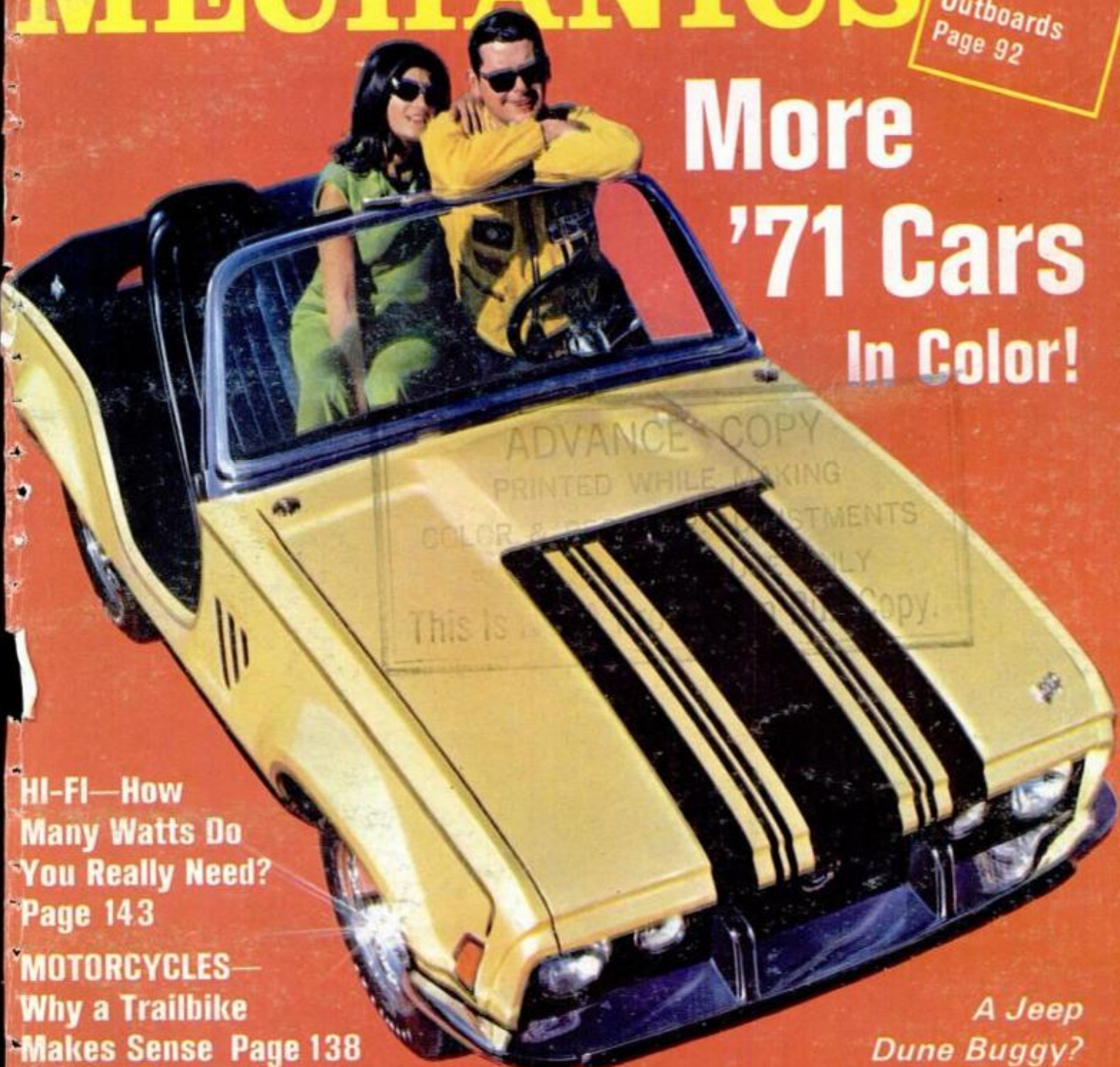


POPULAR MECHANICS

OCT. 1970
50 CENTS

New
Snowmobiles
Page 130
1971
Outboards
Page 92

More
'71 Cars
In Color!



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COLOR & ADJUSTMENTS
This is a copy.

HI-FI—How
Many Watts Do
You Really Need?
Page 143

MOTORCYCLES—
Why a Trailbike
Makes Sense Page 138

CARS—How to Convert to LP-Gas Page 85

AVIATION—Will You Lose Your Right to Fly? Page 88

HOME IMPROVEMENT—Bringing a View Inside With Sliding Glass Doors
Page 116

GREAT THINGS TO MAKE | Electronic Banjo • Electronic Football Game • Homework Desk
Shoe Drawer • Etagere (What's That? See Page 172)

*A Jeep
Dune Buggy?
Page 120*

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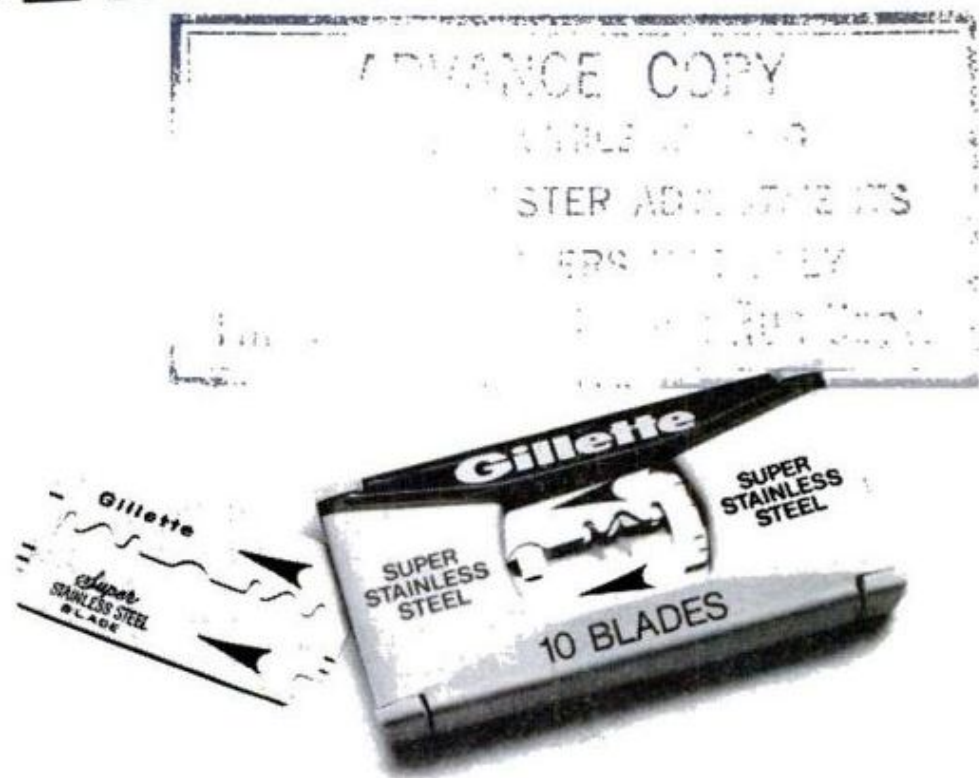
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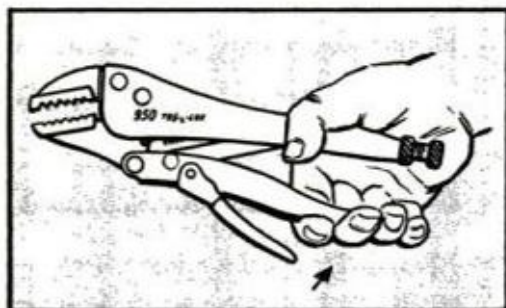
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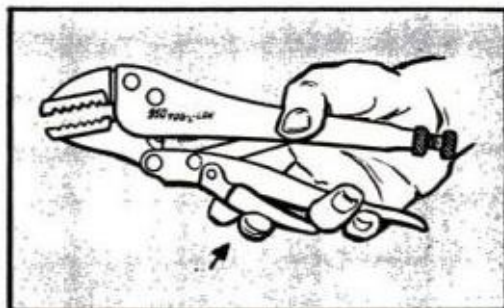
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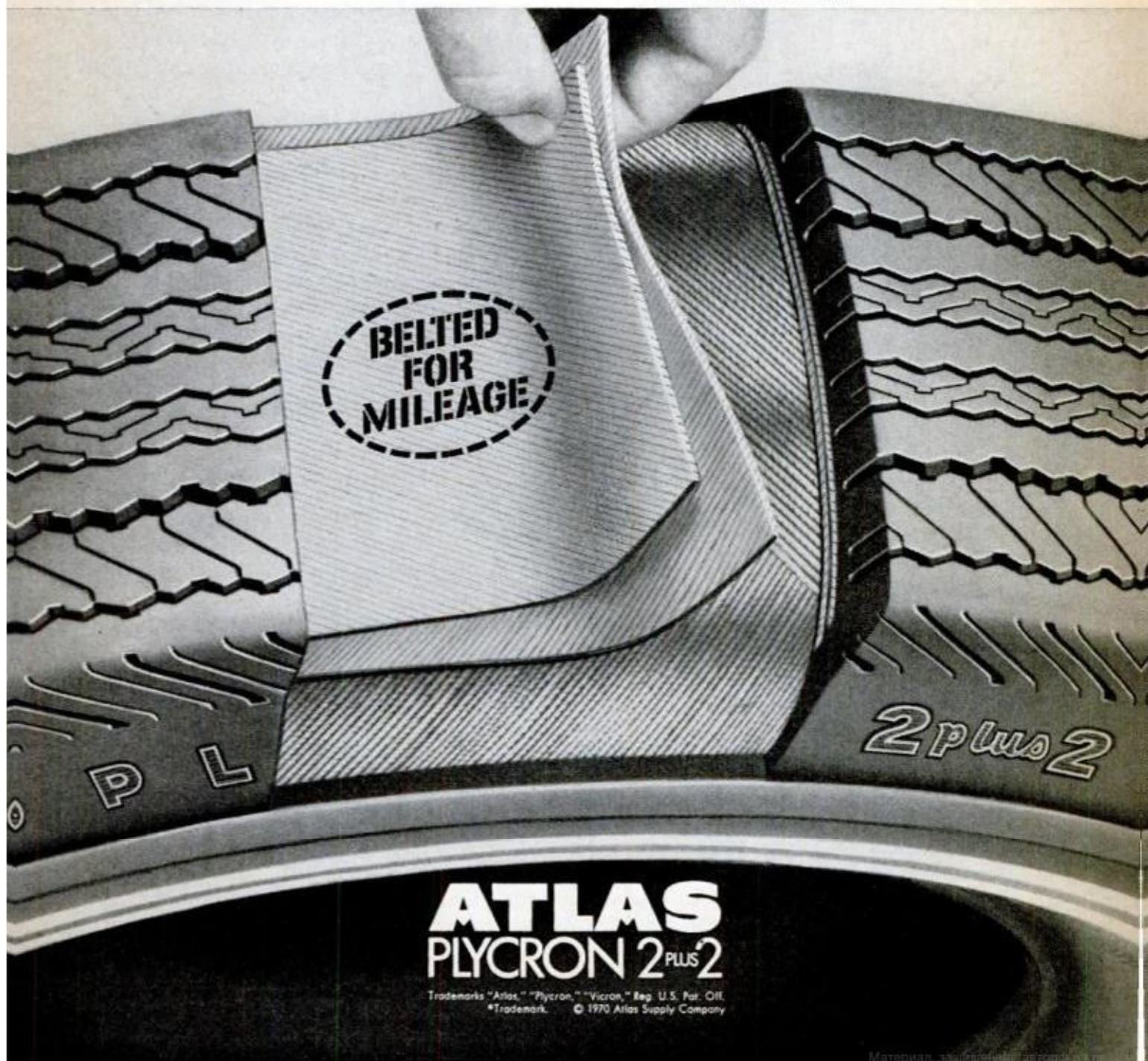
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A Jeep dune buggy? With four-wheel drive and V8 power under a sports-car skin?

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LETTERS TO THE EDITOR

Floating power again?

Very much appreciate the safety tips in *What to Do If Your Car Goes Into the Water* (page 92, Aug. PM). Perhaps a better way of saving lives is to install air bags on the underside or frame of the car. The air bags would inflate when the car hit the water or by water pressure before the car completely submerged.

SPARTA, N. J.

ANGELO J. MAZZEI

No such thing as 'harmless'

I was somewhat alarmed when "PM's pick of the new inventions" (*Just Patented*, page 98, Aug. PM) included the flying smokestack as an antipollution device. The explanation given for the device was: "... so industrial waste products are dissipated harmlessly into the upper atmosphere." Obviously someone does not understand the totality of the pollution problem. I must admit, it is a unique way to pollute the atmosphere—from top to bottom.

AMBRIDGE, PA.

JOHN G. FALTENOVICH

Dump industrial waste into the atmosphere "harmlessly"? This is the same reasoning used early in the century concerning the dumping of wastes into our rivers. After all, who's to know if we dump into the river? Only the people downstream, that's all! Shame on you.

CALGARY, ALTA.

J. W. SEMENEC

The flying smokestack is intended as an emergency aid, not a permanent cure-all. It could help to disperse dangerous fumes in heavy industrial areas where the problem is greatest until ways are found to eliminate pollutants completely. In the current crisis, any attempt to improve the situation seems worth noting.

More meter mail

Three cheers for Reader Wiebe (*Letters*, page 6, Aug. PM). Who needs the British system, with conversion factors like 2, 3, 5½, 30¼, etc., when all you need do in the metric system is move a decimal point?

HUNTSVILLE, ALA.

F. M. ESLICK

Underwater change?

The Face in the Mustang Window (page 88, July PM) was very interesting, [\(Please turn to page 8\)](#)

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LETTERS

(Continued from page 6)

but does leave me a little confused. How did that pathetic little girl who was wearing "... new purple slacks and a white top..." when the car went in the water make such a fast change into the dress depicted in the drawing when she was rescued 15 minutes later? Poetic license?

ARLINGTON, VA.

HARRY H. AVERILL

No. Masculine blindness.

Too bad Nancy didn't know all the rules given to Dutch drivers who frequently slip into canals and rivers off roads and seawalls of Holland:

1. Stay calm. (This quite clearly saved her life.)

2. Switch on headlights so the car can be located.

3. Wait for the car to fill with water. This will equalize pressure inside and out, allowing doors and windows to open.

4. Roll down window or open door and swim out.

BOWIE, MD.

DAVID W. RIGGS

See What to Do If Your Car Goes Into the Water (page 92, August PM).

Most people neglect to set the parking brake when they get out of the car—as was the case with the Mustang.

I've been an auto mechanic for 25 years and have noticed that many parking-brake mechanisms are rusted tight simply because they were never used.

A simple device which consists of a plate 2 by 2 by 1/8 inch to which a cable is attached and a pulley solve this.

Fasten the plate to the lower front face of the driver's door. Run the attached cable through the hinge opening and kick pad over the pulley which is fastened 4 inches above the dimmer switch on the floorboard. Bring the cable back up and pass it through a hole drilled in the arm below the parking brake foot pedal.

When the driver opens the door, the mechanism automatically sets the parking brake. One on my car works very well.

NORWALK, WIS.

ERWIN GRAEWIN

All is well

You Can Drive Your Own Well (page 188, April PM) is really true!

I have just finished punching down 37 feet through hard adobe clay and shale-gravel to an abundance of clear, cool water that tastes like nectar. The only assistance available was that of my 108-pound wife who acted as water carrier

(Please turn to page 10)

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Every few years, somebody comes out with some new kind of razor blade.

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LETTERS

(Continued from page 8)

and cheerleader. My thanks to R. G. Christophersen for such clear, easily followed directions.

SAN JOSE, CALIF.

SCOTT KIRKBRIDE

Too well oiled

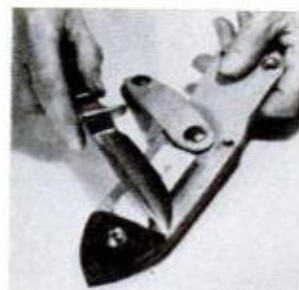
A 'Well-Oiled' Home Runs Smoother (page 172, July PM) is interesting, but on one point I must correct you (or you should have been clearer on the point). The only lube to be used on traverse rods—rubbed on the track—is paraffin. Oil and the like collects dust, gets on drapes and, in general, gums up the works. Having been in the drapery business 30 years, I think I know.

SAN FRANCISCO

A. J. KAUFMANN

Knife price knifed

The item about our Model 450 Lock-Knife in *Exciting New Products* (page 160, Aug. PM) is



very nice and your photos are impressive. However, the price we quoted for the hone is \$4.50 extra. Thus, this knife, with snap-on sheath and hone on the back (as shown), sells

for \$32.45 instead of the \$27.95 listed in PM. It's available from LockKnife, Inc., 11717 E. 23rd St., Independence, Mo. 64050.

EDWARD A. EASTMAN,
PRESIDENT

Back to the ol' drawing board

In looking over *Mini 'Steam' Engine* (page 154, July PM), I found an error. The circle on Steam Port Location Diagram is labeled $\frac{3}{4}$ " but should be $\frac{7}{8}$ ".

MORA, MINN.

DIRK S. CHRISTIE

Guess there's no denying that a circle with a $\frac{7}{16}$ -in. radius has to have a diameter of $\frac{7}{8}$ in.—not $\frac{3}{4}$ in.

I call your attention to a supergoof in *Build This Early American Bedroom Set* (page 146, July PM). Your "Half Pattern of the Headboard Rail" is labeled 23". There's no way for a 54-in. mattress to fit into a 46-in. space.

TALLADEGA, ALA.

JUNE DAVIDSON, JR.

Supergoof is right. There should be nine spindles spaced 5½ in. apart, making head and footboard rails each 55 in. long. ★★★



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With a billion appliances in use, there are probably thousands needing repair right in your own neighborhood. They mean

cash profits for you starting soon. Put your spare time to good use. Appliance servicing can give you the extra cash you may be seeking to do and buy the things you've always wanted.

- Low-cost NRI training covers —
- Small and large home appliances
 - Air conditioning
 - Refrigeration
 - Portable electric tools
 - Small gasoline engines
 - Farm and commercial equipment

Professional appliance testing equipment is included in your NRI course at no extra cost — to help you speed troubleshooting and repair jobs. Mail coupon now for your **FREE NRI Catalog**. No salesman will call. National Radio Institute, Appliance Training Division, Washington, D.C. 20016.



NRI APPLIANCE TRAINING DIVISION • Washington, D.C. 20016
 Accredited Member National Home Study Council

How to buy your first pickup like it was your second.

People usually approach their first pickup with the thought that they're buying a car with a box in the back.

After a while, they think of it in different terms.

They discover that passenger-car engines aren't truck engines. And that passenger-car suspensions were never made for 4,000-pound loads.

So the second time they buy a truck, they know better. And choose a pickup for all the right reasons... and wind up with what they should have had all along. A truck.

That's all well and good—if you can stand the \$3,500 lesson.

Most people can't. But they do it anyway.

They need information. To get second-truck wise before they buy their first truck.

That's just the kind of information we've got.

It begins with our 1971 INTERNATIONAL models. If you're at all familiar with pickups, you'll notice some changes in ours.

A new grill. New hubcaps. A different tailgate treatment. New rocker panel trim. Several new colors to choose from. A few new things. But nothing that can, alone, give you good enough reason to buy one.

That's the job of the information.

Our V-8 engines, for instance. They're truck engines. We didn't pull them out of passenger cars. They are, in fact, the same engines we use in some of our big, gas-engine highway trucks.

So right away, you know two things. They're made for heavy loads. And they last a long time.

But there's a third point you've probably never considered: the advertised horsepower. It's the horsepower you "buy"... but not the horsepower you get. That's because advertised horsepower figures are theoretical. They represent what the engine should be producing—but because of an engine's inherent traits, never does.

What you do get is the *net* horsepower. An example: Our 193 hp. rated V-8 actually produces 173 hp. A good competitor's 200 hp. rated V-8 gives you 150.

So if you were looking for the "more powerful" of the two—you'd choose the wrong one, based on the advertised figures.

It works that way for most of our V-8's... and for most of our competitors' V-8's. They can promise more—we can deliver more.

Another important consideration concerns suspensions. If you're planning to carry a heavy load—like a big camper—you can't judge the suspension by the way the truck test-rides empty. It will ride differently once it's fully loaded. So to determine the safest, most stable suspension, you have to go at it in a different manner:

A coil spring gives you one point of suspension at each wheel. A leaf spring gives you two.

A standard Chevrolet has coil springs all around... for a total of *four* points of suspension. As standard equipment, a Ford has coils in the front, leaf springs in the rear... *six* points of suspension.* As standard equipment, an INTERNATIONAL 1210 has leaf springs all around... giving you *eight* points of suspension.

So you have a choice of 4, 6 or 8 points of suspension. Or, if you're safety conscious—maybe no choice at all. You need 8.

There are plenty of other things. Like fuel tank location. We're the only manufacturer to put it outside the cab... instead of inside like everyone else. Our pickups are easier to get in and out of... with a doorsill that's up to nine inches lower than the competition. We're the only manufacturer to give you direct-reading gauges as standard equipment. You either pay extra with everyone else—or try to get along without them.

There's even more than that. And the logical place to find out about all of them is at a truck specialist's.

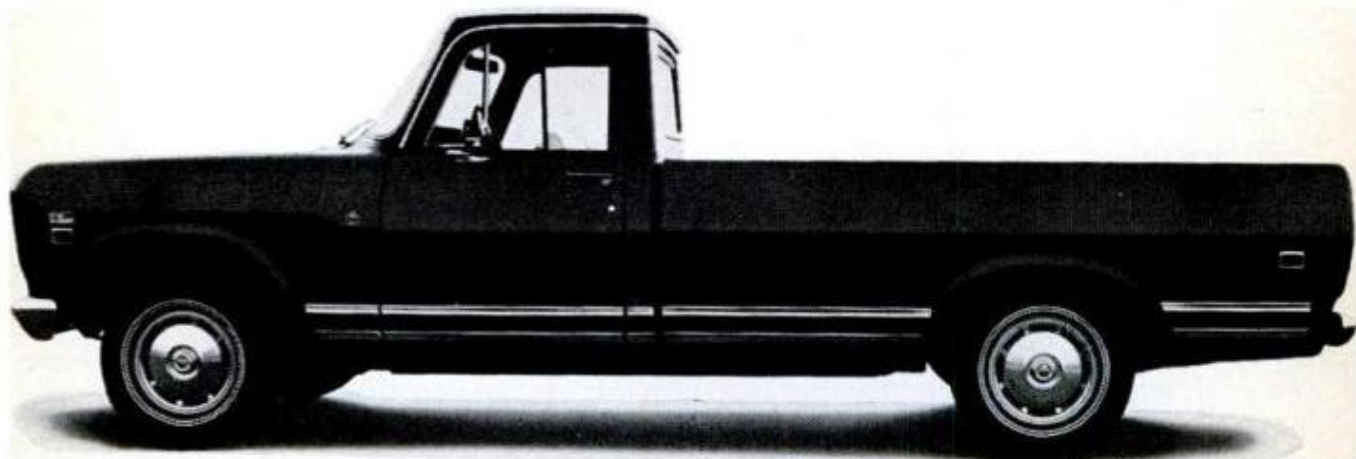
An INTERNATIONAL dealer.

Stop by and talk to him. Expect him to show you our eight pickup models, and tell you why we think they're the safest, best-engineered pickups going.

But also expect him to give you a free booklet full of facts. And more information, if you need it. Or, let us send it to you.

So that you can buy your first pickup like it was your second.

*Competitive specifications mentioned above pertain to manufacturer's 1970 models and do not reflect any changes in 1971 model lines.



International Harvester Company. 401 N. Michigan Ave., Chicago, Illinois 60611.

IH. International Trucks

ON-THE-GO

CAMPING

BY WADE MITCHELL

AMAZING NEW FRONT-WHEEL-DRIVE MOTOR HOME COMING. We're sworn to secrecy, but here are some tantalizing details. Motive power is by Ford, but chassis will have *independent wheel suspension* at all four points. Drive mechanism will *not* be a Toronado unit, according to builders. Overall road height of this new unit is said to be two feet lower than any comparable motor home in the field. The price is expected to be approximately \$10,000.

MAGNUM CAMPER TRUCKS A NEW TREND? An enterprising Los Angeles Ford dealer (Fairway Ford) builds a so-called Super Camper like this. First, start with an F-350 one-ton chassis, add an 8-foot pickup box, install 12 16.5 rear tires in 10-ply grade, rear-fender extensions, and you get a carrier with 2000 pounds more weight capacity than a 3/4-ton pickup. Wheelbase is 135 inches, or 4 inches longer than the 3/4-ton Camper Special, and brakes and frame are larger, too. The end product is sort of a magnum pickup for campers who habitually overload their 3/4-ton trucks, or who wish to haul very heavy 10-foot coaches.

LARGEST VAN EVER FROM DODGE IN '72. Though the factory may deny it, sources close to Dodge Truck Div. claim to have heard a report from Dodge brass that an 11,000-pound GVW van will be available in 1972. If true, an entire new generation of van-campers will be possible. Highest GVW currently available in 1971 model Dodge vans have 7700 pounds capacity in B-300 vans with 127-inch wheelbase. The 1972 van will show an increase of 3300 pounds GVW. Dodge Truck is apparently bidding to take over the light camping-van market.

FLY-IN CAMP-OUT SERVICE. Camp America in conjunction with Eastern Airlines is offering flights to and from several major cities where fully equipped campers are available upon arrival. Rental costs for a family of six come to less than \$5 per person per day for a modern pickup camper-coach. For more information, write Allan A. Swenson, 342 Madison Ave., New York, N.Y. 10017.

INDOOR-TYPE SLEEPING BAGS FOR RVS will be marketed by the Coleman Co. New lightweight bags use changeable sheets and look more like expensive bedding and less like tent rolls. For those who want the fastest, warmest beds, sleeping bags offer the most efficient solution.

ARE TRAVEL TRAILERS GETTING HEAVIER? The average gross weight of travel trailers is increasing more rapidly than overall length. This results in greater cost to the customer, a penalty in towing performance, greater wear on brakes and some increase in engine heating tendencies. But why this increase in weight? One of country's largest producers of travel trailers blames it *on the buyers*. "They want too much accessory equipment. Load 'em up with junk and the weight inevitably climbs. Don't blame us!"

THE LIMITER, a precision "movement limiting device," has been custom-made by Unicus to eliminate the inherent bounce between camper and truck, oversteer on the new longer campers and high-wind instability. It's made of aluminum housing and mounting brackets, steel piston and rubber boot over the piston rod to seal out weather, dust and dirt. It works on overhead, half-cab and nonoverhead models without obstructing your vision. Write Unicus, Dept. PM, 842 N. Cummings Rd., Covina, Calif. 91722. ★★★

“Even with extra asbestos and a firewall, our Autolite battery took an awful roasting during our Lime Rock win. We’re tough on batteries. But you’re tougher on yours.”—Parnelli Jones

Parnelli Jones believes a top driver ought to know almost as much about race-car systems as the top mechanics. So when Parnelli talks, you listen carefully.

“In our Trans-Am Mustang, we tuck the Autolite battery up under the right instrument

cowl. Despite the heat shield my feet get really hot. And that battery gets hotter—maybe 200 degrees—because it’s higher up, and it’s not ventilated. So you can figure on a lot of evaporation in 2½ hours of roasting.”

That’s no problem for Autolite batteries. Their Sta-Ful reservoir has up to three times more water above the plates—to deliver full power, despite evaporation.

“Racing’s tough on batteries. You’re tougher. We’ll change batteries almost every race. You stick with yours for 10, 20, 30 thousand miles and never care a bit about dirt and salt and moisture collecting on top of it, and making a nice path for electric leaks that can stop a battery cold.”

With Autolite, you can forget electric leakage. The one-piece construction virtually eliminates self-discharging across the battery top.

Next time, get an Autolite battery. It passes the toughest test in racing. And the toughest test there is. Your kind of driving.



Autolite 



We pass the toughest test.

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.

2. Jobs in Architecture, Building

ARCHITECTS—Qualify for advanced positions in architectural, engineering offices. I. C. S. courses begin with basics. Knowledge to help prepare for A.I.A. exams. Math, Drawing, Design, B'd'ng, M'ch'n'c'l trades. Write "Architecture" on coupon for FREE booklets.

ARCH. DRAWING—One-course stepping-stone to architecture. Emphasis on drawing practice. No previous experience necessary. Apply now.

CARPENTRY—Largest demand area in building trades. Well over \$4.50 average hourly wage. Over 20,000 openings yearly. Training needed. Send coupon NOW.

PLUMBING-HEATING—Earn \$4.94 hourly—average for plumbing-heating specialists. ICS course has proven track record. Starts with basics. Mail coupon for FREE Success Kit.

3. Art Talent Sought

COMMERCIAL ARTISTS—Experienced artists earn \$175 and more weekly. But training is essential. Course starts with fundamentals. Job-related. Personalized instruction. Break into field full- or part-time. Write "Commercial Art" on coupon.

INTERIOR DECORATING—Non-technical course for homemaker, home furnishings salesperson. Study carpets, furniture, walls, windows, decor, color, taste. Mail coupon now.

SIGN PAINTING—Course prepares you to break into field. Covers all aspects: layout, design, painting, gilding, screen process. Send coupon for 3 FREE booklets.

SKETCHING & PAINTING—Like to draw? Feel you have talent? Get training. For spare-time enjoyment, or use in present line of work. Course starts with basics, covers popular art mediums.

4. Automotive Specialists

AUTO TUNE-UP—The auto repair specialty in greatest demand nationwide. Course assumes no prior knowledge—takes you from basics to finished job. Covers elect. systems. Send coupon for 3 FREE booklets.

MECHANIC (GEN'L)—700,000 employed. 20,000 openings yearly, and employment on the upswing. Famous I. C. S. course taken by thousands in field. Coupon brings Success Kit.

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.

ADMINISTRATION—The key to business success. Famous I. C. S. course covers 3 vital areas: management, production, marketing. Write "Business Administration" on coupon.

EXEC. TRAINING—A company's as good as its top people. Learn to train men, to spot "comers." Mail the coupon.

MARKETING MEN—Advance to management? You'll need marketing knowledge. Course covers management practices, principles, with emphasis on marketing. Get started now.

PROGRAMMERS for digital computers. Space-age specialty. Earn up to \$15,000 yearly. Specialized—training vital. This course gives it.

PURCHASING—Advance to purchasing agent? Break into field? Take this course. Demand for PA's rising. Experienced men earn average salaries of \$8-\$15,000. Send for Success Kit.

SALESMANSHIP—ICS is famous for this course. Covers basics of selling that stay same, no matter the field. 1,000,000 new salesmen needed by 1975. Get started NOW. Write "Salesmanship" on coupon.

YOU CAN GET A BETTER JOB

by spare-time study with ICS

SMALL BUSINESS MGT.—Run your own business. Course tells how. Covers purchasing, merchandising, sales, taxes, accounting, etc.—all you need to know.

TRAFFIC MGT.—Employment forecasts show upward trend for trained traffic people. Course covers entire traffic picture. Prepares you to enter or advance in field. Send coupon today.

6. Chemistry

CHEM. ENGINEERS—Youngest engineering field, expanding with industrial development. Course prepares you for registration exams. Also for breaking into chemical design, development or production departments. Send coupon for Success Kit. It tells whole story.

GEN'L CHEM.—A good course in gen'l chemistry? What easier way than at home, in spare time. Also covers basic math, physics.

NUCLEAR ENERGY—Course for engineers, technicians, maintenance men who want to enter nuclear field. Covers basic math, physics & chemistry leading to study of radioactivity and nuclear energy.

PLASTICS—Qualify as plastics technician. Take this course. Texts easy to read, written by experts. Mail the coupon for 3 FREE booklets.

PULP, PAPER SPECIALISTS—Courses cover engineering to paper machine operator. Demand field, exp'ct'd to increase 75% in next 25 years. Write for information.

7. How to Become a Civil Engineer

CIVIL ENGINEER—Famous course recognized by many states, prepares you to take exams. All aspects of civil engineering. Thousands of graduates. Write now for 3 FREE booklets.

HIGHWAY ENGINEER—Advance in field. Course complete, covers theory, practice. Recognized by many states. Send coupon now.

STRUCTURAL BLUEPRINTS—How to read them. A key to advancement for ironworkers, patternmakers, builders of concrete structures. Mail coupon now.

SANITARY ENG'N'R'NG—Men trained in this field in constant demand. Course covers water treatment-supply, sewerage, eradicating menaces to health. Apply now.

SURVEYING, MAPPING—Course for man who wants to enter civil engineering field, but undecided about branch. Texts illustrated, simply written. Personalized instruction. Mail coupon.

8. Draftsmen in Demand

DRAFTSMEN—Over 4000 openings yearly. Senior draftsmen earn average of over \$625/month. Break into field? ICS training in specialized area can help you. Don't delay. Choose field, then clip coupon.

ARCHITECTURAL drafting course covers arch. drawing, house planning, freehand & ornamental drawing, shades & shadows.

ELECTRICAL—Arithmetic, electricity basics, projection drawing, machine sketching, electrical drafting, other subjects.

ELECTRONIC—Math, mechanical drawing, formulas, electricity, electronic & printed circuit drafting, others.

MECHANICAL DRAFTING—Arithmetic, algebra, geometry & trig, projection drawing, mechanical drawing, machine sketching, others.

9. Electronics, Electricity

APPLIANCE SERVICING—More appliances mean more demand for servicemen. I. C. S. gives you know-how worth money from start. Clip coupon for Success Kit.

ELECTRICAL ENGINEERS—Demand field. Jobs in gov't, industry. I. C. S. training helps worker in field advance to junior, sr. eng'n'r'ng positions. Also helpful in preparing for registration exam. Starts with basics, if you have limited knowledge. Send coupon for 3 FREE booklets.

ELECTRIC MOTOR REPAIRMAN—Course starts with basics, covers AC, DC motors—perfect for would-be maintenance men, or those who seek advancement to supervisor.

INSTRUMENT TECHNICIAN—Specialists in electrical measuring & control equip. will be scarce in late '60's. Take advantage! Course gives training, starting with gen'l principles. Send for Success Kit right away.

PRACTICAL ELECTRICIANS earn an average of over \$5 per hour. Get the know-how! Course covers building wiring, elect. equipm't. Helps prepare for licensing, journeyman exams.

INDUSTRIAL ELECTRONICS—Technical-level course—thorough grounding in electronics. Take first step to cracking this rapidly expanding field. Mail the coupon.

ELECTRONICS TECHNICIANS—With 5 yrs. exp., they average \$7500—many earn more!

Be a specialist in this booming field! Course prepares you. Theory—you learn it. Plus practical application. Mail coupon now.

10. Engineering—a Profession

Take your first step to becoming a registered, professional engineer, with the help of famous I. C. S. courses. There are two routes to eng'n'ng: college and 4 yrs' exp. in field; or high school and 8 yrs' exp. Then, state registration exam. I. C. S. courses help you obtain work where you can gain necessary field experience; give you knowledge you need to pass exams. Instruction available in Civil, Chemical, Electrical, Mechanical Engineering. Texts authored by authorities, are illustrated and simply written for quick comprehension. Study now, in spare time, for future success or retirement career in engineering. Write "Professional Engineer" on coupon. Do it now.

11. Success, Pleasure Through Better English Writing

BUSINESS WRITING—Command the written word—a key to business success! Course covers composition, copywriting, editing, typography, report writing. Send coupon for FREE Success Kit.

FREE-LANCE WRITING—A career for anyone with talent for writing. Course treats techniques, forms and—how to sell articles. Step-by-step instruction. Send coupon.

SHORT STORY WRITING—An avocation that can lead to spare-time profit. Course covers English grammar, elements of a good story. Emphasis on actual writing. Get started now.

PRACTICAL ENGLISH—A bedrock study of basic English. To improve your speech, writing. As refresher in the basics. People judge you by your language. Send coupon today.

12. More Formal Education

FINISH HIGH SCHOOL—It's never too late. And H.S. completion means much greater earning power and job security. I. C. S. High School programs let you complete your schooling at home, in spare time, at your own pace. Variety of courses offered: Business, Secretarial, Vocational, General. Complete only work you need for I. C. S. High School diploma. Start doing it now—by filling out coupon and mailing it!

COLLEGE PREPARATORY high school course also available. Take credits you need for I. C. S. H. S. diploma that prepares you for college entrance exams. It's never too late to start—if you have the desire. How about now?

H.S. EQUIVALENCY EXAM—New short course prepares you to take state exam for H.S. equiv. certificate. Special warranty offered on this course. Send coupon.

13. \$\$\$\$ in Mechanics, Shopwork

AIR CONDITIONING EXPERT—Experienced men make \$150 a week, average, and demand is rising. If you have basic mechanical knowledge, take this course. Instruction in maintenance, too. Write "Air Conditioning" on coupon.

INDUSTRIAL ENGINEERING—Advance to higher position in operation/management of industrial plant: this course gives the knowledge you'll need. Also first step to becoming registered eng'n'r. Send coupon.

INSTRUMENTATION—Several thousand new jobs a year in this demand field. A basic course. Write for Success Kit.

MACHINE DESIGN—A technical field itself, this knowledge is vital to draftsmen, and a big plus for production men, shop workers.

MACHINE SHOP PRACTICE—A basic course, giving overall knowledge of shop oper't'ns. Emphasis on practical facts. Personalized instruction. A must for the man who wants to advance. First step? Mail coupon.

MECHANICAL ENGINEERING—Within your grasp a high-pay field where at least 2600 new jobs open yearly. Write for Success Kit.

SHOP PRINTS—And how to read them. An authoritative, factual study. Vital to men who want to advance in shop work. Mail coupon now.

REFRIGERATION SPECIALISTS—Enter this booming field and learn the hard way? There's no need. Training spurs advancement—it's never been truer! Fill out coupon for complete information.

TEXTILE TECHNICIAN—The job outlook is good—for trained men. Course designed to help you break into field—or advance to management. Write "Textile" on coupon.

TOOLMAKING—The average toolmaker earns \$28 daily. For good reason: he knows a specialized skill. ICS course equips machinists to crack this specialty, where over 4000 jobs open up annually.

SAFETY ENGINEERING—A comparatively new field, and men with formal training are scarce. Be one. Take I. C. S. course. Covers math, plant design, equipment placement, psychology, safety principles, practices. Apply now. Clip coupon.

WELDING—6000 openings yearly for welders, and pay in line with demand. I. C. S. offers several courses, from the basics to specialized areas. Write "Welding" on coupon for 3 FREE books.

14. Secretarial Help Wanted

WHERE THE MONEY IS—It's in specialized secretarial work. Few secretaries know specialized terminology, procedures. Those who do are in demand, command good pay.

LEGAL SECRETARY—Course covers instruction in typing, English, Gregg method sh'rt'h'nd, business law, insurance, office practice, public relations, legal shorthand. Equips you to work in law office. Apply immediately—the coupon's hot.

MEDICAL SECRETARY—Basic secretarial skills covered in detail. Plus: instruction units on duties of a medical secretary, medical terminology, related subjects. Send coupon NOW for information.

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

BOILER INSPECTOR—Course equips you to break into field, inspecting boilers. Subjects include basic science, steam, boiler fundamentals, steam-boiler design, pumps & compressors.

POWER PLANT ENG'N'NG—Want to advance to watch or chief engineer? You'll need knowledge this course contains. Mail coupon right away.

16. Wanted—Trained Supervisors

FOREMAN—You can be one—training speeds the way. Course gives you the broad view of production. Send coupon.

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 \$150-\$200 a week. ICS course covers fundamentals of field step by step. Basic electricity, electronics; AM, FM radio; B & W, color TV. Mail coupon NOW.

RADIOTELEPHONE LICENSES—1st and 2nd class. Courses give thorough grounding in communications fundamentals, preparing you to pass FCC exam, or tuition refunded. Get complete details. Mail coupon for Success Kit.

The Training You Need—from ICS

Get the training you need for the job you want. Get it through I. C. S.—International Correspondence Schools. America's oldest home study institution. 7,500,000 students. Over 6000 training agreements with business and industry. More than 200 courses... thousands of individual instruction units, written by experts, then illustrated and edited to "build the teacher into the text." Personalized guidance from your I. C. S. instructor. Convenient payment plan. Each of the I. C. S. courses on this page has been designed for one reason only: TO HELP YOU BREAK INTO...OR MOVE AHEAD FASTER... IN THE FIELD YOU CHOOSE.

Take the first step right now. Find out about I. C. S. by filling in the coupon and mailing it. You'll receive three valuable booklets—the famous I. C. S. "Success Kit"—completely without obligation.

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Occupation _____

Employed by _____ Working hours _____ A.M. to _____ P.M.

ICS has over 266 career-related courses.

B2848J

Three new low-calorie sweeteners, derived from citrus fruits and regarded as possible replacements for the cyclamates, are being tested by Department of Agriculture scientists. Naringin, made from grapefruit rind, is 100 times as sweet as sugar, 3 times as sweet as the cyclamates and 1/3 as sweet as saccharin, the artificial sweetener now used in diet drinks. Hesperidin, derived from sweet oranges, packs a wallop about equal to that of naringin. But for real taste-bud-twitching sweetness, there's neohesperidin. Made from bitter oranges, it is 1500 times as sweet as sugar, 50 times as sweet as the cyclamates and 5 times as sweet as saccharine. The substances are now being put through two-year-long safety tests with animals.

By "cutting" an opening in the plane's side, a liquid explosive may provide a superfast way to free passengers from an airliner that has crash-landed. Developed by the Federal Aviation Administration, the method recently was used to make a three-by-two-foot hole in a fuselage. The explosive was contained in a hollow tube shaped to fit the desired opening. The cutting operation took less than a second and made a noise like a rifle shot. The explosive is set off by a detonator activated by a crew member. Safety devices would prevent accidental activation. Planned as a backup for conventional escape systems, the method could be used to cut out an entire side of a plane.

Men may ultimately outnumber women if current efforts to keep families small is a long-term success. That conclusion can be drawn from a 10-year survey of 7755 births by a British physician. He says that in families with only two children there were 1.12 times as many boys as girls. But that difference decreased as family size increased, reaching a ratio of almost one-to-one in families with more than five children.

Six orbiting satellites are looking for jobs. Elderly by space-age standards, they're still capable of useful work after having accomplished their scientific missions. NASA seeks proposals from scientists regarding possible new investigations. The "graybeard" of the group is an Orbiting Geophysical Observatory (OGO 1) launched from Cape Kennedy on Sept. 5, 1964. It is in an elliptical Earth orbit of 111,000 miles by 39,000 miles and has 10 scientific instruments that are still operable.

Potential dental cavities may soon be spotted by equipment designed to examine lunar soil samples. An ionizing radiation detector produced by General Electric, the device is being modified for use in a University of Chicago dental clinic. It consists of a radioactive isotope, a radiation detector and a radiation counter. The isotope emits a stream of beta particles that strike the calcium in the tooth and bounce back to be counted by the detector. The counter records data from the tooth and prints out a model indicating those areas that give less than normal radiation backscatter. Healthy teeth reflect the same amounts of radiation from all surfaces. But low amounts of backscatter indicate an area where enamel has begun to dissolve, signaling a potential cavity site. The radiation dose absorbed by the patient is much less than that received from ordinary dental X-rays, according to University of Chicago researchers.

Scientists know much more about the moon's surface than they do about Earth's ocean floor. Researchers were reminded of this ironic fact by results of the Apollo 11 and 12 moon missions, according to the U.S. Naval Oceanographic Office. By studying depth soundings made in the Pacific splashdown areas of the two missions, oceanographers discovered four volcanoes and a volcanic ridge. One reason that we know so little about the ocean floor is that it cannot easily be photographed. In contrast, scientists are loaded with good moon photos.

KEEP PACE WITH SPACE AGE! SEE MOON SHOTS—LANDINGS, SPACE FLIGHTS, CLOSE-UP!

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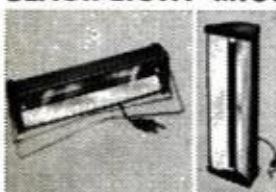
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Projects brilliant, sharp 1/2 foot square image from 8 feet away using up to 5"X5" color, b & w illustrations. Retains all original colors and proportions. Enlarges drawings, blueprints, watercolors, pictures, stamps, coins, other objects. Features high speed, 200mm anastigmatic projection lens (f.3.5, 8"F.L.); powerful peanut-size quartz halogen lamp (50hr. life); unique internal reflecting system. Gives maximum brightness, entire field focus. Flat stage and removable magnetic platen enable use upside down. Turbo-blower cooled. Tough plastic case, 5 1/2 ft. cord.



Stock No. 71.272H (8 1/2" x 6" X 12 1/2" — 11 1/2 lbs.) \$89.75 Ppd.

BLACK-LIGHT MIGHTY MITES



Relatively small (12") fixtures give surprisingly bright blacklight. Mirror-finished reflector makes instant starting 8-watt, high-intensity bulb look like 40-watter. Up to 5,000 hours of safe, long-wave (3660A) blacklight to really turn-on parties, light & theatrical shows, psychedelic decors, holiday decorations. Shockproof end-caps remove for safe, easy replacement of bulb and starter. Stands upright or horizontal. Aluminum case.

Stock No. 71.274H \$14.95 Ppd.
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AMERICAN MADE OPAQUE PROJECTOR



Projects illustrations up to 3" x 3 1/2" —enlarges them to 35" x 30" if screen is 6 1/2 ft. from projector, larger pictures if screen is farther away. No film or negatives needed. Primarily intended for children. Projects charts, diagrams, color or black-and-white in darkened room. 115 v. A.C. . . . 6 ft. cord and plug included. Size 12" x 8" x 4 1/2" wide. Weight 1 lb. 2 ozs. Plastic case.

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Drivin' with Dan

Why can't America produce winning engineers for Can-Am and Formula 1 cars? How wide are the tires used at Indy? What are Offys used for besides racing? Dan Gurney answers these and other automotive questions

Q. *If two cars, alike in all respects except for the rear wheels, run side by side at 50 mph, does the driveshaft turn faster in one car than in the other if one has 13-inch rear wheels and the other 15-inch? (Ten of us are arguing this and nine of them are against me—I say no, the larger wheel just has more riding surface.)—E.J. Bertocini, Pittsburgh.*

A. The answer depends upon the o.d. (outside diameter) of the tire (circumference). The car whose tires have the largest o.d. or circumference would have the slowest-turning driveshaft. But if you mean rim width, you are right. Other things such as tire pressure, tread pattern, rubber compound and thickness would also have slight effects. If you had huge 13-inch tires versus very low-profile 15-inch tires you could still win the argument.

Q. *With America's lead in aviation and in the general auto industry, why can't we produce the engineers and developers for Can-Am and Formula 1 cars like Len Terry, Colin Chapman and Robin Herd? Every successful American racing*

car seems to have English help in the background.
—Carl H. Barner, Barrington, N. J.

A. I'm sure we can, but you're right—we haven't. Jim Hall has done outstanding work in many areas. Maybe there are some young men with creative instincts who are just getting started.

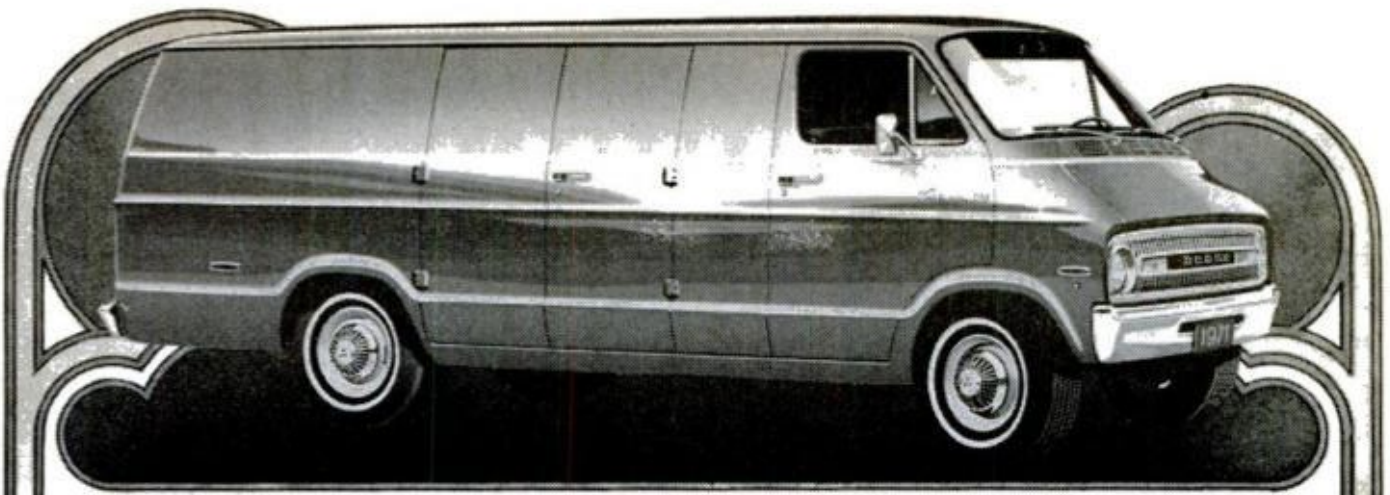
Q. *I haven't been able to find a straight answer to why you suddenly left the McLaren Can-Am team after winning two of the first three races. Were you fired? Did you quit?—Tom Kennedy, Omaha.*

A. Well, Tom, it's like this. I have been with Castrol Oil Co. for several years. Reluctantly, they gave me permission to drive a Gulf-sponsored McLaren. They said it would be okay if I didn't wear a Castrol patch on my driving suit, but "please don't wear a Gulf patch," and I agreed. Gulf wanted me to wear a Gulf patch, and I wouldn't.






Q. *I was planning to buy a ¾-ton, four-wheel-*
(Please turn to page 24)






STOPPED IN ACTION by a long-lens camera, Dan comes off banks onto back straight at full throttle during the 1970 Indy 500



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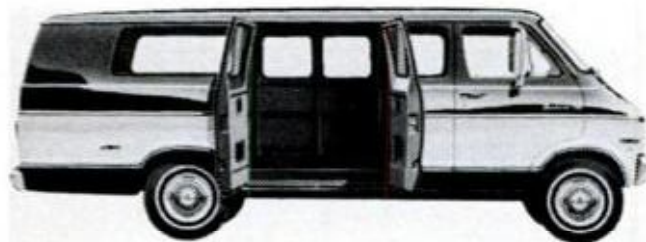
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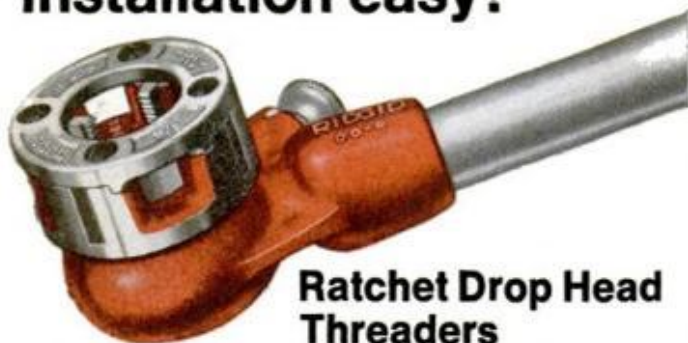


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DRIVIN' WITH DAN

(Continued from page 22)

drive pickup and camper to take cross-country, but several friends have told me four-wheel-drive vehicles are not made for cross-country trips. What do you advise?—Michael Nemlich, Scarsdale, N. Y.

A. Buy it. I wouldn't expect any problem. As a matter of fact, I want one myself.

Q. How wide are the tires they use at Indy, and how much do they cost apiece?—C. Seckman, Nashville, Tenn.

A. The rear ones are about 13 inches wide across the tread, the fronts about 10 inches wide. I understand they cost approximately \$125 each to manufacture.

Q. I have a 1960 Cadillac and have started to use regular gas. What result might this have? What should I do in order to use regular gas in my car?—Leon Slima, Chicago.

A. I think regular gas will work fine. It might help if you retard the ignition timing about 3°. Drive with a light foot and avoid full throttle to prevent detonation or "knocking."

Q. In racing a 1950 Ford on a 5/16-mile oval track, I have trouble with the front wheel lifting too high (about 1½ feet). We are allowed to use lower blocks and/or torch rear springs. How can I obtain better balance for this type of racing?—A. Bergen, Campbell River, B.C.

A. You haven't given me much information to work with, but it sounds like you have a problem with low "roll centers" which are controlled by suspension geometry. It's easy to adjust rear roll center height with a "panhard rod" in the rear. You must have the panhard rod controlling all the lateral forces. The springs should control only the vertical loads. Get an engineering book on the subject to help you.

Q. How is a person supposed to know that he is getting a sound new car? I have heard of people buying a new car only to have the motor drop out on the way home. Why all this?—George W. Meyer, Costa Mesa, Calif.

A. That's why people go for brand names, guarantees and old, established dealers with

(Please turn to page 26)

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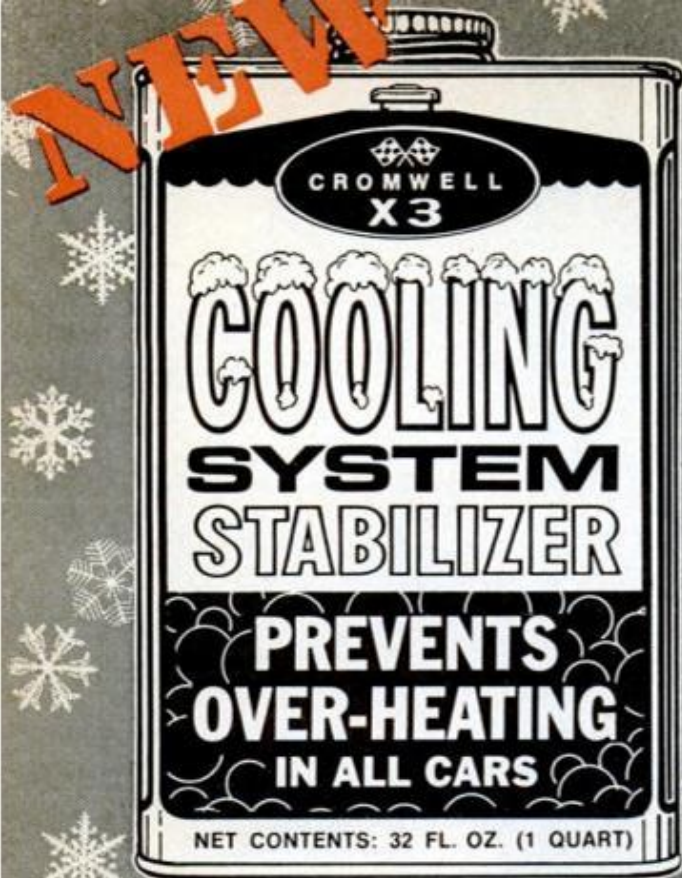
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DRIVIN' WITH DAN

(Continued from page 24)

good reputations. After that, you still don't know, but you have a better chance.

Q. Where are Offys made? What are they used for besides racing?—Richard Hirt, Dumont, N.J.

A. They are made by Drake Engineering in Costa Mesa, Calif., for racing only.

Q. Do you know how Archie Scott Brown, the late British racing driver who had only one arm, changed gears?—John Ryder, Prince George, B.C., Canada.

A. I knew him, but I regret that I cannot answer the question. I remember him as having an indomitable spirit and being full of fight and daring. I think he must have steadied the wheel with the stump of his arm as he shifted with his good hand.

Q. I have read many articles in car magazines that mention 427 SOHC Ford engines. What does SOHC stand for?—Ricky Dwyer, Millerton, N.Y.

A. Good question. It stands for single overhead cam (one per bank of cylinders).

Q. My friend says that in the 100-mile race for Volkswagen sedans at Nassau's Speed Week in 1964, you pushed A.J. Foyt, bumper to bumper, most of the way to victory. I say they wouldn't allow this. Right?—Craig Hupy, Gladstone, Mich.

A. Wrong!

Q. Do you find motor-sports writers here and abroad mostly honest and objective? Which do you read? Which magazines? On the road 40 weeks a year, I'd like to know what's going on in racing.—Joseph Moreton, Beverly Hills, Calif.

A. I prefer the writers who are still genuine motor-sports enthusiasts. I like a motor-sports writer who will go for a ride with a racer. I like the ones who work hard at learning the sport. Some would do well to try a driver-training course. I enjoy *Autoweek* and *National Speed Sport News*, both weeklies. Keep looking and good luck! ★ ★ ★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 78).

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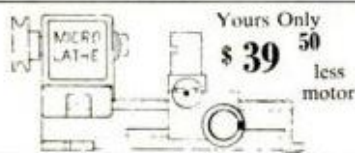
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Design Machine, Dept. PM1, 15018 E. Proctor, Industry, Calif. 91746



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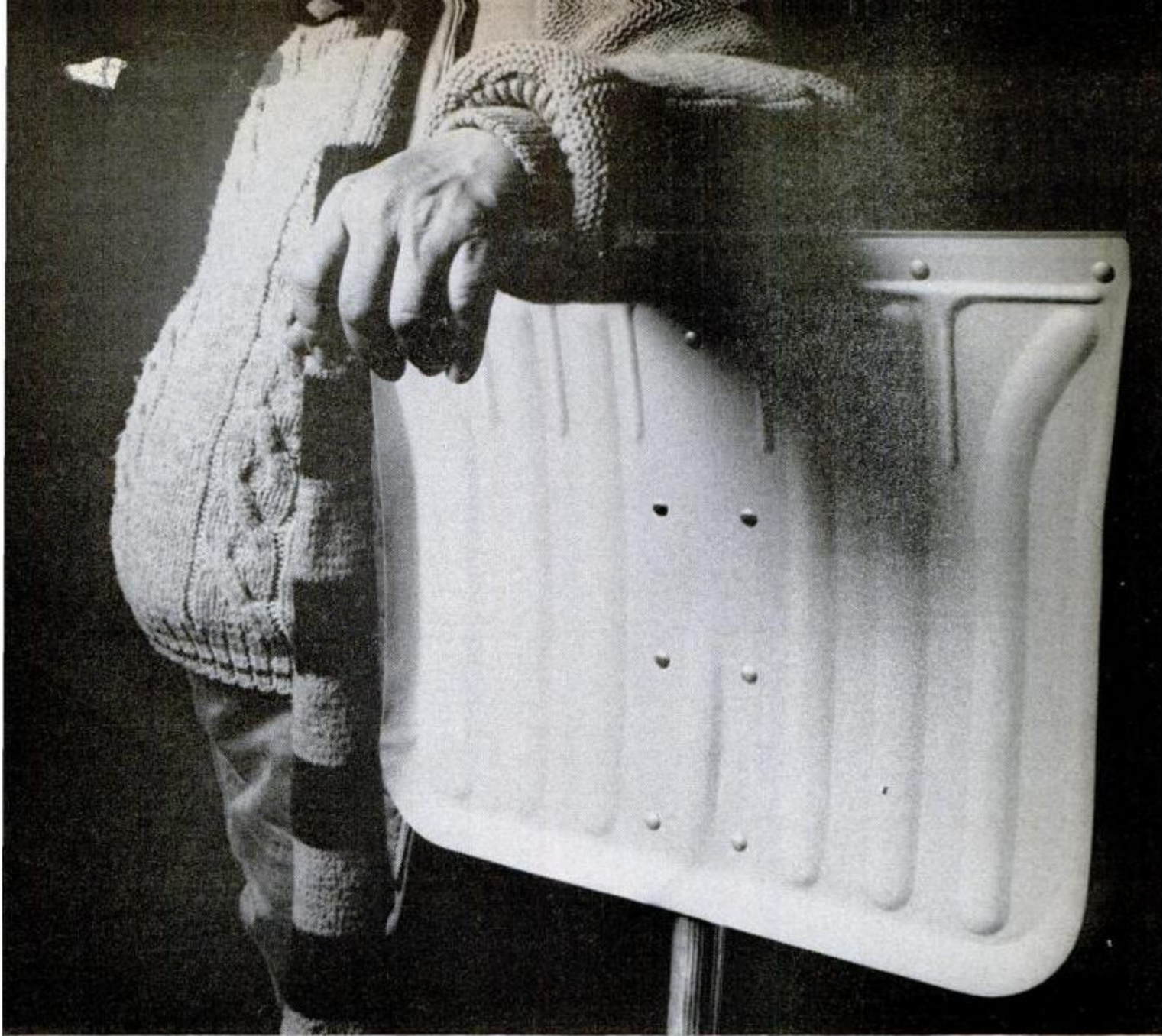
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It's also on no-stick handyman and garden tools that work smoother, easier, faster. These are the best performing snow shovels and tools you can buy.

*Reg. U.S. Pat. Off. for Du Pont's non-stick finishes.



Better things for better living
...through chemistry

WHAT'S NEW
OUTDOORS
 BY ROB KINSON



MOTORCADDY will make it easy to store your outboard motor this fall. An aluminum alloy frame mounted on rubber tires (above) totes your motor from boat dock to the garage. MotorCaddy handles engines ranging from 3 to 20 hp and has an adjustable handle to give you that extra leverage when you need it. Caddy and motor together go up and down stairs, and will fit into your car trunk, station wagon or hall closet for storage. MotorCaddy (Model No. 25) is made by the Yoder Manufacturing Co., 1823 E. 17th St., Little Rock, Ark., and sells for about \$29.95.



MINIS ARE IN—for tools, that is! True Temper sports a miniature toolkit (left) designed for vacationers, campers, hunters or anyone working outdoors. Kit, made up in three different sizes, consists of a shovel, saw and ax. The smallest unit (CK2) has a shovel with handle 18 inches long, a 14-inch ax handle and a 15-inch bow-saw blade. Tools are durable, compact and weather-resistant. True Temper Corp., 1623 Euclid Ave., Cleveland, Ohio 44115.



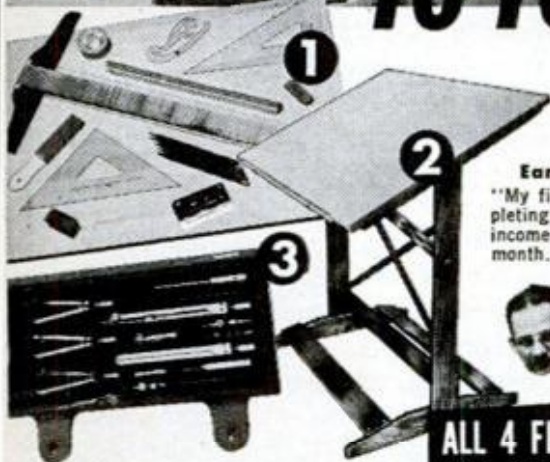
CONVERT YOUR GAME into usable, decorative and professional-looking skins with a do-it-yourself package known as the U-Tan Home Tanning Kit (above). It contains an ingredient called Glutaraldehyde which the maker claims will treat animal hides so that they are soft, flexible, washable and resistant to deterioration. All you need is a knife, coarse sandpaper, flat wood surface and a wooden barrel or plastic garbage can. The basic kit includes step-by-step instructions and enough material to process two normal-size (8 ft. square) deerskins and costs \$4.95. An eight-skin kit is priced at \$11.95. Both are available from U-Tan Co., Div. of Pierini Tanning & Dyeing Corp., 28 Paris St., Newark, N.J. 07105.



PUT OUT SMALL FIRES with an aerosol-can extinguisher (left) just marketed by Cincinnati Industries. Its compact size and safe, easy handling make this portable firefighter a must for your camping, boating or fishing trips, or for storage in the trunk of your car for emergencies. Called the Cindus Fire Extinguisher, it puts out all types of small fires: gas, oil, grease, wood, paper, cloth, or electrical. Safe to handle because it contains no carbon tetrachloride. Available almost everywhere for \$1.95.



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DETROIT LISTENING POST

BY ROBERT LUND

HOW SOON A THREE-WHEEL CAR? A two-seater? A Wankel engine or a turbine? Something really new and different in sizes, shapes and engines in production automobiles? Cars you can buy off the shelf, not those one-of-a-kind fancies the auto companies concoct to lure you into the showroom to look at their standard stuff. The revolution could come a lot earlier than most people figure. Maybe in three or four years. The push that'll force the industry to develop new concepts in cars has nothing to do with criticism of current cars, the flap over pollution, threats to ban the internal combustion engine and the other crusades aimed at getting Detroit to reform. The incentive for the industry to innovate and come up with new configurations and new powerplants is public boredom with status quo cars.

The automakers have been spooked by a growing public indifference to their wares. Henry Ford II is the only one who says it flat out. "I think the glamour of the automobile is decreasing," Ford declares. "People are looking at it as a machine to get from place to place to do something else." That doesn't mean people are antiautomobiles, that they don't need 'em or want 'em. But it's a new attitude that lumps cars with toothbrushes and can openers. You have 'em around for when you need 'em, as Ford says, but you don't do flips over them. The indifference is confirmed by surveys the auto companies have made on intentions to buy. More and more motorists indicate they'll hang onto their cars longer than they used to, stretching them over more years. Where's the incentive to buy a new one when the difference between before and after is so small?

Detroit knows it has to come up with the stuff to rekindle the excitement. That means more daring, different cars; machines that are really new. They're coming.

THE "GO" SIGN TO BRING OUT SMALL CARS has apparently been given by GM to Buick, Olds and Pontiac, although Buick is still a question mark. If Opel, the German import handled by Buick dealers, isn't bruised too badly by the domestic small cars, Buick may decide to stay with Opel and forego a home-grown mini. Olds has engineering and design work for its cub car well in hand and hopes to have it out by the fall of '72. It will be a tight four-passenger job, and not a two-seater as once contemplated.

A CURIOUS LEAP-FROG MANEUVER with a couple of their '71 cars is under way at GM. The you-go-my-way, I'll-go-your-way involves Buick's Riviera and Olds' Toronado. Pre '71, Riviera was a highly formal car pitched at the Cadillac trade. Big, solid, no nonsense. Toronado, while not exactly what you'd call a sports car, was more of a personal, specialty vehicle prior to the '71. This year they've done a complete about face. Riviera's a much sportier car than before and Buick is obviously drawing a bead on younger buyers. Toronado's gone the other way with a long, stretched-out body that makes it look very Cadillacish. The change is hard to figure because such abrupt repositioning isn't like GM. What's up, fellas?

PERFORMANCE VS FUEL ECONOMY. The auto companies have now done enough testing of '71 cars with standard production engines to get a fair feel of what the reworking of powerplants to run on low-octane gas will do to cars in the hands of owners.

The big plus is that if Detroit can switch everybody over to use of unleaded fuel in two or three years, the industry will have made an important score toward solving the pollution problem. There's an immediate side benefit—in taming down engines, they'll operate with less vibration, which should improve performance, cut repair bills and generally lengthen engine life.

There are disadvantages too, engineers have discovered. You'll probably spend a little more on gas if you buy a '71 with a big engine. Auto firms had to choose be-

(Please turn to page 40)

SPARK PLUGS... HOT OR COLD?

AC ENGINEERS THEM FOR YOUR KIND OF DRIVING

Automobile manufacturers install spark plugs to suit normal driving conditions . . . spark plugs that will perform well with an average "mix" of city and highway driving.

But some kinds of driving you may do require a cooler or hotter spark plug for best continuous performance.

For example, one or two ranges "cooler" than normal might give you better performance on the highway. A spark plug that is too hot could lead to pre-ignition and high speed missing.

On the other hand, stop-and-go driving in the city with extended idling periods, may call for a "hotter" heat range. Under these conditions a spark plug that runs too cool will not "burn off" fouling deposits.

How do you know what's "hotter" or "colder" for your engine? Check what the factory recommends as mid-range, and go from there . . . one step up or down in heat range at a time.

And when you're installing a fresh set of spark plugs . . . make sure you get the best . . . AC Fire-Ring Spark Plugs. They'll deliver peak power and economy longer . . . because they're engineered to meet your driving needs.

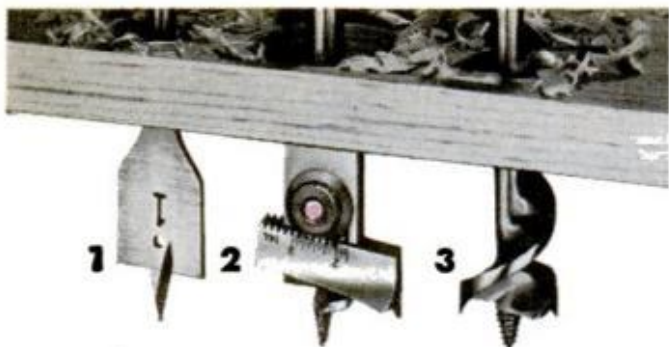


AC uses a simple numbering system on the insulator that tells you the type, size, and heat range. The first number designates diameter. The second number indicates relative heat range . . . like a thermometer. The higher the number, the "hotter" the heat range. The lower the number, the "cooler" the heat range.

Prefix and suffix letters give Type and Design information. In this case, the prefix "R" means the spark plug is a resistor type and the suffix "S" indicates an extended tip design.



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DETROIT LISTENING POST

(Continued from page 38)

tween maintaining fuel economy at some sacrifice of get-up-and-go or the opposite—maintaining performance at a reduction in fuel economy. The decision generally was to take the second course. The difference won't be much, but could run 30 to 50 cents per fill-up. You might also notice increased valve wear. Valve jobs are expensive.

IF YOU'VE SCOUTED THE '71S, you may have noticed several cars with inside hood-release levers. The under-the-dash hood release was widely used on cars 15 and 20 years ago, even on some low-price products. It was phased out on U.S. cars (though some foreign makes retained it) to save on production costs and because car owners complained it was a nuisance to have to pull the handle when a mechanic wanted to get under the hood. Now it's coming back and more makes will have the item next year.

TIP TO INVENTORS. This is for all the inventors who have asked us how to sell an idea to the auto industry. Your best bet is to contact the car companies direct—the parent companies. The individual car divisions don't buy inventions. Send a clear, detailed description of your idea to the company you think might be a prospect. Don't send original papers or drawings, or working models, because you won't get them back. Working models aren't necessary if you have a good written description. Personal interviews can be arranged, if you'd rather do business face-to-face, but write ahead for an appointment. The car companies won't pay your expenses to come to Detroit. Don't ask. Here are addresses to write to:

American Motors: Thomas Myers, New Devices, 14250 Plymouth Rd., Detroit 48232.

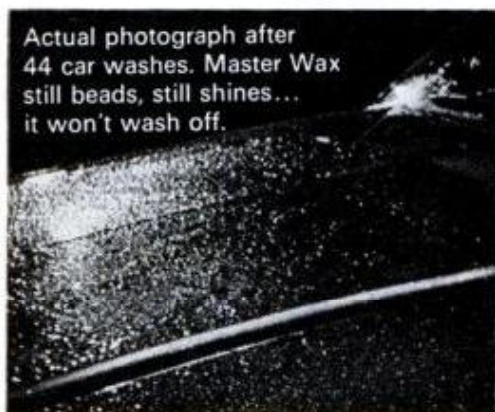
Chrysler: Frank R. Austermann, Outside Suggestion Dept., Engineering Staff Office, Box 1118, Detroit 48231.

Ford: Joseph Crupi, New Devices, Research and Engineering Center, 21500 Oakwood Blvd., Dearborn 48121.

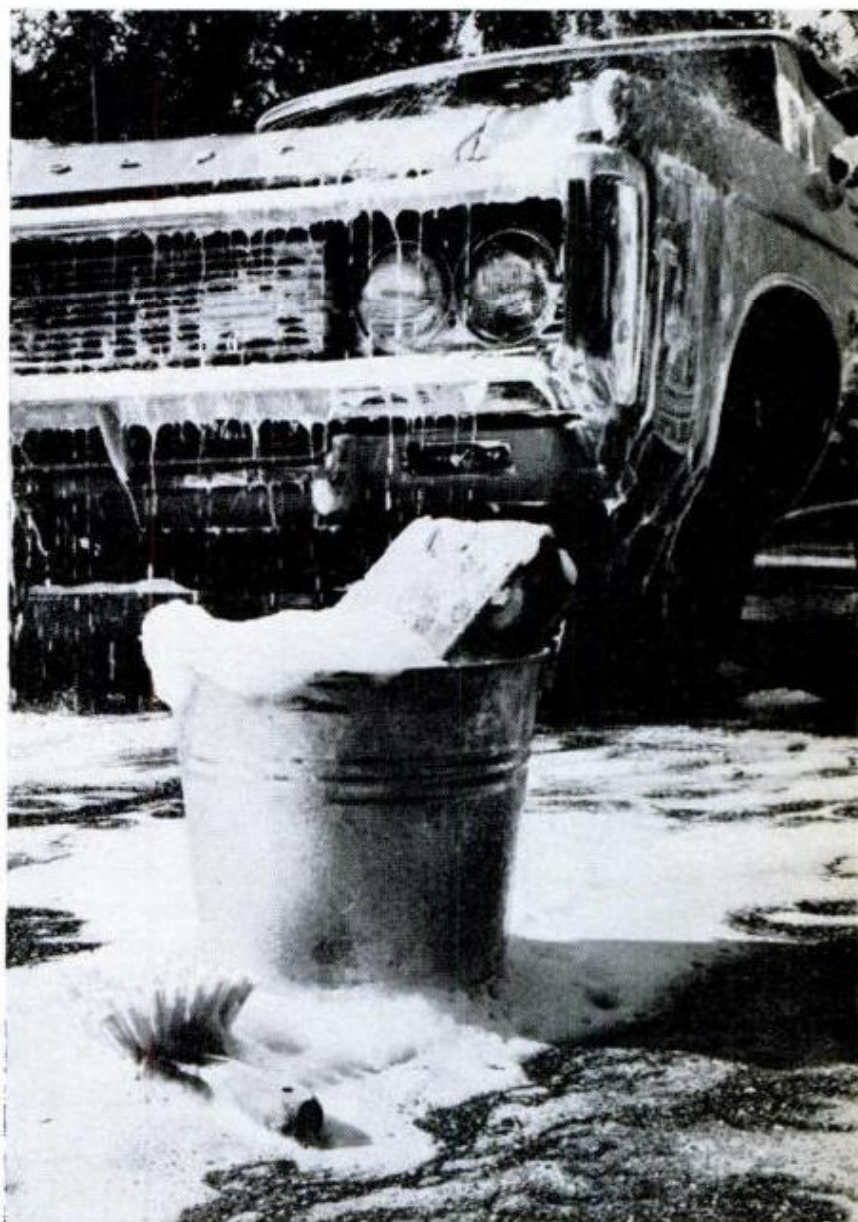
General Motors: New Devices Section, General Motors Technical Center, Warren, Mich. 48090. (For the asking, GM will send you a booklet, *Submitting Ideas & Suggestions to General Motors*, containing a lot of tips on how to sell to auto companies.)

