

Popular Mechanics

**Wood sculpturing—
now anyone can do it**

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**Christmas
gifts you make
for very few \$\$:**

- Heirloom clock
- Novel candles
- Colonial bookstand
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**200-mph homebuilt plane
with snowmobile engine**

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**How to adjust VW
valves, step-by-step**

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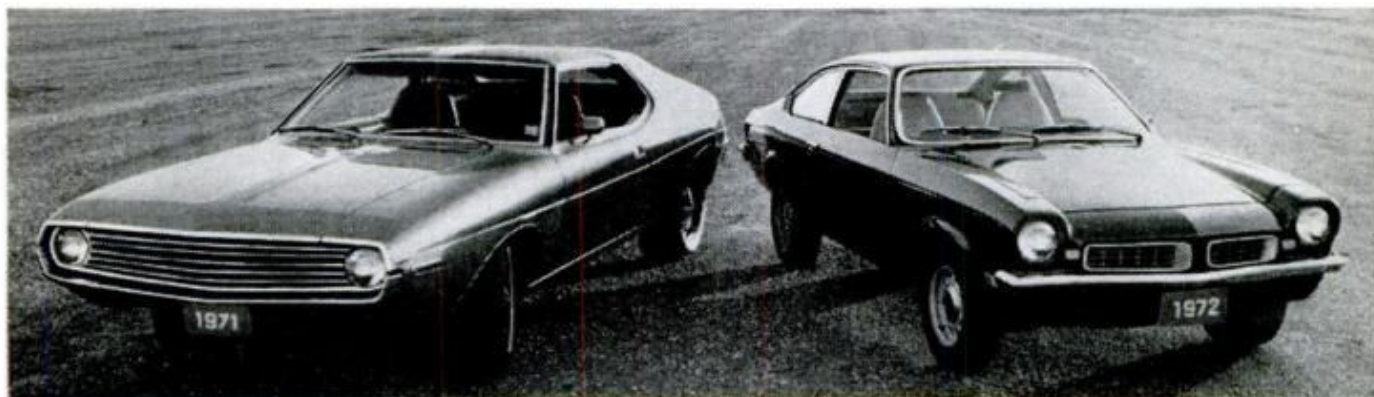


Filter Kings, 17 mg. "tar," 1.3 mg. nicotine; Longs, 19 mg. "tar," 1.4 mg. nicotine, av. per cigarette, FTC Report April '72

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health

High compression. Low compression. Which is tougher on your oil?

Using high octane fuel, high compression engines generate high heat. Low compression engines using low octane and leaner fuel mixtures can run even hotter. And heat is the main reason motor oil deteriorates. Today you have to name your oil. By type. By SAE Grade. By brand.



Recent governmental regulations aimed at controlling automotive emissions have resulted in the introduction of low lead fuels. These fuels, in turn, are made necessary by the advent of new catalytic reactors soon to be required on all cars. For these reasons, car makers have had to reduce the compression ratios of the new car engines. Here's why.

Refresher course on compression ratio. A high compression ratio (10.5:1 is typical) needs high octane gasoline, and a rich mixture of gas-to-air for good driveability. That way you get top performance... but a lot of unburned gasses are passed through the tailpipe into the environment.

A low compression ratio (9:1, for instance) can operate on lower octane gas and a leaner mixture of fuel that's compatible with emissions control systems. The results are more sedate performance and greatly reduced pollution. Plus one more thing: heat. Oil-killing heat.

How heat kills oil. As you know, oil gets thin when hot. But did you also know that oil can *thicken* under heat? The cause is oxidation. That is, oxygen molecules combine with "oil" molecules to make more complex molecules. Under high heat conditions over extended periods, the

oil can become dangerously thick. In extreme cases, it can become almost jelly.

A thickened, oxidized oil loses its ability to flow easily through the



engine. That causes metal-to-metal contacts. And vital parts wear more and more. In severe cases they seize.

Two ways to fight back.

1. Change oil more frequently

Because you can't judge when oil oxidation has reached the danger point, your best protection is to change oil more frequently. Your owner's manual gives you recommendations for normal conditions. But please read the little notes of caution that usually accompany the recommendation. Dusty roads, stop-and-go driving, sustained high-speed driving, heavy loads, extreme temperatures are all conditions requiring more frequent changes. Also be sure you choose the right SAE Grade for your driving climate.

2. Know your motor oils.

Today you have to be specific about motor oil. You should use one that is refined from the best grade of crude oil—then scientifically blended, fortified and proven. There's too much at stake to put just any motor oil into your crankcase.

You should also know that "SE" is a designation for motor oil which meets the requirements for high temperature engine performance and is recognized by the Automotive and Petroleum Industries. We advise that *all* fully equipped cars use it.

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for people up a door before.



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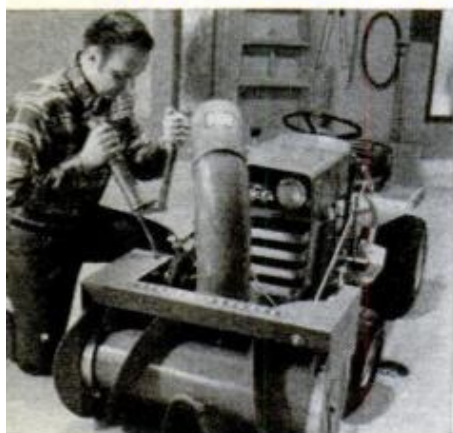
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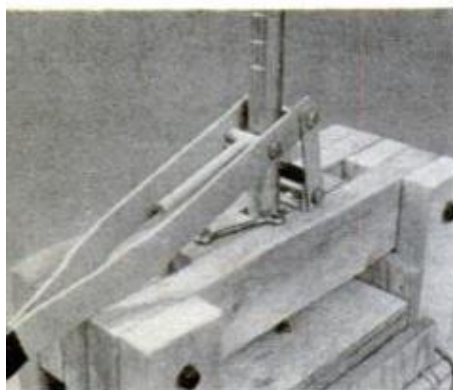
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LETTERS

TO THE EDITOR

Great Workshops

Within the next year, I will be setting up a complete woodworking shop. Being a recent subscriber to *PM*, I notice that you run articles on well-planned workshops. I would appreciate a list of them. **LITTLE ROCK, ARK. G. EDWARD COOK, MD**

We've printed five in the Great Workshop series: June '70; June '71; January '72; June '72 and October '72. And there are more scheduled for future issues.

Intellectually archaic

The phrase "deaf and dumb" which you used in the item on the Morse-code telephone (*New in Electronics*, page 36, Aug. *PM*) is intellectually archaic and really detested. We deaf can be as competent—indeed, as intellectual—as those with normal hearing. (May I remind you that Beethoven was deaf?) Your deaf readers deserve an apology.

CHARLOTTESVILLE, VA. THEODORE BLAKE II

An apology is indeed due. The phrase should have been "deaf and mute."

Bunk bed/desk: Right on!

I'm writing to say that you don't have to be a male to reap the benefits of *PM*. My dad built me a combination bunk bed/desk like the one in *This kid studies under his bed* (page 156, June *PM*). Its walnut paneling and black molding make it beautifully decorative, and it sure has solved the space problem in my room. To the boy who thought this up: Right on!

SANTA MARIA, CALIF. MARY TAYLOR

Overly optimistic about GRAN

Since I have been personally involved with Omega since 1969, I found D. J. Holford's article, *The satellite that may save your life* (page 128, Sept. *PM*), on GRAN (Global Rescue Alarm Network) very interesting. I feel, though, that the article is extremely optimistic and somewhat misleading, quickly passing over the problems associated with Omega.

Omega at present is comprised of four

(Please turn to page 8)

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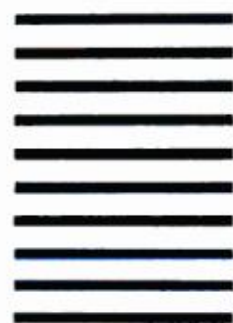
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LETTERS

(Continued from page 6)

(of eight) development stations. With extremely limited output, the New York station broadcasting only 50 watts during poor weather conditions, coverage is limited to the North Atlantic, North Pacific, Arctic and North American continent. The entire system will not be operational until 1975.

Omega is an inherently ambiguous system; that is, at nominal intervals the phase difference repeats itself. With a single-frequency receiver (10.2 kHz) this ambiguity occurs about every 8 nautical miles. With a three-frequency receiver (10.2, 11 $\frac{1}{3}$ and 13.6 kHz) it occurs about every 72 nautical miles. What this amounts to in practical terms is that a navigator must know his position to within plus or minus 36 nautical miles to determine his exact position. To overcome this problem, existing Omega devices "track" the phase difference while the plane or ship is in motion, counting the "lane crossings" as they go. GRAN makes no provision for tracking the lane crossings and, hence, will not work with the existing Omega system.

To overcome the ambiguity problem, persons involved with GRAN have suggested alternate modifications to the existing Omega equipment. Most notable of these alternatives are additional frequencies or modulation of the present carriers. However, these modifications may or may not be the answer!

The above is not intended to imply that the case is hopeless. Omega, even in the semi-experimental stage, has shown itself to be an effective navigation system. If the ambiguity problem can be solved and the money necessary to make modifications found, GRAN may become everyman's rescue beacon. I merely want to point out the fact that GRAN is an experiment, and there is a good deal of development required before the \$200 box will be a reality.

NAVAL ELECTRONICS SYSTEMS COMMAND, WASHINGTON, D.C.
J. RICHARD CLIFFE
ACQUISITION ENGR.

Relay for darkroom timer

In regard to *A darkroom timer you can see in the dark* (page 122, June PM), I
(Please turn to page 10)

The Poulan XXV.

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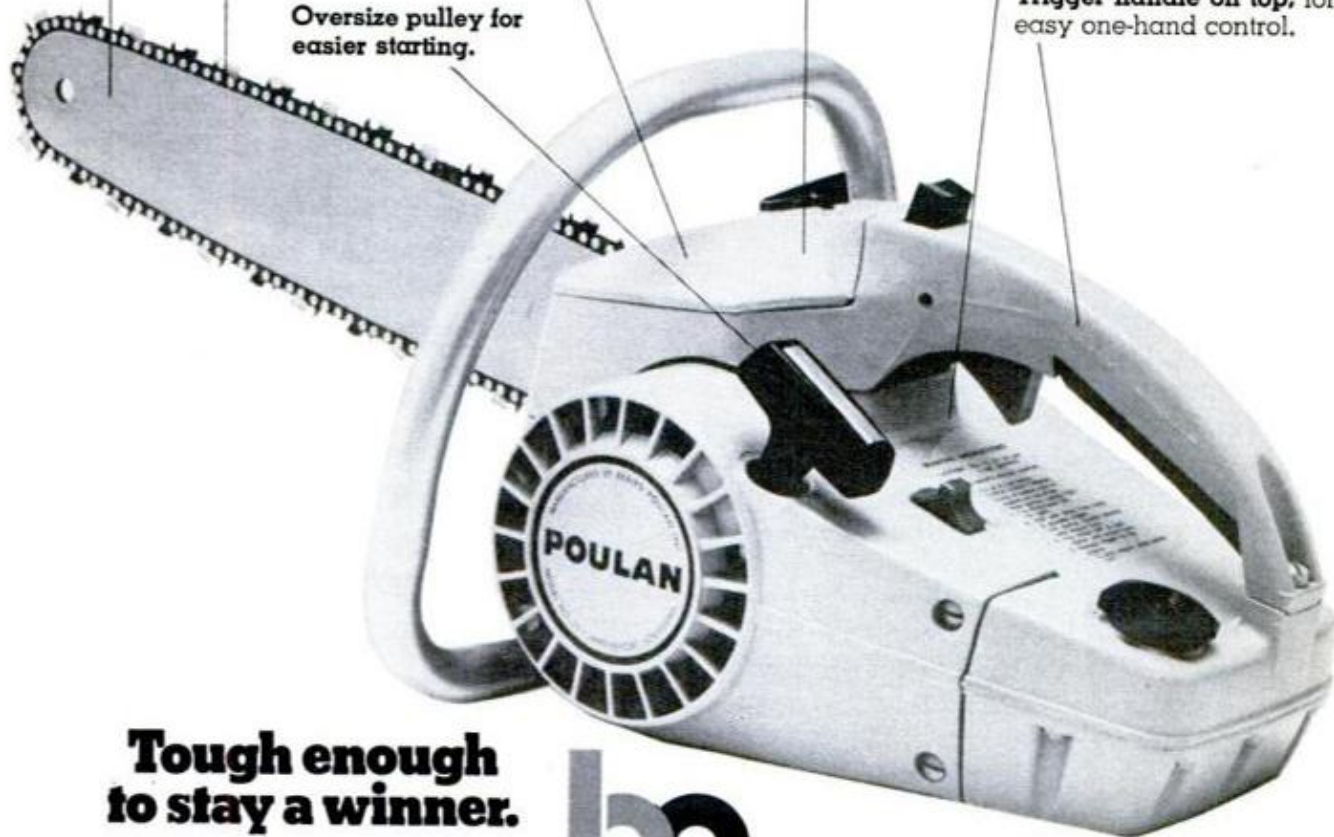
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LETTERS

(Continued from page 8)

not only had a hard time finding the required relay but took one back thinking it was no good because it would not pull in with 6 or even 12 volts.

