERS

Carpet pad for workbench top

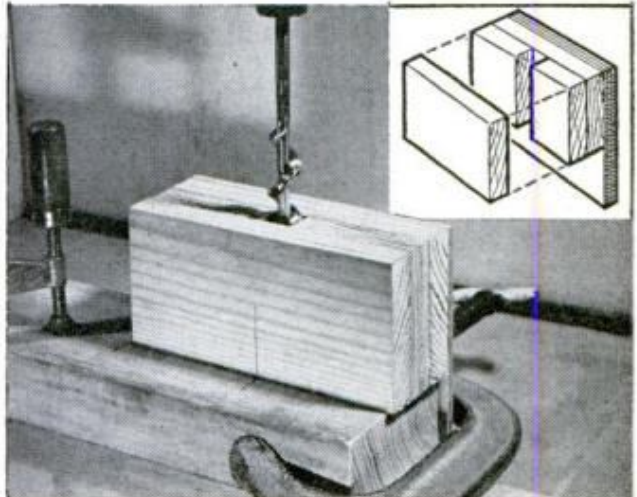
A scrap piece of carpeting tacked over part of your workbench top offers all sorts of advantages. For one, it acts as a protective pad to prevent finished surfaces from being scratched. Also, the rough texture will keep small parts from rolling off the bench. Finally, it makes an excellent work surface for any glass-cutting jobs in the shop.—*Frank Shore*



Use guide to drill dowel holes

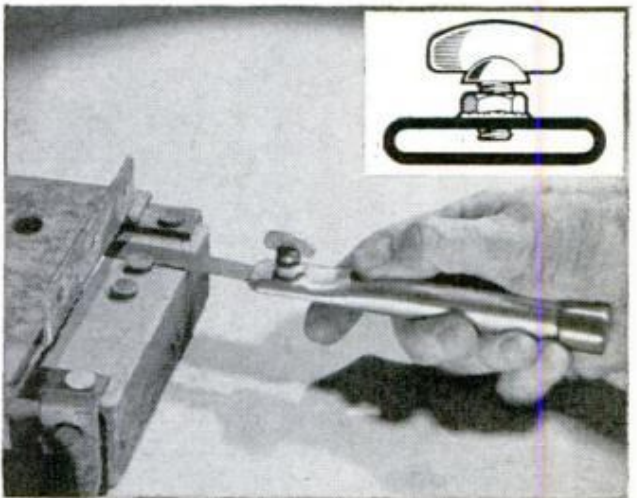
Made from scrap stock, this simple jig is designed to guide the drill bit perpendicularly to the face of the work when you drill dowel holes. Just cut the filler block sections to form a close-fitting square channel for the drill bit. In use, the rear piece is clamped against the work. To aid in positioning, scribe a reference mark on the front of the rail block, locating it in line with the square guide hole and parallel to the hole's vertical axis.

—*F. Louis Rush*



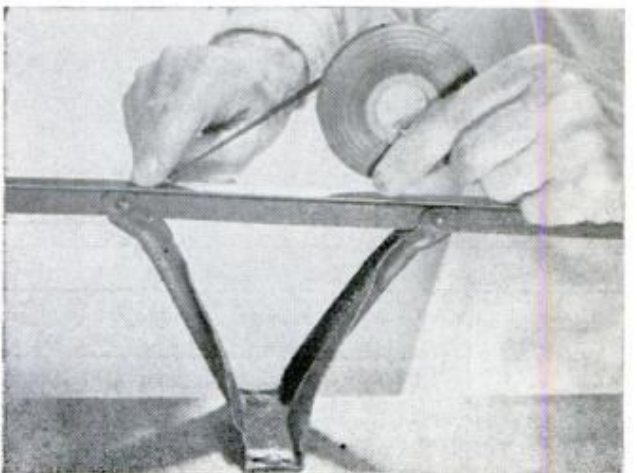
Compact handle for hacksaw blade

This improvised tool is a lifesaver on those jobs requiring the use of a hacksaw in tight quarters where the regular handle won't fit. Cut a 6-in. length of $\frac{1}{2}$ -in.-dia. tubing and hammer one end almost flat, leaving a slot just wide enough to take the hacksaw blade. Next, drill a $\frac{5}{16}$ -in. hole through one side of this flattened portion and solder a $\frac{1}{4}$ -in. nut over the hole. Fit a $\frac{1}{4}$ -in. thumbscrew in the nut, then insert the blade to the desired length and use the screw to clamp it securely in the handle.—*W. Herbert Neander*



Stop rust on sled runners

Nothing slows down a sled like rusty runners, yet it's almost impossible to prevent rust from forming because the exposed bare metal surfaces of the runners are usually damp when the sled is put away. Of course, one precaution you can take is to wipe the runners dry, but this doesn't protect them from moisture in the air. A more efficient idea is to dry the runners, then cover them with two long strips of plastic tape. It's a simple solution, but it works.—*Glen Wilson*

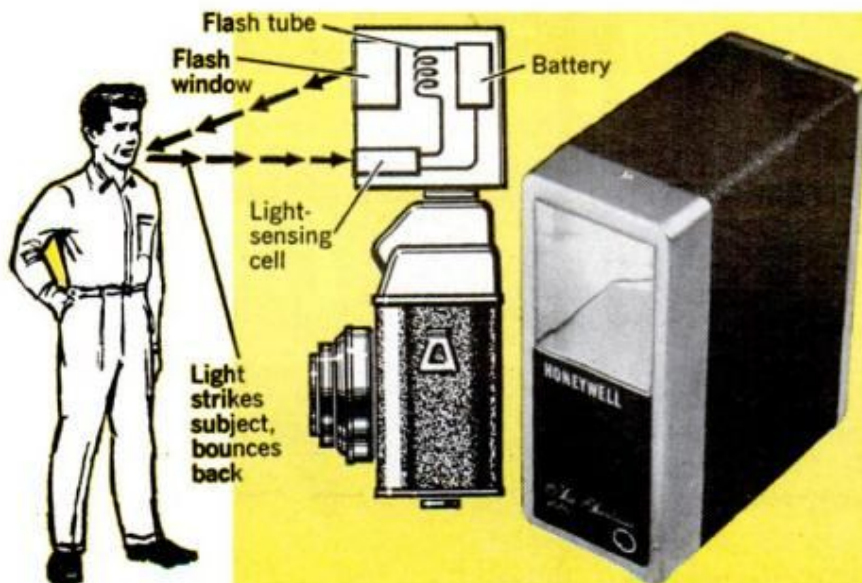


NEW IN



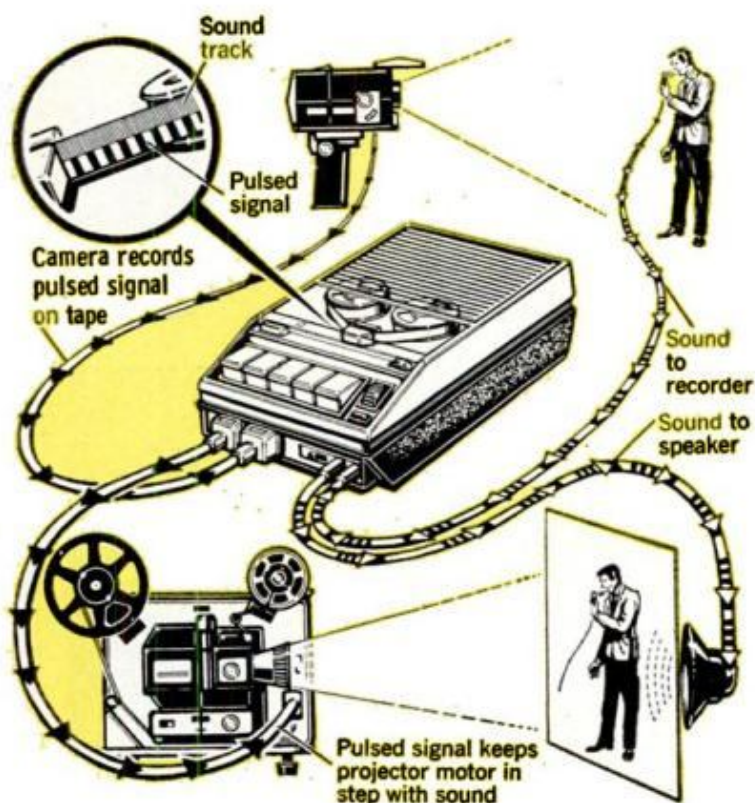
YOU GET TRUE LIP SYNC with this new Bell & Howell system for making sound movies. In the past, lip sync—exact synchronization of a subject's voice with the movement of his lips on the screen—has been poor in quality or costly. Now the Filmosound system lets you make super-8 sound movies for only slightly more than the cost of conventional silent equipment. It consists of three matched elements—camera, projector and a portable,

two-track tape recorder. During filming, the camera records a pulsed timing signal on one tape track and the subject's voice is recorded on the other track. During projection, the timing signal keeps the film exactly in step with the tape so the subject appears to be really talking. The camera does another trick, too. It figures out how far away your subject is so you can focus accurately. The method is based on trigonometry. You aim the camera

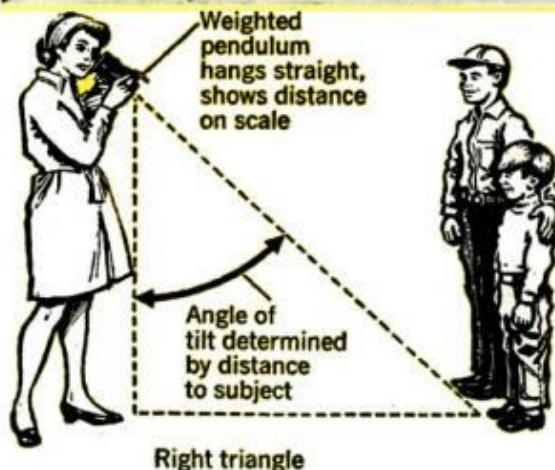


NEW MIDGET FLASHGUN is the first of its size to incorporate Honeywell's automatic exposure system previously available only on much bigger strobes. Not much larger than a pack of cigarettes, it has a light-sensing cell that instantly measures the amount of light reflected by a subject as the flash goes off. When enough light has bounced back to indicate that the subject has been correctly exposed, the flash shuts itself off. The Auto-Strobonar/440 is \$119.50. Honeywell, Littleton, Colo.

PHOTOGRAPHY

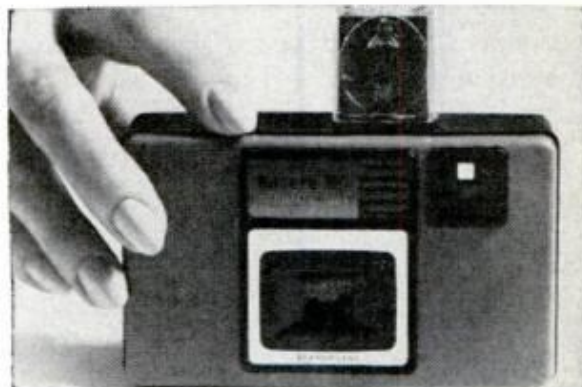


at your subject's feet so the distance becomes the base of a right triangle, as shown at right. A weighted pointer in the camera hangs straight, measuring the angle of tilt. Since the angle is directly proportional to the triangle's base, the pointer shows the subject's distance on a calibrated scale. Two camera models cost \$129.95 and \$159.95; projector \$169.95; tape unit, which can be used as a cassette recorder, \$99.95. Bell & Howell, 7100 McCormick Rd., Chicago.



EASIER SHOOTING of home movies is the object of this new Kodak Instamatic Super-8 camera. It has a power-driven zoom lens controlled by a rocker switch on top. You just tip it forward to enlarge the image and backward to decrease it. Two models are available—the M7 with a zoom

range from 12 to 36 mm for about \$170, and the M9 with a somewhat greater range, from 9.5 to 45 mm, for about \$230. Both take drop-in film cartridges, permit single-frame exposure, and have pistol grips with triggers for easy control of the shutter release.

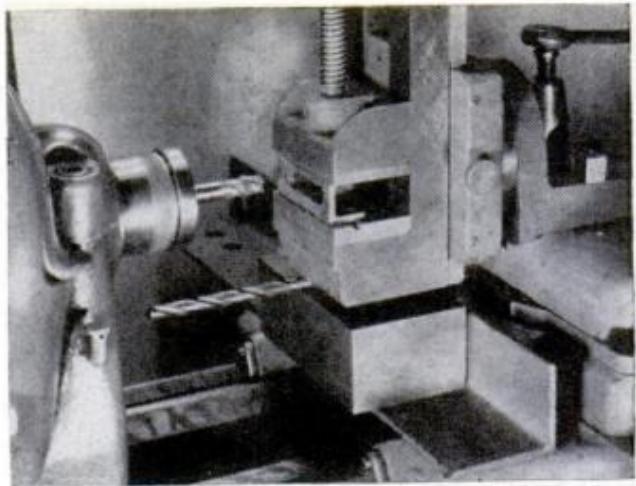


FIRST STILL CAMERA by 3M under the Revere label is this instant-load model with fully automatic electric-eye exposure. You leave the flashcube on at all times and it won't fire until it's dark enough to require flash. Price is \$39.95. 3M Co., St. Paul.