For a broader treatment of the problem, see *How to Sell Your Invention to Detroit*, page 120, March '68 PM. Good luck. ★★

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How much you might save depends on size and location of your house. To find out, locate your zone on the map — then estimate your savings on the charts.

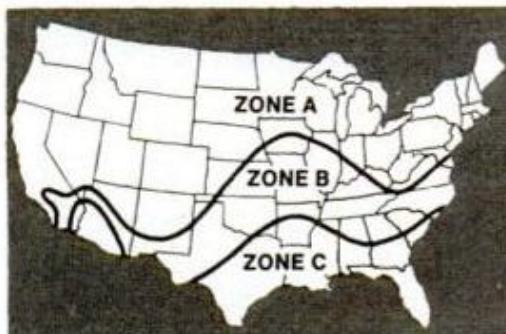
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*T. M. Reg. O-C. F.

Calculate possible savings in your area — add heating and cooling savings for total.



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1500	\$2,225.	\$1,575.	\$625.
2000	\$2,700.	\$1,925.	\$775.



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2000	\$325.	\$650.	\$950.

**Estimated savings: Ranch house on slab, 15% glass area, over 25-year term of mortgage. Heating costs, 10¢ per therm, cooling costs 0.02¢ per KWH. 6" & 3" versus FHA minimum property standards.

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KNOCK KNOCK

Loose piston pin? Or is it a loose rod bearing?
MOTOR's Manual pinpoints which it is—and helps you fix it fast.

You can't afford guessing games when an auto engine tries to tell you something. That's why MOTOR's Auto Repair Manual tells you exactly what a knock, clatter, ping, or backfire may mean, and then shows you how to fix it fast.

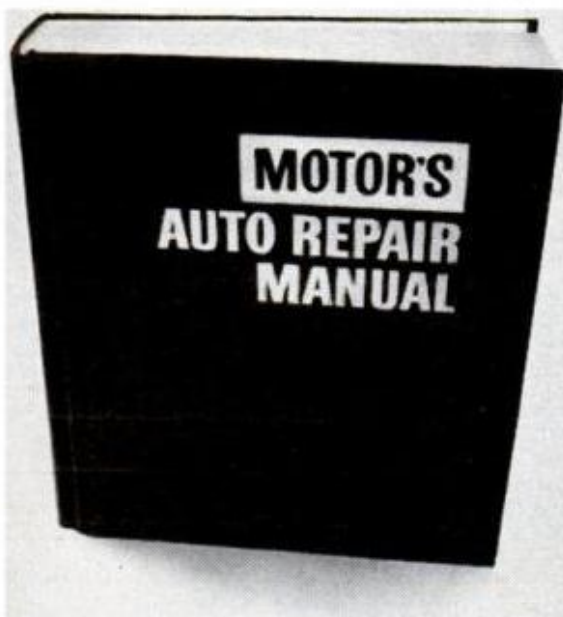
Time-saving tips on sounding out trouble are just one small reason why over 5 million students, beginners, and trained mechanics rely on MOTOR's Auto Repair Manual.

The 1970 edition of this hefty, over 1,000 page Manual lets you find and fix almost any car problem quickly and right. It covers Dodge, Chevy, Valiant, Mercury, Imperial, Cadillac, Ford, Pontiac, Buick, Corvette—over 2,300 models of every American car built from 1964 to 1970 (including all the hot '70's like Blazer, Challenger, Hornet and Rebel, plus Volkswagen. Gives tune-up specs for 30 foreign makes. Even has tune-up and front-end alignment data for 1946-1963 cars.

MOTOR's helps make repairs on all these cars practically foolproof. First, a big trouble-shooter section, plus detailed trouble-shooting information throughout, helps you nail down any of 4,200 car problems. Then, over 225,000 specs, charts, and "this-is-how" pictures show you exactly where to start work. Which tools to use. What to do on any job, from a simple carb adjustment to a full-scale overhaul.

And all this information is the last word. It comes from the car makers themselves. MOTOR's editors distill hundreds of factory manuals and service bulletins to make sure no repair question goes unanswered.

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It pays to expect the unexpected—

A little talk about camper tires that will take unusual punishment.

You're driving along a main highway at high speed and suddenly you hit a pot hole. The kind that jars your teeth. That's the unexpected.

Or you're off in the high country on a summer vacation and the weather man dumps a load of snow. The unexpected again.

Or maybe you make the wrong turn on an old logging road. And you find yourself on the rocky, rutty road to nowhere.

Unexpected? Sure. But isn't it nice to know that you're prepared for it? With reasonably priced tires that are built to take *unusual* punishment. Tires that will do a first-rate job of protecting the major investment you have in your camper.

For example, there's the Transport 110, an all-wheel tire from Firestone with quiet running and long mileage built right in. Moreover, a tire with remarkable impact resistance, and construction that minimizes flex damage.

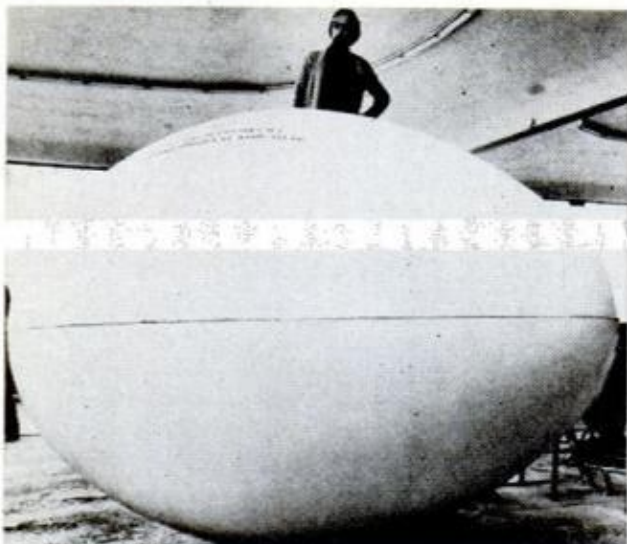
And for a brawny tire that will really dig in and grab in mud, snow and deep ruts, Firestone makes the Super All Traction. This rear-wheel tire just plain eats up the unexpected!

Firestone makes both these tires with its exclusive Triple-Strength Construction. That's the special way Firestone bonds the tread to the body, reinforces the sidewalls and insulates every cord.

Next time you meet the unexpected, meet it with confidence—and tires by Firestone.



NEWS BRIEFS



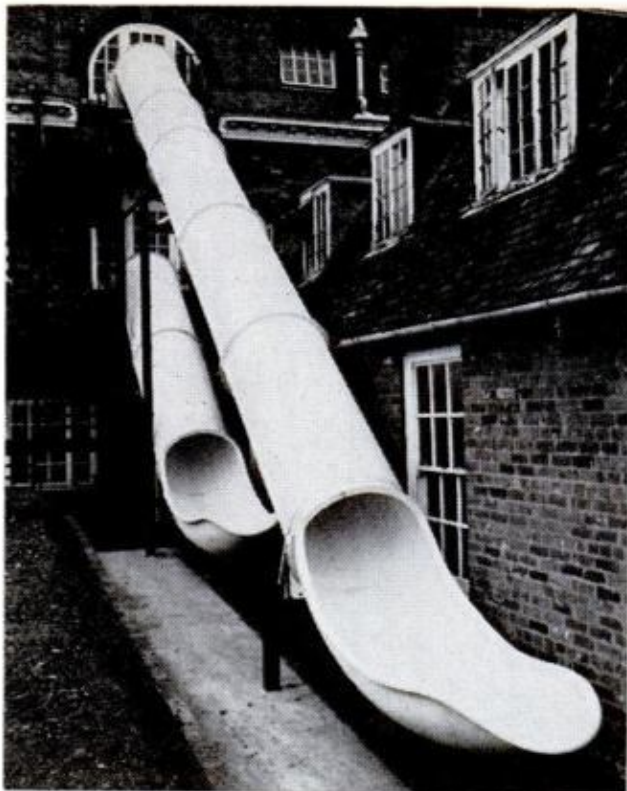
Oceangoing egg

This giant plastic "egg" was built for the Ocean Weather Office, Hamburg, Germany, to carry instruments across the Atlantic after being launched from the Canary Islands.



Fancy cycle

Californian Wesley Horton's \$3000 custom cycle includes such touches as ram's horn-shaped handlebars, wave-shaped front fork and \$900 chrome and \$250 paint jobs.



Chute to safety

Fiberglass chutes have been installed as fire escapes in an English hospital for spastics. They provide quick getaway for patients who can't descend stairways.

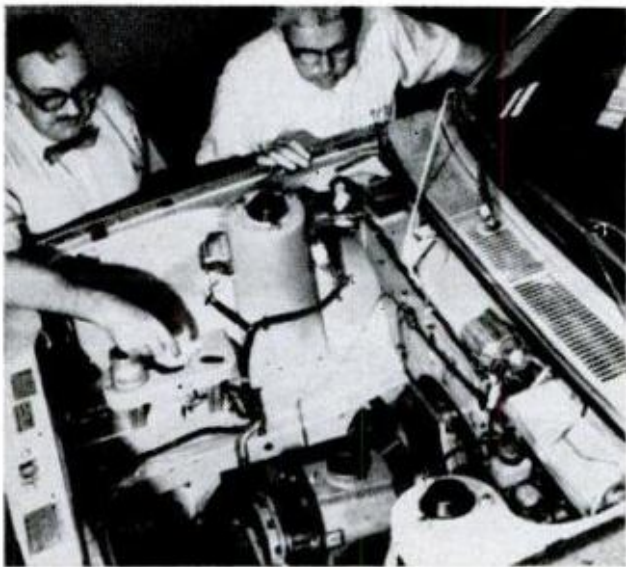
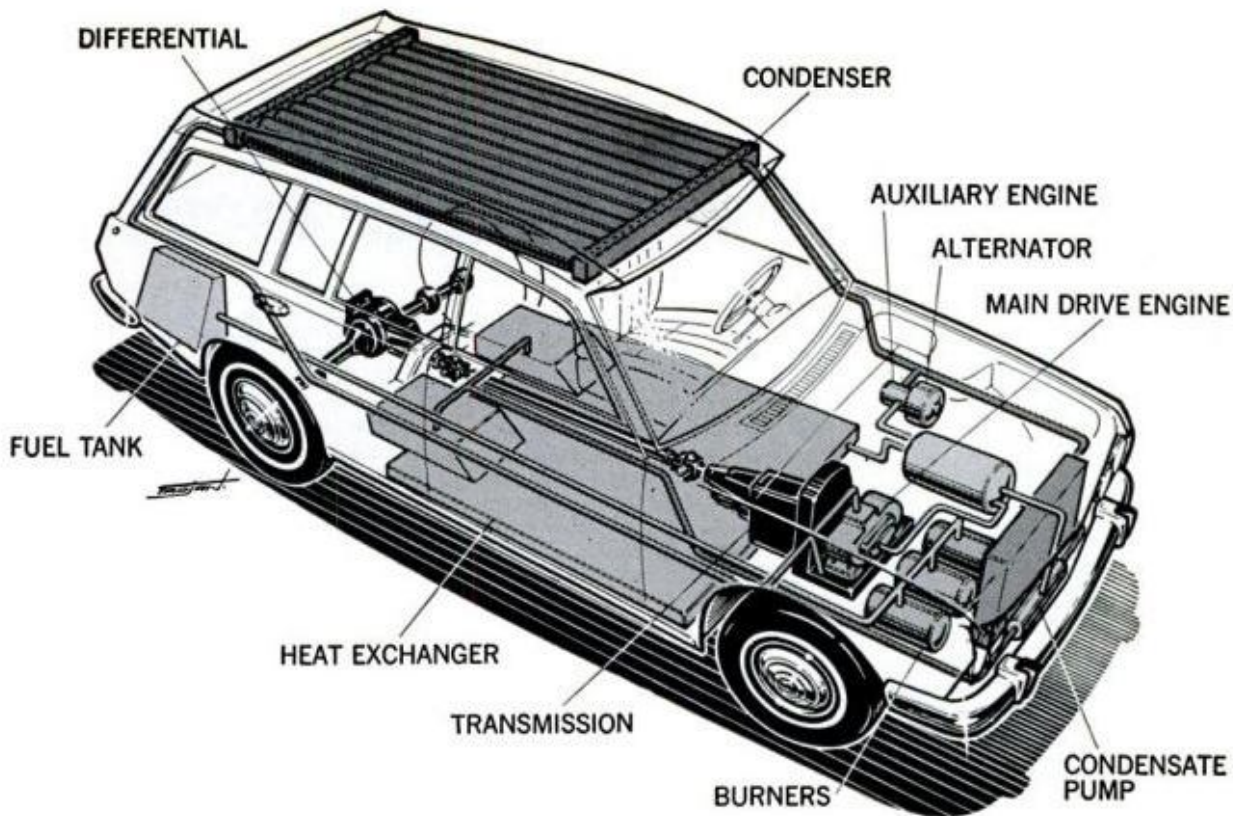


Factory runabouts

Though they hardly look like industrial workers, these young ladies are demonstrating two new electric personnel carriers that are built for use in British factories.

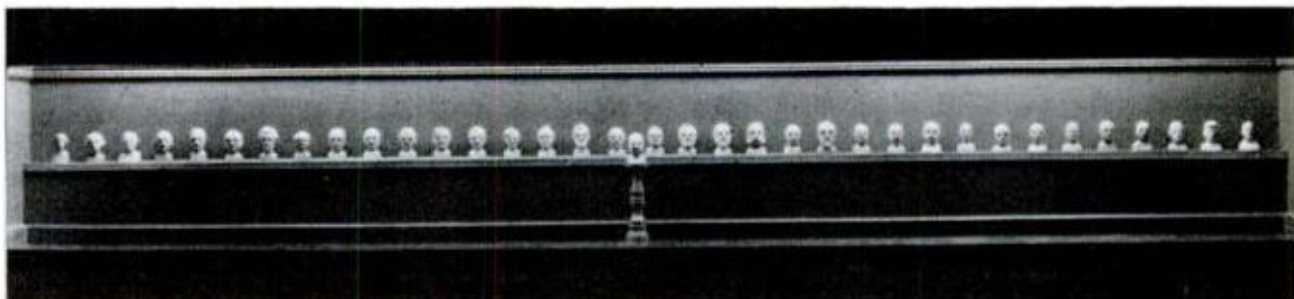
Swiss Snow Bird

The "Snow Bird" is an invention of a young Swiss handyman. It'll go 30 mph, climb slopes of 45°—and travel some 60 miles on just two quarts of gasoline.



Freon engine for Datsun

A new nonpolluting, Freon-powered engine will be available in Datsun cars as early as 1972, according to Nissan Motor Co., maker of the Datsun, and Wallace L. Minto, Sarasota, Fla., inventor of the engine. Datsun plans to build "at least 100" of the cars in 1972 and more thereafter. The engine is similar to a steam engine, but gets its power from high-pressure gas that results from heating Freon (DuPont's trade name for fluoro-carbon). The liquid Freon, which has an extremely low boiling point, becomes gas after it's heated in a small boiler. The gas drives the engine's six cylinders, passes through a condensing unit in the roof and returns in liquid form for reuse.



Tiny gallery of presidents

The Crabtree Miniature Gallery of Presidents displays wood carvings of all 36—in only 16 $\frac{3}{4}$ inches of space. The $\frac{1}{4}$ -inch heads were carved with dentist's tools by August Crabtree, Hampton, Va. At right, about actual size (note penny), are Pierce, Buchanan, Lincoln, Andrew Johnson, Nixon and Grant.





I'd like to give this to my fellow men...

while I am still able to help!

I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my

summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to

gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and

ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

VICTOR B. MASON

1512 Jarvis Ave., Suite M-2-L
CHICAGO, ILLINOIS 60626

Von Schrader offers you three ways to a growing income in your own business

Here's your opportunity to have your own very profitable business. One that offers a service badly needed in the home, in offices and public places. A business where how much you earn depends largely upon you. It's an opportunity to be your own boss. Free from layoffs and work restrictions. Free to work any number of hours you wish. And you don't require any special skills or large investment.

Already thousands of men have gained financial independence and personal satisfaction offering this service. Yet the demand is so big—and growing so fast—that your opportunity for success is better than ever before.

If you're a man who wants to work—but in his own way—see if you don't agree that what you are about to read is an opportunity you can't afford to pass up.

Wall-to-wall carpeting, upholstery, walls: 3 great needs for on-location cleaning

Nothing enriches a room like wall-to-wall carpeting. Every year you find it in more homes at every income level. Then there are all the public places with this carpeting. Places like motels, hotels, restaurants, banks, offices, theaters, stores, cocktail lounges, hospitals, reception rooms, etc.

Since this carpeting can't be sent out for cleaning there's a real opportunity for on-location cleaning services. It's faster, easier and inexpensive to clean carpeting on the customers' premises.

This same opportunity exists for upholstered furniture. It's faster, easier and costs less to clean upholstery on-location.

Now, consider wall and ceilings. Cleaning them with a bucket and sponge is slow, tiring and messy. People will welcome a service that does a professional job of cleaning quickly and without mess.

3 Von Schrader Detergers: each does on-location cleaning at its best

With Von Schrader Detergers—professional cleaning equipment—you'll do on-location cleaning that wins repeat customers . . . make as much money part time as many people earn full time . . . enjoy a steady, dependable business of your own . . . watch your income grow to where you are financially independent. Every home, every building, are a potential source of income.

You can start your on-location cleaning service with any one, two or all three Von Schrader Detergers.
Carpet Deterger. Cleans so deeply and completely it helps restore natural beauty—even revives color. Fast drying.
Upholstery Deterger. Gives deep-level cleaning to every inch of fabric upholstery and synthetics. Leaves furniture looking fresh and new.
Wall Deterger. Washes walls and ceilings 6 times faster (and better) than the



Von Schrader Carpet Deterger. Cleans so completely it helps restore natural beauty. Fast drying.



Von Schrader Upholstery Deterger. Gives deep-level cleaning to fabric upholstery and synthetics.



Von Schrader Wall Deterger. Washes walls and ceilings 6 times faster (and better) than hand method.

bucket-and-sponge method. Cleans easily without any mess.

Von Schrader stands for the best in professional cleaning equipment, as it has for over 35 years. All our Detergers are light-weight and easy to operate. Proven reliable and profitable for thousands of users.

You own your equipment

As a Von Schrader Associate you are your own boss. There's no contract to sign. You pay no fees, dues or royalties. Work out of your home part time or full time. Hire help as your customer list grows. (Many men start by working evenings or weekends while retaining their regular jobs.)

You get supplies

Each Deterger you order includes supplies and accessories, operating instructions and promotional material. You can go after on-location cleaning business immediately.

We'll help you get started

As a Von Schrader Associate your success is our success. So we'll help you every step of the way. That includes free consultation and special business-building materials.

Very small investment

You can have your own on-location cleaning business for an investment so small it's hard to believe. Send for complete information. No obligation.

READ WHAT OTHER MEN ARE DOING WITH VON SCHRADER DETERGERS

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Upholstery: "One day I did a \$135 job. Best week was \$500."—C. Lambert. "We passed over the \$450 mark in five days."—T. E. Baylor

Walls: "Earned the price of Deterger with the work I did the past week."—J. Hews. "I work just 2 or 3 days a week. Best month was \$1200."—J. R. Johnson. "Big motel chain delighted with cleaning results and low cost."—E. Holst



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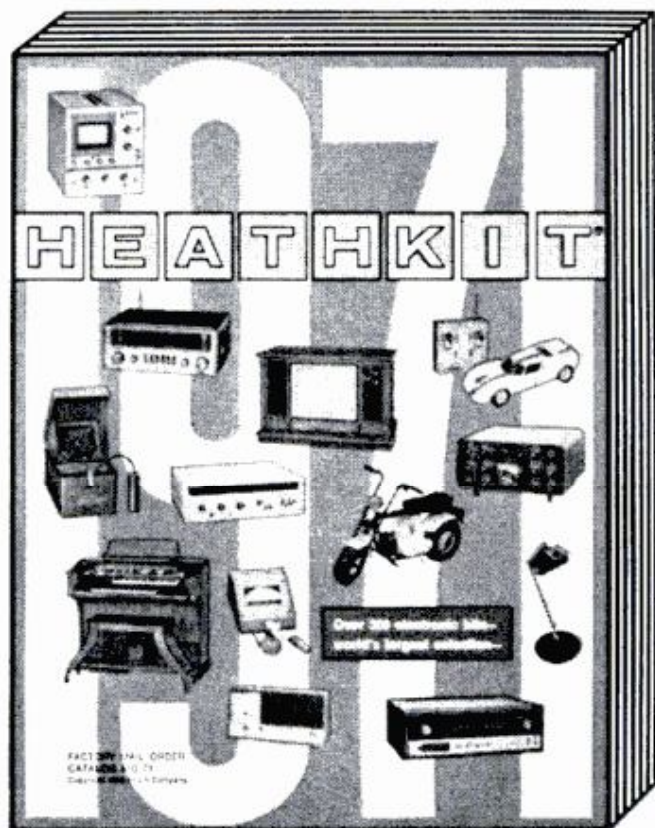
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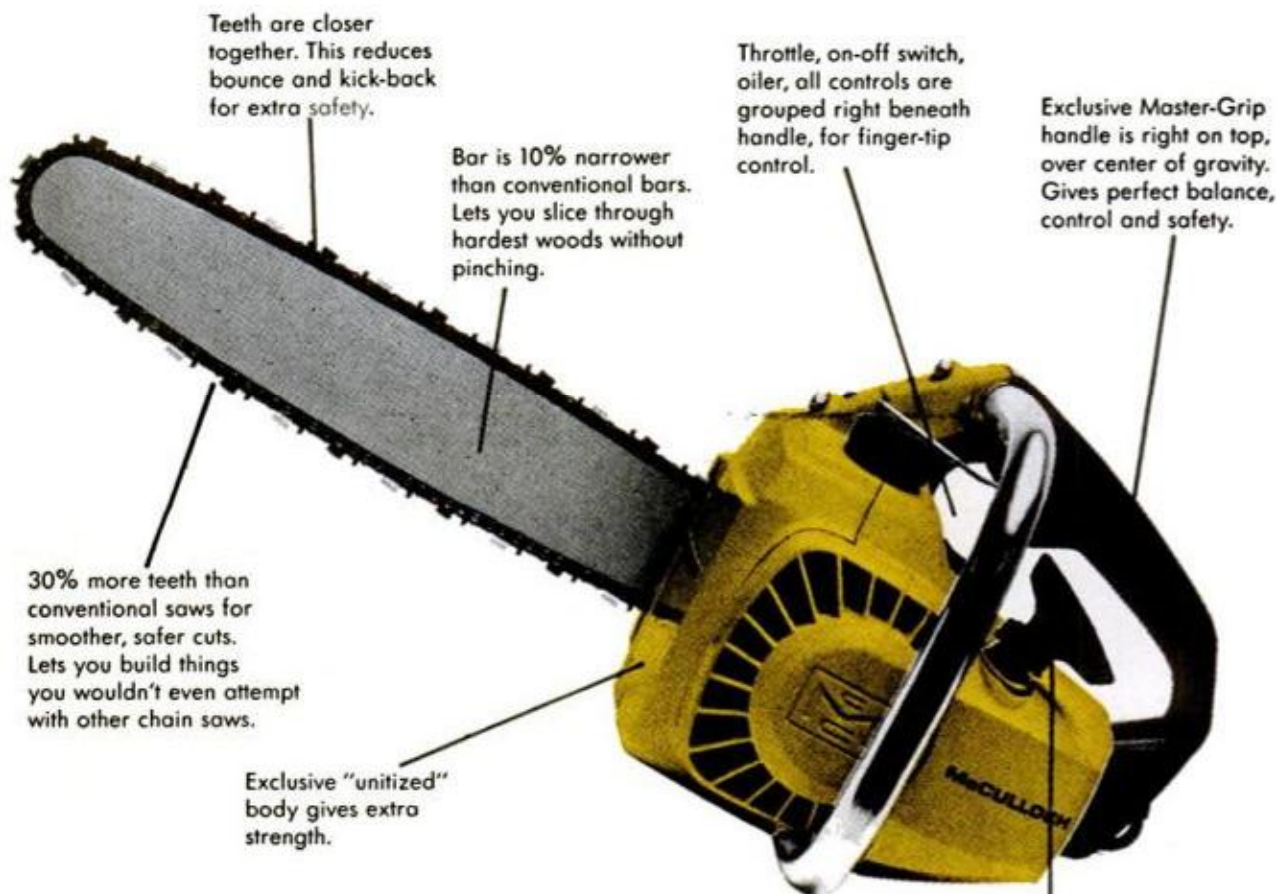
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30% more teeth than conventional saws for smoother, safer cuts. Lets you build things you wouldn't even attempt with other chain saws.

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Here's how the world's lightest chain saw helps you cut the cost of living. You can cut your own firewood. Build tables, benches, tool sheds, planters... things your family needs. And the brand new Mini Mac 6 is the saw to own. Test it against all other saws. It's pounds lighter. Has more exclusive features. Yet it costs nearly 25% less than other super lightweights. It's McCulloch professional quality. Yet it's so maneuverable, it's like using an electric knife. Ask your dealer to show you the Mini Mac 6, or the Mini Mac 6 Automatic which oils its own bar and chain. You'll start saving money the day you buy one.

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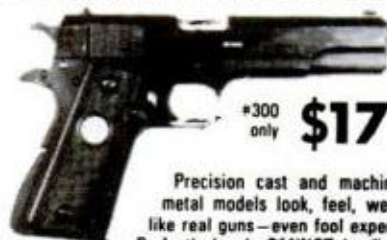
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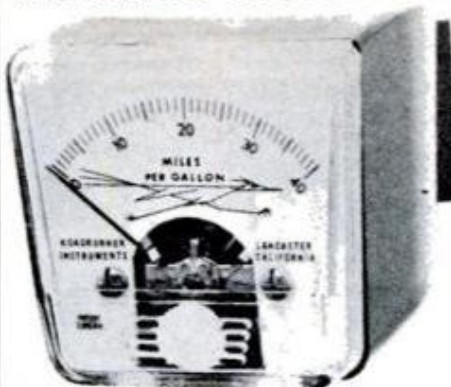
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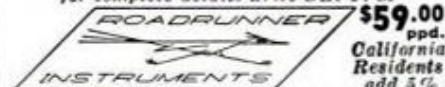
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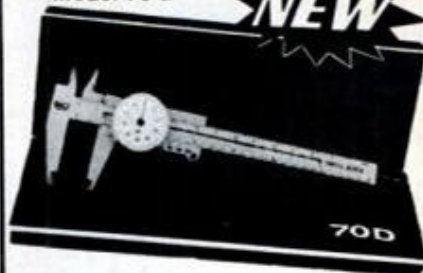


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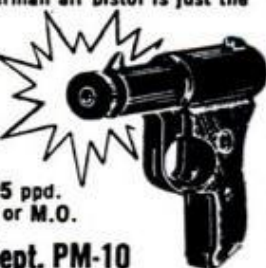
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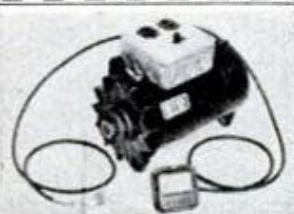
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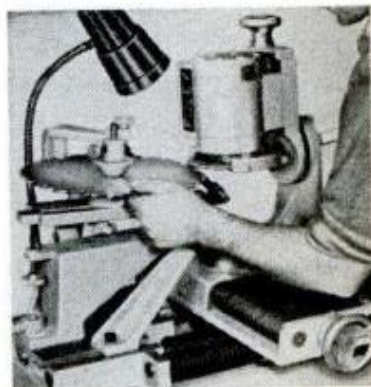
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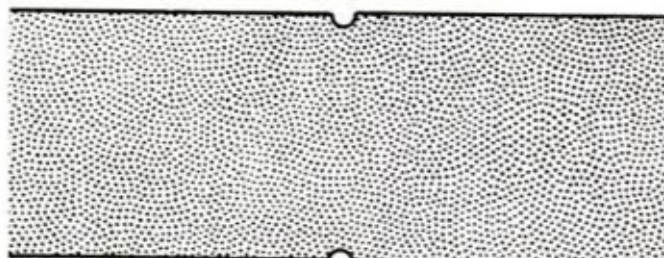
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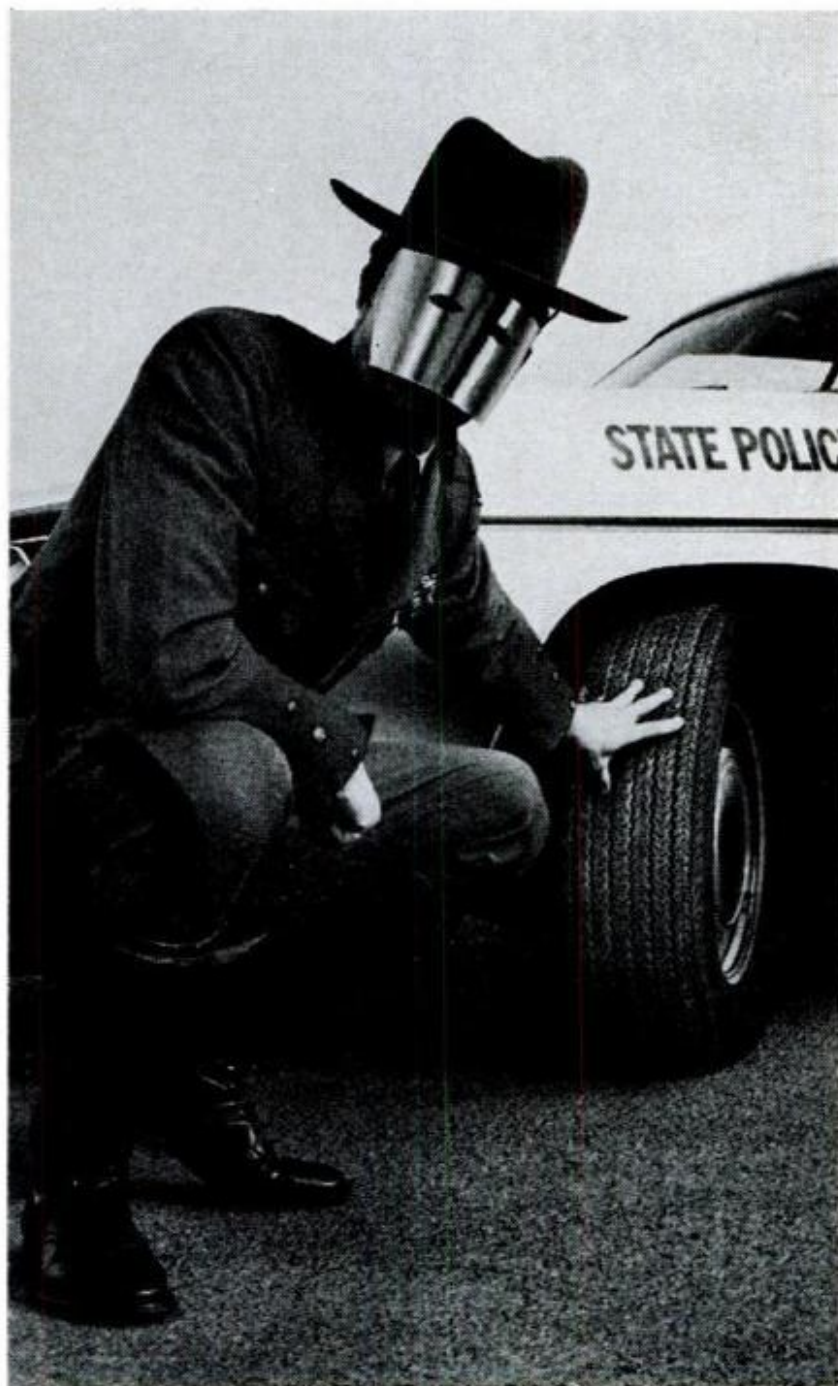
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EL MONTE, CALIF.—Aerojet General Corp. has developed a nontoxic additive of zinc or aluminum that causes DDT to decompose several weeks after it has been applied, reducing the danger of residual contamination of plants and animals. DDT accumulates in the fatty tissues of animals and humans and remains indefinitely. Secretary of the Interior Walter J. Hickel announced a contract awarded to Aerojet to verify the nontoxicity of the new compound in marine animals.

NEW YORK—An all-electric bus designed to carry 18 passengers has been designed and produced by Westinghouse Electric Corp. Ideal for transportation within industrial complexes, shopping centers, and college campuses, the vehicle can operate for eight straight hours and make over 500 stops and starts. Its drawback is speed—6½ mph with full passenger load and 9 mph empty—which would limit on-street use. Twelve-volt batteries stored under the seats power a 4-hp d.c. series-wound motor. The steel and glass bus is 14 feet long, 5½ feet wide and 7½ feet high from road to rooftop.

NEW BRUNSWICK, N.J.—The New Jersey Water Resources Research Institute has developed a "bubble machine"—a mechanical aerator—to increase the oxygen supply in our rivers. Tests conducted on the Passaic and Delaware Rivers show that once organic wastes enter our waterways they cannot be consumed by bacteria because of lack of oxygen. Also, fish will die when the oxygen level in water falls below 2 parts per million. The mechanical aeration device whips up the river water, thereby incorporating oxygen.

NEW YORK—The Aluminum Assn., 750 Third Ave., N.Y., 10017, announced that many companies are beginning reclamation programs to be followed by recycling of aluminum for reuse. Although aluminum accounts for less than ½ of one percent of municipal solid waste, its durability (it never deteriorates) makes it a pollution problem. Aluminum is ideally suited for reclamation because it has a high scrap value (\$200 to \$300 per ton) and is found in a relatively pure state in most solid waste. It is recycled by separation, shredding, melting and mixing with new metal to form new cans, foil and sheets. Reclamation and recycling not only has commercial value, but it will ease the solid waste problem and conserve a vital natural resource at the same time.

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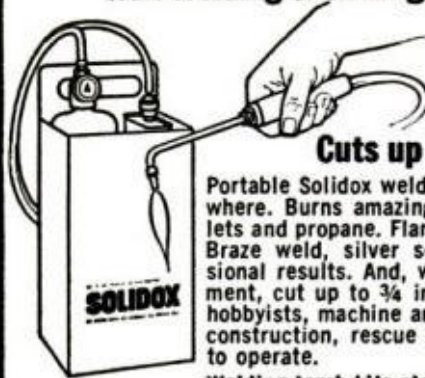
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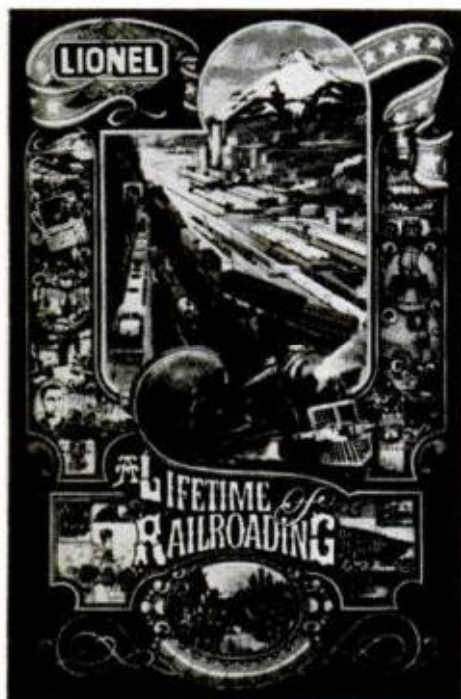
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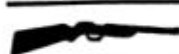
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AUTOMOBILE CLINIC

BY MORT SCHULTZ

Final word on vinyl

The vinyl roof of my 1969 Dodge Monaco is discolored. Attempts to clean it have failed. My dealer is sympathetic. What now?—Louis F. Horne, New York City.

Tell the dealer to keep his sympathy and give you a new vinyl roof covering. Service bulletin D69-23-14 (2/12/69) explains that discoloration results if inferior materials are used to install a vinyl covering. Your stained roof appears to fall under the provisions of this bulletin. If the dealer disagrees, take the problem to the customer relations department of Dodge in Detroit.

Powerless power steering

My 1963 Cadillac with power steering steers okay on the road. But with the car at a standstill (engine idling), it is practically impossible to turn the wheel. What's wrong?—Ken Fregoe, Syracuse, N.Y.

There is a pressure loss, which is caused by a bad relief valve or damaged vanes in the power-steering pump. The test of a power-steering system comes at standstill. On the road, forces help to hide a problem. If you want to convince yourself, take a pressure test. It should show that the system is putting out a minimum of 1000 pounds per square inch.

Will drip dry up?

Our 1970 Chevrolet Nova drips fluid from the rear of the automatic transmission. The dealer contends that the transmission is overfilled and that as soon as the fluid level drops, the drip will stop. The car has been driven 900 miles and is still dripping. Should I listen to him?—Victor B. Zappa, Oneonta, N.Y.

Sure. Be courteous and listen. Then tell him to replace the rear extension seal.

Postscript

Two readers have commented on Candy Candelori's problem in the April 1970 *Auto Clinic*. Candy complained that the Chevelle would suddenly die out on the road. We offered a list of possible causes.

Dr. Victor S. Lait of Flushing, N.Y. had

the same problem because of an oddball reason. Someone had hammered the battery terminal clamp on to the battery post. This loosened a plate in the battery which, on occasion, would ground out and stop the engine dead in its tracks. F.L. Bowen of Inglewood, Calif., believes the problem might be caused by a bad ignition switch.

Growling gears

Although I installed a new clutch, pressure plate and throw-out bearing, my 1964 Comet with standard transmission still growls in third gear between 45-50 mph. What do I do now?—William E. Miller, White Pigeon, Mich.

Go where the problem is—into the transmission. Check in particular the input and output shaft bearings, and third gear for wear and damage.

Sick Six

Recently my 1966 Pontiac Tempest with overhead-cam-6 engine developed a terrible blowback through the carburetor. The carburetor has been overhauled, the engine tuned, and the PCV system cleaned. The problem persists. Why?—Harry Rowan, Long Beach, Calif.

Because you've got big trouble. Take a compression test. I think you'll find an internal cause. From here it sounds like worn cam lobes. Sorry.

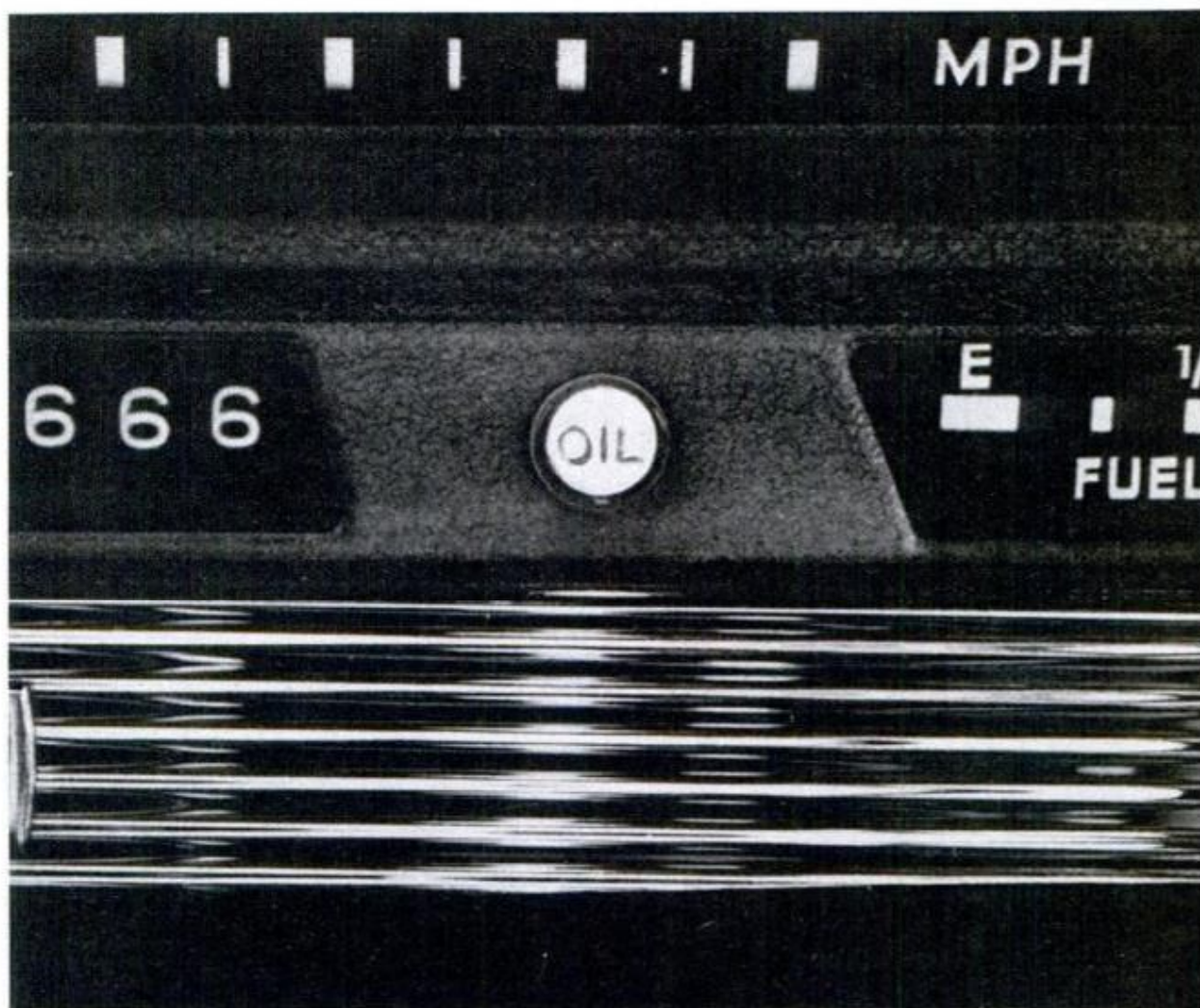
The Bug bugs out

I have a problem with my 1963 Volkswagen that has stumped many mechanics. The car will start okay with the engine warm, but will stall a minute later. To get it restarted, I have to remove the top of the air cleaner and plug the air intake. The entire fuel system has been examined, a major tune-up performed, and the carburetor overhauled. Care to try your luck?—A.L. Herrington, Eugene, Ore.

Why not? However, I almost chickened out because of the strange conditions. When a warm engine stalls, it usually means that it is getting too much gas. But your problem signifies fuel starvation. If the car restarts only when you are making

(Please turn to page 80)

**When the convenience light comes on,
you're about to be greatly inconvenienced.**



If this happens to you, stop your car. Right now. Go any farther and you may seriously damage your engine. Instead, start walking to the nearest quart of motor oil.

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AUTOMOBILE CLINIC

(Continued from page 78)

the fuel mix richer, it signifies lack of fuel. It took a little time for my memory to jog itself, but I finally remembered that at one time VW discovered that some of its cars had bad intermediate flanges. This plastic part is a spacer that fits between the fuel pump and engine. It guides the fuel-pump push rod. Heat caused the hole through which the push rod fit to close. The push rod bound, causing a reduction in fuel delivery. I suggest you install a new intermediate flange.

Deceptive

After 37,000 miles, my 1967 Chevrolet (283-cu.-in. engine) has started to blow oil out the filler pipe. I lose one quart every 150 miles. A mechanic has said that a piston ring is probably broken, but I don't buy this. The engine runs quietly—no knocks or rattles. What can the problem be?—Albert Auprey, Allentown, N.H.

The problem could also be a cracked cylinder wall, but what's the difference? Either way the engine has to come apart. An engine afflicted with a broken piston ring or cracked cylinder wall will run quietly, so don't be fooled. On the slim chance that the problem may be something that's easy to fix, replace the crankcase ventilation valve. It might be plugged, causing a pressure buildup.

Big knock

Will a bad crankshaft bearing make noise for 1,000 miles before it lets loose? The car is a 1969 Chrysler Newport with 383-cu.-in. engine.—David Gutlian, Milwaukee.

If you baby it, yes. However, under normal driving conditions, a loose crankshaft bearing will be "thrown" long before 1000 miles.

A hot one

The car is a 1963 Oldsmobile F-85 with aluminum block. It overheats in slow traffic and when idling. Why?—Melvin Stacey, Olney, Ill.

This is a common complaint with an aluminum-block engine. The cause is aluminum oxide (corrosion) that builds up

in the radiator core. Have the radiator rodded out. Use only the recommended ethylene glycol solution as a coolant year-around. Your trouble will be over.

Datsun diaphragmitis

My 1969 Datsun is getting gas in the vacuum advance. Why?—E.R. Stahler, Macungie, Pa.

Because of a ruptured diaphragm that's pulling in gas from the intake manifold. Replace the diaphragm and you'll be okay.

Service Tips

● **Some 1970 Chrysler Corp. cars** are suffering from the same malady—specifically, having the A-1 wire of the starter relay assembly rubbed by the hood. The relay is located high up on the left side of the firewall. If the condition continues too long, you could experience some unexplained hard-starting problems. The fix is outlined for Dodge servicemen by bulletin D70-8-6 and for Chrysler-Plymouth mechanics by service bulletin 7-8-5.

● **Owners of 1969 and 1970 Chevrolet camper-equipped trucks** will be happy to learn of an auxiliary battery system. It goes under the designation of RPO TP-2 and is designed to provide an economical source of electrical power which can be used while saving the truck's standard battery. With the ignition off, the auxiliary battery is separated from the camper's battery. With the ignition turned on, the two batteries are connected in parallel through a solenoid so that both are charged while the engine is running.

● **Oldsmobile** advises that sometimes a radiator pressure cap won't hold pressure because of foreign matter that collects beneath the pressure-relief-valve rubber seal. There's a quick and effective way of cleaning this stuff out. Insert a piece of paper under the rubber seal, press down on the valve and pull the paper out. Do this all around the circumference of the rubber seal, but take care not to leave a sliver of paper under the seal. This will get rid of foreign matter and may save you money for a new radiator cap.

● **AMC vehicles** may experience a low-fuel warning system malfunction because of an incorrect low-fuel warning light installation or an electrical failure. The system should be checked for correct installation of components first. Tell your dealer to consult service bulletin 5, group 3.000 (4/27/70). ★★★

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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Old red paint

How do you mix the old red paints that were so often used on colonial furnishings? What are the ingredients? I want to finish a reproduction of an old blanket chest I've made.—A.F., Vt.

I've had fair success simply by thinning red paints of the color desired and using them as a stain, rather than a paint. The trick is to get the paint thinned to just the right consistency—not too watery. If it's too thin you generally get a splotchy coloring; if too thick you get an ordinary paint job. You'll have to determine the consistency by tests on small pieces of the same wood.

You can also use artist's reds, thinned so that they act as a stain, rather than a paint. At best it's a tricky business and I can't go along with the procedure all the way. Neither do I recommend that you try the old "recipes" as some of the materials are difficult, if not impossible to obtain. There are several old recipes and, just for the fun of it, here's one: It calls for 3 pounds of red oxide of iron, 2 quarts of skim milk, 8 ounces of fresh-slaked lime, 6 ounces of linseed oil, 2 ounces of white Burgundy pitch, all mixed with whiskey to a fairly thick liquid. The lime is slaked in water, exposed to the air for a time and then thinned with one-fourth of the skimmed milk. The pitch is dissolved in the oil before adding to the original mix a little at a time, then the rest of the milk and finally the iron oxide, stirring in the ingredients as you go. Presumably this makes a paint, not a stain, but according to the record such mixtures were used before ready-mixed paint was available.

Bugs in fireplace wood

I've been told that if I bring fireplace wood into the house I'll populate the place with bugs, that in time they'll eat up the furniture, and maybe the house itself. True, or false?—R.E., Mo.

Mostly false, if you're referring to the several pieces of wood you bring into the house in a carrier for the evening fire and not to the storing of a winter's supply of wood somewhere inside the house. True, you might bring in an occasional spider, a wood roach and even some wood borers.

The latter won't riddle the furniture—they'll be done to a turn by the time the fire becomes ashes—and the spiders and roaches are objectionable only when they become sufficiently warmed to race for cover. Usually these stay put until you replenish the fire.

The bug to worry about is the carpenter ant. If he gets inside the house via the wood carrier there's almost sure to be trouble. Some homeowners spray their woodpile, piece by piece with a spray containing chlordane in a recommended mix, paying special attention to any cracks or crevices. It's wise to stack the winter supply some distance from the house. Lay down two "stringers," stack the wood on these over a piece of heavy plastic and then wrap the plastic up over the stack to keep the wood dry. Remove only what you'll need for one evening.

Removing coated wallpaper

I'm having trouble removing plastic-coated wallpaper. It seems almost impervious to water applied with a sponge—water won't soak through to the paste. I don't want to paint over the paper. I'm sure there's only one layer of paper and I want to remove it and paint the walls. Any suggestions?—J.V., N.D.

This seems to be a common problem. First, be certain the walls are plaster and not plasterboard. If they are plasterboard, I suggest you continue painting, or papering, over the old finish. Removal is possible with a steamer but you risk damage to the plasterboard or gypsum board. If the walls are plastered, scratch the paper with a medium-to-coarse sandpaper tacked to a block of wood. This permits the water to penetrate to the paste and soften it. But be very careful not to cut through to the plaster surface with the sandpaper. Use just enough pressure to break the coating, otherwise you may end up with unsightly scratches on the plaster that are difficult to conceal. After "sanding," sponge the wall as before, or use a rented steamer, if available, and roll the paper off with a wide putty knife.

Unjointed floor tiles

A few floor tiles have curled up at the joints sufficiently to catch the toes of shoes. Can I level them?—W.H., Wash.

Usually you can soften the cement with a heat lamp to readhere the tiles at the loosened joints. Hold the lamp about a foot or so above the joint, then press tiles back into place and weight the joint immediately. ★★★

Exciting news for men who are bald or have thinning hair.

Paul Shepherd gets his kicks out of skydiving. He's prematurely bald. He's active in a dozen rugged sports. He wears a Taylor Topper. Designed and patented by former Senator Glen H. Taylor, the Topper is so different that it will change every idea you ever had about old fashioned hairpieces. It's custom made to fit only you, and perfectly. You can put it on in seconds, and it stays absolutely secure until you want to take it off. Thousands of active men do what they wish and do it better in a Taylor Topper. They look, feel and act years younger. Taylor Topper has a way with men. And women. Naturally!

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John Deere introduces chained lightning.



With one of these, Columbus might have discovered Idaho.

But, even without a whole New World to conquer, you'll go a long way with your new John Deere Chain Saw. It'll pay for itself on firewood, and do a hundred other jobs. Like tree pruning. Trail blazing. Building rustic furniture and fences. John Deere "chained lightning" comes in four great models—from our weekender's saw for trees up to 30 inches in diameter to a self-oiling model that'll take the measure of 38-inch giants. All lightweight, lightning fast, and serviced by the men who sell them. So don't buy a weight problem. See your John Deere Dealer.

Chained 
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For folder, write John Deere, Dept. CS, Moline, Ill. 61265

Product specifications slightly different in Canada.



PROPANE POWER! Should You Switch to LP-Gas?

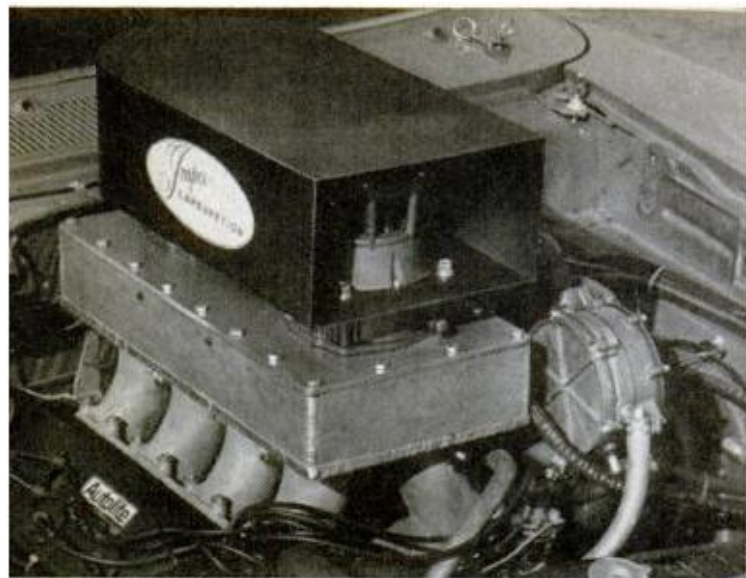
**It can power dragsters,
give your engine longer
life and economy and, best
of all, cut air pollution!**

By FRANK A. TINKER

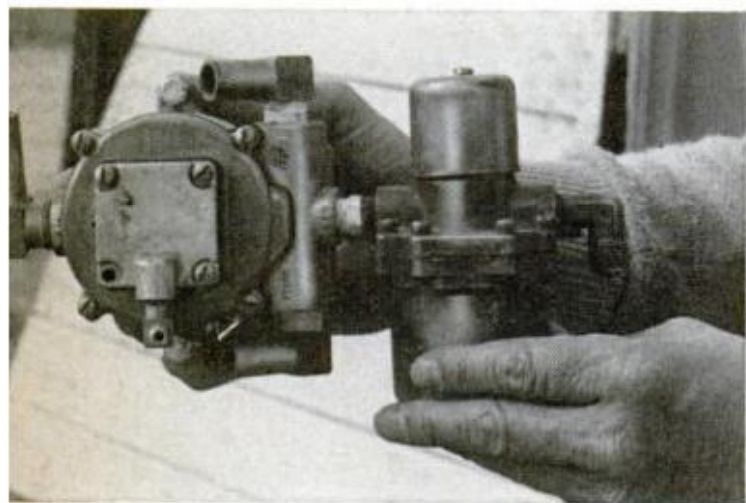
DO YOU REALLY WANT to help clean up the country's air? You can, cheaply and quickly. In a single day, your engine's contribution to air pollution can be reduced by anywhere from one half to 80 percent. How? Simply by a switch from gasoline to LPG—liquified petroleum gas—as an auto fuel. Efficient conversion units which accomplish this without radical alteration of the engine and permit you to switch from one fuel to the other instantly are now readily available.

Gasoline's high hydrocarbon content and the photochemical reactivity of its combustion products contribute to the actual formation of and to the pollutants in smog layers now overhanging cities. Even with lead-free gasoline and auto engines detuned specifically for its use, most principal pollutants in this fuel will remain.

LPG, on the other hand, contains far fewer of the compounds which produce pollutants. For one example, the most reactive (or smog-producing) of these compounds are the olefins. (The smog-forming potential of various chemicals is expressed by numbers indicating their tendency to re-



PROPANE X DRAGSTER has special installation: ram air intake, dual converters for the 426 V8 engine



LPG CONVERTER receives high-pressure liquid from tank in trunk, converts it to a low-pressure vapor



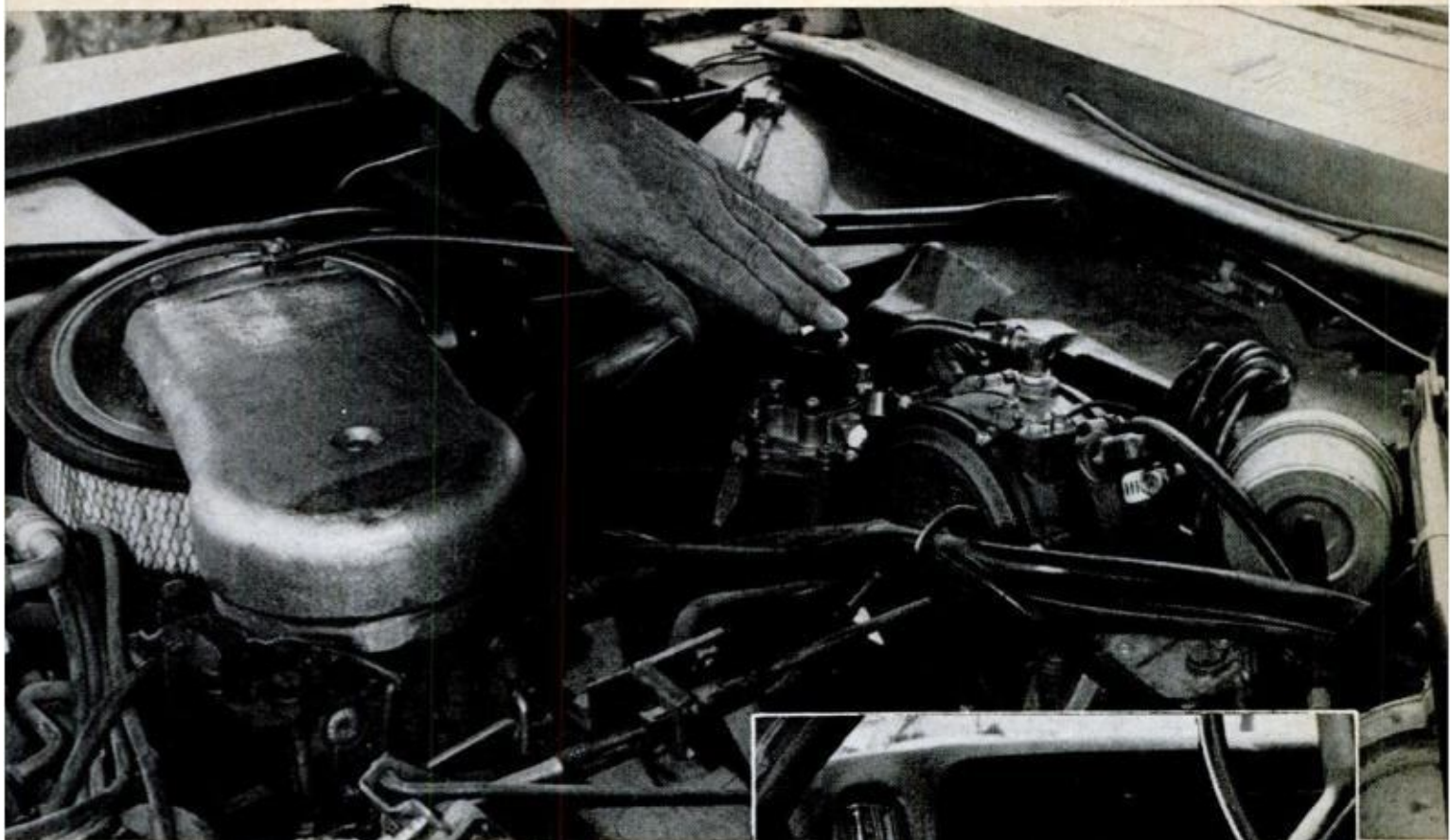
LPG FUEL TANK is visible under one of the trucks in this fleet, one of many fleets converted to LPG

act, for example: 1 for paraffins, 3 for aromatics, 8 for olefins.) A chemical analysis of propane, the most common LPG, shows its olefin content to be one-fifth to one-fifteenth that of gasoline.

Naturally, high-smog areas like Los Angeles are expressing great interest in the conversion of auto engines to some such fuel. During the past year extensive tests have been conducted in California. Some were sponsored in part by LPG associations and auto clubs, performed by recognized test labs, and accepted this year by the Air Resources Board of that state. The most recent tests, done by Olson Labs of the City of Commerce, show some advantages of LPG use. Most common makes of cars were used: Ford, Chrysler and General Motors products, with engines of 225 to 390 cu. in. Every class of pollutants showed a significant drop when the fuel was changed from gasoline to LPG. Hydrocarbons—mainly unburned fuel—were cut drastically, at least 50 percent. One Mustang which produced 256 parts per million (ppm) with gasoline, about average for most cars, dropped to 97 with LPG. All cars using this new fuel produced between 1.7 and .8 grams of hydrocarbons per mile. California's stiff new standards for 1970 allow 2.2 grams per mile.

The engines' exhaust, using LPG, showed similar reductions in carbon monoxide, dropping from approximately one percent to half that amount. All engines ranged between 6.8 and 1.3 grams per mile of carbon monoxide; California regulations permit 23 grams now and may drop to 12 grams in 1975, which will still be from two to ten times the amount LPG produced in these test vehicles.

The third main pollutant, after hydrocarbons and carbon monoxide, is nitrogen oxide. This is more difficult to control in all fuels and is largely dependent on the engine combustion temperature; the hotter the burning, the more oxides of nitrogen, which means that lean and efficient mixtures result in high emission of this pollutant. No



LOCK-OFF VALVE on LPG converter is connected to switch allowing driver to cut LPG flow from tank

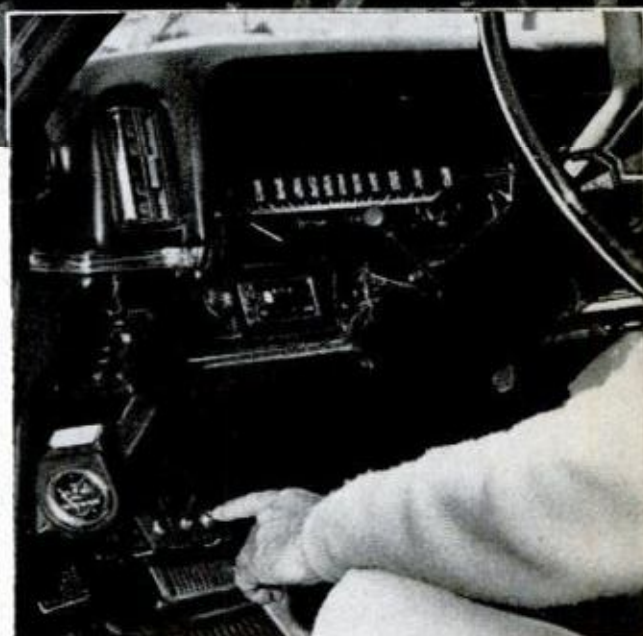
limitation has been set on this emission from cars until 1971, when there will be a restriction in California of four grams per mile. LPG tests showed all cars using this fuel already below this minimum, from 3.8 to 1.2.

Companies in most parts of the country can now offer simple, well-proven conversion units to adapt auto engines to LPG use. Generally these run about \$300 and take one day to install. Also, both Chevrolet and Ford now sell factory-installed LPG units in their trucks.

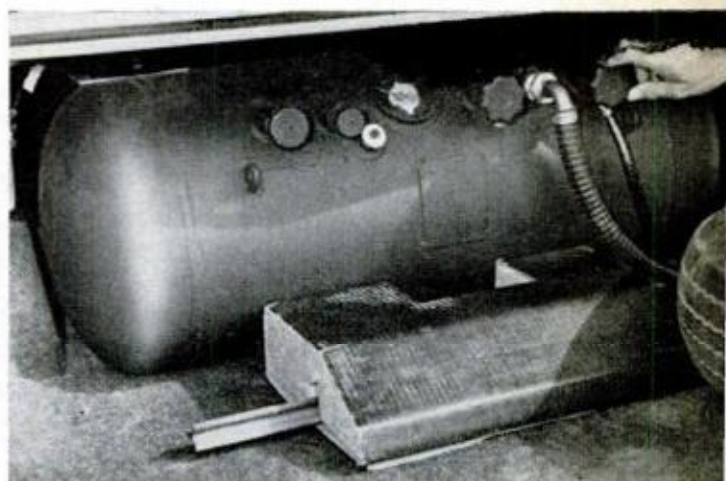
What does a typical auto conversion consist of, and how does it work? The system is very simple: a heavy-gauge, leakproof fuel tank, usually mounted in the trunk; a converter to change liquid gas to vapor, and a mixer to provide the proper air-fuel ratio for combustion. The rest of the engine—spark-plugs, ignition system, exhaust—remains the same.

Two toggle switches mounted below the dash are used to shift from regular

(Please turn to page 208)



DRIVER'S SWITCHES control lock-off valve for LPG and flow of conventional gasoline from its tank



TYPICAL PROPANE TANK is secured in trunk. Among valves are fill, relief, vapor return and withdrawal



Will You Lose Your Right to Fly?

Misleading 'scare stories' about congested air space and collisions may bring laws that will virtually eliminate private flying. Here's the truth—and real solution—as seen by a professional pilot

By FRANK A. TINKER

Technical Art by Jack Mitchell

WE HAD BEEN CLEARED for final approach to the single runway available at this major, supposedly modern, airport. Several small private aircraft were also in the pattern for the same runway as we reported our heavy cargo craft three miles out. One was almost ready to turn on final, a turn that would put him squarely in our path. Surely he would be told to go around the pattern.

But he was not.

"Piper three six Foxtrot, you are cleared to land," came the instruction from the tower. Cautiously, sensing the error that had been made, the Piper acknowledged and began his turn.

There was no time for further tower talk. The aircraft were already in dangerous proximity. I gave our bird climb power, asked the copilot to bring up the gear, and turned abruptly to avoid the lightplane.

At that point we could have filed a report of a near miss, as all pilots were invited to do by the Federal Aviation Agency in 1969, without fear of retribution. However, like many other pilots concerned over the public hysteria about mid-air collisions, we decided against it. It seemed to us that any such report, instead of being used to correct the real cause of aerial traffic jams—in this case, inadequate airport facilities—now merely adds to a misunderstanding which threatens to eliminate private aviation as we have known it here in America.

Such an unfortunate ban can be effected in several ways: by restric-

tive order or by requiring such expensive equipment that the ordinary light-plane owner cannot afford it. Recent "scare stories" about congestion and mid-air accidents, many woefully inaccurate, have created the emotional climate for such unreasonable actions. It would be unfortunate if hysteria were to govern our aviation policies now since the only real cure for aviation's growing pains—an advanced technology within reach of all—seems well on its way.

Last year, despite the clear language of a federal statute that "... there shall be no exclusive right for the use of any landing area or air navigation facility upon which Federal funds have been expended," the main airports in New York (La Guardia, Kennedy and Newark) and Washington National were virtually closed to all aviation but airlines. This was done by requiring reservations before landing, with so many slots being awarded to airlines beforehand that few spaces were left for the private or business pilot. In addition, the Port of New York Authority levied a landing fee—to apply only to nonairline craft—five times its previous level.

Senator Long of Louisiana has called for the relegation of private aviation to "pastures." Recently, stringent controls have been proposed by the FAA for 22 high-density terminal areas around the country, with another 98 apparently on a list to follow. These controls would require expensive electronic equipment on even the smallest aircraft operating in these areas, commit all aircraft to complete ground control regardless of weather, and compress their flights into shallow layers of airspace. These proposed rules, according to Sen. John Tower of Texas, "would result in the death of general aviation."

But these proposals only continue a long trend, that of transferring control of flights from cockpit to ground, from pilot to government employee.

The public thinks the reason is congestion—and its link with mid-air collisions. Last year FAA towers handled

nearly 60 million aircraft movements, a large percentage at a relatively few main terminals. This congestion is anything but new.

PM and this writer called attention in 1960 to the situation at Chicago's Midway Airport. Causes of crowding then were much the same as now—overscheduling of flights, inadequate airports, marginal technical and radio facilities. One factor not a large cause was small private aircraft. Even then private planes were almost never caught in the maelstrom of a major airport.

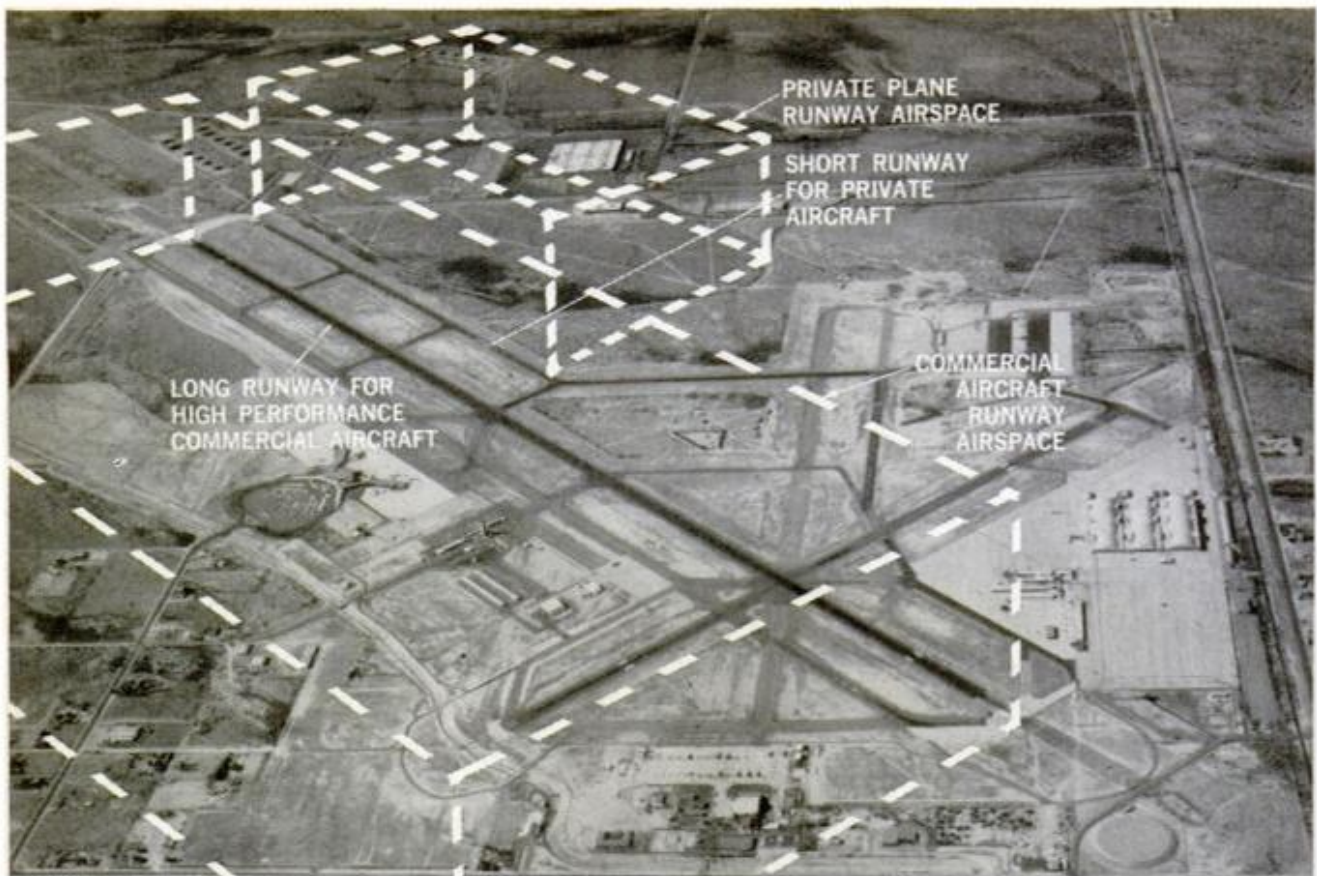
Obviously, overworked air controllers agree: The "sick-strikes" which they called in 1969 and 1970 to protest crowded and inadequate facilities at major airports occurred *after* private

THE AUTHOR: *Frank A. Tinker has been flying for 30 years—combat in World War II and Korea, airlines, charters and freight ferries to Alaska. A former director of the Airline Pilots Assn., he says: "Most airline pilots are looking for constructive answers rather than banishment of private flyers. After all, most are weekenders themselves."*

craft were eliminated from those ports. As for safety, the FAA itself has stated that limitations on private craft using the ports "were intended to provide relief from excessive delays at certain major terminals. They were not, as some persons concluded, intended to correct a safety problem."

Crowding, however, has been made synonymous with the mid-air collision. Certainly there is a problem aloft. More than 1000 "near-misses" were reported in 1968—although no concrete definition of a near-miss exists. In that year there were two collisions between airliners and private craft and in 1969 there were three, with 132 fatalities. These made headlines—although the number of deaths is less than the average *every day* on our highways.

Most near-misses and collisions did not involve airlines. Some occurred while applying agricultural chemicals, herding horses, or spotting fish. Twenty



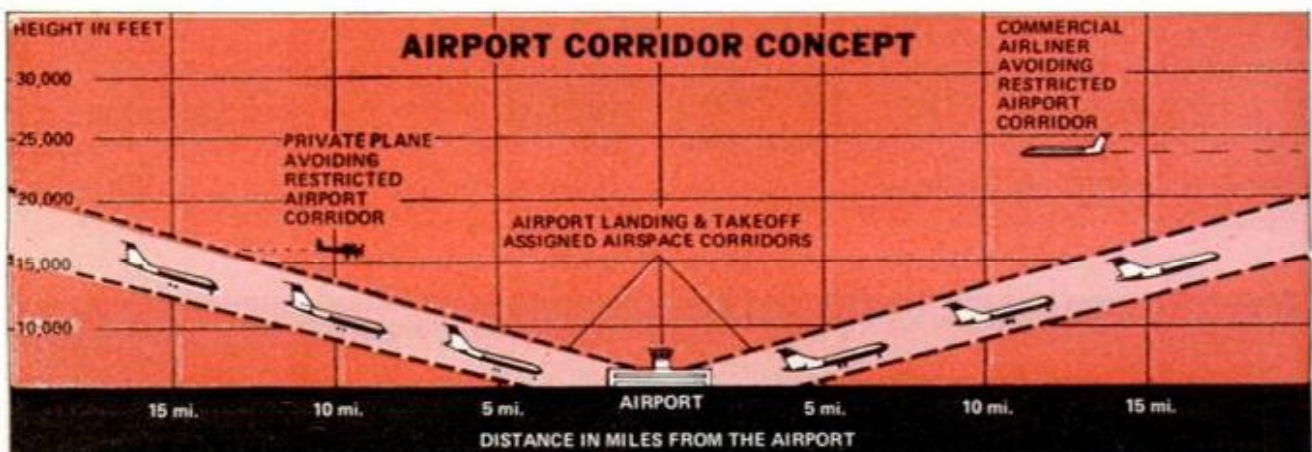
PARALLEL FACILITIES for private and high-performance aircraft allow both to use the airport without interference. Traffic pattern for each (indicated by rectangles) prevents a dangerous "mix" on approach

private craft collided in 1968 while in poorly defined traffic patterns, usually on final approach. Most of these happened at small airports. Probably none could have been prevented by the restrictions now proposed.

The current attack on private aviation has been the first to recommend the virtual grounding of any part of our civilian fleet. How well qualified are the critics? Even large newspapers seldom have an aviation specialist. Much of the information they print about ac-

cidents is highly speculative, obtained mainly from airline sources. When a DC-9 and a Piper Cherokee collided near Indianapolis last September, a typical headline was **SMALL PLANE RAMS JET**. Even the *New York Times* said the small plane "struck" the DC-9's tail. The jet, however, was traveling at a speed several times that of the Cherokee, which would make it difficult, for the latter to "ram" or "strike" the DC-9. In a similar collision between a Cessna 150 and a DC-9 near St. Louis

FLIGHT CORRIDORS, long used by military, are suggested by private and airline pilots. Only positive-controlled planes are allowed (within dotted lines); others avoid, knowing the distance, heading, altitude



in 1968 the CAB found that the airline pilots "could have sighted the Cessna in time to avoid the collision. The Cessna crew could not have been expected to see and avoid the DC-9."