It seems to me that this relay needs 24 or more volts to work—or am I wrong?
CULVER CITY, CALIF. SI KAUFMAN

You are right, says author R. S. Hedin. The transformer should be specified as 12.6 v. rather than 6.3 v. Use Allied Radio's No. 273-1505 or equivalent. If the relay still doesn't work, you can adjust it.

If you use the LM5 relay, you can adjust the spring tension. If you use the LB5 instead, you can adjust the air gap by bending the contacts. (The author's relay required no adjustments.)

If you're having trouble finding the relay, try Newark Electronics 500 North Pulaski Rd., Chicago, Ill. 60624 (or one of its branches); most other industrial electronic supply houses will also have it.

Gliders: older and older

Herbert R. Bolland was correct when he referred to air surfing as a "nostalgic revival" (*Letters*, page 6, Aug. *PM*). But *PM* published plans for hang gliders earlier than the 1913 article he referred to.

Waldo Waterman, an aviator from San Diego, built and flew several hang gliders from plans in *PM* in April, 1909.

In addition, I question Robert Vaughn's statement in the same issue giving credit to Otto Lilienthal for the invention of hang gliding. George Cayley, a 19th century aviation pioneer, did quite a bit of experimenting with gliders. One of his notes mentioned a glider that in 1849 lifted a 10-year-old boy "off the ground for several yards on a descending hill." No doubt a crude hang glider. Lilienthal used the notes of Cayley and many other experimenters to aid in constructing his own gliders.

XENIA, OHIO

CHUCK KING

More uses for solar energy

Will solar farming solve our power crisis? (page 90, July *PM*) seems to be a logical answer to our power and pollution problems.

If this system could be improved, it may be able to be used on automobiles.

The steam could drive a turbine and—presto!—an economical fuel for cars. Also, used in homes, it could be put on roofs and power stations and lines would be obsolete.

PORTLAND, ORE.

JOHN LOGAN

*Quite a few researchers have been working at the conversion of solar power into electricity as well as the storage of the sun's heat. A good example of the latter was covered in the article entitled \$7 a year heats the house (page 89, Feb. '65 *PM*).*

They had 'em in Knoxville

Was just rereading my March '72 *PM* and I noticed an item on page 73 (*Fast mail by trolley*) that took me back to my childhood days in Knoxville, Tenn., during the mid-'20s and early '30s. We had street cars that had a mail slot that was emptied each time the trolley made a turnaround downtown. So Amsterdam has nothing new on good old American ways.

BILOXI, MISS.

COL. ROBERT GREER

Whole new world

I just happened to buy a copy of *PM* and a whole new world has opened up for me. I particularly like the 15 *great ideas for better back-yard living* (page 61, Aug. *PM*), especially the playground equipment. It's just the type of thing I've been looking for. (I notice my husband has marked the putting-green feature.)

RIGA, MICH.

MRS. ANTHONY SCHMID

Watch that edge

In Part 3 of *Bench-saw know-how* (page 158, Sept. *PM*), the straightedge guide for cutting coves should be on the kickback side of the saw blade in the photo and drawing (page 159), should it not? If the saw pushed or kicked the lumber back in the setup you show, it would cut the lumber and maybe a few fingers.

The guide on the other side would hold the lumber from moving, as the cutting teeth are always pushing the lumber.

Please advise readers before someone makes a mistake. (And keep up the great articles.)

WHIPPANY, N.J.

CHARLES F. CROMPTON

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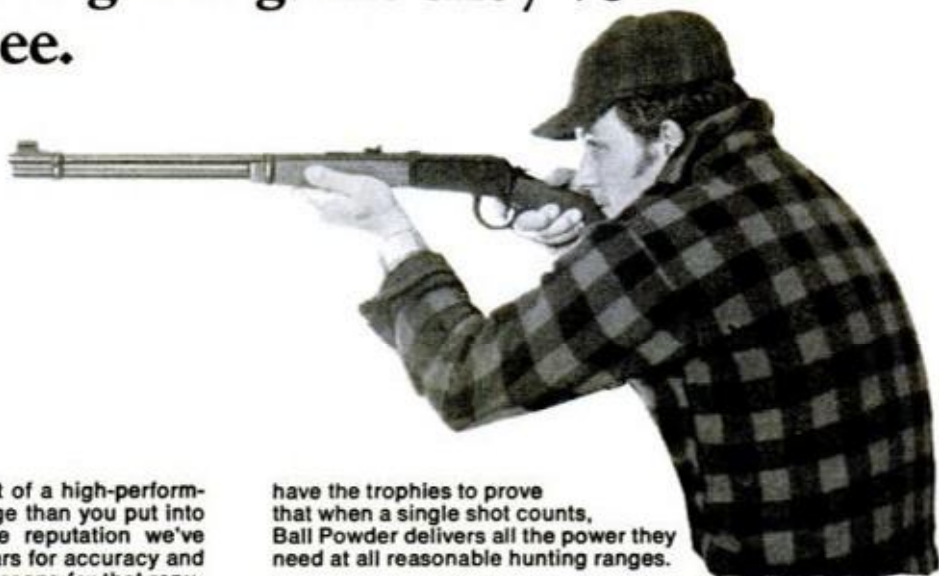
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YOU GO THROUGH ICE, MUD OR SNOW OR WE PAY THE TOW!

We make every Super-X and Super-Speed big game cartridge as if your whole hunting trip depended on it. Because it could.

People at Winchester-Western know from experience all about the "one-shot" school of center fire shooting. That's all the chance many hunters ever get at game they've waited years to see.



You can't get more out of a high-performance big game cartridge than you put into it. We're proud of the reputation we've earned through the years for accuracy and reliability. There are reasons for that reputation, and if you're as serious about big game hunting as we are, you owe it to yourself to read about them.

Brass from our own brass mill: Most hunters expect cartridge cases to be precisely shaped and gauged during manufacturing to assure smooth functioning in all standard chambers. A case not only must chamber easily and quickly, it must also withstand a tremendous expanding pressure during firing, and still be extracted with ease and certainty. And many other sportsmen place still another severe requirement on cartridge brass: For them it has to remain strong and resilient for many reloads. For these demanding center fire sportsmen, only one brass is good enough to be used in Super-X and Super-Speed center fire ammunition. The high-quality Western Brass we've manufactured ourselves for over 50 years. By making our own brass we are able to custom-tailor the grain structure and strength requirements called for by each individual caliber. This assures superior performance whenever your big hunting chance comes along.



Clean, progressive-burning Ball Powder: The man who hunts center fire game knows that if it takes only one shot to fill his limit he's generally got nineteen rounds left over, less sighting-in shots. When he gets back out in the woods the next

year, he has a right to expect that, with reasonable storage in a cool dry place, his left-over ammunition still will perform perfectly. That's just one of the reasons why we use our own Olin Ball Powder in Super-X and Super-Speed center fire loads. An exclusive Olin product for 30 years, this clean-burning smokeless propellant is made through a special graining process that produces high stability and prevents long term deterioration. And hunters throughout the world

have the trophies to prove that when a single shot counts, Ball Powder delivers all the power they need at all reasonable hunting ranges.

Non-corrosive priming: The modern sportsman may be a little spoiled by our clean, non-corrosive priming mixture. There was a time when the best priming mix available could corrode your rifle barrel permanently . . . sometimes even before you got your game back home . . . unless you took immediate and determined steps to clean the bore thoroughly. Today, we still recommend that you keep your favorite center fire rifle in top condition. But you can relax about the priming mix we use in Super-X and Super-Speed. It's real hot stuff when it comes to instant, all-weather functioning, but its corrosion-free performance is easy on your barrel bore.

Silvertip, Power-Point, or Positive Expanding Point Bullets. Custom ballistics to suit the game you're gunning for:



The best hunter in the world can do everything right and still miff his chance unless he selects the proper bullet to do the job. Because in center

fire hunting, hitting your target is only part of the game. Another important consideration is what your bullet does after you've connected. Too heavy a load and you've ruined good meat. Too light, and you've got something no sportsman-conservationist ever wants: wounded game. With Super-X and Super-Speed, proper ballistics is a science, not a guessing game. Silvertip is for big, tough skinned game. It's made to penetrate through thick hide and tissue before releasing energy with double-caliber stopping power. Power-Point is for large, thin-skinned game, hitting with crushing soft-nose impact. New Positive Expanding Point bullets offer optimum accuracy and maximum upset in 90 and 120 grain 25-06 caliber bullets. Check the chart on the next page for full ballistics information, then see your Winchester or Western dealer. **WINCHESTER-Western**, 275 Winchester Avenue, New Haven, Connecticut 06504.





Silvertip

1. Bullet penetrates deep in vital areas.
2. Powder . . . clean, smokeless.
3. Case of brass, made in our mills.
4. Primer . . . non-corrosive weatherproof for all around performance.



Power-Point

1. Bullet with crushing soft-nose punch.
2. Powder . . . progressive burning.
3. Brass that's tailor-made in our own brass mill.
4. Primer . . . non-corrosive weatherproof for all around performance.



P.E.P. (Positive Expanding Point)

1. Bullet designed for extreme accuracy and maximum upset.
2. Powder . . . modern, smokeless.
3. Brass that's custom-formulated.
4. Primer . . . non-corrosive weatherproof for all around performance.