HINTS FROM READERS

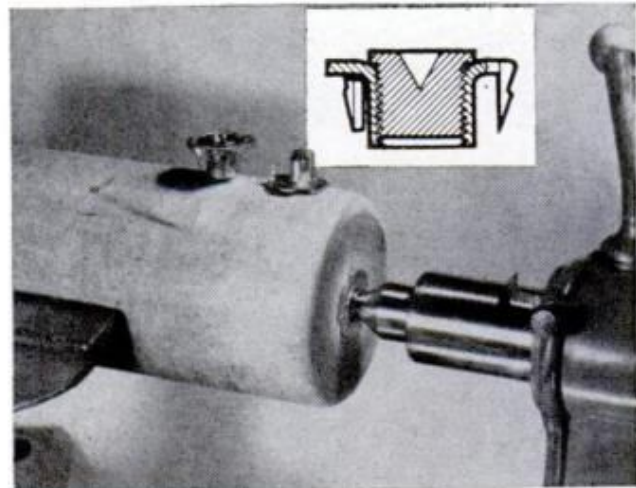
Steady vise when milling

When making horizontal cuts on work held in a lathe milling-attachment vise, you can lessen vibration by using a prop. Lay an angle iron across the carriage to support a steel block almost large enough to touch the vise bottom. Then select a twist-drill shank to fill the remaining gap and serve as a supporting roller on which the vise can move.—*Walter E. Burton*



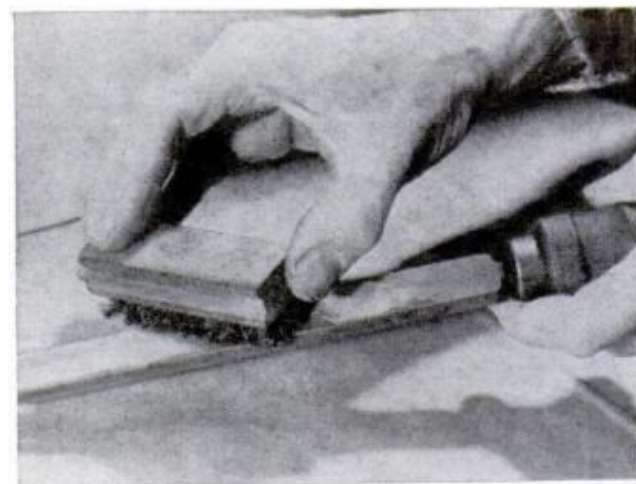
Removable seat for tail center

To prevent your lathe's dead center from digging in, make up several removable seats from different-size Teenuts plugged with tight-fitting bolts. Remove the head from each bolt and center-drill it to take the lathe's dead center. To use one of these seats, just drill the end of the stock for a light press fit. The spurs on the nut will keep it in place, so the fit needn't be extremely tight. Also, a light press fit will make the seat easier to remove when the job is done.—*Peter Legon*



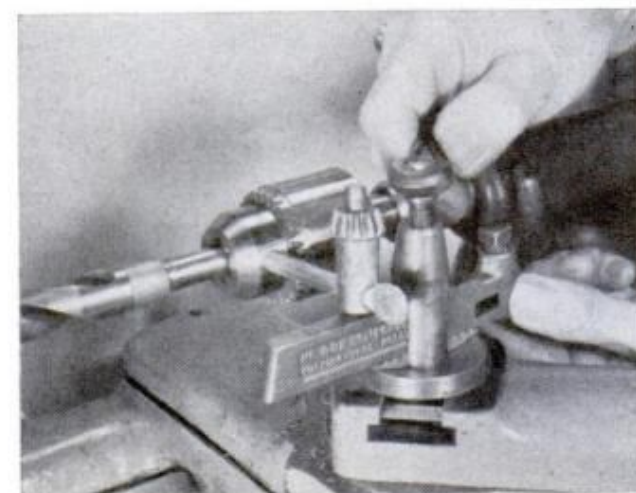
Tips on cleaning files

A little checking may turn up several different tools that will do a much more efficient job of cleaning fine files than a conventional card. A suede brush, for instance, has extremely thin metal bristles which are ideal for reaching all the way to the bottom of the tiny valleys found on Swiss-pattern files. Various other metal-bristle brushes can be equally effective. These are often sold for kitchen use, so a good place to look would be the housewares counter of your local hardware or department store.—*Henry Dykes*



Key prevents chuck from turning

When a drill chuck is used on a taper arbor in a lathe tailstock spindle, it often has a tendency to rotate if you take heavy cuts with a large bit. If it happens to be a key-type chuck, this rotation can be prevented by inserting one end of the chuck-key handle into one of the key-tip holes and resting the other end on a tool-holder clamped parallel to the lathe bed in the toolpost. Keep this in mind the next time you set up for drilling work revolving in a lathe.—*Walter E. Burton*

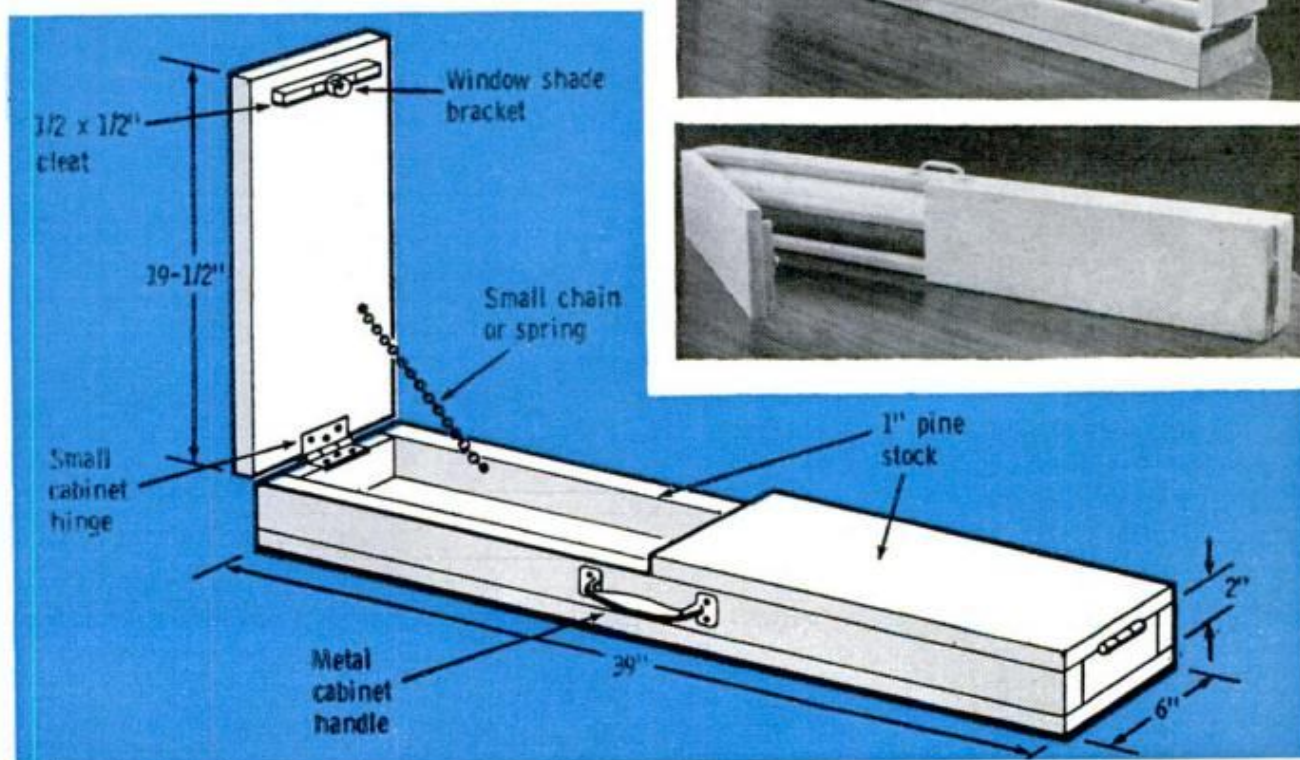
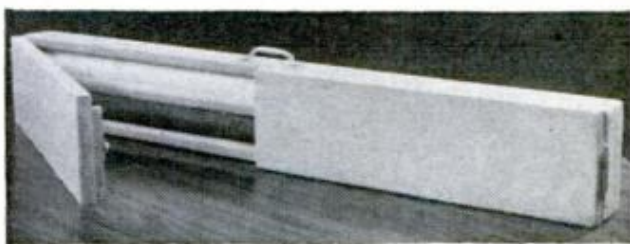
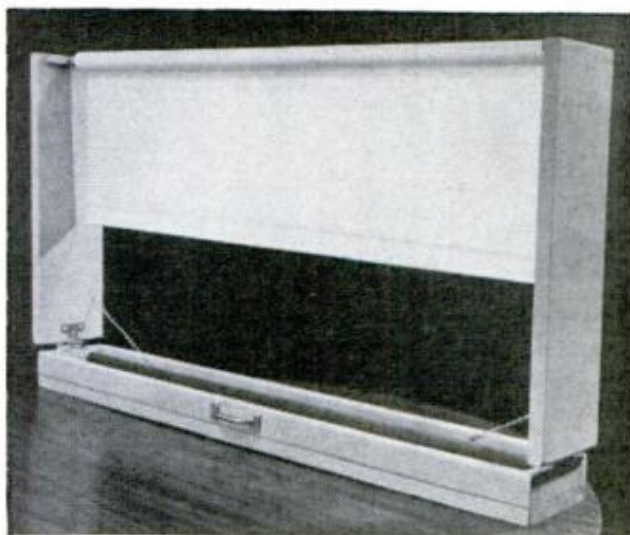
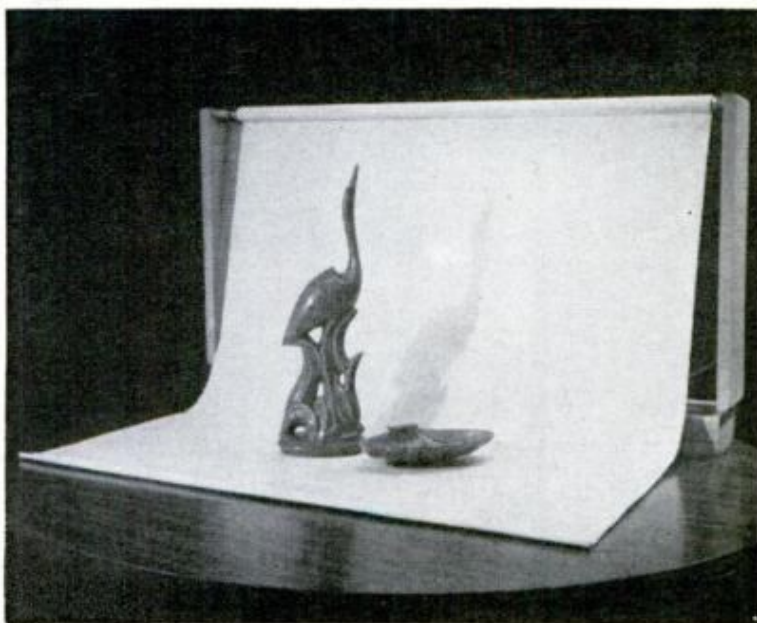


PORTABLE BACKDROP For Tabletop Photos

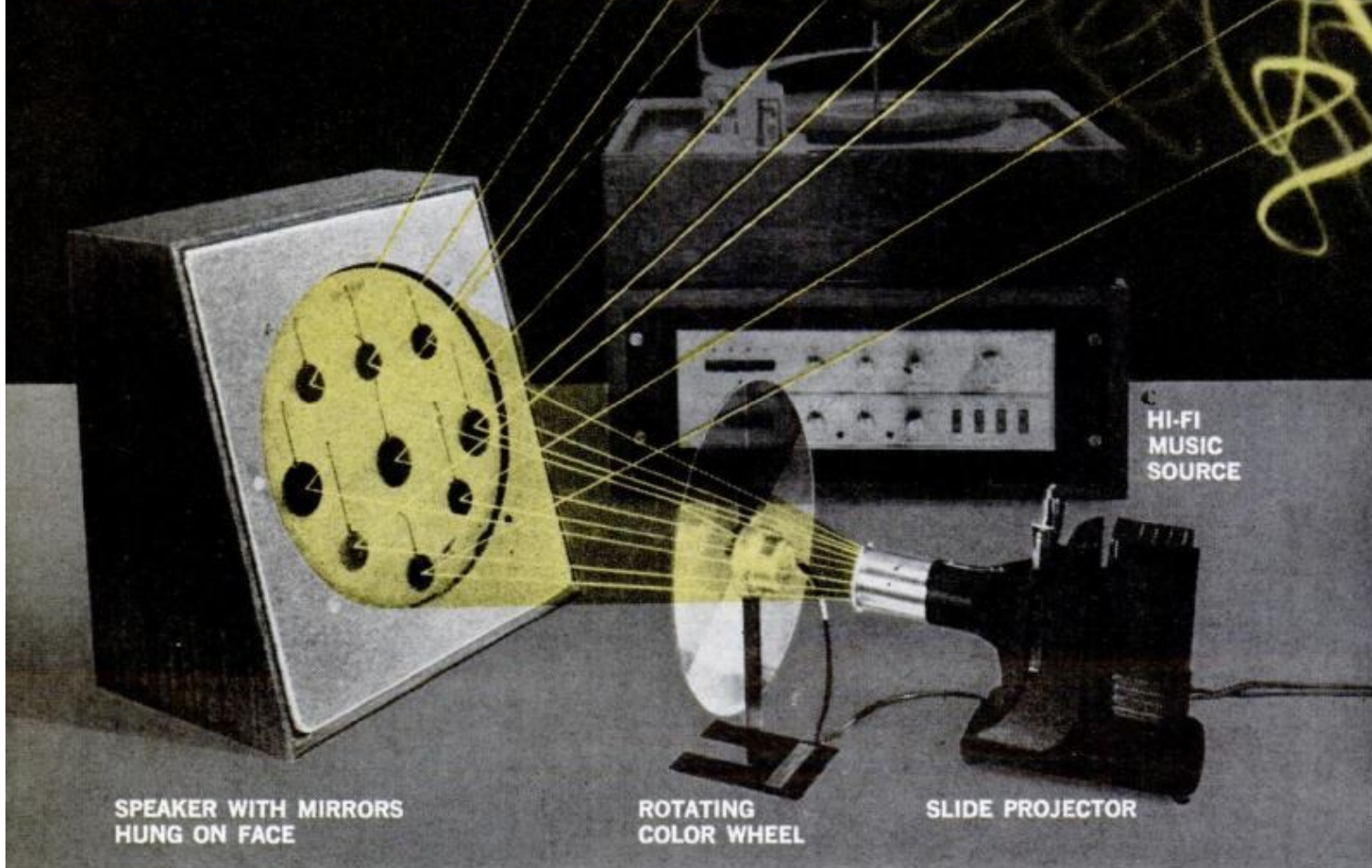
SETTING UP a smooth, clean background is half the battle of getting ready to shoot a tabletop still life. This portable rig makes the job a cinch. It uses standard spring-loaded window shades, which are available in a variety of colors.