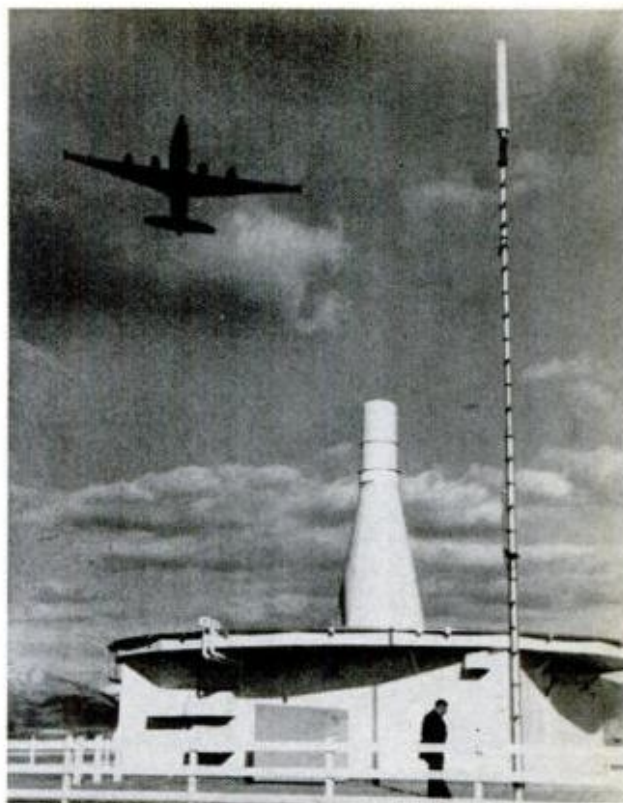
More important, the probable cause of this accident was found to be a combination of inadequate VFR separation standards and the absence of an orderly traffic pattern.

A widely quoted newspaper supplement story (*Parade*, Jack Anderson) claimed that in the Indianapolis collision the private plane was making a landing pass at the airport. The National Aviation Trades Assn. indignantly pointed out that the lightplane was 20 miles from the airport at the time of collision.

Even the terms "private" or "general" aviation may be misleading. General aviation includes not only the weekend flyer in a lightplane—who may hold either a student permit or an airline transport rating—but aerial applicators, air taxis and 6600 multiengine company-owned planes. About 1000 private jets and 1200 turboprops fly in this nonairline fleet which numbers about 133,000 aircraft. There are 10,000 airports in the United States, only one in 20 served by a major airline, and almost as many people move between cities by private aircraft as by airline. Thus the question might easily be posed—which is "private" and which "public"?

Controls are overrated as accident preventatives. The same rules that provide altitude separation between planes also *confine* them to specific levels and create whatever crowding results there. Having to follow airways from one navigational aid to the next compresses traffic into narrow bands of airspace. The first serious mid-air collision was due in part to the precise navigation of the two airliners involved, which came together in an uncrowded airway over the Grand Canyon.

In busy terminal areas all flights are under radar surveillance and ground control. Yet during 1968 there were 58



AIRCRAFT HOMES IN on navigation installation, one of many strung across the country to form airways. Airways compress traffic and often cause crowding

near misses between planes which were both under "positive control." The worst mid-air accident in history occurred when two airliners collided over New York while being directed by controllers. Last year two jets nearly collided in positive control airspace 22,000 feet over Pennsylvania.

The FAA has recently proposed that in terminal areas all flights above a very low level be under ground control. Both private and airline pilots have turned thumbs down on the FAA scheme, saying it is too complicated, compresses traffic at low levels, clogs radar screens with transponder blips and imposes an additional burden on already overworked controllers.

The main crisis arises in terminal areas and at lower levels of flight when different classes of aircraft are operating there simultaneously. The solution is to get high-performance craft into and out of airports, passing safely through the levels where this "mix" occurs. To do this, "flight corridors" have been suggested by both private and airline pilot associations. Similar

(Please turn to page 220)

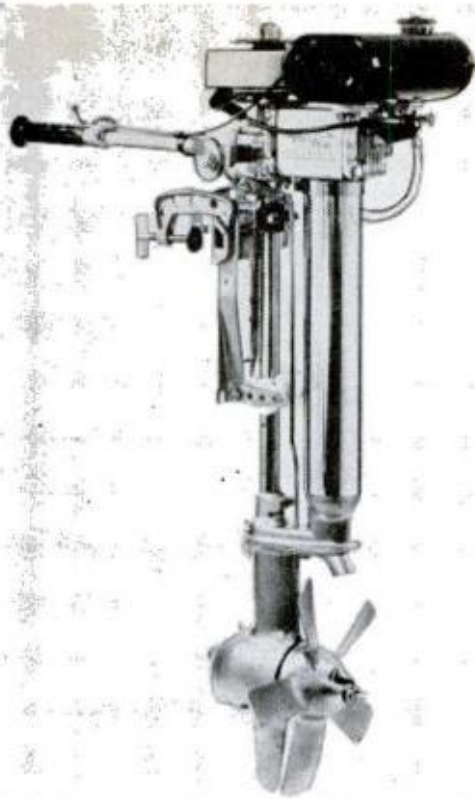
New Outboards For '71

Modifications, not major changes, will be the keynote for next year's season.



By **GEORGE W. REIGER**,
Boating Editor

ADDITIONAL MODELS and engineering improvements show up for 1971 in the lines of each major motor manufacturer. For example, the top of Chrysler's line is still the big 135-hp racing model, three of which are shown above driving Gary Ferguson's *Twister 3*. And the anchor slot is still occupied by a 3.6-hp Swinger turning 4500 rpm. But in between, Chrysler has five new engines, all available in standard or long shaft:



BRITISH SEAGULL 6-hp Silver Century Plus (top) and Evinrude 50-hp loop-charged Lark with tuned exhaust

- 45-hp with Magnapower, an exclusive capacitor-discharge ignition system;
- 35-hp equipped with a high-output alternator;
- 12.9-hp manual or electric-start;
- 6 and 8-hp to improve on and replace last year's 5 and 7-hp models.

The new 12.9 electric-start engine will share with the 20 and 9.9 electric-



BEARCAT 85-hp, four-cycle outboard features aluminum block with detachable cylinder head, sleeves

start models a dome-light feature providing illumination for nighttime boating (fishermen, take note) and a built-in generator supplying power for running lights and accessories.

In addition, all Chrysler models for '71 will have new self-cleaning water pumps that provide 20 percent greater output than last year's models. Finally, Chrysler has developed a new propeller with "dynamic-pitch." All standard high-performance engines from 70 to 120 hp will feature it, yielding up to 3 mph more average speed. High-rake and progressive pitch distribute power more evenly over prop surface, and cavitation, even in tight turns, is substantially reduced.

Big news from Evinrude is the 50-hp Lark. Actually lower in profile than OMC's 40 hp, the 186-pound Lark features capacitor-discharge ignition, temperature and pressure-controlled cooling, "straight-in" fuel induction, and surface-gap sparkplugs. The ignition system has no battery, distributor, breaker points or air gap to adjust;

flywheel magnets and stator coils generate the current charging the capacitor. Another magnet (on the flywheel hub) activates a sensor coil alternately closing two electronic switches which then pass the current from the capacitor to individual ignition coils in proper firing sequence.

The Lark represents the first time loop charging and tuned exhaust systems have been used in a two-cylinder outboard. With these systems, an outboard's cylinders are more efficiently charged with fuel-air mixtures, and then the burned gases are equally well scavenged after firing. Exhaust flows through specially shaped passages designed for maximum flow and control of tuning pulse, and it's then fed into a closed-end megaphone before discharge below water level through the propeller hub. Most remarkably, the tuned exhaust system is fitted into the space formerly allotted to the untuned system.

One of the finest aspects of the new 50 is that overboard fuel drains will be completely eliminated. All your fuel is burned, thanks to "straight-in" induction, which has no fuel-collecting pockets.

With an approved full-throttle range of 5000 to 6000 rpm and speeds exceeding 38 mph, the Lark's displacement is

only 41.5 cu. in., 2.4 cu. in. less than the next model down the line: Evinrude's Ski Twin 40. Lark's price: about \$1050.

Besides the new top-of-the-line and "anchor" model outboards (see special box), and their own version of OMC's 50 hp, Johnson Sea Horse will have a new 100-hp engine in '71. It will maintain the same displacement as last year's 85-hp (which it replaces), but have a larger carburetor, more efficient exhaust ports, and a new optimized spark advance. Full throttle range is 4500 to 5500 rpm with a 92.6-cu.-in. piston displacement. It weighs 252 pounds and will retail for about \$1495.

Mercury's line shows little change in the new season. Breakerless Thunderbolt ignition is still standard in all Mercury six and four-cylinder models as well as in the Merc 400 (40 hp), and direct charge induction, first introduced in the 80-hp Merc two years ago, is now standard in the 135, 115 and 40-hp versions.

Fisher-Pierce has a new outboard to supplement the Bearcat 55. Basically an English Coventry Climax auto engine, the new Bearcat is an 89-cu.-in., 85-hp engine. Comparison tests between the Bearcat 85 and 55 at comparable speeds indicate the new 85 burns just a mite more fuel—this in a four-cycle outboard already known for

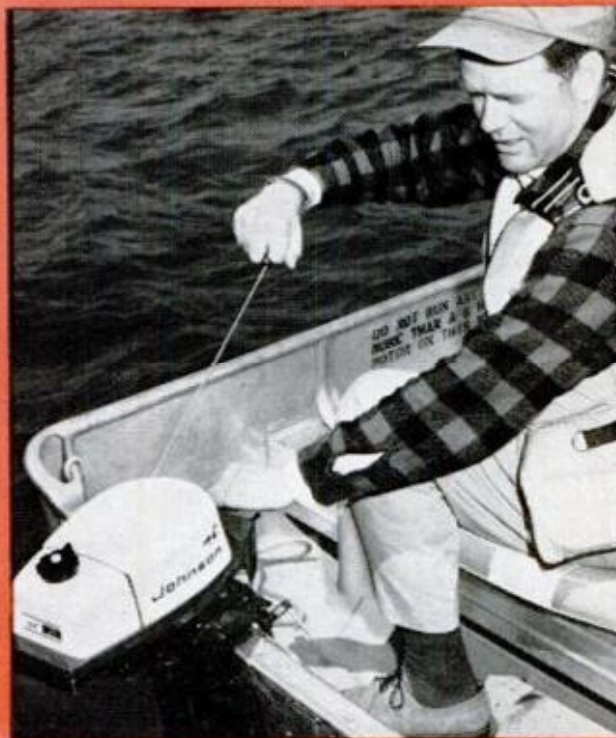
FOR BASS ANGLERS who want both power and power trim, Mercury's four-cylinder, 50-hp model is perfect. The Merc 500 has new and more efficient permanent magnet starter motor, sturdier flywheel assembly and shock absorbers as standard equipment. One advantage of shocks is they facilitate the addition of Mercury's Quicksilver Power Trim—a pushbutton device that remotely adjusts your motor's angle at any speed. Not only will you get perfect planing angles at full bore, but Power Trim will help you negotiate those shallow bars and submerged stumps in your favorite waters for fishing





IN AN EXCLUSIVE PREVIEW PM tested Johnson's new 125-hp and 2-hp outboards. During some very hard driving over white-capped water—including jumps and backing down into oncoming seas, the big 125 never skipped a beat. While full-throttle rpm range (4500 to 5500) and overall weight (252 lbs.) are the same as Johnson's 115 (Will this same basic engine one day be offered in a 140-hp version?), the bore has been enlarged 3½ cu. in., the cooling system has been altered for greater efficiency at high rpm, and lower-unit bearings have been enlarged to accommodate added horsepower.

Big news in the 2-hp is its automatic-rewind, manual-start system with increased rpm range (4200 to 4800) over that of last year's 1½-hp (3500-4500) from which the 2-hp is built. Offering more power with only three pounds extra weight, this engine should please sailors looking for an auxiliary. Price of the 2-hp, \$170; 125-hp, \$1695.



fuel economy! Since no oil is mixed with the gas, Bearcats are smokeless and provide all-day trolling with little or no plug fouling. For more information, write Fisher-Pierce Bearcat Inc., 1149 Hingham St., Rockland, Mass. 02370.

British Seagull has a new 6-hp outboard that's ideal for sailors with small to medium-size racing-cruising sailboats with relatively low-speed displacement hulls. The Silver Century Plus turns an 11-in. diameter, five-bladed prop through 4-to-1 reduction gears and is designed to cruise all day at a miserly 3½ hours-per-gallon fuel consumption rate. Retail price is \$265. Write British Seagull Motors, 151 Mys-

tic Ave., Medford, Mass. 02155, for information on the Silver Century line.

Other gasoline-powered lightweights: Clinton Engines Corp., Maquoketa, Iowa, produces four air-cooled engines ranging from 2 to 7 hp and will be introducing a new 9.9 hp this year.

Commando Motors Div. of McMar, 1583 Monrovia, Newport Beach, Calif. 92660, makes 5.2 and 7.5-hp air-cooled outboards selling for \$194.50 and \$257.

Eska Motors, 2400 Keeper Blvd., Dubuque, Iowa, has three engines at 3.5 to 7 hp.

Muncie Gear Works Inc., Box 400, Cordele, Ga. 31015, makes a 17-lb. Neptune Mighty Mite rated at 1.7 hp and

(Please turn to page 220)

NEWS BRIEFS



Running a tight ship

This stubby craft is simply a bow and stern welded together for a trip from Mississippi to Pennsylvania. Litton Industries will cut it in two and add a new middle section to make it a 1000-footer and world's largest bulk ore carrier. Bethlehem Steel will operate it.



Sound-slides train mechanics

Auto mechanics are being trained at Central Piedmont Community College with a sound-slide system developed by the college that employs a 3M magnetic sound disc for each slide. A student follows, step by step, and can back up the slides for review.



Triumph Stag

New this year from British Leyland Motor Co. is the Triumph Stag, a two-door, 2+2 coupe available as a convertible, hardtop or combined convertible/detachable hardtop. It has a 182.9-cu.-in. V8, 145-hp engine. It will be sold in the United States this year.



Illinois museum keeps the old-timers running

Visitors are getting a nostalgic look at the past and a reminder of the heyday of the railroads as coal-burners puff out clouds of black smoke and trolleys clang their way along the tracks at the Illinois Railway Museum at Union, Ill. The museum has a collection of more than 80 steam engines, streetcars, interurban cars and steam railroad cars, including some



Tektite's mermaids

Five lady marine scientists spent two weeks this summer in Tektite II, NASA's underwater habitation located in 50 feet of water near St. John, V.I. In addition to carrying on research, the ladies were observed during the time for social behavior (as are groups of male aquanauts in Tektite). The information will be used in future selection of space crews.



cars that were privately owned by business magnates. Leaving the station (left-hand photo) is the Shay steam locomotive, built in 1926 for the St. Regis Paper Co. It's pulling two CB&Q coaches built in 1923; the rear of one appears in the second photo. In the third photo are a sleeper and coaches of the Illinois Terminal Railroad. At far right is the observation car of the CB&Q Zephyr. The museum is operated by a not-for-profit corporation, and unpaid volunteers do most of the maintenance and operation.

**Automaker Challenged
On 'Responsibility'**

**Complaints About Cars
Lead Consumers' List**

**Auto Union Urges
Ban on Gas Engine**

**Stricter U.S. Tests
Asked to Curb
Auto Pollution**

**In Detroit, A
Search for Confidence**

**Auto Firms Ask
Delay of Air Bags**

**Detroit vs. Insurers
Hassle Over 'Fragile' Cars**

**Dealers Go Ahead On
Fleet Subsidy Lawsuit**



At a time when the industry is getting it from all sides, PM takes a look at what's right with the automobile

By **BILL HARTFORD**, Auto Editor

THE RIGHT QUESTIONS, it is said, make up half the battle in finding the right answer to a problem. Recently, a reader asked one of *PM*:

"I have a '67 Mercury Cyclone with 72,000 miles, purchased new, good gas mileage with 390 2-bbl., 4-speed. No trouble. *Is something wrong?*"

The only thing wrong, of course, is the assumption that an automobile is supposed to "fall apart" in three years. This myth—perpetrated by even knowledgeable mechanics, but never paid much attention by the auto industry—is reinforced in many minds by our disposable-diaper consumer climate. Anywhere from \$50 to \$150 a month to the bank is the price for a service: trouble-free transportation—an appliance on wheels that's supposed to hum along as long as the payments are made.

The driver who's interested in his

POPULAR MECHANICS

**Ecologists Score
Autos' Effect On
Environment**

**Car Owners Gripe
On Warranties**

When a Fellow Needs a Friend

machine, however, who doesn't let the dings and dents accumulate waiting for insurance to pay for them after a big smash, who uses some wax every now and then, who regularly lifts his hood and does some *preventive* maintenance, who checks body drain holes for trapped water, who gives his engine an occasional spritz of degreaser, is the owner who does not imagine his car is a pile of parts in front of the bank after the last payment. He may need battery and tires, but with payments over he can get them.

Of course, with the '71s too, there'll be that fuel-pump diaphragm that ruptures after a pitiful 6852 miles, and warranties will still work like creaky, rusty doors. A real "safety car" is still on the drawing boards, bumpers are not designed the way they should be, and a non-do-it-yourselfer is likely to be stranded, aggravated and maybe \$10 poorer when he pays someone to shake a bit of dirt from his fuel filter. But while it is impossible to design an automobile with the reliability of a refrigerator, it is simply not true that a car—any maker's car—is designed to fall apart in three years.

What is true is that the '71 cars represent many years of refinement in motor-car design. From nonshattering windshields to smooth and powerful en-

gines, to lifetime lubricated suspension components, right down to airconditioners that even hold-out purists are now ordering, Detroit iron represents what most of us want and expect in comfortable, quiet, dependable personal transportation—and that's despite modern advertising and the notion of creating demand where there is none.

It's also true that these same cars, when dirty, dented, out-of-tune and belching fumes, are grotesque in their appearance and in their danger to the environment. Just as grotesque is the recently heard, dealer-sponsored radio commercial that replaces the Lone Ranger's horse, Silver, with a make of car in the famous theme: ". . . off you go in a cloud of exhaust and hearty hi-o Oldsmobile!" Oldsmobiles do not go off in a cloud of exhaust greater than that of any other cars, but that commercial isn't going to help sell the car to citizens concerned about air pollution.

Besides, there's no need to hard-sell romance. The romance of the automobile isn't over and never will be. Instead of roaring off we may whisper or whoosh off, but we'll go off under our own steam (literally, maybe?). Americans have had a technical infatuation with the automobile for seventy-odd years, but up until now the car has been

(Please turn to page 214)

American Motors



Mounts Its



AMC comes on strong with a hot Hornet, new Javelin, compact wagon and, for big spenders, a moving mid-engine machine

By MICHAEL LAMM, West Coast Auto Editor/Photos by Bruce Moss

AMERICAN MOTORS turned fiercely aggressive and expansionary in 1970. Among important developments, AMC merged with Kaiser Jeep, introduced two well-timed new small cars, brought styling of all lines up to fashion and followed through on a professionally staffed racing program.

If responsibility must be laid to one man, that man has to be Roy Chapin. Chapin vowed aggressive and innovative carmaking ("Six new cars in the next three years"). He has the personal and technical leadership to carry it through. Chapin, so far, has guessed right. As a result, he's admired by colleagues and competitors alike. So is little American Motors as a whole.

AMX/3: At this year's 1971 press previews at Michigan International Speedway, American Motors had one new mid-engined AMX/3 making 110-mph laps of the oval. It came in for phototaking and individual rides (not drives—rides). AMC hopes to build and sell two dozen AMX/3s during the coming year, with no price announced yet but

guesses range between \$10,000 and \$20,000.

The earlier AMX/2 was unveiled in March, 1969, amid very favorable comment. It was designed by Dick Teague's capable styling staff in Detroit and built in Italy by Bizzarrini. BMW helped with testing.

The production AMX/3 presumably will mount the new 401-c.i.d. V8 amidships ahead of a four-speed transaxle. The car uses fully independent suspension, with upper and lower control arms and coil springs.

The car stands a bare 43.5 inches high, has a 105.3-inch wheelbase, does 0-60 mph in 5.5 seconds, weighs 3090 pounds and draws crowds anywhere it lights.

GREMLIN: Coming back to earth, very little change in the 1971 Gremlin (see [The Gremlins Will Get You](#), page 106, April PM; also [How the Gremlin Lost Its Tail](#), page 88, Aug. PM). Outwardly it looks the same except for new, standard pinstriping.

Under the hood, though, the 145-hp



HORNET SC/360

Assault!



MATADOR



AMX/3



JAVELIN AMX



HORNET SPORTABOUT



AMBASSADOR



HORNET SPORTABOUT features sharply angled tailgate giving the functional wagon its sporty flair



NEW JAVELIN has neat interior with curved dash and vertical divider, buckets offered in leather

232 Six becomes standard, and the 199-incher has been dropped. Optionally, there's a new 258-c.i.d. Six rated at 160 hp at 4000 rpm. (The 199, by the way, generally got less gas mileage than the 232 anyway, as shown in *PM's* September Hornet Owners Report.)

There's a choice of column shift or floor stick with all-synchro three-speed manual transmission. Last year, only second and high were synchronized.

There are minor interior innovations, notably the removal of one spring cylinder for the rear liftgate. And a much-needed option is a rear-window air deflector to help keep dust and snow off the glass. Another new option: mag wheels with D70-14 fat-fats.

HORNET: Most notable addition to the Hornet line is a handsome Sportabout station wagon. Dick Teague calls it a

five-door glassback sedan, mostly because the rear is so steeply canted. It comes fully carpeted, in four doors only. With rear seat folded flat, there's a 58.3-cu.-ft. luggage deck. A Space-Saver collapsible spare is standard. Wheelbase of all Hornets spans 108 inches.

Another addition to the Hornet line is the SC/360, a high-performance two-door with the 245-hp, 360-cube V8 standard or a ram-air four-barrel, 290-hp version optional. Along with unique identifying rally stripes and markings, the SC/360 comes with a three-speed floorshift trans (optional four-speed or automatic), heavy-duty clutch, choice of rear-axle ratios, D70-14 Polyglas tires, 14x6 slot-style wheels, Space-Saver spare fancy interior trim, infinitely variable reclining bucket seats and

(Please turn to page 210)

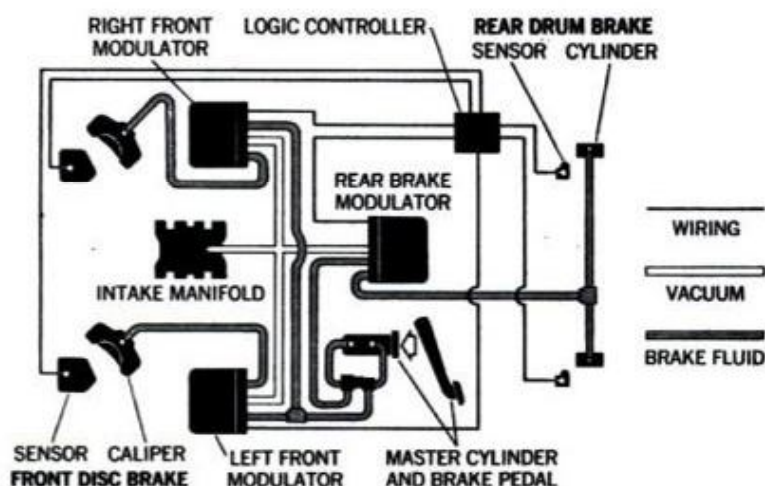
1971 AMERICAN MOTORS SPECIFICATIONS

Car	Body Style	Wheel-base (in.)	Overall Length (in.)	Overall Width (in.)	Track (f/r in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
Gremlin AMX/3	2-dr. sedan	96.0	161.3	70.6	57.5/57.0	232-6-1bbl., 258-6-1bbl., 390-4bbl.
	2-dr. mid-engine	105.3	175.6	74.9	60.6/61.2	
Hornet	2-dr. sedan, 4-dr. sedan, Sportabout	108.0	179.3	70.6	57.5/57.0 ¹	232-6-1bbl., 258-6-1bbl., 304-2bbl., 360-2&4bbl.
Javelin	2-dr. hdtp.	110.0	191.8	75.2	59.3/60.0 ³	232-6-1bbl., 258-6-1bbl., 304-2bbl., 360-2&4bbl., 401-4bbl.
Matador	2-dr. hdtp., 4-dr. sedan, wagon	118.0	206.0 ²	77.2	59.9/60.0 ³	232-6-1bbl., 258-6-1bbl., 304-2bbl., 360-2&4bbl., 401-4bbl.
Ambassador	2-dr. hdtp., 4-dr. sedan, wagon	122.0	210.8 ⁴	77.2	59.7/60.0	258-6-1bbl., 304-2bbl., 360-2&4bbl., 401-4bbl.

*Not all engines available in all models

1, 57.2/56.6 V8 models; 2, 205.0 wagon; 3, 59.7/60.0 V8 models; 4, 209.7 wagon

Chrysler Corp.—It's Add Your Own Option Year



Dodge and Chrysler-Plymouth Divisions make ordering a car even tougher for '71 with a whole new list of cost-extras from stripes to stereo tape

FOUR-WHEEL ANTISKID BRAKE SYSTEM automatically controls pressure at each wheel to prevent lockup when brakes are applied

By **BILL HARTFORD**, Auto Editor
Photos by *Bruce Moss*

THE SKID PAD in the middle of Chrysler's Chelsea, Mich., Proving Grounds is far removed from all dangers associated with normal, everyday driving—no traffic, drunks, trees or telephone poles. It's an excellent place to find out how underestimating stopping distance is what does too many of us in before our time.

Probably like most "older" drivers raised in cars with drum brakes and a minimum of gadgetry, I anticipated driving Chrysler's 1971 Imperial with "Sure Brake" four-wheel antiskid system with some skepticism. I thought I could pump that brake pedal with rapid-fire jabs just as fast as the computer could do it.

First run in the four-door LeBaron hardtop was with the antiskid system inoperative. The feeling of movement in an Imperial traveling between 50 and 60 mph is just about nil, and that's why I felt as if the car actually speeded up when I locked the brakes and began sliding along the wetted-down asphalt section. The car just kept going—pylon after pylon—the only sounds being those of water squishing out from the tires and the swish of the sprinkler nozzles as the car passed one after another. The rear end slowly came around and the LeBaron finally stopped broadside.

For the next run, I snapped up the toggle switch activating "Sure Brake," ran up to the same speed, hit the brake and held it down hard. This time it didn't

71-CARS

SATELLITE SEBRING is one of five two-door hardtop models in 115-inch wheelbase lineup



**PLYMOUTH
SATELLITE SEBRING**

DODGE DEMON 340



DODGE CHALLENGER R/T

◀ **DEMON 340**, performance model in new Demon series of Dart compact lineup

◀ **CHALLENGER R/T** is hot one among Dodge's Deputy and Challenger ponycars



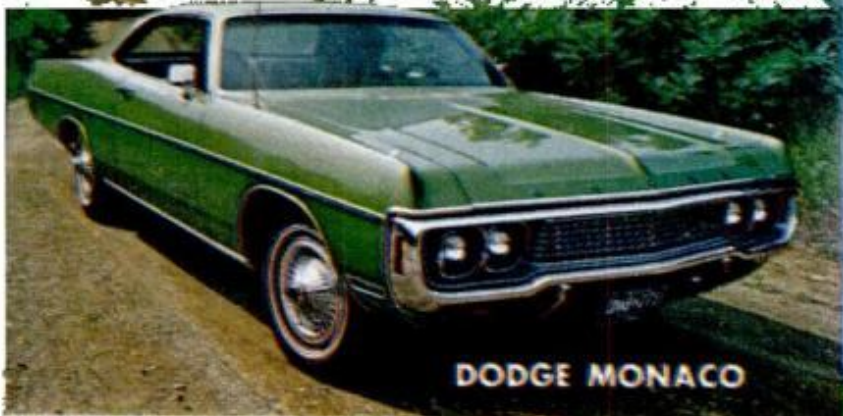
DODGE CHARGER 500



PLYMOUTH FURY III



PLYMOUTH BARRACUDA



DODGE MONACO

◀ **MONACO**—top of the full-size Polara line —has revised grille, bumpers; no-vent side glass on all cars; keyless door locking

SIMCA two and four-door sedans have tailgate, folding rear seat, luxurious interior, radials standard ▶



SIMCA 1204



PLYMOUTH DUSTER 340

▲ **DUSTER 340**, top of superselling Valiant compact line, gets bolder new markings for its second season

▶ **CORONET BROUGHAM** is high-line model of Coronet intermediates. On longer wheelbase, all are four-door

◀ **CHARGER 500** (and all new Chargers) is two-door hardtop on shorter wheelbase than four-door Coronet

◀ **FURY III** two-door hardtop is one of 21 Fury models with improved suspension and road noise isolation

◀ **BARRACUDA** convertible, among six models in the line. New grille, tail lamps, wheel covers mark the '71s

▶ **NEWPORT**, Custom, 300, New Yorker two-door hardtops offer sunroof, with convertible dropped from line

POPULAR MECHANICS



DODGE CORONET BROUGHAM



CHRYSLER NEWPORT



HEADLAMP WASHER SYSTEM includes nylon brushes, solenoid, actuators and washer reservoir with pump



CASSETTE PLAYER-RECORDER stereo tape unit is optional as are Hurst shifter, sport steering wheel

feel as if the car were speeding up. As it came to a straight-line stop in a little more than half the previous distance, I detected by seat of the pants only a slight feeling of brake "pulsing," and thought about what was happening in the system:

On each car wheel is a small, toothed wheel. The teeth pass through an electromagnetic field as the wheel rotates. The sensors at each wheel count the teeth going by, and this way tell how fast the wheel is slowing down when the brakes are jammed on. When the computer determines that a wheel is slowing down so fast that it will soon lock, it signals the modulator which lets up on the hydraulic pressure to the brake, and then reapplies it a fraction of a second later. Sounds simple, but Chrysler has been working on it with Bendix Corp. for years (See *Coming Soon! 'Skidproof' Cars*, page 104, Feb. '68 PM.) Early in its development the system was designed to fail safe; still, Chrysler waited until the '71 models to introduce a system that has the utmost in reliability.

I still had the third and best run to make. A pylon was placed in the center of the pad. Instructions were to hit the

brake as before and *steer around the pylon*, brakes full on! Well, there was nothing to it. The advantage of four-wheel antiskid braking is, in theory, full steering control and I found out it's true. Alas, Chrysler's the only car-maker using the four-wheel system and, alas, alas, the Imperial is the only car in the line offering this extraordinary option.

Slightly changed concealed-headlamp doors mark the exterior of the '71. Headlight washers are optional. Decklid nameplate calls out "Imperial by Chrysler." Compression ratio of the 440-c.i.d. V8 has been reduced to 9.0 from 9.7 to run on regular-grade fuel. A cassette unit, keyless locking, improved automatic temperature control and new interior trim add to comfort, convenience and luxury.

SIMCA, COLT, CRICKET: The French-made Simca 1204 is an import in hand, Colt and Cricket are two in the bush. Specs and pictures of the two are included, although they won't be sold until Jan. '71. Simca for '71 is unchanged on the outside (except for brighter, new paint colors), but even more extraordinary inside with nylon carpeting added to its smart and comfortable bucket seats (tully reclining, of course) and controls layout. The front-wheel-drive mini continues with radials, front discs and fully independent suspension as standard; offers automatic transmission and airconditioning optional.

DEMON-DART, VALIANT-DUSTER: The Dodge and Plymouth compacts posted a phenomenal year in 1970 and show no sign of letting up. The cars, unchanged for '71, have only the "new taillight

DODGE



DEMON A LA DUSTER puts Dodge in running with a new, handsome 108-inch-wheelbase sporty compact



PLYMOUTH CRICKET (above left) will be produced in England by Chrysler United Kingdom, Ltd. **Dodge Colt** (above right) will be produced in Japan by Mitsubishi Automotive Co. Both subcompacts go on sale Jan. '71

treatments" and new variations in colors and trim that mark them as new models. The design-your-own-car approach is evident here with engine, trim, stripe, color, power, air and other options available to transform any of these models from smart, but nondescript, fleet-like business coupes to eye-

catching, genuine sporty performance machines. The new Demon and successful Duster, both two-door coupes on the smaller wheelbase, are, in the 340 version, because of size, power and handling, more fun to drive than other cars in the line. Color them Citron Yella,

(Please turn to page 218)

1971 CHRYSLER-PLYMOUTH AND DODGE SPECIFICATIONS

Car	Body Style	Wheel-base (in.)	Overall Length (in.)	Overall Width (in.)	Track (f/r in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
Dodge Colt	2-dr. hdtp., 4-dr. sedan, wagon	95.3	160.6	61.4	50.6/50.6	97.5-4-2bbl.
Plymouth Cricket	4-dr. sedan	98.0	162.0	62.5	51.0/51.0	91.4-4-1bbl.
Simca 1204	2-dr. sedan, 4-dr. sedan	99.2	155.3	62.5	53.8/52.6	73.5-4-1bbl.
Dodge Demon Dart, Swinger	2-dr. coupe 2-dr. hdtp., 4-dr. sedan	108.0 111.0	192.5 196.2	71.6 69.7	57.5/55.5 57.4/55.5	198-6-1bbl., 225-6-1bbl., 318-2bbl., 340-4bbl.
Plymouth Valiant, Duster	2-dr. coupe, 4-dr. sedan	108.0	188.4	71.1	57.4/55.5	198-6-1bbl., 225-6-1bbl., 318-2bbl., 340-4bbl.,
Plymouth Barracuda	2-dr. coupe, hdtp., convert.	108.0	186.7	74.4	59.7/61.6	198-6-1bbl., 225-6-1bbl., 318-2bbl., 340-4bbl., 383-2&4bbl., 426-(2)4bbl., 440-(3)2bbl.
Dodge Challenger	2-dr. hdtp., convert.	110.0	191.3	76.1	59.7/61.6	198-6-1bbl., 225-6-1bbl., 318-2bbl., 340-4bbl., 383-2&4bbl., 426-(2)4bbl., 440-4bbl.&(3)2bbl.
Dodge Charger, Coronet	2-dr. coupe, hdtp. 4-dr. sedan, wagon	115.0 118.0	205.4 207.0	76.9 77.7	59.7/61.6 59.7/61.6	225-6-1bbl., 318-2bbl., 340-4bbl., 383-2&4bbl., 426-(2)4bbl., 440-4bbl.&(3)2bbl.
Plymouth Satellite	2-dr. hdtp. 4-dr. sedan, wagon	115.0 117.0	203.5 204.6	79.1 78.6	59.7/62.0 59.7/62.0	225-6-1bbl., 318-2bbl., 383-2&4bbl., 426-(2)4bbl., 440-4bbl.&(3)2bbl.
Plymouth Fury	2-dr. sedan, hdtp., 4-dr. sedan, hdtp., wagon	120.0	215.1	79.6	62.1/62.0	225-6-1bbl., 318-2bbl., 360-2bbl. 383-2&4bbl., 440-4bbl.&(3)2bbl.
Dodge Polara, Monaco	2-dr. hdtp., 4-dr. sedan, hdtp., wagon	122.0	220.2	79.2	62.1/63.4	225-6-1bbl., 318-2bbl., 360-2bbl., 383-2&4bbl., 440-4bbl.
Chrysler	2-dr. sedan, hdtp., 4-dr. sedan, hdtp., wagon	124.0	224.6	79.1	62.1/62.0	383-2&4bbl., 440-4bbl.
Chrysler Imperial	2-dr. hdtp., 4-dr. hdtp.	127.0	229.7	79.1	62.4/62.0	440-4bbl. *Not all engines available in all models

71-CARS

**GM's
Sporty
Movers**



MONTÉ CARLO



OLDSMOBILE CUTLASS



PONTIAC GTO



CHEVROLET CHEVELLE SS

PONTIAC GRAND PRIX



OLDSMOBILE TORONADO



PONTIAC FIREBIRD TRANS AM



CHEVROLET CAMARO Z28



BUICK RIVIERA

ALL GENERAL MOTORS Divisions—Chevrolet, Pontiac, Buick, Oldsmobile and Cadillac—share new features like disappearing station wagon tail-



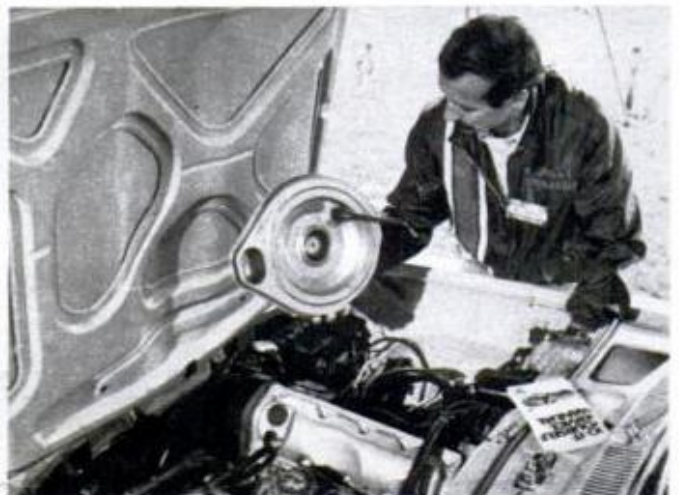
gate, chassis and other design improvements, but competition and rivalry is strong and each has its surprises



YOU'VE GOT TO HAND IT to the eight-year-old kid who from 100 yards can separate the vertical center bar grille from the horizontal motif, the square light from the round, the dual scoops from the dual slots and scream, "Cutlass S!" or "Buick GS!" You

can't beat him at his own game. Underneath the "distinctive" face each GM division contrives for some of its more look-alike cars, however, is the "real" car that is engineered into the divisions' '71 models. Real improvements and refinements, however hidden: New steering gear and linkage *ahead* of front-wheel centerline for better directional stability; wide-span lower control arm; one-piece cast steering knuckle; constant-velocity rear universal joint on driveshaft allowing lower car without high tunnel; sealed side terminal batteries; snap-out instrument panels; Glide-Away tailgate shown on Pontiac wagons above (and from inside on following color spread), but offered by Chevy, Buick and Olds, too. All divisions partake of a common fund of design and manufacturing know-how, but it's not all come-together and each would be happy to bump No. 1 from its entrenched and coveted sales position. You guessed who.

CHEVROLET: Vega is one of those cars that looks as well or better in the metal than in the ads, and, like candidates on election night, the folks at Chevy are waiting (*Chevrolet text continues on page 212; for other General Motors cars, turn to page 114*)



VEGA KAMMBACK, like all models of Chevrolet minicar, has the engine bonnet hinged at front. One-piece disposable air cleaner is discarded and replaced every 50,000 miles. Comprehensive, 112-page Do-It-Yourself Service Manual, on cowl above, shows how to remove and replace the inexpensive plastic grille, do other maintenance and repair work. Partially visible at the left is car-on-nose shipping method

POPULAR MECHANICS

Материал, защищенный авторским правом

1971 GENERAL MOTORS SPECIFICATIONS

Car	Body Style	Wheel-base (in.)	Overall Length (in.)	Overall Width (in.)	Track (f/r in.)	Engines in Model(s) Series* (Displacement, cu.in.—V8 except as noted—carburetion)
Chevrolet Vega	2-dr. sedan, coupe, wagon, delivery	97.0	169.7	65.4	54.6/54.1	140-4-1&2bbl.
Chevrolet Corvette	2-dr. coupe, convert.	98.0	182.5	69.0	58.7/59.4	350-2&4bbl., 454-4bbl.
Pontiac Firebird	2-dr. coupe	108.0	191.6	73.4	61.3/60.0	250-6-1bbl., 350-2bbl., 400-2&4bbl. 455-4bbl.
Chevrolet Camaro	2-dr. coupe	108.0	188.0	74.4	61.3/60.0	250-6-1bbl., 307-2bbl., 350-2&4bbl. 396-4bbl.
Chevrolet Nova	2-dr. coupe 4-dr. sedan	111.0	189.4	72.4	59.0/58.9	250-6-1bbl., 307-2bbl., 350-4bbl.
Chevrolet Chevelle	2-dr. coupe, convert., 4-dr. sedan, wagon	112.0 116.0 ¹	197.5 201.5 ²	75.4	60.0/59.8	250-6-1bbl., 307-2bbl., 350-2&4bbl. 400-4bbl., 454-4bbl.
Pontiac T-37	2-dr. coupe, hdtp., convert., 4-dr. sedan, hdtp., wagon	112.0 116.0 ¹	202.8 206.8 ¹ 203.3 ⁴	76.7	61.0/60.0	250-6-1bbl., 350-2bbl., 400-2&4bbl. 455-4bbl.
Buick Skylark	2-dr. coupe, hdtp., convert., 4-dr. hdtp., sedan	112.0 116.0 ¹	202.8 206.8 ¹	N.A.	59.0/59.0	350-2&4bbl., 455-4bbl.
Oldsmobile Cutlass	2-dr. coupe, hdtp., convert., 4-dr. hdtp., wagon	112.0 ⁵ 116.0 ⁶	203.6 ⁵ 207.6 ⁶		59.7/59.0 76.3 ⁷	250-6-1bbl., 350-2&4bbl., 455-4bbl.
Chevrolet Monte Carlo	2-dr. coupe	116.0	206.5	75.6	60.2/59.3	350-2&4bbl., 400-4bbl., 454-4bbl.
Pontiac Grand Prix	2-dr. coupe	118.0	212.9	76.4	62.0/60.0	400-4bbl., 455-4bbl.
Buick Riviera	2-dr. coupe	122.0	217.4	N.A.	63.8/63.7	455-4bbl.
Oldsmobile Toronado	2-dr. coupe	122.3	219.9	79.8	63.5/63.6	455-4bbl.
Cadillac Eldorado	2-dr. coupe, convert.	126.3	221.6	79.8	63.5/63.0	500-4bbl.
Chevrolet	2-dr. coupe, convert., 4-dr. sedan, hdtp., wagon	121.5 125.0 ⁸	216.8 223.2 ⁸	79.5	64.1/64.0	250-6-1bbl., 350-2&4bbl., 400-2&4bbl. 454-4bbl.
Pontiac Catalina (Grande Ville)	2-dr. hdtp., convert., 4-dr. sedan, hdtp., wagon	123.5 126.0 ⁹ 127.0 ¹⁰	220.2 224.2 ⁹ 230.2 ¹⁰	79.5	64.0/64.0	350-2bbl., 400-2&4bbl., 455-2&4bbl.
Buick LeSabre (Centurion)	2-dr. coupe, convert., 4-dr. sedan, hdtp.	124.0	220.1	N.A.	63.8/63.7	350-2&4bbl., 455-4bbl.
Oldsmobile Delta 88	2-dr. coupe, hdtp., 4-dr. hdtp., sedan	124.0	220.2	79.5	64.1/64.0	350-2bbl., 455-2bbl.
Buick Electra	2-dr. coupe, 4-dr. hdtp.	127.0	226.4	N.A.	63.8/63.7	455-4bbl.
Oldsmobile 98	2-dr. coupe, 4-dr. hdtp., wagon	127.0	226.1 225.3 ¹¹	79.0 79.5 ¹¹	64.1/64.0 63.8/63.7	455-2&4bbl.
Cadillac	2&4-dr. hdtp. 4-dr. sedan 4-dr. sedan, limousine	130.0 133.0 151.5	225.8 228.8 247.3	79.8	63.0/63.0	472-4bbl.

*Not all engines available in all models

1, 4-dr. models, wagon; 2, 4-dr. sedan, LeMans wagon 206.5; 3, wagon 59.3/59.2; 4, GT0; 5, "S" coupe, 4-4-2; 6, F-85, Cutlass, Supreme (Cutlass wagon length 213.3, Vista Cruiser wb 121.0, length 218.3); 7, F-85, all others 76.8; 8, wagon; 9, Bonneville, Grand Ville; 10, wagons; 11, Custom Cruiser wagon



BUICK CENTURION



PONTIAC CATALINA



OLDSMOBILE CUSTOM CRUISER





PONTIAC "T-37" intermediates (new number for tired Tempest nameplate) include Le Mans and GTO models

PONTIAC: Firebird, with its Esprit, Formula and Trans Am variations, is the "small" car in the lineup, but is still the biggest in its styling achievement and factory-available performance and handling hardware. Interiors continue high-style sports-car-modern with addition of new optional rear-seat console and high-back buckets. New voltmeter (also on Catalina lineup) replaces ammeter in gauge package. It reads from 8 to 18 volts. Variations from safe 12 to 16-volt range give clue to improper regulation, alternator drive belt problems, shorted diode, defective battery. Gutterless, "Raindrops-falling-on-my-head" roof line is same: sleek but soggy. **T-37** ("T" for the departed Tempest nameplate?), Le Mans, Le Mans Sport, and GTO intermediates have new front ends and hoods with all kinds of nifty new nostrils. GTOs are shown on color page 108. Like all Pontiac models, the cars have side-impact beams and flashing side markers actuated by the directional turn signals. T-37 and GTO become head turners with two special packages: GT-37 and Judge. All engines (for all Pontiacs) have been redesigned to drop compression ratio for regular fuel operation and yet maintain



BUICK GS, top-of-line performance model in intermediate Skylark series, sports new grille for 1971

or boost performance with such changes as new cams, better breathing, larger valves.

Grand Prix gets a whole lot of improvement in looks up front with a new grille, split horizontally by the bumper, and single headlamps. Sharp, angular bends of the sheet metal continue right back to the short, boattail rear deck. Once again, an easy car to get excited about, more so after you drive it. Cassette tape player and rechargeable flashlight that mounts in the glovebox and is kept charged by car's electrical system are options (also on all other Pontiacs).

The Pontiac lineup—meaning the full-size cars, Catalina, Catalina Brougham, Bonneville—is capped off by a new nameplate, Grand Ville. The luxury top-of-the-liner comes as two or four-door hardtop and convertible. It's got superb forward visibility with thin, reinforced roof pillars. All Pontiacs have new so-called center-flow ventilation system. Extractor slots are in the rear deck instead of door-lock pillar. Hope it works better.

Pontiac station wagons include the two and three-seat Le Mans wagons (dual-hinged tailgate) and the two and three-seat Safari, Grand Safari wagons with the new disappearing tailgate.

—B.H.

BUICK: Riviera is really new. There is no other backside like it on the road. The fastback roof tapers to a V down to the end of the deck. There are flat surfaces either side of the V, forming the trunk lid. It's a looker, somewhat reminiscent of the which-way's-it-headed

POPULAR MECHANICS



NO-MAINTENANCE battery, now available only on Grand Prix SJ and other models with 455 engine, features sealed side terminals and sealed-in lifetime supply of electrolyte contained by condensation baffles in the top



OLDSMOBILE 88, 98 have touch-sensitive steering-wheel center; .040-in. of pressure will blow horn

Studebaker of a generation ago. Take a straight-on look at it from the rear and you'll see how the bustle could easily pass for the prow. One thing the treatment's done is get rid of the dinky luggage compartment Riviera's had heretofore. There's 25 percent more trunk space in the new version.

Skylark, Skylark Custom and G. S. continue in intermediate series. Total cars in division are down to 27 from 36.

Centurion, Le Sabre, Electra: Wildcat name has been dropped. In its place there's a new series, Centurion. The selection of body styles is the same as Wildcat offered—hardtop coupe and sedan and convertible. Centurion price is between LeSabre's and Electra's.

All cars have the steering gear and linkage ahead of the front wheels, and the other features mentioned for GM. On Riviera is an optional, anti-wheel spin, maximum traction—Max Trac—unit that actually *controls* the power to the driven wheels (unlike a positive traction axle that just *transfers* power to the rear wheel with the most traction). It consists of a small analog computer that receives information from two sensors monitoring front and rear wheel speeds. The computer automatically modulates engine power to maintain maximum traction at the rear wheels. The computer compares wheel-speed inputs from the sensors and when rear wheel speed becomes 10 percent greater than front wheel speed, the computer signals an oscillator to actuate a power switch connected to the coil feed wire and interrupts the ignition circuitry for 10 milliseconds.—*R.L.*



CADILLAC ELDORADO has longer wheelbase, crisp new sheet metal; fixed rear window is styling hooker

OLDSMOBILE: Catalog count is down to 28 cars for '71, against 29 choices in '70. There are 10 intermediates, eight 88s, four 98s, five wagons and Toronado—28 models, count 'em. Olds is trying to get away from number designations for its products and only one car, a sedan, carries the F-85 label this year. The rest of the intermediates go under the Cutlass name.

Custom Cruiser, a full-size wagon, is the newest thing out of Lansing. Olds hasn't had a big wagon since 1964. On a 127-inch wheelbase, cargo space in the CC is large enough to accommodate a 4x8 sheet of plywood and it has the trick tailgate, as do wagons produced by other GM divisions.

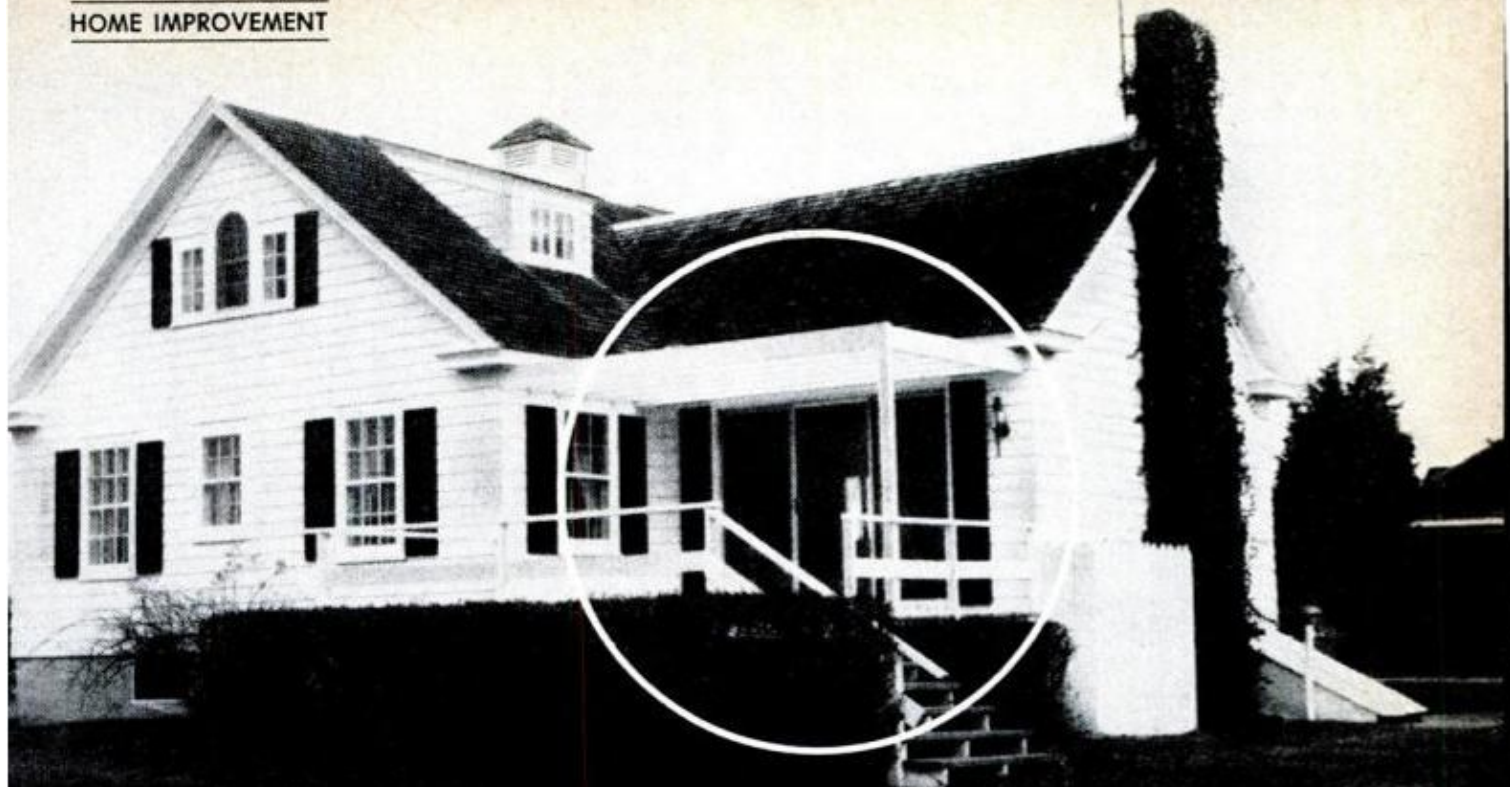
Toronado has a wheelbase three inches longer than the '70 version—122 inches for '71—and front and rear shoulder room has been increased five inches. The 88s and 98s have more leg, head and shoulder room front and back.

In the way of better serviceability or, even better, *less* service, a rubber thermostat bypass hose has been replaced by a metal pipe pressed into a cast iron outlet. The connection to the water pump is made with a short section of strong, straight hose. This means you shouldn't have to replace the hose during the life of the car.

Olds has come up with a couple of ideas to improve shock absorbers and they just may be the best in the business. No. 1, it's used a Teflon-coated piston to reduce friction. Because Teflon is impervious to moisture, changes in atmospheric conditions don't affect the

(Please turn to page 214)





Open the Wall and Let the Outdoors In

If there's a view outside your home worth looking at, a pair of sliding glass doors will let you take it all in



BEFORE (above): Home was built with a typical door and double-hung window construction. Photos at top of the page and on the facing page show how the new treatment has enhanced its livability inside and out

By **HARRY WICKS**, Workshop Editor

Color Photo by *Bill Maris*

Styling by *Robert Lotgren*

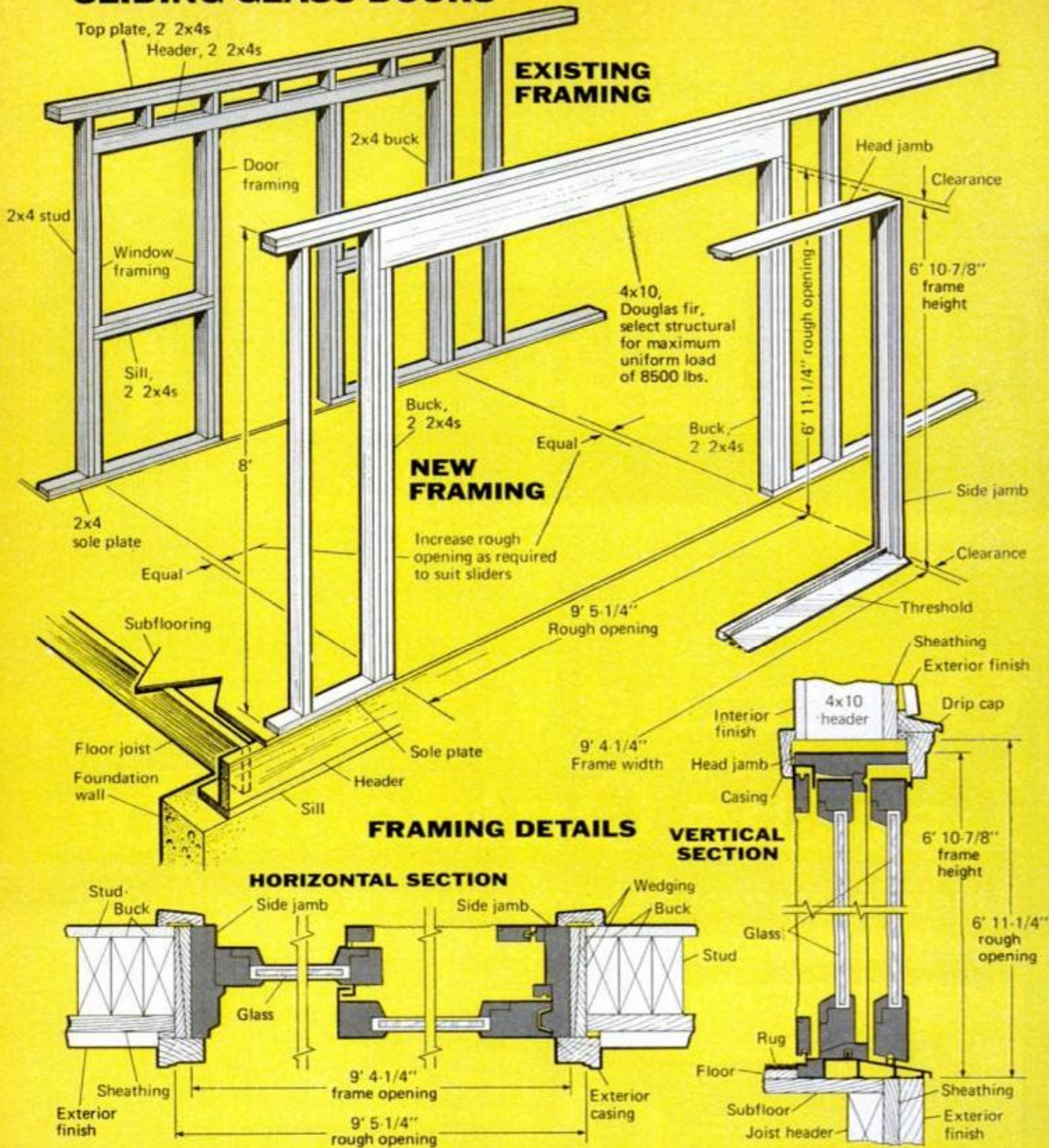
RECENTLY a *PM* reader sent us a photo of his summer home on the eastern tip of Long Island and asked the question: "What can I do to modernize my weekend retreat and get even more enjoyment from it?"

The editors huddled, and Wayne Leckey, Home and Shop Editor, came up with the suggestion that, if the home were his, he would make one wall in the kitchen-dining area all glass to let in that great view. And the owner did.

The good-looking results, from both inside and out, are obvious in the photos on these pages.

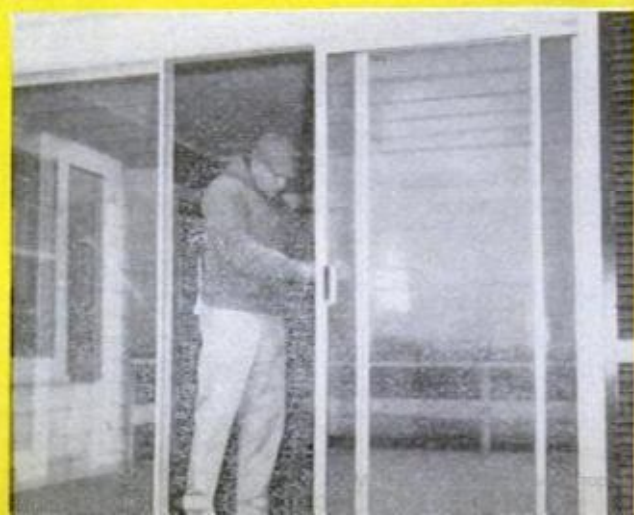
The important point, when laying out a job such as this, is to insure that the installation matches the architecture of the home. The job is not diffi-

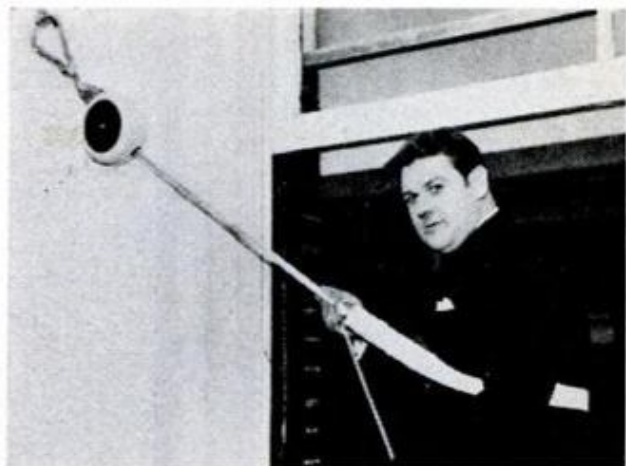
SLIDING GLASS DOORS



cult. As shown in the existing and new structural framing drawings above, it consists basically of opening the wall and installing studs and header to suit the doors you buy. Be sure the framing you install meets minimum requirements of the Federal Housing Administration. If the area you intend to glass-in is longer than that shown here, be sure to check with your local building department that structural members meet the local code requirements. ★★

FINAL TOUCH to big improvement is lock installation





Quickest way out

A steady, controlled descent to the ground is assured the residents of buildings who flee a fire by using the Rescumatic Fire Escape. Slipping into a safety belt at the end of a steel cable, the user goes out the window while a geared pulley controls his descent. At this time, a belt at the other end of the cable moves up for the next escapee.



Atomic-powered dog

Goldie, a labrador, frisks about while her heart, 100 times a minute, gets an electric shock from a pacemaker. Its atomic battery (lower right, in comparison with a cigaret) is powered by a pellet of plutonium. The pacemaker was inserted at London's National Heart Hospital. (See *Atomic Power to Keep Your Heart Beating*, page 104, Sept. PM.)

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Bubble-top VWs

A West German merchant converted two VW buses into traveling stores, with clear plastic domes to let daylight in.



Sand spray clears oil spill

Chemically treated sand, sprayed from nozzles in 60-foot booms, successfully cleared an oil spill in a test by Shell. The oil clung to the sand and sank to the bottom.

A Jeep in 'Wolf's' Clothing

By BILL HARTFORD, Auto Editor



With four-wheel drive and V8 power under the sports-car skin, this beautiful beast of a Jeep could run the roughest stretches of Baja without ever being caught

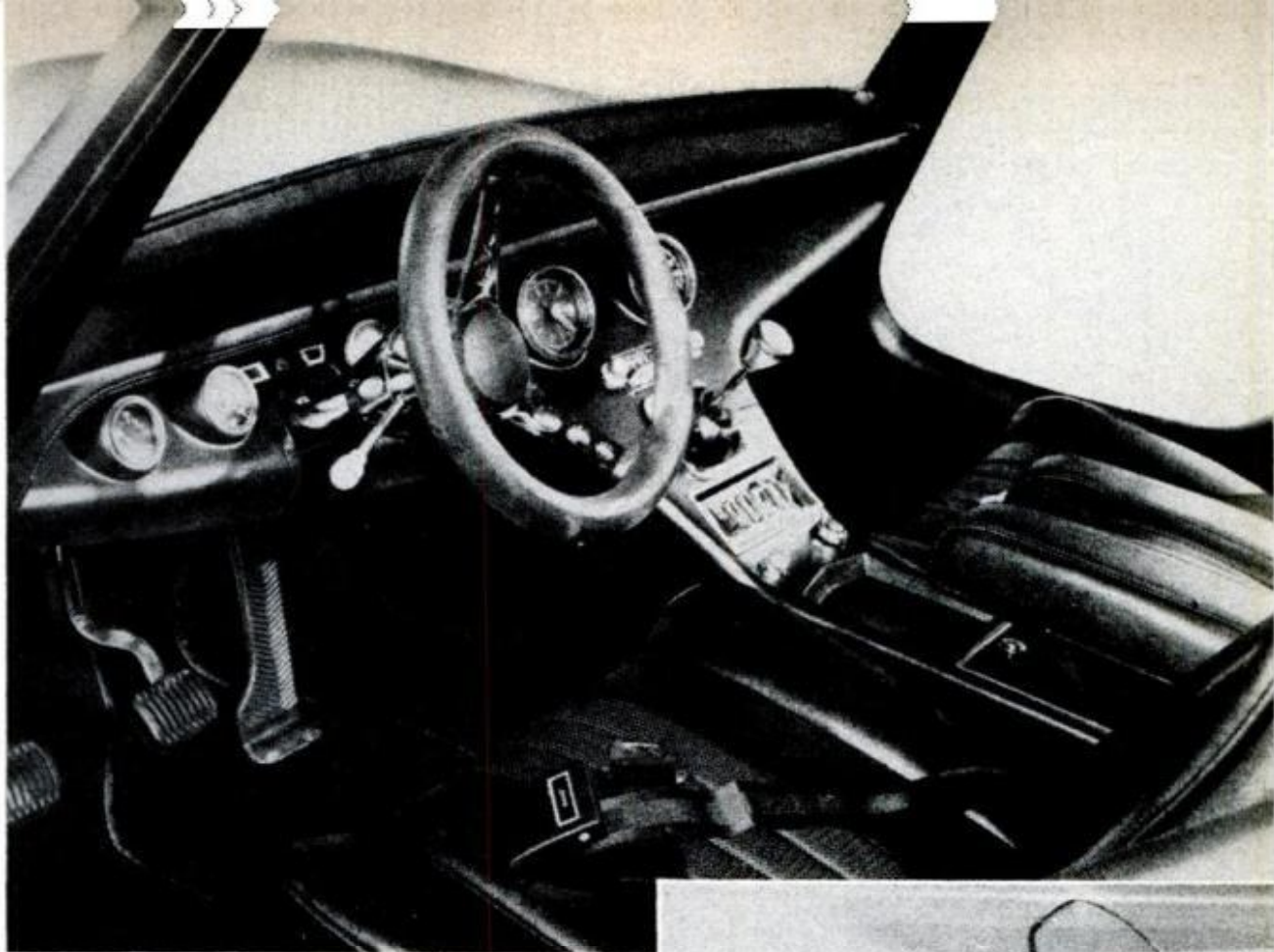
THE KID DOWN THE BLOCK, you know the one . . . all those tools, the magic touch with cars. The one who hammers out his own fenders and hammers down to the corner in 4.3 seconds after adjusting the carbs on his own personally stylized creation. If he took a four-wheel-drive Jeep chassis, dropped on a sports-car body, pinstriped it and called it the XJ001, he'd be a local folk hero, known miles around for his one-of-a-kind car.

When the Jeep Corp. does it—takes its famous CJ-5 chassis, modifies it slightly, puts on a full fiberglass body, lots of racing accessories—it has put a lot of effort into an "idea" car, a show car, a public-reaction barometer, but one that could some day go into production!

Jeep, now part of the American Motors family, gave the XJ001 its premiere at this year's New York International Auto Show. The prototype model, fresh

FRONT BUMPER AND ROCKER PANELS are designed to bolt on, be easily removable or replaceable. The nerf-bar-like rear bumper, angling down under, also functions as a skid in severe uphill-angle situations





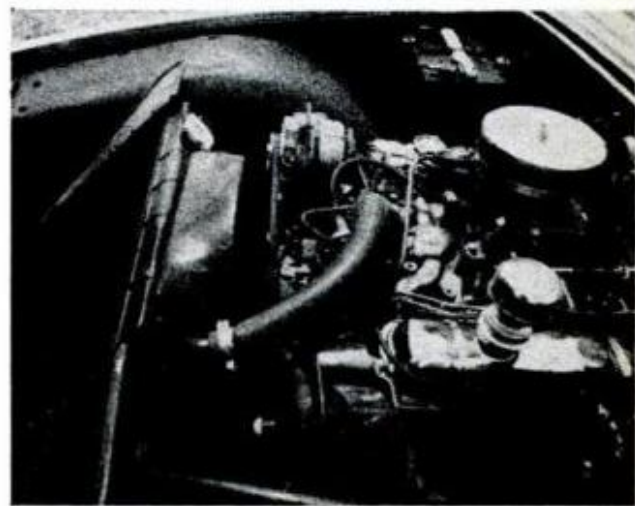
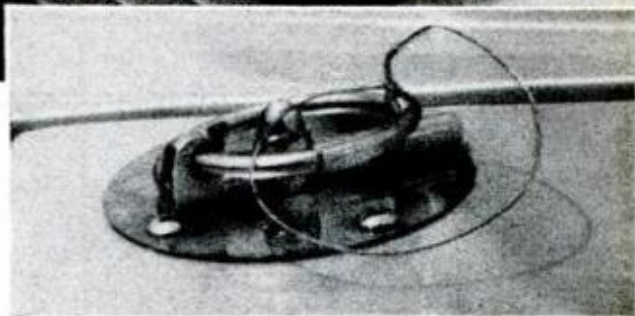
JEEP XJ001 INTERIOR is superbly laid out, has a full Stewart-Warner instrumentation. Small-diameter steering wheel is among race-car hardware. Hood locking pins (right) hold down bonnet on chromed and spotless American Motors 360-cu.-in. V8 engine

from the design studios and Toledo's research and development division, is officially an "experimental test platform for innovations that can be applied in the rapidly expanding off-road recreational vehicle field."

Even with the 4wd chassis, the XJ001 is only 57 inches high at the windshield, the frame of which is a roll bar. With its 81-inch wheelbase, the Double-O-one is brutish, with lines that make it look like it's ready to lunge at the nearest sand dune. The 144-inch-long, 72-inch-wide offroader uses Jeep's new Quadritrac transfer case which directs power to all four wheels. Quadritrac is a center-differentiated, full-time four-wheeler that features chain drive and auxiliary low range for sure moving through the rough stuff. AMC's 360-cu.-in. V8 is used up front, but the engine compartment and drive train will take a variety of powerplants.

The interior of the XJ001 is nothing short of fantastic. Seats are one-piece

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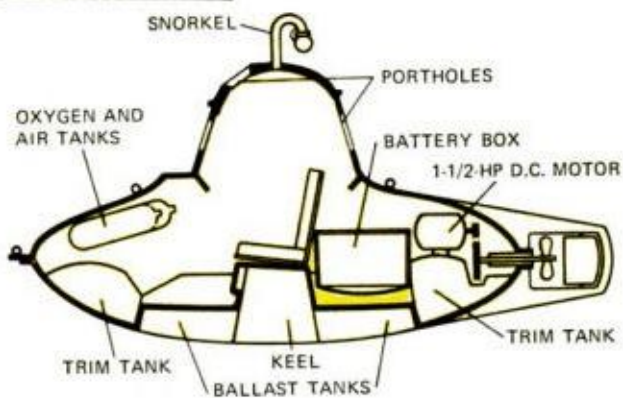


molded foam buckets. The console, with four-speed stick an integral part, sweeps up to join the well-padded instrument panel.

We came close to driving the XJ001 offroad in New York, but knew the cries of "Holy Toledo!" coming out of Central Park would have cut our lark short. ★★★

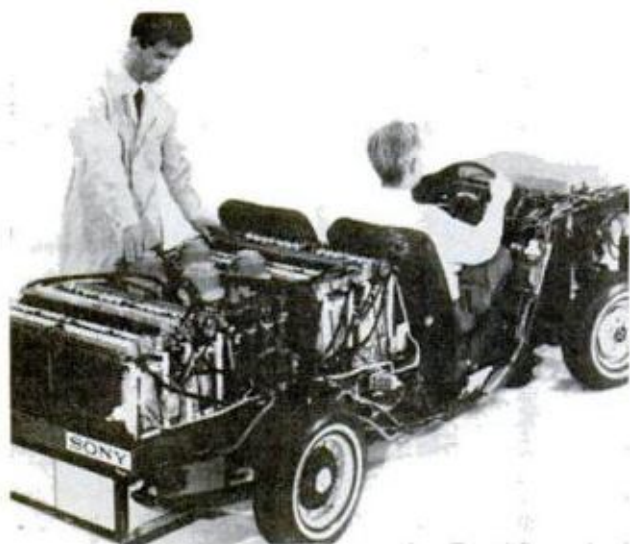
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NEWS BRIEFS



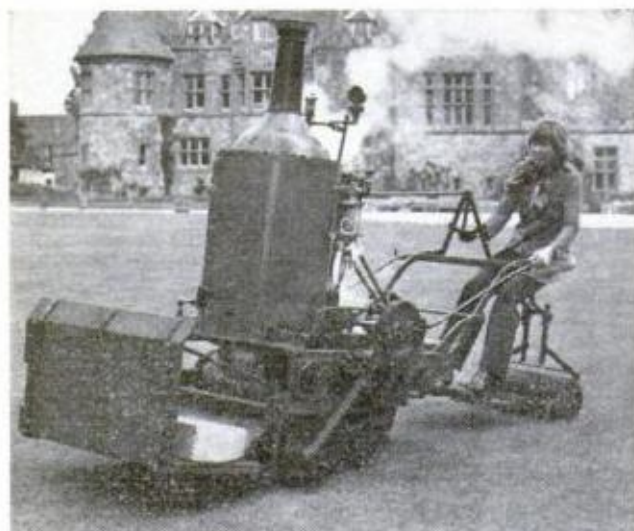
Fiberglass sub is powered by electricity

You can explore underwater at one to five knots for as long as 18 hours in the 11-foot, electrically powered *Sub-Bug*. Automatic water ballast-exhaust bobs the craft to the surface if it descends below 150 feet, and a hatch opens underwater to permit escape in an emergency. The *Sub-Bug* is made of fiberglass over steel ribs by Sea-Line Sports, Brier, Wash.



Sony electric car

Fine, pulverized zinc, fed into a mixing tank, becomes the electrolyte-fuel for the metal fuel batteries that power this experimental Sony electric car. The firm says it operates at half the cost of gasoline.



Seagoing pyramid

One of the strangest water craft to come along is Lex de Groot's "Water Walk," a triangular plastic rig that enables him to move over the surface. Each side measures 15 feet. De Groot, of Amsterdam, Holland, is shown demonstrating the Water Walk.


Highballing on a lawnmower

Clanking across the lawn of an English estate is a steam-powered mower that was designed in 1897. The machine was built in the 1930s by Leyland Motor Co. apprentices, and was put into operation for a recent festival at Beaulieu.

THE TRUTH ABOUT PET FOODS

You can kill your pet with 'kindness'— by feeding him all-meat canned foods that were never intended to be his sole diet

By LEE COE



IT WAS HARD TO BELIEVE the scrawny collie on the veterinarian's examining table was almost a year old. Stunted, with sparse coat, her hip bones protruded and her deformed ribs and leg joints indicated rickets. This was not an isolated case; today in a land of plenty, animal doctors treat many pets in this condition.

"What do you feed her?" asked the veterinarian, having determined a simple stool inspection that internal parasites were not causing the trouble.

The owner named a well-known but inexpensive brand of pet food. "She gets two large cans twice a day and lately we've been giving her one more

at noon. She really gobbles it down."

"She'd have to eat a wheelbarrowful of that stuff to get any nourishment from it," said the doctor bluntly. "Even then she wouldn't get all she needs."