RECOMMENDED CENTER FIRE GAME LOADS

Cartridge	Bullet Wt. Grs.	Bullet Type	Muzzle	Velocity (fps)			Energy (ft. lbs.)			Mid-Range Trajectory (inches)			
				100 yds.	200 yds.	300 yds.	100 yds.	200 yds.	300 yds.	100 yds.	200 yds.	300 yds.	
<i>Gunning for coyote, fox, woodchuck? You'll get best results with these calibers and bullet weights —</i>													
22-250 Super-X and Super-Speed	55	PSP	3810	3270	2770	2320	1770	1300	935	655	0.3	1.6	4.4
222 Remington Super-X and Super-Speed	50	PSP	3200	2660	2170	1750	1140	785	520	340	0.5	2.5	7.0
225 Winchester Super-X and Super-Speed	55	PSP	3650	3140	2680	2270	1630	1200	875	630	0.4	1.8	4.8
243 Winchester (6mm) Super-X and Super-Speed	80	PSP	3500	3080	2720	2410	2180	1690	1320	1030	0.4	1.8	4.7
243 Winchester (6mm) Super-X and Super-Speed	100	PP(SP)	3070	2790	2540	2320	2090	1730	1430	1190	0.5	2.2	5.5
25-06 Super-X and Super-Speed	90	PEP	3500	3090	2730	2420	2450	1910	1490	1170	0.4	1.8	4.7
<i>And these are the deer cartridges</i>													
243 Winchester (6mm) Super-X and Super-Speed	100	PP(SP)	3070	2790	2540	2320	2090	1730	1430	1190	0.5	2.2	5.5
25-06 Super-X and Super-Speed	120	PEP	3120	2850	2600	2360	2590	2160	1800	1480	0.5	2.0	5.5
270 Winchester Super-X and Super-Speed	130	PP(SP)	3140	2880	2630	2400	2850	2390	2000	1660	0.5	2.1	5.3
270 Winchester Super-X and Super-Speed	130	ST(Exp)	3140	2850	2580	2320	2850	2340	1920	1550	0.5	2.1	5.3
270 Winchester Super-X and Super-Speed	150	PP(SP)	2900	2620	2380	2160	2800	2290	1890	1550	0.6	2.5	6.3
30-30 Winchester Super-X and Super-Speed	150	OPE(HP) } PP(SP) } ST(Exp) }	2410	2020	1700	1430	1930	1360	960	680	0.9	4.2	11.0
30-30 Winchester Super-X and Super-Speed	170	PP(SP) } ST(Exp) }	2220	1890	1630	1410	1860	1350	1000	750	1.2	4.6	12.5
30-06 Springfield Super-X and Super-Speed	150	PP(SP)	2970	2620	2300	2010	2930	2280	1760	1340	0.6	2.5	6.5
30-06 Springfield Super-X and Super-Speed	150	ST(Exp)	2970	2670	2400	2130	2930	2370	1920	1510	0.6	2.4	6.1
30-06 Springfield Super-X and Super-Speed	180	PP(SP)	2700	2330	2010	1740	2910	2170	1610	1210	0.7	3.1	8.3
30-06 Springfield Super-X and Super-Speed	180	ST(Exp)	2700	2470	2250	2040	2910	2440	2020	1660	0.7	2.9	7.0
308 Winchester Super-X and Super-Speed	150	PP(SP)	2860	2520	2210	1930	2730	2120	1630	1240	0.6	2.7	7.0
308 Winchester Super-X and Super-Speed	150	ST(Exp)	2860	2570	2300	2050	2730	2200	1760	1400	0.6	2.6	6.5
308 Winchester Super-X and Super-Speed	180	PP(SP)	2610	2250	1940	1680	2720	2020	1500	1130	0.7	3.4	8.9
308 Winchester Super-X and Super-Speed	180	ST(Exp)	2610	2390	2170	1970	2720	2280	1870	1540	0.8	3.1	7.4
32 Winchester Special Super-X and Super-Speed	170	PP(SP)	2280	1870	1560	1330	1960	1320	920	665	1.0	4.8	13.0
32 Winchester Special Super-X and Super-Speed	170	ST(Exp)	2260	1870	1560	1330	1960	1320	920	665	1.0	4.8	13.0
<i>These are the choices of the experts for open or plains shooting where long range accuracy, flat trajectory and ultra-high velocity count most —</i>													
243 Winchester (6mm) Super-X and Super-Speed	100	PP(SP)	3070	2790	2540	2320	2090	1730	1430	1190	0.5	2.2	5.5
25-06 Super-X and Super-Speed	120	PEP	3120	2850	2600	2360	2590	2160	1800	1480	0.5	2.0	5.5
270 Winchester Super-X and Super-Speed	130	PP(SP)	3140	2880	2630	2400	2850	2390	2000	1660	0.5	2.1	5.3
270 Winchester Super-X and Super-Speed	130	ST(Exp)	3140	2850	2580	2320	2850	2340	1920	1550	0.5	2.1	5.3
30-06 Springfield Super-X and Super-Speed	150	PP(SP)	2970	2620	2300	2010	2930	2280	1760	1340	0.6	2.5	6.5
30-06 Springfield Super-X and Super-Speed	150	ST(Exp)	2970	2670	2400	2130	2930	2370	1920	1510	0.6	2.4	6.1
308 Winchester Super-X and Super-Speed	150	PP(SP)	2860	2520	2210	1930	2730	2120	1630	1240	0.6	2.7	7.0
308 Winchester Super-X and Super-Speed	150	ST(Exp)	2860	2570	2300	2050	2730	2200	1760	1400	0.6	2.6	6.5
<i>For large game — including moose, grizzly and Kodiak bear — you can count on the knock-down power of these —</i>													
*30-06 Springfield Super-X**	220	PP(SP)	2410	2120	1870	1670	2830	2190	1710	1360	0.6	3.9	9.8
30-06 Springfield Super-X and Super-Speed**	220	ST(Exp)	2410	2180	1980	1790	2830	2320	1910	1560	0.8	3.7	9.2
300 Winchester Magnum Super-X and Super-Speed	220	ST(Exp)	2720	2490	2270	2060	3620	3030	2520	2070	0.6	2.9	6.9
300 H&H Magnum Super-X and Super-Speed	220	ST(Exp)	2620	2370	2150	1940	3350	2740	2260	1840	0.7	3.1	7.7
308 Winchester Super-X and Super-Speed**	200	ST(Exp)	2450	2210	1980	1770	2670	2170	1750	1400	0.8	3.6	9.0
338 Winchester Magnum Super-X and Super-Speed	250	ST(Exp)	2700	2430	2180	1940	4050	3280	2640	2090	0.7	3.0	7.4
338 Winchester Magnum Super-X and Super-Speed	300	PP(SP)	2450	2160	1910	1690	4000	3110	2430	1900	0.8	3.7	9.5
375 H&H Magnum Super-X and Super-Speed	300	ST(Exp)	2550	2280	2040	1830	4330	3460	2770	2230	0.7	3.3	8.3
<i>**Not for Grizzly or Kodiak Bear.</i>													
<i>You're more than a match for any game in the world with these.</i>													
300 Winchester Magnum Super-X and Super-Speed**	220	ST(Exp)	2720	2490	2270	2060	3620	3030	2520	2070	0.6	2.9	6.9
338 Winchester Magnum Super-X and Super-Speed**	250	ST(Exp)	2700	2430	2180	1940	4050	3280	2640	2090	0.7	3.0	7.4
338 Winchester Magnum Super-X and Super-Speed**	300	PP(SP)	2450	2160	1910	1690	4000	3110	2430	1900	0.8	3.7	9.5
†458 Winchester Magnum Super-Speed	500	FMC	2130	1910	1700	1520	5040	4050	3210	2570	1.1	4.8	12.0
†458 Winchester Magnum Super-Speed	510	SP	2130	1840	1600	1400	5140	3830	2900	2220	1.1	5.1	13.5

*—Western Brand Only
HP—Hollow Point

†—Winchester Brand Only
PEP—Positive Expanding Point

PSP—Pointed Soft Point
PP(SP)—Power-Point Soft Point

FMC—Full Metal Case
SP—Soft Point

OPE—Open Point Expanding
ST(Exp)—Silvertip Expanding

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Photo Hints

Ironing-board shooting table

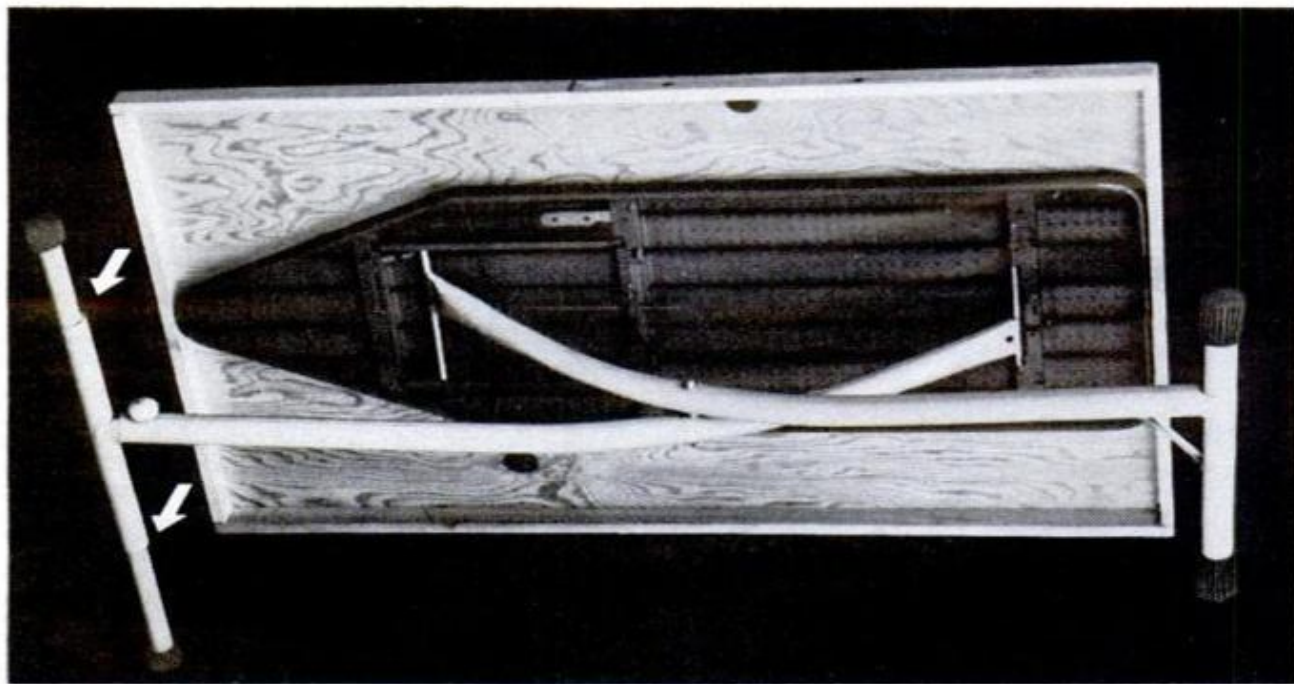
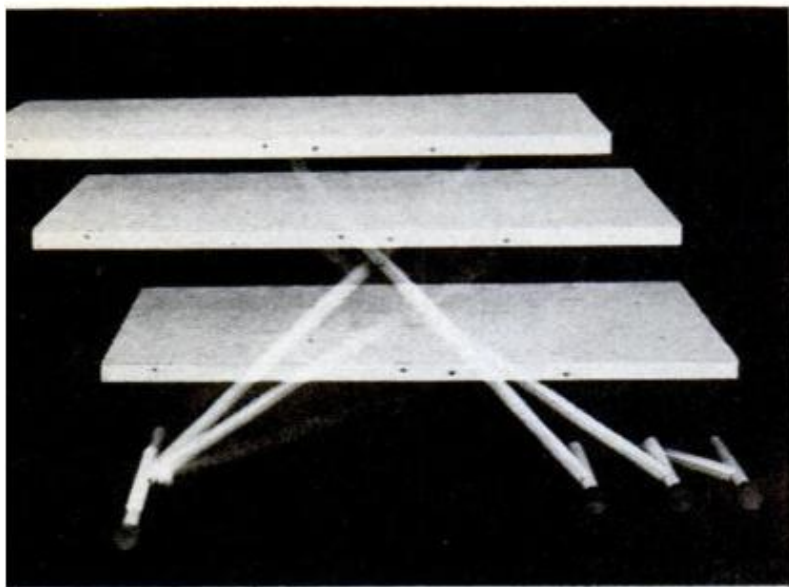
Still-life and close-up photography is fun. And the accessories so available today have solved many of the problems involved—but not the problem of finding a table just the right height for every subject.

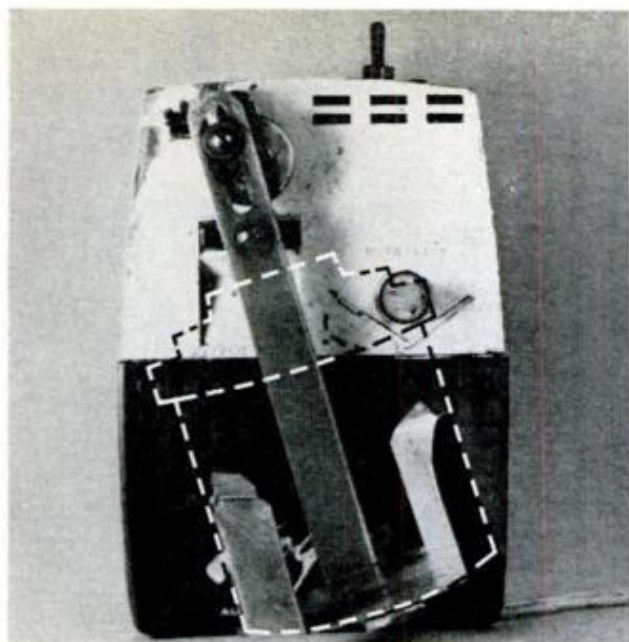
Some subjects should be photographed from above, others at an angle, and still others head-on. For years I used the floor, bridge tables and piles of books to get my tabletop subjects just where I wanted them. Then I

watched my wife adjust her ironing board and realized its adjustment range (from 36 inches to floor level) was just what I needed.

Because ironing boards are too narrow for my purposes, I made a lightweight top from $\frac{1}{4}$ -inch plywood, reinforced at the edges with $\frac{3}{4}$ -inch by $1\frac{5}{8}$ -inch furring strips. The plywood should be cut just enough longer than the ironing board to let the furring strips overhang the ends (my tabletop is $53\frac{1}{2}$ inches long, to fit my 52-inch board). For easier access to the ironing board's height adjustment lever, I mounted the board a bit off-center within the new top's 28-inch width (but just two or three inches off, to prevent instability) and marked the lever's location on the table edge. My top is permanently bolted to the board (with flathead bolts in countersunk holes); if you still want to iron on your board, use one with a removable cover, or make some sort of clamp to hold the top on. I also wedged lengths of $1\frac{1}{8}$ -inch-diameter clothes pole into the ends of one foot to give the table greater stability.

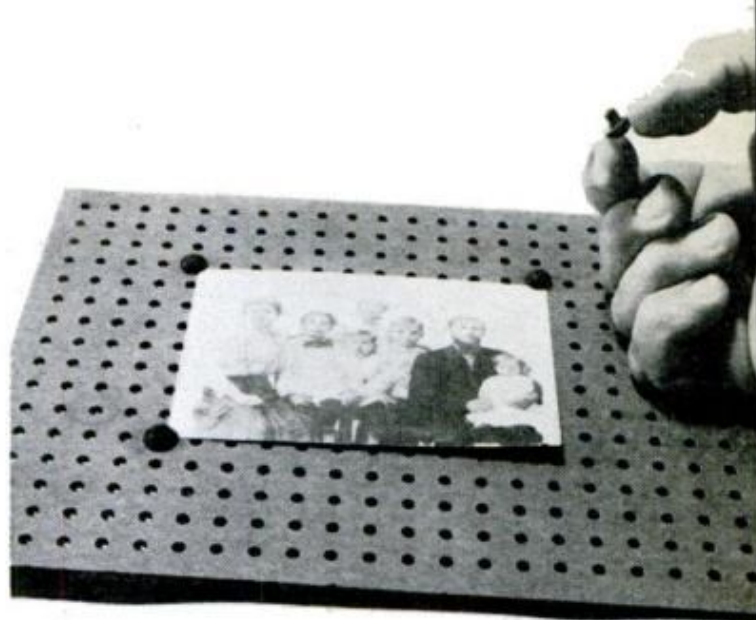
—Harvey Shaman, Kew Gardens, N.Y.