The case holds two shades rolled up, one white and one black, so you can switch quickly to either a light or dark background depending on your subject. The two hinged doors swing up to form vertical support arms. All you do is hook a shade into brackets at the top of the arms and roll it out. The result is a seamless backdrop that covers the table and curves up neatly behind your subject. The case shown here is designed around 36-inch-wide shades, but you can adjust the dimensions to suit any size.

Except for two small cleats, the case is made entirely of one-inch pine or similar stock. The brackets that hold the shade are the type sold for mounting inside a window casing. Short chains or springs hold the doors so they won't open past the vertical position.—*Bob Corley*



NEW IN ELECTRONICS



SPEAKER WITH MIRRORS
HUNG ON FACE

ROTATING
COLOR WHEEL

SLIDE PROJECTOR

HI-FI
MUSIC
SOURCE

PSYCHEDELIC HI-FI: Mirrors on speaker cast whirling light reflections as they jiggle in time to music

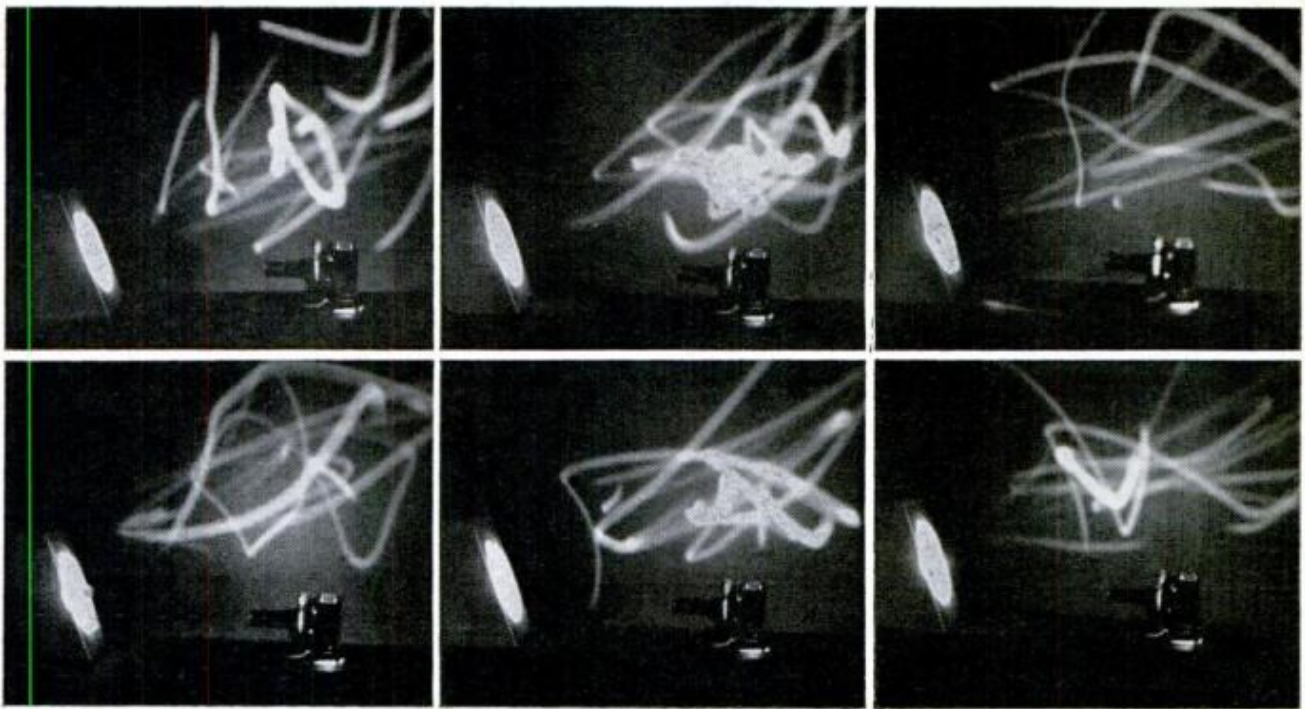
WILDLY DANCING STREAKS of colored light flash in time to music in this new psychedelic home entertainment system developed by Edmund Scientific. Called Music-Vision, it works like this: Small round mirrors are fastened to a thin rubber membrane stretched over the face of a speaker. A bright light is aimed at the mirrors so they cast reflections on the surrounding walls and ceiling. When music is turned on, sound waves in the speaker strike the membrane, causing the mirrors to jiggle. The reflections they cast jump crazily in time with the music's beat. Such dazzling effects can add a new kind of colorful fun to informal parties.

The speaker can be connected to any sound source—hi-fi system, phonograph, tape recorder, radio and the like. For the

light beam, you can use an ordinary slide projector directed at the mirrors. To narrow the beam to a sharp pinpoint, metal aperture plates are available. These have small holes in them and slip into the projector in place of a regular 35-mm slide to cut down the beam's diameter. Placing a color wheel between the projector and speaker will cause the lights to flash in different colors as the wheel rotates.

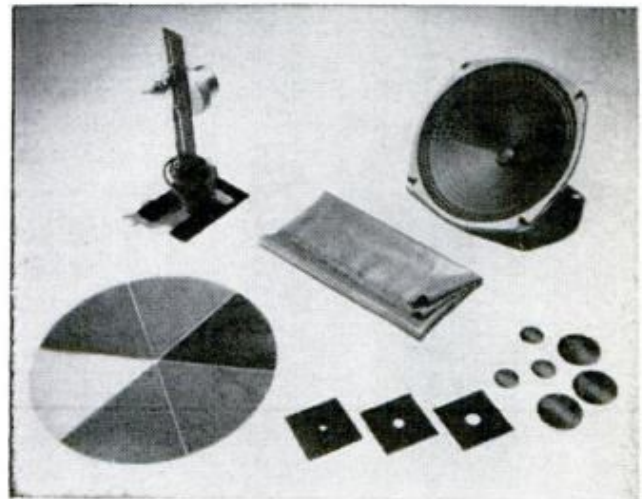
Kits and parts are available in various combinations. A complete kit, including an 8-in. speaker, mirrors, rubber membrane and color wheel, sells for \$22.50 (No. 71,009). A similar kit, but with the speaker and mirror unit preassembled, costs \$45 (No. 71,030). Another kit with a larger 12-in. preassembled speaker unit is \$57.50 (No. 71,032).

If you want to use your own speaker,



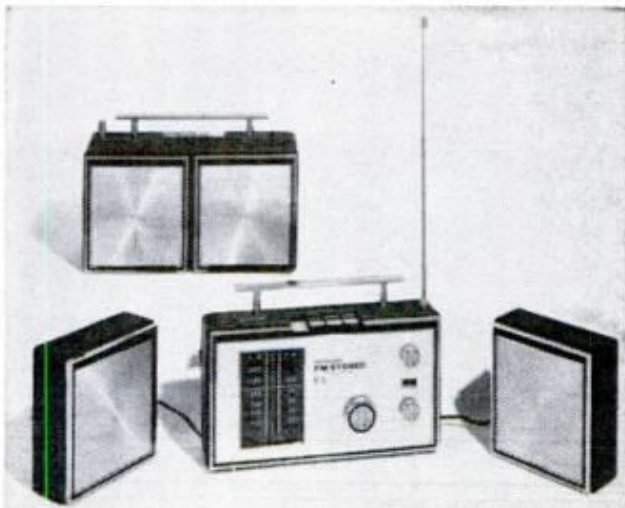
you can buy the mirrors, rubber membrane, color wheel and aperture plates separately. You can also buy completely assembled speaker and mirror units by themselves. The 8-in. size is \$35 (No. 70,999). The 12-in. size is \$49.50 (No. 71,027). Information on other kits and parts can be obtained from Edmund Scientific Co., 380 Edscorp Bldg., Barrington, N.J. 08007. ★★★

PARTS REQUIRED for psychedelic effects are color wheel, speaker, rubber diaphragm material, tiny mirrors and aperture plates for pinpointing light beam. You can buy them individually or in kit form



DETACHABLE SPEAKERS are cleverly arranged on this new stereo FM and AM/FM portable radio. Hinged at the sides, the speakers store in back and swing around to the front for listening. They also can be removed and placed farther apart for better stereo effect. The compact, battery-powered unit weighs only 4½ lbs. and sells for about \$80. Hitachi Sales Corp., 48-50 34th St., Long Island City, N.Y.

WANT TO CONVERT a mobile transceiver to home use? This pedestal-type power supply is designed to fit under a transceiver and provide an attractive appearance. The streamlined, slope-panel unit converts 115-volt a.c. to 12-volt d.c. and is said to work with all transceivers, even some that do not have provision for use on your house current. Price is \$29.95. Amphenol, 2875 S. 25th Ave., Broadview, Ill.



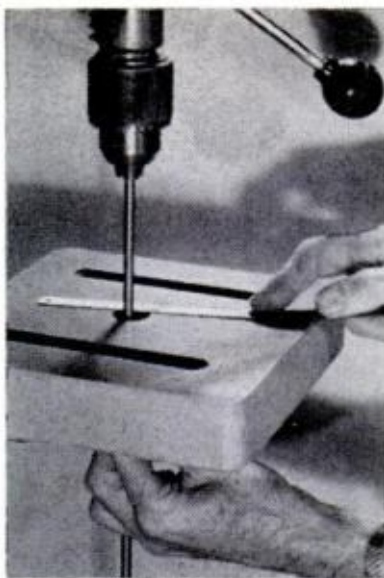
HINTS FROM READERS



Stop toolpost slippage

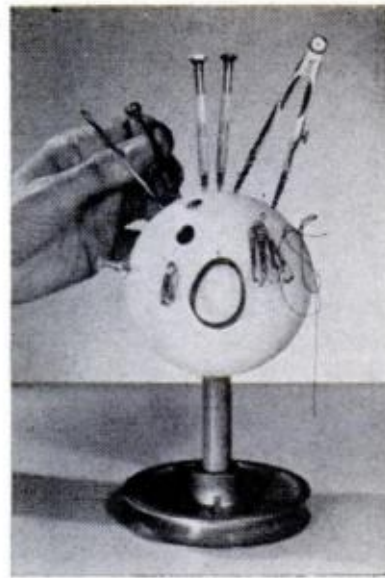
It's more than a bit exasperating to have a lathe bit start digging into the workpiece simply because the mating faces of the toolpost ring and compound rest have been worn smooth. In that event, a simple friction ring can be cut from aluminum foil (or even a pie pan) and inserted between the ring and the flat face of the compound rest.

—Y. L. Trudeau



Cut rods on drill press

Hardened steel rods, lengths of piano wire and other rods that are too limber to hold in a vise can be cut in just a few seconds if you chuck them in a drill press as shown. Set the machine to run at a low to medium speed and pull on the bottom length of rod to keep it tight against the drill press table. Then just hold a hacksaw blade up against the rod to cut it.—Dick Kelly



Protect pointed tools

This handy shop caddy will protect your compass, jeweler's screwdrivers and other pointed instruments from accidental damage, yet it costs only pennies. It's simply a plastic foam ball (of approximately 3½ to 4 in. in diameter) mounted on a dowel and a suitable base. Drill the ball to accept the dowel (use a drill press spur bit), then apply white glue to join the ball and dowel.