How can this be, when grocery shelves are loaded with pet foods claiming to have all the nutrients necessary for an animal? Ask any licensed veterinarian. He'll tell you that pets with rickets, skin troubles, urinary failures, eye infections, weakness, irritability, poor coat, and a dozen other ailments are frequent patients—all suffering from the same basic cause, an inadequate diet. Almost as common is the pet with ailments caused by obesity



WHICH BRAND: The supermarkets offer bewildering array. Cheaper in the long run: a balanced diet

after being coaxed into gluttony by its owner.

There are two principal reasons for this unintentional cruelty: First, although there are well-balanced, wholesome pet foods on the market, there are others whose nutritional value is deficient. Second, you may not know just what your pet needs for good nutrition and may be misled by folktales or overenthusiastic advertising.

The average pet used to live largely on table scraps and what he could scrounge from the countryside. Today, it must depend entirely on what you give him. In earlier days, even professional kennel owners cooked quantities of corn-meal mush and mixed it with supplements such as meat scraps and fat, milk and cottage cheese. These formulas evolved from much dietary experimentation and each kennel keeper swore by his particular mixture. Only when manufacturers of cereals and other foods found it profitable to use their by-products in pet prepara-

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CATS WILL EAT DOG FOOD, but they won't get proper nourishment from it. Their diet must be richer

tions was a scientific attempt made to establish both the caloric needs of animals and the proper balance of nutrients in a commercial food.

Today, more pet food is sold in America than baby food. At last count some 3000 pet-food manufacturers were selling their products (under 15,000 labels) to be eaten by about 25 million American dogs and 20 million cats. Gross sales recently passed a billion dollars annually, and the total \$2 billion spent on pets in this country, business statisticians point out, exceeds the gross national product of entire nations such as Ghana, with its eight million people. This speaks well for the generosity of Americans, and may also say something about their gullibility.

The major companies in this field range from food giants such as Carnation (Friskies), General Foods (Gaines), Ralston (Purina) and Quaker Oats (Ken-L-Ration) to tobacco firms like Liggett & Myers (Alpo) now seeking to diversify. Such pro-

POPULAR MECHANICS

cessors invest heavily in research and use hundreds of animals to test food combinations.

However, believing that dogs are only dogs, many people think it makes sense to buy the cheapest brand. This is the natural inclination when the label indicates all the nutrients are included, even in the same percentages. The list of ingredients may appear similar, including cereal grains, meat and poultry by-products, bone meal, and so on. When a pet appears to prefer the taste of a cheaper off-brand, it seems to be a convincing reason for using it. Yet, if some brands are fed as an exclusive diet, trouble almost inevitably results.

The reason, according to researchers, is that it is possible to include ordinarily valuable food elements in forms not readily assimilable, if at all, by the pet's digestive system. "Meat by-products," for instance, suggests the trimmings from cuts for human consumption. In some cheap dog foods, however, they can include gristle, hair, lung tissue, pig's feet, hooves, tails, and the like, most of which cannot be transformed into nourishment by the pet, although all are proteins. Likewise, carbohydrates may be indigestible cellulose and the fat a worthless mineral compound. One exasperated vet, to demonstrate by obvious exaggeration how labels may mislead, devised a diet for dogs that seemed to contain all the necessary elements. But the fat in his formula was crankcase oil, the animal protein was old leather boots, the carbohydrate was wood shavings.

The various food elements needed by pets must be present not only in usable form but also in the *proper proportions* to be of any value. Dogs can benefit from a food containing up to 60 percent starch, but only if the other necessary nutrients such as amino acids, fats and vitamins, are present in adequate amounts. The same is true of minerals. If calcium and phosphorus, for example, are not present approximately in the proper 1.2 to 1 ratio, most of the calcium is not utilized.

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POOR DIET in puppyhood caused loss of stiffness in this German shepherd's ear. Many abnormalities and fatal illnesses result from improper feeding

Improper feeding is often the result of a common belief that carnivorous animals need nothing but meat. After all, this argument runs, the animal in the wild would eat flesh and nothing else. But the fact is that such animals devour *all* of their kill—innards, bones, marrow, and blood—while butchers' meat consists mainly of drained muscle flesh and fat. And wild carnivores frequently supplement their diets with everything from berries to mud and edible grasses. A small dog would actually have to eat several times his own weight in lean hamburger daily to obtain the necessary amount of calcium. Some nutrients would be unobtainable from such a diet.

A cat brought to an animal hospital recently had bones as flexible as rubber. The owner had been feeding it nothing but meat (ironically, on the advice of another veterinarian when the cat showed an allergy to fish). Unable to stand or control its feeble movements, it was restored to something near normal health after lengthy treatment and a switch to a well-balanced commercial cat food that did not rely on fish as its principal source of protein.

While a pet food must appeal to the animal for him to eat it, an obvious liking for a particular food need not reflect its nutritional value and may, in

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AUTHOR AND WIFE PUT NEARLY 1000 KILOMETERS on Datsun 1200, shown on bridge over Ago Bay. Barely visible below railing at left is one of many rafts from which pearl oysters are grown in suspended cages

They Said I Was Crazy To Drive in Japan

But it was fun and easier than we had expected in Datsun's snazzy little 1200

By **ROBERT P. CROSSLEY**
Editor

MY FRIEND MARTIN LITTON invited me to run the Grand Canyon rapids again last summer. I told him I'd rather do something more exciting. So I went motoring in Japan.

Another friend suggested taking our wives to Expo '70. We got the reservations, but his wife backed out. She said she was afraid to fly. But she didn't say it until I told her we were borrowing a car from Nissan Motor Corp., Ltd.

The Japanese I talked to here didn't exactly encourage me.

"What's the matter?" asked one. "You crazy?"

"Why don't you ride our nice trains like everyone else?" suggested another.

I called Hertz.

"Oh, yes, we rent cars in Japan. But you have to go to our international office to make the arrangements."

The international department, a striking blonde with a Teutonic accent, looked startled. "You mean someone sent you up here to rent a car in Japan? We don't even have a map of Japan."

Nissan Motors, U.S.A., said they would be happy to lend me a car in Japan, even though no American journalist had ever asked for one before. They wished me well, but they thought I was nuts.

I explained that I had driven a VW through Austria, a Volvo across Sweden, a Mercedes the length of Germany and a Renault all over France—and



FAST LINES OF 1200 show in this view at portal of one of expressway's 20 tunnels, some over a mile long



CLEAN AND EFFICIENT, service stations pose no problem. Friendliness overcomes language barrier

motoring was the only way to really see a country.

I had been in Japan before, but as a guest of JETRO, the Japanese External Trade Organization. I had a full-time guide, and we did most of our traveling on Japan's 128-mph New Tokaido Line. (See *The Train That Gives the Jets the Jitters*, page 94, April '68 PM.) On our few excursions by car we had a chauffeur with white gloves.

Nissan suggested I drive their new Sunny 1200, which was just making its American debut as the Datsun 1200. Smaller than Datsun's popular 510 series, the 1200 is direct competition for [Toyota's Corolla](#) (See [Classy Little Corolla](#), page 22, June '68 PM) which has gone over big since it came to this country two years ago. The 1200 is going to be competition for a lot of other cars, too, imports and American.

We didn't want a car in Tokyo so we arranged to get the 1200 the day we

left for Osaka. Mr. Mitsutada Mano, a USC alumnus in Nissan's export division, picked us up at our hotel, the New Otani, and drove us to Nissan's new glass-and-steel office tower for the traditional *oshibori*, or hot washcloth (Japan's greatest custom), and a cup of tea with one of his bosses.

Our 1200, a sporty fastback to be sold here as the 1200 Coupe, was waiting at an outlying lot. Mr. Mano volunteered to pilot us in his car to the beginning of the Kobe-Tokyo Expressway, opened earlier this year. "Drafting" him through the outskirts of the world's largest city, without letting too many cars get between us, called for aggressive driving. We knew we'd be dead if we ever lost him. We had talked big about driving in Japan, but in truth we did have some apprehensions.

The drivers. Were they really "kamikazes"?

The car. Could we manage a right-





ROOMY TRUNK ACTUALLY HOLDS TWO SUITCASES. Datsun gets 69 hp out of high-revving, short-stroke OHC 4. Front bucket seats adjust to a reclining position; rear seats fold down for extra luggage space

hand drive and a left-hand stick shift?

The rules. How would we make out keeping to the left? (The Swedes gave up and shifted to driving on the right after we drove across *their* country.)

The roads. The Japanese we knew in New York said they were terrible, then admitted they didn't drive.

Service stations. Would they be there when we needed them? What would they be like?

Road signs. This worried us most. In Europe, you figure that Wien is Vienna and Koln, Cologne. And a kilometer is a kilometer in any language. But what about a country where you can't read the alphabet, let alone the language?

Like so many things one worries about, not one of these apprehensions caused us trouble.

Japanese drivers were skillful, law-abiding and courteous, even the cab drivers. Within 10 minutes I was shifting left-handed with aplomb and remembering to swing wide across oncoming traffic when making a right turn onto a two-way street.

The roads were good. The Expressway, a costly engineering triumph (\$2.78 million per kilometer) with a succession of tunnels and curving viaducts through the coastal mountains at the base of Mount Fuji, is equal to our best toll roads. But, like turnpikes everywhere, it bypasses everything of interest. You go like hell, but you don't see much. Lesser national highways, mostly two-lane, are what we had before the Interstate explosion. There are a lot of trucks and buses, but once you get in the real countryside they thin out fast.

Rest stops on the Expressway are fancier than on most U. S. pikes, with passable restaurants, clean restrooms,

gas stations, and a mechanic on duty. Service stations off the Expressway cover as wide a range as they do in America. The good ones, bearing familiar signs like Esso and Caltex or Japanese names like Mitsubishi, are deluxe, with pull-down gas hoses, spotless restrooms, and a whole corps of sharply uniformed attendants to wipe your car and wave you on your way.

Japan has 16 million cars in an area smaller than California, which has only 11 million. With that many motorists, there had to be road signs. But with relatively few foreign drivers, we expected the signs to all be in Japanese—the way we thoughtful Americans post everything in English. We were wrong. Every exit on the Expressway was clearly marked in English directly under the big Japanese characters. We had no trouble knowing when to turn off for Nagoya at Exit 21. Even the route leading to downtown Nagoya—a city of two million—was marked in English. I impressed my wife by driving straight to the Miyako Hotel, where I had been but once before, without so much as an extra spin around the block. Even on the lesser highways we traveled later, at every important junction there were signs in English. This could be as much for the Japanese as for visitors. The Japanese have a predilection for mixing Japanese and English.

Controls on television sets built for the Japanese market are labeled "contrast," "volume" and "brightness." And the cars you see everywhere have model names like Bluebird, Prince and Crown. I guess that's no worse than Detroit's weakness for affectations like Gran Turismo and Le Sabre.

I had promised my wife a ride on the

Hikari, or bullet train, so we left the 1200 in Nagoya and grabbed the super express for Kyoto. The 92½ miles took 48 minutes, and you can't drive *that* fast on any Expressway. That may explain why the Expressway hasn't taken many passengers from the railroad. There are still two trains in each direction every half hour. They're still clean and smooth-riding. And each has 16 cars instead of the 12 we wrote about in '68.

Japanese railroad stations resemble airport terminals in the United States, and the NTL's reservation system is as sophisticated as those airlines use here. The agent punched a computer to see if seats were available on the next train. The answer being affirmative, he punched it again, and out came fully printed tickets with seat numbers and price. I gave him a 1000-yen bill. He pulled out an abacus to figure my change. That's Japan.

Kyoto, of course, is Japan's premier sightseeing town, set beautifully between two rows of mountains and running over with shrines, temples and gardens of incredible loveliness. This summer it was also running over with tourists—lots of middle-aged Americans on buses, but also lots of Japanese, including thousands of school kids.

From Kyoto we took a tour bus to Nara, and by reading the fine print discovered that we could switch buses there and proceed to Osaka without going back to Kyoto. Nara is chiefly famous for the Daibutsu, or giant Buddha, a bronze statue 53 feet high sitting cross-legged in the world's largest

wooden building. Again thousands of tourists in long rows of buses, each group led by a guide waving a little flag. On our earlier trip we thought the flags were a quaint Japanese custom. But we weren't in a group that time. Nor did we laugh at the whistle-blowing young hostesses who signaled the driver how far to back his bus at each parking lot. There must have been a hundred buses in the dusty lot at Todaiji Temple, home of the giant Buddha. One driver was *washing* his bus while he waited. That's Japan too.

We thought we'd seen crowds, but the next day we went to Expo. Getting there was easy on Osaka's clean, modern subway. The day was Sunday. The weather was sunny, but not really hot, and more people showed up than had ever attended a World's Fair on one day—anywhere; 621,000 of them—good-natured, curious, friendly, but still 621,000. Expo was several cuts above the New York Fair of 1964-1965 except that it lacked the imaginative genius of Walt Disney's cavemen and Abe Lincoln. To their credit, the big industrial pavilions like Mitsubishi, Hitachi and Matsushita avoided all huckstering of their own products.

The three top attractions were the Japanese Pavilion and those of the Soviet Union and the United States. The Russians' steeplelike tower, topped by the hammer and sickle, dominated Expo's skyline. A huge statue of Lenin greeted you in the foyer. The exhibits portrayed Soviet life in detail, but beat

(Please turn to page 222)

HOW THE DATSUN 1200 COMPARES WITH TOYOTA COROLLA SPRINTER AND VW BEETLE

	Datsun 1200	Corolla Sprinter	Volkswagen Beetle
Displacement	1171 cc	1200 cc	1584 cc
Engine	Front	Front	Rear
Cooling	Water	Water	Air
Main bearings	5	5	3
Compression ratio	9:1	9:1	7.5:1
Horsepower	69 @ 6000 rpm	73 @ 6000 rpm	57 @ 4400 rpm
Top speed	Over 90 mph	94 mph	81 mph
Miles per gallon	30	28	26
Wheelbase	90.5 in.	90 in.	94.49 in.
Length	152 in.	152.8 in.	158.7 in.
Width	59.6 in.	58.5 in.	61 in.
Height	53.1 in.	54.3 in.	59.05 in.
Weight	1609 lbs.	1566 lbs.	1808 lbs.
Turning circle	27 ft.	30 ft.	36.1 ft.
Power/weight ratio	23.6 lbs. per hp	21.14 lbs. per hp	31.7 lbs. per hp
U.S. price (P.O.E.)	\$1866	\$1856	\$1839

Snowmobiles In '71

Better machines and some new designs will headline the coming season

By **GEORGE REIGER**
Outdoors Editor

DESPITE recessions, receiverships and companies just plain going out of business, the snowmobile industry is as rambunctious as ever! While Wheel Horse, Fox Corp., Silverline and Homelite are bowing out of snowmobiles, Suzuki has entered the field with a 360-cc-engine model called the Nomad, selling for \$895, and Harley-Davidson is rumored to be on the verge of coming in. And when I talked with the head of Kawasaki Motors in Minneapolis recently, he indicated his firm might be about to market something to go under and around the snowmobile engines it already produces. Even John Deere and International Harvester are said to be out looking for companies to buy—or they might even engineer their own!

But in the world of present produc-

tion, Bombardier is still the leader. This year there are three additions to a genuinely varied line of machines: the Valmont, a twin-track with single-track mobility; the wide-tracking, yet lightweight (335 pounds) Skandic; and the Elan, a compact-sized, full-performance machine weighing only 246 pounds and with the lowest Ski-Doo price ever: \$595.

Another Canadian-based complex rapidly moving up the competitive ladder is Giffen Industries, maker of Boa-Ski, Moto-Ski and Sno-Prince. With an estimated production of more than 95,000 units this fall, Giffen will be second only to Bombardier's projected figure of 250,000.

Boa-Ski features a super 634-cc, 36-hp Cobra model; Moto-Ski, a Mini-Sno economy model with a 223-cc JL0 engine and costing as little as \$595; and Sno-Prince features a 386-cc Lloyd en-



gine rated at 22 hp in one of its Cyclones.

Chief American competition for the Canadians is headquartered in Minnesota where Arctic Enterprises expects to produce 80,000 machines this fall. In addition to traditional Panther models,

Arctic is introducing a lightweight Lynx with a suggested retail price of \$795; the Puma, a production version of last year's racing model; and the EXT, a new racing design with a wedge-shaped hood. Prices on the Puma and EXT range from \$995 to \$1495.

Other major Minnesota firms are: Fuqua Industries with Scorpion's Mark III 40-cc, 35-hp Stinger at the top of the line; Textron's Polaris with a new compact Playmate powered by 175-cc and for sale at \$595; Gravely's Sports Power Inc. with four redesigned Sno-Ponies featuring light weight and "fail safe" steering linkage; and Tele-check International with Boatel's luxurious Grand Prix for \$1795.

A new Minnesota manufacturer very much on the make is Sportcraft Industries (Swinger) with an idea catering to the simple proposition that fun and safety of snowmobiling is in the driving, not in the riding—and in family outings, not solitary excursions. The firm markets a mini-snowmobile with

HYBRID SNOWMOBILES: Ridge Runner (1) uses two 15-in. tracks for good stability, flotation and hill climbing traction. Options include a 54-in. snowplow for winter work, and a stereo tape deck, bucket seats and hardtop canopy for play. Basic price: \$1995. Write 1625 Washington St. N.E., Minneapolis, Minn. 55413. Alsport's Tracker (2) features independently braked twin-drive tracks and quick conversion from skis to wheels. Starts at \$1795. Write 84 Whittlessey, Norwalk, Ohio 44857. Canada's Passepartout (3) calls itself an ASATV (all-season all-terrain vehicle—good grief!) with a 336-cc Sachs engine generating 22½ hp; it seats four. Write Valcartier Industries, Box 790, Courcellette Co., Portneuf, Que. Evinrude Motors (Milwaukee, Wis. 53216) recognizes hazards of hill-climbing with two front skis and wide tracks in its SSS (4) by using only one steerable front ski. With sports-car-type options side-by-side seating coupe may herald a new type of luxury snowmobile. Similar snowdozers and coupes (not shown) are made by Innovar Inc., Box 874, Dunnell, Minn. 56127 and Playcat International, Box 39, Drummondville, Que.



Snowmobiles In '71

**ARIENS'S
ARROW 350S**

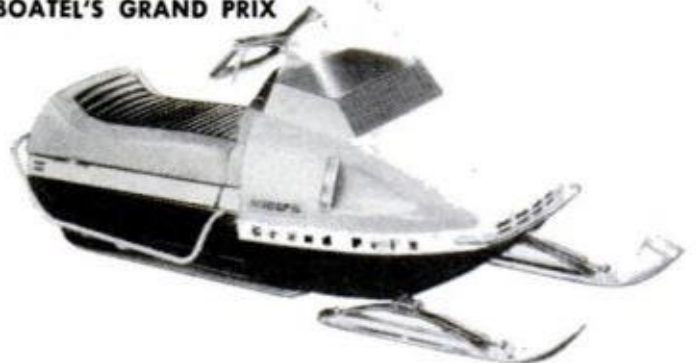


YAMAHA'S SL 3388

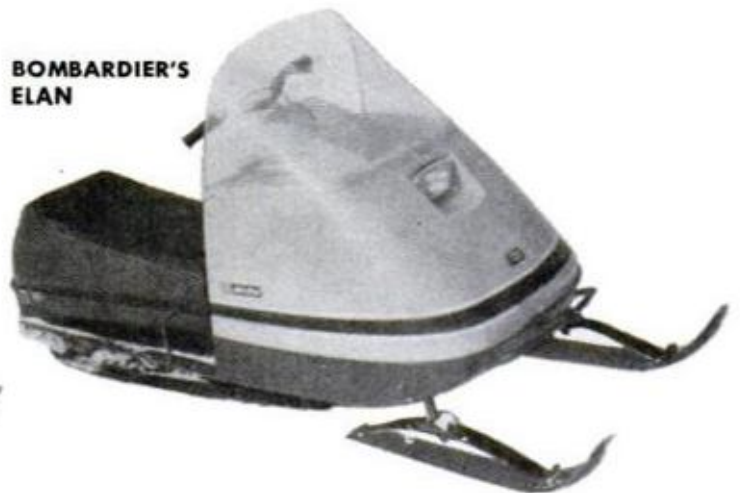
**ARCTIC CAT'S
PUMA 440**



BOATEL'S GRAND PRIX



**BOMBARDIER'S
ELAN**



JOHNSON'S LIGHT-TRAC SKEE-HORSE

a little 10-hp Chrysler engine retailing for \$499.90. The machines are marketed two at a time—a kind of His and Hers purchase, or you can buy a kit for \$379 and build one yourself!

Elsewhere the big news is Coleman's purchase of Skiroule with an anticipated production of 35,000 units this season. Coleman's emphasis will be on family snowmobiling, and its power line runs only from a 250-cc engine to a 440-cc model—dropping last year's 793-cc powerplant.

Rupp Industries plans to produce

30,000 snow machines this year with a 440-cc WT model at the top of its power line.

Conroy's Sno-Jet will make 36,000 units and feature four new models with 12 power choices from 15 to 40 hp.

Bangor Punta anticipates production of 25,000 machines divided between two subsidiaries: Alouette and Starcraft. Both companies will feature a family and fun line—Alouette's XLs and Starcraft's Escorts—and a sporty performance series—Alouette's GTs

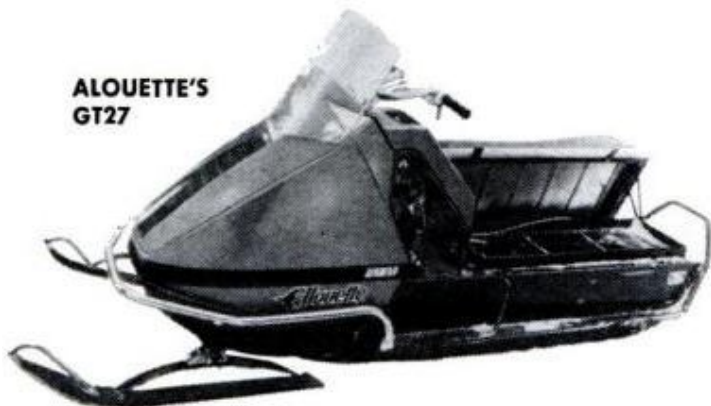
STARCRAFT'S
ESCORT 290



POLARIS'S
VOYAGER 488



ALOUETTE'S
GT27



ESKIMO'S
NR 167/70



MOTO-SKI'S
ZEPHYR 399

SNO-PONY'S
180



and Starcraft's Eliminators. Engine options for both brands range in power from 15 to 60 hp.

Of the two big outboard competitors, Outboard Marine Corp. will probably produce more machines (approximately 25,000 units), but Mercury wins laurels for having done its homework and come up with such attractive features as hinged cowls with durable latches for easy access to the engine, a "spoiler" windshield that deflects the flow of cold air over the head of a kneeling driver, and a steel-ca-

bled-reinforced track for improved climbing capabilities.

The top of OMC Evinrude's standard line of Skeeters and Bobcats is the E2015 with a 30-hp engine over a 20½-in. track, selling for \$1495. Johnson's Skee-Horse series will include five models topped by the 32-hp, 437-cc Rampage. And Mercury's all-new models for '71 are the 398-cc Lightning (lead photo) and the 339-cc Rocket.

Ariens has redesigned its Arrow line for the coming year and features

(Please turn to page 226)



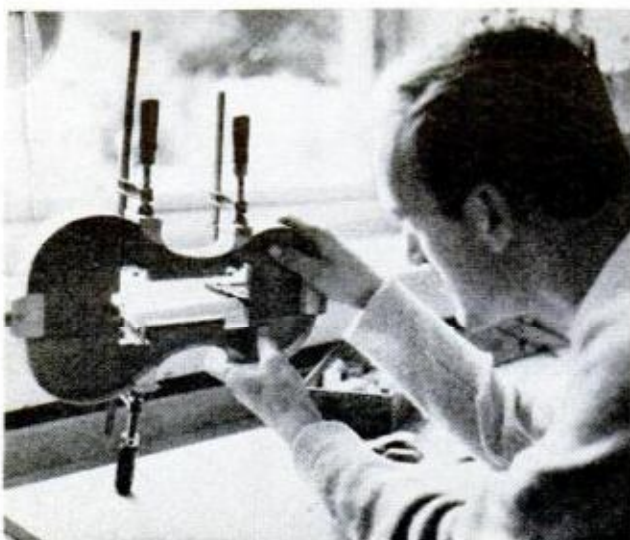
90's the limit

Because the accident rate is high for newly licensed drivers, the French limit them to 90 kilometers per hour (about 56 mph) for a year. A "90" on the car lets everyone—especially police—know of the limit.



Germany's Matador

Two 30-mm anti-aircraft cannon and a radar dome are unusual features of Germany's Matador tank. The radar-controlled guns are designed to be used against low-flying airplanes—those that are too low to be stopped by anti-aircraft rockets.



Violinmaker's school

In Mittenwald, Germany, violinmaking is a town tradition that dates back to about 1742 when, according to municipal records, Matthias Klotz was recognized as a "world-famous master violinmaker." Now the Matthias Klotz School continues to teach the arts of playing and making violins. (Ability to play is considered essential to the making of them.) The wood comes from 250-year-old spruce trees growing above 3000 feet in the Bavarian mountains. It must dry out for 15 years, and when the instruments are made, they're hung in the sun to dry (photo above) before they're lacquered or painted. The photos at left show students at work.



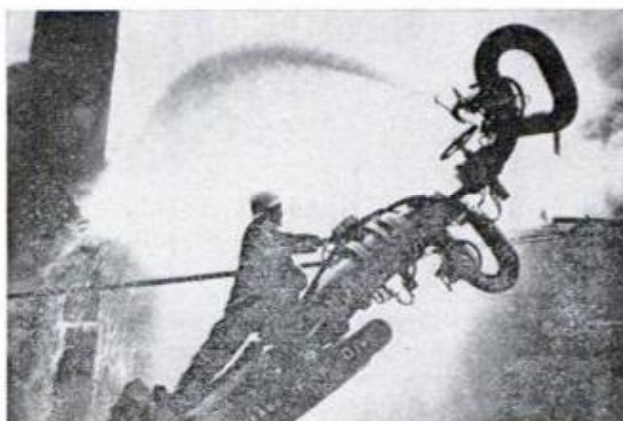
Sea-bottom observatory

Standing on the sea floor off the coast of Japan is a cylindrical observation tower which visitors can reach by monorail and then descend to view ocean life 32 feet below the surface. Twenty-five heavy plate-glass windows give a view of the surroundings, lighted at night by floodlights. The tower, located at Shirahama, was built by Hitachi Zosen.

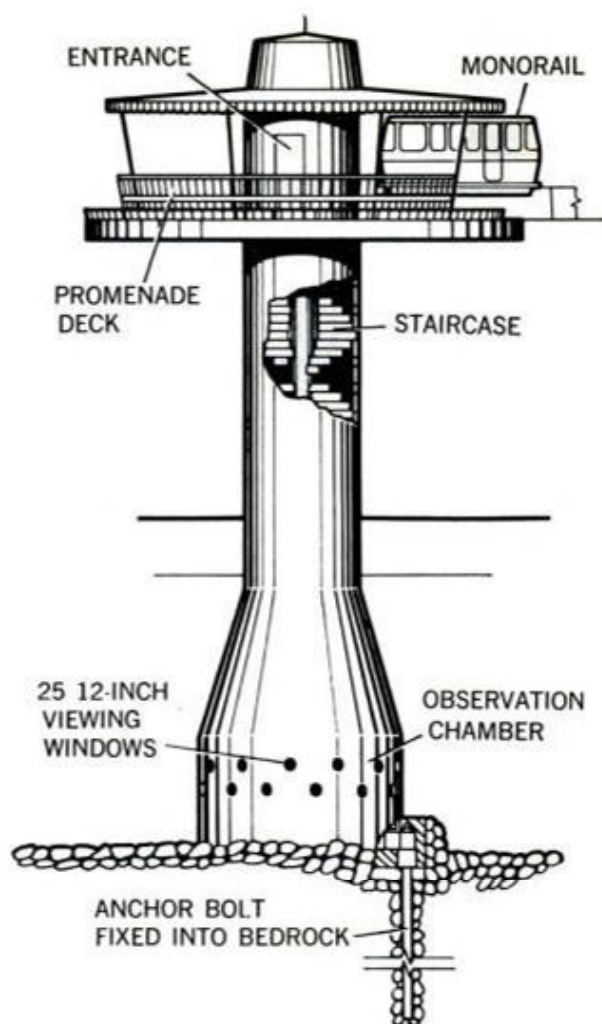


Measured squeeze

By sliding a plastic insert forward and watching a scale marked on the tube, the user of this device can dispense measured amounts of liquid, cream, syrup or gel. It's called the E.Z.M.T. Plastic Tube Insert.



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Wheels for Buzzi

After being struck by a car on the streets of Zurich, Buzzi, a three-year-old dog, was unable to walk. A veterinarian outfitted the invalid with a platform on wheels, so now Buzzi is able to move about and is described as "perfectly happy" with the arrangement.

Big John

The Chicago Fire Dept.'s new water cannon, dubbed Big John, can be hooked up to as many as 21 pumpers and can shoot a stream of water almost three blocks. The high-pressure water gun is shown being used for the first time on an industrial fire.

135



1. BAILING OUT of a disabled fighter plane would be safer with the system shown at left. As the pilot ejects, the cockpit canopy automatically swings up and detaches, forming a shield in front of the seat. The object is to protect the pilot from dangerous air blasts at supersonic speeds and also to prevent accidental jamming of the canopy—a serious hazard to safe ejection. The canopy locks into pivoted arms on the seat during ejection, then is blown free just before the pilot's parachute opens

4 CANOPY SEPARATES FROM SEAT AS SPEED DECREASES SO CHUTE CAN OPEN

EXPLOSIVE CHARGES IN ARMS BLAST TELESCOPING SECTIONS APART

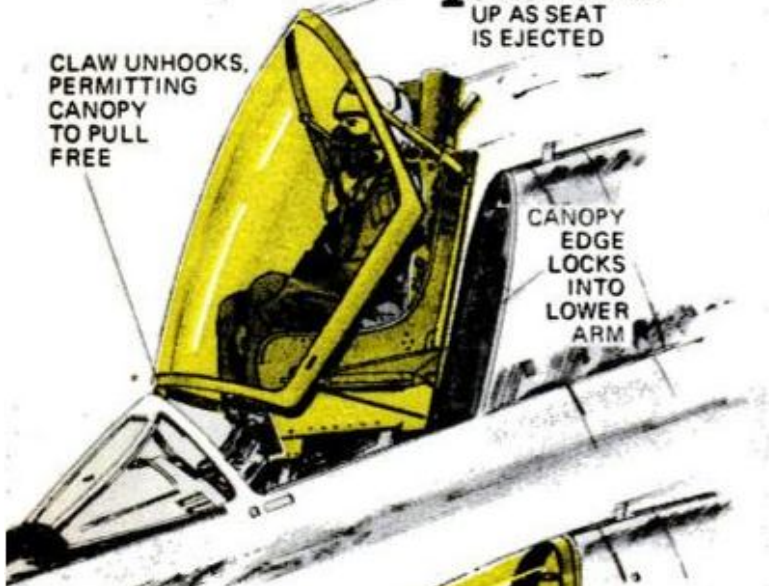


3 SEAT AND CANOPY BLAST FREE OF PLANE

2 CANOPY SWINGS UP AS SEAT IS EJECTED

CLAW UNHOOKS, PERMITTING CANOPY TO PULL FREE

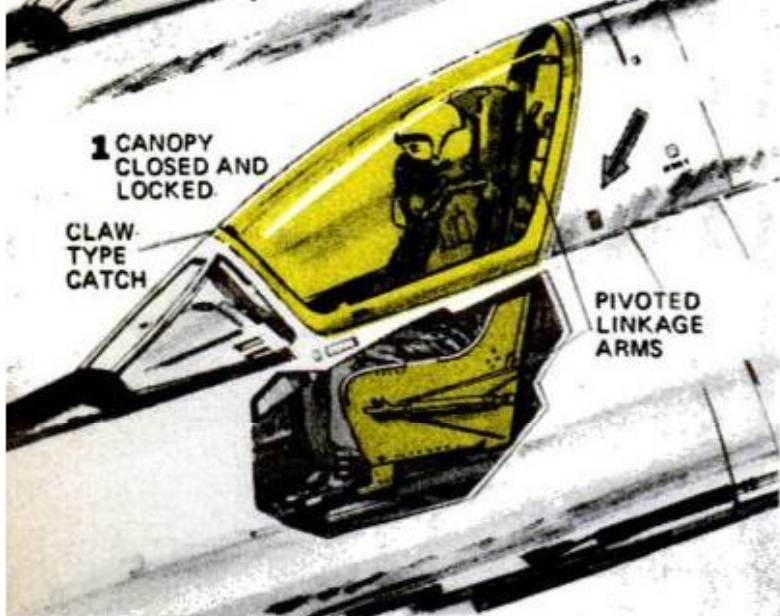
CANOPY EDGE LOCKS INTO LOWER ARM



1 CANOPY CLOSED AND LOCKED

CLAW-TYPE CATCH

PIVOTED LINKAGE ARMS



2. POP-UP FURNITURE comes flattened like a pancake, then expands to shape when a cover is removed, exposing it to air. Made of cellular plastic foam, it's collapsed in a vacuum before shipping and sealed in an airtight wrapper. Unlike inflatable furniture that must be blown up, it absorbs air by itself and can't be punctured after once expanding



3. BURGLAR-PROOF DOOR can't be forced open by the old trick of slipping a thin tool or card between the door edge and frame to slide back the latch bolt. A projecting lip on the striker plate shields the bolt and blocks any tool inserted from the outside. The slight gap between the door and the frame created by the lip is covered by molding, putting an additional obstacle in a burglar's way

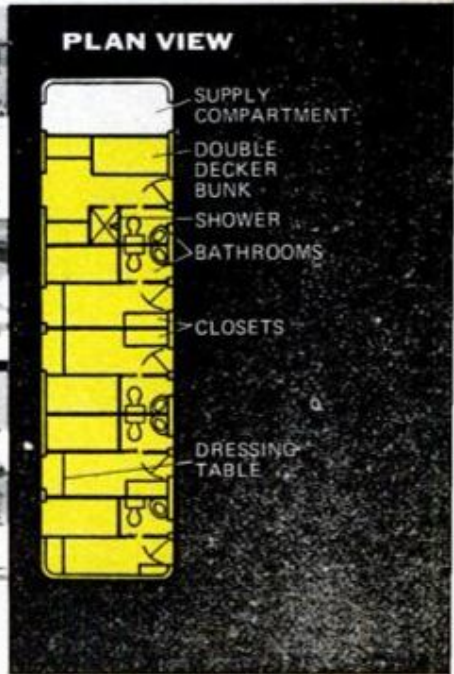
Just patented

PM'S PICK OF THE NEW INVENTIONS

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



4. SELF-VENTING UMBRELLA can't turn inside out in a high wind like ordinary ones frequently do. Slots around the top let inside air pressure escape without bending back the stays. The vents are covered by semicircular flaps that prevent rain from getting in while letting air out. They work like the control slots on a parachute, helping to keep the umbrella upright and make it easier to hold onto even in strong gusts



5. MOTEL-ON-WHEELS is designed to provide temporary lodging for tourists visiting fairs, special sports events, seasonal resort areas and other occasionally used facilities. A giant tractor-trailer, fitted with five living compartments, travels

from one location to another, saving the cost of permanent motel accommodations. At each site, the trailer is unhitched, freeing the tractor to bring in additional units or to haul conventional cargo trailers while the mobile motel is parked for use

Inventors of the items shown on these pages are as follows: 1. Manfred Feld, Herbert Lieser, Hans Lincks and Helmut Stockert, Munich, Germany (No. 3,446,463); 2. James E. Rappoport, Atelier International, 139 E. 57th St., New York, N. Y.; 3. Charles E. Palmer, 10 Elizabeth St. S.,

Port Credit, Ontario, Canada; 4. John David Farley, New York, N. Y. (No. 3,456,661); 5. Leo M. Shea, 20602 Lancaster Ave., Harper Woods, Mich. (No. 3,484,131). The International Inventors Assn., Inc. is located at 680 Fifth Ave., New York, N. Y. 10019.

SADDLE UP FOR DIRT!

The dirt-bike boom has bred all-new machines designed just for running in the rough and boosted the number of outback trails and competition courses coast to coast

By DOUG RICHMOND

OFF-THE-ROAD RIDING was, until recently, done on ordinary street machines to which the manufacturer had grafted a set of high-clearance exhaust pipes and installed a set of waffle-tread, knobby tires. A massive skid plate protected the engine which was too low to begin with.

Behold! A whole flock of heavy, awkward cycles that handled a bit worse than log trucks and peddled under the "street scrambler" label. But this machinery couldn't hold a throttle to the few, authentic rough-ground trials and motocross machines that began to trickle in from Europe: Ground clearance was anywhere from 8 inches to a whopping 12. Front wheels were often 21 inches. Engines were almost invariably two-stroke singles with wide power bands and four-speed gearboxes. Frame geometry and suspensions were designed for the job to be done. They weighed 100 to 200 pounds less than the street and scrambling hybrids. And they went like lightning across ground so rough as to make walking difficult and through mud and sand and water two feet deep.

From their influence came improvement across the board in off-road machinery. Interest in off-road competition has soared. Whether they're used for



competition or fun, popular off-road motorcycles available today often take their names from the type of competition for which they were designed.

Enduro. Currently the most popular type of competition in the United States is the enduro, a motorcycling counterpart of the European rally for automobiles. The score is figured on a time-and-distance basis. It is usually quite a trick to get over the course at all, let alone maintain the correct pace. The course is usually plotted through remote back country with creeks, bogs, hills, down timber, standing timber, rocks and other impediments to prevent the rider from keeping the correct speed, usually around 24 mph.

The motorcycles must be all-around machines with good handling and suspension, a fair turn of speed to enable full advantage to be taken of the "easy" stretches, and a great deal of lugging power to pull a rider through the spots where the going verges on the impossible. Did-not-finish rates of more than 50 percent are quite usual. The emphasis is on riding skill with speed distinctly secondary. One enduro event, the Cowbell in Northern California, regu-

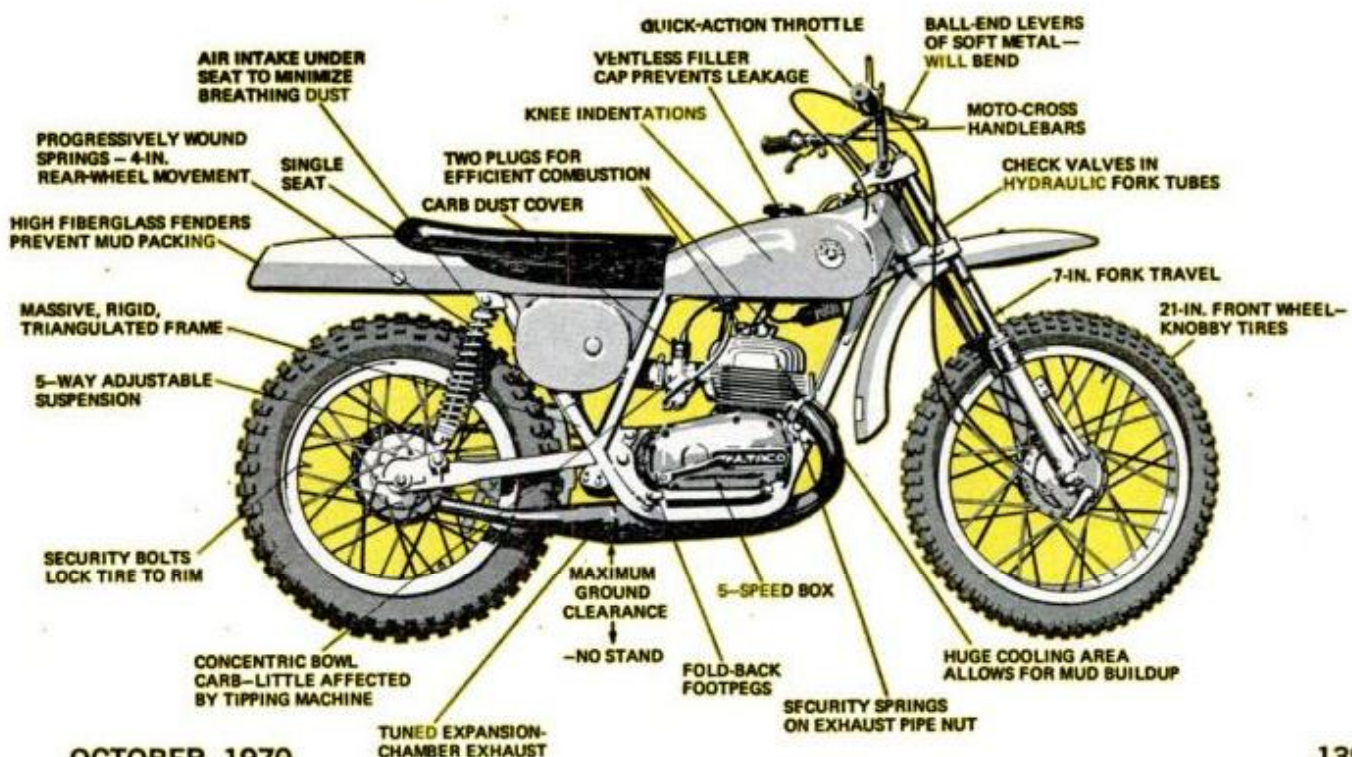
larly attracts well over a thousand entrants, from 16 to well over 60 years of age.

Trials. A form of competition in which speed plays no part at all is the English trials. Competitors attempt to ride through well-nigh impassable "observed sections" without touching the ground, falling off or stopping the engine. Cycles used for this are designed to be easy to balance: An experienced trials rider can stop anywhere, consider the situation a bit, and ride on, all without touching a foot to ground! Engines are adjusted to pull strongly and evenly throughout the range from almost-stopped to their rated power. Often they have extra weight added to their flywheels and always have oodles of torque for lofting the front wheel over obstacles by engine power alone. Such bikes, frequently ridden at very low speed, are called "plonkers."

Although trials bikes are quite specialized the more recent versions tend to have one or two "fast" gears intended for traveling between the observed sections which may be some distance apart.

Motocross. The third popular form

DIRT MOTORCYCLES—special-purpose right from the ground up—look very different from street machines





MOTOCROSS RIDERS get knee-deep in the Big Muddy



ENDURO OBSTACLES give the advantage to the light-weight machines. In competition bikes get airborne!



of rough-ground competition is a fairly recent import from Europe but it's growing like Iowa corn! Called motocross, it is at the opposite end of the competition spectrum from trials and is a racing event *pur sang*. The name obtains from the fact that it's usually run in three contests, called "motos" or "legs," with leaders in each event being awarded points according to

their finishing position. Overall winners are chosen by toting up the points at the end of the day—the guy with the most wins. Except for scoring a "scrambles" is much like a motocross.

Motocross bikes are extremely fast. They're lightweight, have quick throttle response and get gobs of power from their high-compression engines with tuned, ear-splitting exhausts.

These are the three types of competition from which the machines get their names. Originally, the so-called "trial" bikes were small-displacement off-the-road machines, usually around 100 cc. But the term and the machinery have been enlarged to the point where a trail bike is usually an enduro-type cycle without regard to engine displacement: My 250-cc Bultaco Matador is as much a trail bike as my 11-year-old son's 125-cc Lobito. And nobody raises an eyebrow when the 441-cc BSA Victor is called a "trail bike," for that's what it's often used for.

Trail bikes aren't as fast as street machines. No use having 120-mph capability in a woods bike. The Baja 1000, the annual race the full length of Baja California, with over 200 miles of pavement and 650 miles of dirt, averages around 40 mph, for example.

Trail bikes have other differences,

too. Most of them are two-cycles, with huge cooling fins to do their job, even when covered with mud. They've got lots of ground clearance, and as much as 7 inches of fork travel. The rear of the tank and the front of the seat will probably be quite narrow to facilitate stand-up riding—the technique used by most good off-pavement riders when the going is really tricky. Electrics are rather primitive with the lights omitted entirely or quickly detachable. Lights are usually direct-driven from the generator with no battery. Ignition is usually “energy transfer,” basically like a magneto except that the parts are not all in one housing. Full electronic ignition with no contact points is becoming more popular.

Frame geometry varies between street and dirt bikes. As a rule of thumb the off-pavement machine will have more fork, or rake angle. Trail—the self-steering or caster action of the steering geometry—is also generally greater. Trail is the distance that the footprint of the front tire “trails” behind the point at which a center line through the steering head hits the ground. It must be emphasized that there is no exact formula for a good-handling trail bike. There may be great and obvious differences in the frame dimensions between two equally well-thought-out, competitive machines. Furthermore, frame geometry and handling characteristics are not locked-in on most trail bike designs. By changing the position of the fork clamps, fork springs and weight of dampening oil in the forks—all easily made changes—it is possible to effect radical changes in handling characteristics.

The most recent development along the lines of quickly adjustable forks is the introduction by Kawasaki of the “Hatta” forks which make possible field changes in spring tension, rake and trail.

Nearly all machines feature spring-loaded footpegs that hinge back on impact and return undamaged to their original position. The footpegs are

(Please turn to page 224)

DIRT BIKE MANUFACTURERS AND IMPORTERS

American Honda, 100 W. Alondra Blvd., Gardena, Calif. 90247.
American Jawa (C-Z), 3745 Overland Ave., Los Angeles, Calif. 90034.
BSA Motorcycles, 80 Pompton Ave., Verona, N. J. 07044.
Bultaco Services, P.O. Box 101, Santa Clara, Calif. 95053.
Cooper Motors (Maico), 2815 West Olive, Burbank, Calif. 90670.
Cosmopolitan Motors (Benelli), Hatboro, Pa. 19040.
Harley-Davidson Motor Co., Inc., Milwaukee, Wis. 53201.
Hercules Distributing Co. (Sachs), 1812 Colorado St., Santa Monica, Calif. 90404.
Kawasaki Motors, 1062 McGaw Ave., Santa Ana, Calif. 92705.
MB (Moto-Beta) Sportcycles, 311 Alexander, Tacoma, Wash. 98421.
Montesa Motors, 3657 Beverly Blvd., Los Angeles, Calif. 90004.
Norton-A.J.S., 6765 Paramount Blvd., North Long Beach, Calif. 90805.
Pobatco (Hadaka), Box 327, Athena, Ore. 97813.
Penton Imports (Penton, Husqvarna), 1423 Foster Park Rd., Amherst, Ohio.
Triumph Motorcycles, Box 6790, Baltimore, Md. 21204.
U.S. Suzuki Motor Corp., Santa Fe Springs, Calif. 90670.
Yamaha International, Box 54540, Los Angeles, Calif. 90054.
Yankee Motor Co. (Ossa), Box 36, Schenectady, N. Y. 12301.

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DOWNHILL RUN in Baja 1000 finds rider ready with his hand on brake



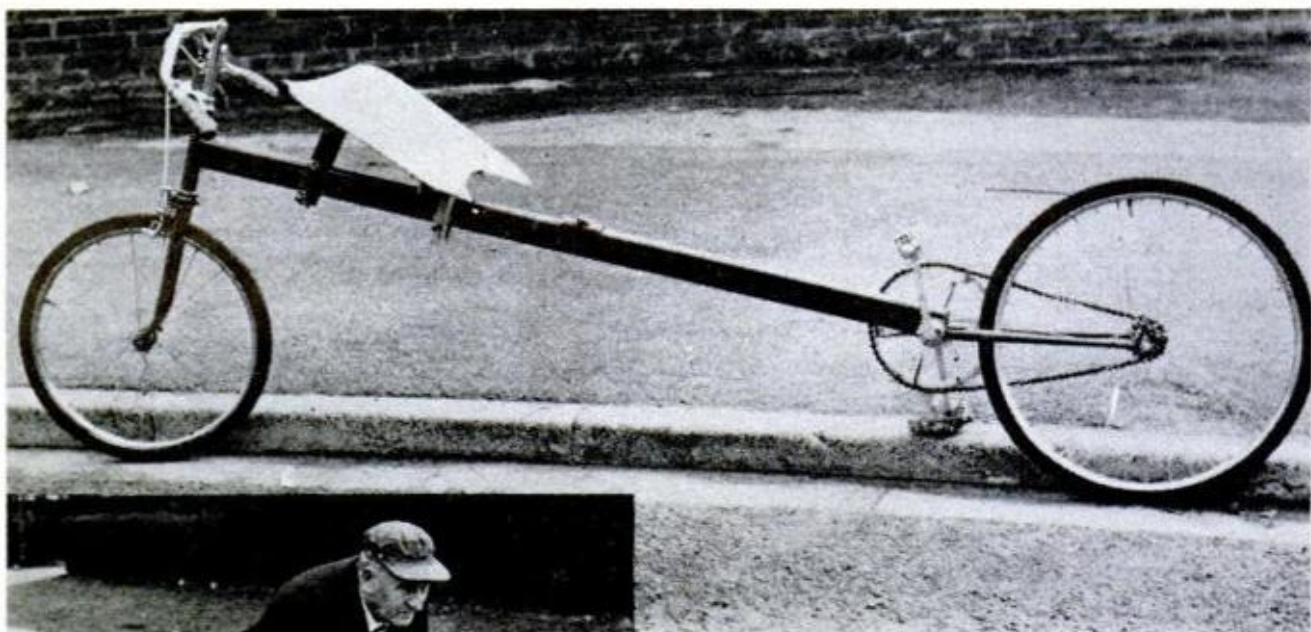
Sound detects the unsound

A new sonic detector, developed by Trans-Global Electronics and Ford of Britain, can spot leaks in brake systems and body repairs. In the photo, a sound generator is inside the windshield and the detector outside as an operator looks for potential water leaks.



No doubt about it

Visitors have no trouble spotting the house number on Charles Baverstock's home near London. The large numerals are formed by the leaves and stems of pyracantha plants, trained over seven years to grow that way.



Flat-out bicycling

Claiming that his design makes full use of the rider's leg power and that the near-horizontal position of the rider cuts wind resistance, Thomas Patrick of Middlesex, England, hopes to exceed 35 mph when he becomes skilled at using his homemade bicycle. The 70-year-old inventor doesn't stop there, either. He believes that if he adds glider wings to his machine, he can make a successful man-powered flight.

What's Watt in Choosing A Hi-Fi?

Like a car's horsepower, the number of watts an amplifier puts out is an important key to good performance. Here's how to determine the amount of power you need and how to unscramble the various output rating systems manufacturers use.

By HANS FANTEL

HOW MUCH HI-FI POWER do you really need? In choosing an amplifier or receiver, it's often easy to assume "the bigger, the better." Like a fast sports car, the high-powered hi-fi set has a racy glamour that's hard to resist. But buying watts, like horsepower, can get expensive. Often you can save money and still get good performance by knowing the minimum amount of power that will satisfy your needs.

A lot of watts doesn't necessarily mean a lot of sound. A 100-watt amplifier doesn't play 10 times as loud as a 10-watt amplifier. The human ear doesn't trans-

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25 Watts?



40 Watts?



50 Watts?



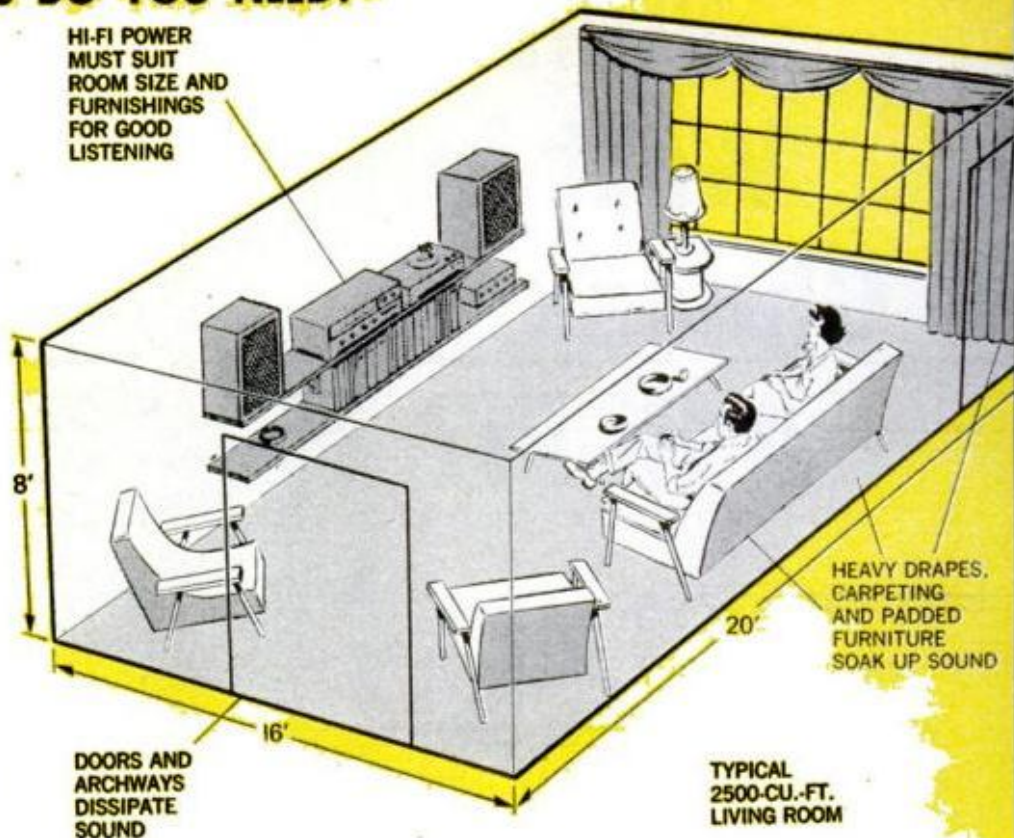
THREE STEREO RECEIVERS (above) all put out good power. How much is enough depends on your room acoustics and listening tastes. As example of how rating systems vary, Knight-Kit KG-980 (top) gives 25 watts per channel on IHF Music Power scale and 17 watts continuous power. Scott LR-88 (center) is rated 40 watts per channel IHF, 30 watts continuous. Heathkit AR-29 (bottom) is 50 watts per channel IHF, 35 watts continuous

HOW MANY WATTS DO YOU NEED?

ROOM SIZE and furnishings have a lot to do with amount of hi-fi power you need. The bigger the area and the more heavy drapes and upholstered furniture you have, the more output is required to overcome loss through sound absorption. Wall openings like doors and archways also dissipate sound and must be allowed for. Here are recommended minimum per-channel IHF power requirements for a typical living room depending on your type of acoustics:

1. "Live" acoustics (hard, bare floor, no rugs, few curtains, smooth walls)—15 to 20 watts.
2. Average acoustics (curtains and some rugs, some but not much upholstered furniture, normal door openings)—25 to 30 watts.
3. "Dead" acoustics (wall-to-wall carpeting, heavy drapes, stuffed chairs, couches, pillows, many wall hangings, large hall or archway openings)—40 to 50 watts.

Figures are for rooms of 2000 to 3000 cu. ft. Double wattage for 4000-6000-cu.-ft. rooms.



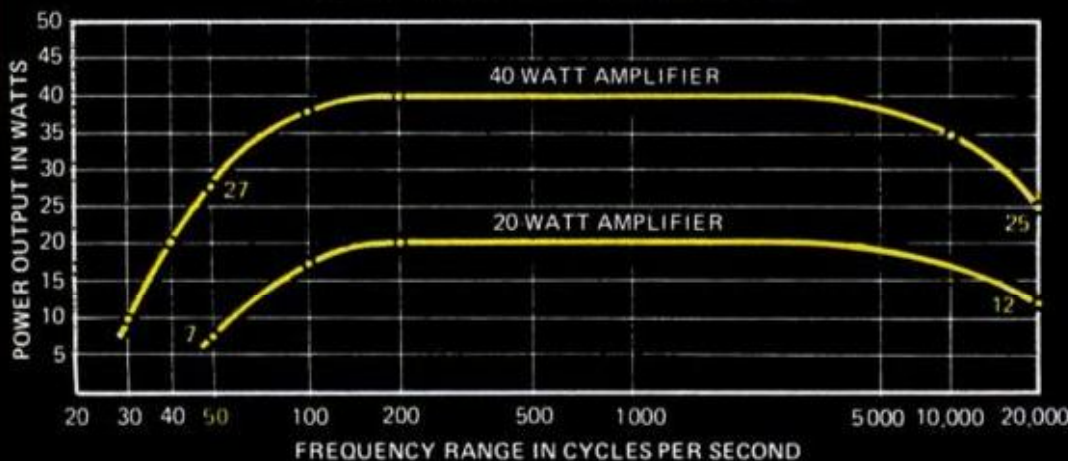
late power output into a proportional sense of loudness. In terms of volume, the difference between 25 and 50 watts is only 3 decibels—a very small amount.

Why, then, pay for power you can't hear? The answer is that you *can* hear it, but not in terms of brute volume. You hear it as extra smoothness and clarity of sound in loud passages and in better bass reproduction. This is where adequate power is essential. You don't run your hi-fi set at full power all the time any more than you run your car a full throttle all the time, but in both cases it's impor-

tant to have sufficient power reserve for critical moments. To an amplifier certain passages in music are like steep hurdles—the crash of a kettledrum, the deep thump of a bull fiddle or the thunder of a great symphony orchestra working up to a climax. At such moments, the power content of music jumps tremendously.

You can make any amplifier sound loud merely by cranking the volume control way up. But the point is, the weak one won't be able to maintain true fidelity under the added power demand of critical passages. At these points, it breaks into

HOW TO READ A PERFORMANCE CURVE



WHY ADEQUATE POWER

is important is shown in graph at left. For good bass reproduction, you need plenty of oomph at the low end of the frequency range—just where most amplifiers fall off sharply in power. At 50 cycles, 20-watt amplifier is down to only 7 watts, while the 40-watt still puts out a hefty 27 watts. At the high end, the 40-watt delivers 25 watts and the 20-watt 12. Thus high-output amplifiers are less affected by power drop-off at critical frequencies

distortion and the music sounds harsh and grating. These passages may last only a few seconds, but the ear subconsciously records them as irritating and unpleasant. This leads to the well-known phenomenon of "listener fatigue"—you're not quite sure why, but you soon get tired of the music and want to turn it off.

By contrast, an amplifier with sufficient power reserve glides smoothly over such tonal hurdles. You feel more relaxed and can keep the music going for hours.

Good power also helps to pump out better bass. To get an idea of the energy contained in the really low notes, visualize such instruments as the kettledrum, tuba and bass fiddle. Consider the sheer physical force required to play them. To reproduce this energy in your living room takes a lot of extra watts. The trouble is that most amplifiers fall off in output at the upper and lower ends of the frequency range. Power measurements are usually made in the mid-range, around 1000 cycles. When you get down to bass notes at 35 to 50 cycles, an amplifier rated at 20 watts may actually be able to squeeze out no more than five watts without splattering distortion all over the place. The result is that the music lacks a feeling of power and solidity in the low range—just where it's needed most.

Again, the answer is plenty of reserve power. A 40-watt amplifier may fall off in the low frequencies just as much as a 20-watt amplifier, but it will still have a lot more power left at the bottom than its weaker counterpart. You can see from the two curves compared in the accompanying graph that a typical 40-watt amplifier, despite a sharp dropoff in power, is still putting out about 27 watts at 50 cycles, while a 20-watt amplifier is down to as little as 7 watts. This 20-watt difference may not be too noticeable in the mid-range, but down at the deep bass frequencies it can become critical. This is the main argument for buying extra power—like a fast

(Please turn to page 202)

STEREO LINEUP at right shows how power output varies widely in a typical group of modern receivers. All are well-engineered, popular sets—good buys within their respective power classifications. First five from top are complete, self-contained stereo receivers. One at bottom is a control preamplifier intended for use with a separate amplifier and stereo tuner. The output figures shown here represent the IHF Music Power ratings for each channel. To obtain the total power ratings for both channels, double these figures

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ELECTRO-VOICE E-V 1181—20 WATTS



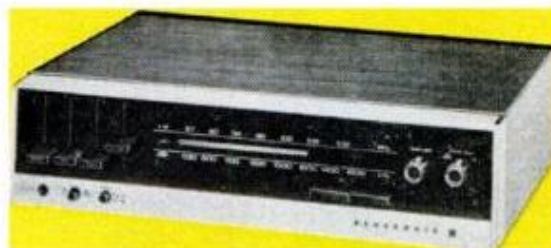
SCOTT 342-C—50 WATTS



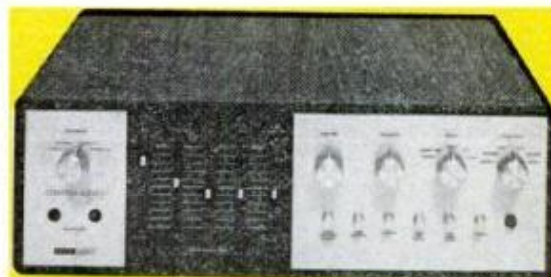
FISHER 202—50 WATTS



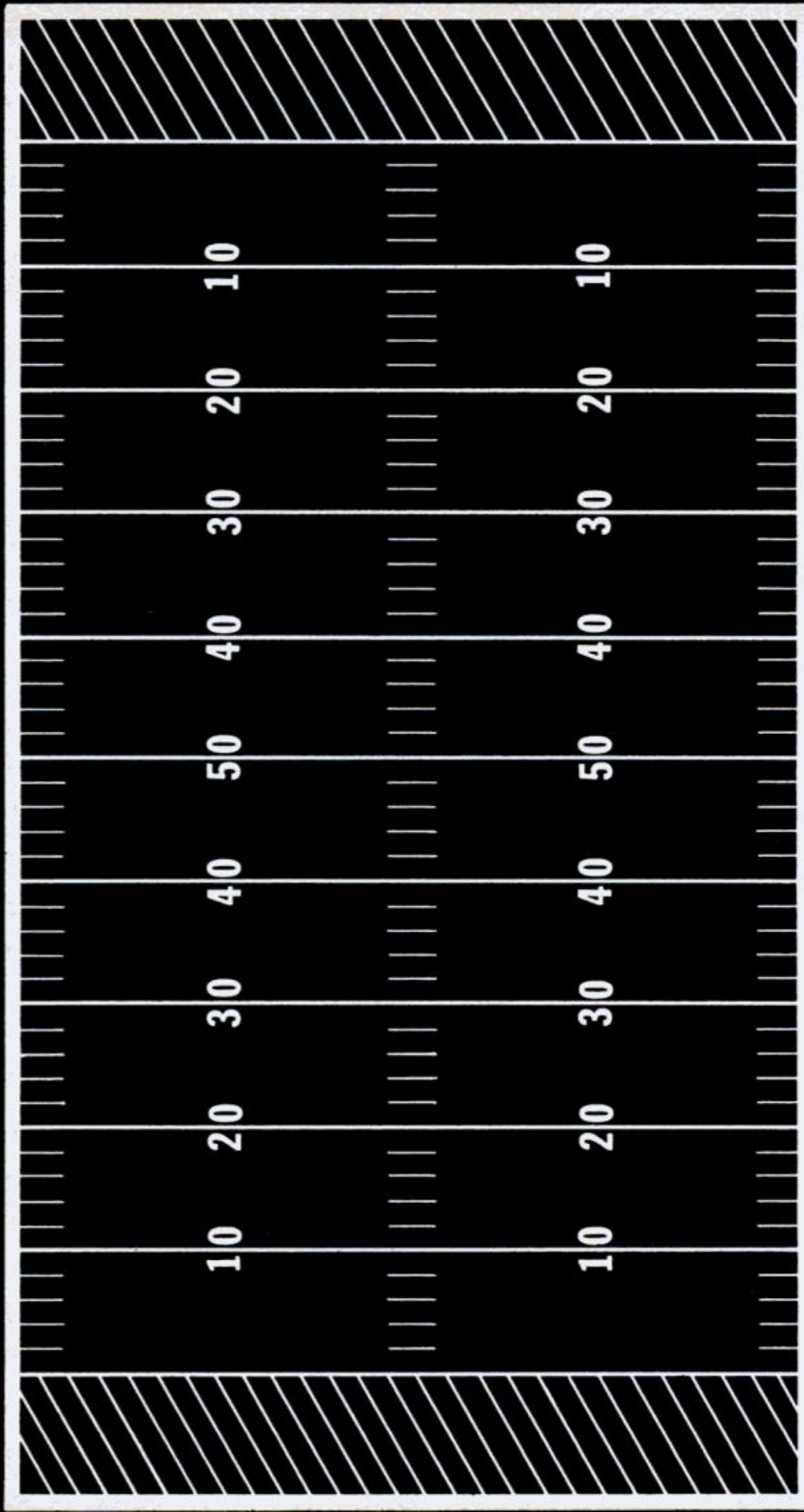
SANSUI 5000—65 WATTS



PANASONIC SANTA MONICA—9 WATTS



HARMAN-KARDON CITATION—75 WATTS WITH SEPARATE AMPLIFIER

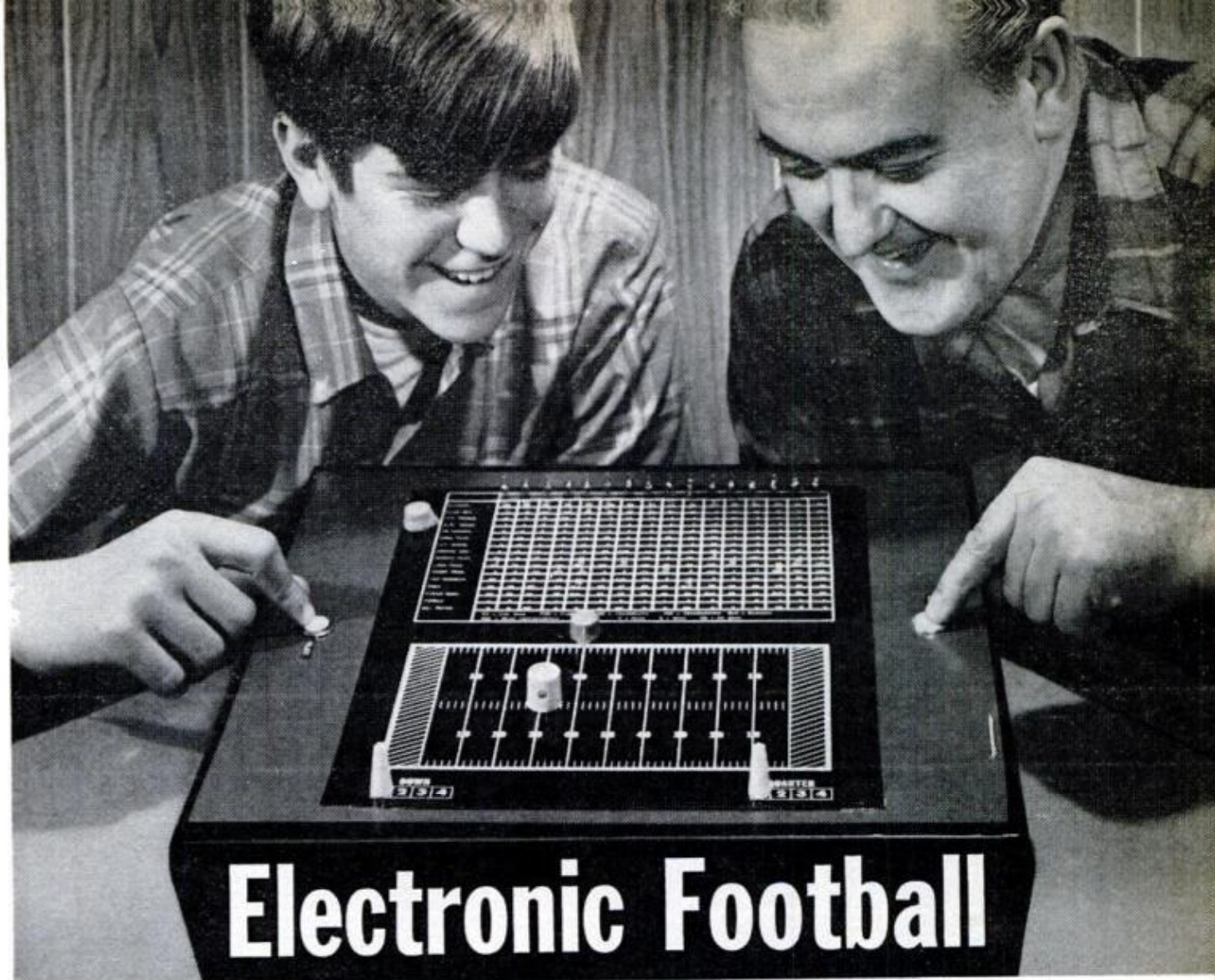


DOWN

1	2	3	4
---	---	---	---

QUARTER

1	2	3	4
---	---	---	---



Electronic Football

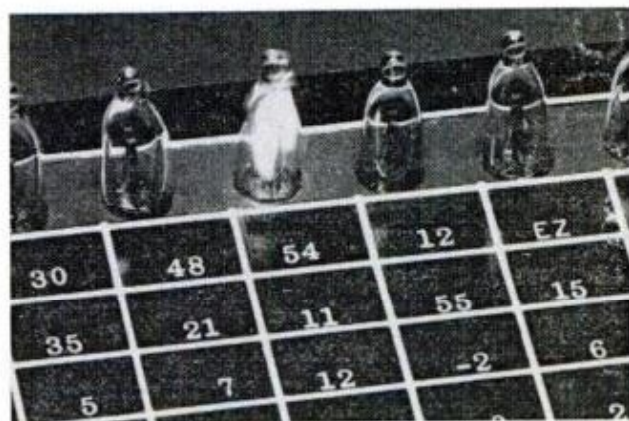
Lets You Play Like the Pros

By RUDOLF F. GRAF and GEORGE J. WHALEN

Photos by Robert D. Borst

This home-built game, based on an intriguing random-chance circuit, will give you hours of fun long after the football season has ended

IT'S YOUR BALL, fourth down, two yards to go for a first down, 18 yards to go for a touchdown. What do you do? Go for broke and try a pass for the score, or play it safe and stay on the ground, hoping to bull your way to a first down? This is the kind of excitement you can have with this electronic football game based on an ingenious random-chance circuit. You select whatever play you want to try from a chart—long pass, screen, end run, draw, quarterback sneak—and a light flashes on, telling you how many yards you gained or lost. There are chances for fumbles, interceptions, blocked kicks, long runbacks—

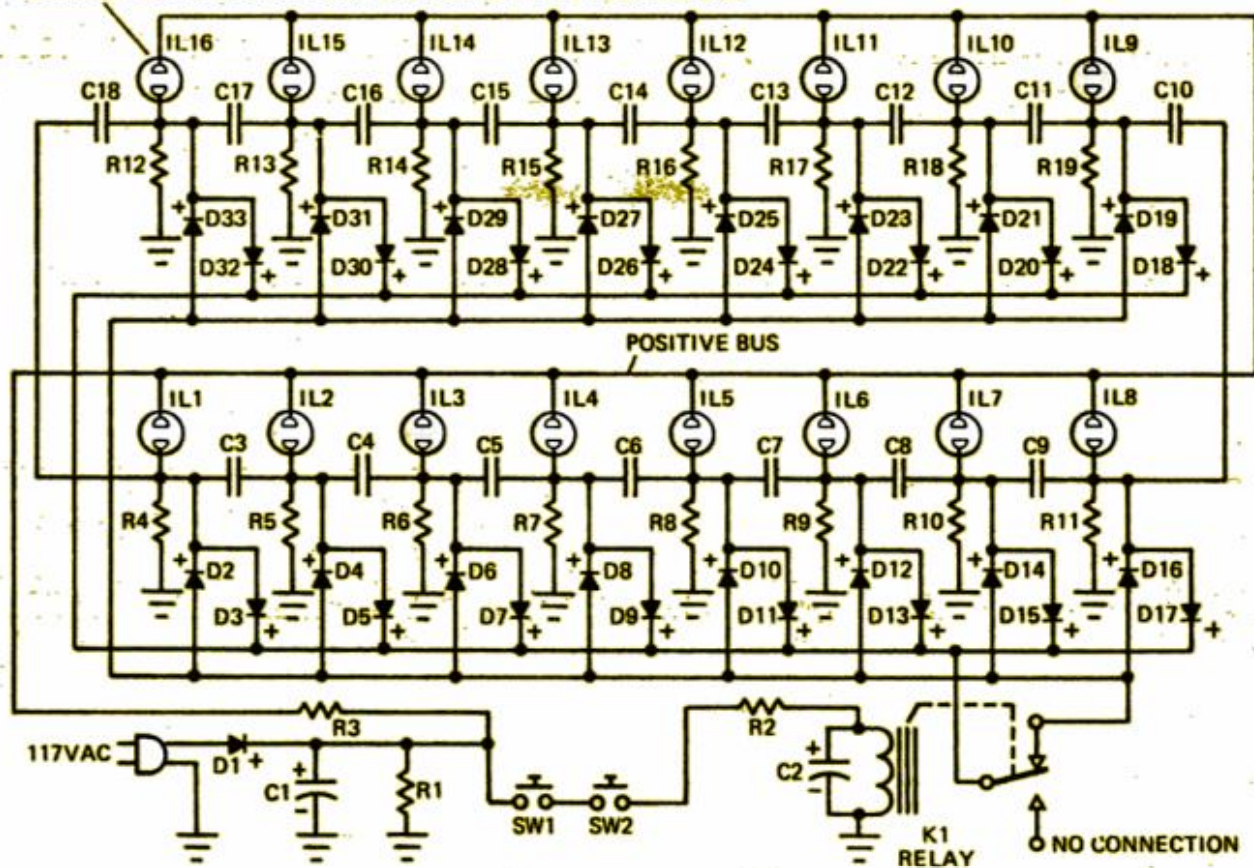


LIGHTED NEON LAMP, one of 16, indicates amount of yardage made or lost on each play. Lamps flash on and off at random, giving new result each time

	55	40	53	10	30	48	54	12	EZ	41	37	49	51	15	52	58
KICKOFF	2	9	20	14	35	21	11	55	15	24	5	22	16	45	4	23
KICK RET	-3	4	0	10	5	7	12	-2	6	0	2	15	3	-1	7	1
OFF TACKLE	1	1	0	2	-1	0	3	0	2	7	-1	2	0	4	2	1
QB SNEAK	5	-1	2	0	7	3	1	6	3	-1	10	2	1	2	4	3
FB CENTER	1	20	17	0	-2	16	2	1	20	15	18	1	-2	2	0	2
DRAW PLAY	4	-4	1	5	-1	2	0	7	3	3	10	-1	4	1	8	2
OFF GUARD	3	-1	-2	5	0	30	FUM	12	25	-5	45	15	3	20	-3	5
AROUND END	17	3	-7	0	20	-5	12	INC	5	45	³ INT	7	INC	0	4	-1
SCREEN PLAY	⁵ INT	TD	INC	INC	²⁵ PNF	INC	²⁰ INT	INC	45	30	INC	²⁵ INT	INC	35	³⁰ PNF	INC
LONG PASS	3	4	INC	⁷ PNF	⁵ INT	5	6	INC	²⁰ INT	4	INC	7	7	¹⁰ PNF	INC	INC
SHORT PASS	15	0	5	-4	20	7	FUM	TD	8	-3	0	5	40	4	10	FUM
INT RUNBACK	36	25	37	48	⁻⁸ BLK	35	47	38	45	⁻⁵ BLK	46	50	40	39	55	41
PUNT	12	23	20	29	BLK	27	18	28	40	14	BLK	35	15	BLK	38	30
FIELD GOAL	L	K	L	L	L	K	K	L	L	K	K	L	K	L	L	L
FUMBLE	G	G	NG	G	G	G	NG	G	G	NG	G	G	G	NG	G	G
EX. POINT																

EZ - End Zone FUM - Fumble INC - Incomplete INT - Intercepted BLK - Blocked
 PNF - Pass Interference L - Lose K - Keep G - Good NG - No Good

CONNECT LEAD OPPOSITE DOT ON EACH LAMP TO POSITIVE BUS

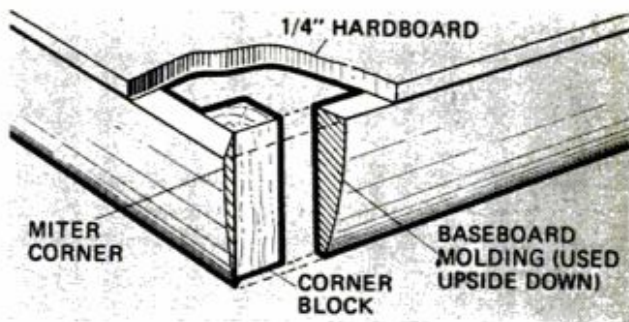


all the things that happen in real football.