Electric can opener agitates film

An old electric can opener makes a fine developing-tank agitator. Replace the serrated driving wheel with a homemade crank disc, and make a crank arm attachment that will fit your developing tank. Replace the old pushbutton switch with a toggle.—R.K. Pedersen, Plainfield, N.J.



Simple borderless easel

To make an easel for borderless enlargements, or to hold prints flat for copying, sand the shanks of four rubber cabinet feet until they fit the holes in a piece of perforated hardboard. You can move the feet to fit any size paper or snapshot.—Marshall Lincoln, Wickenburg, Ariz.

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and Sesame Street.

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Minolta



When identified by a factory-sealed "M" tag, Minolta 35mm reflex cameras are warranted by Minolta Corporation against defects in workmanship and materials for two years from date of purchase, excluding user-inflicted damage. The camera will be serviced at no charge provided it is returned within the warranty period, postpaid, securely packaged and including \$2.00 for mailing, handling and insurance.

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NRI announces a dramatic new way to learn Automotive Repair at home

Top auto experts praise NRI's new training plans

NRI's two new home training programs in Automotive Servicing and Repair have been acclaimed by three of America's foremost automotive experts. Richard Petty, America's winningest stock car racer says, "I especially like the way NRI has programmed essential training equipment they give you into step-by-step instruction." Tom McCahill, car tester and writer, commented, "The Master Automotive Technician



course gives ambitious guys a great start on a top dollar career. And that Tune-Up and Electrical Systems program can save do-it-yourselfers a bundle." William H. G. France, president of NASCAR reported, "The new NRI courses for mechanics are amazingly complete and seem to cover all major aspects of today's sophisticated cars. If you're at all interested in automotive training, I suggest you investigate NRI."



Professional equipment included at no extra cost

NRI gives you the choice of Master Automotive Technician training or a shorter Automotive Tune-Up and Electrical Systems course for the man seeking greater understanding of basic car repair. The Master course covers every major aspect of auto repair, from changing spark plugs to operating your own garage or car-care center. You not only learn the how and why with NRI's proved-in-use "bite-sized" texts, but you also get professional training equipment you need to actually do the work on your own or other cars as you move along in your home training. Equipment you get—at no extra cost—includes your own ignition-analyzer scope, as well as a dwell-tachometer, timing light, complete set of tools, volt-amp tester and assort-

ed gauges. You get ten kits in the Master Automotive Technician course, eight with the shorter Automotive Tune-Up and Electrical Systems Training program. The professional tools and equipment you get from NRI are yours to keep and use in the years to come, as you build a top-pay career as a Master Mechanic, or earn \$5 to \$7 an hour in spare time, or simply save money by repairing your own cars at home.

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The same pioneering home training methods and innovations which have made NRI the leader in other career training fields are now offered to ambitious men who want to turn their interest in cars into a solid, well-paying career. Take a tip from Richard Petty, Tom McCahill and Bill France, and train at home with the leader. Rush coupon now for free NRI Automotive Catalog. NRI, 3939 Wisconsin, Washington, D.C. 20016. **NO SALESMAN WILL CALL.**

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Kit for kit, dollar for dollar, you get more for your money from NRI.

The TV-Radio Servicing Course includes a wide-band service type oscilloscope and a color bar cross-hatch generator . . . along with

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You'll soon find yourself earning \$5 to \$7 an hour, in your spare time . . . even before the course is completed.

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Train with the Leader—NRI.

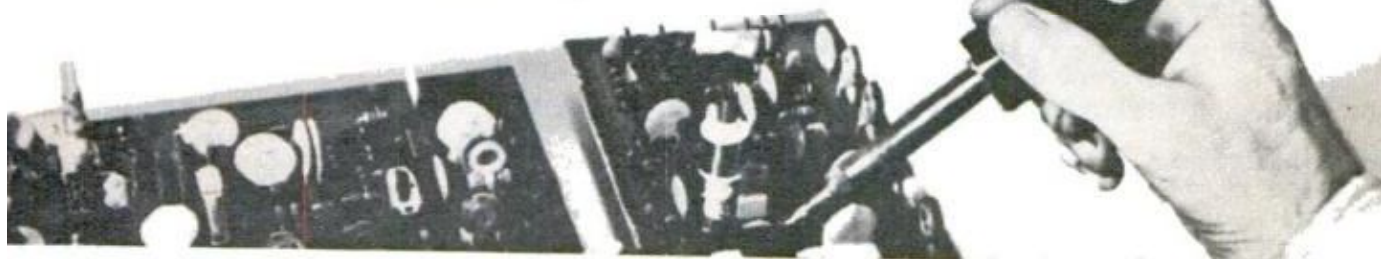
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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Boxing-in a basement beam

I'd like to know how to box-in a 4x8-in. steel beam in my basement ceiling. Lally columns were easy to cover, but how can I make that beam attractive?—Bill Chase, Baltimore.

The simplest way is to use pieces of 1/4-in. paneling on the beam sides and set them into a length of grooved 3/4-in. stock placed along the bottom of the beam. This technique was described in *Finish Your Basement Like a Pro*, page 154, Dec. '69 PM. In this instance, a wooden beam was used, so paneling could be tacked to it directly. If you have a steel I-beam you can run 1x2 furring strips next to each side of the beam's top plate and nail them to joists above. This provides a nailing area for upper edges of the panels.

Renewing 'painted-in' screws

Screws in window frames and door-stops of my home have been 'painted-in'—heads are covered and the slots nearly filled. How do I get 'em out for cleaning?—Frances Beal, Akron, Ohio.

Place a screwdriver bit on the painted-in slot and rap the handle sharply with a wood mallet (save your best screwdriver; use an old one). Usually one rap per screw will remove enough hardened paint from the slot to permit normal removal with the screwdriver.

Drop all screws so removed into a small glass container or shallow basin partly filled with a strong solution of washing soda or other appropriate solvent. After a couple of hours or so the paint will be softened for removal with a wire brush.

Removing fabric stains

I spilled chocolate topping on my sofa, but didn't notice the stain until it had hardened. How can I remove it?—J. Hansen, Beatrice, Neb.

Since you didn't identify the fabric, I can't guarantee to give you the correct procedure. Generally, however, dry-cleaning fluids are safe on most common fabrics. Just twist a ball of cotton on the end

of a small dowel—or handy stick or sliver of wood—and sponge the stain lightly. Follow with a warm, damp cloth, rubbing lightly away from the center. Repeat the procedure if necessary.

Oops . . . more stains

I spilled a small amount of ink on the seat of an upholstered chair. Can you tell me how to get out the stain?—John Weaver, Salem, Ore.

Ink removal—especially from any pile fabric—can be tricky. I'd try the dry-cleaning method mentioned above first, using just enough to cover the stain. Apply it with a ball of cotton, then blot it with a dry cloth, refolding the cloth after each blotting. This should get at least part of the stain. If not, apply ink eradicant (No. 1 solution) to an inconspicuous place on the fabric as a test for color fastness. If okay, apply it to the stain with an eyedropper and remove it with a blotter. Repeat until the blotter shows no stain, then rinse the fabric with cold water and let it air-dry.

When autumn leaves . . .

My house faces north. When the wind is right, leaves from trees to the northwest scoot along the front of the house, whirl and then pile on the east side—sometimes as high as the windows. Can you suggest some way to prevent this?—Bill Nation, Palmyra, N.Y.

I can make only a general suggestion since you do not indicate how your home is placed in relation to adjacent houses and side streets. You'll have to find a way to shunt the flying leaves past the corner—perhaps a movable fence built in sections that will stand upright and can be placed end to end. However, if a street adjoins your house on the east, this method might block a motorist's view of the intersection. In that case, it might be effective to space baffles (low screens)—made in the same fashion as above—along the front of the house. These would tend to catch the leaves and bank them in smaller, more manageable piles. Location and spacing of baffles is up to you. ★★

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems of wide interest will be discussed in this column.

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Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

KING: 19 mg. "tar", 1.4 mg. nicotine
SUPER KING: 20 mg. "tar", 1.5 mg. nicotine, av. per cigarette, FTC Report APR. '72

ALL By BILL McKEOWN OUTDOORS

ALONGSIDE THE PLEASANT BEND of a winding southern river, we asked a successful bass fisherman what large-mouth lures he was using. He showed us some new plastic worms, and we were plenty pleased when he said he had first read about them here. Time was when the sport seemed to be only trial and error with fish often holding the upper hand. But at Chicago's recent American Fishing Tackle Manufacturers Assn. show, there were not only extensive assortments of good new gear but also free booklets and brochures with excellent detailed advice from experts. We noted useful tips in catalogs from Daiwa, Zebco, Heddon, Johnson Reels, Garcia, Arbogast, Best Tackle, Shakespeare, Gladding and Eagle Claw. All can probably be found at local dealers, or obtained directly from these manufacturers.

CAMPING THIS TIME OF YEAR—the so-called "off season"—is becoming so popular with hunters and skiers as well as families heading south that Safari Camps, one of the campground chains, now offers year-around free telephone reservation service. The number for the 30-state system is 800-325-2597. This summer Ticketron introduced advance reservations for campsites in Virginia's state parks. And Kampgrounds of America now number nearly 700, with a new string along the Trans-Canada Highway and several Koamex Kampamentos under construction or completed and open in Mexico as well.

ANY HUNTER WHO HIKES A LOT knows the advantage of a sling that leaves both hands free. Uncle Mike's, Box 13010, Portland, Ore., has announced new quick-disconnect swivels and slings in models to fit just about any rifle or shotgun.

RECREATIONAL VEHICLE OWNERS get around more than anyone, and recently gypsy moths have been trying to join up. Trees stripped of leaves in New England and the Northeast show the damage these insects can cause, but moths were also trapped this summer as far away as Wisconsin and Alabama. The insets lay tiny brown fuzzy egg masses in sheltered spots on trailers, tents, sleeping bags, vehicles and even backpacks that have been near infested areas. Short of soaking

the countryside with chemicals, the best way to control the spread of the moths appears to be cooperation by campers and travelers in the inspection of their rigs and gear. RVs that visited any of the infected areas even months ago should be inspected for hitchhiking egg masses that may hatch in the spring. Maintenance to get the bugs out of your equipment should be taken literally.

FLORIDA MAY COMPETE with California for visitors, but it's copying that western state with new free open-air tram bus tours through the Shark Valley region of Everglades National Park. Similar to the shuttle-bus service in use two years in the Yosemite Valley and Mariposa Grove sections of Yosemite National Park, the tours provide a chance to view a 14-mile wilderness loop of the park without the heavy traffic of private cars. Entrance fee to Everglades Park is \$2 for car and occupants, but there is no charge for the 1½-hour tours. They originate at a parking area inside the park entrance off the Tamiami Trail, 30 miles west of Miami. Alligators along the tour route are reported to find the visitors interesting, and vice versa.

BOATING AIDS TO NAVIGATION and birds of North America that are among endangered species are depicted in two large, colorful posters, available for 50 cents each from the Binoculars Div., Japan Light Machinery Information Center, 437 Fifth Ave., New York, N.Y. 10016. The commercial message—how to choose binoculars—is useful and takes up only a small portion of the bottom of each poster. . . . No commercial at all is included in three particularly readable booklets describing boat handling and safety from Michelob, Anheuser-Busch, Inc., St. Louis, Mo. 63118. Boating organizations can contact the company for information regarding distribution of the free booklets. Michelob has also prepared a 27-minute color film covering basic boating that is available for boat clubs.

Bass—Southern Style is a new 25-minute color film produced by Evinrude outboards and photographed by Eldon Robbins. It illustrates both "bass-busting" techniques and the handling of the newly popular bass boats. Solana Studios, 4365 North 27th St., Milwaukee, Wis. 53216, distributes the film to clubs. . . . And from Sports Center departments of Sears, Roebuck stores or from their catalog, *Fishing & Boating Tips* by Ted Williams and Murray Crowder is a 28-page 25-cent bargain that shows some of Sears rods, reels and boats in some of the illustrations but is all good information without any product pitches in

(Please turn to page 24)

Dodge makes pickup history.



The Club Cab. At your Dodge Dealer's soon.

The exclusive DODGE CLUB CAB gives you an extra 34 cubic feet of storage space inside for the things you don't want to leave outside.



The extra carrying space behind the seats of every Dodge Club Cab means that when it rains, you store. This useful space is ideal for keeping valuable equipment secure, out of the way, and out of the weather. There's room for everything from tools to groceries to optional auxiliary jump seats. And Dodge does it all without

taking any room from the box. What's more, you can get that Club Cab with a full-sized pickup box into any standard 20-foot garage.

The Club Cab, like all Dodge Sweptline pickups, gives you front disc brakes, double-wall construction all around, and independent front suspension. You also get the new Electronic Ignition System for surer starts in any weather. This system is not affected by cold or rain. It eliminates points and condensers that wear out and is virtually maintenance-free. The Electronic Ignition... another example of how extra care in engineering makes a difference in Dodge... depend on it.