NEXT MONTH IN SHOP AND CRAFTS

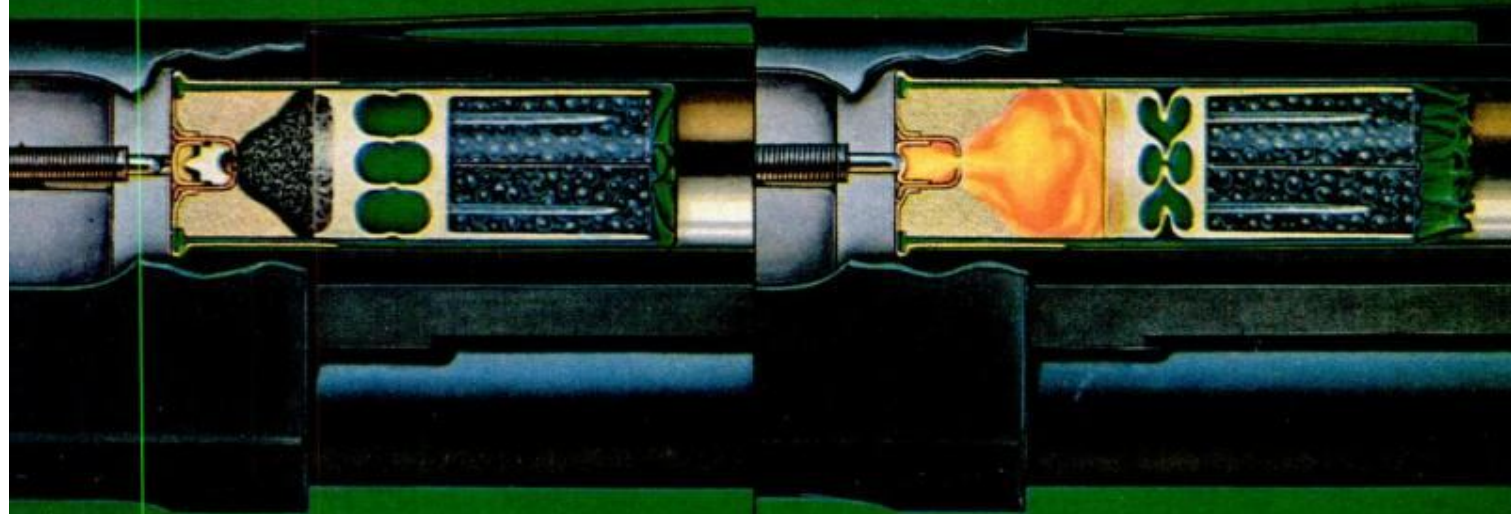
BUILD A STORAGE CABINET FOR YOUR POOL TABLE. There's space going to waste beneath your home pool table—but you can take full advantage of it by building this pair of neat-looking cabinets that slide under the table. Presented in full color and with detailed plans, this is a project ideal for the family room.

BUILD A HOUSEBOAT—FOR UNDER \$1000. You read it correctly—less than \$1000 is what it will cost to build this 25-ft. houseboat. What's more, it's also trailerable so you can take it along on your summer vacations or move it from lake to lake easily. Complete plans for construction will be available.

BUILD THIS CONNECTICUT SHELF CLOCK. This fine example of colonial design combines good looks with practicality since it makes a handsome timepiece. Its simple lines will blend well with either contemporary or Early American furnishings. It will be shown in color and with complete plans.

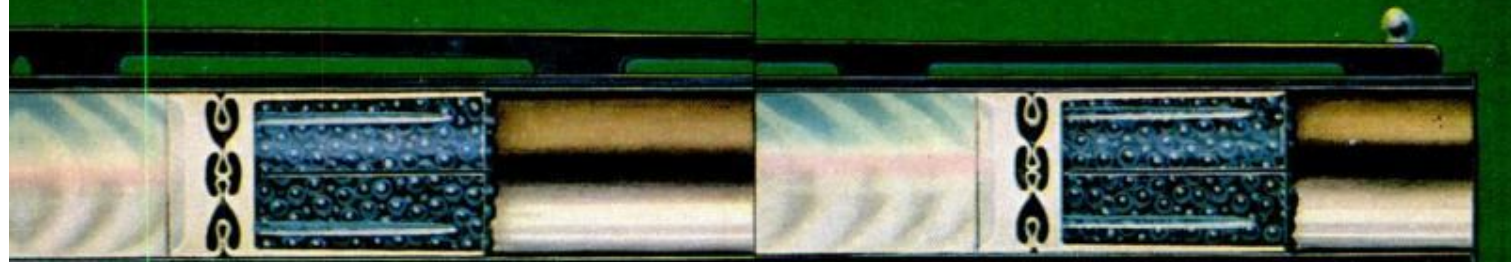
HOW TO MILL ON YOUR DRILL PRESS. You can convert your drill press to a light-duty milling machine simply by making these few toolholders and a simple spindle support. With them, it's possible to take care of almost any common milling tasks you're likely to encounter in a home workshop.

5 milliseconds in the life of a "Power Piston" wad.



1 This is what the "Power Piston" one-piece wad (loaded in a Remington Express plastic shell) looks like from the time it leaves the factory until you pull the trigger.

2 Right after firing. The built-in shock absorber in the "Power Piston" compresses and absorbs the initial impact of the explosion, so the shot won't be crushed together.



3 Halfway down the gun barrel. The back end of the Remington "Power Piston" opens up to seal the barrel and keep the expanding gas from leaking past and losing power.

4 At the muzzle. Though the shot column is moving at top speed, the sides of the Remington "Power Piston" have kept it from touching the barrel and flattening the pellets.



5 A few feet past the muzzle. The "Power Piston" now peels back and drops away, but the shot column is on its way at full power, with no flattened pellets to spoil the pattern.

For some time we've been telling you that Remington and Peters "Power Piston" wad shot shells shoot harder, keep your barrel clean longer and put up to 10% more shot in the pattern. But let's face it—you were just taking our word for it.

That's why this little demonstration. We feel that if we can show you what a "Power Piston" does, you'll have more confidence in our shells. Also we can clear up a common misunderstanding. The "Power Piston" does not make the pattern smaller. It just puts more pellets into it by eliminating "flyers"—flattened shot that goes wild. No matter what gauge you shoot—12, 16, 20 or 28. And that's a fact.



Remington DUPLICATE **PETERS**

Try a box of Remington/Peters shells with "Power Piston." See how good a shot you really are.

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THE TIME OF YOUR LIFE

(Continued from page 113)

should pay for a watch and how to be sure of getting a good one is somewhat relative. Up to a point, you're paying for better craftsmanship and can expect to get it. Above a certain level you're buying frills—a fancier case perhaps, or extra features such as found on a chronograph. Also, despite standardized production methods and rigid controls, watches do vary in quality, even within a given model line. Getting a good one is a little like buying a car—there's a certain chance involved. The difference is that higher-priced watches are more likely to be consistently good than lower-priced ones.

Size is a factor, too. It's easier to make an accurate watch with big parts than with small ones. For this reason, given equal quality of construction, a pocket watch is still likely to be more accurate than a wristwatch, and a man's wristwatch more accurate than a woman's.

What of other features? Take "shock-proof," for example. No wristwatch can survive a hammer blow, but the effects of ordinary bumps can be minimized by protecting the main axle. All quality watches have a spring-suspension system to protect the balance wheel's pivots and jeweled bearings.

How waterproof is "waterproof"?

What does "waterproof" promise? The main enemy of watches is not water but dust. A waterproof case is the best protection against both. Actual waterproofing varies widely. A watch claimed to be waterproof may simply be designed to shed splashes or a momentary dunking. If you want to wear your watch swimming, there are types specifically designed for divers that will withstand prolonged submersion.

"Fogging up" of a watch crystal is always an indication of a leak. Under normal factory conditions—68°F. and 40 percent humidity—the water trapped inside a watch case is only 1/150,000th of the air enclosed. Even if all this condensed on the crystal, it could not fog.

Antimagnetic quality is important for you are constantly surrounded by magnetic fields: your electric toaster, TV, electric drill and refrigerator, to name a few. A strong magnetic field can stop a watch, and a weak one can cause it to vary by as much as 15 minutes a day. Nonmagnetic watches are protected either by using nonmagnetic materials for the balance, mainspring, lever and hairspring, or by having a shield of soft iron around the case to absorb outside magnetism.

Wristwatch cases of stainless steel give the longest wear and the best waterproofing, but many people prefer gold. Karat gold means that the case is a solid-gold alloy. Gold-filled or rolled-gold plate means the case is made of a base metal to which a layer of gold is bonded.

Imports outnumber home brands

Where does your watch come from? Actually, only three companies still manufacture watches exclusively in the United States—Hamilton, Bulova and U. S. Time (Timex). Many watches are either imported or are assembled here from imported parts. Along with the Swiss, the Japanese are making a strong bid to become a major supplier of imported watches. While the Swiss have been famous for their precision hand craftsmanship, the Japanese are employing giant electronically controlled, computer-automated factories to turn out tiny parts fast as well as accurately. The Japanese firm of Seiko is already the world's largest single maker of jeweled-lever watches, producing some 10 million a year.

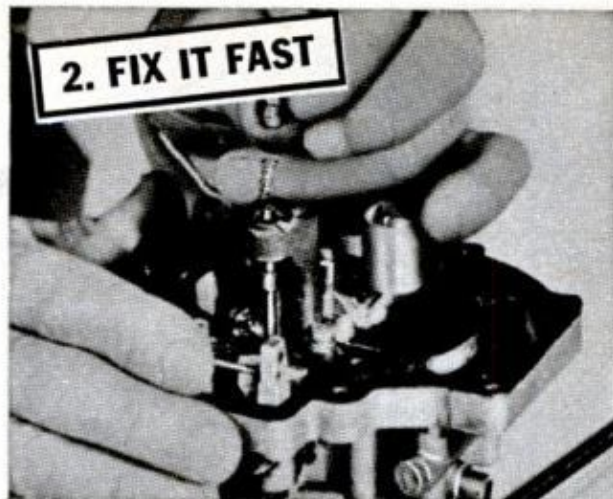
Because of a strange loophole in tax law, there's a good chance your watch may have come from the Virgin Islands. Until recently, manufacturers were able to assemble watches there from foreign parts and ship them duty-free into the U. S. In one year, more than 4½ million poured in. Now Congress has set a quota limit, but the flow is still big—nearly 4 million watches a year. The parts come from Japan, Switzerland, France, Germany and Russia, but you'll never know which are in your particular watch because the law does not require the parts to be identified.

A watch for every purpose

Along with the phenomenal number of watch brands that exist are an equally imposing galaxy of watch types. If you go in for parachute jumping, you can get a wristwatch with a small knife blade that springs out to slash yourself free from the harness in an emergency. A math student or engineer can get a wristwatch to solve problems in algebra and trigonometry, a banker to compute the current rates of monetary exchange, and a diplomat to tell the time anywhere in the world.

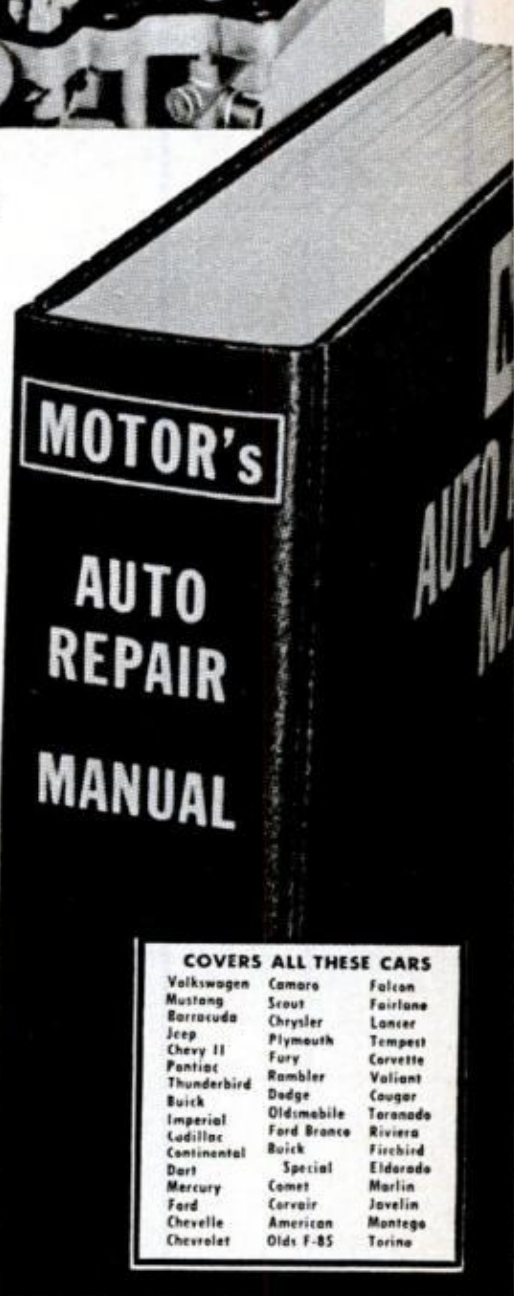
The most common special wristwatches are calendar and alarm types. Chronographs measure elapsed time in fifths of a second in addition to telling the time of day. Skindivers can get a watch that is waterproof at 300 feet deep and records total diving time in minutes. There are many even more specialized chronographs,

(Please turn to page 196)



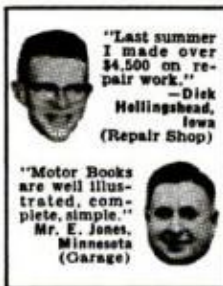
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THE TIME OF YOUR LIFE

(Continued from page 192)

such as one to tell pilots air speed, fuel consumption, distance traveled and arrival time.

An increasingly popular wristwatch is the automatic or self-winding type. This uses natural body movement to wind its mainspring. Besides the convenience, it has several advantages: It can't be overwound; it runs for nearly two days on its power reserve; it's more accurate than hand-wound watches because the mainspring is under full tension at all times; and less water and dust get in because the stem is used far less.

In tune with our atomic age is the development of electric and electronic watches. The first electric came out some 10 years ago. Powered by a tiny battery that lasts a year, this timepiece uses an electromagnetic drive in place of a mainspring.

Using an electronically controlled drive is Bulova's Accutron. It's guaranteed not to gain or lose more than two seconds a day. It has no springs and only a few gears. A tiny mercury battery powers its transistorized electronic circuit. A miniature tuning fork vibrates 360 times a second. The fork is linked to a finger that advances an index wheel one tooth for each vibration. The wheel, in turn, drives a gear train to move the hands. So precise is the Accutron that NASA has installed it in various spacecraft.