To make the game easy to build, we have reproduced the playing field and play-selection chart actual size on these pages. Just clip them out and mount them on a 15x15-inch square of 1/4-inch hardboard to produce a neat, professional-looking game board. The electronic parts are hidden in a recess under the board.

While the game is based on chance, it's cleverly designed to offer the same statistical ratio of risks and rewards found in actual football plays. If you decide to try a long pass, for instance, you'll find that the possible gains are bigger than for running plays but that there are also more chances the pass will fall incomplete or be intercepted. If you elect to stay on the ground, grinding out short yardage, the possible gains are smaller, but there are mathematically more chances to make them and less risk of losing the ball. You can thus work out your own strategy, just like the pro do.

The play selector chart has 16 tiny neon bulbs arranged in a row across the top. The circuit that controls them is called a ring counter because they go rapidly on and off, one after another, around and around like a ring. They flicker on and off so fast—about 150 times a second—that they all appear to be on at once.



CORNER DETAIL of game board shows how tapered baseboard molding can be used upside down to frame the top. Plain wood strips 2 1/4 inches wide will also do, but rounded molding adds a trim appearance

Also on the playing board are two push-button switches, one for each player. Each play starts with both players pressing their buttons. This lights all bulbs simultaneously. The player with the ball then selects a play from the chart and releases his button. This breaks the circuit and all bulbs go off except the one that was lighted the instant the button was released. This remains on, indicating the results of the play. If, for example, you choose a draw play and the second bulb remains on, you look down the chart and see that you made a 20-yard gain. If, on the other hand, the fifth bulb remains lighted, you were thrown for a two-yard loss.

You then start another play with each



LIGHTS ARE MOUNTED on strip of corrugated cardboard, making them easy to wire. Punch holes for each bulb's leads, feed ends through to the back side and solder them there to wires running to the

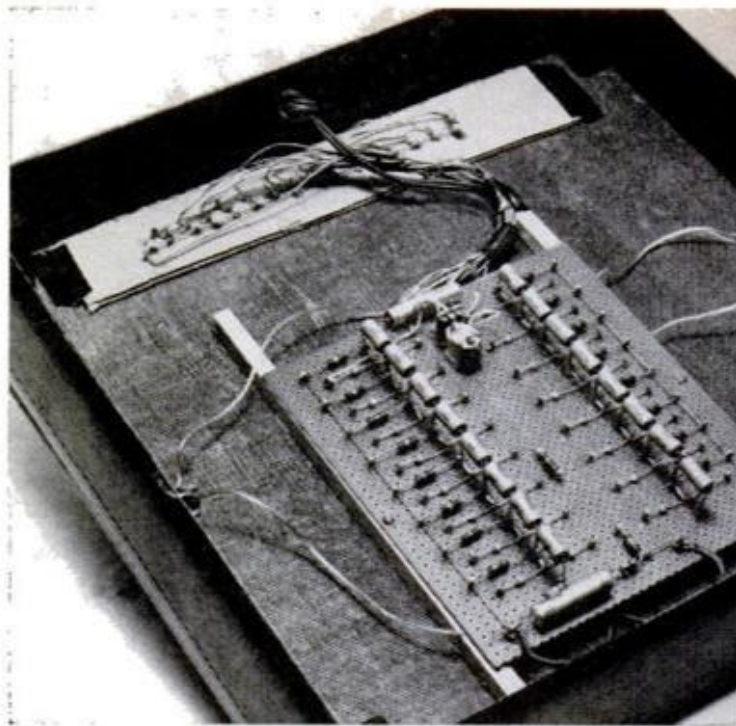
player pressing his button and all the lights go back on. It's occasionally possible for two bulbs to remain lighted at the same time after a button has been released. In this case, you replay the down.

In laying out the game board, temporarily tape down the play selector chart with the row of small circles near one edge. These circles represent holes for the 16 neon bulbs that protrude from under the board. Using a prick punch, mark these holes on the board, remove the chart and drill them out with a $\frac{1}{4}$ -inch bit. Also drill holes for the pushbutton switches.

Paint the board green or black and fasten down the cutouts with rubber cement or black plastic electrical tape. Carefully cut the bulb holes out of the play selector chart with scissors or a paper punch before attaching it. To keep the cutouts from becoming smudged and worn with age, you may want to tape a sheet of clear cellulose acetate over the top.

You can frame the board with strips of scrap wood $2\frac{1}{4}$ inches wide or use stock baseboard molding. The latter, turned upside down and mitered at corners, gives the board an interesting tapered look.

All of the electronic parts are mounted on a piece of perforated phenolic board about 7x9 inches. Use flea clips to attach them. The circuit is actually simpler than it looks. Except for the power supply and relay, it consists of one basic grouping of



main circuit board. Electronic parts are arranged on a small piece of perforated phenolic board, as shown at right. Board is mounted on $\frac{1}{2}$ -inch strips to space it way from underside of hardboard top

parts repeated 16 times. The resistors and capacitors control the bulbs' firing rate. The diodes short out the capacitors when either player's button is released. This reduces the voltage to the point where only the bulb lighted at that instant can remain on. The rest go off and do not have enough power to restart. This works because it is a characteristic of neon lamps that they require more starting voltage than running voltage.

Be sure to observe correct polarity when installing the diodes or the bulbs will not light properly. A band or plus mark identifies the cathode end. The bulbs must also be connected in the proper way. You'll find one lead on each lamp identified by a marker dot. Connect this lead to the positive bus wire. The bulbs are mounted on a separate cardboard strip so you will have 17 wires running from this strip to the main circuit board—one common bus and one individual lead from each of the 16 bulbs. Press the bulb tips gently up through the holes in the playing board and tape the strip to the underside.

Except for the neon lamps, all of the parts are readily available either locally or from Allied Radio, 100 N. Western Ave., Chicago, Ill. 60680 and Lafayette Radio, 111 Jericho Turnpike, Syosset, N. Y. 11791. Allied and Lafayette catalog numbers are given in the parts list shown

(Please turn to page 228)

POPULAR MECHANICS

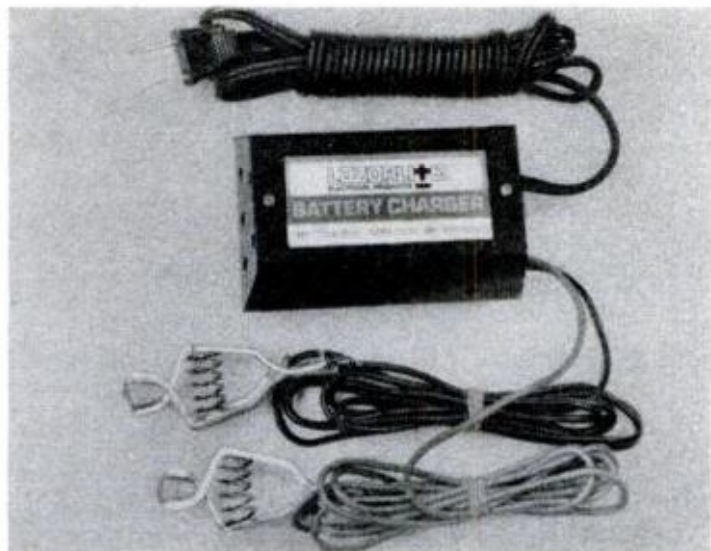
NEW IN ELECTRONICS



LATEST AM/FM STEREO RECEIVER by Scott features a smartly styled sloping panel and an unusual keyboard for switching speakers and other functions. Output is 53 watts per channel continuous power. An automatic safeguard cuts power if the output transistors become overloaded. Price for Model 3800 is \$399.95. H. H. Scott, Maynard, Mass.



IT LOOKS LIKE WOOD but isn't. This handsome stereo console, first of a new nonwood hi-fi line by GE, is made of molded polystyrene and polyurethane foam. It's said to have the richness of wood while offering lower cost, greater durability and better acoustics. One clever trick: The back is molded to look like the front so console can be used free-standing as a room divider.



YOU CAN KEEP YOUR CAR BATTERY up to full power with this inexpensive home charger. Designed to mount conveniently on a garage wall, it plugs into 115 volts a.c. and delivers 12 volts d.c. Charging rate is automatically regulated so it's reduced as battery reaches full capacity. Price is \$4.95. SBH Associates, 3140 Spring St., Redwood City, Calif.



YOU CAN WIND cassette tapes manually with these accessory knobs. The toothed knobs fit into the spindle holes and engage the sprocketed reels. With a knob in each hole, you can wind the tape forward or backward for editing and splicing or to take up slack. Knobs are \$1.50 a pair from Robins Industries, 15-58 127th St., College Point, N.Y.



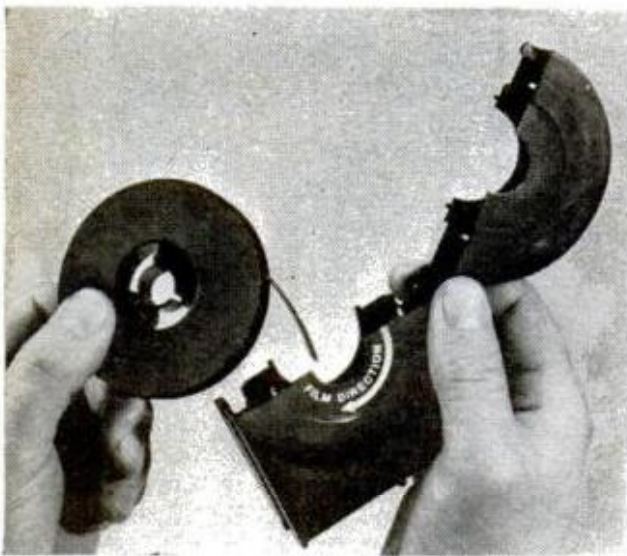
NEW SEE-IN-THE-DARK navigation aid enables a ship to pick its way safely through a crowded harbor at night as if it were broad daylight. The ship sweeps a path ahead of it with an invisible infrared searchlight beam. The reflections are converted electronically into a visible image on a TV-like screen. System was devised by West German firm of AEG-Telefunken in Frankfurt.



New Magic for Home Movies: Instant-Loading Projectors

Handy drop-in film cartridges speed reel-changing and end the fuss of threading and rewinding. Some of these clever think-for-themselves machines are already here and other models are due to come soon

By BURT MURPHY



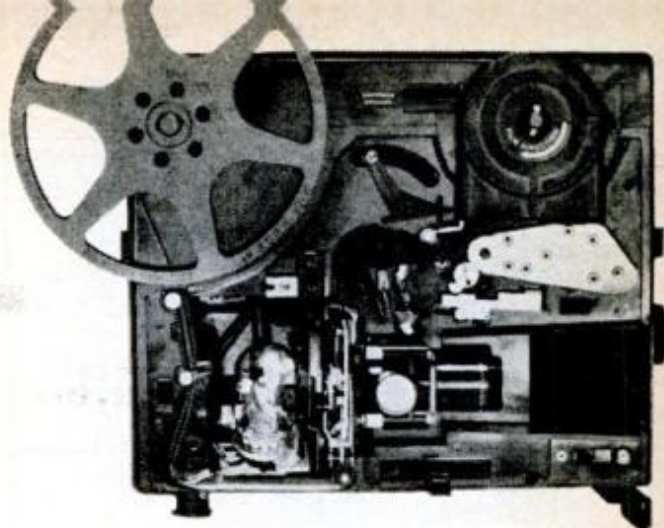
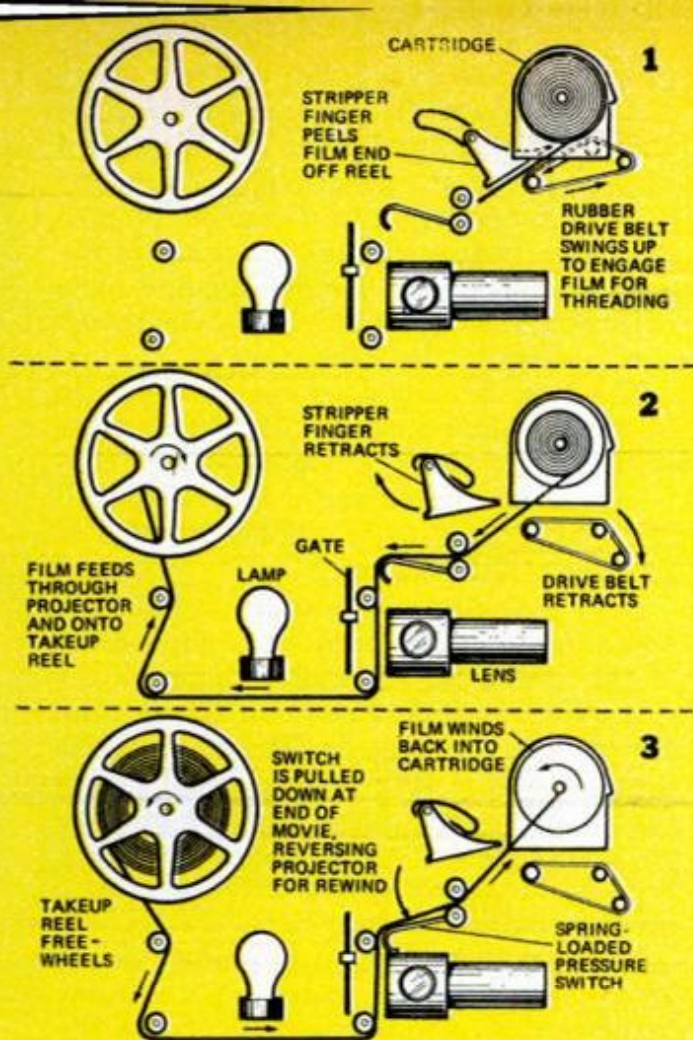
LOADING A KODAK CARTRIDGE is a simple matter of flipping up the hinged lid and dropping in a standard film spool. Spool can easily be removed at any time for editing the film or switching reels

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DRIP IN A FILM CARTRIDGE, flick a switch and the picture appears almost instantly on the screen. At the end of the reel, the machine shifts automatically into reverse and the film rewinds rapidly back into the cartridge. To switch reels, you just slip out the used cartridge, insert a new one and you're all set to go again—in less than five seconds. It's as simple as that. Your hands never touch the film itself at all.

This new no-fuss, no-fumble convenience for home movies is now available on several projectors, with more to come soon. Kodak already has two instant-load models on the market, the Instamatic M105 and Instamatic M109. Another big maker, Bell & Howell, plans to put its line of cartridge projectors on sale this month. For those who want sound movies,

POPULAR MECHANICS

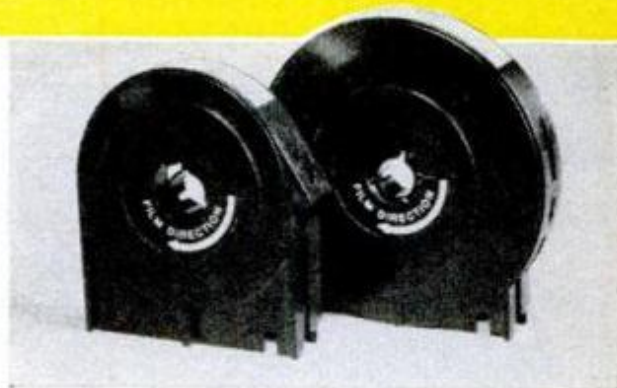


HOW AN AUTOMATIC PROJECTOR threads itself and rewinds the film is shown in drawings of Kodak system at left. When cartridge is inserted at the top, a stripper finger slides up through a slot and peels the film end off the reel. At same time, a rubber drive belt swings up to engage the film and draw it down into the projector. Motor-driven rollers feed the film through the machine and onto the takeup reel. The reel's flanges grip the film and wind it on the hub. When the film reaches the end of the supply spool, it pulls taut, depressing a spring-loaded switch. This automatically reverses the projector, thus winding the film back into the cartridge from the takeup reel

there's a Fairchild/Eumig projector, the Model 711, that incorporates both cartridge loading and a built-in system for recording and playing back magnetically striped film. Also due to make an appearance shortly is Paillard's highly sophisticated Bolex Multimatic—a magazine-loading projector that holds a whole stack of film cartridges and shows them one after another like a record changer.

All of the new self-threading, automatic-rewind projectors take Super-8 film and some also accommodate the older standard 8-mm format. What's nice about the instant-load system is that it doesn't make obsolete any of your present movies. The film is still kept wound on the original plastic spools—the kind you've always been using. The only difference is that the inner end of the film must be locked to the spool by inserting a small peg or clip in the hub so it can't pull loose. Once this is done, you just drop the spool into the cartridge—an enclosed plastic shell—and you're ready for automatic operation.

While the Kodak and Bell & Howell cartridges are not interchangeable, each company is licensing other projector makers to use its cartridge design. This means



TWO CARTRIDGE SIZES available from Kodak are 50-foot type (left, above) and 100-foot one (right). Later, Kodak will offer a 400-foot size similar to Bell & Howell's. Photo below shows a 50-foot cartridge inserted in Kodak's Instamatic M109 projector. Handy rocker switch on the side lets you control threading and rewind operations at the mere touch of a finger





**50-FOOT
CARTRIDGE**



**400-FOOT
CARTRIDGE**



**400-FOOT
STANDARD
OPEN REEL**

HOW ONE PROJECTOR can take reels of different sizes is shown in this series of close-ups of new Bell & Howell machine. Small 50-foot cartridge (at top) and large 400-foot size (center) both fit into slot on top of projector. Because drive is from the rim, no center spindle is required and reel diameter makes no difference. At bottom, an auxiliary spindle permits use of regular open reels as well

that if you adopt, say, the Kodak system, you'll be able to show your cartridges not only on Kodak machines, but also on a variety of other makes. The Fairchild/Eumig, for instance, is designed to take Kodak cartridges. In addition, most of the new machines also handle regular open reels of film so you can easily switch from one system to the other.

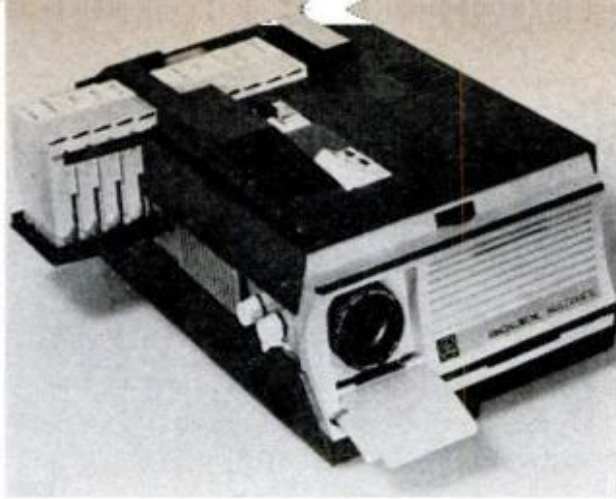
The Kodak cartridges are available in 50 and 100-foot sizes for 65 and 90 cents respectively, with a 400-foot-capacity cartridge to be offered later. Bell & Howell plans to provide its cartridges in 50, 100, 200, and 400-foot sizes.

Both systems are basically similar in operation. When a cartridge is slipped into the projector, a small stripper finger springs up through a slot and engages the film on the spool inside. The finger peels the end of the film off the spool and a rubber drive belt draws it down into the projector. From there, the film is fed through the machine and onto the takeup reel by motor-driven rollers.

The fact that the film is pinned to the supply spool is the secret of the automatic rewind. At the end of the spool, the film is pulled taut, but can't come off the hub. This pull exerts pressure on a sensitive spring-loaded switch inside the projector. When the switch is tripped, it reverses the drive mechanism and the film rewinds back into the cartridge at high speed without your having to touch a thing. You can also activate the rewind manually at any point. If you get part way through a reel and decide you don't want to see the rest of it, you merely touch a button and—zip—the film is back in its cartridge.

The two systems differ slightly in that Kodak uses a conventional hub drive on rewind, while Bell & Howell has adopted a rim drive in which a rubber wheel moves in to engage the edge of the supply spool and rotate it backward. The cartridges vary in diameter according to their capacity, but all have the same width at the base so they slip interchangeably into the same loading slot on the projector.

Kodak's M105 and M109 projectors are basically the same except that the M109 takes both Super-8 and regular 8-mm film, while the M105 is designed for Super-8 only. Both machines are available with either a 22-mm, f/1.5 fixed lens or a 20 to 32-mm variable zoom lens. Both provide



STACK-LOADING BOLEX MULTIMATIC, still experimental, holds row of 50-foot cartridges in automatic changer mechanism. It projects each cartridge in turn, rewinding it as next one is being shown

single-frame still viewing as well as forward and reverse. The M105 is priced at \$139.50 and the M109 at \$159.50.

The Fairchild/Eumig 711 features a 17 to 30-mm, f/1.3 zoom lens and takes Super-8 film, either silent or magnetically striped for sound. It has a plus-18-frame image-to-sound separation and a record/play/erase sound head. Its price is \$380. The Bolex Multimatic is, by far, the most advanced in concept, but is still in the design stage. It holds up to a dozen 50-foot cartridges in an automatic changer mech-

BELL & HOWELL SYSTEM, slightly different from Kodak's, uses pivoted drive wheel that swings up through a slot in the cartridge to engage the rim of the film spool on rewind. In threading, stripper



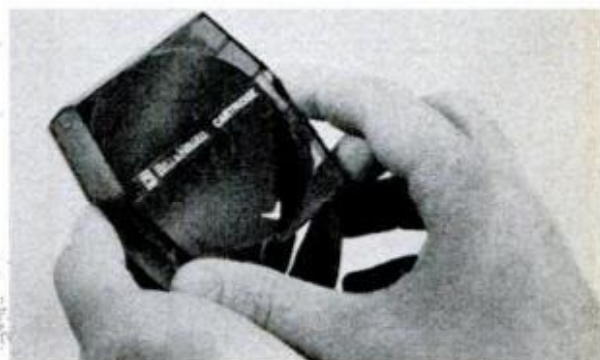
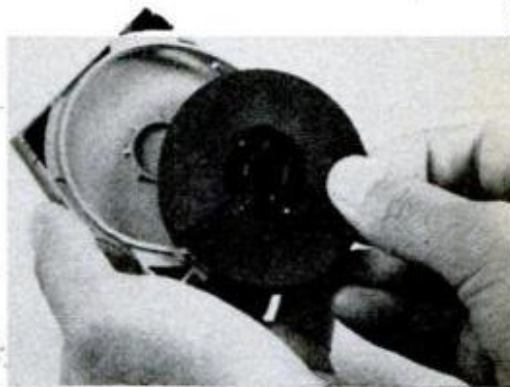
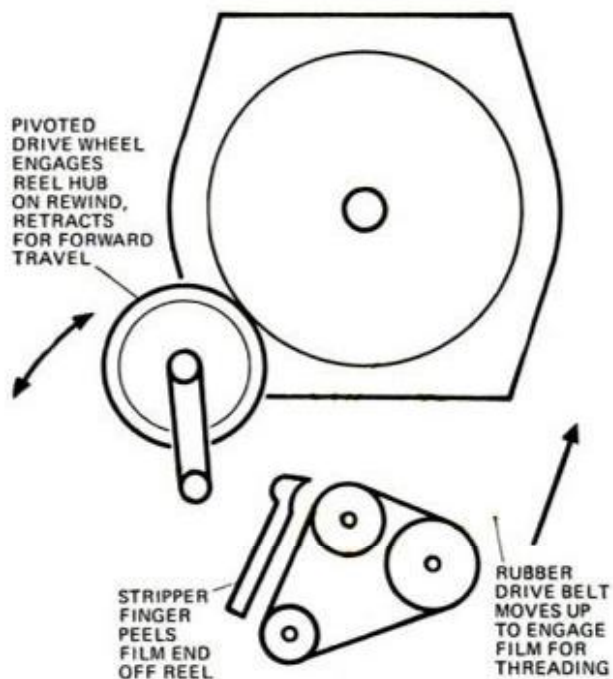
FAIRCHILD/EUMIG SOUND PROJECTOR takes Super-8 film in Kodak cartridges. Its built-in sound system records and plays back film that has been magnetically striped after processing. Price is \$380

anism and rewinds one while showing the next. It's expected to sell for around \$250.

The new cartridges not only end the fuss of projector threading, but also simplify film storage. The plastic shell provides a protective cover, eliminating the need to store reels in film cans or boxes. You can whisk a cartridge out of the projector and up onto a shelf just as it is. The flat-bottomed containers stack compactly together and don't roll around, making it easy to keep an orderly and readily accessible film library. ★★★

finger peels film end off spool and rubber belt draws it down into projector. To load plastic cartridge, you remove the cover, drop the film spool over center post, then snap the cover back on (right, below)

RIM-DRIVE SYSTEM



Tune Up and Tune Out Air Pollution

Reduce your engine's exhaust emissions by making the right adjustments and, if you have an older car, installing a new smog-control kit

By MORT SCHULTZ

THERE IS SOMETHING YOU CAN DO about air pollution if you own a car. That something is a tune-up that's aimed specifically at reducing emissions. If everyone cooperates, automotive air pollution in the United States can be reduced by at least 50 percent.

Unfortunately, there are those who are misled by technical developments. They think the closed ventilation system which auto-



mobile manufacturers are putting on new cars is a permanent remedy. This is just not true.

If kept clean, the closed crankcase ventilation system will virtually eliminate crankcase emissions by redirecting unburned blow-by gases back into the combustion chambers for reburning instead of allowing them to vent into the atmosphere. However, deposits hamper the equipment's efficiency.

Furthermore, for the closed crankcase vent system to work at peak efficiency, the car's engine must be maintained at critical settings. But, as you know, adjustments do go astray as parts wear and get dirty.

So it boils down to this: Without a periodic tune-up the closed crankcase ventilation system is of little value in reducing air pollution. The how-to of the tune-up will be explained later.

In addition to relieving crankcase emissions, a closed crankcase ventilation system helps to reduce the amount of exhaust emissions by allowing more thorough combustion of the fuel mixture. However, the system doesn't eliminate exhaust emissions as it does crankcase emissions. Keep in mind that automotive air pollution (crankcase and exhaust emissions) consists primarily of unburned fuel.

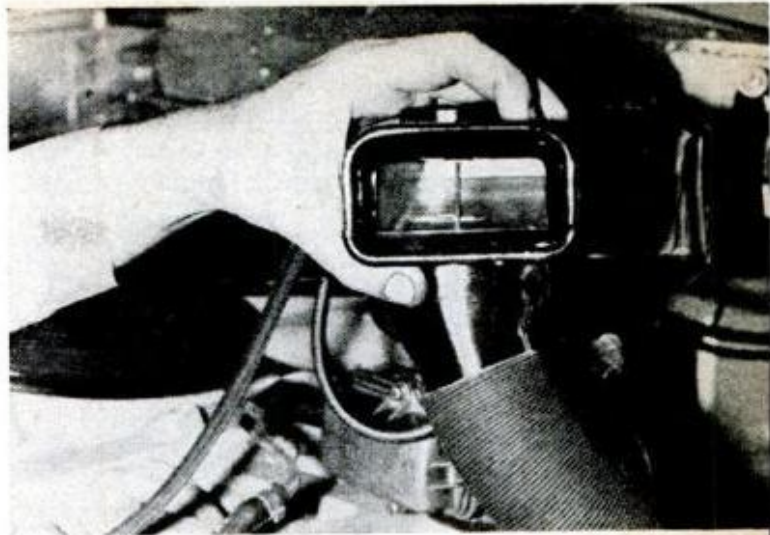
In order for a closed crankcase ventilation system to gain maximum reduction of exhaust emissions the engine must operate on a lean fuel mixture (approximately 14 to 1) and with retarded ignition timing. Retarded timing allows the spark to occur at a peak in the compression stroke where a more complete burning of the fuel mixture will take place without engine performance being adversely affected.

Cars sold in California have been required by law to have closed crankcase ventilation systems since 1966, and although all cars were required to have them by 1968, some manufacturers adopted them on a nationwide basis earlier than 1968.

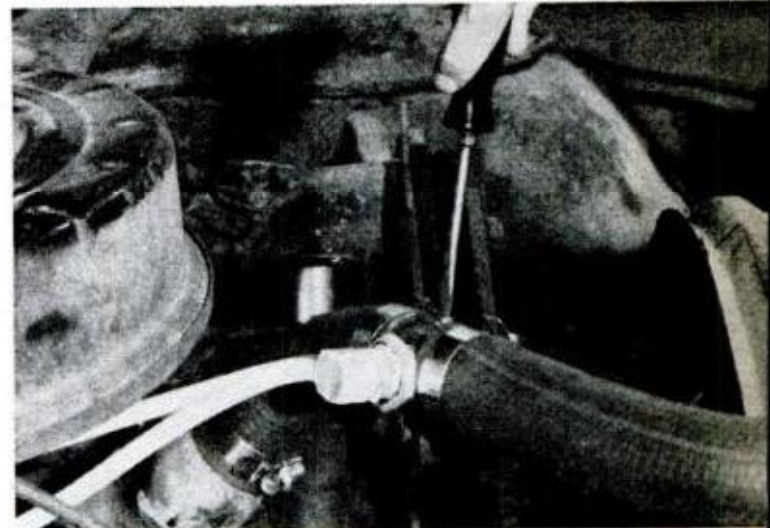
What can you do about air pollution if your car *doesn't* have a closed crankcase ventilation system? More now than ever before!

Brand-new exhaust emission control kits have been developed by the automobile manufacturers for installation in

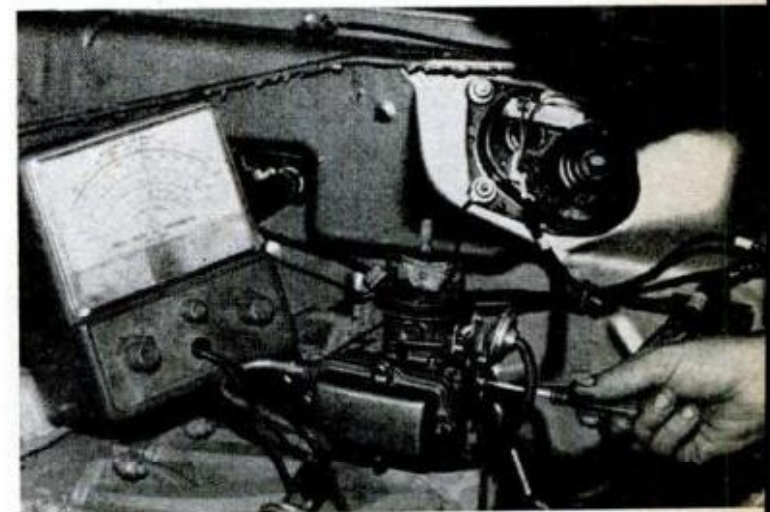
OCTOBER 1970



BUTTERFLY PLATE in air-cleaner snorkel is often overlooked when the crankcase ventilation system is checked out. This valve should open to outside air when under-hood temperature reaches about 105° F.



VACUUM CONTROL SWITCH of GM exhaust emission kit is installed in top-tank radiator hose. Lines go to distributor vacuum advance and vacuum source. The kits for older model cars are available at dealers



CARBURETOR IDLE SPEED is adjusted using a tachometer. Carburetor idle mixture adjustments (opposite page) require use of a combustion analyzer which measures percentage of pollutants in exhaust

older cars. They will reduce by approximately 50 percent the amounts of hydrocarbons, carbon monoxide and oxides of nitrogen that these cars put into the air.

As this article was being prepared, Chrysler had made its kit available through dealerships for \$12.50. The price doesn't include installation, which is easy. But following installation, a tune-up is necessary. Here price will vary depending on the shop and how much of the job you can do yourself.

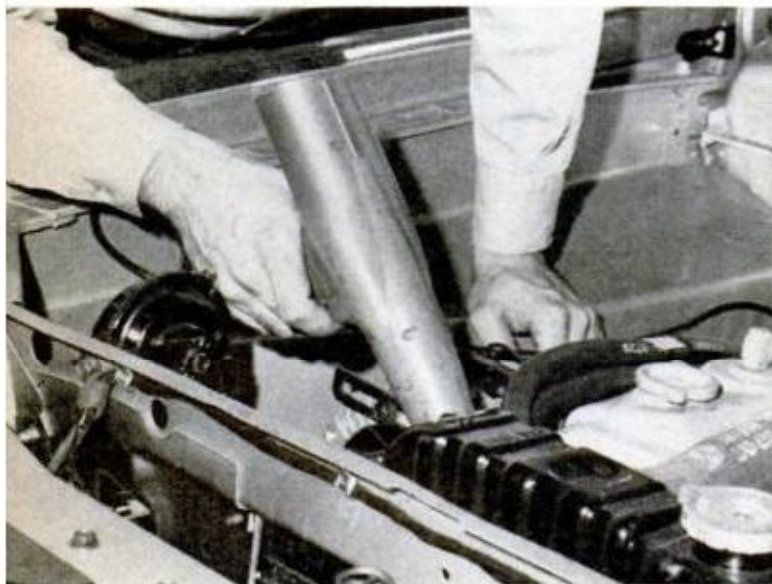
GM and FoMoCo kits are available through their dealers for about the same price as Chrysler's. With few exceptions, the kit of one car maker will fit the engines of another.

All of these kits reduce exhaust emission by allowing a more complete burning of the fuel mixture at leaned-out carburetor settings and retarded timing. Each, however, does it in a somewhat different way. An explanation of the GM kit will give you an idea of how they all work.

The heart of the kit is a vacuum control valve that switches off the distributor vacuum advance by diverting vacuum away from the unit, so that the vacuum advance no longer controls ignition timing. This allows spark to occur at that retarded position where maximum burning of the leaned-out fuel mixture is assured.

The vacuum control valve provides a safeguard if the engine begins to overheat as a result of late timing. As soon as the engine temperature approaches a

IGNITION TIMING—requiring the use of a timing light—is another necessary adjustment to make when an exhaust emission kit is installed, or whenever you perform an anti-air-pollution tune-up on your car



critical point (about 205°F.), a plunger in the valve recouples the distributor vacuum advance with its vacuum source, and the vacuum advance functions in the regular way.

When the temperature decreases, the spring-loaded vacuum control valve once more blocks off the vacuum advance from its source.

To install this new exhaust emission control kit, remove the vacuum hose extending from the distributor vacuum advance to its vacuum source and cut away a section of the top tank radiator hose. Install the vacuum control switch in the radiator hose and secure it with clamps. The exact amount of radiator hose to cut is spelled out in instructions accompanying the kit.

Vacuum hoses are then run from the carburetor side of the vacuum control switch to the engine vacuum source, and from the distributor side of the switch to the distributor vacuum advance. The carburetor idle speed, and mixture and ignition timing are set to specifications given in the instructions.

As we pointed out before, no anti-air-pollution equipment, whether closed crankcase ventilation system or exhaust emission control kit, will work effectively unless the engine is properly tuned.

It is also true that the amount of air pollution an engine emits can be significantly reduced even if the car has no anti-air-pollution equipment.

Earlier this year, engineering students at the University of Michigan took emission readings of 43 cars before and after tuning them up. They found that carbon monoxide and unburned hydrocarbons (air pollution) were reduced an average of 55 percent at idle. A car at idle releases the greatest concentration of pollutants.

This proves that we can all do something about air pollution other than gripe. We can perform an anti-air-pollution tune-up once every 12 months. Here's how:

1. Since an efficient ignition system is necessary for complete combustion, start by assuring yourself that the battery is fully charged, and that battery posts and terminals are clean and tight.

2. Be sure that sparkplugs are not damaged or worn beyond use, and are cleaned and gapped to specification. All specifications required for the anti-air-

pollution tune-up can be obtained from your car's service manual, your dealer, or from a general automotive manual such as *Motor's Auto Repair Manual*, which is probably available in your local library.

3. Check the distributor breaker points for wear and damage, and replace them if necessary. Make sure that points are properly aligned, and that dwell and gap are set to specification. Clean the distributor cam and apply a drop of light engine oil to the wick that keeps the cam lubricated.

4. Check all secondary cables for cracks and leaks by connecting one end of a test probe to ground. Disconnect a secondary cable at the sparkplug and insulate it from grounding by laying it on a rubber hose. With the engine idling, move the test probe along the length of the cable. If a spark jumps, the cable is leaking.

Also check the resistance of secondary cables with an ohmmeter. The service manual will give you the exact allowable resistance, which depends on the length of the cable. Generally, if resistance is more than 30,000 ohms, you should replace the cable.

5. Be sure the carburetor air cleaner is not damaged, oil-soaked or dirty. If damaged or oil-soaked, replace it. Some elements can be cleaned of dirt; others have to be replaced. Follow the recommendations in your car's service manual.

6. Be sure the manifold heat-control valve is working freely. Apply a few drops of manifold heat-control-valve lubricant to each end of the valve shaft and work it in by moving the valve. The exhaust manifold should be cool when lube is applied.

7. The positive crankcase ventilation (PCV) valve allows unburned crankcase emissions to be recirculated back into the crankcase. If the valve is plugged, pressure will build up in the crankcase to force oil and fumes through bearings and seals. Instead of helping the air-pollution problem, the valve would contribute to it.

With the engine idling, remove the PCV valve assembly from the rocker cover. You should hear it hissing. Cover the end of the valve with your fingers. You should feel a strong vacuum. If the valve is plugged, replace it with a new one and also make sure that the PCV hose and vacuum port in the carburetor are free of all deposits.

OCTOBER 1970



PCV VALVE in positive crankcase ventilation system is hard to clean and it must be replaced periodically

8. Does the choke plate work freely? Is the choke set to specification? The carburetor choke shaft should be lubricated with a few drops of carburetor cleaner to prevent the accumulation of gum deposits that will cause the choke to bind.

9. As spelled out in the service instructions for your car, adjust the carburetor idle speed using a tachometer. If the carburetor is equipped with a dashpot, which helps prevent stalling, make sure it, too, is properly adjusted.

Many engines with the closed crankcase ventilation system also have an idle speed solenoid to keep the engine from dieseling because of the leaner fuel mixture and later timing. Dieseling refers to an engine that keeps running after the ignition is shut off. This idle-speed solenoid should be adjusted as detailed in your manual (see also *How to Stop a Dieseling Engine*, Oct. '69 PM).

10. Set ignition timing to specification. If you have installed the new exhaust emission control kit, be sure that you make the proper allowances for timing (and also for carburetor adjustments). These will not be the book specs, but those on the instruction sheet accompanying the kit.

11. Adjust the air fuel ratio to specification. A combustion analyzer and tachometer are needed to do this properly. The engine is warmed to operating temperature, and correct idle speed is assured with the tach as the probe of the combustion analyzer is inserted well into the tailpipe. The specified air/fuel ratio is obtained by adjusting the carburetor mixture screws.

★★★

EXCITING NEW PRODUCTS

BY CATHERINE BILSKI

SNOOPY in his Sopwith Camel biplane has been captured in a 39-piece plastic kit that features snap-together parts (requiring no glue), wheels that roll and a battery-driven propeller. The model can be mounted on its doghouse stand or removed to simulate flight. Also included are an electric motor, a battery contact, pressure-stick markings, a "Curse You, Red Baron!" sign and instructions and assembly. Available from Monogram Models, Inc., 8601 Waukegan Rd., Morton Grove, Ill. 60053.



SPRAY-ON, WASH-OFF REMOVER takes off everything—paint, enamel, lacquer, varnish, shellac, urethanes, stains and marine finishes. You simply hold the can of Stripper 8 to 12 inches from the surface and spray on a liberal coat. Let it stand 5 to 15 minutes until the old finish becomes soft and wrinkled, then flush it off with water or scrape with a putty knife. It will not irritate skin. Made by Behr Process Corp., Box 1287, 1603 Talbert Ave., Santa Ana, Calif. 92702, a 20-oz. size aerosol-can sells for \$1.98.

PAINT LIKE A PRO with the Sash and Trim Brush Guard on your brush. The Guard adds a steady hand for "cutting in" window sash, keeps brush off the glass. To use it, just retract the guard to dip brush in paint, then push it forward to paint. It can be attached to flat or round-handle brushes. Brush Guard comes complete with an attached one-inch pure-bristle brush, sells for \$2.98 postpaid and is manufactured by Watro Products, Dept. PM, 156 Muir Ave., Hazleton, Pa. 18201.



DESIGNED TO LAST a lifetime, Eagle's new Touch-A-Matic switches eliminate arcing and eroding of contacts. The diagram shows how this slow-break switch works. As you move the lever, it presses down on a ball seated on a coil spring. Once lever passes the pivot point, the ball snaps to close the silver-cadmium-oxide contacts swiftly. Tension created by the spring gives the mechanism additional momentum it needs to create the "quick make." Single-pole switch sells for 49 cents; the three-way type, 79 cents. All switches are encased to keep them dust-free. They're made by the Eagle Electric Co., 2310 Bridge Plaza South, Long Island City, N.Y. 11101.



FIG. 1—OPEN



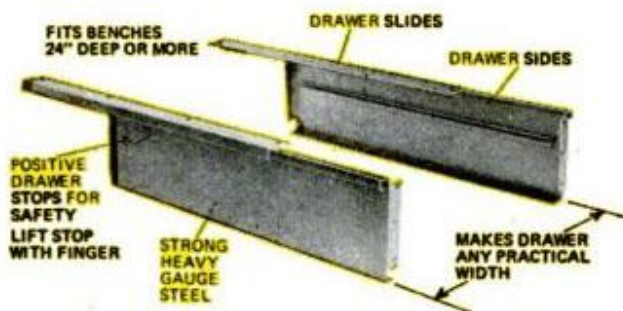
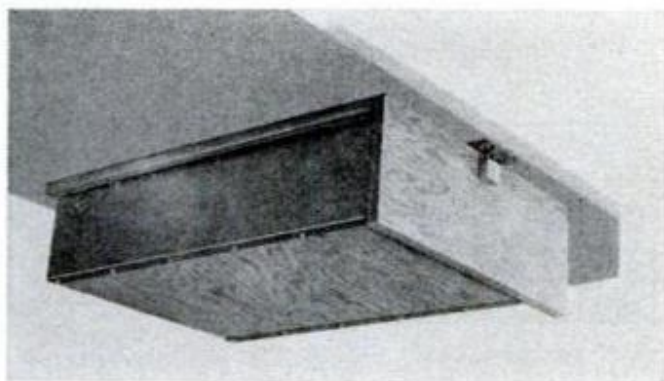
FIG. 2—CLOSED



FIG. 3—SLO-BREAK

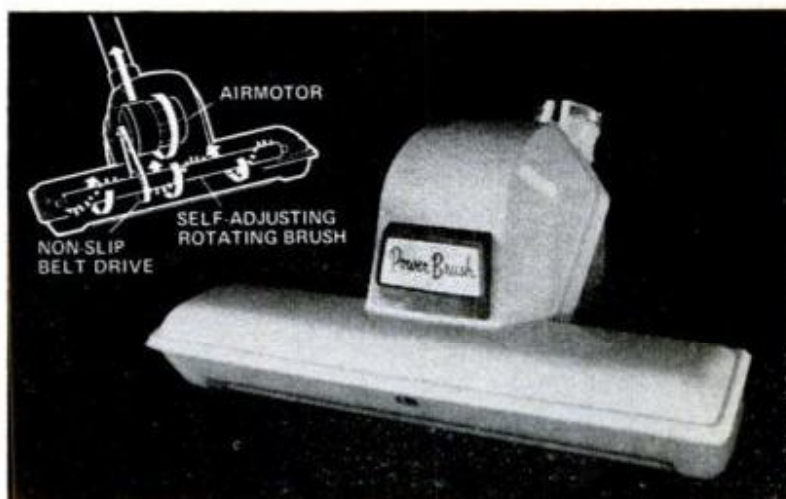


FIG. 4—OPEN



BUILD YOUR OWN BENCH DRAWERS easily and quickly with the Workbench Drawer Kit No. 55. The set includes right and left steel sides and slides, lock plate and screws. Bottom, front and back of the drawer can be made of $\frac{1}{2}$ or $\frac{3}{4}$ -inch lumber or plywood. Inside rails carry a make-your-own sliding tray, if desired, and the easy-to-install lock plate and padlock insure security against theft; they also keep children safe from cutting tools. Packaged with complete instructions (wood and padlock not included), the kit sells for \$7.50 per set from the John Sterling Corp., Richmond, Ill. 60071.

ADD MORE PICK-UP POWER to your tank-type, canister-type or built-in vacuum cleaner with this attachment called Power Brush. Suction from the cleaner operates an air motor which drives the rotating, horsehair brush at 4500 rpm. Brush is claimed to pick up lint, threads and pet hairs which suction alone would not get. The brush can be attached in seconds to any vacuum-cleaner wand. Priced at \$21 postpaid, it's available from the S & C Distributors, 4407 Brookdale Ave., Oakland, Calif. 94619.





A WORKBENCH FIT

Smooth, durable work surface of this basic piece of workshop

THE STARTING POINT—and focal point—of any respectable workshop or hobby center is a workbench that provides a rigid, durable surface. You'll find that safety, skill and enjoyment all increase when this basic shop "tool" is well designed. The version shown fulfills those requirements with a plus. The plus is ample storage below.

The work surface is Masonite's 1¼-in.-thick Benelex 401, an industrial product specifically designed for laboratory and factory work surfaces. It's about twice as dense as rock maple—so dense in fact, that it's also used as a neutron shield when disposing of radioactive nuclear wastes. The 5 sq. ft. of material required for the bench shown weighs about 45 lbs. Thus, if you plan to build a larger bench, bring a friend along when you go to pick up the stuff.

You'll notice that the woodworking vise has been bolted to the end of the bench rather than to the front. In this position it's called a backvise. The steel stop (dog) can be raised to hold a long board in conjunction with a bench stop that's inserted into the appropriate hole along the top. The bench design here permits the stops to accommodate sheets of paneling (or various length boards) up to 51 in.

The 1¼-in.-deep well at the rear keeps small tools and parts from being accidentally knocked off—or from dancing off when you are doing some heavy pounding. The well is simply a pine frame that's glued to ¼-in. hardboard.

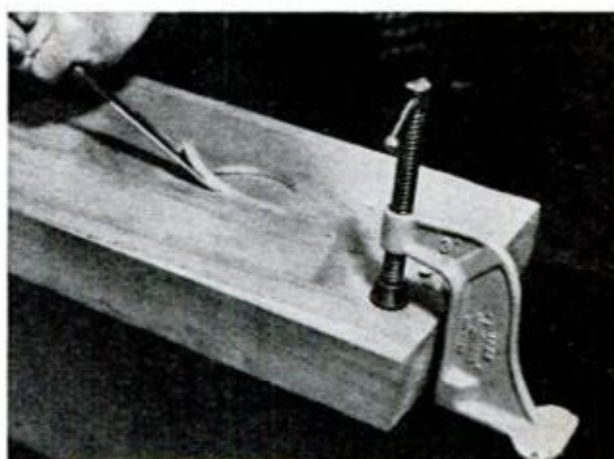
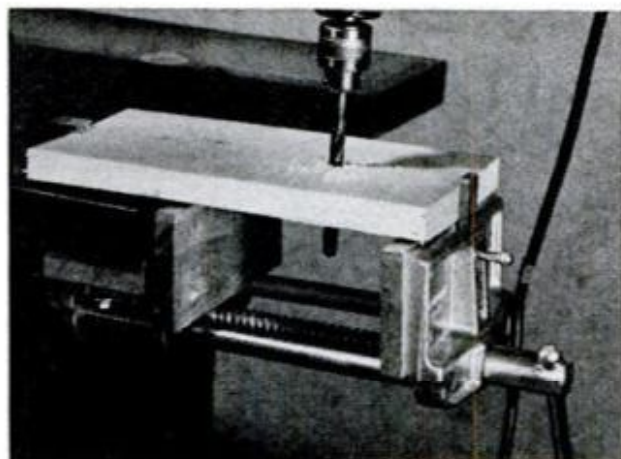
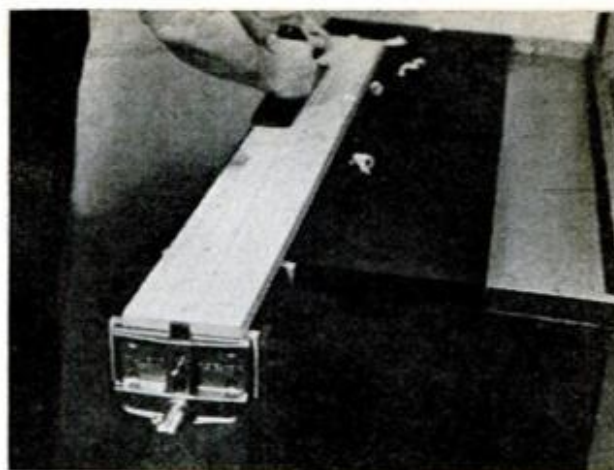
● **How to build it.** Assemble the steel (Pridecraft used here) legs according to the instructions which you get with them. Before tightening bolts, check the entire assembly with a framing square. Install

TYPICAL BENCH USES:

PLANING A LONG BOARD. (right) is much easier when workpiece is held between backvise and "dog." This holding method is just as good when you use a portable belt sander

DRILLING THROUGH A BOARD (below) is a snap if it's held firmly. There's no chance it will whirl about as the drill breaks through

CLAMP-TYPE HOLD-DOWN (below, right) is an inexpensive supplement to a backvise that can be purchased locally at hardware stores



FOR A PRO

By DAVID WARREN

equipment is sure to make building any project more enjoyable

the electrical outlet on the right leg if you are right-handed (in the left leg if a southpaw).

Next, you can cut the top, sides, back and shelf, plus the sliding doors, to size. Drill finger holes in the doors and chamfer the edges with a plane or router so that they will slide easily.

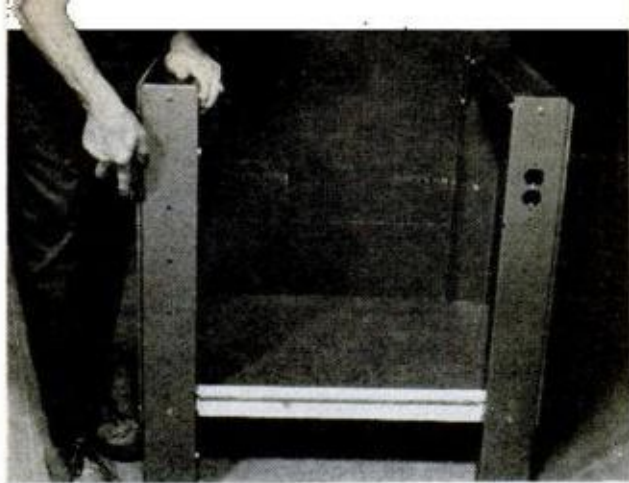
After cutting, remove upper bolt (A in the instructions) from the outside of the leg. With the smooth side of the hardboard facing outward, place top and front edges of board flush with the leg; the rear edge will extend about $\frac{1}{4}$ in. Mark the location of the hole using the leg hole as a guide. After drilling the $\frac{1}{4}$ -in. hole, replace the bolt with a longer 1-in. machine bolt. Swing the panel back and mark the location of the other six holes to be drilled. Repeat bolting procedure for all six.

● **The back.** Remove both bolts on the

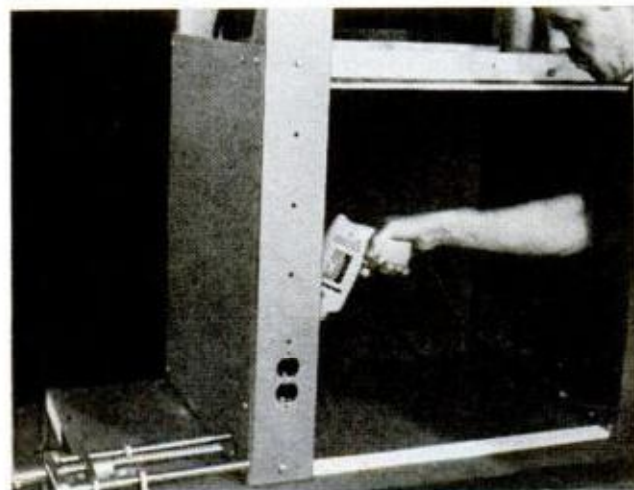
back of each leg and hold the back panel between the overlapped sides. Fasten the back so it extends $1\frac{1}{2}$ in. above the legs. Mark and drill three holes on each side of the back and bolt it to the legs.

Cut the 1x2s for the shelf support and nail and glue as shown in the drawing. Drill and bolt the shelf to the leg stretchers. Nail and glue the shallower grooved sliding-door channel to the shelf. Position it so that half the rear channel intercepts the rear edge of the legs. Mark and drill the four $\frac{1}{4}$ -in. bolt holes in the top. Place sliding doors in their channels and bolt the top down.

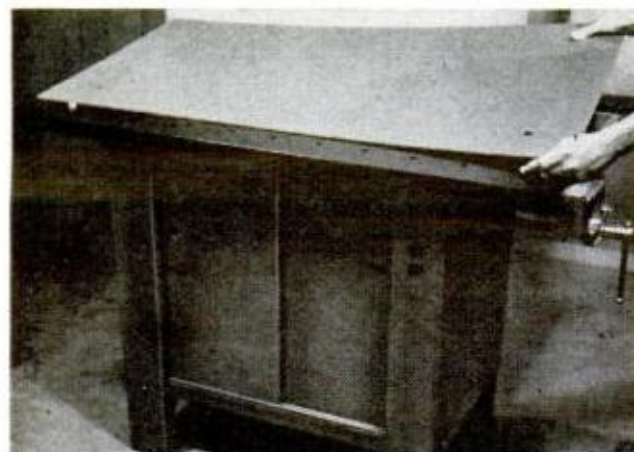
● **Benchtop.** Lay the hardboard on a flat surface, apply a bead of epoxy glue along the edges of the Benelex and position it on the top. It isn't desirable to clamp an epoxy glue joint, but a shim here and there underneath the hardboard may be



LEG ASSEMBLY goes fast if you follow the instructions that the manufacturer includes in the package

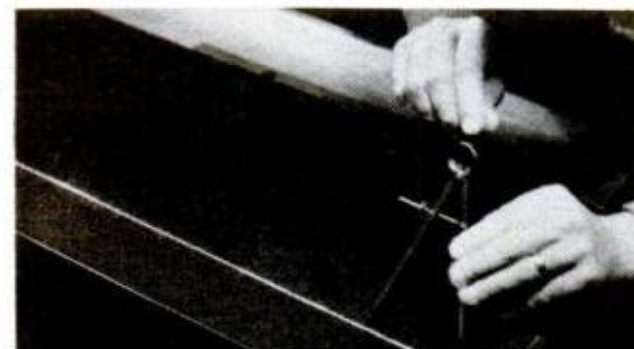


POSITION BOARD, then drill the holes for bolts. Use 1-in. machine bolts to fasten the sides and back

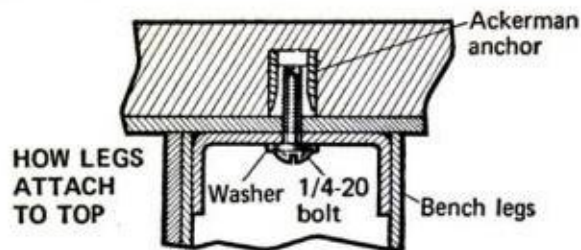


NEXT STEP is to glue a 2x4-ft. sheet of hardboard to Benelex using bead of epoxy glue around edges

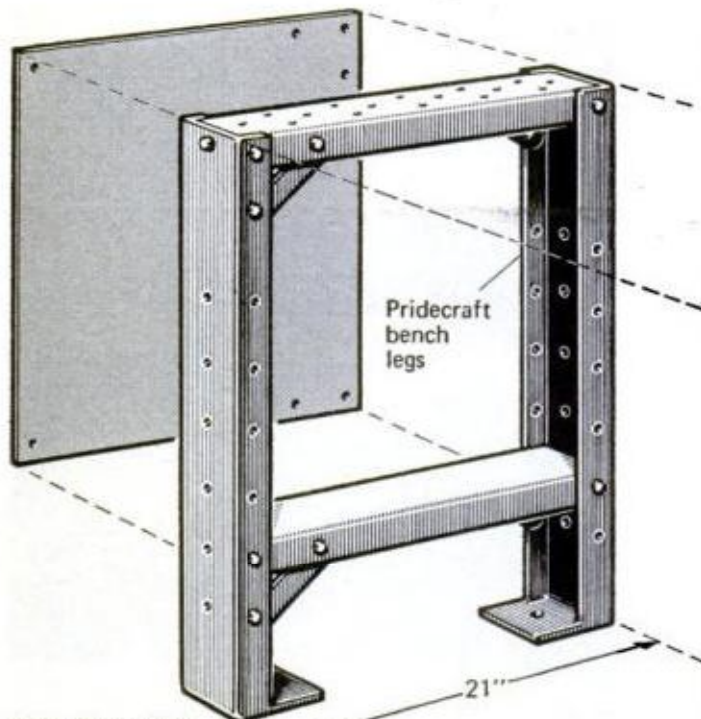
CENTERLINE with a chalkline, step off for dog holes 4 in. apart and then drill 5/8-in holes



HEAVY-DUTY WORKBENCH

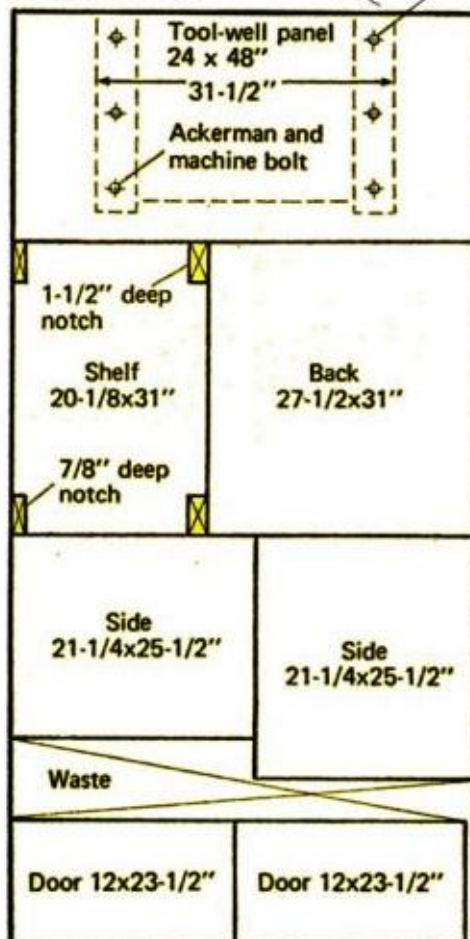


HOW LEGS ATTACH TO TOP



Note: Base width can be varied to suit owner's needs

1/4" flathead bolt



CUTTING PLAN

needed to insure that top and Benelex touch all around.

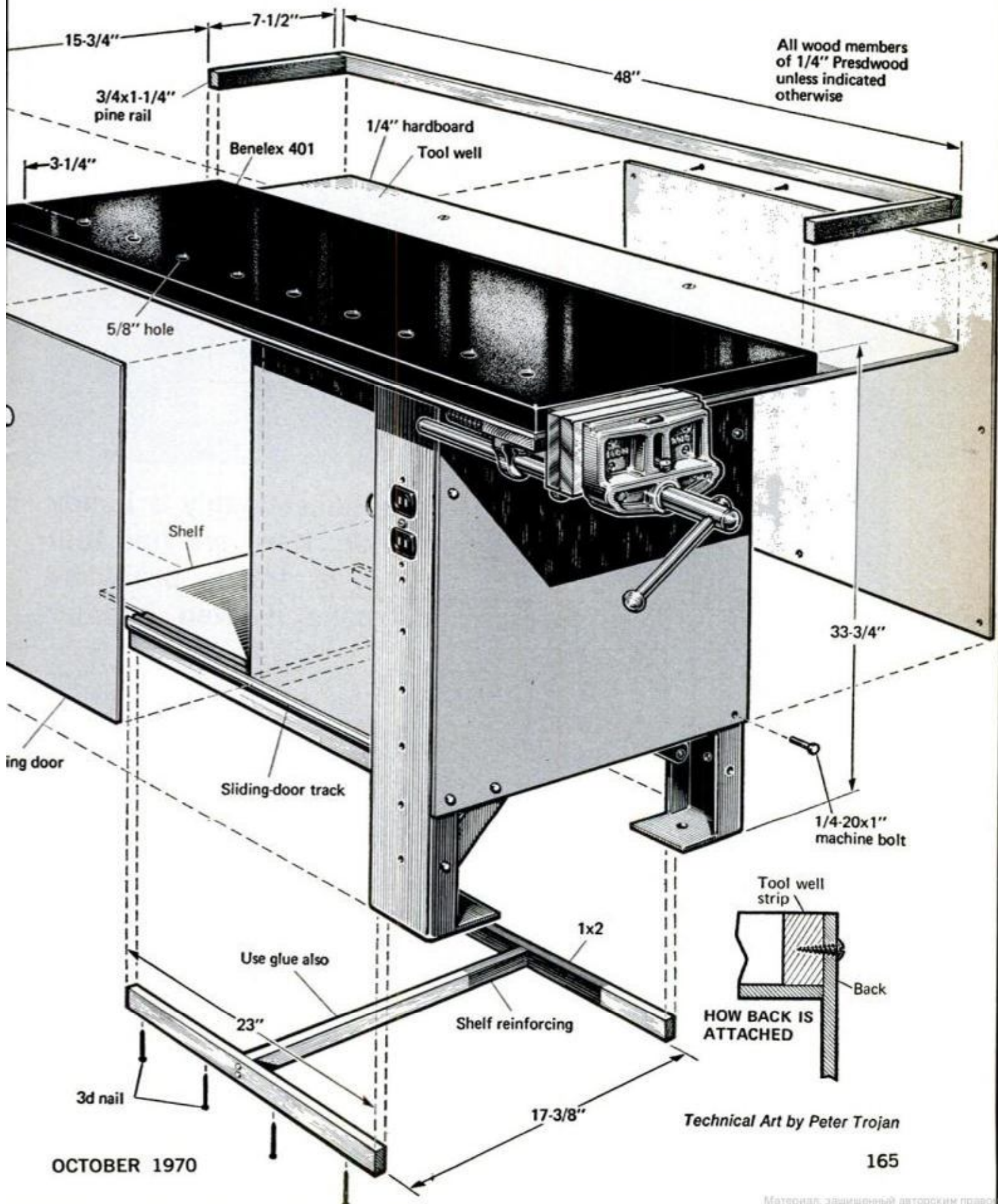
When the glue has dried, fasten the pine strips that form the tool well. To complete the top, plane a 1/8-in. chamfer along the outer edges.

● **Installing the back vise.** Unscrew the nut portion of the vise to disengage the

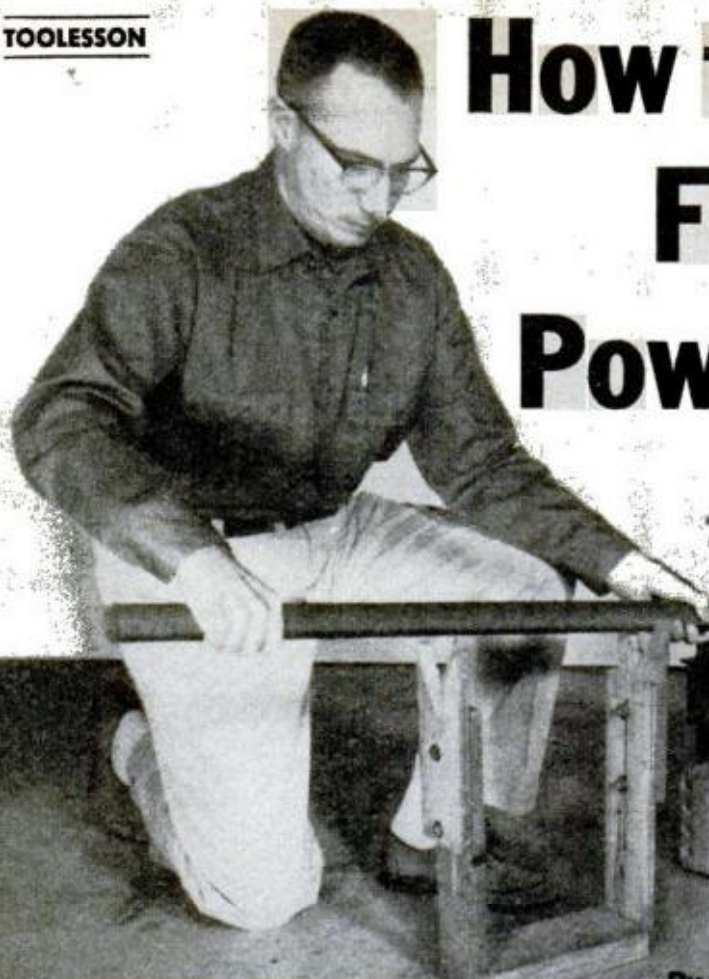
two portions. Cut the vise cheeks (which prevent marring a workpiece) slightly oversize. As with the electrical outlet, place the vise to suit your right or left-handedness.

Use any scrap 3/4-in. material to shim the vise so the upper metal edges are 1/16

(Please turn to page 230)



How to Get More From Your Power Hacksaw



By PARRY C. YOB



WORK SUPPORT STAND is made of $\frac{3}{4}$ -in. pine and built to a comfortable working height. Slots in the sides make the unit adjustable to particular tasks

T-SHAPED SUPPORT speeds work by insuring prompt termination of cut. Support is bolted to permit its removal when you need to cut odd-shaped workpieces



It's unquestionably a handy machine. Here are tips that will solve tough problems and make it even handier

YOUR DECISION to tackle a metal-working project—or *not* to tackle it—may often be based on the amount of time it takes to cut stock to length even before you begin machining or welding. Torch cutting is fast, but can cause poor fits. And a torch can't be used for such metals as brass, bronze or stainless steel.

The obvious alternative is a power hacksaw: I feel that the most satisfactory type is a small drag-cut machine. Although slower than the band type, its lower initial cost and cheaper blade cost make it attractive for a home shop. Also, its automatic shutoff feature allows you to do something else while the machine is making a time-consuming cut.

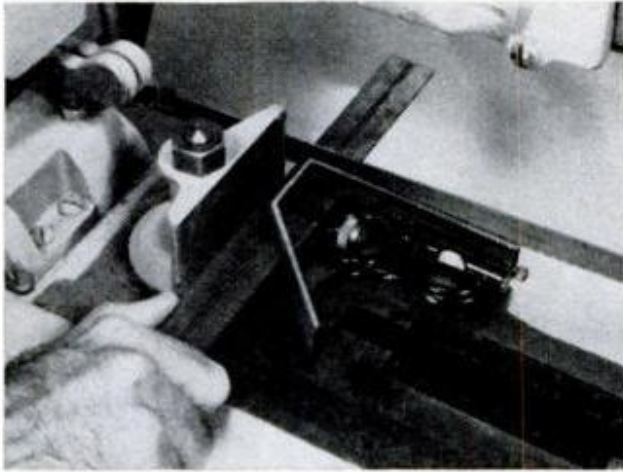
To get the maximum from your power hacksaw, proper setup and maintenance are essential. For best performance, the saw and motor should be mounted on a

suitable low base. Don't make the mistake of using a high, unstable stand and do allow at least two feet of space from the wall, or you will be moving the saw every time you need to cut a long-length piece.

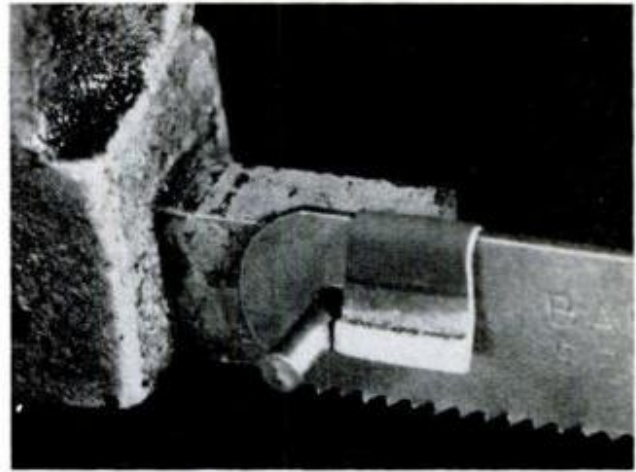
The automatic shutoff works well when properly adjusted, but toward the end of the cut, the unsupported piece will bend

downward, allowing the blade to cut into the face of the work. When the saw is unattended, the cut may run lengthwise of the bar for as much as a quarter of an inch before the piece falls free or the blade breaks. A simple T-shaped support, attached outboard of the saw blade, will

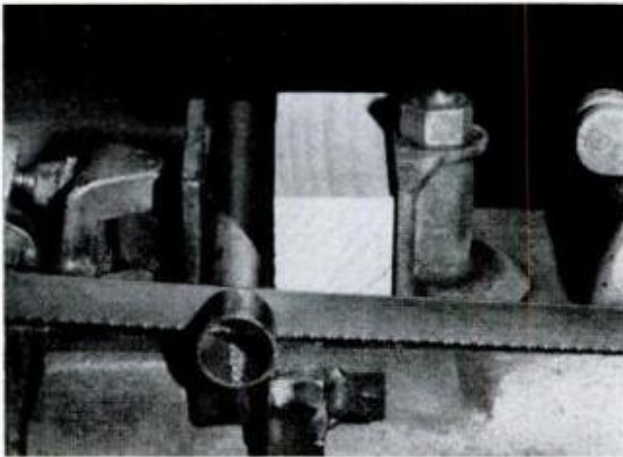
(Please turn to page 232)



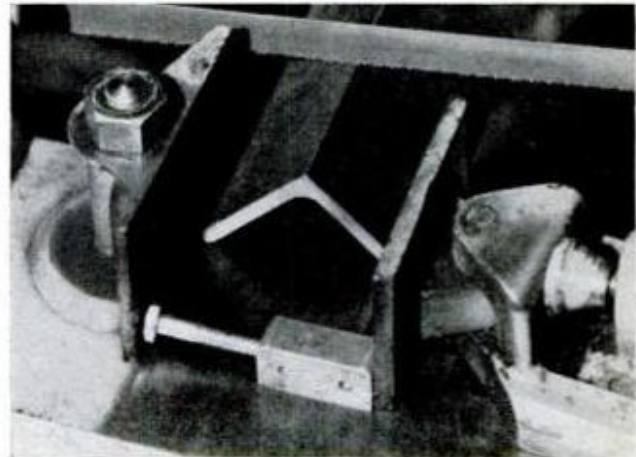
USE A SQUARE to check fixed jaw adjustment on the saw vise. Remove the clamping jaw to make job easy



METAL SHIM, properly placed, will keep blade from wandering. Without it, saw can drift 1/2 in. or more



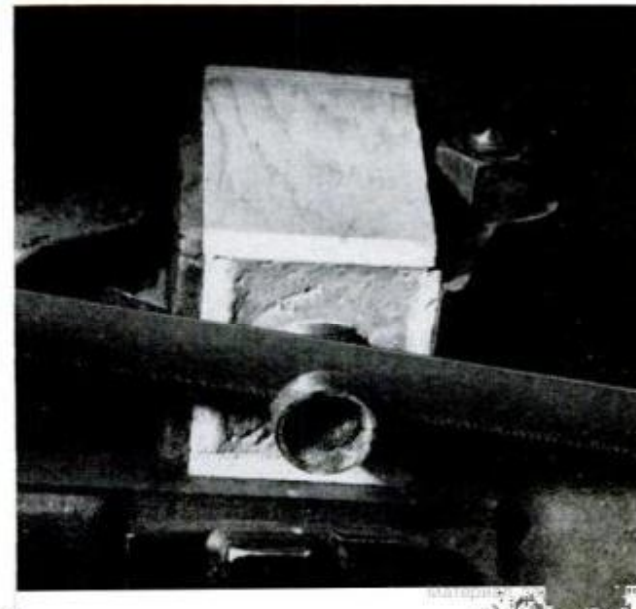
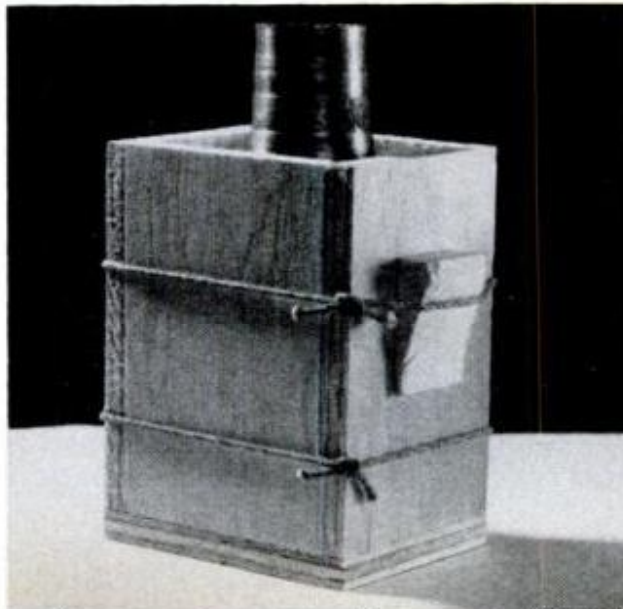
TO CUT SEVERAL PIECES from same width stock, distribute wear by using block between jaw and work



SHORT PIECES are held more securely in the vise if you make a jack to spread, and keep, jaws parallel

SMALL WOODEN FORM lets you mount an irregular piece in plaster cement. Coat part with grease first

HELD SECURELY in cement casting, a difficult piece is easily cut. Cement cracks away with hammer taps





The Right Way To Paint With Spray Cans

HOLD CAN 10 to 12 in. from work; keep it moving parallel to surface to avoid paint build-up and runs

Photos by Robert Borst

WHILE THE PRESSURIZED spray can has made painting ridiculously simple, there's a knack to handling these self-contained spray guns beyond just pressing the button.