AGAIN THIS YEAR

WHAT'S NEW IN PICKUPS COMES FROM DODGE...DEPEND ON IT.

NOVEMBER 1972

23

Материал, защищенный авторским правом



NEW FOR '73 BY CHRYSLER is the Conqueror III, said to be the company's hottest with 340-cu.-in. Super Bee III V8 engine powering stern drive or water jet. The 18½-footer rides six, with bucket seat for helmsman, upholstered banquette aft for five. New Chrysler line has 28 powercraft from 14 to 23 feet for I/Os or outboards

ALL OUTDOORS

(Continued from page 22)

the text. Sears also offers free movies to clubs covering fishing, basketball, golf, football, grouse hunting, climbing and camping.

TESTING OUTDOOR EQUIPMENT in Europe recently, we noted that travel trailers have a way to go to catch up with American designs, although their small sizes are better suited for city streets just wide enough for one knight in armor. But tents are more luxurious. Large plastic "picture windows" and canvas dividers to separate family rooms from the bedrooms make two weeks spent in a European tent less crowded and a lot more comfortable.

Boat facilities are also enviable in some harbors. The Porto Jose Banus marina at Nueva Andalucia near Marbella on Spain's Costa del Sol is the most modern and attractive we have seen.

TWO AMERICAN MOTOR HOMES are reported to be preparing for introduction early next year with chassis from famous European car and truckmaker, Mercedes Benz. They are likely to be the first diesel-powered motor homes generally available as well.

Ford is also rumored to be looking at an entry of its own in the RV field with a camper body to fit inside the new Ford pickup trucks. Starcraft is said to be the builder of the camper body; it presently has no pickup camper in its extensive line of tent trailers, travel trailers and motor homes. General Motors is already producing a motor home. Dodge, a major manufacturer of chassis for completion by motor-home builders, has given no indication that it's presently interested in production of a complete recreational vehicle.

SNOWMOBILE SAFETY statistics seem to indicate that accidents are much less of a problem for the nearly 2-million owners than indoor viewers-with-alarm would seem to think. In an independent medical study last year by Dr. Larry J. Sell of

Manistique, Minn., financed as a public service by a grant from Arctic Enterprises, it was found that improvements in modern machines have dropped accidents related to mechanical failures to less than 3½ percent of the total, down 4 percent from the previous year. His study of reported accidents in northern Minnesota and Michigan showed that injuries and occasional fatalities were not increasing in nearly the same proportion as the volume of the new machines in use, and that back injuries were not the major factor they were supposed to be.

Most injuries were to the lower leg (46 percent) indicating many machines were ridden over insufficient snow and struck unseen rocks, stumps, ice and chuck holes. Deceleration accidents that threw the driver forward causing upper-body and head injuries were the second most frequent type. Helmets and face visors of approved types were a definite head protection.

The average snowmobile injury victim in Dr. Sell's study was a man about 26 years old with three years' snowmobiling experience. His accident occurred on Saturday or Sunday during the afternoon in more than 50 percent of the cases, although night injuries followed closely and accounted for 43 percent. Nearly 25 percent of the injured suffered bone fractures. ★★★

REPLACEMENT PARTS FOR RV ACCESSORIES seem to be a problem to find, particularly when you're on the road and away from your dealer. One source is the ITS catalog, stocked by many trailer supply outfits and some campgrounds. You can find the nearest one by writing Indiana Trailer Supply, 2600 South Nappanee, Elkhart, Ind. 46514, one of the largest RV parts and accessories suppliers. Gear replacements for campers, boatmen, trailer and motor-home owners and mobile-home residents are listed.

And have you noticed the number of indoor types who don't know the difference between a motor home and a mobile home, or who haven't discovered that a motor home has an engine while a mobile home seldom moves at all? ★★★

Seagram's 7 Crown. It's America's whiskey.

Thank you, America, for making our whiskey your whiskey.



7 Crown and Friends in Manhattan.



The smoothest moment in Arizona.



Grand sight. Grand taste.



SEAGRAM DISTILLERS COMPANY, N.Y.C.
AMERICAN WHISKEY—A BLEND, 86 PROOF.



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-BM
CHICAGO, ILLINOIS 60626

How to put your hands to work making money

Do you remember what you paid the repairman, the last time you had trouble with your TV, Air Conditioner, or Automobile? Do you know how much it would cost today—to fix your roof, install new kitchen appliances, or change the electrical wiring in your home?

Now, turn it around—and look at it this way: do you realize how much money you could earn today if you were a trained Electrician, Auto Mechanic, or Electronics Technician? And do you realize how many job openings exist in these fields... either full or part time?

Suddenly, it's a wide-open world of opportunity, if you're one of those fortunate people who enjoy working with their hands. If you can choose one of the high-paying fields where your talents are needed and appreciated. And if you can get the kind of career training that today's employers and consumers are willing to pay big money for.

To help you select a field that's right for you, we've listed 14 opportunities on the attached postpaid card and in the coupon below. And you are invited to find out what you should know about the field you like best, by simply mailing the card or coupon.

Free Guidance Booklet

In return, you will receive a free Career Guidance Booklet that describes the opportunities, income, and job security you might expect in your newly chosen field. It will also explain how


ICS can help you get the training you need to break into this new career field...right in your home...during your spare time...without losing a single day's pay from your present job...and without ever setting foot in a classroom.

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In addition, you'll receive a free "Demonstration Lesson" that lets you see for yourself why picking up the job skills you need—the ICS way—may be easier than you think.

Major corporations use ICS career training. Please bear in mind, as you fill in the attached postpaid card, that more than 8,500,000 men and women have turned to ICS for career training since 1890. And some 3,300 American firms and government agencies are also using ICS training programs to upgrade their employees. (Among these firms are such names as *Ford, U.S. Steel, Chrysler, Mobil, 3M Company, Alcoa, Pan Am, GE, Motorola, and RCA.*)

ICS career training is Approved for Veterans, and is Accredited by the Accrediting Commission of the National Home Study Council. Now it's your turn to discover how ICS can start you in a rewarding new career. Just mail the attached postpaid card today, for your free guidance materials. (If card is missing, please fill in the coupon below and mail it to: ICS, Scranton, Pennsylvania 18515.)



RA 310S

ICS International Correspondence Schools
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Please send me free Career Guidance Booklets and a free "Demonstration Lesson" for the field I have checked below. I understand I am under no obligation.

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<input type="checkbox"/> Architectural Drafting	<input type="checkbox"/> Drafting (Mechanical)	<input type="checkbox"/> FCC Licensing (Electronics)
<input type="checkbox"/> Automotive Mechanics	<input type="checkbox"/> Electrician	<input type="checkbox"/> TV Servicing & Repair
<input type="checkbox"/> Auto Body Rebuilding Specialist	<input type="checkbox"/> Electronics Technician	<input type="checkbox"/> Check here for special information, if age 16 or under
<input type="checkbox"/> Engineering (Civil/Electrical/Mechanical/Chemical)		
<input type="checkbox"/> Communications/Broadcasting Technician		
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Adam. The brown cigarette.

Getting back to natural taste.

Brown makes the difference. The special brown wrapper actually adds to Adam's natural, mellow flavor.
Adam. It's a good taste to get back to.

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20 FILTERS

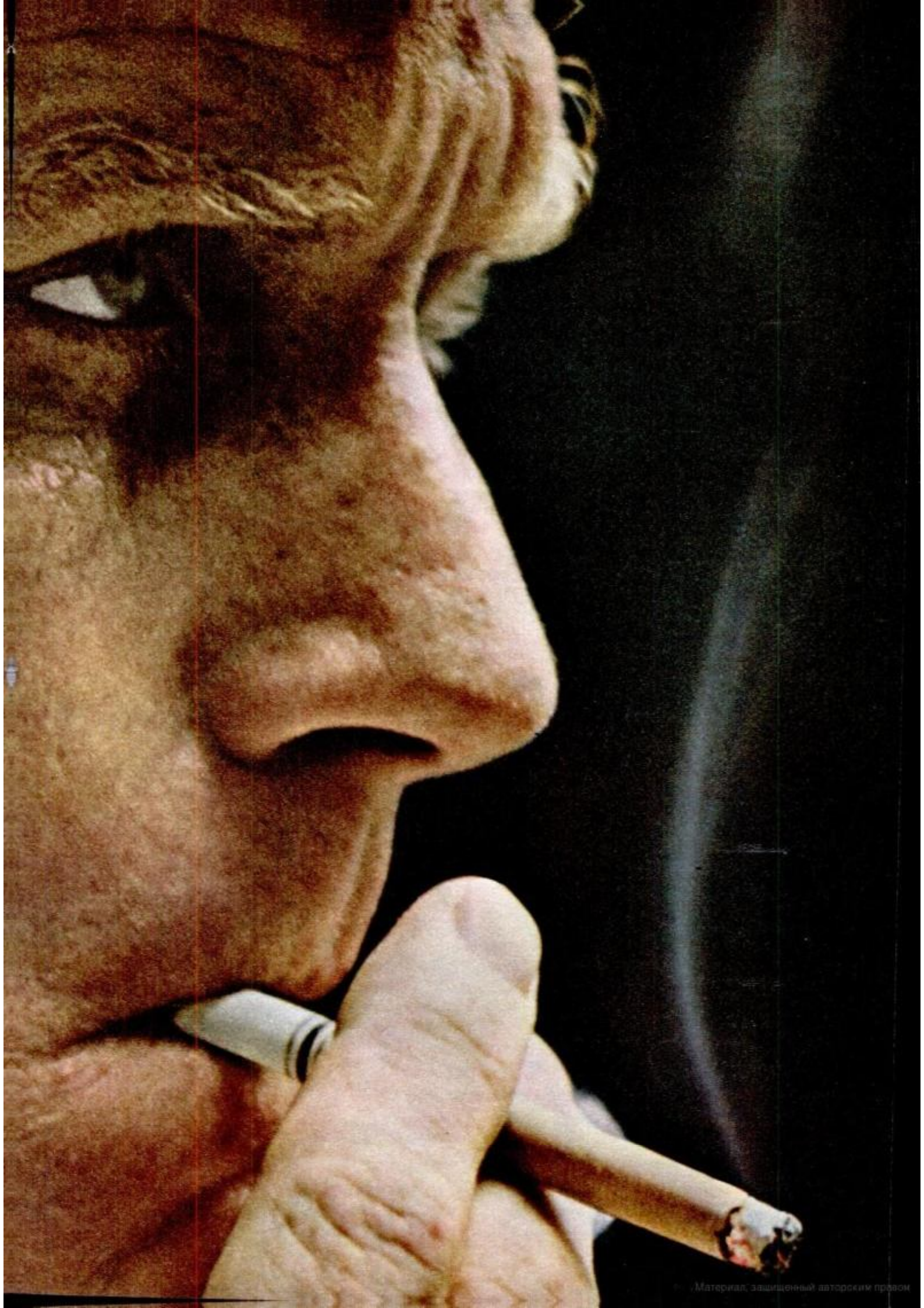
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Adam

Adam

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

King: 20 mg. "tar," 1.4 mg. nicotine. Extra long: 21 mg. "tar," 1.5 mg. nicotine av. per cigarette by FTC method.



DETROIT

LISTENING POST

BY ROBERT LUND

FROM DETROIT VIA HOLLYWOOD. The new car pictured below starts out as a Lincoln Continental Mark IV (at \$10,000) and ends up a Bugazzi at \$30,000. The transformation takes place at California Show Cars, Inc., at 6417 Selma Ave., Hollywood. The Mark IV is stripped to the chassis in the small factory, the body is resculpted, and the interior is redone in glove-leather suede. Plush carpeting is fitted and touches of Italian marble are added to dash and doors. Dubbed America's most expensive prestige automobile, the Bugazzi has lots of surprises—from the special headlights all the way back to the carpeted trunk replete with "chromed hand tools individually packed in vinyl cases." Not leather?—B.H.

BUICK'S NEW MID-SIZE MACHINE, Apollo, will get its first showing at the Chicago Auto Show next Feb. 24, although the car won't go on sale until April. This will be the fourth car GM's pulled off one body starting with Chevrolet's Nova, that begat Pontiac's Ventura II, that begat Oldsmobile's Omega, that begat Apollo. The Buick version will be given a slightly different front and rear treatment than Omega, but you won't need a magnifying glass to see the resemblance to Omega.