Coming: Atomic clocks for everyone

How accurate is accurate? Your wristwatch tells the time for 86,400 seconds in the day. If it should vary by even a full minute every day, it would still be more than 99 percent accurate. Many watches vary by as little as 10 seconds a day, and some by even less. Atomic clocks using the oscillation of ammonia or other molecules are accurate to within one second in 30,000 years.

One of these days you may have an electronic watch just as accurate as any scientific timepiece. It will be run by radio impulses from an earth satellite linked, in turn, to an atomic clock on the ground.

Future watches won't be just for keeping time, either. Waltham engineers foresee this exciting possibility: "Wristwatches in the year 2000 will be used for more than time measurement. They will be total communications centers, containing devices not only for accurate timing but also for voice and vision communication and recording—they'll even contain simple miniaturized computers." How about that for a prediction!

★★★

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- PLATFORM BOAT—Plans for pontoons and a deck; base for any kind of floating fun.

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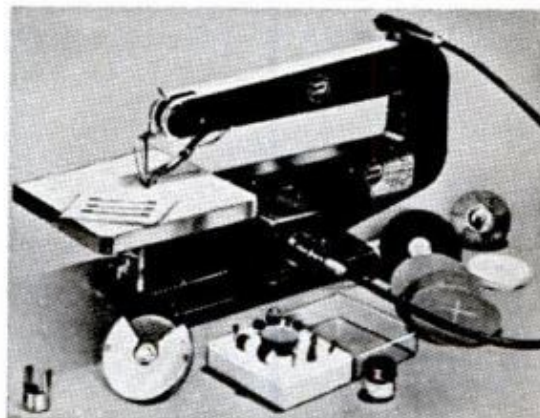
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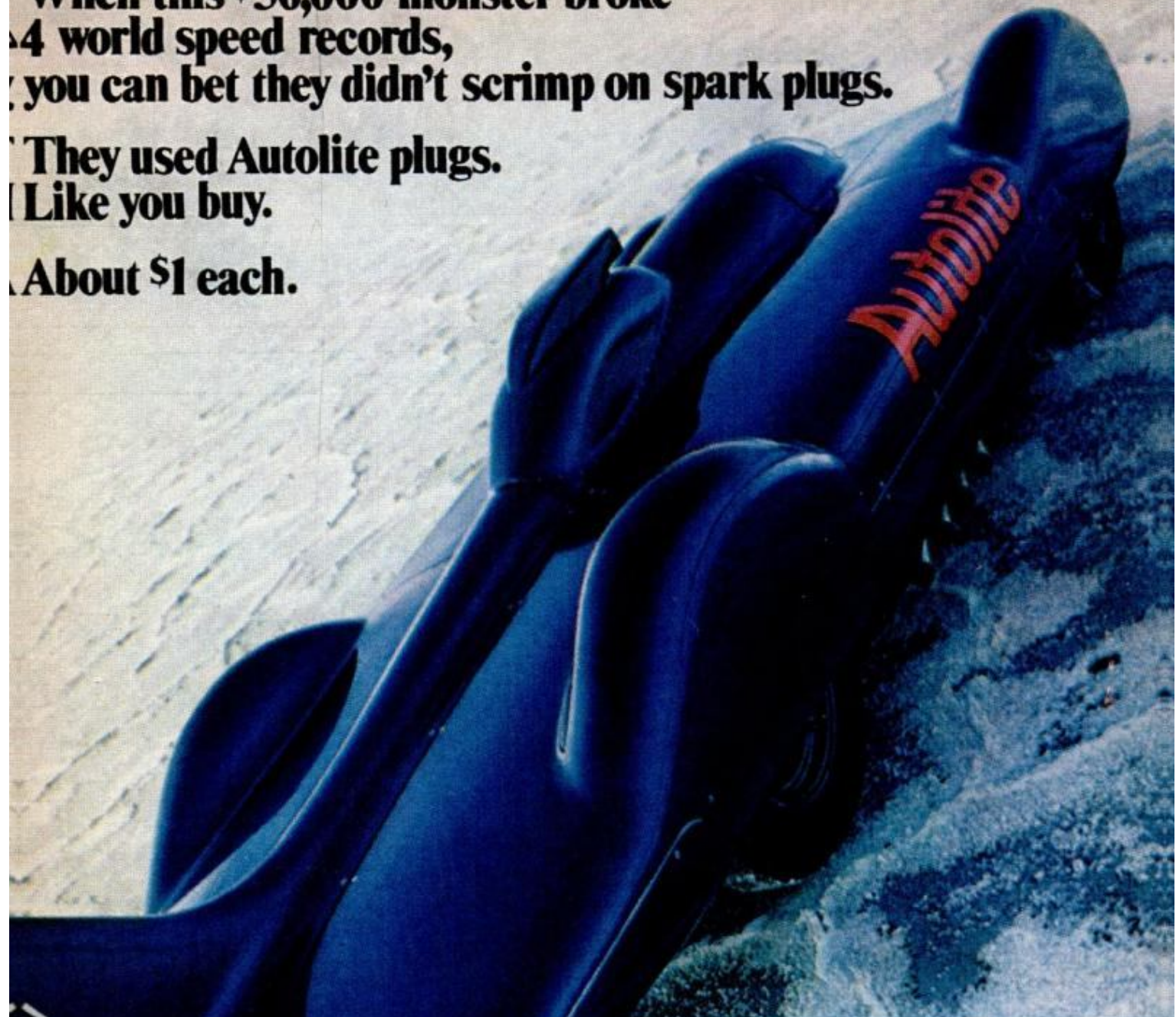
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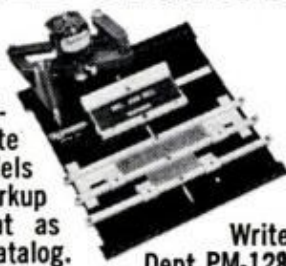
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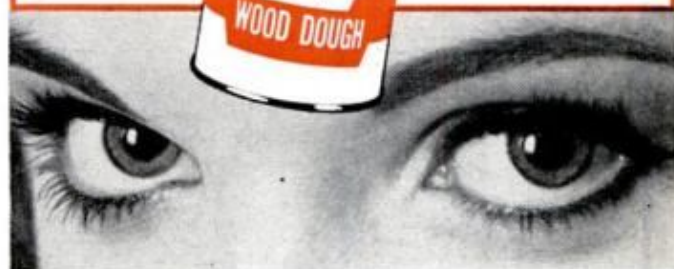
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BITTERROOTS—BY SNOWMOBILE

(Continued from page 117)

as many in their party; their horses sank belly deep along here where our cats we were racing. The Lolo Trail was the "buffalo road" the Nez Percé used on their trips east to hunt on the plains. Because it followed the ridges of the Bitterroot Mountains, it was the shortest and fastest route. The trick was to stay on the ridges (it still is), travel fast (because there is very little game on the high ground) and travel as little as possible in the steep, thickly timbered canyons.

On their first trip westward—in September, 1805—across these mountains, Lewis and Clark wandered from the ridges and were forced to kill one of their horses for food; two of their worn horses were turned loose. On the fifth day they ate a colt and traveled in a blinding snowstorm. This 100-mile stretch took nine days.

On their return east in June, 1806, they were stopped by 15-foot drifts and had to turn back. After camping at Dollar Creek, they began their second assault with three expert Nez Percé guides. The Indians kept them on the ridges and they made the eastward crossing in five days. We were attempting to do it in 24 hours with one overnight camp.

I was glad we had expert guides, too, men who had packed in here many times, because we had left the Motorway and were following a winding course through heavy timber that was closer to Lewis and Clark's actual route. The object of the game was soon clear: *keep moving*. We were climbing steadily and the snow at the base of the trees was light and fluffy. If the well-packed track made by those ahead of you took a sharp turn and you were traveling too fast to make it, dodge the trees and try to make your way back to the track. Then stop and lend a hand by pushing the cats that didn't make it and were bogged down at the base of a tree or stopped by downed timber. You are waist-deep in snow when you are pushing and you sweat a lot and you soon have cotton in your mouth.

Wild ride over the ridges

After four hours on the trail, we stopped at our first gas cache. We topped off our tanks and lunched on cold beans and franks. Delicious!

Full of beans, we hit the trail again in a wild downhill race across mountain meadows. As we flew over moguls, the greenest of us learned why snowmobilers kneel when the going is rough and fast. With one knee on the seat and a foot on

the running board, you find that your spine doesn't go through your skull when you hit a bump. And you can quickly shift your weight on turns—or, as we learned later, part company with your mount—if that's the better part of valor.

We were speeding along the ridges, putting miles behind us while the going and weather held good. The view from the crests of the ridges was staggering. It was as Lewis put it in his journal: "From this place we had an extensive view of the stupendous mountains, principally covered with snow like that on which we stood. We were entirely surrounded by these mountains, from which, to one unacquainted with them, it would have seemed impossible to have escaped."

Resting at Sherman Saddle, where Lewis and Clark had camped, we felt like experienced snow-catters after having kept up with the leaders for five hours. But the real test lay ahead.

"We have some real tough side-hilling ahead before we're through today," said Jim Jackson.

"What's tough about it?" I asked.

"You'll see."

I did. Half an hour later I rounded a curve to find the side of the mountain dropping off to the left in a steep unbroken snow field. I was on the left side of my machine and it started heading downhill. I slid off the seat, grabbed a rear brace as it went by, and hung on. Luckily the crust was soft and my body acted as an anchor, stopping the cat before it started to roll. Otherwise it might have tumbled for a quarter mile and getting it back on the trail would have taken hours.

Orville Shelgren helped me get back on the trail.

"Hang as far out as you can on the uphill side. Keep moving and when you feel her getting away from you, hit the brake."

It was advice we used most of the afternoon. All up and down the column men hung far out on the side of their cats like sailors hiking on the windward rail.

We paused briefly on the side of Bald Mountain where Lewis and Clark camped on their return east. It had taken them two days to get this far. We passed the canteens around, and tightened our belts for the worst going of the day—a long, treacherous stretch of downhill side-hilling. The men in our party were in good physical shape but they were tiring; the exertion and the altitude were getting to them. First one, then another snowmobile left the trail and rolled over. There was more annoyance than danger in this.

We pulled up at a knob known as Devil's Chair for our last refueling stop

(Please turn to page 202)

CHAPTER TWO: THE RENAULT 16 SEDAN-WAGON



Our story opened with the Renault 10. And that chapter is being written every day. At last count, there were over 35,000 Renault 10's on the road.

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There is much, much more we'd like to tell you about the Sedan-Wagon. Not the least of which is its price. \$2,445 P.O.E.* But it is rapidly becoming apparent that in writing about chapter two, we are beginning to write a book.

To be continued.



FOR MORE INFORMATION SEE NEAREST DEALER OR WRITE RENAULT INC., 100 SYLVAN AVENUE, BOX 37, ENGLEWOOD CLIFFS, NEW JERSEY 07632

BITTERROOTS—BY SNOWMOBILE

(Continued from page 200)

of the day. The fellows were less talkative; they were saving their breath for the last push to our overnight camp. Ranger John Leasure broke out his short-wave radio and called the Lochsa Ranger Station in Kooskia. Lochsa replied that Clyde Baker and Sid Hinkle, who hadn't shown at Dollar Creek when we made our morning departure, had hit the trail five hours later and were attempting to overtake us before nightfall. We shut off our engines and Shelgren signaled for silence. We listened for the sound of their engines on the ridges, but all we could hear was the souging of the wind through the pines. It was growing dark and colder and you wondered about those men side-hilling on the worst stretches in the dark. We had left them a well-packed track—but a long one.

Logging camp welcome haven

The column wound its way down a six-mile side trail, side-hilling wearily most of the way. Suddenly it opened into a logging road leading to Gravey Creek logging camp and as I sped ahead of the column and rounded a hill a coyote, confused by the roar of our engines echoing in the valley, raced across the road and disappeared over the hill. It was the only game we had seen all day. Lewis and Clark had sighted little more.

The loggers had left the camp before the first snow; they had offered us their cookshack and bunkhouse. By lamplight, Jim Jackson and Orville Shelgren started cooking while the rest of us used the twilight to spread our sleeping bags on cots. As we filed into the cookshack we heard a snowmobile engine in the distance. Headlights of two cats swung into the valley—Sid and Clyde had made it.

We all went out to welcome them. They were men in their late fifties, experienced outdoorsmen. We needn't have worried about them spending the night on the trail; they carried extra gas, snowshoes, a tent and provisions.

"You didn't think we were going to miss supper, did you—with Shelgren and Jackson doing the cooking?" laughed Sid, a big, jolly ex-bush pilot.

Hot chicken broth, stewed chicken and rice, thick slices of warm bread and butter and mugs of coffee made a meal fit for a king—who had spent the day on the Lolo Trail. We trooped back to the bunkhouse; we were beat. There was a little kidding about the day's mishaps. Then—silence.

At dawn we brushed the night's snowfall off our machines, strapped on our

sleeping bags and started our engines. We had covered 60 miles the day before and felt it in our legs, arms and shoulders. But the six-mile stretch out of Gravey Creek worked this out. We were ready for what lay ahead. And none too soon.

The highest ridges were covered with new powder that made it hard to get a running start on steep slopes. Breaking trail, Jackson and his son were forced to make frequent detours. They bogged down; we all had to wade ahead and help shove each machine to the top. For an hour it was like putting the ball across the Packer's goal line, but we did it and lay panting in the snow.

Coming off a ridge near Moon Saddle, the column started down what looked like a 40 percent grade. One by one we followed Jackson down a wild obstacle course of giant pines. Slip off the track, and your machine would end up in a bowl-like depression at the base of a tree. The trick was to use both brake and throttle together to maintain traction.