With the following hints from experts at Kerr Chemicals, Inc., Des Plaines, Ill., and a little practice, anyone can become an expert painter and achieve professional-looking finishes.

The brush-mark-free finish, plus no after cleanup, easily justifies the somewhat higher cost of aerosol paints. Too, leftover aerosol paint stays fresh in the sealed container; there's less waste.

Since you can't reach into a spray can to mix the contents with a paddle as you do with ordinary paint, aerosol paints are mixed by shaking. Most aerosol cans have a steel-ball agitator which functions as a stirring paddle. If, when shaking the can,

you can't hear the agitator, it may be imbedded in the pigment. To free it, snap your wrist a few times. As soon as you hear a rattle, continue to shake for a minute. True-color reproduction and a clog-free nozzle depend on thorough shaking.

Mask the area around the object or surface to be painted. The temperature of the can should be about 70° F. or warmer. If outdoors, paint on a calm day or in a wind-sheltered area.

Hold the spray can 10 to 12 in. from the object. Point the can an inch or two to one side of the surface. Start moving your hand. As it comes close to the edge of the surface, press the spray head. Stay parallel to the surface in one direction. Stop the spray as soon as it passes the far edge at the end of each stroke.

If you move too slowly, the coating will run and drip. Should this happen, stop

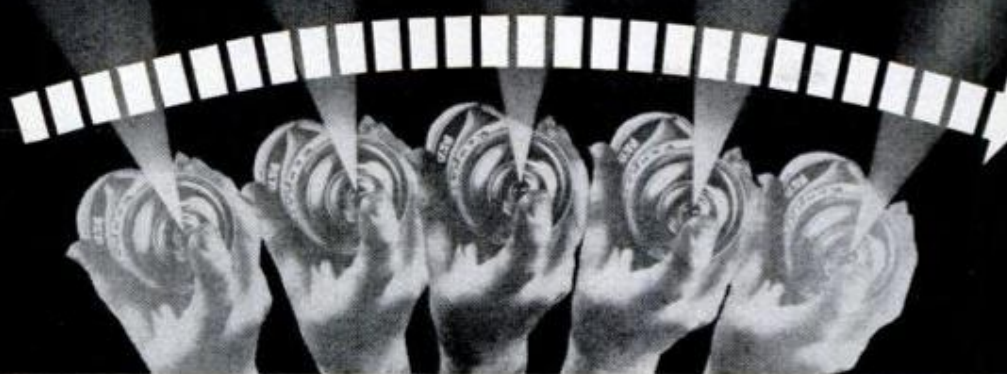
Coating too thin

Coating too heavy here

Coating too thin

WRONG WAY

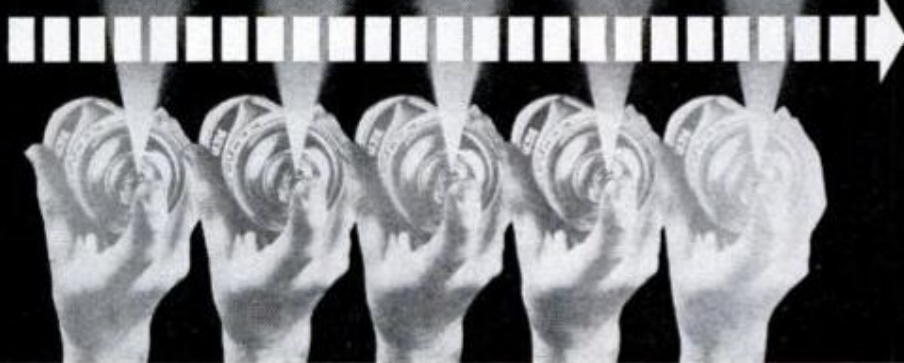
PHOTO DIAGRAM at left shows what happens when you paint a vertical surface with a sweeping motion. The distance between spray head and surface varies, producing a paint film which is heavy at the center and light at the ends



Uniform coating

RIGHT WAY

PAINT GOES ON in a uniform layer when distance between spray head and surface is same throughout parallel sweep. Always start spraying before reaching beginning edge of work and stop after passing far edge. Keep the can moving



spraying, wipe off the paint with a lint-free cloth and start over.

Since several thin, even coats will give you a smoother, more professional-looking job than one thick coat, go back after a few minutes to get coverage and hiding quality. Aerosols paints are generally quick-drying. You can apply succeeding coats in as little as 5 minutes. Repeat until the surface is covered. The paint will cure completely in 12 hours.

Paint hard-to-reach places first. When the can is full, you can spray in any position except upside down. Finish up on accessible, vertical surfaces where the can may be held nozzle up. When you tilt a nearly empty can, turn the spray head until the siphon is in the lowest part of the can.

While painting, pause occasionally and shake the can. This action has no effect on the propellant gas, but keeps the paint mixed. If the spray still seems to lose force, clear the nozzle. Turn the can up-

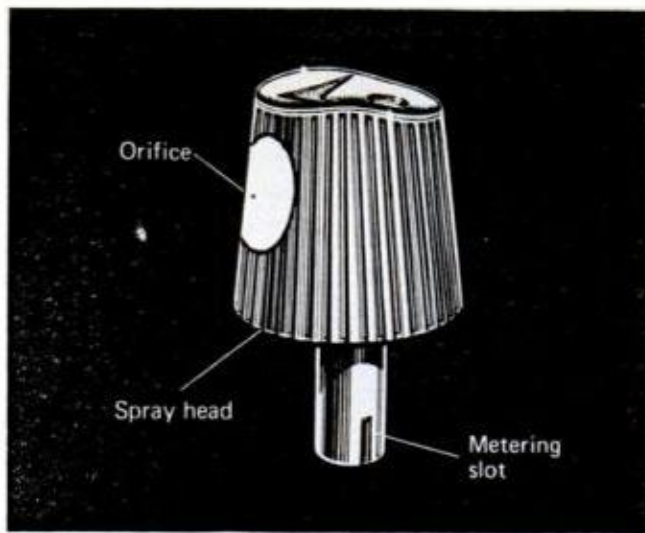
side down. Press the button and hold it for one second. Aim the nozzle at a dropcloth or newspaper as some paint will be forced out of the valve.

Always clear the spray head when the job is done and paint is left in the can. This will leave it free for the next job.

If necessary, the spray head can be pulled off and further cleaned by running a pin along the metering slot at the base of the button. Replace it on the valve carefully to avoid releasing any paint. Wipe off any paint around the nozzle and protect it with the cover of the can.

Most makers supply enough paint to cover about 24 sq. ft. A few provide enough paint in a standard 16-ounce can to cover up to 32 sq. ft. Aerosol chemists say actual coverage varies with the porosity of the surface and how you apply it.

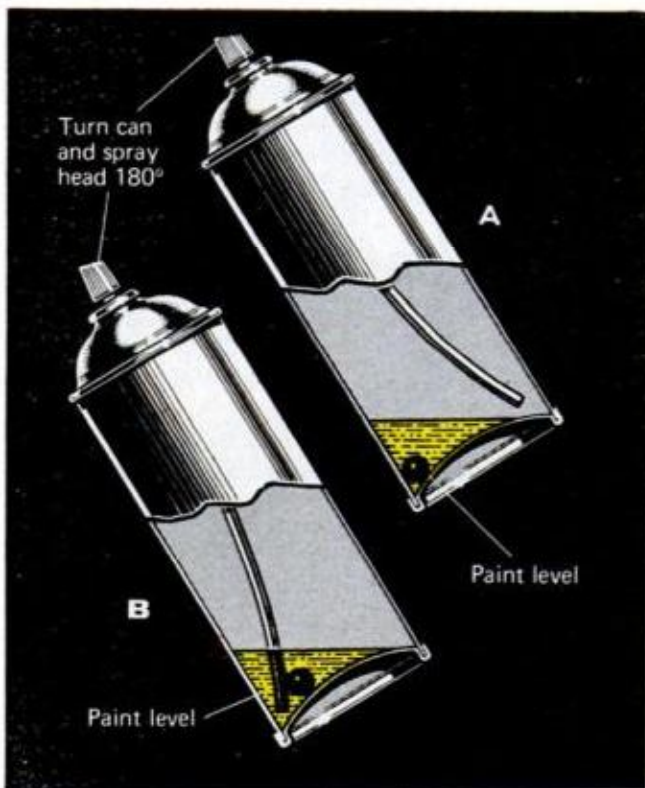
You can't tell how much paint you're going to get by weight. The propellant gas in some aerosols weighs more than the



TYPICAL SPRAY HEAD has metering slot in stem. If spray fails, remove head, clean slot with thumbnail



WORK AWAY when spraying flat surface so over-spray (mist) settles ahead of full wet coat following

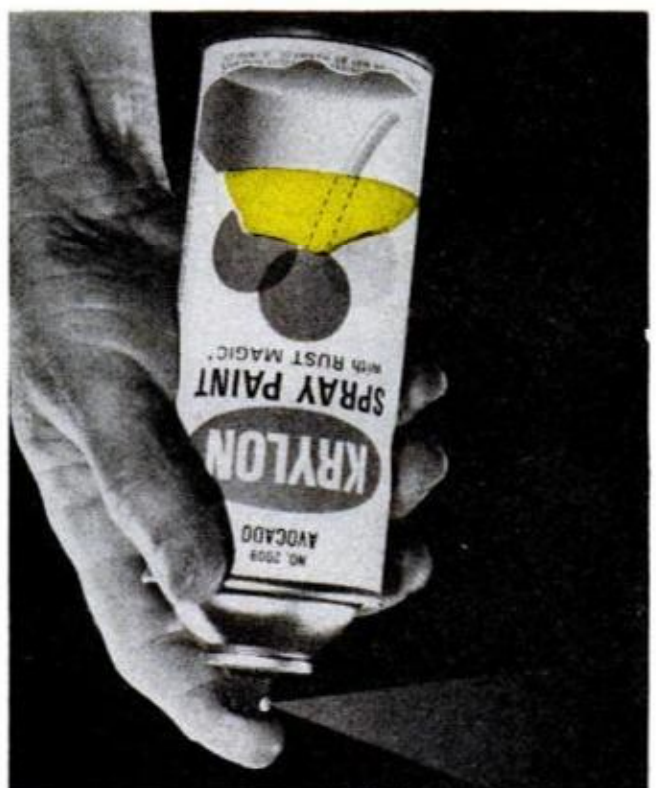


PAINT IS LOW and can won't spray when tilted? Give spray head half turn; tube may not be in paint

The heavier can is likely to hold more gas (which weighs 11 lbs. per gallon) than paint which weighs only 8 lbs. per gallon. Read labels carefully. Choose a can that specifies "Contents One Pint."

About half of the space in most cans is occupied by the paint. The other half holds gas compressed to 43 lbs. p.s.i. on the average. Two manufacturers (Kerr Chemicals, Inc. and Minit Spray Corp., Des Plaines, Ill.) provide a can with 70 percent paint and 30 percent gas at safe pressures. This is still more than enough gas to empty the can.

Paint is flammable. Sealed paint con-



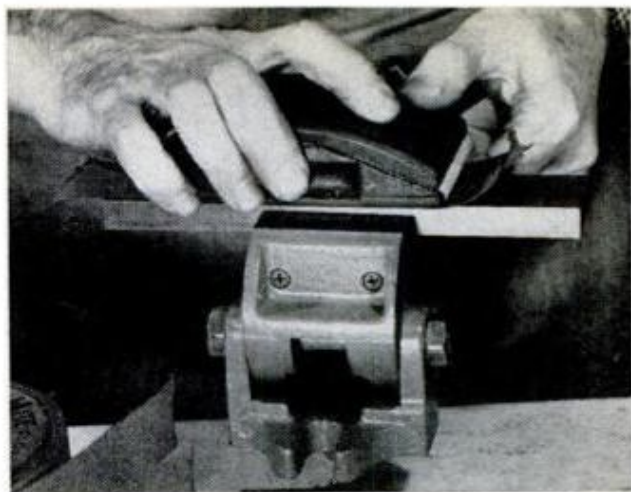
AFTER PAINTING, turn can down and give spray head a few bursts to clean the pin-hole orifice

tainers, regular or aerosol, should not be exposed to heat. Store spray paints in a dry place, out of direct sun rays and out of reach of children. Remember that aerosol cans are under pressure, so do not puncture them. Even if emptied of paint, enough pressure is left to be a hazard. Before disposing of a can, hold down the release valve until the contents, including the gas, are exhausted. Do not expose it to fire. This can dangerously expand any gas remaining and cause the can to burst. Do not use flammable aerosols near open flames or cigarettes, and avoid inhaling the spray or spraying near the eyes. ★ ★ ★

HINTS FROM READERS

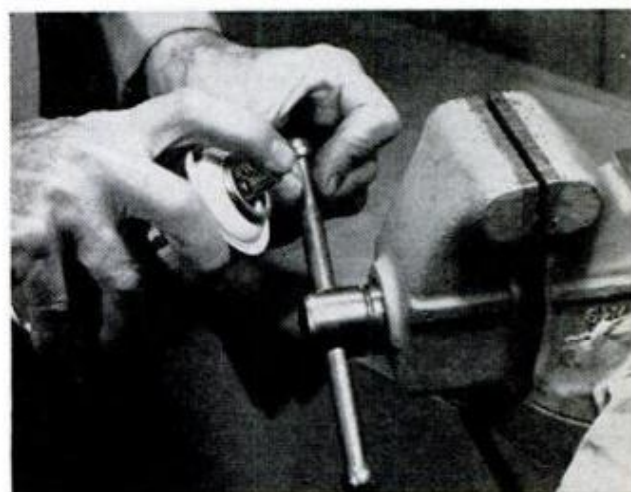
Sandpaper holds abrasive sheet

If you are using a sanding block and want to switch quickly to abrasive paper or cloth of another grit, simply place the new piece between the block and the work. The abrasive already held by the block will grip the back of the new piece firmly enough for normal sanding. The photo shows sandpaper holding a strip of abrasive cloth.—*B. W. Ervin*



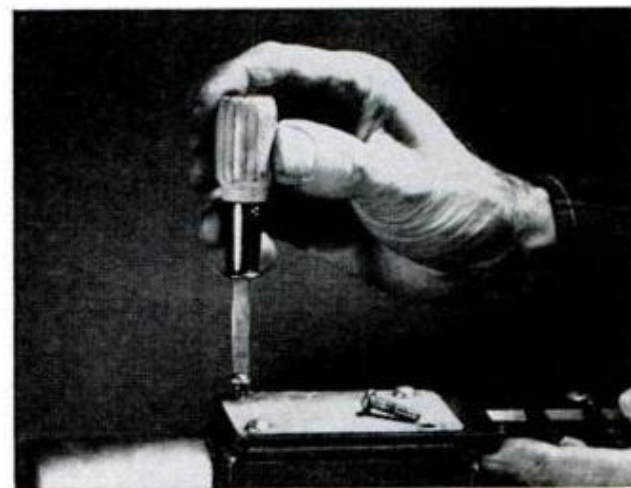
Freeing stubborn vise handle

There's no doubt that an often-used vise will soon have a sticky handle due to an accumulation of dirt and grease. One way I've found to remedy the problem is to apply a solvent such as lacquer thinner to soften the gummy mess. Slide the handle back and forth until it works freely and use a rag to wipe off the softened dirt.—*David W. May*



Restarting a screw in its hole

A good trick for reinstalling a screw—particularly a self-tapping type—is to turn it backward first until you feel a definite jerk (and perhaps hear a click). At this point you can start turning the screw in and you'll find that the threads readily engage. If done by chance, a screw may cut new threads, and then you will have a problem.



Emergency needle threader

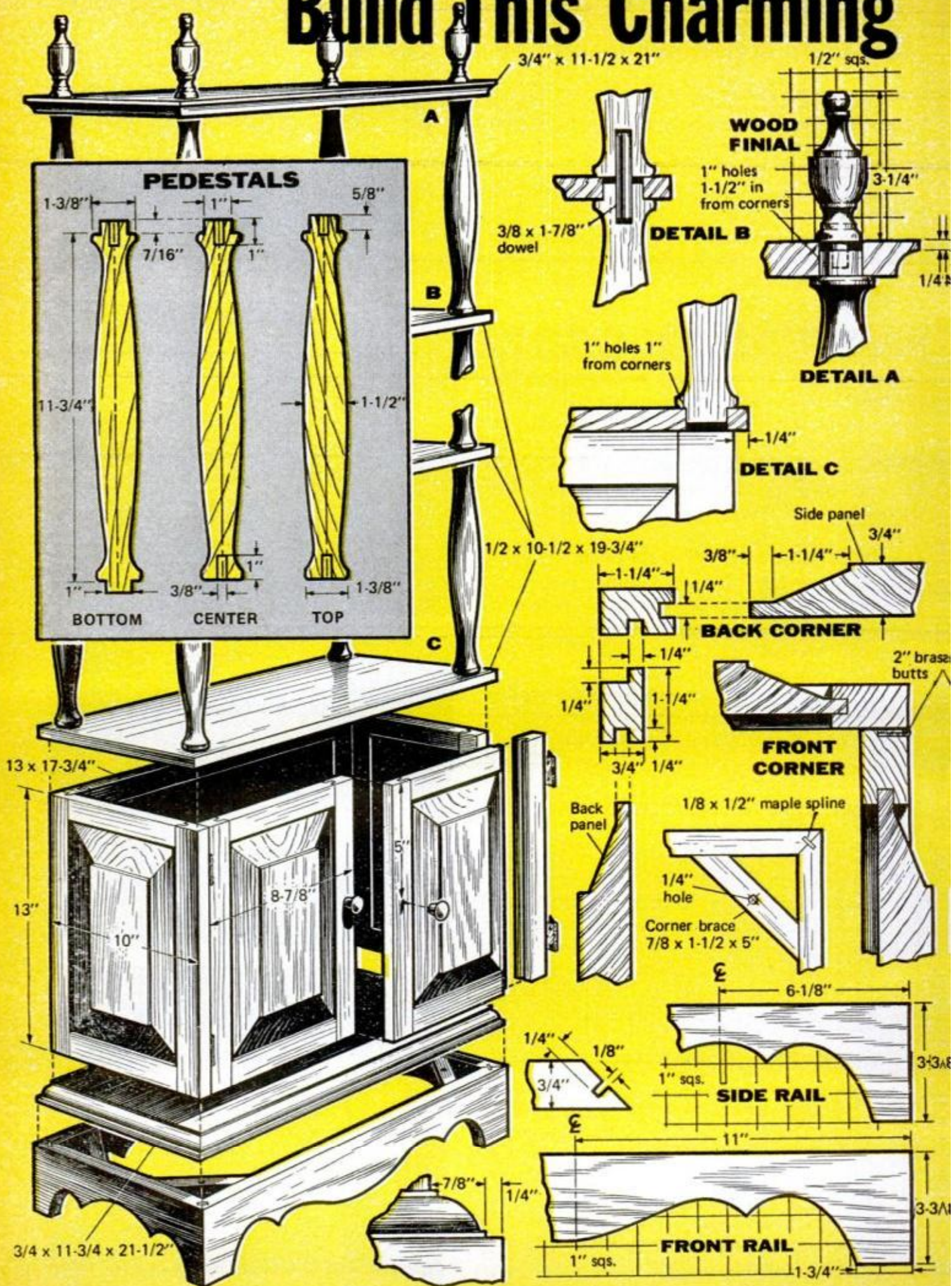
Here's a trick *PM* men can pass on to their wives. Not having time to look for a replacement when my wife broke her needle threader, I made a substitute that worked fine. Using sisal twine I selected a fine thread and passed a loop through the needle's eye. Then, it was simple to insert the wool yarn through the loop and pull it through the eye.—*Lester P. Young*



Wrinkle-free sanding disc

When you're installing a sanding disc on a flexible rubber pad (the type used in electric drills), the disc is more likely to remain free of wrinkles or "waves" if it and its rubber support are bent toward the motor at a couple of points as the bolt is tightened. This seems to expand the hole, counteracting the pull-in tendency.—*W. E. Burton*

Build This Charming



Curio Cabinet

Often called an etagere, this ornamental stand with shelves will be a graceful addition to your home.

By CLARE DAVIS

Technical Art by Fred Wolff

PERFECT FOR DISPLAYING your prized pieces of bric-a-brac, this graceful tier of open shelves and supporting storage cabinet make a handsome piece for the foyer of your home. The original, made of red oak, was finished with sealer and three coats of clear lacquer, but it will look equally as elegant in walnut or any other fine cabinet wood.

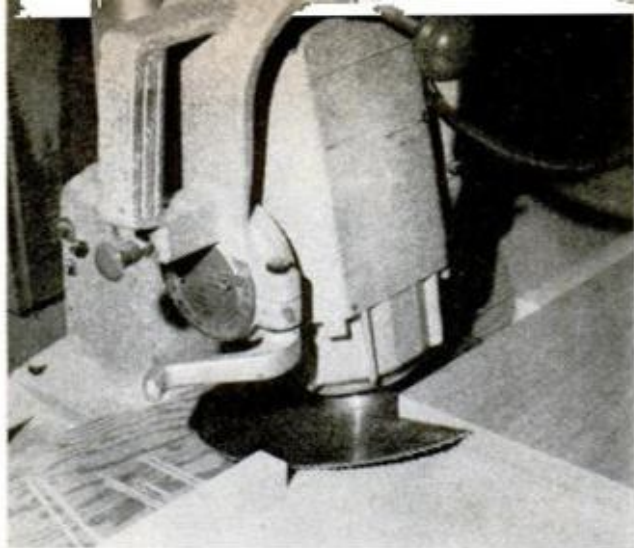
Basically, it consists of three sub-assemblies: a base, a cabinet and a tier of open shelves. The base, measuring $12\frac{1}{4} \times 22$ in., is made of four mitered pieces which are joined with glue and $\frac{1}{8} \times \frac{1}{2}$ -in. hardwood splines. In the original all four members were scroll-cut. The back member could be left plain if the unit is to be placed against a wall. You'll need to make full-size paper patterns for the scrolls for tracing on the work. These are made by ruling off 1-in. squares and drawing in the design as given in the patterns for the front and side rails.

Bandsaw the pieces, then glue and spline them together and check for squareness. Mitered braces ($1\frac{1}{2} \times 5$ in.) are added to the four corners after being counterbored for screws. The latter are used to attach the base to the floor of the cabinet.

The cabinet consists of five raised panels which provide the back, ends and doors. Except for overall size, all are made alike basically in that solid-stock centers are set in grooved stiles and rails.

The raised panels can be formed quickly on either a radial or bench saw by tilting the blade, but you won't be able to form a tongue as shown. Such a shape actually requires a special shaper cutter. However, the tapered cut as it comes from the saw will en-





RAISED PANEL INSERTS of solid stock can be cut with either radial or bench saw by tilting the blade

ter the groove snugly if carefully made. To form a neat $\frac{1}{8}$ -in. shoulder at the end of the tapered cut, each panel is passed face down over the saw with the blade raised a scant $\frac{1}{8}$ in. Notice that tenons are cut on the top and bottom rails to enter the grooves in the stiles.

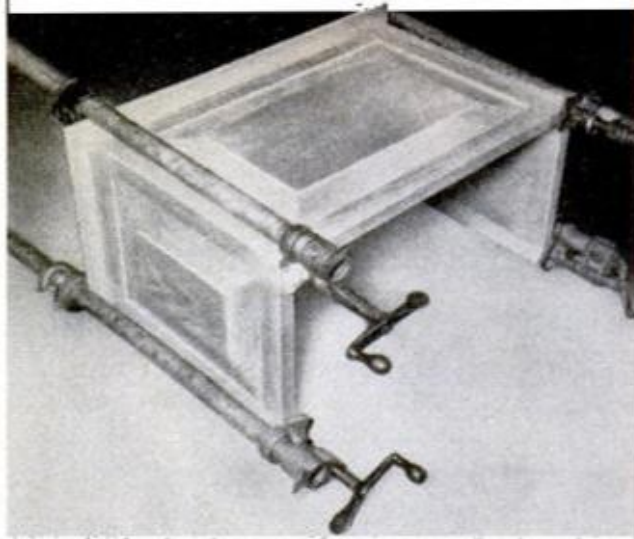
Use glue only on the rail tenons, not on the panels themselves. Finally, glue the ends to the back panel and clamp.

While the glue is drying, glue up solid stock for the floor of the cabinet, cut it to size and shape the edges with a corner-bead cutter in your router. Glue, plus screws driven up from below, is used to attach the floor to the assembly. If desired, the floor can be merely glued and clamped first, and the screws driven later. Here you should watch that the work doesn't shift as it's clamped. The scroll-cut base can now be attached to the floor with screws through the corner braces.

The three $\frac{1}{2}$ -in shelves of the upper assembly are identical in size and all have 1-in. holes bored 1 in. in from the corners. The thicker top shelf has similar holes drilled at the corners but $1\frac{1}{2}$ in. in from the edge. This leaves the turning of the twelve shelf-supporting spindles and the four finials. Basically they are alike except that the four bottom ones have a tenon turned on both ends. Dowels and glue are used to join the spindles end to end. In the case of the finials, tenons are turned to fit the holes in the spindles. Finally, the tier unit is glued to the cabinet and the doors are hinged with brass butts. Small stop blocks are placed on the inside and bullet catches used to hold the doors shut. ★★ ★

SHELF-SUPPORTING SPINDLES rest in holes drilled in corners of shelves. Dowel pins join the spindles

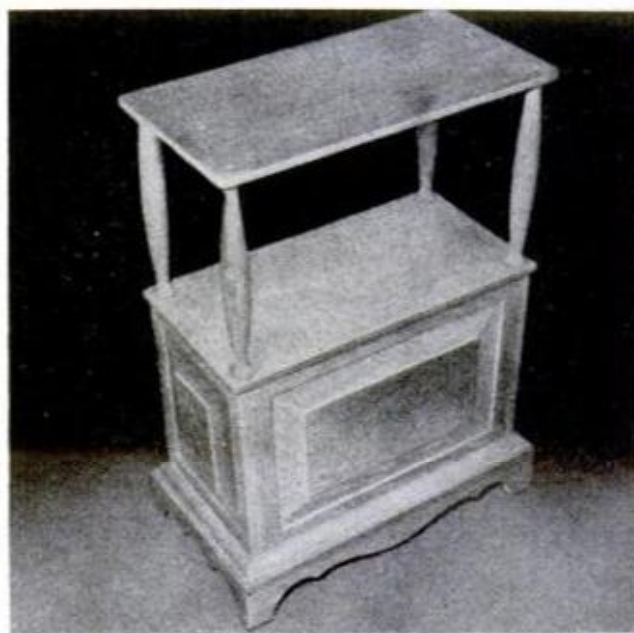
174



CLAMPS ARE USED first in gluing bottom to cabinet base, later flathead screws are driven up from below

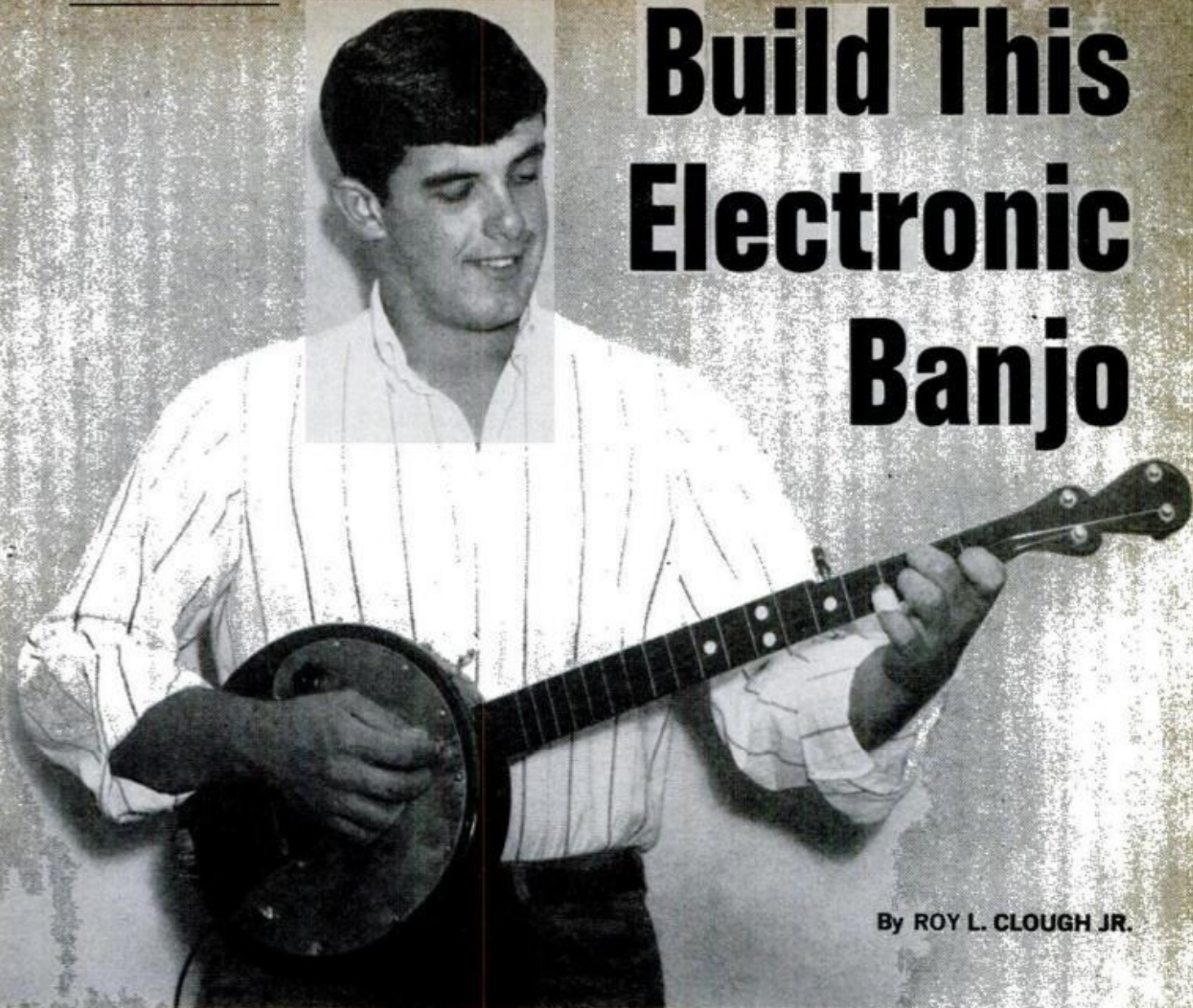


COMPLETED CABINET BASE is shown with scroll-cut bottom attached. Use brass butts to hinge the doors



POPULAR MECHANICS

Build This Electronic Banjo



By ROY L. CLOUGH JR.

Any hi-fi amplifier can power this exciting-sounding electrified instrument. Designed around stock banjo hardware, it is easy to build and fun for your whole family to play

ELECTRONIC musical instruments are big these days, and this snappy little amplified banjo can provide entertainment for the whole family. It combines the fun of building with the fun of playing and makes a good father-son project sure to help bridge the generation gap.

You can build it from scratch or use the plans as a guide to help you restore an old banjo from a second-hand store. Most of the dimensions are not critical except for spacing of the frets and location of the bridge and sound pickup. You can make your own pickup if you wish, as shown in the plans, but it's probably simpler to use a standard guitar pickup available from

musical-instrument shops and electronic-supply houses like Allied Radio. Parts like the tailstock, bridge, nut, frets and pegs are stock replacement items and can be obtained at any good music store.

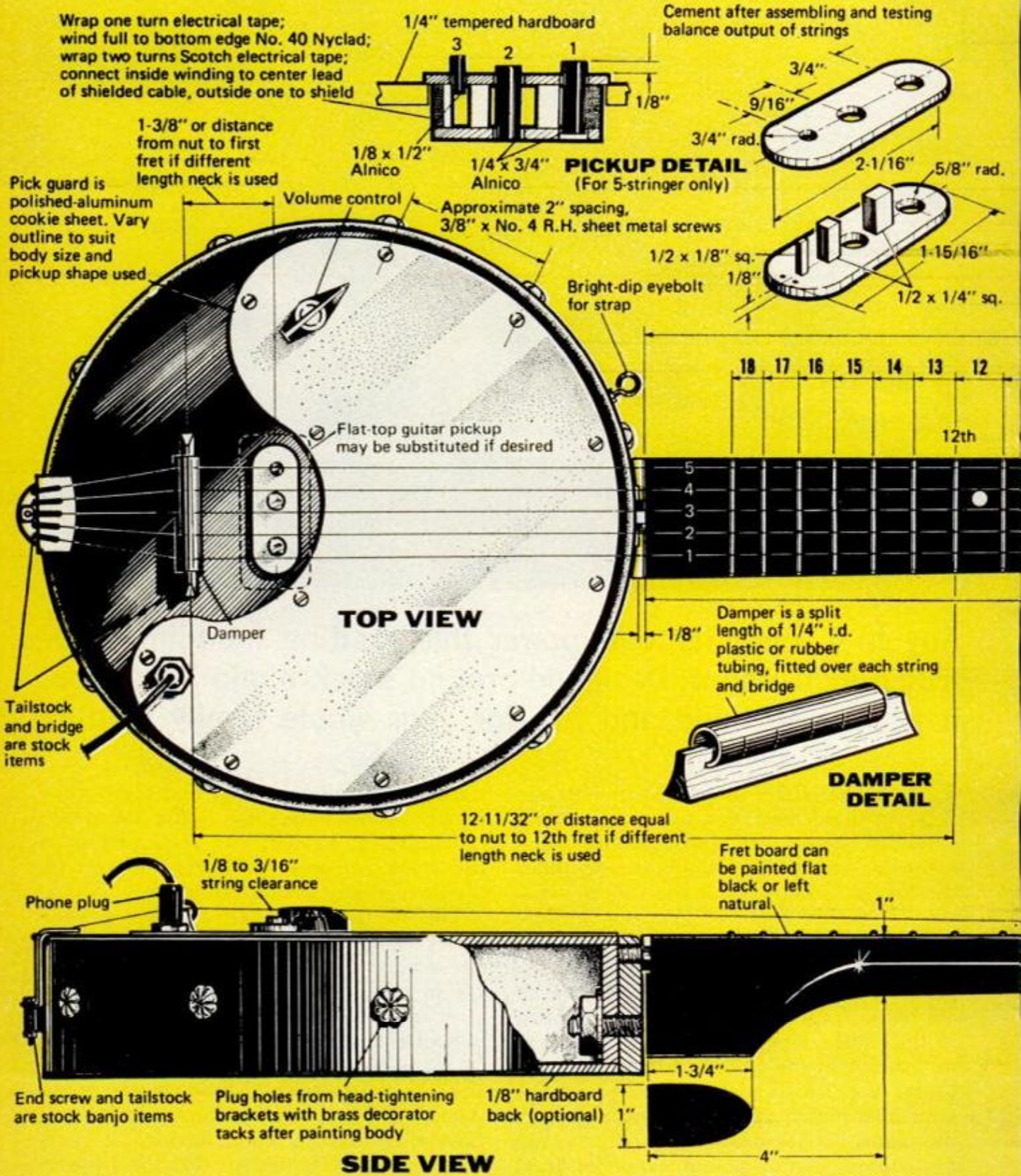
The plans shown here are for a five-string banjo, which is more versatile than the ordinary four-string type. If you prefer to make only a four-stringer, simply omit the side extension on the neck that supports the fifth string. The neck should be made of hard rock maple or some other dense, close-grained, kiln-dried hardwood. Since banjo strings don't pull nearly as hard as guitar strings, a reinforcing rod isn't needed. Cut the neck to

rough shape on a bandsaw or jigsaw, then finish by hand shaping to final contours.

The fretboard is not a separate piece—just the top surface of the neck. You can finish it black or leave it natural. To mount the frets, make very fine saw kerfs across the top of the neck and press the frets into them. They'll usually hold by themselves, but you may want to cement them in with epoxy. You can buy sets of

precut frets and trim them to fit the neck width or get uncut fret stock and make your own. The "nut" is a slotted strip that holds and spreads the strings between pegboard and first fret. Usually bone, it can also be bought ready-made.

The pegs on which the strings are wound can be either the standard banjo friction type or the geared guitar type. If you choose the latter, follow the alter-



nate shape for the pegboard, as indicated by the dotted line. This allows more stock around the bigger guitar pegs.

In spacing the frets, carefully follow the table of dimensions given in the drawing. Note that these are not distances between frets, but are distances from the nut to the fret locations. Also note that the distance from the bridge to the 12th fret (octave) is the same as the distance from the nut to

the 12th fret. The distance between the pickup and bridge is the same as that between the nut and first fret. These dimensions can vary, but the relationships between them must remain the same if a different neck length is used.

The easiest way to make the round body shell is to adapt an old one from a discarded banjo. Since the electronic pick-

(Please turn to page 234)

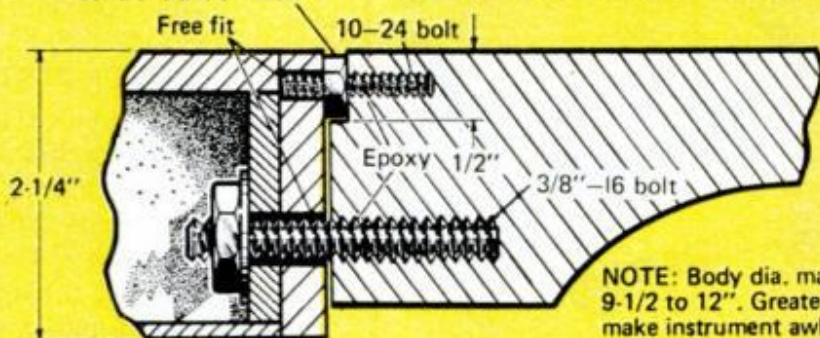
Electronic Banjo

FRET SPACING

1-1-3/8"	10-10-13/16"
2-2-11/16"	11-11-19/32"
3-3-29/32"	12-12-11/32"
4-5-3/32"	13-13-1/32"
5-6-3/16"	14-13-11/16"
6-7-7/32"	15-14-5/16"
7-8-3/16"	16-14-7/8"
8-9-1/8"	17-15-7/16"
9-10"	18-15-15/16"

(See numbered locations on drawing below)

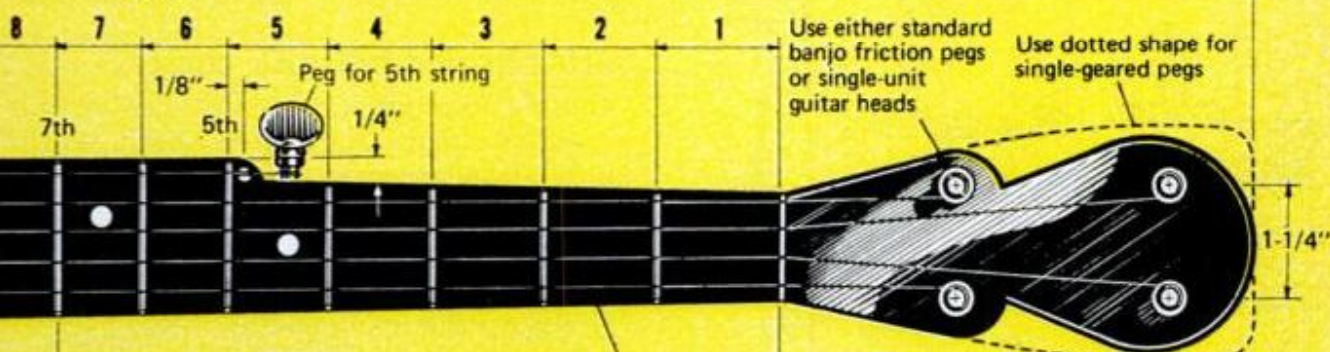
This stud and nut control slant of neck



NECK JOINT DETAIL

NOTE: Body dia. may vary from 9-1/2 to 12". Greater size might make instrument awkward to hold and play

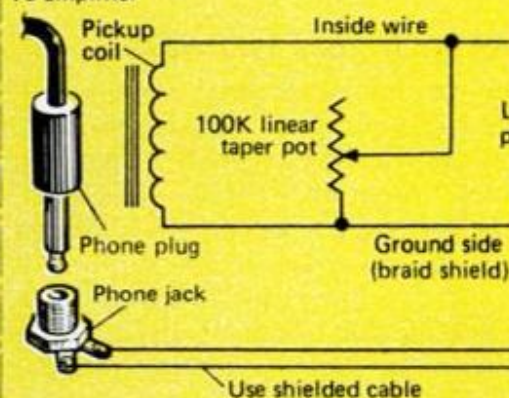
22-3/4"



Use either standard banjo friction pegs or single-unit guitar heads

Use dotted shape for single-gear pegs

To amplifier



5/16" spacing for four or five-stringer

WIRING DIAGRAM

Control pot (see text)

Outside winding goes to ground (shielded side)

Fine wire around magnets

No. 20 stranded hookup wire

Use shielded cable

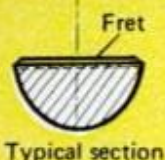
2-1/16"

2-7/16"

15/16"

2"

9/16"



Typical section

1/8" brass screw, 5-string only

5/16"

3/4"

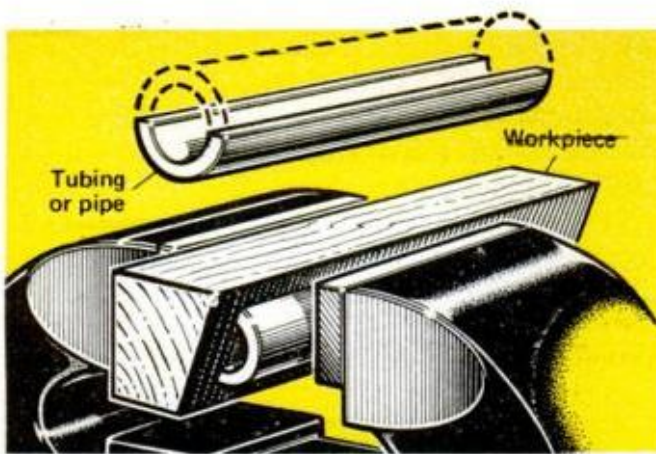
Peg hole

Marker dots: 1/4" dia., 1/16" deep; fill flush with black or white epoxy

SECTION AT PEG FOR 5TH STRING

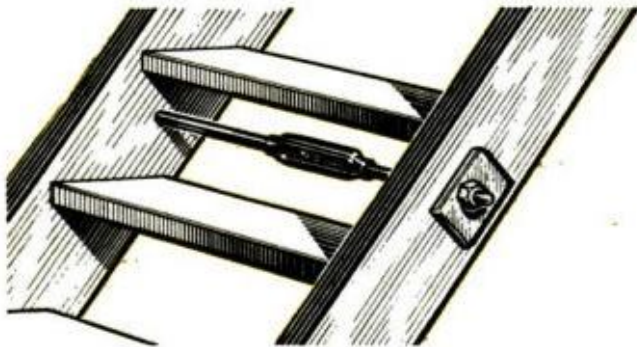
Technical Art by Hank Tomkalski

HINTS FROM READERS



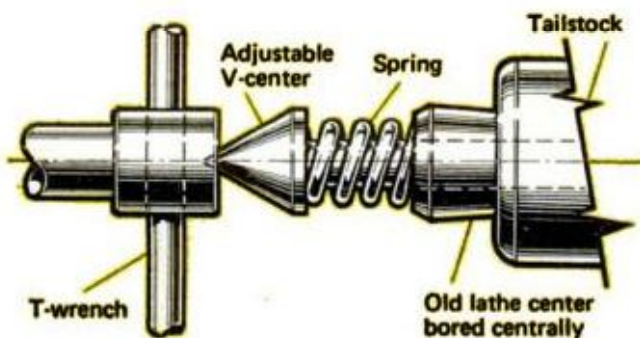
Holding tapered workpiece in vise

If you ever had to clamp a workpiece that has tapered sides in a vise, you know that it is difficult because the piece keeps "squeezing" out. I've found that an easy way to keep it from moving is to place a half section of tubing or pipe between the tapered face and vise jaw. This gives a rocking action which insures tight clamping.—*Harvey Muller*



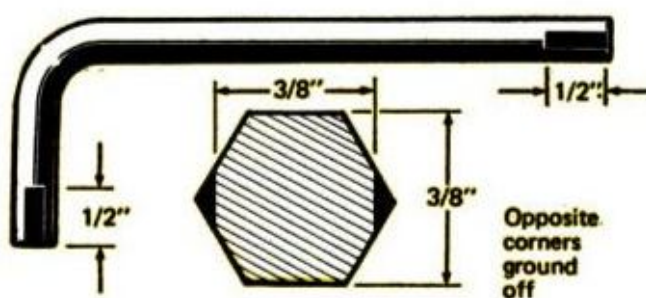
Getting stairs back in shape

Basement stairs are usually of simple construction with treads let into dadoes in the stringers. Occasionally a few treads will start to leave their grooves. To pull the stairs tight again, try using a turnbuckle through the stringers as shown. Use a hefty-size steel plate to serve as a washer to insure against fracturing or splintering the wood.—*George Mayerchak*



Spring-loaded tailstock center

Here's an auxiliary tailstock center that is self-compensating when it's used to guide a tap wrench to thread chuck-held work. It's spring-loaded so it can't exert undue pressure on the tap as it is being fed into the work. It's made by center-drilling an old lathe center, turning a V-point to slip inside and adding a light compression spring.—*R. J. Hill*



Hex wrench goes two ways

You can make a good long-and-short handle for your socket-head wrench, and still allow the hex wrench to perform its intended function. First, select a hex wrench with an over-the-flats dimension of your square-drive socket wrench. Then grind off two opposite corners of the hex cross section for about $\frac{1}{2}$ in. at the ends.

—*Anton M. Barkey*



Bolts cut without damaging threads

For years I have used the method shown to cut all sizes of bolts and nails without damaging threads or nailheads. And the best part is, it saves looking for scrap to drill out and hold the piece for cutting. Simply mount the workpiece in either type of clothespin and then clamp the entire setup in the vise. Try it; it works perfectly.—*A. J. Porder*

Make This Lathe Indexing Attachment

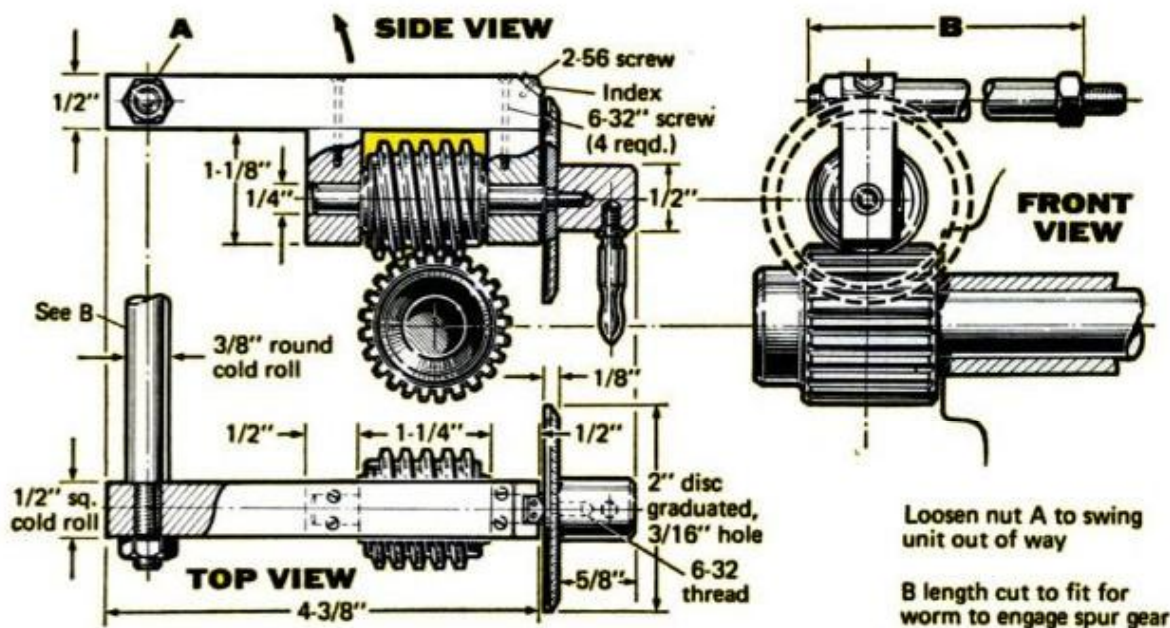
By CHARLES J. KSANDA
Technical Art by Peter Trojan

WHEN I READ Walter E. Burton's fine article on *How to "Plane" on a Lathe* (page 194, Oct. '69 *PM*), the thought occurred that a simple device I have used for circular dividing and angular indexing might be of help to other *PM* readers.

The attachment consists of a U-shaped bracket which holds a single-thread worm, or tangent screw, graduated dial disc and an index that permits accurate settings. The unit is permanently mounted on the headstock of the lathe with a single bolt. One turn of the tangent screw turns the spindle 15° (since the spur gear on the spindle has 24 teeth).

I fitted my attachment with two dial discs: One is divided into 60 parts, the second into 90. Between the two, I am able to graduate a circle to within $\frac{1}{4}$ to $\frac{1}{6}$ of one degree. With appropriate setting of the dial, the circle can be divided into any even or odd number of parts.

The drawing (side view) shows the tangent screw engaged in the spindle spur gear. Directly below, the latter is shown when not in use. To engrave the lines, use a cutting tool mounted on the compound slide and determine the length by using the micrometer scale on the cross-feed screw. ★★★



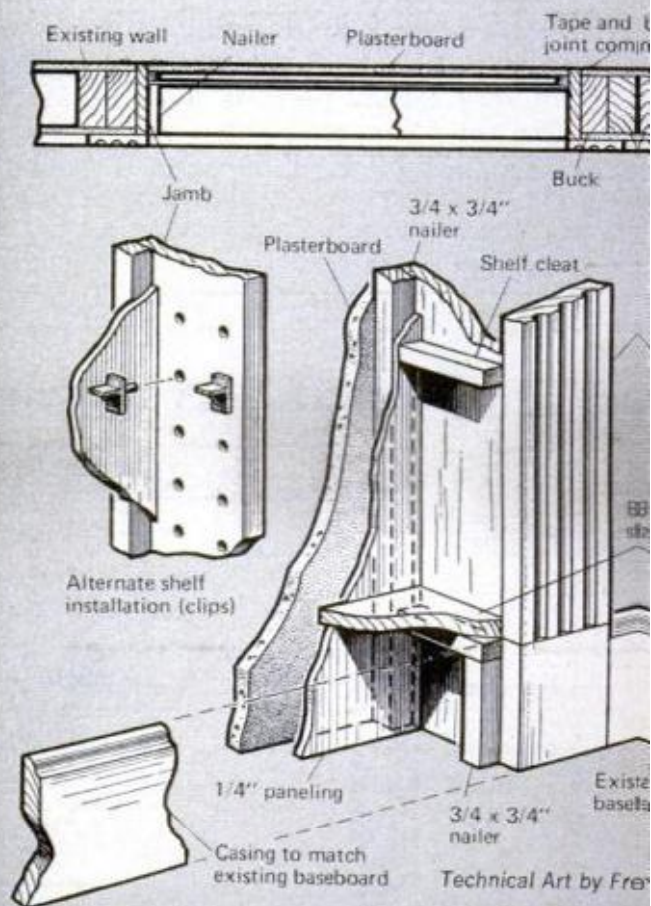
Shelves in a Doorway



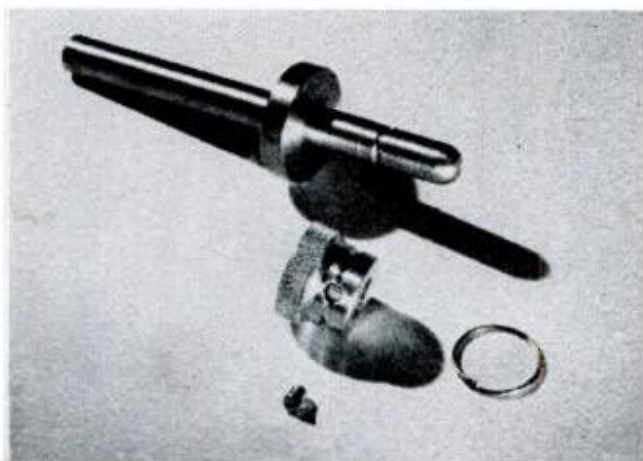
RECENTLY, when we removed the second-floor porch from our home, the question came up: What should we do with the space where the doorway had been? Our solution was to brick up the exterior (to match the existing finish) and use the space inside for an attractive whatnot shelf.

Though my built-in is on an exterior wall, the same shelves can be applied to an interior wall if you are planning to close up a door. For simplicity, I tacked cleats to the jambs to support the shelves, but, if you want a more sophisticated look, drill holes and use the shelf hardware as shown below. Either way, it's bonus space for a knickknack collector.

—S. L. Smay



Solve Holding Problems With a Threadless Nut



ESSENTIAL PARTS: grooved rod, knurled nut with a hole for the pin and a groove for the wire spring

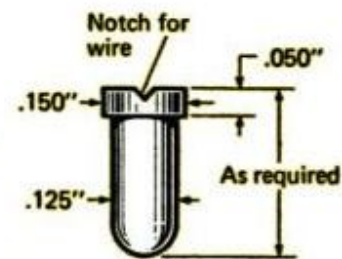
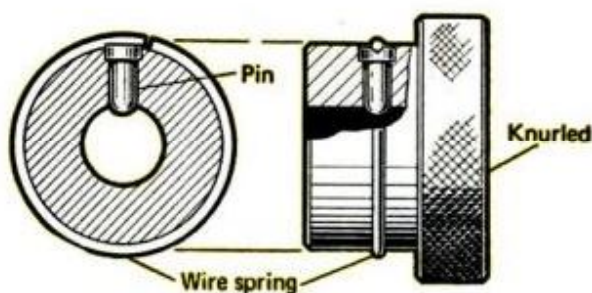
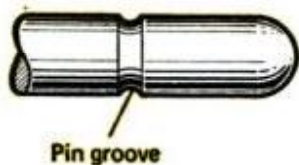


STORING WASHERS is one of many uses for push-pull nut; it's handy way to carry them in toolbox

THERE'S a strong possibility that some of your mechanical holding problems could be solved by an easily made fastening device that, unknown to you, has given you service on office machines and the like. It is a threadless thumb nut which is simply pushed into position and pulled for removal. It's useful where something must be prevented from moving endwise on a shaft or pin but the restraining force need not be great, or where an adjustable stop is needed to indicate certain fixed positions or dimensions.

The nut has a smooth (unthreaded) hole sized to slide freely without excessive play, over the shaft rod or stud that is its "bolt." A ring-shaped wire spring resting in a groove around the outside of the nut seats a round-nose pin in a radial hole extending into the center bore. Pin and hole are tapered for an easy sliding fit, and dimensioned so the rounded-pin nose extends a fraction of an inch into the nut bore when the pin is fully seated. To install the nut, you simply push it onto the shaft, whose rounded end forces the pin outward; when the pin reaches the shaft groove, it moves inward and stops the nut in that position. To shift or remove the nut, simply apply enough force (parallel to the rod) to move the pin back out of the groove.—B. W. Ervin

THREADLESS NUT



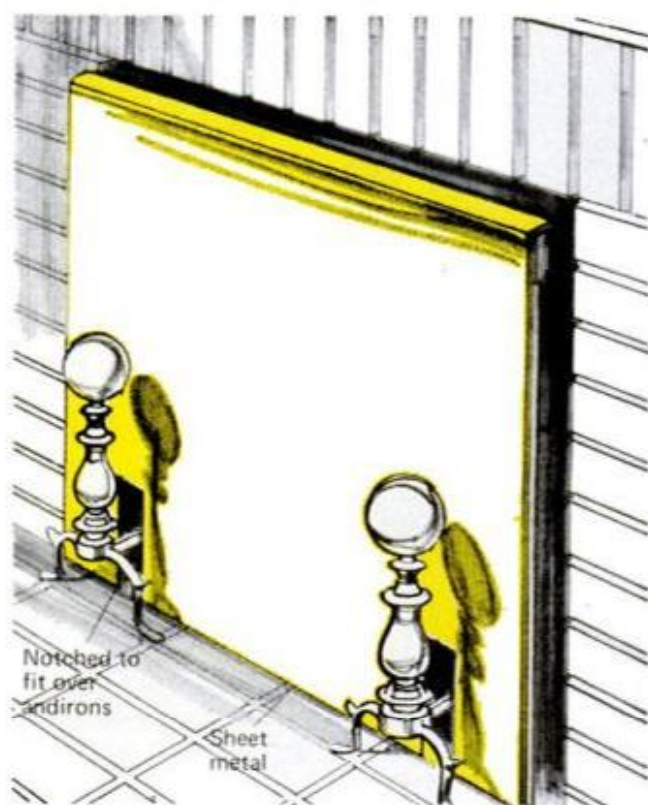
TYPICAL PIN DIMENSIONS



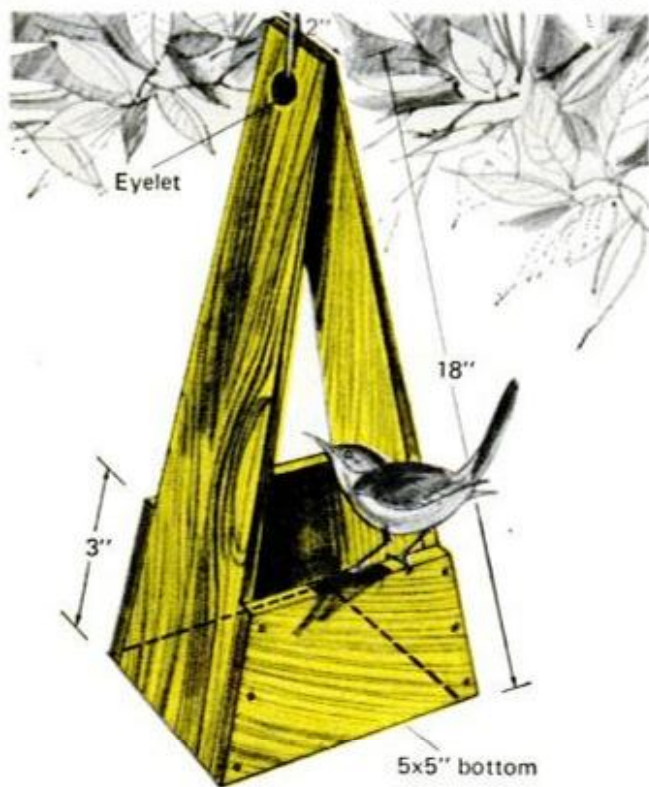
SOLVING



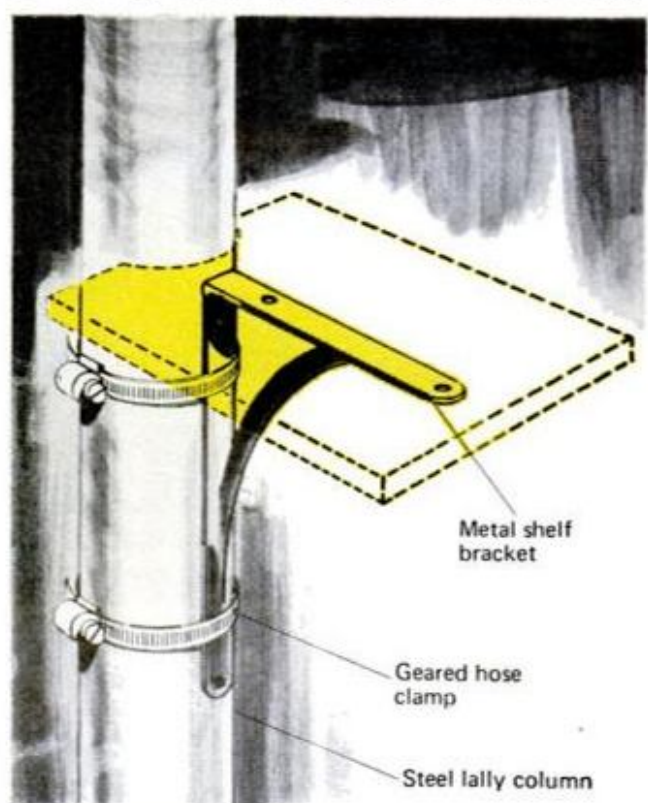
A CONVENIENT WAY TO CARRY SMALL, gummed address labels is to place them in an empty matchbook. Simply moisten the bottom labels and stick them to the back of the matchbook flap.—*Fannie Braunstein*



IT'S SO NICE TO HAVE A FIRE around the house—until you want to retire for the night. To eliminate worry from sparks, I cut a piece of sheet steel to hook over the top of the fire screen.—*D. G. Richardson*



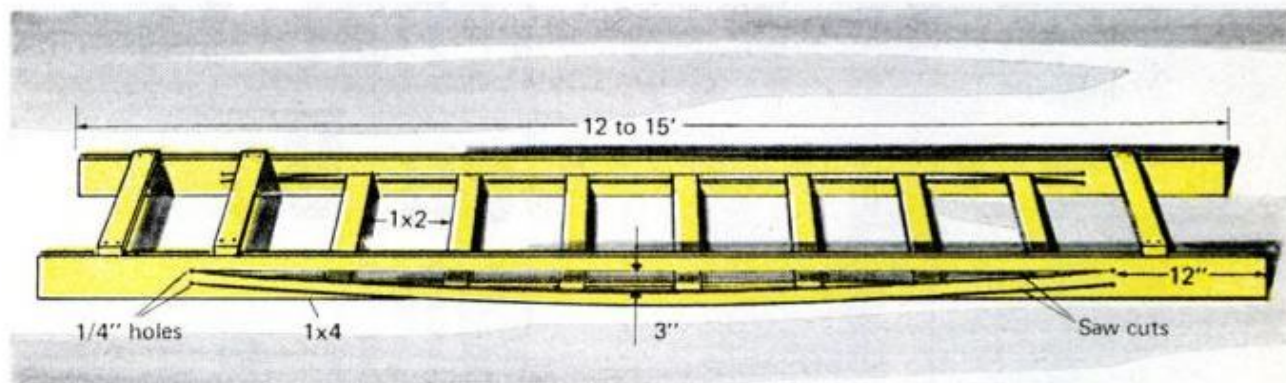
HERE'S A BIRD FEEDER THAT I built of cedar shingles left over from a recent roof job. Two shingles form the sides, remaining pieces are just scrap. Hang it high enough for birds to feed safely.—*P. E. Fiechter*



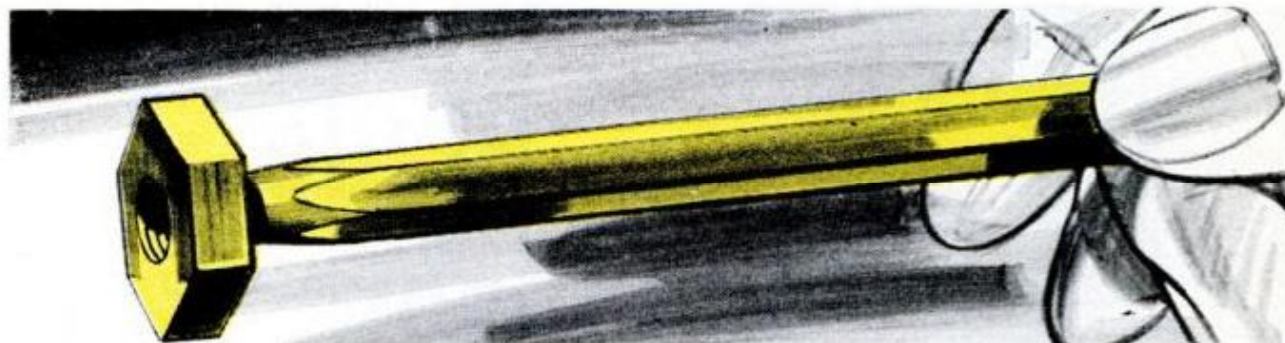
NEED ADDITIONAL SHELVING SPACE in the basement? Make use of the lally columns. Scribe a plywood shelf to fit the column, and use worm-gear hose clamps through a shelf bracket to attach it.—*Peter Legon*

HOME PROBLEMS

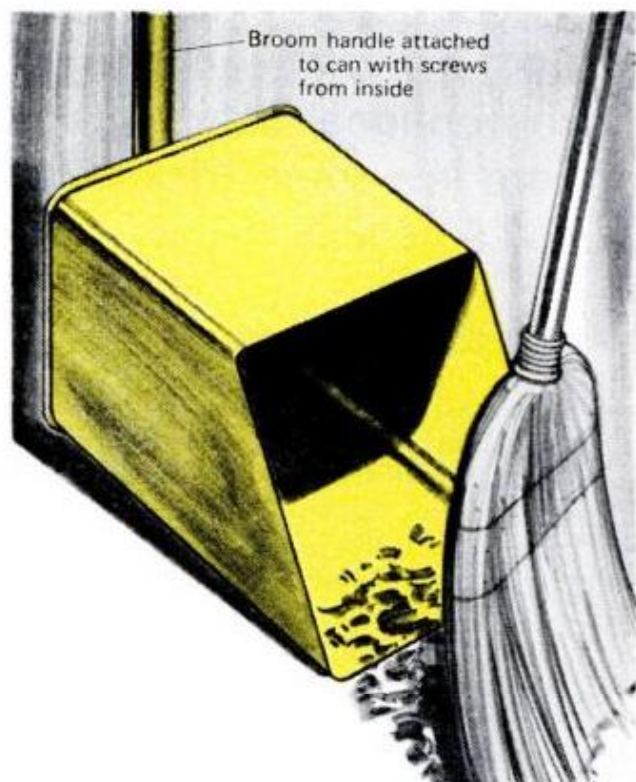
Illustrations by Adolph Brotman, Worman Associates



LIGHTWEIGHT BUT STRONG LADDER features novel "split" construction. Uprights are of 1x4 stock and rungs are 1x2s. For safety use a stain, not paint, to protect the ladder from weather.—*Jean J. Eiler*



TO START A SMALL NUT in a difficult-to-reach place, you merely break off the point of a pencil and then push the nut on the tip remaining. This will hold the nut securely until it's started.—*William Swallow*

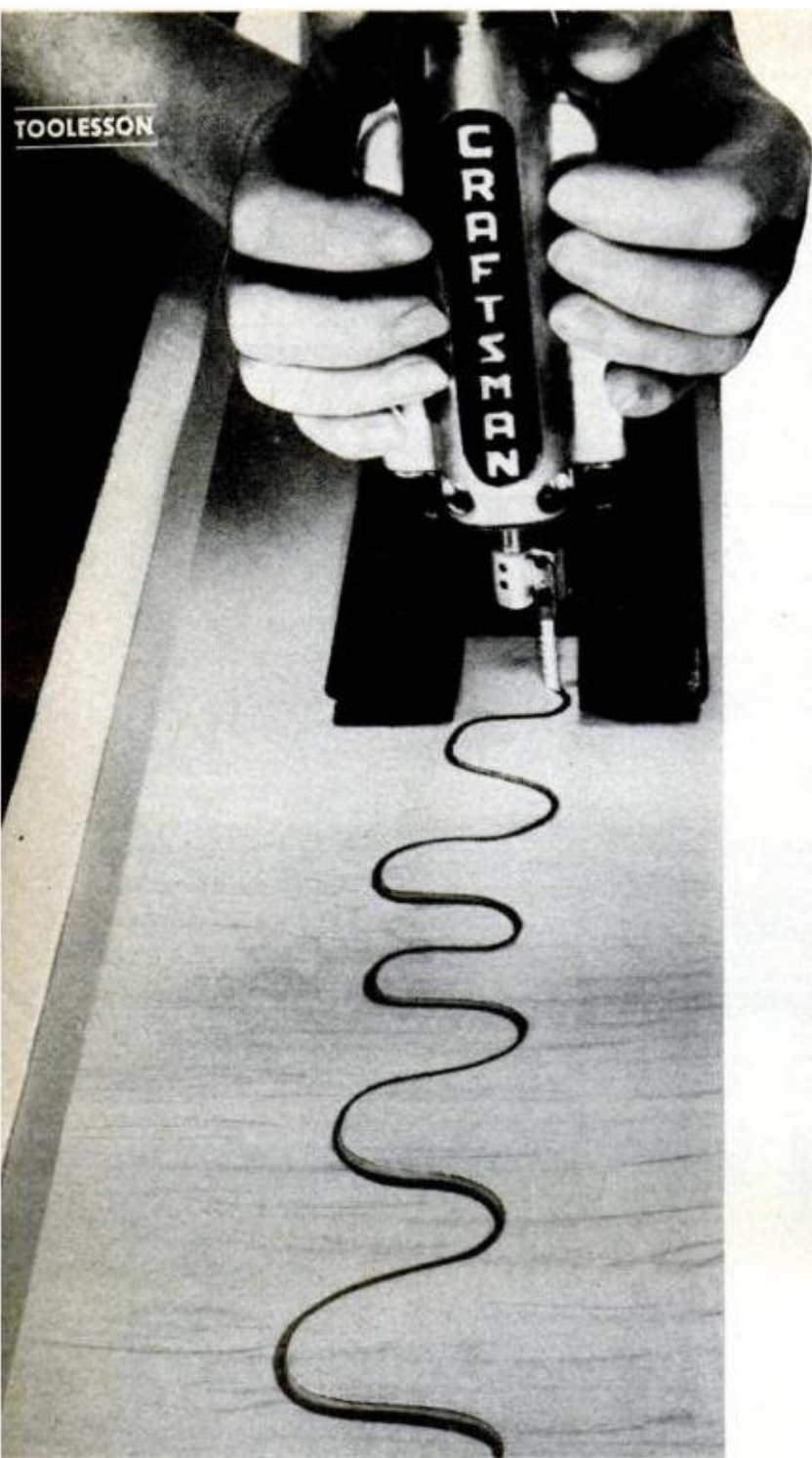


YOU CAN MAKE A COMBINATION workshop trash can-dustpan at no cost if you cut a five-gallon gas can as shown. The handle is simply an old broomstick attached to the bottom with small bolts.—*Hi Sibley*
OCTOBER 1970



TO TAKE APART A STUBBORN FAUCET—when you can't grip it with a wrench—try this. Loop a cloth, such as a dish towel, around the handle and pull on one end as you hold the other.—*John F. Dinges*

TOOLESSON



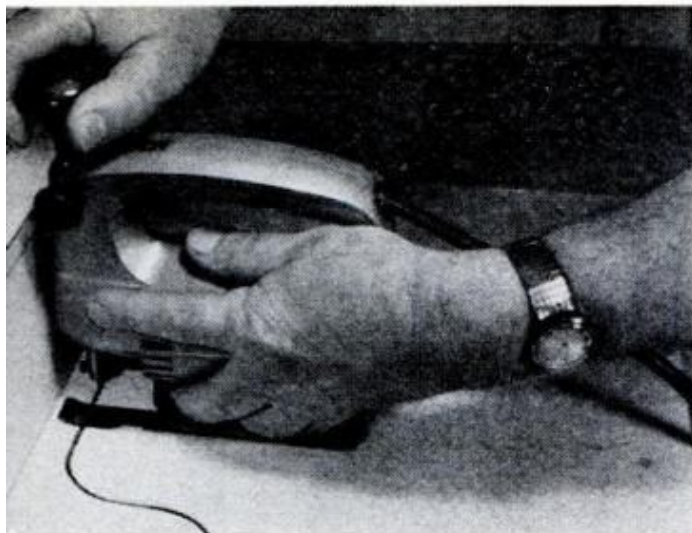
Look What You Can Do With a Swivel- Blade Sabre Saw

'Impossible' cuts are easy. And, if you already own a conventional sabre saw, here are some tricks that you'll be able to use

By **GEORGE E. DANIELS**

UNTIL SEARS AND THOR introduced their new swivel-blade saws, few of us ever got to see one. Yet you see the handiwork of such a tool every day. Advertising signs, theater and TV scenery and displays in department stores are generally made with a Cutawl—the granddaddy of them all. From that tool you can borrow an amazing bag of tricks for the new swivel-blade sabre saws—tricks like sawing backwards for greater precision, cutting plywood and insulating board without a trace of sawdust, making razor-clean cuts, cutting a dozen or more gaskets or templates in one shot and cutting through plywood laid out on the workshop floor. And there's more.

How swivel-blade saws work. Like a furniture caster, the swivel blade turns automatically to the direction of movement. Push the saw forward, sideways, backward, anywhere around the compass, and the blade pivots to cut in that direction, *regardless of the position of the saw body.* So you never have to turn the tool around to follow the variations in a cutting line. The swivel action lets you follow a line with such ease that it actually takes only a few minutes' practice on scrap material to get accustomed to it. And you can scroll-cut in tight spots where you never could before—for example, in



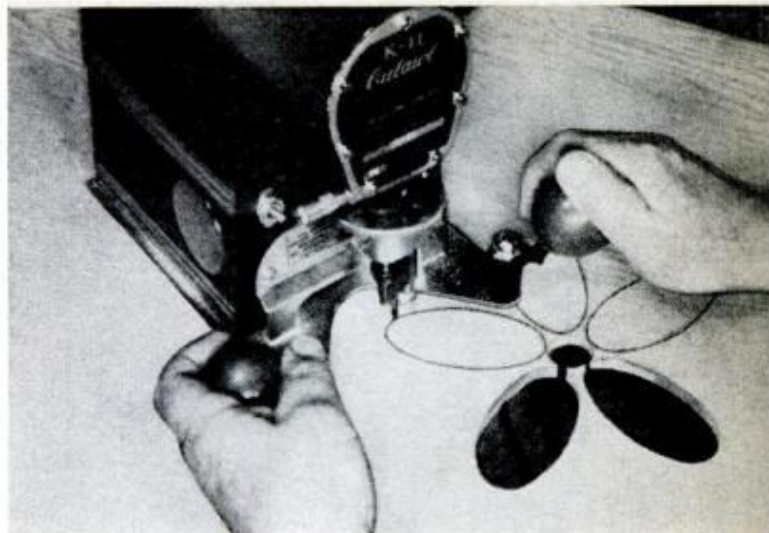
KNOB STEERING with straight blade gives Thor model positive blade direction control on tight jobs

the bottom of a box too small to swing the tool or close to a baseboard in ductwork.