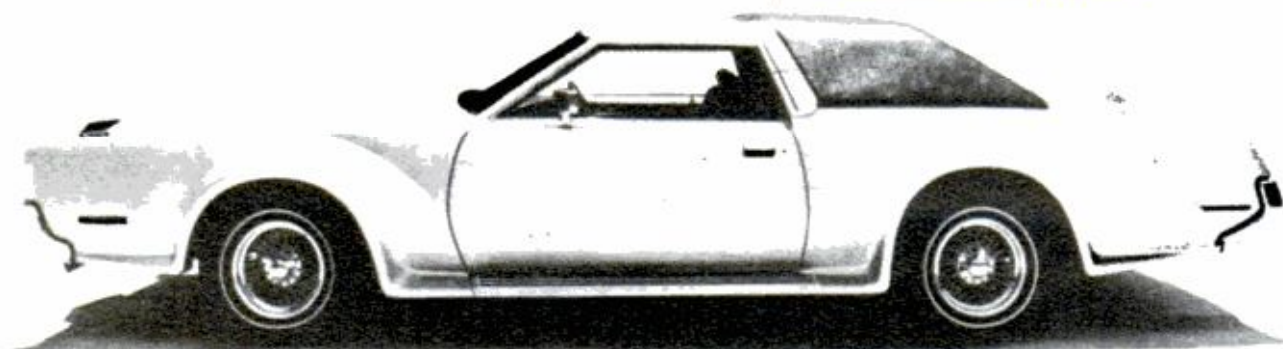
AS POPULAR MECHANICS PREDICTED (They plan to win with hydrogen, page 40, Aug. '72 PM) hydrogen was the fuel of the 1972 Urban Vehicle Design Competition show at the GM Proving Grounds. Winning the big emissions trophy, and breezing past 1976 federal emission standards, was a hydrogen-powered VW Beetle from Brigham Young University. The late entry raised many an eyebrow in the GM Emissions Lab. The UCLA car, featured in our story, won the overall i.c. engine trophy after a last-minute

shift from liquid to 6000-p.s.i. gaseous hydrogen.—B.H.

WHICH WANKEL? There appears to be a debate going on within GM over which version of the Wankel to put in production. Difference of opinion is over the number of rotors and size of the engine, with one school favoring a single rotor and the other a multibank approach. The guys doing the arguing won't have much to say about the final decision. The decision will be made by GM's finance committee when it rules on the price bracket of the car carrying the engine. If it's a standard-size car selling for \$3500-plus, the engine will have two rotors. But if it's a small car pegged for the mass market, the nod will go to the single rotor.

WANKEL VS. TURBINE. Chrysler's banging the drum harder than ever for the turbine. Why? It wasn't so long ago that Chrysler threw in the towel on the turbine. After more than 10 years of tinkering with the engine, Chrysler probably has as much prestart-up money in the turbine as GM has, up to this point, in the Wankel. Is Chrysler's advocacy of the turbine over the Wankel a face-saving device to justify the millions the company's poured into trying to develop a turbine for a passenger car? Nobody likes to be ribbed for betting on the wrong horse. While the Wankel's a lot closer to the finish line than the turbine, it's too early to say Chrysler bet on the wrong horse. The reason Chrysler's high on the turbine again is that the rules of the race have changed. The turbine has a leg up it didn't have a few years ago. It's an expensive engine to build. Chrysler ran off some rough cost figures several years ago, gulped and put the project on the shelf. Now the auto companies are work-

(Please turn to page 36)



Introducing the Hornet Hatchback. A sports car with room to travel in.

Isn't that a nice idea? A car that does everything a sports car should do.

It moves like one. It handles like one. But it doesn't cost like one.

And the Hornet Hatchback gives you

lots of extra room when you need it. Just fold down the back seats and load up through the hatch.

And only American Motors makes this promise: The Buyer Protection Plan backs every '73 car we build, and we'll see that our dealers back that promise.



Buckle up for safety.

AMERICAN MOTORS BUYER PROTECTION PLAN

1. A simple, strong guarantee, just 101 words!

When you buy a new 1973 car from an American Motors dealer, American Motors Corporation guarantees to you that, except for tires, it will pay for the repair or replacement of any part it supplies that is defective in material or workmanship. This guarantee is good for 12 months from the date the car is first used or 12,000 miles, whichever comes first. All we require is that the car be properly maintained and cared for under normal use and service in the fifty United States or Canada, and that guaranteed repairs or replacement be made by an American Motors dealer.

2. A free loaner car from almost every one of our dealers if guaranteed repairs take overnight.

3. Special Trip Interruption Protection.

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Black Walnut
74" x 16 $\frac{3}{4}$ " x 10"

Here is Emperor's **DO-IT-YOURSELF SPECIAL**

for Christmas

Model 120 as shown

solid $\frac{3}{4}$ " genuine black walnut
Grandfather Clock case kits

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All pieces pre-cut and pre-sanded. Breakfront swan neck and finial, waist and dial doors and dial frame pre-assembled. Complete hardware furnished. Each piece may be re-ordered individually.

SAVE HUNDREDS OF DOLLARS

Take advantage of this special. Assemble a traditional heirloom for your home or for Christmas gifting. We'll show you why Emperor has become the world's largest builder of grandfather clocks.

MODEL 120 FEATURES

- Full turned hood columns
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- Floor levelers
- Full-length waist door with curved arch
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Emperor enhances the charm of cherished grandfather clocks with original designs worthy of the finest settings. Fine craftsmanship gives Emperor Clocks a warm, rich beauty. Clock movements imported from West Germany insure lasting dependability. The entire Emperor Clock line is sold three ways . . . completely finished clocks with movements installed, assembled unfinished cases without movements and do-it-yourself kits without movements.

MONEY-BACK GUARANTEE

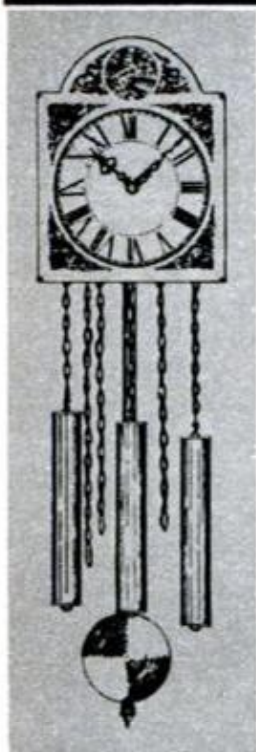
We at Emperor Clock Company appreciate our customers. If you are not completely satisfied with our products, return collect in original shipping carton within 30 days for complete refund. No questions, no excuses.

ORDER NOW FOR PROMPT SHIPMENT

OFFER GOOD THROUGH DECEMBER 31, 1972

CHRISTMAS SALE!

OFFER GOOD THROUGH
DECEMBER 31, 1972



100M Movement
With Tempus Fugit Dial
ONLY \$79.50

EMPEROR MOVEMENT FOR MODEL 120

WEIGHT DRIVEN — EIGHT DAY

The Emperor Clock movement 100M is manufactured by famous West German clocksmiths now in their third generation of producing the world's finest clock movements. It reflects the craftsman's attention to detail — the product of skills passed down through time. The solid brass dial is surrounded by embossed overlays. The face has a high, permanent polish with serpentine hands. In the arch above the dial is a shaped aluminum world with the words "Tempus Fugit" inscribed in black enamel. Or, if you prefer, choose the moving moon dial with lunar calendar.

The completely weight-driven movement strikes the famous Westminster chimes on musically-tuned rods: four notes on the quarter hour, eight on the half hour, twelve on the three-quarter hour and sixteen on the hour. The hour is struck on additional tuned rods. All plates in the movement are solid brass, and all pinions are hardened steel. Installation and adjustment of the Emperor Clock movement is easily done in 15 minutes, following the step-by-step instructions supplied with the movement, which includes the weights, brass weight shells, pendulum and bob, black serpentine hands and arch top dial face.



100M Movement
With Moving Moon Dial
ONLY \$94.50

IMMEDIATE DELIVERY - 1 YEAR WARRANTY

MAKE BIG MONEY BUILDING EMPEROR CLOCKS!

Many hobbyists across the country have become regular Emperor Clock dealers, buying kits and movements for assembly and re-sale to friends, neighbors and retail stores, creating extra income and handsome profits. No woodworking experience necessary!

ORDER DIRECT WITH THIS FORM! OFFER GOOD THROUGH DECEMBER 31, 1972

KITS AND MOVEMENTS SHIPPED AT ONCE

WORLD'S LARGEST MANUFACTURER OF GRANDFATHER CLOCKS

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GENTLEMEN: SHIP THE FOLLOWING — F.O.B. FAIRHOPE, ALABAMA

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QUANTITY	DESCRIPTION	WEIGHT	PRICE	SALE PRICE	EXTENSION
	Model 120K Do-It-Yourself Case Kit w/o movement	53	\$129.50	\$89.50	
	3 OR MORE, each			85.50	
	Model 120U Assembled/UNfinished Case WITHOUT Movement or Glass (NOT Pre-Stained)	65	195.00		
	Model 120A Completely Finished Clock				
	With Tempus Fugit Dial, Westminster Chimes	95	369.50		
	With Moving Moon Dial, Westminster Chimes	95	384.50		
	Model 100M Movement COMPLETE With Tempus Fugit Dial, Westminster Chimes (for Model 120)	32	79.50		
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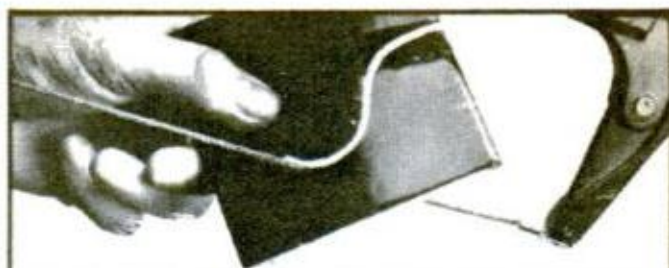
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DETROIT LISTENING POST

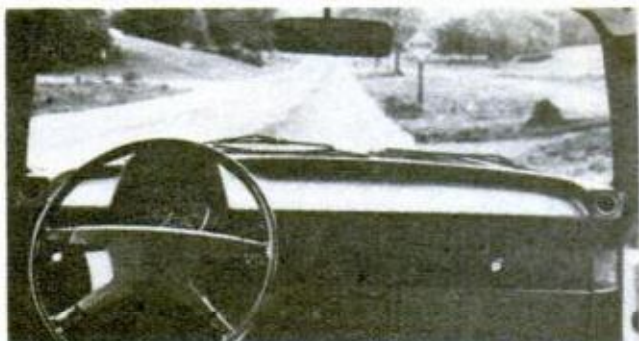
(Continued from page 32)

ing up hard figures on what it will cost to install catalysts and reactors on cars to meet coming standards on emissions. If you factor in the price of the extra plumbing on an internal combustion engine—conventional or Wankel—Chrysler claims the turbine comes out ahead pricewise. That's why the company sees the turbine as a real contender as the engine of the future.

GETTING A CAR SERVICED and repaired under warranty is supposed to improve now that the '73s are here. The auto companies have come up with new programs supposed to make it easier for owners to obtain warranty service and have complaints fixed. But nothing's really changed. What they don't tell you is there's a feud going on between Detroit and the dealers. It's been going on for years.

The dealers say the car companies make it difficult for dealers to collect reimbursement when they fix a car with a factory defect. In reply, the auto companies say they have to make the regulations tough in paying warranty claims because if they don't, the dealers submit phony or inflated claims and try to collect for work they haven't done. The National Automobile Dealers Assn. recently issued a pious statement that appeared to ask for a better shake on warranty work for the customer. But if you read the document through, what it really said is that service will improve when Detroit "eliminates red tape and complicated claim procedures to provide prompt reimbursement to dealers" on warranty claims. Same old stuff. The customer's the pawn and victim and service isn't going to get better until Detroit coughs up. There's one exception. American Motors is trying to be fair with everybody with its "Buyer Protection Plan."

IT'S A BEETLE, believe it or not! The 1973 VW has a new, deeply curved windshield that gives



the interior a much roomier feeling. The wrap-around design also results in a new dashboard with improved ventilation outlets. Other changes for '73 include new front seats, rear taillights, rear fender sheet metal and bumpers.—B.H.

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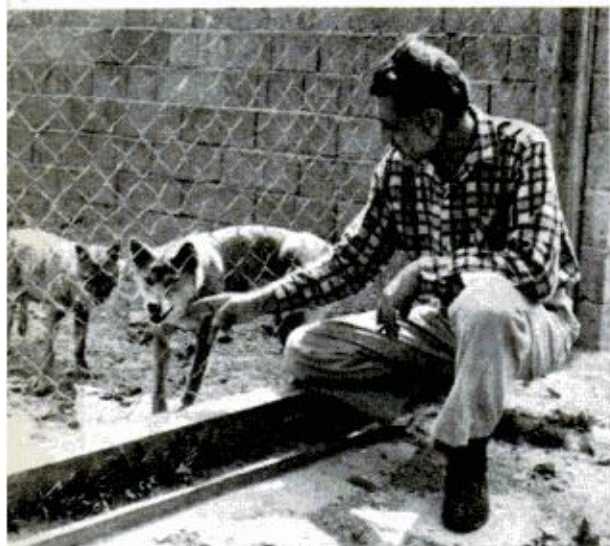
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science worldwide

By JOHN PEARSON



Zebra stripes are stress lines



Breeder and two from dingo line



Biobelt: new way to view heart

HOLOGRAPHY—A 3-D PHOTOGRAPHIC PROCESS—is more than an interesting gimmick. IBM engineers use it to test computer parts for possible failure. Using a laser beam, they photograph the part twice on the same film. Stress applied during the second exposure shows up as dark bands, indicating areas that might fail in actual use. The photo seen at left was made of an IBM hologram of a model car.