One by one we squeaked out close victories. But when end-man Shelgren started down, the trail was a well-packed toboggan slide. The sled he was towing started fishtailing; he speeded up; saved it, then lost it altogether. His snowmobile skidded off the trail and rolled over as it went into the deep bowl at the base of a pine. Orville was under it. We started scrambling up the slope, falling on our faces in our hurry to get to him.

"Orville!" shouted Jackson as he neared the snowmobile. "You okay?"

"Ohh-kay!" came the reply, like a voice from the bottom of a well.

Even the experts may fall

It took eight men to move the cat. Orville had slid to the trunk of the tree and when his machine rolled over it rested on the bottom branches, caging him. He climbed out of the hole hopping mad.

"I should have known that blasted sled would jackknife!" Then he laughed and he was fair game. He would hear about this every time we stopped during the day.

We pushed on through sudden snow squalls that swept across the ridges like the start of a blizzard. Then as suddenly the sky would clear and the sun was warm. We refueled at Squaw Creek, ate a cold lunch and began our last—and worst—stretch of side-hilling. Hiked out on the sides of our machines, we fought to hold them in the track. Even old pros like Clyde Baker had trouble staying in the groove.

I was "staying with 'er" for almost an hour when I hit a bump and the cat left

(Please turn to page 204)

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BITTERROOTS—BY SNOWMOBILE

(Continued from page 202)

the trail and headed for the edge. I parted company, my snowmobile started tumbling and only a big pine kept it from going into the next county. A roll of film dropped out of the underseat compartment and rolled on the crust. I scrambled after it, started rolling head over heels like a bear cub, passed it, stopped, turned and caught the can of film as it rolled to me. I needed that; it had the shot that proved Shelgren had rolled over, too.

Not far from here Capt. Lewis's horses had slipped. "The one which carried my desk and trunk turned over and rolled down a mountain for 40 yards and lodged against a tree, broke the desk. The horse escaped and appeared but little hurt."

But both springs on my mount were broken. The parts sled was a mile ahead, so Shelgren and Jackson jury-rigged the springs with rope. It was up to me to nurse the baby home. Late afternoon fatigue took its toll; two more machines rolled over—no injuries, no damages, just dented pride and membership in the club.

This adventure open to anyone

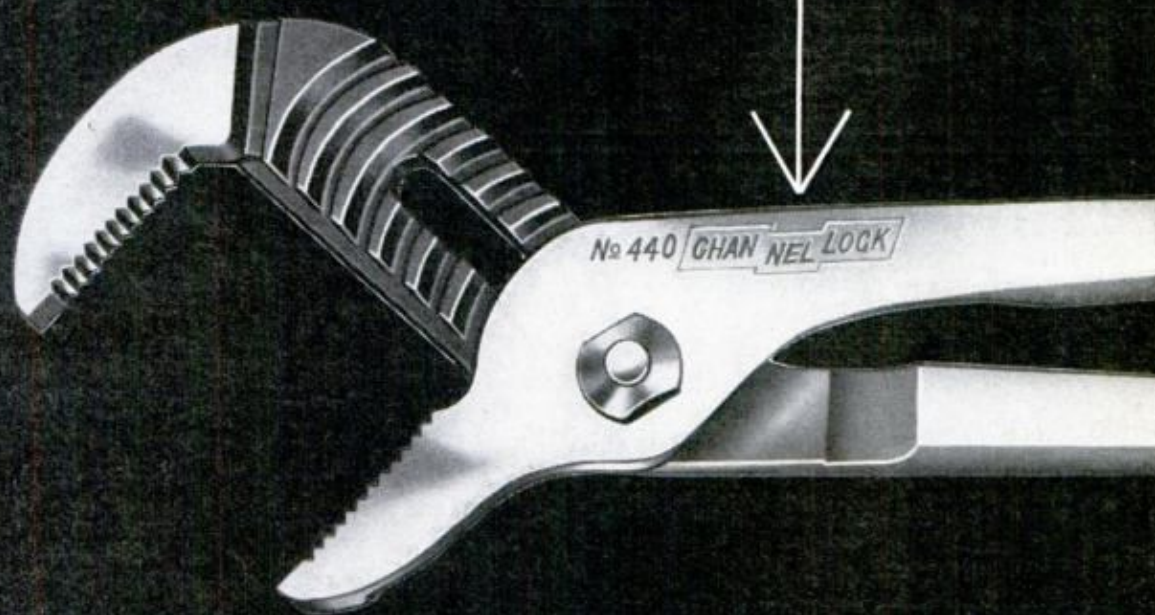
It was now downhill all the way—a 10-mile race to Powell and dinner at Lochsa Lodge for the rest of the gang. I fell far behind, easing along on my broken springs and enjoying my last look at this ruggedly beautiful country. Brave men had passed this way. While it doesn't take bravery to cross the Bitterroots today, it's good to know that there are still plenty of men who are eager for a crack at adventure and willing to pay the price in effort and sore muscles.

If you want a piece of this action, just drop a line to Orville Shelgren or Jim Jackson, Kooskia, Idaho. They are experienced packers and guides and will rent snowmobiles and get you in and out of the greatest wilderness area in the country. Together, Orville and Jim can handle as many as 20 people on a trip.

The Lolo Trail takes two days; it's not a jaunt for fat old ladies or for anyone who gets panicky on a narrow trail in high places. The side-hilling is tough. You do a lot of hauling and pushing to get your own and other's snowmobiles moving when they bog down. It's more of a physical workout than a ride, so if it's a challenge you want, you'll find it by going the whole distance on the Trail.

For a less grueling trip, run part of the Lolo Trail, or try some of the great one-day trips—to Elk Summit, the ghost town of Dixie, or over the Penman Grade to the old gold-mining camp of Orogrande. ★★

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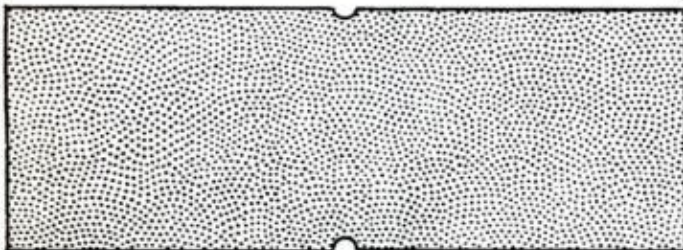


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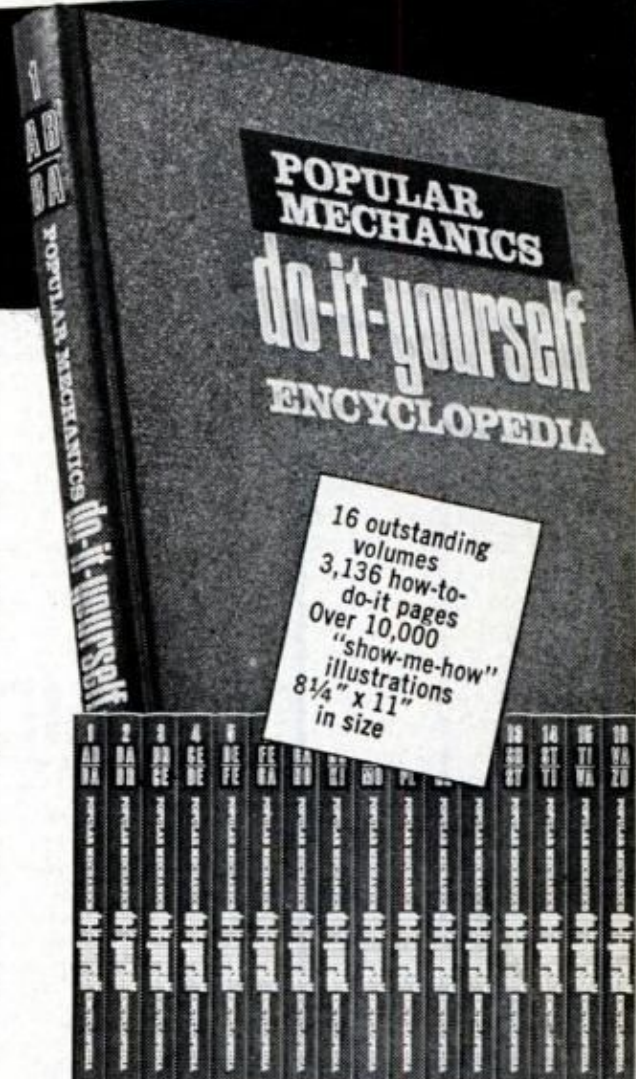
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BIGGEST 'FLYING' BOAT YET

(Continued from page 91)

from the water, her keel as much as eight feet from the surface. The ship seems to ride on three stilts. The stern strut and foil is now the ship's rudder and stabilizer.

Men at the controls have some of their work done by an automatic pilot. Ultrasonic height sensors at bow and stern make continuous readings of the rise and fall of the wave contour passing under the hull. This is fed directly to the foil control system to produce a smooth ride, regardless of surface conditions. Some hydrofoil craft control height by use of flaps on their foils. On the *Plainview*, this is accomplished by movement of the entire foil, changing its angle of attack.

Hydrofoils are getting major attention in antisubmarine warfare. A hydrofoil destroyer could become the only surface ship that can outrun and outmaneuver a nuclear submarine. It would be large enough to carry sophisticated detection and tracking gear and torpedo launchers. In a foil-borne chase, it would be immune to the bouncing and tossing that can interfere with the accuracy of weapons systems in a conventional ship traveling at high speed.

Other promising areas are mine warfare, reconnaissance missions, amphibious assaults, short-haul transportation of personnel, and oceanography.

Probably the most obvious place to put hydrofoils is on a gunboat—used to move a concentration of light firepower along coastlines or across major inland waters. It's no surprise the first Navy hydrofoil craft designed and built for use in combat were gunboats—the Boeing *Tucumcari* and Grumman *Flagstaff*.

Aside from general statistics—they're about 70 feet long and weigh about 60 tons—they demonstrate that with hydrofoils there is more than one way to fly. The *Flagstaff*, like the *Plainview*, has what engineers call the "airplane" configuration—two main foils forward, a single foil aft. The *Tucumcari's* configuration, called "canard," has the main foils aft.

Propulsion systems differ, too. For slow cruise with hull in the water, the boats use diesel-driven water-jet propulsion. On foils, the *Flagstaff*, switches to a propeller on its rear strut, powered by a Rolls-Royce "Tyne" gas turbine. The *Tucumcari* stays with water jet propulsion using a Bristol Proteus gas turbine.

The *Plainview* and the gunboats are making hydrofoil enthusiasts out of their sailors. "Sure the old PT boats were fast," as one of them says, "but they'd

(Please turn to page 214)

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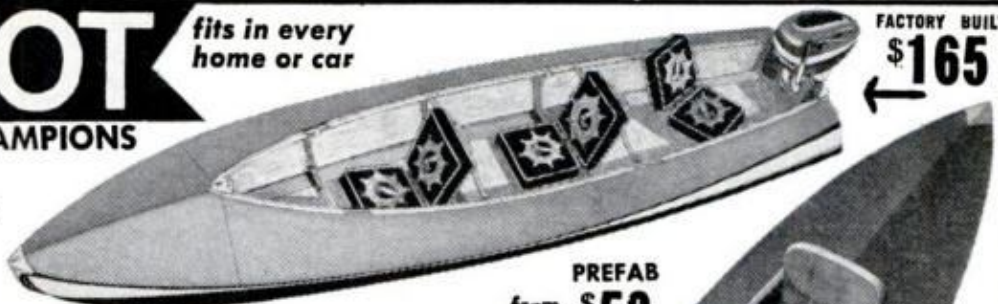
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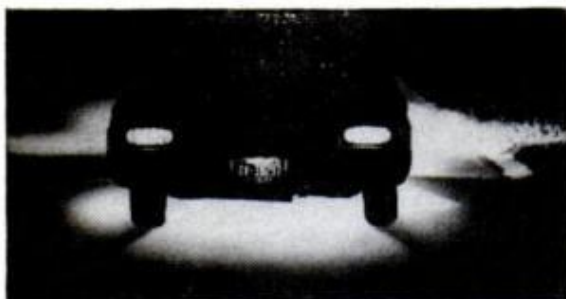
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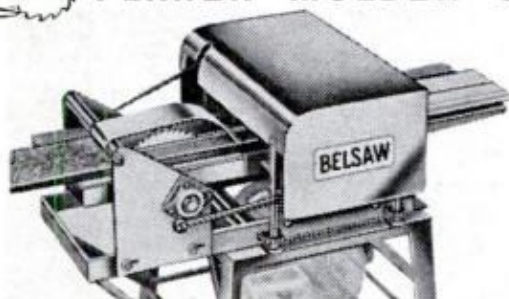
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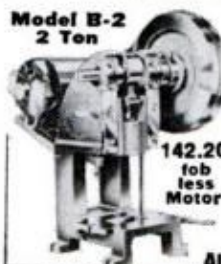
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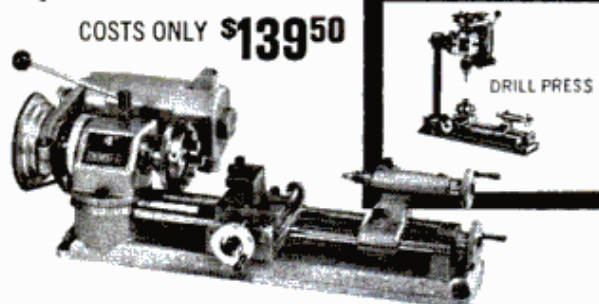
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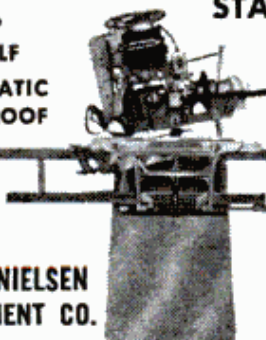
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HOW TO GET A GOOD BODY JOB

(Continued from page 82)

to see that the car sits level. Crawl around a little bit and ask questions. It's your car."