Either of the new saws can also be used with swivel locked. The Sears model locks with the blade facing forward, backward, or at right angles to either side. The Thor locks with the blade facing in any direction. With blade locked sideways, the Sears Scroller can cut (nose in) parallel to a wall 1 in. away, the Thor 1/2 in. away.

Why the pros saw backwards. Because swivel-blade saws cut as well backward as forward, the professional sign and scenery maker's Cutawl is designed to operate with its nose facing the user. This way, the cutting line and the blade are always in wide open, clear view for maximum precision in complex scroll work. You guide the tool by gripping the knobs attached to its shoeplate on each side.

You can make similar handles for



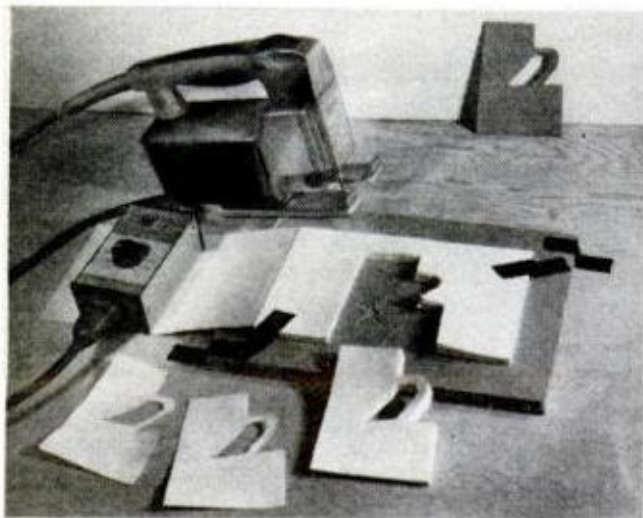
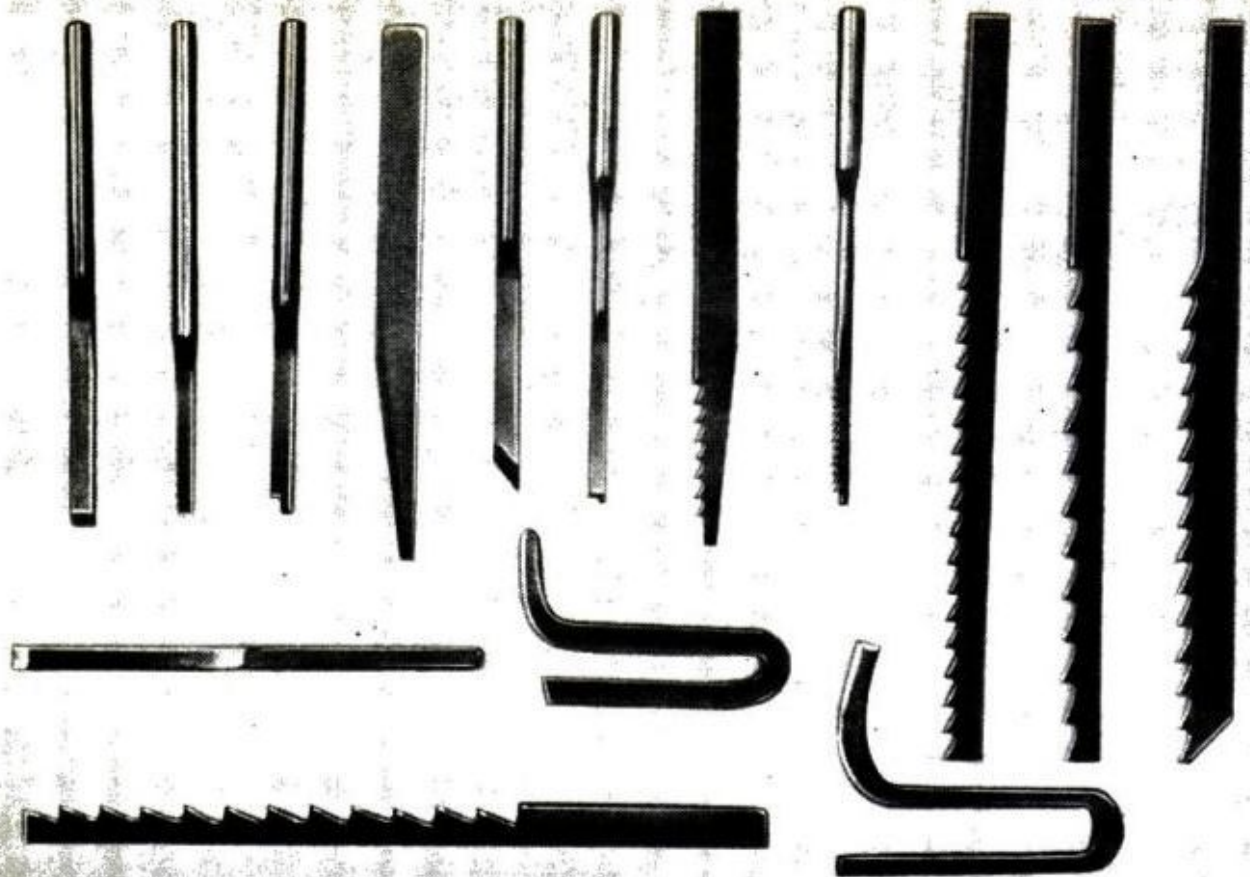
UNOBSTRUCTED VIEW OF BLADE and cutting line is built into the Cutawl because blade faces the user

either of the new swivel saws. On the Sears Scroller, they can be attached through holes already drilled in the shoeplate for the "Splinter-Free Attachment." (This is a metal down-pressure plate through which the saw blade passes into the wood. It rides on the edges of the cut to prevent fraying of surface fibers, but can be used only with the blade locked facing forward.) On the Thor you'll have to drill the shoeplate holes. (The photos above show you how to use the handles.) You can also guide any of the tools by the top handle, of course, when it suits the job.

The razor-clean cut that's so important to signmakers is produced by blades with teeth that point downward instead of upward, as on conventional sabre-saw blades. You can duplicate this performance simply by mounting your sabre-saw blade upside down if your saw is one of

SWIVEL-BLADE SAWS (left to right): Cutawl, \$200; Craftsman Scroller, \$59.50; and Thor Roto Blade, \$44.95





100 TEMPLATES AT ONE SHOT can be cut through pad with a chisel blade in the standard Stanley saw

CUTAWL BLADES at top vary from chisel point for thin layers of soft materials up to production-type wood blades. Bent wire adapters below let you adapt specialty blades to your standard sabre saw

the many types that permit it. Depending on the blade, you may have to grind off a few teeth to fit it into the mounting slot or perhaps cut off the unused blade shank. With downward-pointed teeth, any surface splintering occurs on the underside of the work (as on a table saw). Thus, you can mark cuts on the finished side for better fitting and no chance of flip-over-type pattern foul-ups.

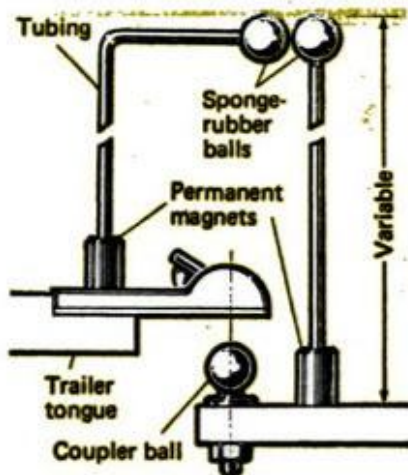
To cut without sawdust you use a chisel blade which punches its way through the work instead of cutting on the upstroke. The absence of sawdust is only one of the advantages. You can also make cuts that no other type blade can make in materials standard blades can't cut. And, since there's no kerf, the cut sections fit so snugly you have to push them out.

If your saw is of the type that can take inverted blades as described above, it can probably also take a bent wire adapter (shown in photos) for Cutawl chisel-saw blades. The saw's blade-mounting arrangement must be of the flat-sided slot, [\(Please turn to page 236\)](#)

QUICKEST WAY TO CUT BLADES shorter or so teeth point downward is with an abrasive cutoff wheel



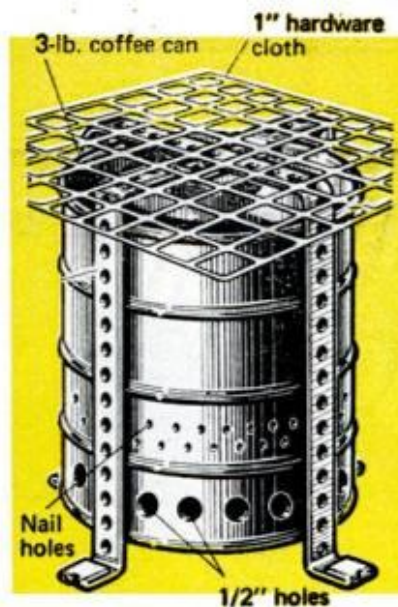
HINTS FROM READERS



Aligning trailer hitch

Even when you're alone, lining up the coupler ball and socket on your trailer hitch is easy if you rig it as shown. Then simply back up the car and when the balls align so does the coupling. Cut the tubing long enough to make the bright rubber balls easily visible to the driver.

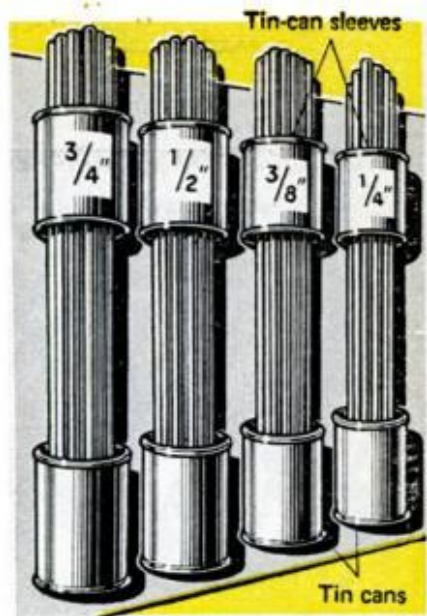
—W.O. Nelson



Mini-campstove

Here's a campstove that takes up less room than a minnow bucket, yet does the job satisfactorily for two campers. It's a 3-lb. coffee can with 12 1/2-in. holes drilled around its base. Fill the can half-full of charcoal, saturate with starter fluid and ignite. Use hardware cloth as a grill.

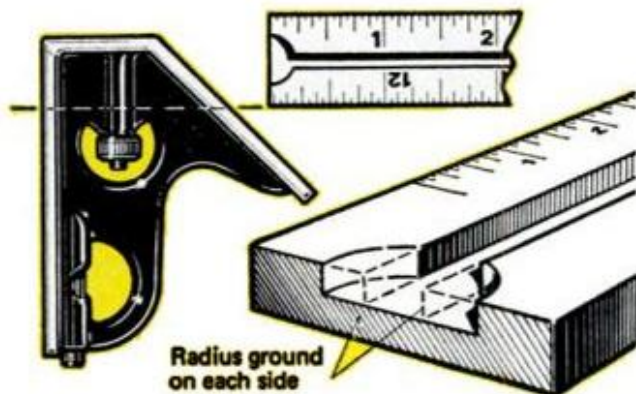
—George G. McNeley



Neater dowel storage

A few tin cans of the same size can keep different size dowels organized if installed in pairs as shown. Simply cut the bottom out of the upper cans and toenail each pair of cans in place. The rack can be fastened to the back of a door, or to a piece of plywood which can be hung on the wall.

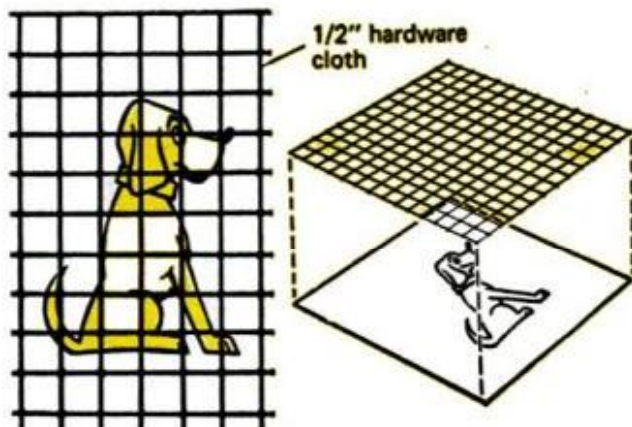
—Victor H. Lamoy



Improved combination square

Often it is necessary to disassemble a combination square so that you can make use of the blade as a straightedge. That part is simple enough, but frequently it is frustrating when you try to get the thing back together again. If you hold the end of the blade against a grinding wheel and grind the radius as shown at left, you'll find that reassembly is a snap every time.

—Harold Neibert

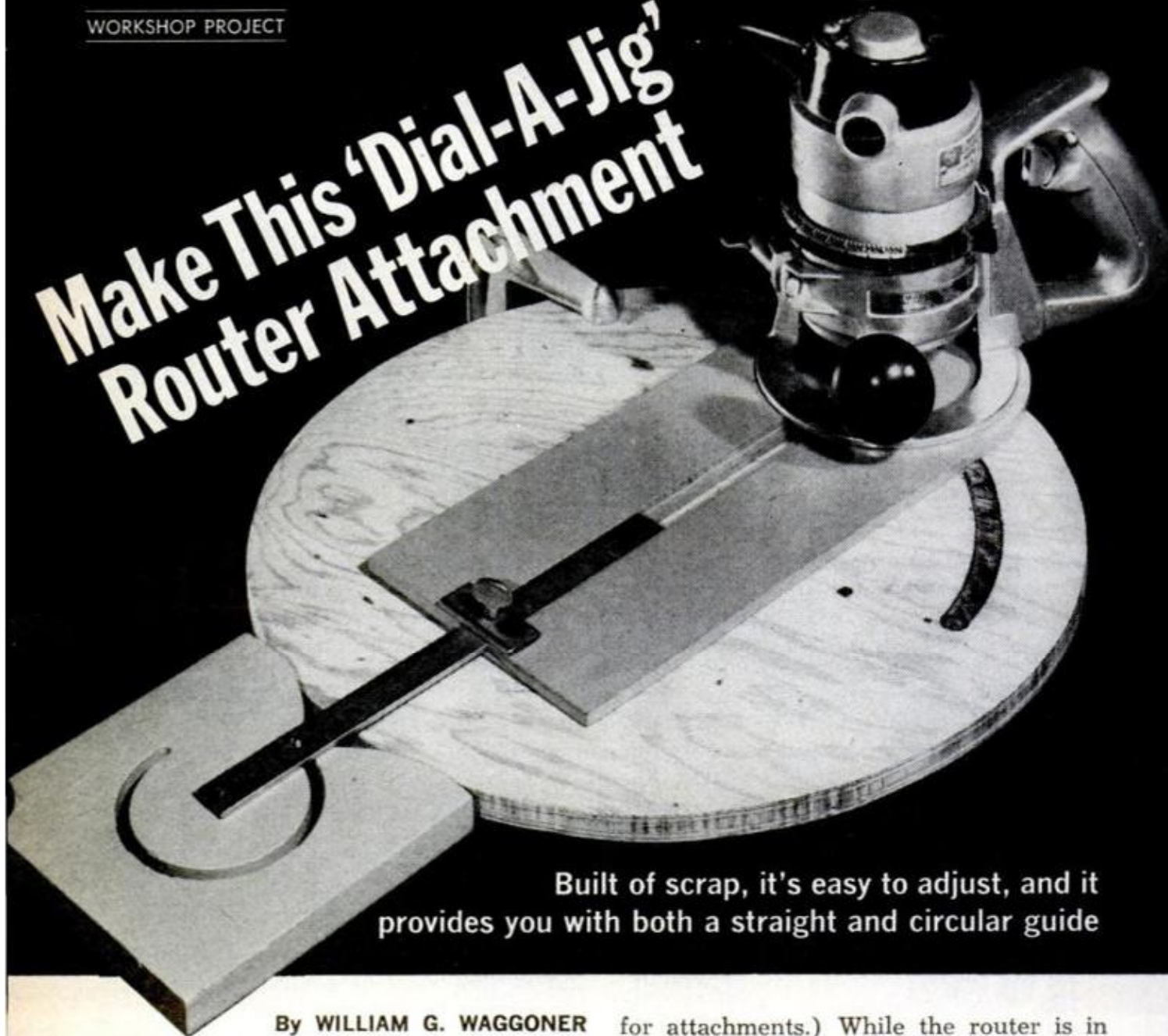


Hardware cloth saves ruling

An easy way to put a small drawing onto a scaled "graph" without marking it up is to place a piece of hardware cloth—with 1/2-in. squares—over the picture to be copied and then put the setup in a photo copier. Hold the cover down firmly for a clean reproduction and you will have a copy of the picture reproduced on squares. Now, by hand, you can enlarge the art to any size you desire.

—Dean W. Walton

Make This 'Dial-A-Jig' Router Attachment



Built of scrap, it's easy to adjust, and it provides you with both a straight and circular guide

By WILLIAM G. WAGGONER

TAILORED TO SUIT the router you own, this attachment is smooth operating, easy to adjust and does the chores that normally require two separate attachments. Besides serving as a guide for curved and angular work, it can also be used for slot and circle cutting. The big plus is that the circle-cutting attachment—for cutting discs, circular holes and concentric designs—is adjustable from 1 to 21 in. simply by reversing the tongue in its slot.

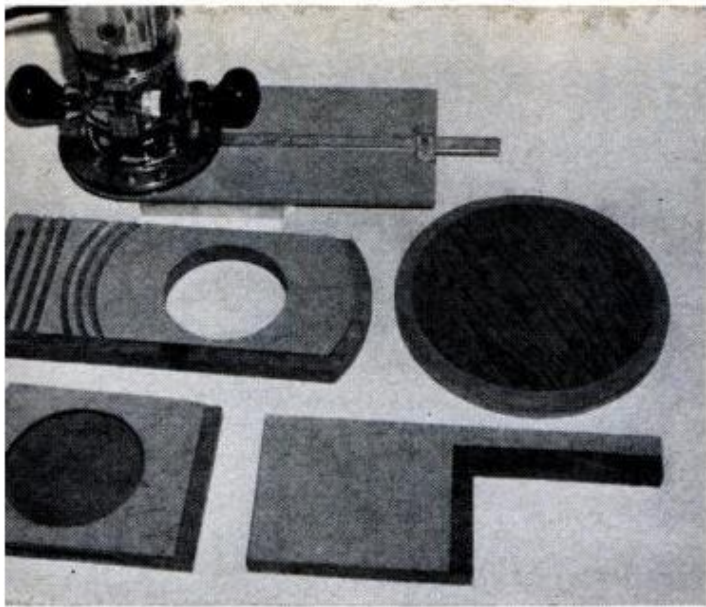
After cutting the 1/4-in. hardboard to the proper rectangular dimensions for your particular router, mount the router on one end and scribe about the router base for the half-circle shape. (Most router bases have holes provided by the manufacturer

for attachments.) While the router is in place insert a small bit and drill a pilot hole. Remove the router and enlarge this pilot hole to 1 in.

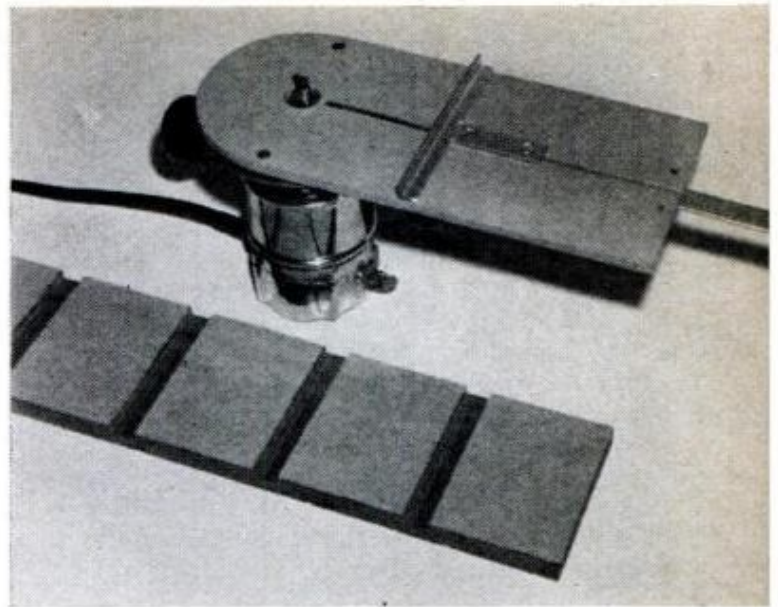
Rout the 3/4-in. slot to within about a 1/4 in. of the circumference of the 1-in. hole, then rout the 1/4-in. slot all the way through. It is easy to do this by clamping the material on a table against a fence and using the fence as a guide for your router base. After routing, trim the scribed circular section.

Next, cut two pieces of bar stock 2 1/4 in. long (of the same material as the adjustable tongue). The flat metal is available at hardware stores in 3-ft. lengths. Make certain that the length you select is straight.

Clamp the two pieces you have cut to one end of the adjustable tongue and drill



SEVERAL OF THE CUTS that are made possible by using the attachment are shown above. With a little ingenuity, you can get even greater versatility

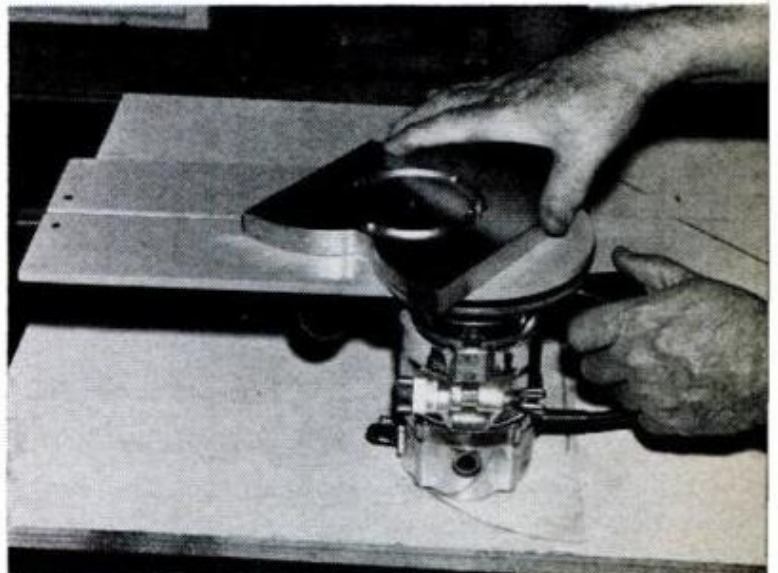


SLOT AND GROOVE-CUTTING ATTACHMENT is made by butt-welding one of the 3/4-in. flats to a piece of 1/2-in. angle iron. Matching pieces are then perfect

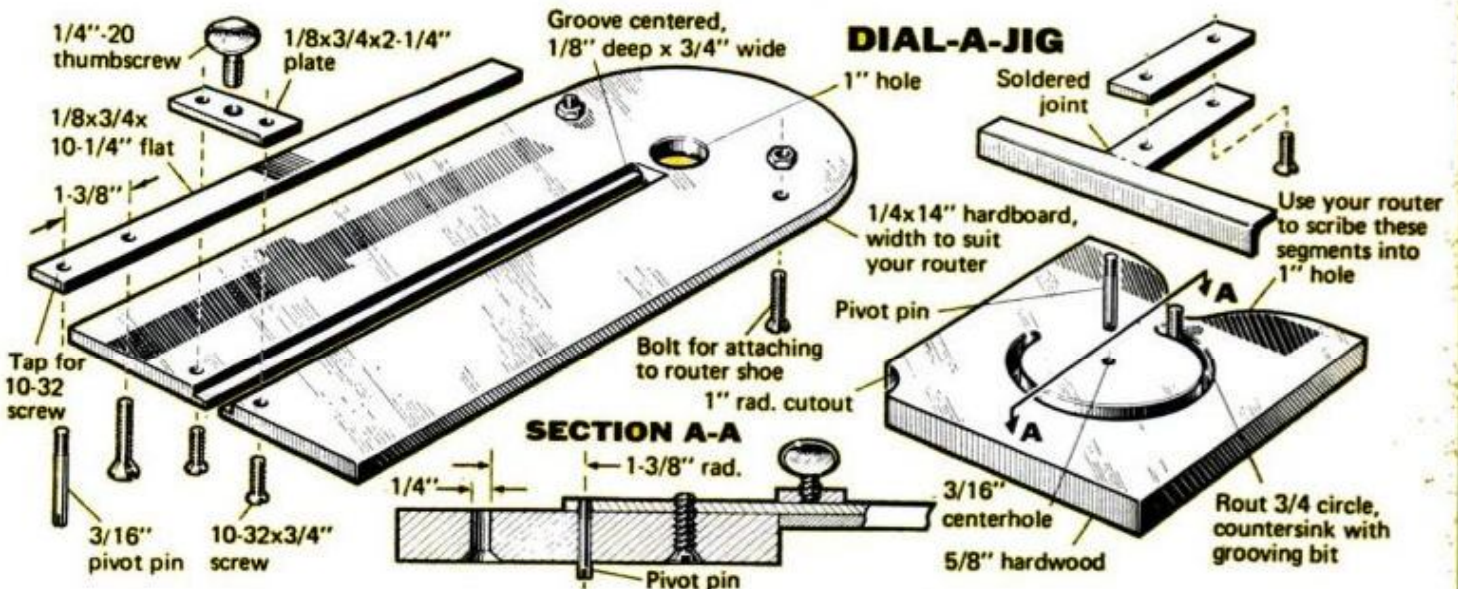
through all pieces at one time with a No. 20 drill. Space these holes 1 3/8 in. on center. Thread the holes (10-32) in the tongue and one piece. Ream out the remaining piece 3/16 in. and countersink for a flathead bolt. This piece is to be butt-welded to a section of 1/2-in. angle iron to form the slot-cutting attachment pictured above, right.

For the center pin of the "dial-a-jig" fixture and circle pivot, thread the end of a 3/16-in. rod so that when it's screwed into the tongue, it will tighten without extending through the tongue. Slot the end of this pin with a hacksaw.

The little time you will need to build this practical attachment will more than repay you with the versatility it adds to your router.

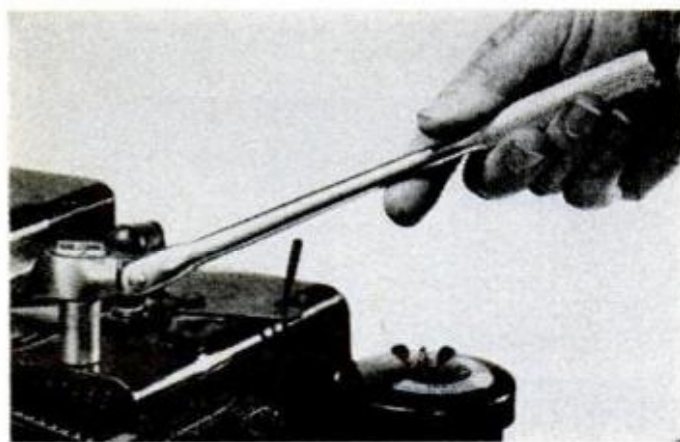


TO ROUT CIRCULAR SEGMENT, move the jig instead of the router. Drawing (below) shows the jig's simplified construction and how its parts go together



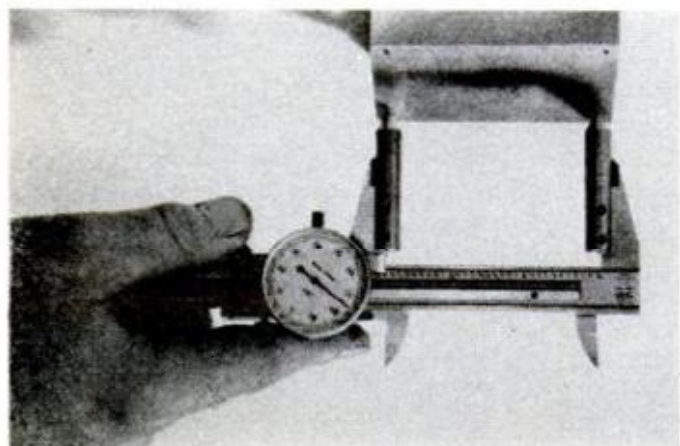
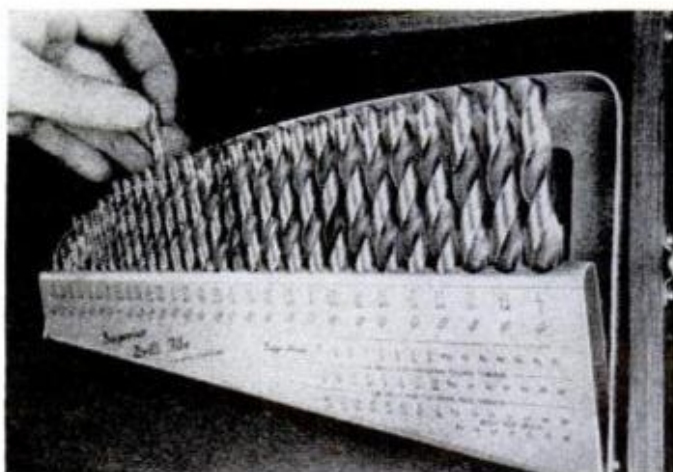
New tools you should know about

DIAL THE RIGHT SPEED from 0 to full rpm with Model 219 solid-state motor speed control. Attractively styled in a steel housing, the unit has an on-off switch, pilot light, three-wire grounding cord and overload protector with manual reset button. It controls all universal (brush-type) motors and fixed-load, shaded-pole motors such as for fans, but is not intended for vibrator or induction-type motors. You can control the speed of drills, circular saws, sanders and polishers to suit the job; also control temperature of soldering guns. Sells for \$16.95. Dremel Manufacturing Co., Box 518, Racine, Wis. 53401.



DESIGNED FOR EASIER SERVICING of sparkplugs and for work in other tight spots, this $\frac{3}{8}$ -in.-sq.-drive Flex-Ratchet has a hinged handle that swings up or down in a 180° arc to clear obstructions. It requires only a short backstroke because of a 45-tooth mechanism in the business end. A self-locking device secures the head in six different positions. Forged of a special, heat-treated steel, the wrench is finished in heavy chrome plate and priced at \$10. For where-to-buy information, write to Husky Tools, New Britain Machine Co., Box 1320, New Britain, Conn. 06050.

KEEP DRILLS CONVENIENT and ready for use with this compact holder. Dubbed Superior Drill File, it mounts inside the toolbox cover. Placed in a straight line for good visibility, drills fit pockets marked with fractional and decimal sizes, lock in place when cover is closed. Tap and drill information is stamped on the face of the rack. The mounting plate has two keyhole-type holes to permit easy disassembly, but a round hole is also provided for a center-screw, permanent installation. Priced at \$4, less drills, the holder is available by mail order from Superior Engineering Co., North Branch, Minn. 55056.



CENTERLINE GAUGE adapts readily to most calipers in less than two minutes with adjustment accurate within plus or minus .001 in. It can be quickly removed to restore the o.d. capabilities of the caliper, also used to check distances between holes or to an edge from a hole. There's no need to add or subtract, since a reading is in exact figures, eliminating mathematical error. Tool, made of quality-alloy steel, will pay for itself when used in place of a height gauge 20 times in a day, according to maker. \$9.75. New Way Engineering Co., Box 187, Hawthorne, Calif. 90250.

HINTS FROM READERS

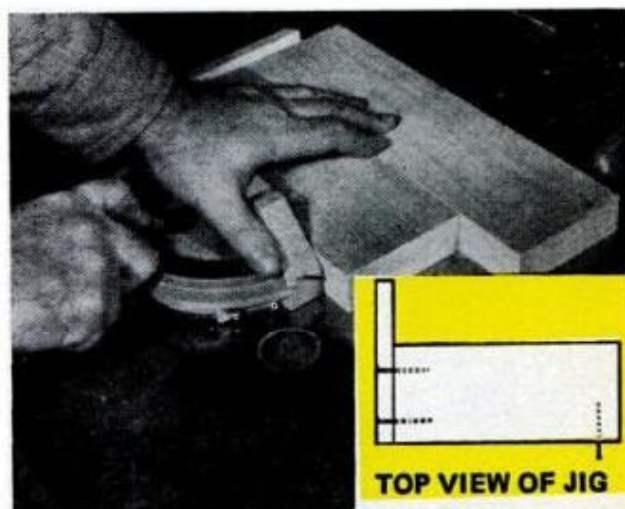
Roller skate supports drum

An inverted roller skate will make it a lot easier the next time you have to handle a large drum or cylindrical object. Simply place the skate so that it supports the drum near one end, and position wooden blocks at the other end of the barrel to keep it level. Another arrangement would be to use a pair of skates and eliminate the blocks.—*W. B. Ervin*



Jig speeds multiple cutting

There's no need to screw-fasten a stop to your miter gauge when you have a lot of same-size cuts to make on your table saw. Make an L-shaped jig as shown in the drawing from shop scrap and drive a 6d or 8d finishing nail in the edge. In use, simply hook the jig against the end of the miter gauge and hold it there while work is being cut.—*Raymond Bried*

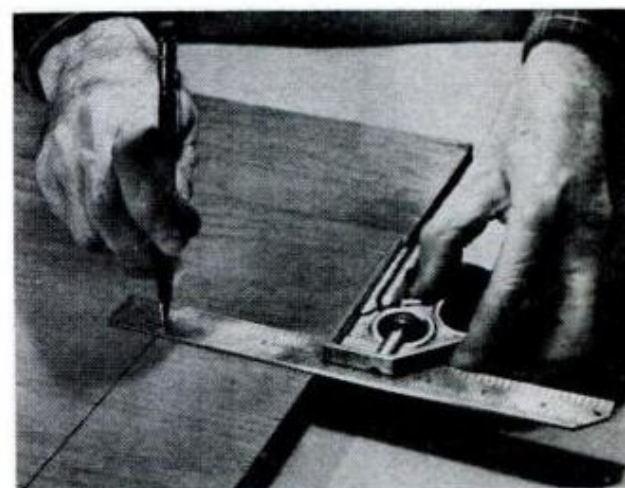


How to make putty stay put

A frequent complaint from homeowners is that putty, or glazing compound, just doesn't stay in place. To eliminate that aggravation, clean out all loose putty and then apply a priming coat of oil-base paint to both wood and glass before puttying. After the putty is in place, simply paint it to match the window sash.—*Tom Johnson*

More accurate scribing

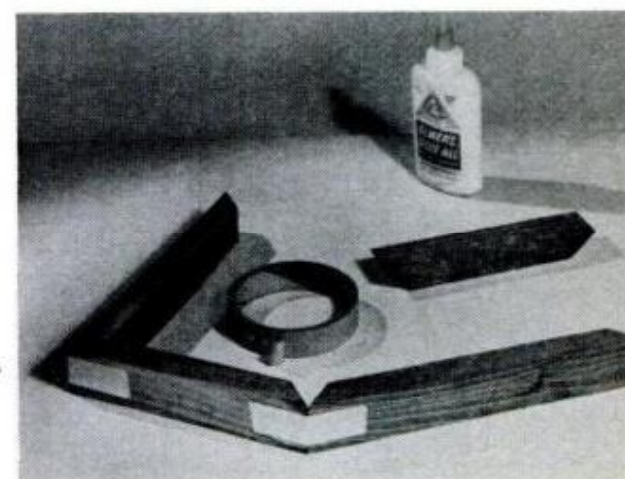
After drilling a small hole in the end of the tongue in my combination square, I found that with a pencil point inserted I could scribe lines quickly and without any chance of the pencil moving. It sure beats the old method of holding the pencil on the end of the tongue where it easily—and often—slips off.—*Robert Finch*



Making tight miter joints

While assembling a picture frame recently, I ran short of clamps. Then I hit upon the idea of using masking tape to hold the joints securely. Close the joint by making contact at the outer edge first, then spot several pieces of the masking tape at strategic points. Apply glue to the joint and close it; the tape will then hold the work in place until the glue is dry.

—*Sterling Ruark*



Projects to Keep Your



ROOMY COMPARTMENT under lift-up writing surface is even handy to little brother when desk is used to store coloring books



Home Study Desk

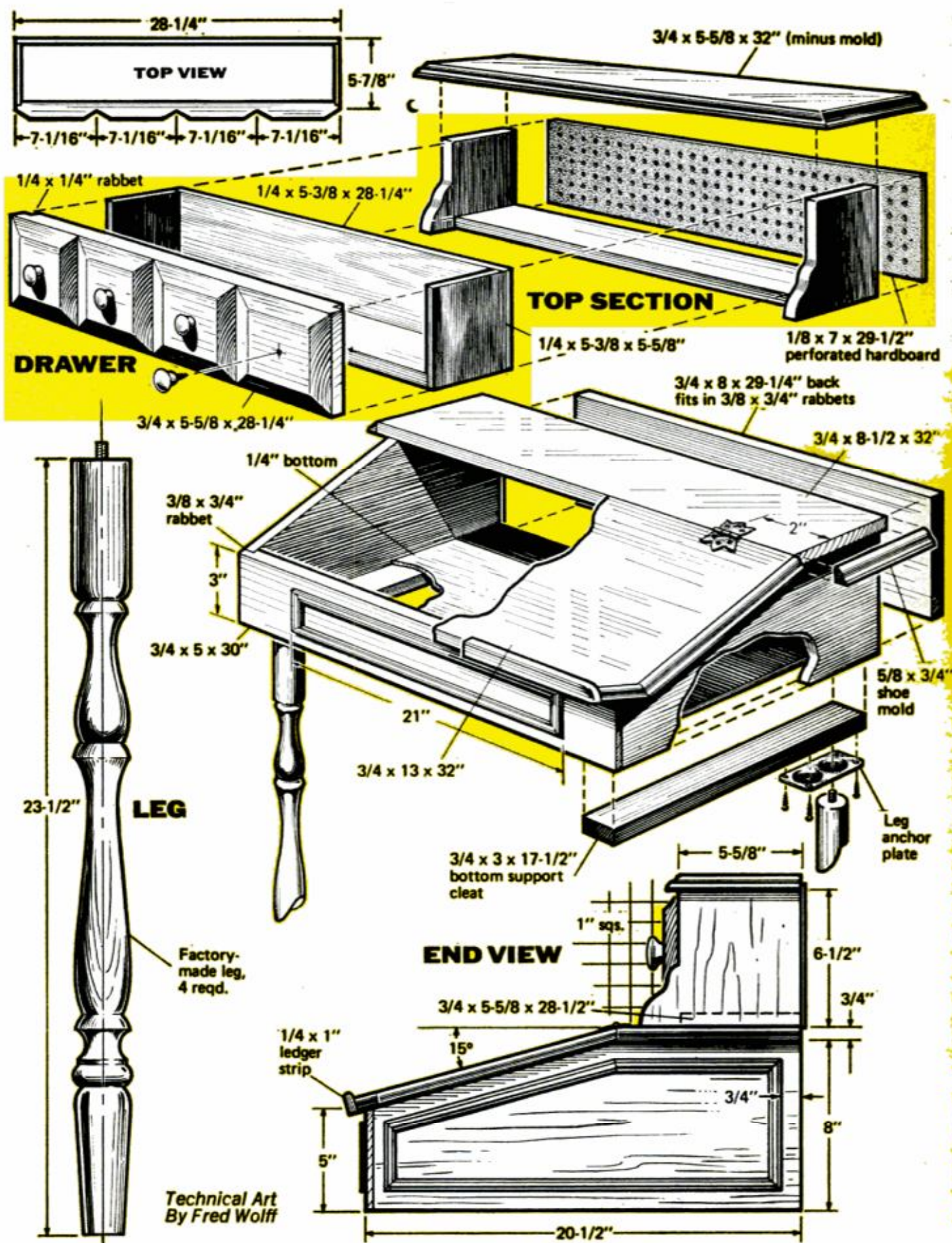
Homework will be less of a drag with a desk like this. Not only will its slanting school-desk top put youngsters in a classroom mood, but its roomy compartments will let them keep books, papers and pencils conveniently at hand.

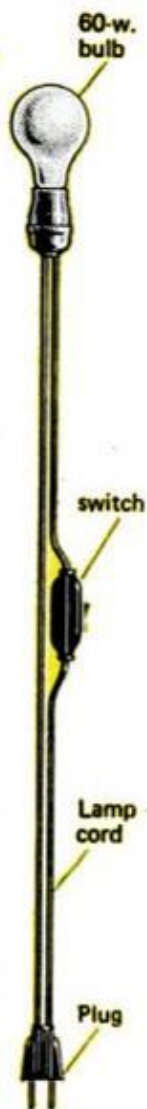
You can make the whole thing of pine and paint it if you wish, or pick a harder wood and stain it.

Study the construction carefully before you begin. You'll notice that the end pieces of the bottom section rest in rabbets cut in the front member and that the back member rests in rabbets cut in the end pieces. The leg cleats along each side support the 1/4-in. plywood bottom. The metal plates which you get when you buy the legs are screwed securely to the cleats.

The top section with its perforated hardboard back is made separately and attached to the bottom section with flat-head screws. The drawer with its dummy four-drawer front follows conventional drawer construction and is made to slide freely in the top section.—*Peter Smith*

Workshop Humming



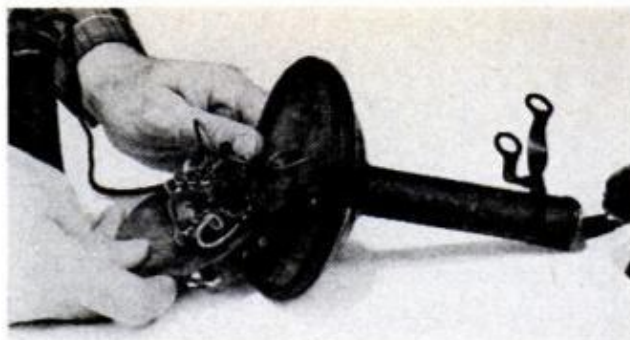


Telephone Table Lamp

It's hard to say goodbye to old telephones when they make such conversation pieces as this. Victims of progress, these old upright phones of the Roaring Twenties can still be purchased from surplus firms at \$8 to \$10. Pick one which is good mechanically.

The biggest job is adding a supporting rod for a harp and shade. This requires boring a $23/64$ -in. hole in the knuckle joint of the mouthpiece and tapping it for a 6-in. length of $1/8$ -in. threaded fixture pipe. The phone is stripped of all internal wiring and its switch, which is replaced with a micro switch. The threaded pipe is covered with brass tubing, and the lamp is wired as shown with socket, lamp cord and plug. Removing the receiver from the hook lights the lamp.—*Bob Brightman*

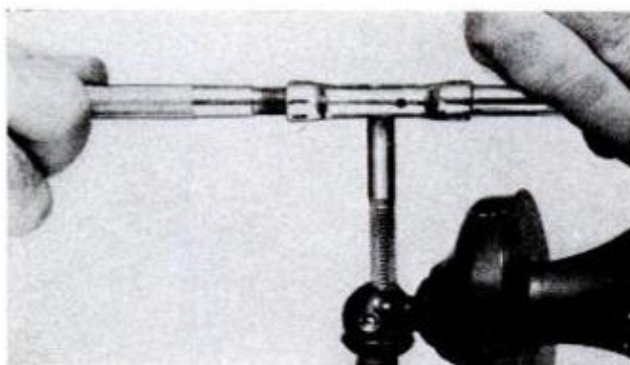
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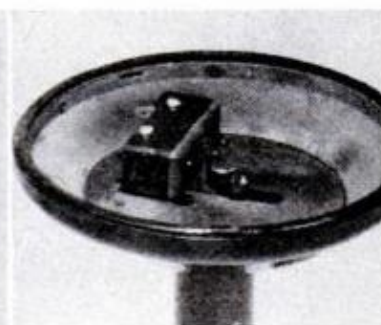
TAKE OFF THE BOTTOM PLATE and remove all the old wiring, including switch. New switch is required



REMOVE THE MOUTHPIECE by knocking out the pin and clamp it in a vise for drilling and tapping hole



TAP HOLE with a $1/8$ -in. pipe tap. It's possible to drill and tap hole without removing the mouthpiece



LOCATE SWITCH in base so movable rod inside column will operate switch when receiver is lifted off the hook

TURN PIPE into tapped hole, cut off 3 in. Then slip brass tubing over pipe and hold it tight with a hex locknut

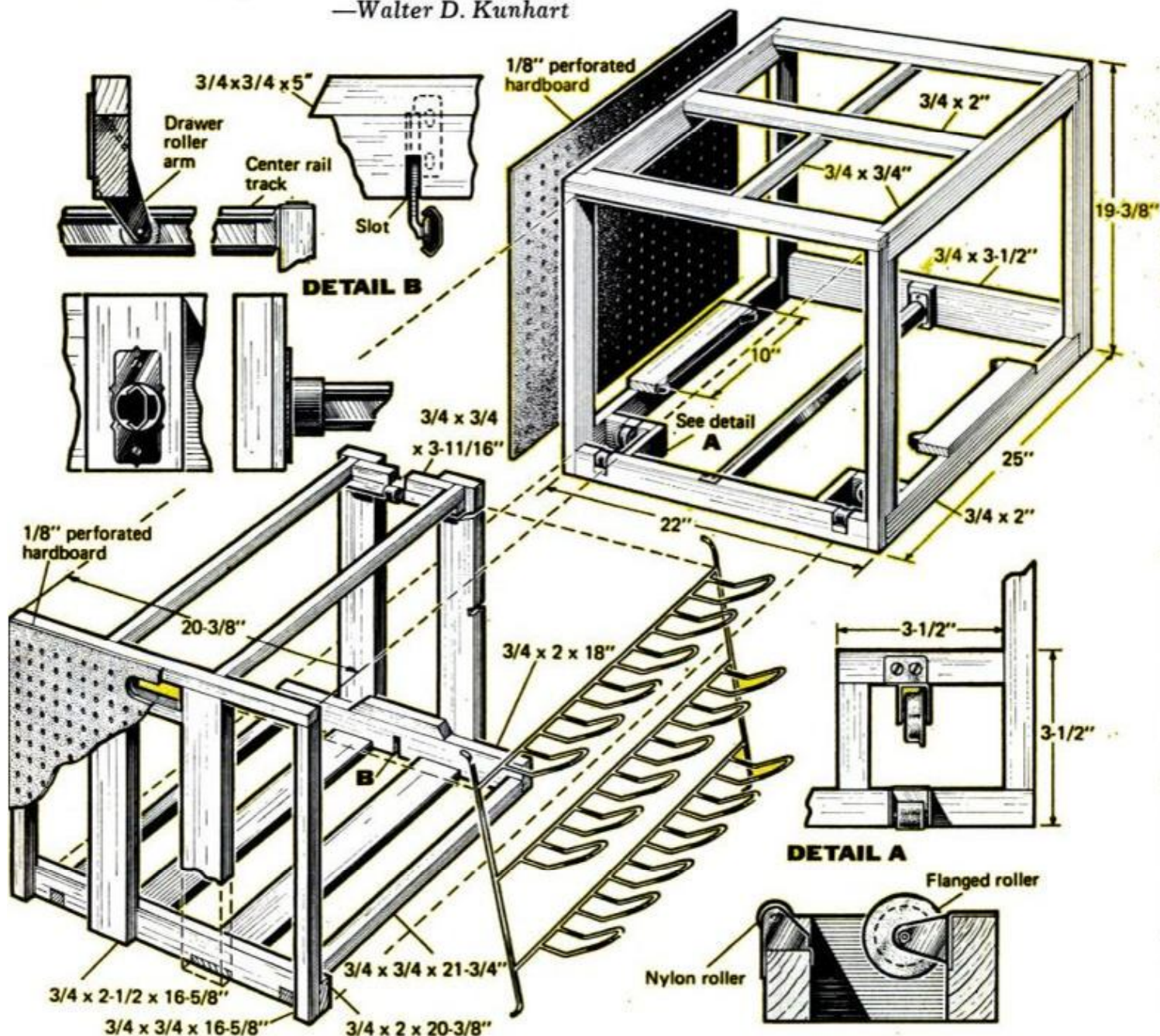
POPULAR MECHANICS

Roll-Out Shoe Drawer

How many times have you stumbled over your wife's shoes sticking out from under the bed, or opened a closet door to be greeted by a "Fibber McGee" avalanche of dusty footwear? That's why I built this closet roll-out shoe drawer.

The drawer is designed to accommodate two common metal shoe racks. It rolls smoothly on a metal drawer track and seven nylon rollers. I cut off about 4 in. from the shoe-rack legs, leaving 1 1/4 in. for attaching with half-round clamps. At the front the racks are clamped directly to the back of the front uprights; at the rear the uprights have to be notched slightly in four places. Cover the sides, top and the drawer front with 1/8-in. perforated hardboard to provide ventilation.

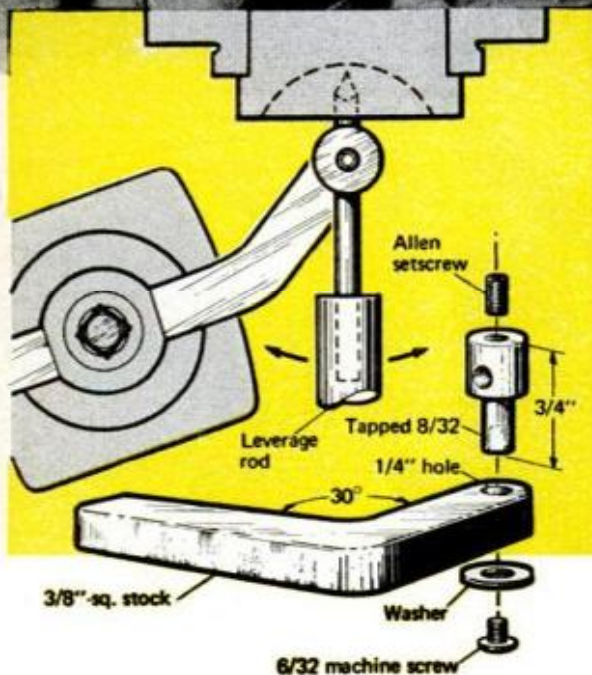
—Walter D. Kunhart



HINTS FROM READERS

Spherical-hole cutter

Recently, when I had to turn a reasonably accurate spherical hole in aluminum stock, I found that I lacked a tool to do the job. After some thought, I made the miniature lathe toolpost shown at the left. First I bent a piece of $\frac{3}{8}$ -in.-sq. keystock (to about 30°), then I machined a small toolpost to turn freely in a reamed hole in the end of the keystock. A 6-32 machine screw and washer hold the toolpost in place. Slight play in the toolpost pivot can be neutralized by pushing upward on the handle as it is moved to swing the bit through its cutting arc. I roughed out the cut with a large bit to start. Then with the radius tool mounted in the lathe toolpost, I gradually fed the carriage by hand until the tool was at the face of the work, ready for the finish cut.—*Carl M. Copenhagen*



Wear-free drawer slides

Next time that you have a project that involves using plastic laminate, don't throw away those scrap pieces because they can be cut into strips and used as drawer slides and guides. Construct the drawer to be $\frac{3}{16}$ in. smaller, both in height and width, than the drawer opening to allow for the $\frac{3}{16}$ -in.-thick laminate plus clearance. Glue a strip to both sides for smooth operation.—*Elwin Trump*

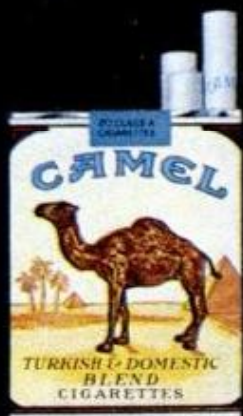
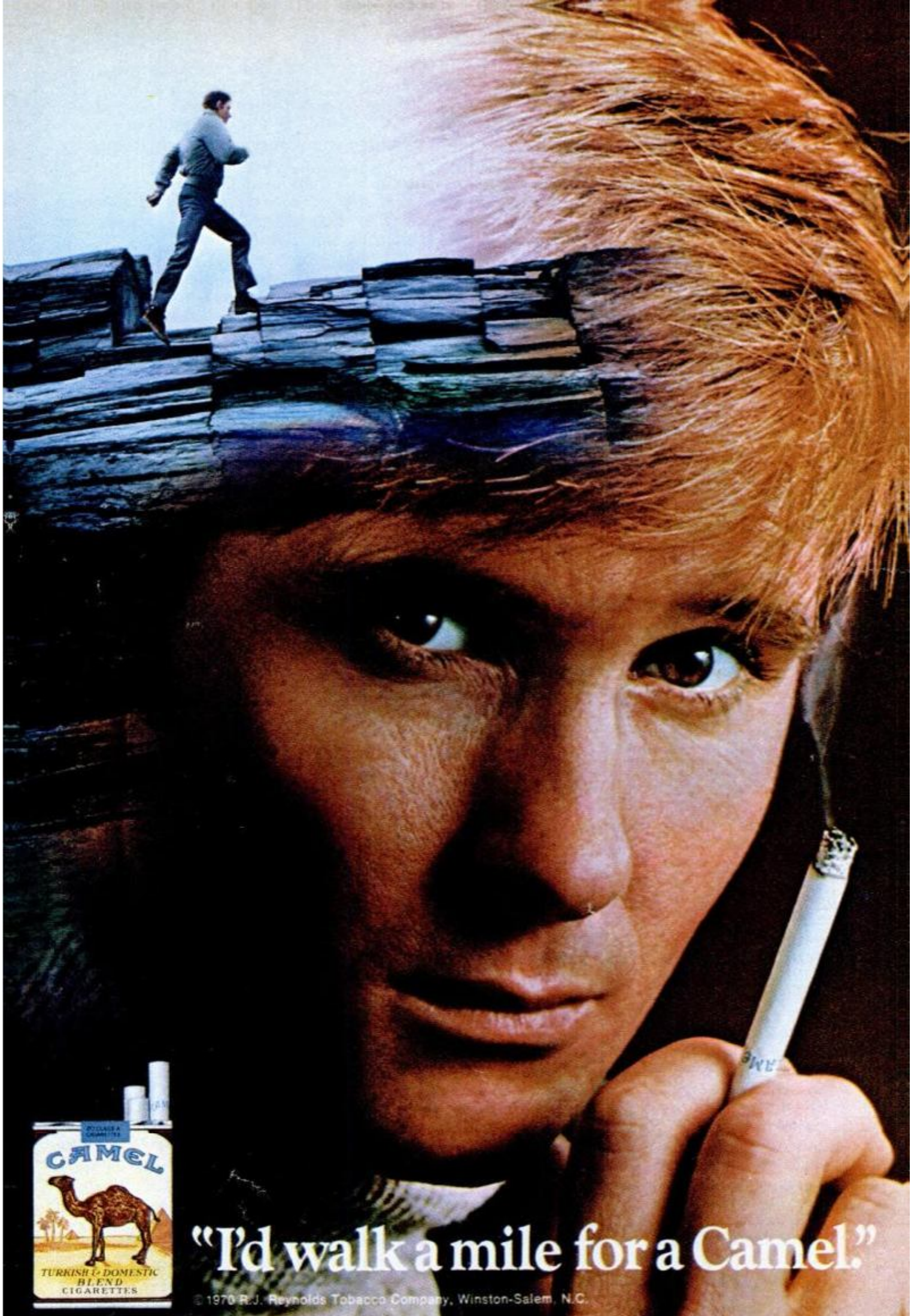
NEXT MONTH IN SHOP AND CRAFTS

SAY MERRY CHRISTMAS WITH PM'S ELECTRIC GREETING CARD. Here's a Christmas display for your front lawn that is sure to make passersby think you are an electrical wizard. Designed by PM's Home and Shop Editor, the display dispenses season's greetings night and day. In daylight, Santa is visible to all, while at night, 15 lights pop on one at a time until he's all "lit up." Plans for building the card are in the November *PM*.

CHAIRSIDE CANDLESTICK LAMP. It's a combination lamp and table with a warm Colonial look. A project for the wood-turning enthusiast, the design incorporates a handsome base of black wrought iron. It's a charming piece you'll want to make.

A FACEPLATE LATHE FROM ODDS AND ENDS. While limited to faceplate work, you'll be able to turn out handsome bowls and cups galore. You can make the machine for practically nothing from a discarded washing-machine motor and scrap materials. Watch for it in the November issue.

THINGS TO MAKE FOR CHRISTMAS. Let your workshop play Santa this year by turning out gifts for the family. Included in this shop feature are an Early American wall clock, an electronic checker game, a Christmas-candle holder and a toast rack. Don't miss this nine-page feature in the November *PM*.



"I'd walk a mile for a Camel."

© 1970 R.J. Reynolds Tobacco Company, Winston-Salem, N.C.

THE TRUTH ABOUT PET FOODS

(Continued from page 125)

fact, lead to gross over or underfeeding. A nearly useless dog food can be flavored to suit the animal's palate (onion and garlic practically guarantee enthusiastic consumption). Yet no matter how much he eats, his body will still be "hungry." Manufacturers may supplement these foods with vitamins, but unless they are properly stored and used relatively soon they deteriorate and are deficient.

Regardless of claims for "flavor," you should clearly understand that your dog or cat does not need or prefer variety in his food, and probably would be much better off without it. Flavoring added to much pet chow nowadays—liver, beef, fish—is just that and little else. Sometimes a token increase in the real ingredient is indicated on the label, but the basic mix of cereals and by-products remains approximately the same.

The advertising is selling *you*, not your

Many well-meaning owners substitute their own eating habits for the animal's.

pet, by appealing to your taste for gravies, sauces and the like. This is a standing joke in the pet foods industry, where nutritionists admit the average pet would get along as well if there was but one flavor.

Many well-meaning owners substitute their own eating habits for the animal's. *They* like a variety of flavors; so, the dog, tempted, eats more than he ordinarily would, or should. *They* eat three times a day, so the pet gets the same schedule and usually loses several years of his life.

A comic figure to kennel keepers is the owner who believes his pet is so special that it cannot survive on ordinary foods. For this customer the pet food processors now make such expensive goodies as beef burgundy, kidney stew, and ribs of lamb and veal. An animal fed such delicacies is, nearly always, listless and overweight.

The form in which the pet food is purchased is left largely to the purchaser and the size of his purse. The most common is canned; the most economical is dry kibbles, and the most convenient may be semidry foods with much sugar added as a preservative. A small dog may not eat enough canned food to affect the budget, and this may be most suitable to apartment dwellers. Large dogs, however, can become costly boarders if fed the many cans of dog food they require. A good

quality dry food, besides being more economical, is usually acceptable, especially if it has been fed since the pet was young.

To prevent spoilage, these dry foods contain a minimum of fat, so it may be wise to add such available supplements as bacon or other meat fats—even vegetable oil. If dry cat foods are fed exclusively, a meat or fish fat is a good additive and generally relished by the cat.

The best route to finding the right pet food, and usually the whole matter of your pet's health, is to choose a recognized product and, if your pet does well on it, stick with it. While labels on pet-food containers are helpful in selecting *complete* diets over other products intended merely as supplements (such as canned meats for dogs), the ingredients appear so similar that it's difficult to choose solely on this basis. Perhaps the two best indications of dog-food quality are the percentage of protein given (anything over 10 percent is good) and the listing of *meat* (as well as meat by-products) as one of the ingredients. This, coupled with a comparison of prices for different complete pet foods should give a reasonably accurate idea of their respective quality.

Check with your veterinarian. He cannot ethically recommend a specific company's product; he can, however, tell you when one is unsuitable. Ask him—or a kennel owner with healthy animals—what he feeds. Start you pet on this basic food as soon as possible, with supplements as recommended by the vet for your pet's younger and working months. Forget about flavors. Feed regularly, usually once a day when he is grown, and the same time each day. Limit table scraps severely for small dogs.

Is there anything wrong with starting a pup on regular dog food? The table below is a partial list of average minimum daily nutrient requirements for dogs, per pound of body weight, as recommended by the National Research Council. Note the *difference* between adult and puppy requirements:

	Adult	Pup
Protein (in grams)	1.7	4.5
Carbohydrates	8.0	14.7
Fat	0.6	1.1
Minerals—Calcium (in milligrams)	120	240
Phosphorus	100	200
Vitamins—A (international units)	45	90
D	3	9
B-12	.25	.50

(Rest of B vitamins twice as much for pup as adult dog.)

In addition, the caloric needs of dogs vary according to breed, size, activity and age, and whether the animal lives outside or in a warm house. Minimum requirements have been found to vary from 70 calories per kilogram (2.2 pounds) of body

(Please turn to page 200)

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THE TRUTH ABOUT PET FOODS

(Continued from page 198)

weight up to 130 calories. Dog-food manufacturers recognize this wide span when they recommend amounts to feed, letting the individual owner decide how much is best for his particular pet.

It is obvious from the table that a diet adequate for adult animals, even one based on a good brand, can be grossly deficient for a growing pup—even when the pup eats all he can, or wants.

Some companies recognize the inadequacy of their regular product for younger animals and market preparations specifically for this use. Even so, veterinarians often find it advisable, particularly with pups of large breeds, to prescribe milk and a vitamin-mineral supplement.

Supplements are always recommended for pregnant and nursing bitches, hard-working hunting dogs, guide dogs and other active breeds. Inspected raw meat is one such common supplement. (This

Canned meats are simply too rich for any animal as an exclusive diet.

does not include raw game such as venison, too often loaded with parasites.) Cottage cheese, milk and meat canned especially for animals are also acceptable. None, however, should make up more than one-third of the total amount fed.

A good reason for limiting the amount is that it may not merely supplement the carefully balanced diet of the regular dog food but will become the main meal itself.

This applies particularly to the all-meat canned foods now so widely sold. *These were never intended to be fed as the sole diet, but many owners have bought and used them as such with disastrous results.* Like the supplements mentioned, all-meat canned food should be fed one-to-one with kibbled biscuit or cereal. Advertising does not stress this, although it usually appears on the label in fine print. Canned meats are simply too rich for any animal as an exclusive diet. Diarrhea, bloating and bad breath are the usual early results. Continuous feeding may overwhelm a dog's kidneys. Proteins are hard to digest and leave a large waste residue which the kidneys must filter from the blood. Constant strain of doing this overworks this organ and some of its cells die. Eventually the animal suffers from uremic poisoning simply because there are not enough cells functioning to do the fil-

tration job. When this occurs, an animal may require a special diet, prescribed by a vet, containing a high-quality protein that leaves little waste residue for the kidneys to cope with.

As for cats, an owner should know that the nutritional requirement of his pet differs sharply from that of dogs. Kittens require about 250 calories per kilogram of body weight, nearly twice that of puppies. After a few months this need drops to 150 calories and an inactive adult house cat will do nicely on 60 calories.

Cats do not need carbohydrates as such, but they can assimilate starches. Fibrous foods such as tough, stringy meat are very poorly digested. A high quantity of fat is needed by both kittens and older cats. Kittens must have at least 30 percent protein in their diet, and 50 percent is recommended. Few cat foods contain this amount. Whole milk may be fed as a supplement to a good prepared commercial food. Raw liver, brewer's yeast and fish are other good supplements.

Obviously, a pet food which tries to supply nourishment for both dogs and cats cannot be a well-balanced diet for either. Dogs usually like cat food and on occasion it can be used as a supplement. But dog food cannot begin to supply a cat's needs.

What about bones? Nearly everyone has heard that chicken bones aren't good for a dog. Make that *all* bones that can be cracked and splintered by a dog. If he swallows the splinters, the sharp bone may puncture the esophagus, stomach or intestines. Without drastic surgery, the pet is usually doomed to suffering and death. Steak and chop bones can do the same. While most veterinarians have found it safer to ban all bones rather than have you offer the wrong kind, a beef knucklebone (joint end of the steer's thighbone) will give your dog the chewing he needs safely.

What about dog candy, dog biscuits and the like? These are supplements to a balanced dog food. They should not exceed one third of the entire amount of food fed to your dog. Large and active dogs can handle a reasonable amount, but small or sedentary dogs will get fat or else become spoiled and refuse their regular dog food. A dog biscuit makes a good light breakfast for active pets. The biscuits also offer some extra chewing which is good for their teeth, although a knucklebone gives more gnawing opportunity without starchy calories.

Finally, resist the idea that your pet shares your appetite. He's an animal, with tastes and needs vastly different from yours. Accepting this is half the battle. The rest is common sense. ★★★

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FREE STUD DECAL! Looks great on window or bumper. Yours free where you see 'Stud' displayed.



'Stud' is a trade mark of Union Carbide Corporation

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The Discovery Company

CHOOSING A HI-FI

(Continued from page 145)

car's acceleration, it's there when you need it.

But this doesn't mean you have to go overboard, either. The thing to do is to find out how much power is adequate for your particular needs and then be sure you get at least this much. To do this, you have to consider three main factors: the minimum power requirements of your speakers, the size of your listening area, and the type of furnishings you have.

Most of today's bookshelf-type acoustic-suspension speakers require about 15 watts of power each. So this is the basic minimum to start at. Next, the bigger your room, the more sound it eats up, and the more power you'll need. For an average-size living room of 2000 to 3000 cubic feet, you can probably get by with 15 to 20 watts per channel.

This assumes, however, that your room has what is known as "live" acoustics—

... most reliable way of rating an amplifier is in watts of 'continuous power'

lots of hard, bare surfaces that reflect sound instead of soaking it up. A good example is a family room with a tile or linoleum floor, few drapes and lightly upholstered outdoor-type furniture. When you start to add rugs, large curtained areas, wall hangings and heavily upholstered chairs and sofas, you have to revise your calculations.

Some recommended minimum power requirements are listed next to the drawing at the top of page 144. You'll note that they range all the way from 15 to 20 watts per channel for a "live" room up to 40 to 50 watts per channel for a "dead" room—one with a lot of sound-absorbing furnishings. These figures are based on an average 2000 to 3000-cubic-foot room and need to be increased up to double the amount for rooms of 4000 to 6000 cubic feet. Remember, too, that they are for one stereo channel. Total amplifier power must be doubled to handle both channels.

In considering an amplifier's rated output, it's important to bear in mind what the wattage figures refer to and how they're arrived at. When you talk about a 100-watt light bulb, you are referring to the amount of power that the bulb consumes. In the case of an amplifier, the wattage figure pertains to the amount of power that the set puts out.

Unfortunately, power consumption is easy to determine, but power output is tricky and can be measured in a variety of ways, each producing a different result. An amplifier that tests out at 40 watts by one method of measurement may rate only 20 watts by another. Some ratings are conservative; some are deliberately inflated to give the impression that a set is more powerful than it really is. You have to know which rating system is being used to make a wise choice.

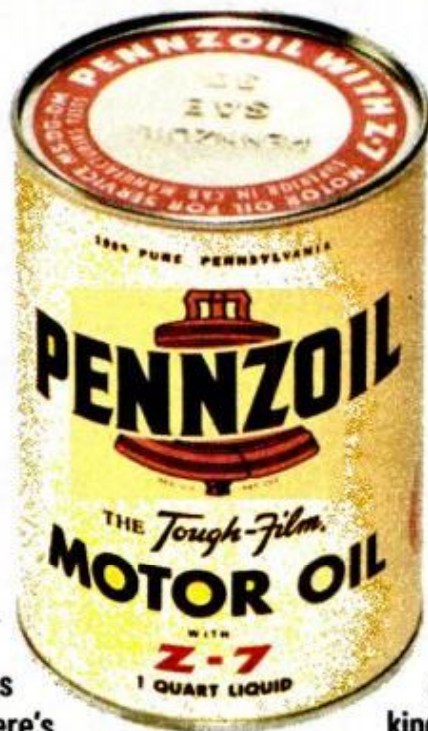
The most reliable way of rating an amplifier is in watts of "continuous power" (also called sine-wave power or rms power). This is a tough, honest, unequivocal test and is used on some top-quality equipment. Many manufacturers feel, however, that wattage ratings should make allowance for an amplifier's ability to exceed the continuous power rating for brief bursts of sound, such as drumbeats and cymbal crashes. Consequently, the Institute of High Fidelity, an industry association, recently agreed on a measuring system that permits somewhat higher wattage figures. This is called "IHF power" or "music power." It is used today by most makers of good audio equipment. While it yields more flattering ratings than continuous power—usually 10 to 15 watts higher—it is a fair test of performance. All of the minimum power requirements discussed in this article are based on IHF-rated output for *each* channel.

Some makers use the term "peak power" in their ratings. This is literally double-talk. It means nothing but an arbitrary doubling of an amplifier's continuous or IHF output to give an exaggerated rating. Still other makers follow EIA standards established by the Electronic Industries Assn. These were devised primarily for non-hi-fi equipment and permit far greater distortion levels than are tolerated for fine-quality products. While continuous and IHF power ratings are made at a maximum permissible distortion of only 1 or 2 percent, an EIA-rated amplifier may have a whopping 5-percent distortion.

In choosing a hi-fi set, always ask what the IHF power rating is, and make certain the figure is for each channel separately—not the two combined. Some makers list only total power so that a set rated at 40 watts may actually be delivering only 20 watts per channel. Furthermore, if the rating is in peak power, you can cut this figure in half again and the result is a mere 10 watts per channel. After you've determined the true wattage a set is capable of putting out on each channel, then—and only then—can you decide whether the amount is sufficient to meet your particular needs. ★★★




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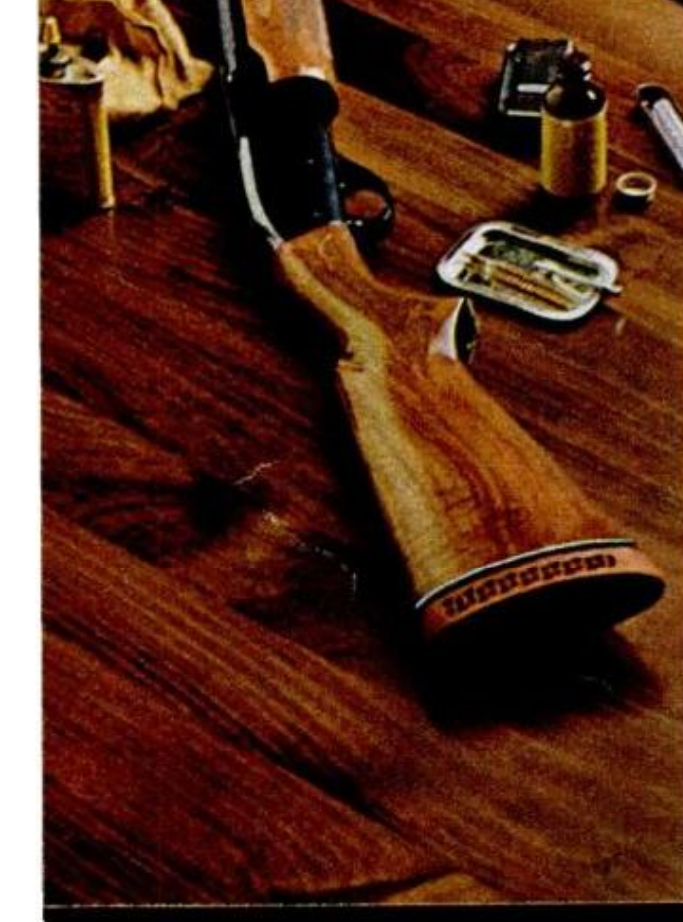


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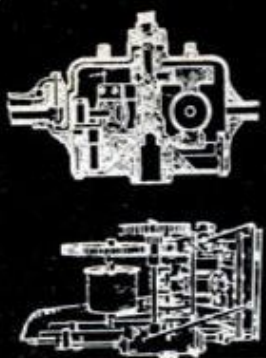
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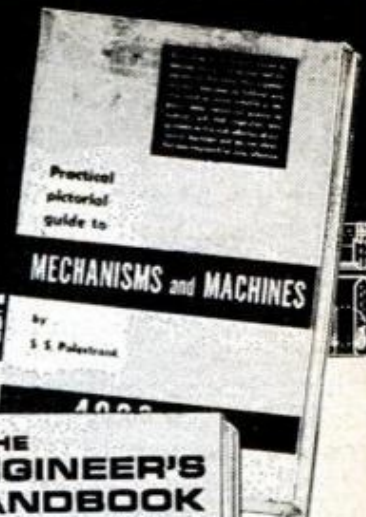
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PROPANE POWER!

(Continued from page 87)

gasoline to LPG or vice versa. One controls the fuel flow from gasoline tank, another activates a valve in the LPG line from tank to engine. Cruising at 60 mph it's impossible to tell when the changeover in fuels occurs.

The LPG goes from the tank through its control valve into the converter, where a relatively slight pressure drop causes the propane to vaporize. Under atmospheric pressure, LPG fuels turn to vapor at temperatures well below freezing (propane, minus 440°F.). This vaporization, of course, absorbs heat as evaporating water might, thus lowering the temperature of the unit. Consequently, to maintain the temperature at efficient levels, this converter is jacketed and warm water from the regular engine coolant system is routed through it. Two simple attachments, entry and exit, using ordinary radiator tubing, complete this circuit.

The carburetor, or mixer, receives the

Cruising at 60 mph, it's impossible to tell when the changeover in fuels occurs.

vapor, combines it in proper proportions with air from the regular intake, and routes it through an airtight elbow into the regular carburetor and the engine's combustion chamber. A valve in this mixer provides a choke for fast starting and seals off the LPG when the engine is turned off. The gasoline supply had been disconnected by the toggle switch when the change to LPG was made.

In addition to lowering the pollution level, the use of LPG provides other advantages. Ford points out a few on its all-LPG truck units: no small holes to clog or delicate parts to malfunction on a carburetor; no fuel pumps, float valves, or plumbing; no vapor lock possible; long life for ignition parts. The LPG Assn. enlarges upon this list, reminding the buyer that, for one thing, there is little odor connected with burning its product, as any butane stove will show. The already vaporized, tightly contained fuel eliminated the large evaporative loss which causes much of the pollution from gasoline engines, especially when hot. With no carburetor bowl, no vapor escapes here. With the tank sealed, no fumes escape through vents or are expelled as it is filled.

Prolonged engine life is a large selling point for LPG. No droplets of liquid fuel

wash the lubrication oil film from valve stems and cylinder walls and these parts last much longer, especially when the car is used in short-trip city driving. Significantly, Ford gives a warranty of two years or 100,000 miles on its high-standard (534 3D) V8 engine with LPG conversion.