RED CHINA'S RECENT NUCLEAR DETONATIONS have sextupled the stratospheric levels of undesirable strontium-90 and cesium-137, according to scientists at the University of Arkansas. They say that the highest level of radioactivity in ground air ever recorded at Fayetteville, Ark., occurred after China's Jan. 7, 1972, explosion of a uranium-235 device. A later blast, on March 18, indicated that the Chinese now can make plutonium devices as well as the uranium type. Arkansas University researchers have been monitoring radioactivity levels over Fayetteville since 1960.

BECAUSE DOGS HAVE BEEN SO FULLY INTERBRED over the centuries, there are few breeds left with all the characteristics of the animal that once was the dog. So says Eberhard Trumler, a West German who is attempting to breed the "real" dog. He works with two breeds—Australian dingo and Norwegian elkhound—which he says have remained essentially unchanged since the Stone Age. By selective breeding within each breed, Trumler is attempting to find out what went wrong with the lines of modern pure-bred dogs. He's also crossbreeding elkhounds and dingos to learn other secrets.

PAN-SIZED CHINOOK AND COHO SALMON are produced in a sea-farming project being conducted in Washington State's Puget Sound by Domsea Farms, a Union Carbide subsidiary. The tasty fish are ready for market within one year after incubation. They get their start in freshwater ponds, then are transferred to pens floating in saltwater. They are given only prepared feeds. The goal of the project is to determine if this type of fish farming is commercially feasible.

THE HUMAN HEART IS VIEWED from three different angles with the Biobelt system, developed for NASA by Lockheed Missiles & Space Co. Electronic hardware worn in a belt about the waist unscrambles electrical signals from the heart. Transmitted to a command electronics unit, the signals are used to create three different views of the heart on a cathode tube. Signals from the belt can be sent through space, per-

(Please turn to page 42)

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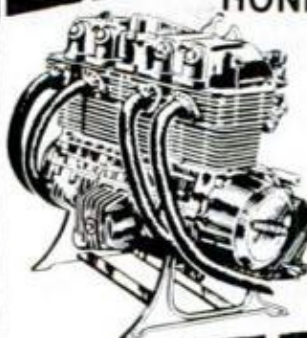


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Build big 1/3 scale see-thru motorized working model of the 4-cyl. engine that makes 750 Four most advanced motorcycle on the market. 68 hp. engine that won Daytona revs up to 8000 rpm, top speed over 125 mph. Features overhead cam 4-stroke engine design; 4 synch carbs, 4 upswept mufflers, & hemi heads with offset valves. Shows valve opening & closing, piston cycle, flashing plugs, etc. 187 metal & plastic pre-colored parts, display stand, instructions. Requires 2 "AA" Batteries (not included).

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Amazing New

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General Motors recently paid \$50 million for rights to the Wankel. Ford just signed up! Now you can thrill to the fun of building your own see-through, 1/3 scale working motorized model. This revolutionary pistonless type engine replaces piston, cylinder and crank assemblies with rotating discs (sections removed to form firing chambers). Kit features flashing plugs, rubber fan belt, stick-shift, on-off switch, instructions. Requires two 1.5v batteries (not included).



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SCIENCE WORLDWIDE

(Continued from page 40)

mitting doctors on Earth to visually monitor the heart action of astronauts on a mission.

The environment

TESTS OF SAMPLES OF OLD ICE reveal that most of the carbon monoxide in the atmosphere is due to natural rather than man-made sources. Scientists at Stanford Research Institute, Menlo Park, Calif., said that the largest source of carbon monoxide appears to be methane, a gaseous hydrocarbon produced by the decomposition of organic matter. The ice samples, dating from 500 B.C. to 1850 A.D., were obtained from Greenland and Antarctica.

WHAT CAN YOU DO with empty detergent packages, plastic bleach containers and sardine cans? You can build a castle, com-



plete with spires, towers, moats and drawbridges. That's what a 74-year-old Englishman did. A retired commercial artist, he worked evenings for over a year creating a castle fairytale like those he'd seen along Germany's Rhine River. He undertook the project, he says, for the amusement of his grandchildren—and himself.

CHICKEN MANURE IS RECYCLED into chicken feed by a process developed by the Organic Pollution Control Corp., Grand Haven, Mich. The process is said to reclaim that half of the feed that remains virtually undigested as it passes through the chicken. Manure first is milled, then blended with other predried ingredients. The mix moves through an oven that turns it into something resembling black grass seed. Bacteria and other impurities are destroyed in the process—the final product is ready to be mixed with new seed. ★ ★ ★

The snow job gets a happy ending.

Dump that old shovel. Let one of these rugged New Holland snow removers do the heavy work this winter. And suddenly you'll smile when the flakes start to fall.

NEW FROM NEW HOLLAND: WALK THE SNOW AWAY! No more heave-ho. A big double auger bites through the snow. A high-speed impeller whooshes it up to 30 feet away. Powerful drive wheels do the pushing. You do little more than steer! New Holland introduces three new snowblowers this year: heavy-duty 8-hp. and 5-hp. models (both clear a 26-inch path) and a compact 4-hp. size that cuts 18 inches.



START SITTING DOWN ON THE JOB!

That means a New Holland lawn and garden tractor with a powerful snowthrower out front. Four models: the 16-hp., 14-hp. and 12-hp. machines cut a 48-inch path, while the 8-hp. unit is 36 inches across. All have no-shift hydrostatic drive (the 8-hp. model is also available with mechanical transmission), a step-through driver's platform (no hump to climb over) and automatic compression release (for reliable cold-weather starting).



ANOTHER WAY TO SHOVE SNOW AROUND.

A dozer blade on the front. You can raise and lower it right from the driver's seat. (And when things warm up, you can use the same blade to level gravel and dirt.)



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LAWN AND GARDEN EQUIPMENT

Drivin' with Dan

Why do most European cars have better resale value? Does manual transmission mean better fuel economy? How do Revson and Andretti rate in Formula 1? Dan Gurney answers these and other automotive questions

Q. *What is to blame for the poor resale value of American cars vs. almost all European cars: the quality of U.S. cars or the way they are marketed?—Pete Wetson, Oklahoma City.*

A. They are purchased for prestige in many instances. When used, they lose most of that. Then when it gets down to economy, they are not as good as a smaller foreign job. That is changing though. American cars are still the most reliable in my book.

Q. *Is there any way to disconnect those infernal seat-belt buzzers on new cars? Believe me, I've tried.—Al Raschi, Brooklyn.*

A. You can give up and put them on! Even if you never have an accident, they actually hold you in position when you are driving. *Popular Mechanics* feels strongly about the lifesaving potential of safety belts, and that legislating their use may be the most effective way to get people to wear them. You

can be sure that no do-it-yourself disconnect stories will run in *PM*!

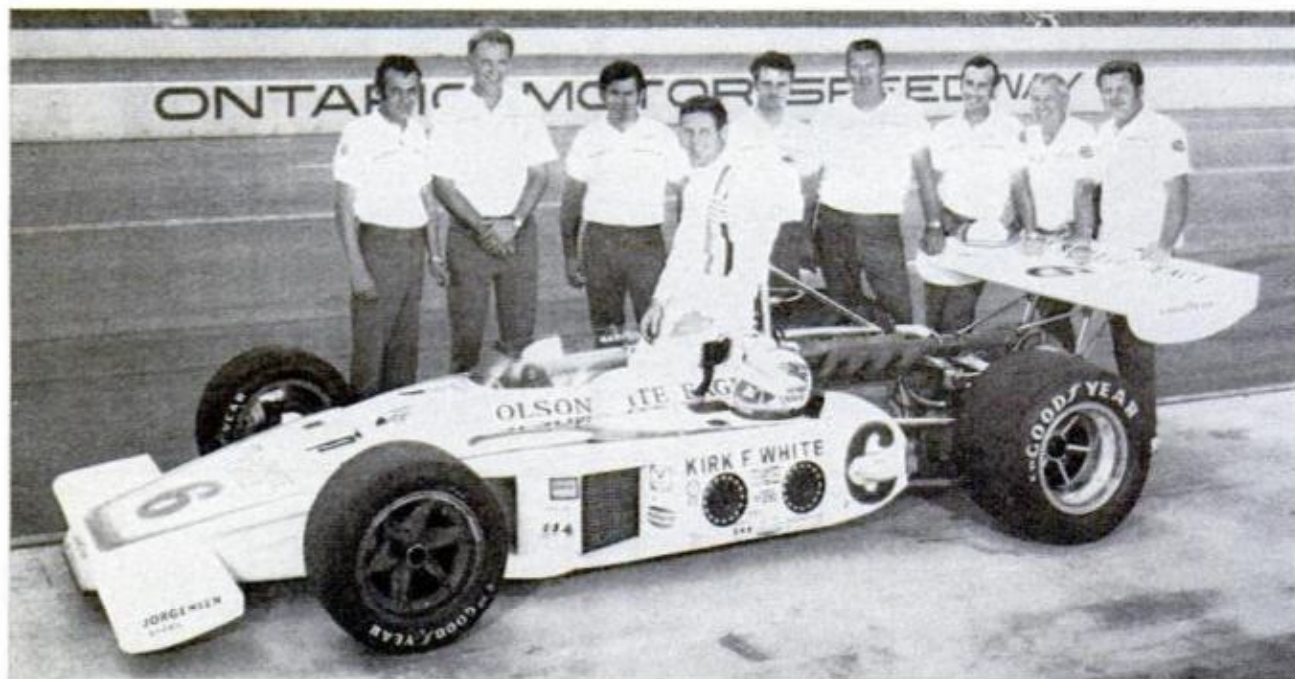
Q. *In this day and age, is there any significant fuel-economy improvement in a manual transmission vs. automatic? And in fact, aren't you just asking for needless clutch trouble with a manual?—G. F. McAfee, Tyler, Tex.*

A. I doubt if you will see a big fuel-mileage gain either way as a function of the gearbox. Clutch trouble is not very common anymore. Automatic transmission trouble, on the other hand, supports a lot of big transmission shops!

Q. *If a broken rotor cap was all that was wrong with Bobby Unser's Eagle in the Indy 500, why didn't you just replace it and continue?—Wade Goodson, English, Ind.*

A. We could have replaced it, but unfortu-

(Please turn to page 46)



200 MPH PLUS! All American Racers team is all smiles about Bobby Unser's world record 201.965-mph run to qualify for Ontario 500. Teammate Jerry

Grant became first man to break the 200-mph closed-circuit mark in the No. 48 Eagle earlier in qualifying. Quite a year for AAR on the Championship Trail

Super Snooper



"Vidicon" is an AC Super Snooper. It's a special x-ray inspection of spark plug insulator assemblies, instantly presented on a TV screen as shown above. It's a regular check AC uses to make sure the terminal screw is properly located in the Iron-Glass Center Seal.

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AC Fire-Ring Spark Plugs... built tough, tested tough, to help assure you quick starts and a smooth-running engine.

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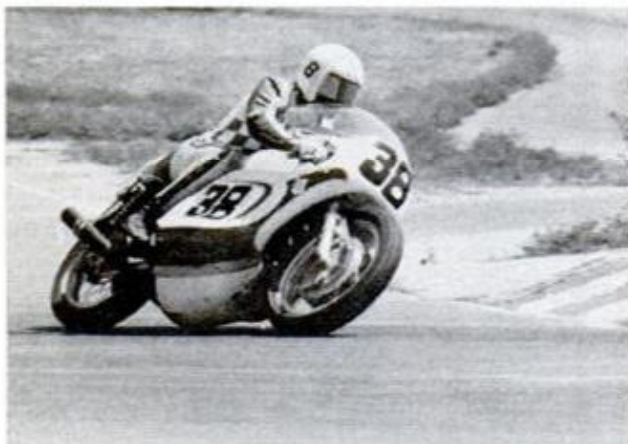
DRIVIN' WITH DAN

(Continued from page 44)

nately it would have taken 30 minutes to do it because it is in a very awkward position. We also had an oil leak which made it doubtful that we could finish, so I decided that it was best to call it a day.

Q. I recently saw a strange motorcycle on the road: The front was almost completely enclosed and only the wheel was sticking out of the streamlined enclosure. Was it a special racing motorcycle?—Amy Christopher, Freeport, N.Y.

A. Not necessarily. The "enclosure" is called a "fairing," and various types are available, even for street bikes. They afford the rider protection against the airstream and rain, allow a greater top speed and better fuel economy. Racing fairings are the most aerodynamic, with increased top speed the most



important consideration, of course. The accompanying photo shows a racing fairing on Chuck Palmgren's AAR-built Yamaha at Laguna Seca.

Q. I presume you have been carefully watching our two current American Formula 1 drivers, Pete Revson and Mario Andretti. It would be helpful to know your analysis of their current status in F1, apart from their automobiles' capabilities.—D. D. Brockmeyer, St. Paul, Minn.