Threlfall says that one simple check involves a couple buckets of water.

"Pick a level spot and throw the water so it wets an area as wide as the car," he says. "Then back through it slow and straight so the tires get wet. Then drive straight ahead and get out and check; if the front and rear-wheel track marks aren't straight and in line, then the frame's off kilter."

Both Threlfall and Bristow agree that a good auto body man is somewhat like a good family doctor.

"You don't need him until you need him, but then you need him bad," Threlfall points out. "And like finding a family doctor, you have to go by the man's reputation. You wouldn't buy a cancer cure off a pushcart, but, believe me, a lot of people will buy body work from a guy who works out of the trunk of his car and drives around looking for banged-up cars. He says, 'For \$30, I'll fix it right here, Mister.' It's an out-and-out clip, but people fall for it every day.

"If you need body work, shop around for estimates. Most good shops will charge you for them, but it's worth it just to give you a better idea of what's involved. Usually the shop that gets the job will subtract the cost of its estimate from the finished job price.

"Above all," Threlfall says, "do a little preplanning. Figure that one of these days you're going to need some body work, so ask questions and poke around. Take a little time and visit a few shops. Tell the owner or manager right out what you have in mind, that you're lining up a body shop just in case you may need one someday. Any legit guy, if he has the time, will be glad to show you his shop, his equipment, the type of work he does and how he does it. Honest, it pays."

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BIGGEST 'FLYING' BOAT YET

(Continued from page 210)

knock themselves to pieces doing 40 knots in the kind of water we fly through."

General enthusiasm among hydrofoil technicians is high. One predicts that the next step will be a hydrofoil ship of 1000 tons! "I'm convinced," he says, "that the hydrofoil is going to change the look of the Navy in the next 10 years. Wait and see."

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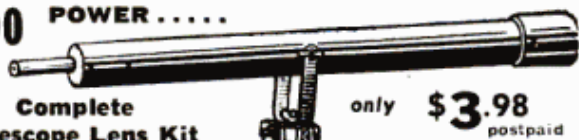
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FINANCING A CAR

(Continued from page 98)

any attempt to collect the loan. At the end of each year, they send you a statement of simple interest due. If you pay the interest in cash, the loan amount remains constant. If you do not pay the interest, it is added to the loan amount and the following year's interest is computed on the new, larger balance. Interest is, thereby, compounded annually until paid. Because of this lack of pressure by the company, you may neglect making regular payments and end up paying more interest than you would to a bank. So, if you decide to borrow from an insurance company, be prepared to discipline yourself until the loan is repaid. One way around this problem is to borrow from a bank, putting up the cash value of your insurance as collateral, instead of directly from the insurance company. The bank will actively follow up on the collection of interest. If you don't pay, it will collect the principal from the insurance company.

● **Car Dealer**—As part of your shopping tactics, query the dealer on his financing plan. Most dealers will bargain for interest the way they bargain on car prices. Some are willing to cut the price of a car if they can finance the purchase. So compare the total package price of your car plus financing against the combination of a cash car price with financing from another source. Usually a dealer assigns a car contract to a credit or acceptance company that pays him in cash. He may receive a rebate from the finance charges as part of his commission, depending on the rate of interest. Even so, dealer financing is likely to cost more than a similar loan from a bank or credit union. Use your Financing Cost Chart to sort out the actual costs.

● **Consumer Credit Companies**—Most expensive credit source is likely to be a small loan or credit company organized exclusively to extend installment credit. In some states these companies are licensed to charge as much as 3½ percent per month (42 percent yearly). Again, use the Financing Cost Chart to compare total credit costs.

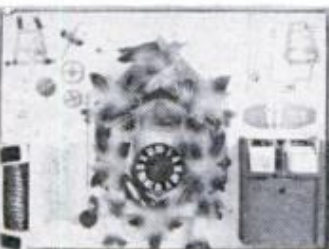
Protect Your Deal—In addition to determining finance charges, check the fine print of any conditional sales contract before signing for such things as delinquent fees charged if you pay late or miss a payment, repossession procedure and reclaiming rights, prepayment allowances (how finance charges are reduced if you pay early), and your legal responsibility if you resell the car before the contract is completed. ★★

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TRAFFIC COP OF THE SKY

(Continued from page 107)

sleep right away, no matter how tired I am."

"I've been working 10 hours a day, six days a week, for the last year," he says with some bitterness, "and I expect to go on working six days a week, 10 hours a day, for the next two years."

Why?

"Too many airplanes, too few airports and too few controllers."

The recent rash of publicity about the crowded skyways and the controllers' rebellion, during which they slowed air traffic down by hours, was neither exaggerated nor unjustified, Knoetgen claims.

"It brought us attention, and it forced the people who could do something about it to do something about it."

Basically, Knoetgen feels, the airlines should arrange their schedules to avoid peak-hour congestion, cities should build more air-traffic facilities and the FAA should hire more qualified controllers.

"It takes two years to train a green recruit," he says, "and some of them just don't have the talent or temperament to handle the job when it gets rough."

But the jobs are there. Knoetgen today is a journeyman controller employed by the FAA. In government language, he's a GS-12, which in civil service gives him a base salary of close to \$13,000. He started at \$4490 (today controllers start at \$5900) when he was 21, working up from assistant controller to ground controller to hand-off controller to journeyman. The overtime is almost meaningless.

"Government regulations put a ceiling on how much time-and-a-half we can earn," Knoetgen says, with a wry grin, "so I'd be better off working a normal five-day week."

And his future?

"Nobody knows. We're in a strange business because it's so new. We're actually the first generation of radar controllers, so nobody knows what will happen to us."

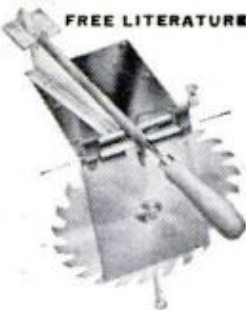
He does know that it can't last long. The quick reflexes and snap decisions, involving hundreds of lives, will get to a man after a few years on the job. Most controllers consider 40 or 45 the end of the line. After that, probably administrative positions within the FAA, some of which pay \$20,000 a year or more.

Jim doesn't seem worried, though. Controllers who can handle the job have to have a lot of confidence in themselves. And, after 10 or more years on the radar screens, that kind of confidence can be put to good use in many capacities. ★★

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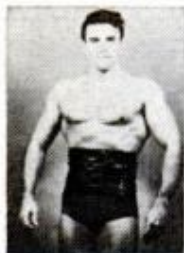
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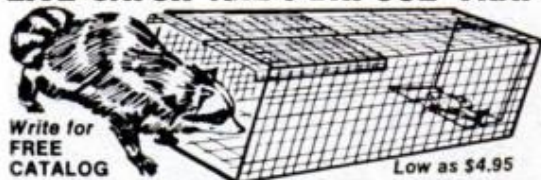
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WORLD'S SMALLEST COLOR TV

(Continued from page 121)

conditions are neither ideal nor easy to control.

An interesting sidelight on the Sony tube is that it isn't a new-fangled invention. It's based on an idea dreamed up nearly 20 years ago by an American physicist, Dr. E. O. Lawrence (of cyclotron fame). Called the "Chromatron," the tube was offered to American TV manufacturers in the early sixties. We saw the Chromatron demonstrated at that time and, like most observers, came away impressed by its brilliant performance. But no manufacturer would touch it. It required too many time-consuming steps to be economically feasible on a mass-production basis.

Sony took the Chromatron and added a raft of improvements that licked the production problems. The original Chromatron required that its glass tube be pumped out several times during manufacture. This allowed red, blue and green phosphors to be deposited separately on the screen in a process known as "electron printing." For the present tube, christened the "Trinitron," Sony developed (with the aid of a computer) a much faster system of "optical printing." No vacuum is needed for laying down the pattern of screen stripes so production time is slashed. The one-gun arrangement with its sophisticated electronic lens is also a Sony development. Thus the company took what amounted to an engineering curiosity and turned it into practical hardware.

A battery portable?

The bright glow of Sony's Micro Color is dimmed slightly by a few unavoidable problems inherent in its superb design. One is a fairly hefty price tag. Sets currently on the market carry a list price of \$429.95. Sony believes this will drop as production increases, but it may take a while.

Another debit is power consumption. Although transistors and other solid-state components slash the set's power drain to a mere 55 watts, even this is on the high side for completely portable battery operation. It means that the set in its present form must operate with a line cord plugged into house current. A battery powerful enough for it is considered too large and heavy at this time.

Yet, despite these points, there's no denying that color has made it into the miniature class. What next? How about a color set thin enough to hang on the wall like a picture? Not so farfetched—they're working on it now. ★★★

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TOY ELECTRIC JEEP will go up to 2 mph and carry a 200-pound load. The 25½-inch-long Echocar is powered by a rechargeable 6-volt battery. (Lower photo shows battery recharging from house current; sample power wheel lies at left.) Jeep is \$49.95; forklift and crane versions are \$64.95. Aristo-Craft Distinctive Miniatures, 314 Fifth Ave., New York.



ADULT-SIZE TRICYCLE has battery-powered front wheel, can go about 100 miles at 10 to 20 mph before recharging. Stelber Cycle Corp., 91-31 Queens Blvd., Elmhurst, N.Y.

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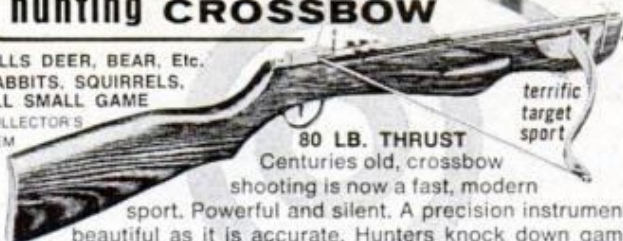
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PREPARE TO BEAT THE COLD

(Continued from page 139)

brush to clean corrosion from the tower.

Distributor cap and rotor—Inspect cap and rotor for cracks, carbon tracks and badly burned contacts. Replace if necessary. Clean towers with your tower brush.

Distributor points—Replace if burned, blued, pitted or badly worn. Check point gap and dwell. If points need replacing, replace the condenser as well.

A prime cause of cold-weather starting failure is insufficient distributor-point opening. Severe arcing will occur if the breaker point rubbing block is worn, causing points to have an opening of less than .006 in. Arcing greatly reduces secondary ignition voltage, which leads to misfiring and hard starting. A worn block is often due to poor lubrication.

So, after you've set points to specification, make sure you properly lubricate the rubbing block with distributor cam lubricant. Don't use too much. A good applicator is a cotton-tipped swab stick you can buy in a drugstore. Put a small amount of the lubricant on the tip of the cotton, apply to the cam and spread over the surface.

Sparkplugs—If plugs haven't been replaced in 10,000 miles, change them now. If they have seen only 5000 miles of use, file electrodes clean and flat with an ignition point file. Then set sparkplug gap to specification with a sparkplug feeler gauge. Finally, with your ignition all set to go, check and adjust its timing.

The major causes of wintertime fuel-system failure are ice in the system, dirty fuel filter and a faulty automatic choke. The first two are easily handled.

Once that temperature gets cold enough to freeze the glue on your bumper stickers, add a can of anti-icing additive to the fuel tank to dry up condensation which forms in the fuel system. As long as the weather remains cold, add a can every so often. You can minimize condensation by always keeping your fuel tank full.

As for the fuel filter, if it hasn't been replaced in 10,000 miles or so, now's a good time to do it. Simply remove the old one and hook up a new one of the type recommended for your car.

Now, check the position of the choke plate. Only if the engine is hot should the plate be open. If the plate won't operate properly, check it for binding. Dirt around choke plate and linkage causes trouble, so use a choke cleaner to remove the dirt.

If the plate still refuses to operate properly, the trouble is probably a bad thermostatic spring. Replace it and be sure to adjust the choke to the spec recommended by the maker in the manual. ★★

BY KEVIN V. BROWN
AVIATION
 JETSTREAM

DOWNTOWN AIRFIELDS? At least one airline is toying with the idea. Eastern Air Lines, which pioneered the shuttle run between New York, Washington and Boston, is seeking ways to save its harried commuters the trouble of getting caught in traffic jams at these major terminals.

It demonstrated a McDonnell-Douglas Model 188 STOL aircraft, which can seat 64 passengers and take off within 1000 feet and land within 500. Such an aircraft, in regular service, wouldn't need the longer runways of larger airports, but could take off from shorter strips close to the heart of a city—in the case of New York, from a strip at the regular airport set off to one side of the field so it would not interfere with regular traffic patterns.

The great advantage is that the flights could be scheduled irrespective of other traffic in the area, speeding up operations.

Model 188, which is actually manufactured in Europe, is primarily a test bed for studying the problems of STOL operations for commercial flights. It cruises at 250

mph, but Eastern hopes to have shuttle STOLs that will cruise at 400 mph or better and carry more than 100 passengers.

The Federal Aviation Administration has more or less given its blessing to such operations. It has laid down guidelines for STOL airports, suggesting 1500-foot runways 100 feet wide, with taxiways 60 feet wide, and able to support planes weighing 150,000 pounds. Current airport runways average one to two miles long.