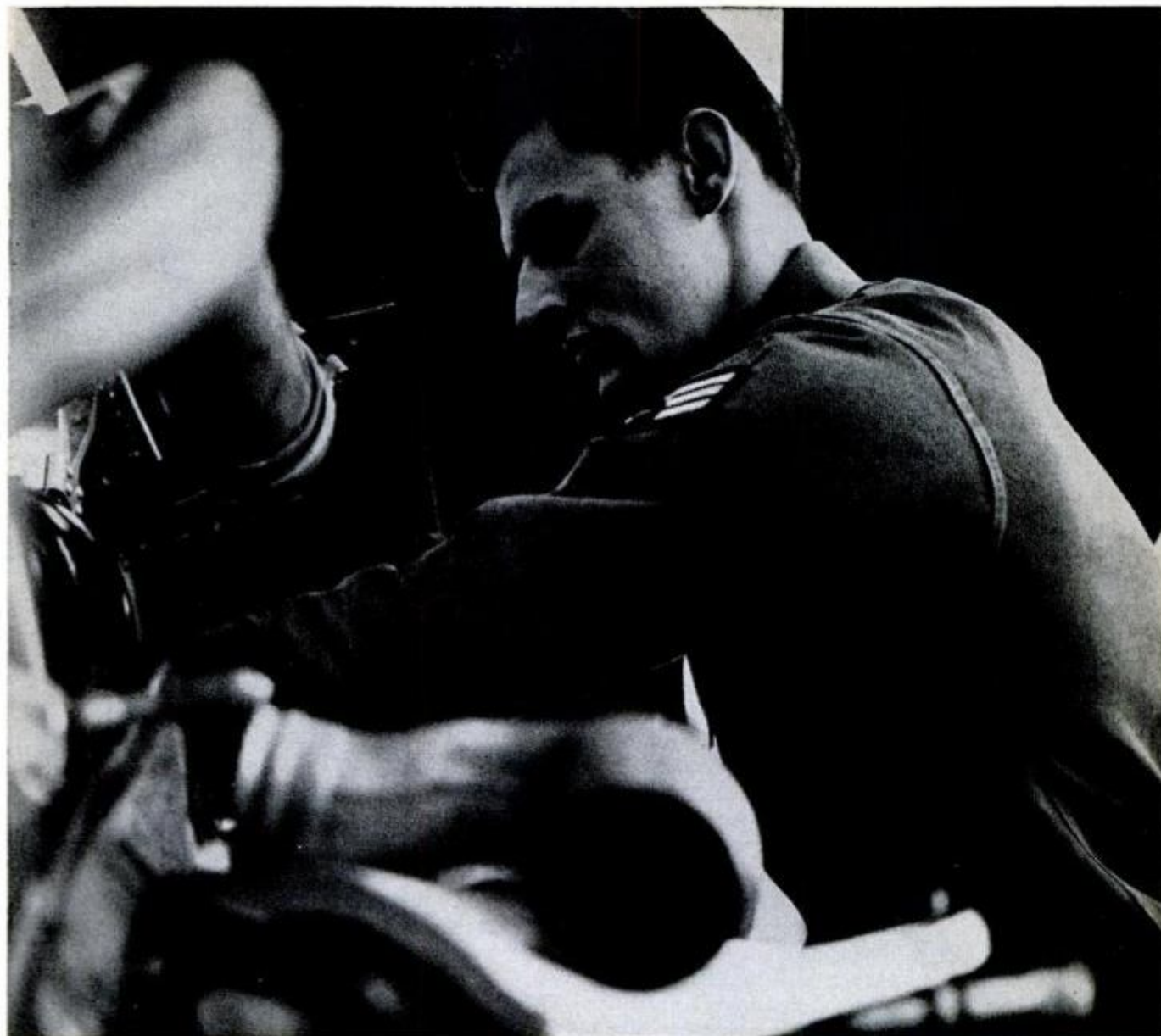
Since there is little carbon deposit in the cylinder head or contamination of oil by carbon, all parts of an LPG engine should run cleaner. The difference can be seen, according to users, in the condition of the engines' lubricating oil after several thousand miles of use. Even a finger casually run along the inside of the exhaust pipe can tell the difference in soot deposits here.

The General Telephone Co. of Florida converted all but a few units in its 1100-vehicle fleet to LPG in 1964. It reports greatly reduced trouble with fuel systems, ignition and exhaust. Soot and carbon were burned out of the latter and the oil has remained much cleaner. Life of their sparkplugs was doubled or tripled. And, of course, the air of the surrounding countryside was that much cleaner.

The Western LPG Assn. and Impco are also sponsoring a dragster—the Propane X—which will use LPG in its races. This Dodge Charger 500 is powered by a 568-hp engine which, when fueled with LPG, is said to give smoother power response, eliminate fuel starving in its strenuous acceleration, and provide smooth torque through all rpm.

Today the largest prospective users of LPG are companies and municipalities that maintain fleets of vehicles and can afford to install their own supply tanks. Because it is not yet available at every corner gas station, its exclusive use may not seem feasible for the average driver. However, test cars run in most states have encountered little difficulty in locating outlets. LPG associations publish directories showing where their product may be bought. Some drivers who combine city and country driving use the dual system, shifting from gasoline to LPG as they enter the city. Owners of truck-campers have added conversion units so they could depend on their LPG for emergency use. Mileage on these test vehicles has averaged only slightly less (from ten percent to one-tenth of a mile per gallon) with LPG than with regular gasoline.

LPG is manufactured as a by-product of gasoline and other petroleum specialties, so the output of propane or butane could be expanded. But whether this could be done rapidly and extensively enough to fuel the nation's entire auto fleet is doubtful. That would depend on the urgency given the project. ★★



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UNITED STATES AIR FORCE

'71 CARS—AMERICAN MOTORS

(Continued from page 102)

a wide selection of other standard and optional features.

As in the Gremlin, the 232-c.i.d. Six becomes the base Hornet engine (no more 199), with the 160-hp 258 Six, 210-hp 304 V8, and the SC/360 V8s optional.

New vented-rotor, front-disc brakes (power-assisted) are optional in all V8 Hornets, and so is variable-ratio power steering. AMC had this option last year, but not in all lines, and it's improved for 1971. Besides giving better road feel at speed and quicker turning for parking, variable ratio means 3.2 steering-wheel turns lock to lock.

MATADOR: The name Matador replaces Rebel, which replaced Classic last year. Apparently Rebel connoted too much bomb-tossing. But Matador means more than a mere name change. Wheelbase has been stretched from 114 to 118 inches, giving 206 inches overall length (199 in the 1970 Rebel).

The Matador comes in three body styles: wagon, two-door hardtop and four-door sedan. Styling is more massive than the Rebel's, and interiors more luxurious. Full carpeting is standard, as are brushed aluminum instrument panels, deeply embossed vinyl door panels, bright trim moldings around windows and wells.

The Matador's high-performance version is called "Machine" and comes with either of the two highest-horsepower V8s (290 and 330). It uses the hardtop body and includes the following standard equipment: power front-disc brakes, twin exhausts, E60-15 Polyglas tires on wide, styled wheels, Space-Saver spare, and heavy-duty suspension. All-synchro four-speed manual and automatic transmissions plus a variety of rear-end ratios are again available.

AMBASSADOR: Airconditioning continues standard on the 1971 Ambassador, but this year it's joined by standard automatic transmission and a basic V8 for all models but one.

There are three series in three body styles: DPL, SST and a new one known as Brougham. These come as four-door sedans and wagons or two-door hardtops. Front and rear styling has been slightly modified. Wheelbase remains at 122 inches, but overall length is up three inches due to addition of rubber-faced bumper guards.

The new Brougham becomes the company's luxury leader. Standard equipment includes not only air and automatic transmission but individually adjustable reclining seats, a six-foot roof rack for wagons, rear-window air deflector and a

translucent woodgrain exterior paneling.

Ambassadors offer the same engine lineup as Matadors, with the exception of the 232 Six. Instead, the 258-c.i.d. Six is standard on base DPLs. All other series begin with the 304 V8. All AMC engines except the 401 are designed to use low-lead regular gasoline.

Ambassador V8s may be ordered with vented power disc brakes, adjustable air-shock rear suspensions, variable-ratio power steering, headlights-off delay switch, and Space-Saver spare.

JAVELIN: AMC's ponycar gets radical new styling and quite a few under-the-skin mods. Its wheelbase and overall length are up only one inch each, but the entire car looks much longer than 1970. Massive front and rear fenders kick up in Group 7 fashion, and there's a spoiler-like lip on the rear of the roof. Interiors have also been completely redone. The Javelin's styling is the sort you either love or hate.

There's no more two-passenger AMX this year. Instead, Javelins come in three series: Javelin, SST and Javelin AMX. All are four-passenger hardtops.

Regular Javelins have a wide, deep grille, with its inner baffling slightly reminiscent of the 1970 Thunderbird. The Javelin AMX has a stone screen ahead of the grille, which Dick Teague says was inspired by the Green Label Bentley. The J/AMX's hood is fiberglass and has a reverse airscoop designed in conjunction with Mark Donohue (so they told us). In all, it's a most impressive car to look at, and even more impressive to sit in.

The front-seat area of all Javelins is divided into two distinct sections. Instruments stand in an outjutting island ahead of the driver. On the passenger's side, though, the dash fades back into the firewall, and there's this great, huge, roomy space with nothing but a glovebox beside the passenger's left knee and an air vent above the driveshaft console. Gauges are TV-screen-shaped, set into engine-turned-aluminum (Javelin or SST) or walnut burl (J/AMX), with flat toggle switches and everything very business-like.

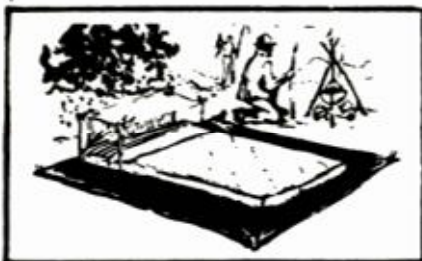
Among the Javelin's standard items is a new Weather-Eye heater that thermostatically adjusts to keep an even temperature inside the cockpit. Nonpower vented disc brakes up front are optional, as are powered discs, variable-ratio power steering, fast-ratio manual steering, improved airconditioning, twin-canopy vinyl roof covering, rally instrument cluster, all sorts of suspension and handling packages and rear axles ranging from 2.87 to 3.91.

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'71 CARS—GENERAL MOTORS

(Continued from page 110)

for the first month's sales figures to come in—just for reassurance of what they've believed all along: the car will be the hottest property of any GM division. Since the Vega was first reported (*The Minis Are Out to Rule the Road*, page 112, Sept. '70 PM) the accessory and hopup people have gone overtime working on sporty hang-ons and performance hardware for the mini. Our first reaction, when all the front-end sheet metal was stripped off in a demonstration of what can be done by an owner using the service manual, was that the car looked terrific bumperless. There's sure to be a big aftermarket in small nerf bars.

Corvette for '71 has the same dramatic and "mean" body shape, but the quality of the surface is improved. It has always been immediately recognizable as fiberglass, but an improved resin process, referred to as "low-profile," gives the body a smoother surface for a smoother finish. New exterior colors and trim are offered and all engines in all Chevy lines have been designed to operate on 91-octane fuel.

Nova loses its four-cylinder powerplant and gets the 145-hp, 250 c.i.d. Six as base engine (307 V8 in Nova SS). There are new colors, side-terminal battery, high-output headlights, more expensive-looking steering wheel standard. New options for the tried and true compact include a couple of sport steering wheels and on the SS, a suspension option of front and rear stabilizers and special shocks. Sideguard beams, built into Chevrolet car doors are not on Nova and Corvette.

Camaro, shown in red in its Z28 version on page 109, carries over from its '70½ introduction. Rally Sport and SS packages also continue as interior and exterior options on the base model. Changes for '71 include new taillight lens, larger backup light, spoilers, wheel covers, vinyl roof and exterior colors, high-back buckets, instrument panel knobs and sport steering wheels. Camaro, even more so for '71, is a

car that just about doubles in price going from the base setup to the full-flight, flaps-down Z28. As with all Chevy models, the fuel tank-to-carburetor system is sealed for evaporation control.

Chevelle continues with six models in the intermediate Chevelle and Malibu series. Malibu convertible now includes power-operated top standard. Convertibles and coupes stay with a 112-in. wheelbase; sedans, 116 in. Overall length, front and rear track are up a fraction of an inch, with all models lower by a like amount. New options include fingertip windshield wiper control on tip of transmission control lever (also on Monte Carlo, Chevrolet models), cushioned-center and sport steering wheels, soft black instrument-panel knobs and trim. On the outside, restyled grille and front bumper, round taillights set in rear bumper and other trim and molding refinements are new for '71.

Monte Carlo, the "compact" among GM's other, slightly larger, luxury, personal coupes, is recognizable from the '70s by its finer-grid grille, wider-spaced headlights, built-in parking lights and other trim and emblem changes. Introduced last year, the Monte Carlo also has an SS top-of-the-line version. Extra soundproofing is part of this package which includes 454 V8, dual exhausts, sport wheels, automatic level control and special chassis components and sporty markings.

Chevrolet, with Biscayne, Bel Air, Impala and Caprice in nine models, is most changed car in Chevrolet's '71 lineup. On a longer wheelbase and longer overall, all models are slicker than ever with new vertical front fender lights, recessed door handles, thin windshield pillars, more curved side glass. Caprice exteriors feature egg-crate grille, crest and moldings, making this top-of-the-line model look more like a Cadillac than Chevrolet. Double-panel roof construction and center-flow ventilation are new body features. Chassis features include all previously mentioned for GM's cars as well as power front discs/drum rear for all models.

—Bill Hartford

CORVETTE fiberglass body has smoother new surface



CHEVY NOVA new base engine is 145-hp, 250 c.i.d. Six



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(Continued from page 99)

just a machine (of course one with extraordinary sociological significance like all important machines). In 1970, however, Detroit became a scapegoat. The air-gulping automobile is the most conspicuous and ubiquitous manifestation of an affluent consumer society that has paused to question actions and policies, or nonpolicies, that have been taken for granted. Behold, the automobile sits idling (when emissions are greatest) in central city traffic. It wouldn't be true in the first place if cities were planned for people—not machines. But it's the car that takes the rap.

The '71 models are being introduced in a year when all the right questions are being asked: What will be the results of ever more cars? Larger cars? Of eliminating lead from gasoline? Of stricter emission standards? Of banning the internal-combustion engine? Of perpetuating the Highway Trust Fund at the expense of a more balanced national transportation system of road and rail? Even the time-honored annual model changeover has been questioned. Should it be every two years? How about a moratorium on style changes with the money saved used for pollution-free engine research?

The subject of air pollution is so complicated that even the right questions come hard and the answers harder: What are the effects of fuel and engine variables on characteristics of particulate emissions? How widespread is lead pollution and just what is its effect on terrestrial, aquatic and atmospheric environments? What is an accurate vehicle projection for 1990? The answer to the latter determines the answer to how strict future emission standards should be.

The fact is that, at this writing, GM's test-marketing of emission-control kits for pre-1968 cars is a failure, with one owner in 600 buying one. So what comes next? Will you be forced by law to do your part? Be required by law to install one? Be forced to accept, say, the limited range and speed of a workable, if not ideal, electric automobile that could be produced now and rushed to market to save our air?

Considering safety, it is extraordinary to ponder the fact that seat belts were not available on cars before the sixties, and it's true that impending legislation sparked the automakers to build safer cars. But, cowering giants, they find themselves on the defensive regarding air bags, for example, which are being rammed down their throats because the idea sounds good on paper. The system has un-

resolved technical problems, coupled with the fact that shoulder and lap belts which are not being used will still be important in a feasible air-bag system.

The federal government recently revised its auto-emission measuring methods after finding previous ones inadequate—embarrassing, but a natural result of the necessarily slow compilation of environmental data. At a time when concerned individuals, agencies—yes, even Detroit—are asking questions and looking for solutions to complicated problems, the automakers are taking the rap for putting cars into our hands. That's when the fellows need a friend. ★★★

'71 CARS—GENERAL MOTORS

(Continued from page 115)

consistency of shock absorbers. No. 2, it has immersed a Freon-filled plastic envelope in the hydraulic fluid. This prevents air from becoming trapped in the fluid, a condition that can cause a loss of shock control at high temperatures and during long runs. Olds says its supershocks will last about 40 percent longer than conventional shocks.

In the something-for-safety department, Toronado has auxiliary taillights immediately below the rear window. They don't replace the taillights. But they give you an extra set of lights built high up on the car to tell drivers coming up from the rear when you're going to turn or stop.

A nifty gadget that'll cost you extra is a light next to the fuel gauge that glows red when the tank drops below four gallons of gas. It's available on everything except the intermediates.

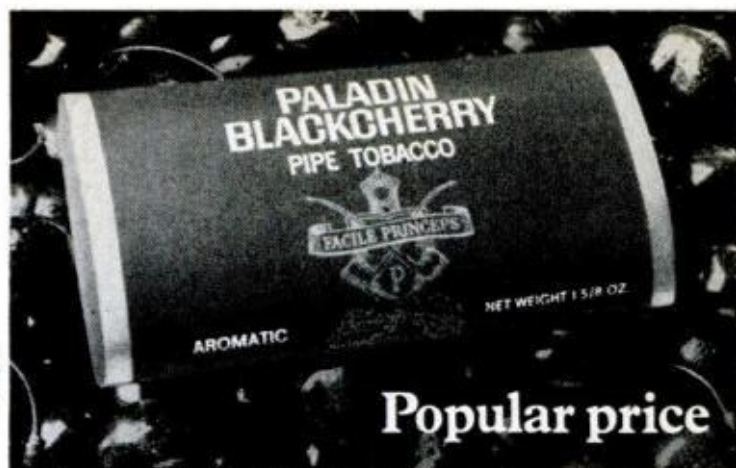
Summing up: Olds may not have it in excitement. But you can't fault the car on elegance. Olds regulars will love 'em.—R.L.

CADILLAC: Secure in its position at the top of the GM price and prestige ladder, Cadillac has not at this writing shown its '71 ships.

Eldorado. We managed to get a picture of the Eldorado, however, and gasped at the funny, gimmicky little rear "window." The funny thing, though, is that it grows on you and is likely to show up on pretenders in the future. Wheelbase is up a whopping 6.3 inches to 126.3 although overall length stays about the same. A convertible in the Eldorado series replaces the De Ville convertible. Rear-wheel skid control is available and compression ratio of the 500-c.i.d. engine is a comfortable 8.5 to 1 for unleaded regular fuel.

Calais, De Ville, Fleetwood continue with the 472 c.i.d. V8; also 8.5 to 1 compression, down from 10 to 1.—B. H.

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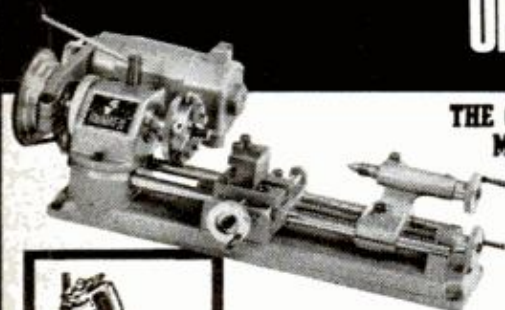
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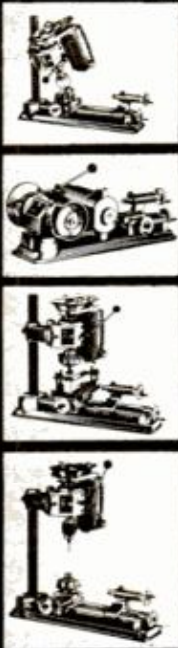
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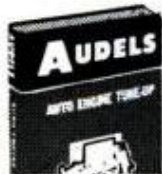
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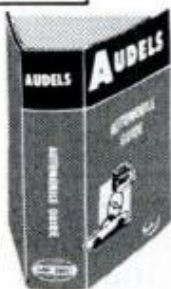
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'71 CARS—CHRYSLER CORP.

(Continued from page 107)

Hemi orange and Green-go and call them mini-muscle cars.

CHALLENGER, BARRACUDA: The sporty compacts from Dodge and Plymouth get a new low-price model. Available in this economy year will be a sports coupe with a fixed, rear-quarter window and 198-c.i.d. Six, an engine heretofore available only in Dart and Valiant compacts. Barracuda continues with Gran Coupe and 'Cuda models, and Challenger with Deputy, base and R/T (S.E. and R/T convertible discontinued). Barracuda joins the Challenger with dual headlamps in its new grille. Both cars, all new last year, have only grille, taillamp, other light and trim changes. Elastomeric bumpers are available across the board.

CHARGER, CORONET, SATELLITE: Both Dodge and Plymouth have split their intermediates into two entirely different lines. Dodge Charger, Super Bee, Charger 500, R/T and S.E. are two-door-hardtop, 115-in.-wheelbase models and Coronets are all four-door models on 118-in. wheelbase. Plymouth Satellite coupes, Road Runner, Sebring, Sebring Plus and GTX are two-doors on 115-in. wheelbase with the four-doors on 117 in. All the cars have completely new sheet metal, ventless side glass, hidden wipers, recessed door-handle design for overall streamlining.

POLARA, MONACO, FURY: Real passenger-car comfort gets the emphasis in the Dodge and Plymouth full-size cars for '71. New 360-c.i.d. V8 minimizes vibration with specific design and construction techniques. Providing 225-hp at 4400 rpm, it runs on regular fuel. Part-throttle kick-down is available with more engines than last year. Chassis and body improvements include more rubber insulators. Two-door hardtops have been added to Fury II and Polara series (officially the "Polara Special" economy series). All cars go to ventless side glass, and are otherwise different in front and rear-end treatment. Dodge has a 14-model lineup in Polara, Custom, Brougham and Monaco series; Plymouth 21 models in Fury I, II, III, Sport Fury and Sport Fury GT series.

CHRYSLER: Newport, Newport Custom, 300, New Yorker and Town & Country series offer 13 models. Convertibles are discontinued but sun roof is optional on two-door hardtops. All engines are modified to operate on regular fuel and Torsion-Quiet Ride extends to wagons. Interiors are significantly changed. Ventless side glass extends throughout the line. Lots of luxury is standard, even more optional.

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(Continued from page 91)

corridors, long used by military planes, permit traffic to pass through such areas, yet do not close them to other craft. Positive control is required only for planes using the corridors.

This would reduce the outlay for sophisticated equipment which today threatens to ground many private planes. A transponder with the many channels required by air traffic control now retails for nearly \$1000, installed. Many-channeled communications equipment is already mandatory for planes using airports with towers. Anticollision devices could add astronomical costs.

If general aviation's uphill battle is won it probably will be with technological advances.

Airports have been modernized in many places, with equal and separate facilities for both airlines and general aviation. Traffic patterns are separated, different terminals are provided and conflict between the two classes of planes is rare. In terminal areas, where the crush of traffic makes parallel facilities inadvisable, "reliever" airports have helped—and more are scheduled—to take pressure off main terminals and still provide convenient locations for business and private pilots.

Aloft, the need for transponders may be alleviated by the improvement of ground radar sets capable of discerning *all* targets more clearly. Most important is the development of height-finding radar. Today's sets provide only the direction and distance of the target, but others soon on the market will indicate the plane's altitude. Such tools, unlike restrictions will greatly improve the safety factor of aviation.

Along the airways, congestion is already being relieved by another advanced aid, the "area-navigation" system. Using on-board computers aircraft can navigate almost directly to their destination instead of following crowded air lanes.

The ultimate anticollision tool, an airborne system which will warn pilots against dangerously close aircraft, is also well along in its development. An elaborate electronic collision-avoidance system is favored by the airlines, but this would work only when all aircraft were similarly equipped and the present cost is about \$50,000.

General aviation favors a cheaper, simpler pilot warning indicator. The Electronic Research Center of NASA in Boston recently showed such a device. It operates from lights aboard the planes, the flashing of which is picked up by grids on the windshields of other craft. Position of the

lights on these grids indicates the other craft's direction. Highly visible stroboscopic lights, whether or not a part of a warning system, have been recommended by all parties and are being widely installed.

Several long-standing weaknesses remain to be improved, however. One is cockpit visibility—even in new jets. Near Milwaukee, in 1968, the pilots of a Convair 580 were advised three times by controllers that they were overtaking another target but, because of insects on the windshield they could not see a Cessna 150 until they plowed into it.

There is also the increased attention airline pilots must pay to items within the cockpit during descent and takeoff.

"That controller had *better* get everybody out of the way when we come in," confessed a friend who flies a DC-8. "I'm not looking outside 10 percent of the time during an approach."

Finally, airline scheduling during peak demand hours still creates much terminal congestion. Airlines cater to passenger's normal desire to fly during daylight. Some major terminals are thus almost deserted after mid-evening. If airline flights could be spread more evenly over the day and night, crowding and hazard could be reduced immediately.

All these are realistic solutions, well on their way into practice. Barring general aviation from public airspace, regimenting all flights, and hiking the cost of flying needlessly are shortsighted answers at best. Over the long run, they would indeed return private aviation to the pastures—but is that where we want it? ★★

NEW OUTBOARDS FOR '71

(Continued from page 95)

claims it costs about 15 cents per hour to run.

Yamaha produces three power ratings from 7.5 to 15 hp with unique optional engines that burn kerosene. Aimed at South Pacific and East Asian markets where gasoline is often scarce the kerosene outboard burns a mixture of fuel and oil in the same proportion as standard gas engines. But because there's more potential energy in a gallon of kerosene than in a gallon of gas, the kerosene engines generally get better mileage.

Finally, Sears, Roebuck will be marketing six models ranging from a 3-hp for \$99.95 to a new 7½-hp (to be available next May) for \$239.95. Other mail-order houses like L. L. Bean and Montgomery Ward will continue to offer outboards in the new year. ★★

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DRIVING IN JAPAN

(Continued from page 129)

you over the head with how good it's been since the Revolution.

The United States Pavilion was the most popular with the Japanese. For once, a U. S. exhibit made me proud to be an American. Instead of a spectacular building with nothing in it, as at New York and Montreal, whoever planned our show for Expo '70 figured out what the Japanese would want to know about America and put together a remarkably real picture of American life—at its best, it's only fair to say. One section caught Japan's keen interest in sports. Along with Babe Ruth's uniform were caps of all 24 major-league baseball teams, helmets of each pro football team and two Indianapolis racing cars, plus a dune buggy, a hot rod, an ATV, a sailboat and a gyrocopter.

The star attraction, though, was the U. S. Space exhibit. It outdrew its counterpart in the Soviet pavilion because

The manager came out to see us leave . . . he didn't believe we had driven there ourselves.

Americans had *been* to the moon. Life-sized U. S. astronauts left footprints in the lunar dust beside a full-size LM. Other astronauts tumbled in space from invisible wires, and a tiny piece of moon rock glowed in a glass case. Someone deserves a medal for displaying fiberglass couches of the original Mercury astronauts so bright-eyed grammar schoolers could climb into them and have their pictures taken beneath a sign reading "Glenn," "Schirra," or "Cooper."

Sports and space, of course, were only a part of the exhibit. The real stroke of genius, however, was in the design and illumination of the building itself, which permitted anyone to take pictures of any exhibit with natural light. The pavilion's pancakelike, translucent dome barely projected above ground. Inside you walked on ramps above a floor that reflected light like the mirror behind a flashlight. Somebody in Washington knew the Japanese are the world's most tireless picture-takers and designed the building for them. By contrast, the Soviet pavilion was a bit gloomy, and you needed a lot of flash to photograph their spaceships.

We returned to Nagoya by train and retrieved the Datsun from the hotel garage. I had gotten into Nagoya all right, but I was worried about getting out, especially

since we would not be leaving on the Expressway. Before going up to our room I asked the pleasant young girl at the desk if she had a map of Nagoya that showed how to get out of town on Route 1. She said she'd try to find one. Next morning I asked the young man who had replaced her if *he* had a map. He said, "Just a minute," reached into our mailbox and handed me a map neatly drawn in pencil showing just how to find our way out of downtown Nagoya and onto National Highway 1, leading south toward the Ise Peninsula. That's Japan too.

Route 1 serves an immense industrial area south of Nagoya, with docks and refineries stretching along the edge of Ise Bay. The going was slow. In one stretch we counted 20 trucks to 10 passenger cars. We were three hours going the 113 kilometers to Ise. From there on, we were in the scenic Ise-Shima National Park. We stopped for lunch at Toba, site of the famous Pearl Island where Kokichi Mikimoto irritated the first oyster into producing a cultured pearl in 1893. Today the real pearl farms are farther south near Kashikojima, where thousands of oysters impregnated with tiny slivers of mussel shell from our Mississippi River dangle in crates from rafts in Ago Bay. That was our destination for the evening. The luxurious Shima Kanko Hotel had added a whole new wing since '67, and the private railroad which owns it had improved the line from Toba and built a fancy new station so it could run through "Vista" cars from Nagoya. That's Japan again.

That afternoon we drove over to Cape Daio to a picturesque fishing village. The fishermen were repairing their nets after a day's catch, while old women filleted hundreds of small fish to dry in the sun. In a covered market we watched a buyer sorting baskets of huge abalone, rejecting the ones that didn't writhe.

That night at the Shima Kanko we slept on cushions on the floor of a Japanese-style room and bathed in a deep cedar tub, the size of a large wastebasket.

The manager came out to see us leave next morning. He didn't believe we had driven down there by ourselves. We mentioned we weren't looking forward to that truck traffic south of Nagoya. "Why don't you take the ferry across Ise Bay from Toba?" he suggested. "You can cut up through Toyohashi and get on the Expressway at Exit 18."

We just made the 10:00 o'clock ferry, parked the Datsun behind a tour bus and went topside for a one-hour cruise past tiny islands, hundred of fishing boats and a couple of hydrofoils to Iarko. From there

(Please turn to page 224)

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DRIVING IN JAPAN

(Continued from page 222)

it was pleasant country driving to Toyohashi and the Expressway.

The Datsun was a real pleasure to drive. It made me realize that small cars have become so roadworthy, so easy-handling and so comfortable that they upset the popularly held American myth that you need a big car for over-the-road driving. And surprisingly it didn't seem small, even when surrounded by big trucks.

Datsun claims a top speed of "over 90 mph." I let the 1200 out on a straight stretch of expressway, and the needle touched 160 kmph. If the speedometer wasn't lying, that's exactly 100 mph. Pretty fast for a 69-hp, four-cylinder engine. The 1200 racked up another figure that's hard to believe. Datsun claims 30 mpg. I kept track of fill-ups between a couple of far-apart stops. After changing liters to quarts and quarts to gallons and kilometers to miles, I got 39 mpg! This included that 100-mph spurt and many miles over 70. Okay, don't believe it.

The 1200, nicely finished with top-quality vinyl, had comfortable, fully reclining bucket seats in front. We put two large suitcases in the trunk with no squeeze. The brakes, discs front, drums rear, had a nice, everything-under-control feeling, although we never put them to a severe test. In almost 1000 kilometers we encountered no bugs whatsoever. I'd have to give the 1200 an "A" for workmanship and quality control. Make that an "A-"; the rubber trunk-lid gasket fell off.

Nissan obviously means business. Last May I had a chance to inspect the *Kanagawa Maru*, newest of its five oceangoing car ferries, when she made her first visit to our East Coast. Longshoremen drove 1900 of the larger Datsuns ashore at Houston, Jacksonville and Newark.

We got a momentary glimpse of Mount Fuji on the return trip—just enough to know there really was such a mountain. As the Expressway dumped us off at the edge of Tokyo, we started to worry. Could we find our way back to the New Otani? Luckily I found the same torn-up boulevard Mr. Mano had led us out on and followed the concrete supports of an unfinished elevated highway to Shibuya Station. Soon I could see the 17-story New Otani. We were home free.

Oh yeah? How did I get on the Shuto Expressway? How did I get in that endless tunnel under the Imperial Palace grounds? How did I end up in front of Science Museum the other side of the Ginza? I felt relieved. You can get lost driving in Japan—without leaving Tokyo. ★★

SADDLE UP FOR DIRT!

(Continued from page 141)

strong enough to bear the full weight of the rider even if he rides over a six-foot cliff! Adjustable handlebars are common and fenders are so designed that they won't pack with mud. Rear suspension shocks are commonly adjustable to 3° or 5° of stiffness by simply turning a cam.

Laying a dirt bike on its side should no longer cause the carburetor to drain into the cylinder and intake manifold, flooding the engine and making it all but impossible to start within the hour. And the carburetors are deliberately made as simple and adjustment-free as possible; many don't have chokes, but depend on depressing the float with an outside button to enrich mixture for cold-starting. A small thing, but every rider who has run choke-equipped cycles in the rough has had the experience of having the choke jarred to the on position, resulting in a flooded engine.

Trail bikes are stronger

Trail bikes must be much stronger than their street counterparts. When the street-bike makers first started work on their "street scramblers" frames broke right and left. The answer was to beef up the existing frames, which is why so many of the older street scramblers are actually heavier than their equivalent street bikes. Most dirt bikes now on the market have been designed from scratch and are lighter and stronger.

Most trail bikes sold today are actually enduro machines, but even if an enduro rider decides later that he wants to give motocross a go, for example, all he has to do is make a few simple, bolt-on modifications and he has a motocross bike capable of holding its own against all but the most exotic factory specials.

Some of the little niceties the street rider takes for granted are omitted on dirt bikes. Not many center stands are seen on trail bikes—these tend to hang down and get caught on trees and rocks. And dirt-bike fenders won't go far toward keeping the rider clean!

Most popular enduro-type bikes are in the 100 to 125-cc class because they're less expensive than larger models—\$400 to \$700 as opposed to \$700 to \$1000 or more for 250-cc machines. They cost less to maintain, are light and easy to ride, and have enough power to take a rider anywhere. Except where sheer speed is a factor, these tiddlers can hold their own with the larger machines: The rougher the ground the less advantage the larger machines have! ★★

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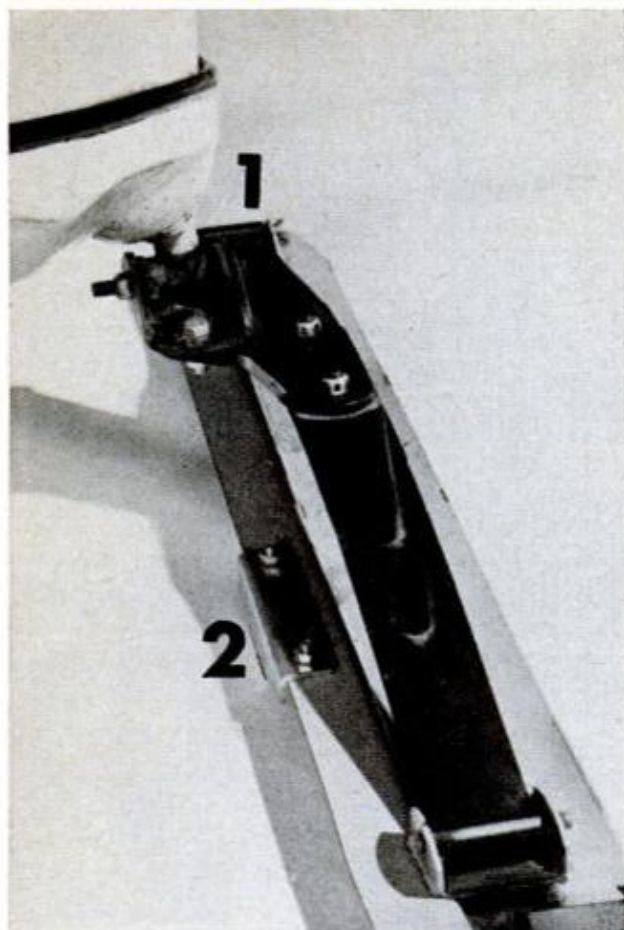
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SNOWMOBILES IN '71

(Continued from page 133)



SKI-SPREDS (1) widen distance between snowmobile skis, increasing machine's stability and improving steering control. Price: \$6.95. **Ski-Prufs** (2) lend positive action to skis running over compact snow or ice. Price per pair: \$3.95. Both from Cascade Products, 10653 Johnson Rd., Minneapolis, Minn. 55431. Similar to the Ski-Pruf but longer is Ski Rail (not pictured) by L&L Recreational Products, Box 20-227, Minneapolis, Minn. 55420. Price: \$6.95 per pair. **Turf Skis** (3) convert snowmobiles to dry land use by means of elliptical hard-rubber rollers set in a slight arc. Price per pair: from \$98.50 to \$109.95. Write 65 Rogers St., Cambridge, Mass. 02142. Also new for '71 is Cosom's Tote-A-Boggan (6030 Wayzata Blvd., Minneapolis, Minn. 55416) which rolls up when not in use but unfolds for placement under your track if machine breaks down. Any accompanying snowmobile can then easily tow you out. Price: \$9.95. New safety light and flag staffs from Electro Enterprises, 4118 Cedar Ave. S., Minneapolis, Minn. 55407, feature a 6-foot Hi-Lite model for \$16.95 and SOS, Box 193, Medicine Bow, Wyo. 82329, sells an 8-foot telescoping Saf-Tenna flag and related snow equipment

a 400SS racing model with a 437-cc twin-cylinder Sachs engine and slide rail suspension system.

Chaparral has four new models in its Skylark, Firebird, Executive and Thunderbird series with engine options from 299-cc through 800-cc representing JLO, Hirth and CCW.

Massey-Ferguson has four brand-new Ski-Whiz models ranging from an 18½-hp size to a 399-cc, 28.3-hp 500ST version.

In Yamaha's stable of machines is an economy lightweight called the SL-292 for which there's a modification kit that will give you even more rpm than the standard 5500 with 20 hp.

Bolens produces Huskies ranging from 292-cc to a growling three-cylinder 440-cc model. Polaron Products has four Cyclone and Tornado models starting with a 295-cc version and topped by a 399-cc, 26-hp model selling for \$1345.

Gilson Brothers produces five Kohler-equipped models running from 295-cc to 440-cc. Also available: electrical start and speedometer kits.

In addition to machines marketed by Sears, Roebuck; Montgomery Ward, and J.C. Penney, the following other manufacturers are making snowmobiles and information about their lines may be had by writing to them:

Arlberg, AL&W, Ltd., 59 Bramalea Rd., Bramalea, Ont.

Auto-Neige (Eskimo) Snowmobile Inc., 171 Hymus Blvd., Pointe-Claire, 730, Que.

Auto-Ski, Inc., C.P. 242, Lévis, Que.

Bonanza (Stormer), Dept. 7, 1775 S. First, San Jose, Calif. 95112.

Dauphin, 1200 Des Hetres Blvd., Quebec, Que.

Leisure-Mor, Inc. (Sno-Pac), 512 W. 9th St., Green Bay, Wis. 54306.

Moleba, 80 Ste. Marguerite Ville Mercier, Ct. Châteauguay, Que.

Moto-Kometik, Box 490, St. Jean-Port-Joli, Que.

Northway Snowmobile Ltd., 2066 Charrier, Dorval, Que.

Jet Dynamics (Stinger), St. Cloud, Minn. 56301.

Roll-O-Flex, Box 1384, Regina, Sask.

Ski-Zoom, 4001 Metropolitan Blvd. East, Montreal 546, Que.

Snow-Flake, Sheboygan Falls, Wis. 53085.

Williamsburg Bronze Corp. (Sno Phantom), Kingswood, W. Va.

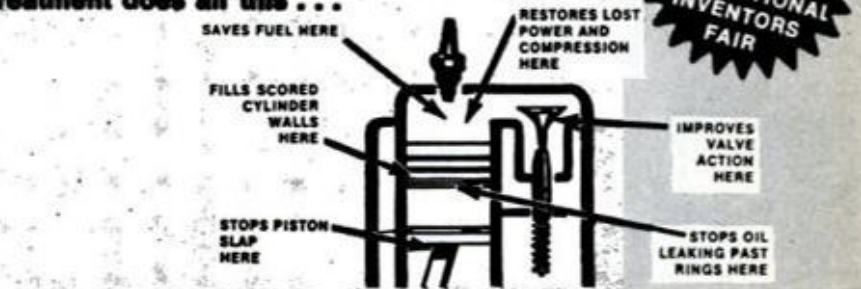
Finally, there's an industry trend toward improved and more fashionable snow suits and accessories as well as general safety consciousness. Snowmobiling is coming of age! ★★★

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Intake Valve Face	Very Heavy
Exhaust Valve Face	Heavy
Intake Valve Seat	Heavy
Exhaust Valve Seat	Medium

The above tracing of the radioactive Motaloy is positive proof of the actual transfer of the Motaloy particles from the gasoline tank on to the surfaces of the above surveyed parts of the engine.

JUST DROP 4 Motaloy tabs into your gas tank . . . and you've started your engine rebuilding job! Each tab is a scientifically compounded alloy of 9 metals and elements. As you drive, tiny Motaloy particles are released into the fuel. These Motaloy molecules are carried through the fuel line into the combustion chamber . . . where the intense heat of ignition activates them to soften, then remove carbon deposits. Then, Motaloy starts metal-plating pitted and worn surfaces of cylinder walls, piston rings, valve seats, and stems.

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The more you drive, the more protection Motaloy deposits in the form of a fine, anti-friction metal plating that rebuilds, smooths, and protects vital surfaces! As Motaloy continues to plate and re-plate, engine compression is increased without a ring and valve job! Gas mileage improves, your engine eats less oil! And over fifteen years of use by over a million motorists — some of them with cars that have locked over 100,000 miles after a single Motaloy treatment — prove that Motaloy can keep your engine running younger and peppier . . . for years longer!

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longer . . . and a better trade-in or resale price whenever you decide to sell! And Motaloy's track record on cars that have rolled up 50,000 . . . 70,000 . . . even 90,000 miles shows fantastic results in improved compression, lower gas and oil consumption, better pickup, smoother running — just as if the engine were years younger! Give your car's engine a new . . . and longer . . . lease on life with amazing Motaloy! Remember — a single Motaloy treatment lasts for the life of your car! And Motaloy cannot harm even the finest engine in any way!

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*Gold Medal, Naples, Bronze Medal, Brussels, 1964.

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WORKBENCH FIT FOR A PRO

(Continued from page 165)

in. below the top surface. Drill 1/4-in. holes through the shim and 1 in. deep into the Benelex; then enlarge holes to 1/2-in. dia. Dab epoxy glue on the outside of each lead anchor, insert into hole and spread with a setting tool. Drill 1/4-in. holes through the inside vise cheeks and 1 in. deep. Enlarge both holes to 1/2-in. dia. and insert the anchors. Countersink the hole in the cheek. Fasten cheek to vise and benchtop with flathead bolts.

Re-engage the screw portion of the vise, install the other hardwood cheek, align the cheeks, and tighten the vise. Drill 1/8-in. pilot holes into the cheek, and fasten it with flathead screws to complete the vise installation.

● **Assembling top to base.** With the vise closed and the top inverted, turn the base upside down and position it on the top.

Allow a 1/8-in. gap between the end of the vise guides and the side of the cabinet. Mark four holes in the Benelex and two holes in the tool well. Drill holes, spread four lead anchors in Benelex and bolt the legs to top just finger-tight. Glue the upper door channel in place with epoxy.

When the glue has set, loosen leg bolts, place doors in channels and bolt legs down tight. Turn bench upright, and fasten to the back panel with four wood screws. Mark off the row of dog holes in line with the dog in the vise. After stepping off 4-in. spaces between holes, drill 5/8-in. holes through both Benelex and hardboard.

● **Finish.** Sand or plane all edges flush. Apply paste wax to the Benelex and sliding-door channels. Remove vise cheeks and wax them too. Mask Benelex, convenience outlet and bright metal parts of the vise. Spray the bench with Illinois Bronze's Hamm-r Gold No. 321.

● **Installation.** You'll get maximum rigidity if you bolt the bench to the floor with 1/4-in. bolts into lead anchors. By installing the bench as an island, or at least two or three feet from a wall, you can steady 4x8 sheets, such as paneling, with the backvise and bench dog.

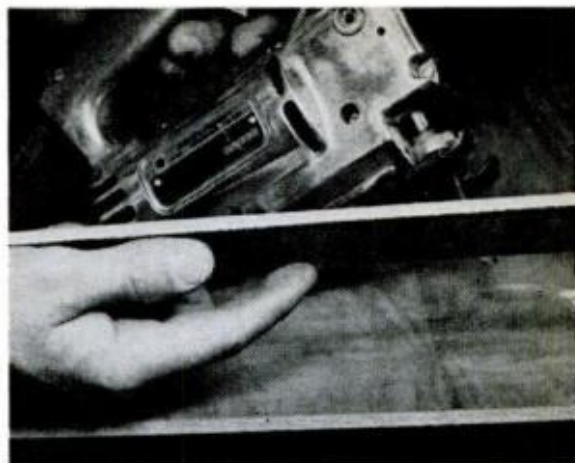
For information on your nearest Benelex dealer, write Masonite Corp., 29 N. Wacker Dr., Chicago, Ill. 60606. All other materials are readily available at your local hardware and lumber dealer. (Sears also stocks bench-leg kits). Or you can buy a complete pre-cut workbench kit ready for drilling and assembly from Rosenthal's, 95 E. Crystal Lake, Crystal Lake, Ill. 60014. Bench, including Benelex, vise, and Stanley bench stop: \$59.95. Price excludes freight. ★★ ★

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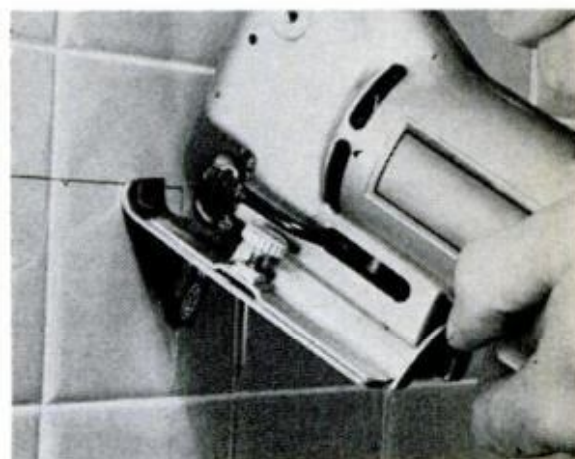
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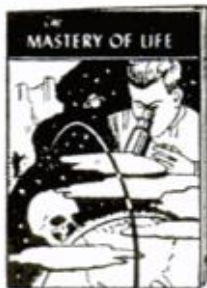
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POWER HACKSAW

(Continued from page 167)

prevent the sagging piece from working its way beneath the blade.

When cutting long pieces, it is convenient to have at least one work support stand of the type shown. The height of the uprights should be about an inch less than the distance from the floor to the bottom of the saw vise. The Vs in the adjustable pieces are cut at 60° to hold round or hexagonal stock. The ends can be reversed to provide support for flat or rectangular bar stock. A roller dolly may be used, but it can be a hazard unless clamps are provided to avoid movement and damage to the saw. The support shown here should always be placed near the point of balance.

Dos and don'ts. Except for making sure that the gibs and bearings are snug, adjustments for slanting cuts should never be attempted on the saw mechanism. Such adjustments would be futile, and could damage the machine beyond repair.

Several factors control blade life. The first is the use of the proper tooth spacing. It pays to follow the manufacturer's recommendations on this point. Never start a new blade in an old cut. Start a new cut to avoid losing the "set" of the teeth.

Workholding forms. Place equal volumes of plaster of Paris and common Portland cement on a piece of newspaper. Roll from corner to corner to mix, and break up any lumps. Place the dry mixture in a tin can, and mix with water to about the thickness of mayonnaise. Using a spatula or putty knife, pack the wet cement around the metal set in the form to fill the box. Allow the material to set for about 45 minutes. Then, remove the form-holding strings (see photo) and clamp the whole box in the saw vise as shown. The cement will have sufficient strength to hold the piece during the cut. When the cut is completed, spread the sides of the box near the top, and remove the plaster block. The box (form) may be retained for future work, and the plaster block will crack under light hammer taps.

Finally, if you plan to leave the area while the saw is in operation, additional precautions should be taken with the belt and motor pulley. If the belt is loose, a slight sticking of the blade may stop the saw, and the friction of the small motor pulley will frequently set fire to the belt. If you leave the room, you will have no chance to stop the motor before this happens. If the motor pulley becomes worn and polished to the point where slipping occurs, it should be replaced. Belts should be kept in good condition and tight. ★★



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BUILD THIS ELECTRONIC BANJO

(Continued from page 177)

up does not require a skin head, this can be damaged or missing—you don't need it. Remove the original head-tightening hardware and fit the top of the shell with a circle of 1/4-inch tempered hardboard for the head. Holes left from the clamps can be covered with decorative tacks.

If you're making your own shell, you can use several methods. You can turn it on a lathe, bandsaw it from laminated wood built up to correct thickness, or wind it from thin wood strips wrapped around a form. If you choose the last, use strips 1/16 inch or less thick, bending them around a straight-sided kettle or similar form until you've built up a thickness of 1/4 to 3/8 inch. Use plenty of glue between the turns. Body diameter can vary from about 9 1/2 to 12 inches.

To support the hardboard head, the shell must have a lip or rabbet around the rim to form a recess. You can rabbet the rim on a lathe or with a router, or you can make the shell in two separate rings, with the inner one narrower to provide a recess at the top. An even simpler way is to glue a series of small support blocks around the inside of the shell.

The studs that join the neck to the body are made from ordinary bolts with the heads hacksawed off. They're cemented into holes in the neck with epoxy, but are a free fit in the body. The nut on the upper stud permits the neck to be slanted slightly away from the body to adjust the height of the strings. This is a critical adjustment and should be carefully made to bring the strings as close as possible to the frets without actually touching them. The closer the strings, the easier the instrument is to play.

If you make your own pickup, use fine wire for the coil windings. No. 40 Nyclad, made by Belden, is a good choice and is available from mail-order houses like Allied Radio, 100 N. Western Ave., Chicago, Ill. 60680. The exact number of turns isn't critical—just fill the coil form flush with the bottom flange. The small Alnico magnets can be obtained at some radio and hobby shops or from Edmund Scientific Co., 300 Edscorp Bldg., Barrington, N. J. 08007. Use any thin, nonmetallic material for the coil flanges, such as 1/8-inch tempered hardboard or sheet plastic.

The pickup should be mounted just below the strings so the strings don't touch it when the last fret is pressed. The pick guard is cut from a polished aluminum cookie sheet and is shaped to clear the pickup. An important added detail is the

(Please turn to page 236)

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BUILD THIS ELECTRONIC BANJO

(Continued from page 234)

damper slipped over the strings on the bridge. This has the effect of muting the strings' vibrations slightly, giving the instrument its characteristic plunking sound.

The advantage of having a volume control right on the banjo is that you can vary your playing volume yourself as you go along without having to have someone do it for you at the amplifier. Commercial pickups can be purchased with their own volume controls or you can add one yourself, as shown in the plans. This is just a 100K linear taper potentiometer connected across the leads from the pickup coil. Plug the pickup into any hi-fi, combo or public-address amplifier and you're ready to play.

The strings can be any metal banjo type. Gut or nylon won't work, but you don't need iron-wound strings, either. Standard tuning for a five-string instrument is D, B, G, C, G with the last one an octave above the third string. Some folk singers tune the C string up to D. You can also tune the instrument E, C#, A, E, A and play directly from "A"-diagram music for the steel guitar. Self-instruction books for beginners are sold at music stores. ★★

SWIVEL-BLADE SABRE SAWS

(Continued from page 186)

screw-held type like Stanley, Forsberg or the like. Select wire that's slightly thicker than the slot, bend it around the chisel shank, hammer it flat, and file it to fit.

The same trick can be used to adapt ultra-narrow Cutawl saw blades to your saw. Advantage of the ultra-narrow blades: The narrow $\frac{3}{32}$ and $\frac{1}{8}$ -in. widths let you turn the blade at right angles in its own kerf. Since chisel-blade shanks are round on one side and flat on the other, you have to grind the round side flat to make them fit in most sabre-saw mounting slots. The important point to remember about chisel blades is that they *must* rise *completely* out of the work surface on every stroke. You'll probably have to use a plywood shim attached to the underside of your saw's shoe plate for this. Check your saw (with chisel blade in it) at top and down stroke positions to decide the necessary shim thickness.

Cutting multiple templates or gaskets in a single operation is another chisel-blade trick. To do it, simply stack the desired number of sheets of gasket material with a paper pattern on top. Then lower the chisel blade into a starting hole, and cut all the sheets at once. If you're cutting

paper templates, merely outline the form on the top sheet of a pad of paper and use the chisel blade to cut through the pad.

In all chisel cutting keep a very firm grip on the tool, especially at the start, to prevent bounce. The chisels can easily cut $\frac{1}{4}$ -in. plywood and insulating wallboard. With either chisel blades or ultra-narrow saw blades you can make sharp-angle cuts by pivoting the tool around the reciprocating blade. No forward movement is necessary during the turn. In chisel-blade work, a plug-in tool-speed regulator is usually necessary (unless your sabre saw has its own speed regulator) as chisel blades tend to overheat at usual speeds.

To cut a panel flat on the floor, you simply lay it on top of soft wallboard and shim your saw's shoeplate so the blade penetrates the work and punches slightly into the wallboard. This sign and scenery maker's trick provides overall support for the work and lets you stop worrying about cutting into the work support. You *always* cut into it, but it can be reused. If your saw has a fairly long stroke, cut the saw blade short.

The best tool for cutting blades short (hardened ones included) is a thin "wafer"-type, small-diameter abrasive cutoff disc. You can buy these (with mandrel) in large hardware stores and use them in a power drill or high-speed grinding tool. Cut about halfway through, then click off the blade end with pliers. (Note: for safety, wear goggles.) If the lower blade end is cut off at the usual angle, it can rise slightly out of the work surface on the up stroke, provided you keep forward movement of the tool in the moderate range.

About the tools and tricks. Both the Cutawl and the Sears Scroller have headlights, also have built-in speed regulation. The Cutawl and the Thor can also vary the friction on the swivel unit, but only the Cutawl varies the length of its stroke—though, unlike, the two new sabre saws, it doesn't tilt. All three can make "plunge" cuts, the sabre saws by conventional "tilting in," the Cutawl by simply lowering the reciprocating blade straight down into the work. All offer a wide variety of saw blades, as narrow as $\frac{3}{32}$ in. for the Cutawl, $\frac{3}{16}$ in. for the sabre saws.

If you can adapt the Cutawl blades to your saw, you can buy them direct from the Cutawl Co., Bethel, Conn., at prices from \$3.20 a dozen for $\frac{1}{8}$ -in. wide blades to \$10.40 a dozen for special fabric-cutting chisels. Miniature abrasive discs for cutting off your conventional blades can be ordered through the same company from 10 cents apiece for the $\frac{7}{8}$ -in. dia. to 30 cents for the $1\frac{1}{4}$ -in. size. ★★

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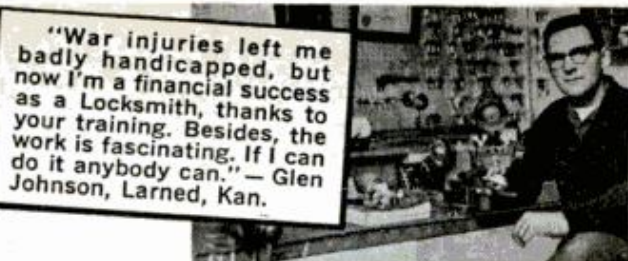
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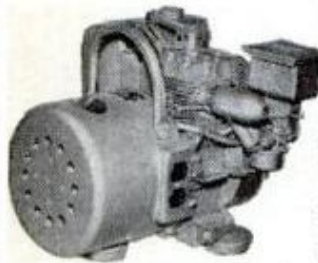
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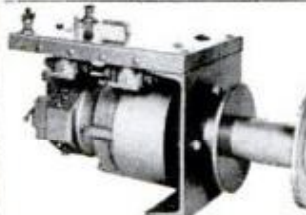


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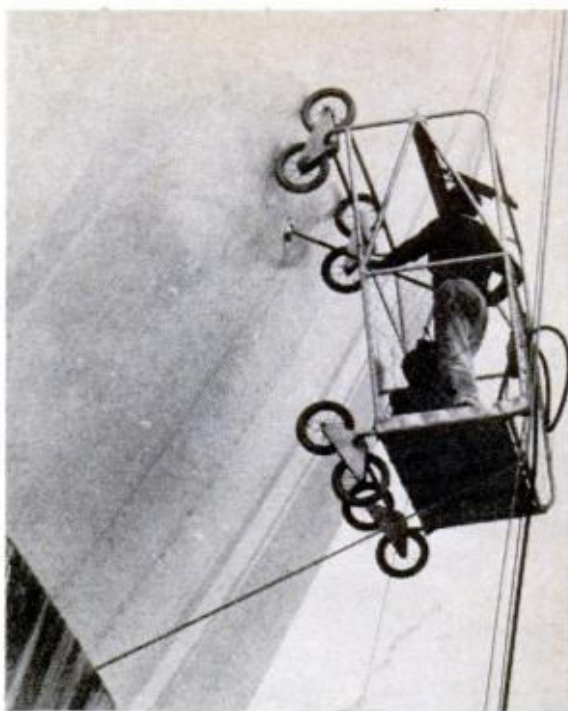
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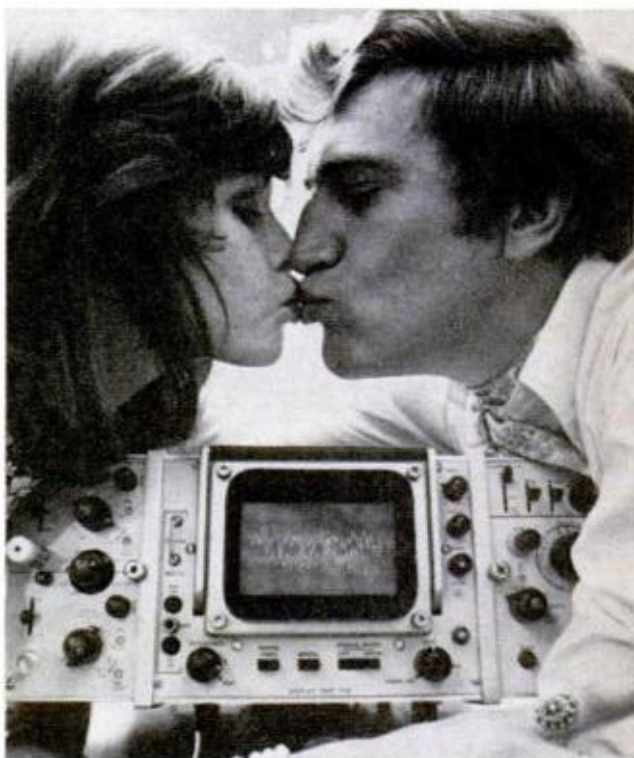
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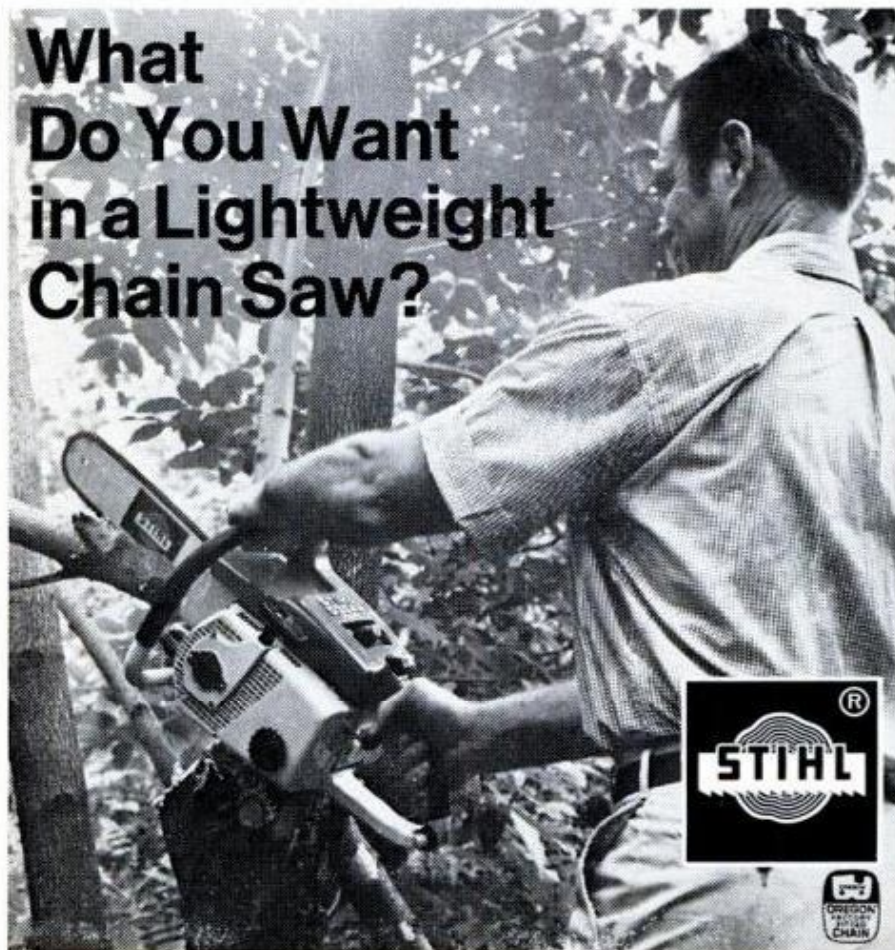
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The Heckler & Koch HK-4, recently put on the market by Harrington & Richardson, comes equipped with five different clip magazines and four sets of barrels and recoil springs. Simply by changing barrels and magazines, a shooter can switch calibers.

The little pistol has double-action trigger pull (like a revolver) on the first shot as well as single-action (like an automatic) thereafter. All four barrels are tested at the factory in the gun they accompany, and test targets show that all four shoot to about the same place at medium handgun ranges.

Switching center-fire barrels and cartridges is simpler than going to the .22 rimfire barrel, since this involves altering the position of the firing pin. However, even this is no great chore as the bolt faceplate is easily removed and the pin can then be shifted. It's just an extra step.

Veteran gun users and collectors will recognize the HK-4—it's an updated version of the German Mauser HSc, World War II model. It's lighter than its "daddy," and has been adapted to modern production with castings.

Such an easily convertible pistol can be used for home protection as well as on the "plinking" range. The .380 ACP offers 192 foot-pounds of muzzle energy against the high-speed .22 long rifle's 112 foot-pounds. Inexpensive practice with the latter will make you more accurate if you ever *have* to use the former.

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Because Dura-Copy "prints" with ink instead of coating with carbon, impressions are sharp, and as many as 15 copies can be made with one typing, each one clearly legible and smearproof.

*Copy for copy, costs less than 1/3 as much as flimsy short-life ordinary carbon paper

A package of 100 sheets of a popular brand of carbon paper sells for \$4.50, and gives about 5 copies per sheet—not all of which are clear and sharp. That's about 500 copies for \$4.50 or about 9/10¢ a copy. Each sheet of Dura-Copy is guaranteed to give 100 sharp, clear copies . . . so a package at \$4.95 gives you a minimum of 2,000 copies . . . at a cost of less than 3/10¢ a copy . . . less than 1/3 the cost of ordinary carbon paper, copy for copy!

dura-copy Guaranteed* Long-Life Copying Film
by merlite (the successor to carbon paper)

sells itself for you . . . even while you sleep . . . on fabulous new FREE TRIAL PLAN!

Ever hear of a product which sells itself? Here's one that does! We supply our active salespeople with FREE sample sheets of our fantastic new patented (U.S. Patent No. 3,117,018) Dura-Copy Guaranteed Long-Life Copying Film—the successor to carbon paper. They leave these sheets on 7-DAY FREE TRIAL at offices, factories, stores, institutions—wherever there are typewriters. Then they come back a week later and—more often than not—they get an automatic order for one or more packages . . . because, in the week, Dura-Copy has sold itself . . . literally! (At the left you'll see why customers throw away their obsolete carbon paper and switch to Dura-Copy.)

Outlasts Ordinary Carbon Paper 20 to 100 Times!

*Each Package Guaranteed to Give at least 2,000 Clear, Sharp, Crisp Copies . . . or WE REPLACE IT . . . FREE!

For the reasons given at the left, Dura-Copy outlasts ordinary flimsy carbon paper by 20 to 100 times. This is no idle claim. We back this claim with an amazing FREE REPLACEMENT GUARANTEE (shown at right) which is printed on every package of Dura-Copy you sell. This Guarantee wins many easy, fast orders!



You Make up to 120% PROFIT per Package . . . Orders for 2 Packages an Hour Pay You up to \$5.40 Hourly Profit!

Each package of letter size (8½ x 11½") sheets of Dura-Copy sells for \$4.95 . . . and you make up to \$2.70 profit on every one. Orders for 4 packages an hour pay you \$10.80 profit, spare time or full time. At that easy rate, you could earn \$64.80 in a 6-hour day. Larger firms order 2, 6, 12 or more packages at a time, boosting your earnings even higher and faster! And on our 7-DAY FREE TRIAL PLAN, you can make this kind of money without any real selling!

FREE! MONEY-MAKING SALES OUTFIT!

By return mail we'll rush you—prepaid and FREE—a complete illustrated Sales Outfit to start you on the road to big money immediately. To get your Sales Outfit fast, fill in and mail the coupon TODAY!

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*In Canada: Merlite Dura-Copy Company, 67 1/2 King Street West, Toronto, Ontario, Canada.

What's so unusual about an 8" tilt arbor power saw that crosscuts, rips, miters, cuts compound angles, makes coves, dadoes and makes mouldings?

Absolutely nothing. Performing these operations makes the AMCO saw no different than any other well engineered 8" tilt arbor power saw on the market. It won't perform any faster because the speed of any saw is controlled by the speed of the motor and the sharpness of the blade. It won't do the cutting with greater accuracy than any other make because, although it's a full capacity machine of heavy duty 100% cast iron and steel with a precision ground cast iron table, no machine can cut more accurately than the skill of the operator will allow.

BUT THERE IS THIS REMARKABLE DIFFERENCE!

It has to do with the bite on your pocketbook. The AMCO 8" tilt arbor power saw sells for about 1/5 of the price of just about any similar tool on the market. You save that 80% because: 1 . . . its streamlined design reduces weight. The weight of the iron and steel in any product has a direct bearing on its cost. But as long as it's sturdy enough and heavy enough to let you do anything with it that you would expect of any of the much heavier machines, that can't make any difference to you. 2 . . . We perforate the table top. That not only cuts down on the cost of the metal—but it reduces the necessary grinding and polishing time. 3 . . . We own special patents which provide added efficiency, accuracy and savings. 4 . . . The metal castings are made in our own foundry so we have better quality control and a second profit is eliminated. 5 . . . The parts are made, assembled, tested and packed right in our own factories. 6 . . . We ship direct to the user. 7 . . . Since 1931, we've built and sold more than a million tilt arbor saws and other bench type power tools. That makes us the largest producer of this type of commodity in the United States. It also provides you with some truly reliable assurance that you don't have to spend \$70.00, \$80.00 or \$100.00 for a dependable, fully functional 8" tilt arbor power saw. That \$19.95 price is for real. So is the saw. It will do everything that is expected of a top quality, precision engineered machine. And AMT guarantees it!

BLADE TILTS . . . TABLE STAYS LEVEL

- Locks securely at any angle to 50°, raises, lowers 0"-2 1/4"
- Patented tilt mechanism, accurate etched scale
- Patented motor mount takes std. 1/4 h.p. or larger motor, keeps belt tight, assures perfect alignment at any angle, transmits full power
- Takes std. blade, saw insert removes to take dadoe heads, cutters, etc. (not incl.)
- Accurate miter gauge assembly
- Ground spindle
- Enclosed steel base
- "Compo" bearings
- Accessories available at factory prices
- RIP FENCE, if desired for easier work alignment: Std. size (for bench saw) \$3.50; larger fence (for cabinet base, as ill'd.) \$4.50.

FREE! CATALOG OF AMERICA'S GREATEST POWER TOOL VALUES!

MAIL QUICK ACTION COUPON TODAY

AMERICAN MACHINE & TOOL CO., Dept. PM00, Royersford, Pa.

- Send AMCO 8" Tilt Arbor Power Saw at \$19.95
- Include standard Rip Fence #354 at \$3.50
- or longer Rip Fence #354C at \$4.50 (for use with cabinet base).
- Precision Ball Bearing Spindle at \$5.00
- Payment in full enclosed \$ or
- \$3 deposit enclosed, balance C.O.D. I MUST BE FULLY SATISFIED OR WILL RETURN WITHIN 10 DAYS FOR FULL REFUND. No questions asked.
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1 MILLION DO-IT-YOURSELFERS CAN'T BE WRONG

Among them are some of the most power-tool wise craftsmen on earth. SHELDON GALLAGER, POPULAR SCIENCE MONTHLY shops and crafts editor, reported in a recent issue, "a good buy . . . a clever design that permits the blade arbor to tilt. For anyone looking for an inexpensive machine with good table capacity, this saw-plus-cabinet deal is a nifty."

It's the reason that "WORKBENCH" magazine awarded the AMCO power tool line their coveted "Shop-Tested Seal", why they call this bench saw "an excellent tool". It's the reason we can provide you with these added assurances of dependability and satisfaction.*



8" TILT ARBOR POWER SAW

\$19.95
f.o.b. factory

Wt.: 25 lbs.



Includes completely assembled cast iron and steel 8" saw with ground cast iron table, blade guard, less blade.

If desired, RIP FENCE for easier work alignment, \$3.50 additional.

Precision Ball Bearing Spindle for commercial service, \$5.00 add'l.

Saw unit mounted in cabinet base made from FREE plans furnished.

SPECIAL OFFER! FREE CABINET BASE PLANS

Use your AMCO 8" tilt arbor saw as you receive it (inset photo) . . . or transform it easily, inexpensively into a floor model (as shown). A sheet of 3/4" plywood and 3-4 hours are all you'll need. Result: A cabinet base floor model guaranteed to do the work of units selling for \$300. Use your AMCO saw to do the cutting. Plans provide 27" x 24" work surface, 33" height, tool storage compartment.

*UNCONDITIONAL 10-DAY MONEY BACK GUARANTEE

You must be fully satisfied. If not, return in 10 days, freight collect. Money refunded in full, no questions asked.

*10-YEAR FULL PARTS AND SERVICE GUARANTEE

Any part or parts of any AMCO power tool which may become inoperative for any reason within ten years after the purchase date will be repaired or replaced by the factory without cost to the purchaser. Your only cost: for postage.

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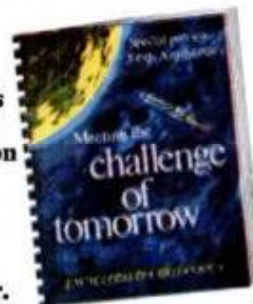
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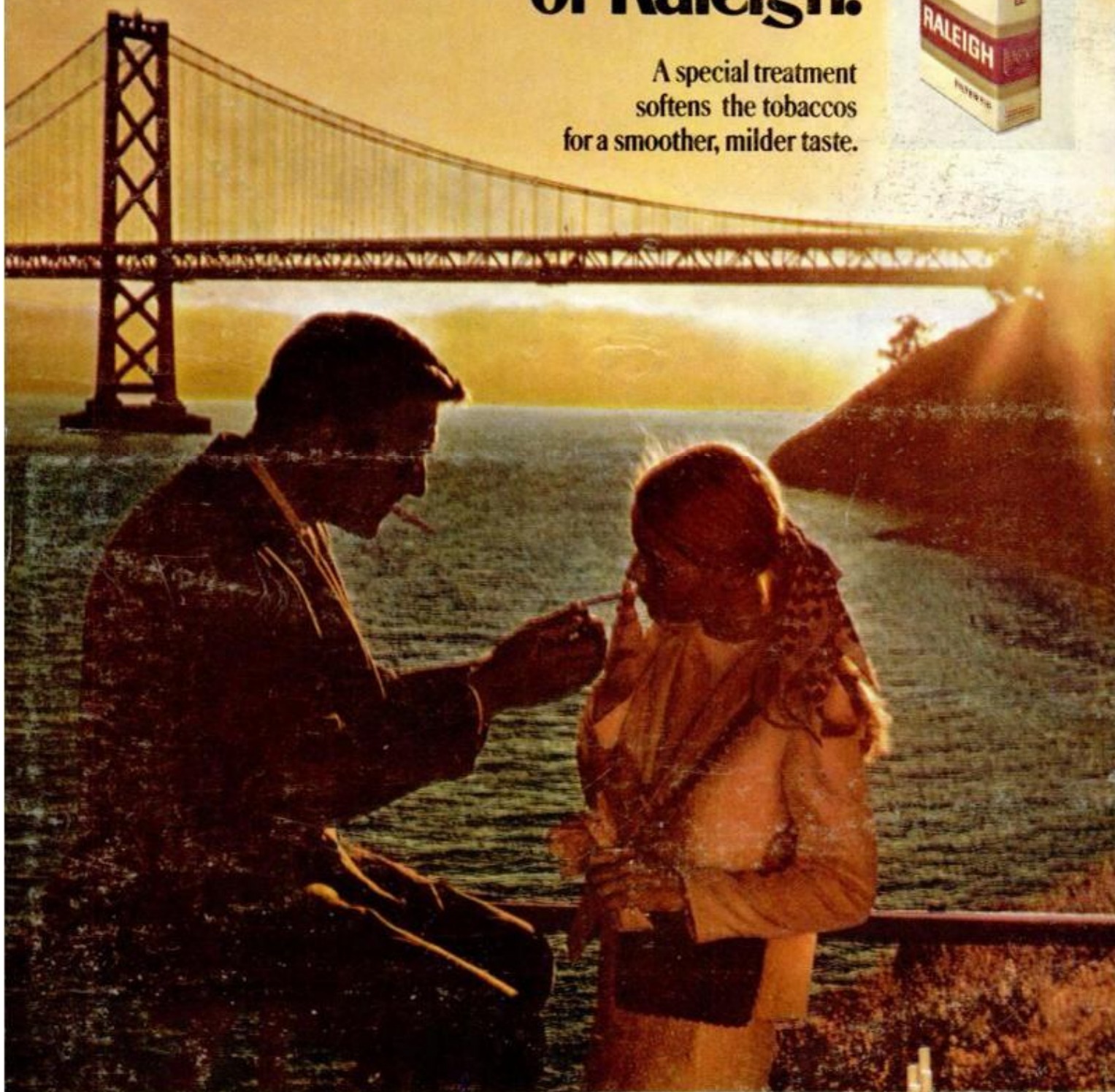
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