Several configurations to achieve STOL capabilities have been tried. Model 188 uses one of the more standard configurations, based mostly on full-span flaps. Cruising, the STOL flight characteristics are comparable to standard aircraft, but the steep takeoffs and landings may take some getting used to by passengers. ★★

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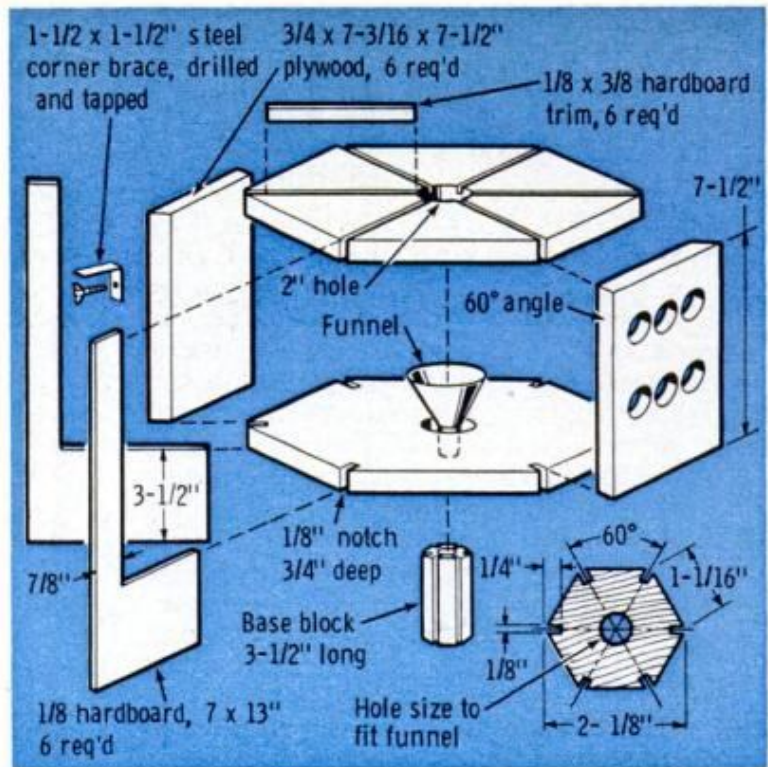
MUSICAL CENTERPIECES

(Continued from page 157)

drum. Prior to assembly $\frac{1}{8}$ -in. saw kerfs, radiating to the six corners, are made in the top and down the edges. The side members are actually lined up with the corner slots so you have a continuous $\frac{1}{8}$ -in. slot from top to bottom. The sixth side member is the door. This piece and the two adjacent to it have holes drilled in it to let the sound out.

The assembly is supported by six L-shape legs cut from tempered hardboard. These, as well as the narrow strips for the top, are inserted in the slots during final assembly. Note that the legs also fit in slots cut in a slotted central base block, which is glued to the bottom.

The base is covered with six pieces of bright red felt, starting from the 2-in. hole in the top and bringing it down the side. These are cut to lap the slots slightly and are stapled at the hole and to the underside of the base. The hardboard legs and the narrow top strips hold the felt in the slots. In the case of the



door opening the felt is tacked to the underside of the top. The door is covered separately with enough felt being left at the bottom to provide for tacking it to the underside of the base. This provides a hinge. ★★★

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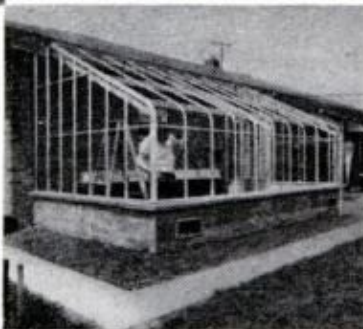
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BUILD THIS R/C GASSER

(Continued from page 161)

over the receiver to hold it snugly in place on a thick layer of foam rubber. The wiring connector board also is insulated from the aluminum plate by a 1/8-in.-thick piece of hard rubber. Fit a plastic spacer between the bottom of the board and the plate to keep from damaging the printed circuit connections.

The fiberglass body, roughly formed, needs about 1/2 in. cut from the bottom half, 1/4 in. from the top half. Also it's necessary to cut away the wheelwells of both pieces. I chose to cut away the front and rear windows, using a Dremel hand grinder and a fine circular saw blade.

Clearance holes must be drilled in the lower half for all chassis screwheads. This section then is secured to the chassis with a front, rear and center screw and nut. Thus, removing the body is possible without dismantling the entire car. To hold the two halves together, fit the sides of the top half with a pair of protruding screws, snap a thick rubber band on one screw, pass it under the car and secure it to the other screw.

To break-in the engine, mount it on a test stand and fit it with an 8-in. propeller and a fuel supply. With the carburetor venturi fully open, prime the air intake with fuel, open the needle valve 2 1/2 full turns, connect a 1 1/2-v. battery to the glow plug and rapidly flip the prop counterclockwise. If the engine doesn't kick over easily, prime the intake, close the venturi and flip the prop repeatedly. If, after a minute of flipping the prop, you're still unable to start the engine, open the venturi and try again. My initial tries at starting took over 35 minutes, due mainly to the tightness of the engine, but once running, it idled smoothly and restarted very easily.

At idle speed, run the first tanks of fuel slightly rich; that is, the exhaust should be smoking thickly and spewing out unburnt fuel. The second tanks should be a little leaner, with the needle valve opened only 1 to 1 1/2 turns. After this, the engine should start with just a flip or two—only when it's this easy to start should it be permanently installed (with double nuts) in the car. Starting it in the car then becomes a matter of passing a sash cord under the flywheel (to form a U) and pulling it upwards smartly with one hand and releasing it with the other.

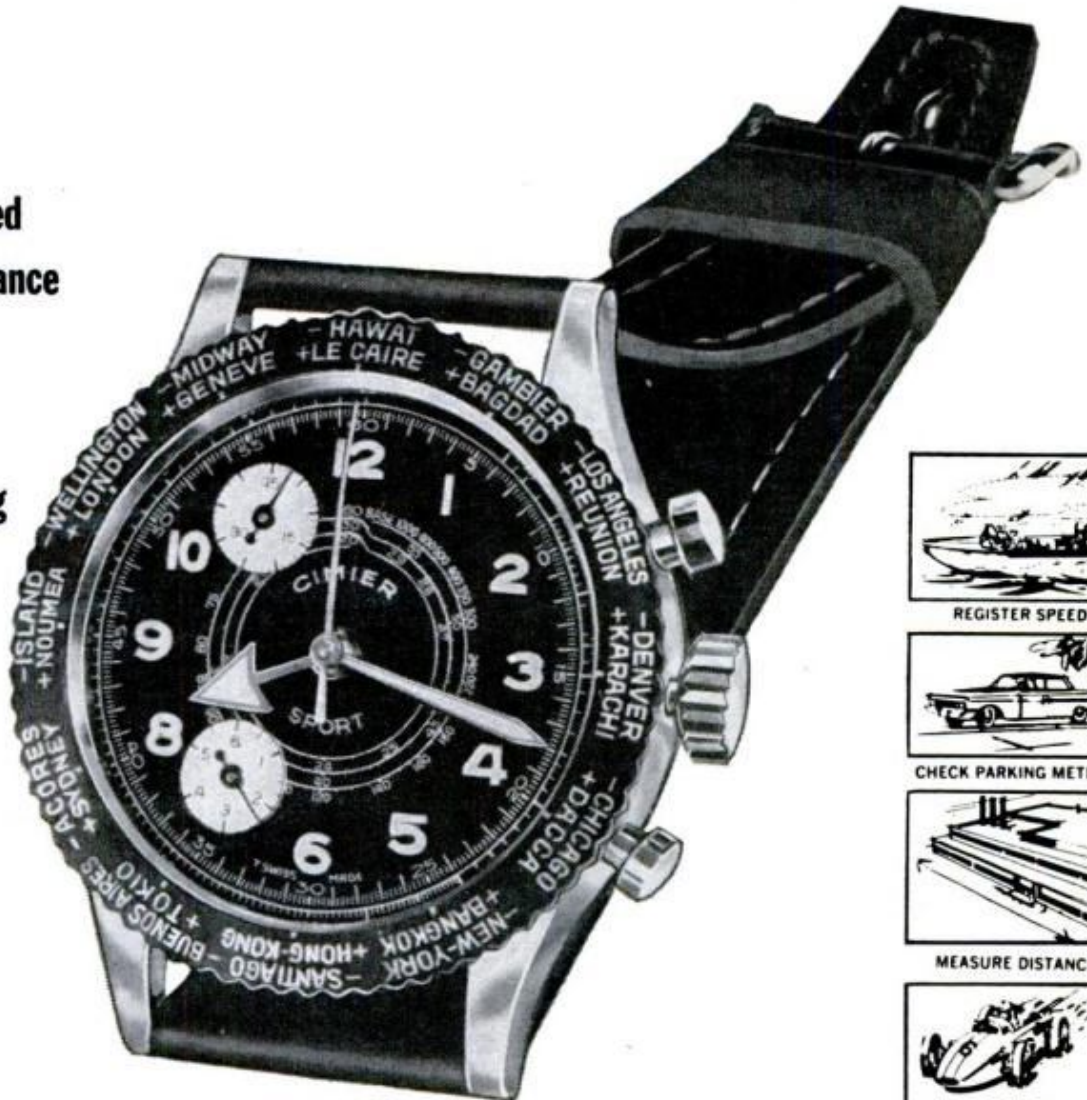
The kit costs \$139.95, from Aristo-Craft, 314 Fifth Ave., New York, N.Y. The R/C system, priced at \$274.95, can be ordered from Citizen-Ship, 810 E. 64th St., Indianapolis, Ind. ★★

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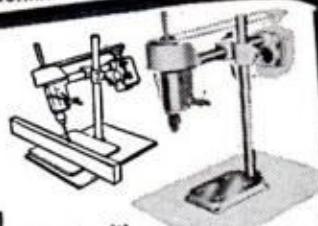
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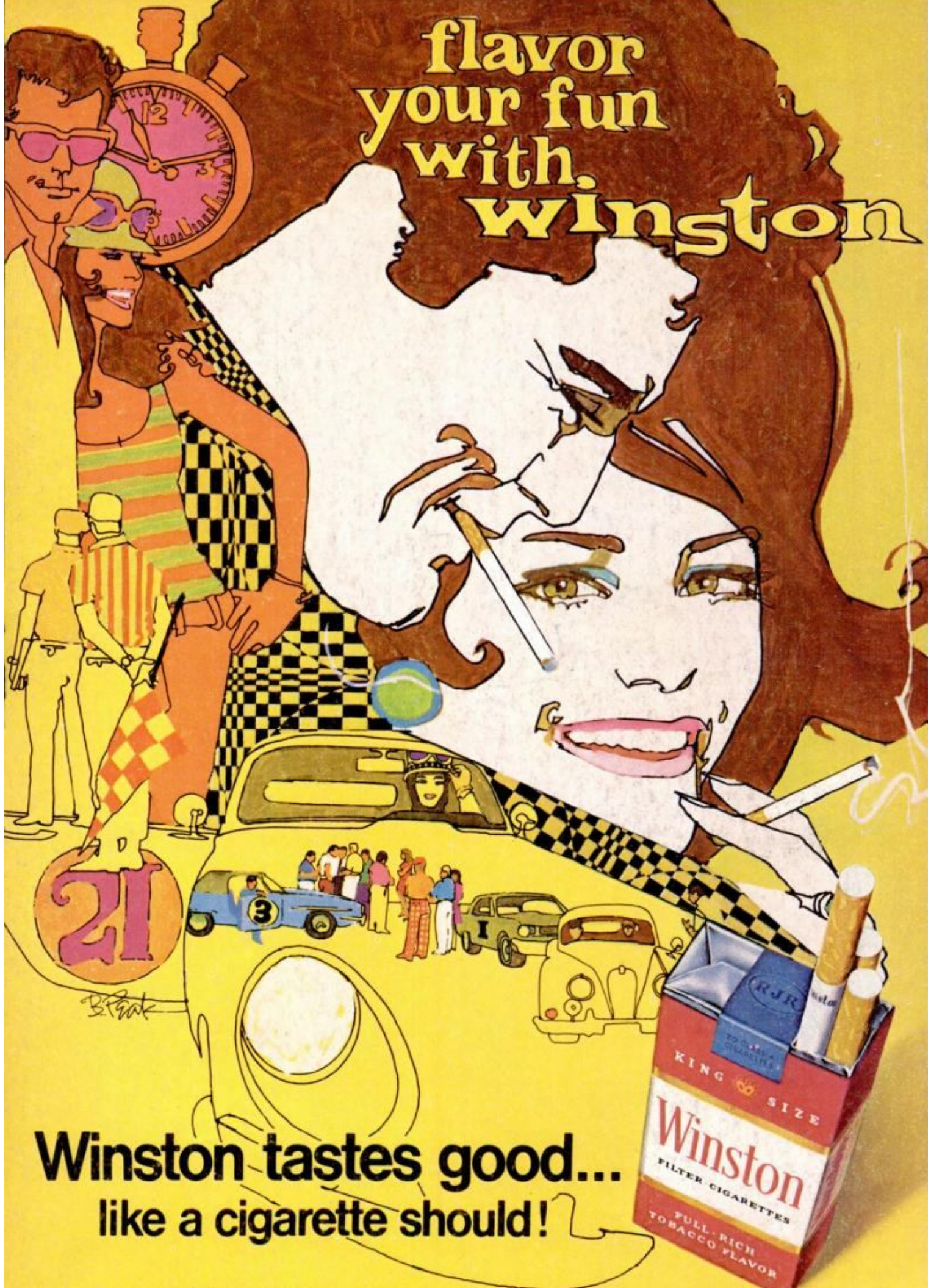
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