A. Both men are quite capable of winning an F1 race on a fair and square basis. They are the top American oval-race drivers at this time. Mario is very aggressive. Peter is deceptively fast and clean. Neither driver is doing it on a full-time basis and, still, I believe Mario is considered to be the fastest driver on the Ferrari team, and Peter has been fastest on the McLaren team more often than not.

Q. I've been seeing what I'll swear are Ford Pintos being towed around in my neck of the

woods. They've got numbers on them and are apparently being raced. What kind of racing?—Leo Greenblatt, Leominster, Mass.

A. I'm sure you've been seeing Pintos set up for modified stock-car racing. Something of a Pinto revolution is sweeping the modified stock-car circuits in the Northeast. The



traditional modified used to be based on '36 to '40 Fords and Chevies. The accompanying photo shows a '72 ready to run.

Q. With all this downforce I read about being created by the new Indy-car shapes, I wondered if it has come to the point where you get significant braking from the downforce when the driver backs off the accelerator. I don't mean engine braking.—Tommy Ott, Oak Park, Ill.

A. Yes, you are correct. In fact, at Indy this year, many drivers qualified without using their brakes at all because of the effect. There is a lot of drag.

Q. A recent issue of an auto-racing newspaper said that "there is unexpectedly heavy interest by U. S. teams in entering Formula 1 next year with American cars." Do you know who the managers and drivers will be? Penske/Donohue?—John Shepardson, Warsaw, Mo.

A. I've heard that Penske is interested; Donohue, too. I've also heard that the U.O.P. Shadow team intends to make an effort with Jackie Oliver driving.

Q. Have you considered taking a shot at any other type of racing besides Indy with your team of Eagle cars?—Billy Matthews, Fresno, Calif.

A. AAR hopes to make a Formula A in 1973. This should give us a leg up on making a full-fledged F1 car sometime in the future. ★ ★ ★

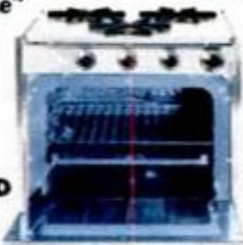
If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 48).

Winnebago's 1973 D-18 Brave.

At \$6,900*, this is your best value in a low-cost motor home.



Before you buy any motor home, find out what the price includes. Many things that are standard equipment in a Winnebago are "optional at extra cost" or simply "not available" on other makes.



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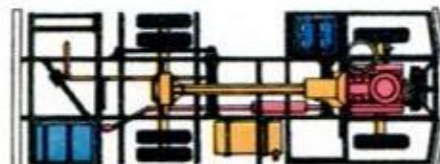
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Send the coupon. Even if you're not ready to buy, you can rent-a-way from it all for a weekend. You'll have fun and at the same time discover how Winnebago gives you more.

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AUTOMOBILE CLINIC

BY MORT SCHULTZ

Grand Prix

I get a bad growl from the rear of my 1969 Pontiac Grand Prix which continues when I place the transmission in neutral and allow the car to coast. What do you think?—James Heller, Houston.

A rough rear-wheel bearing. To confirm your diagnosis, jack up and spin the rear wheels by hand while listening at the hubs. Replace the bad wheel bearing in that wheel which produces the noise.

Wasting watts

The generator indicator light of my 1971 Buick Skylark remains on with the ignition turned off. Can you tell me why?—Brian Schwarz, Toronto.

Probably because of a shorted positive diode in the car's Delcotron, which is causing a continuous drain on the battery through the Delcotron. I suggest you remove and disassemble the part, then test to find the bad diode and replace it.

VW valve adjustment

I'm confused over the valve clearance of the Volkswagen. My manual says to adjust valves for a clearance of .004 inch with the engine cold, but someone told me that this is wrong. Please help.—Sidney North, Elkton, Md.

The latest advisory from VW says that the intake and exhaust valves of all engines produced after November 1964 should be adjusted for a clearance of .006 inch with the engine cold. "Cold" means the engine should be cooled down several hours before the adjustment is made. For a full story on VW valve adjustment, turn to *Saturday Mechanic*, page 154.

Capricious Capri

The engine of my 1970 Capri has started to idle rough. A complete engine tune-up and a search for vacuum leaks have failed to uncover the cause. What is eluding us?—Robert Simons, Memphis.

This engine is equipped with a deceleration valve that is mounted adjacent to the carburetor. The purpose of the valve

is to meter an additional amount of fuel mixture to the engine during deceleration for more complete combustion and, therefore, less emissions. The valve contains a diaphragm which may have ruptured and is leaking, producing an excessively lean mixture that is causing the engine to idle rough. To check it, let the engine idle and cover the small hole in the bottom of the valve. If the idle improves, the valve is defective and should be replaced.

Cricket fuel economy

My Plymouth dealer tells me there is nothing wrong with the engine of my 1971 Cricket. Yet my fuel economy stinks. Any suggestions?—Art Criscuolo, Toledo, Ohio.

Funny you should ask. I recently ran across a letter from Bob Kline, who is Chrysler Corp.'s director of service, pointing out that misuse of the manual choke will put a strain on your fuel budget. A full choke should be used when starting the engine if the engine hasn't been run for an hour or more. Pull the choke fully out and operate the ignition key, but don't depress the gas pedal until the engine has started. When the engine starts, push the choke in about halfway. Twist the knob a quarter turn in either direction to maintain the setting. Usually, the choke can be pushed all the way back in within five minutes after starting, and should certainly be completely disengaged by the time the coolant temperature gauge's needle starts to move.

Busy buzz

Any idea what could be causing a buzzing noise in the voltage regulator of my 1972 Oldsmobile Delta 88?—Joseph Haas, Rocky Mount, N.C.

It could be a loose cable connection at the battery. However, you can't tell by simply feeling to see if it is tight. Oldsmobile advises that the cable may seem tight because of the plastic insulator at the connection of this side terminal battery, but

(Please turn to page 50)

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AUTOMOBILE CLINIC

(Continued from page 48)

may actually be loose and making poor contact. To be on the safe side, battery cable bolts should be torqued to 90 in.-lb.

Click-clack

May I make a suggestion to those who are hearing clicking noises while driving and believe that a differential or axle bearing has gone bad? If your car has wheel discs, remove them and drive the vehicle. I found out with my Chevrolet that loose wheel discs can create a noise that is similar to a bad bearing.—Warren MacNeill, Tarrytown, N.Y.

You may, Warren, and thank you.

Hot Javelin

Since it was new, my 1971 Javelin with 232-cu.-in. six-cylinder engine has been hard to restart with the engine warm in hot weather. Carburetor adjustments have failed to correct the problem. Can you help?—Steven Goodman, Phoenix, Ariz.

AMC cars with six-cylinder engines built during 1970-72 have experienced this kind of condition when the temperature has hit the 90°F. mark, or higher. The cause is a buildup of fuel vapor pressure in the fuel line between the fuel pump and carburetor. Another symptom other than hard restarting is stalling on a left turn. AMC has issued a vapor relief kit (part No. 8121748) that helps to correct the trouble.

Capping a gusher

I have a 1965 Volkswagen that leaks oil from the filler cap. I put a new gasket inside the cap, but no luck. The cap fits very snugly so this isn't it either. My VW dealer tells me this is a normal thing with the VW and can't be helped. Any ideas?—Herm Hansen, Sycamore, Ill.

A couple. First, check out the things that may cause the problem, such as a clogged oil-return screen and overfilling of the crankcase. I think you'll find, though, you have to install an oil deflector plate between the generator mount and crankcase to keep the oil from being

tossed up the filler tube. The problem was recognized several years ago by VW—that's why the plate was issued. I'm surprised your dealer didn't think of it. Tell him the plate carries part No. 11310122B and needs a gasket (part No. 113101219).

Shot shift tubes

I drive a 1968 Mercury Montego which has a three-speed column shift. My problem is the shift tube, which is inside the steering column. It seems to last only 25,000 miles. After four years and six shift tubes, I've had it, especially since the car now has 100,000 miles on it, is still in good condition, and I want to drive it another 100,000. What's wrong?—Gerald W. Young, Blooming Grove, N.Y.

There are two primary reasons for shift tubes to go bad as frequently as yours have. One is an improper mating surface between the shift tube and the shift socket which is causing misalignment and undue wear on the tube when you shift. I've a hunch this is probably what's happening, so next time you have to replace the tube, also replace the socket. Another possibility is that a broken steering shaft is banging up the shaft tube—remote, but still possible.

Service Tips

● **Chevrolet recommends** that if you remove disc brake pads or drum brake shoes when doing a brake job that you mark the pads or shoes to identify their locations on the car. If pads or shoes are to be reused, they should be reinstalled in their original locations.

● **1971 Chrysler Corp. cars** may be hesitating on acceleration. Is the car equipped with a 383-cu.-in. engine with four-barrel Carter AVS 61258 carburetor? Does the code number 168-1 follow the model number stamped on the carburetor? If so, you should ask a dealer to replace the step-up rods in the carburetor with those bearing Chrysler part No. 3685663 and the discharge nozzle with one having Chrysler part No. 3685664.

● **Hard heater hoses:** Are you finding it difficult to slip new heater hoses on their connections? Make it easy on yourself. Soak the ends of the hose in very hot water for a few minutes. Now watch the action. ★★★

GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of general interest will be published in the column.

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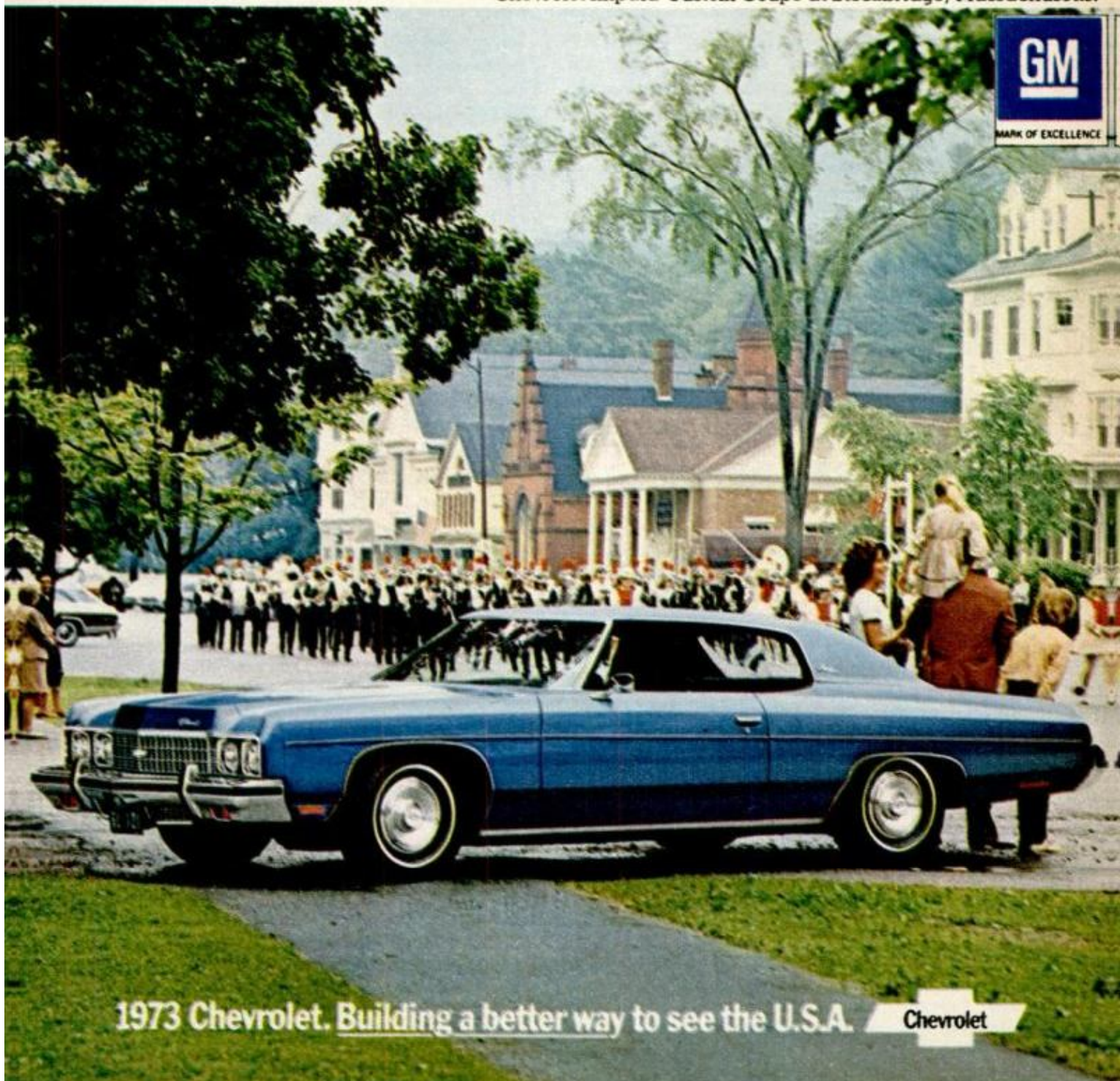
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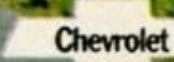
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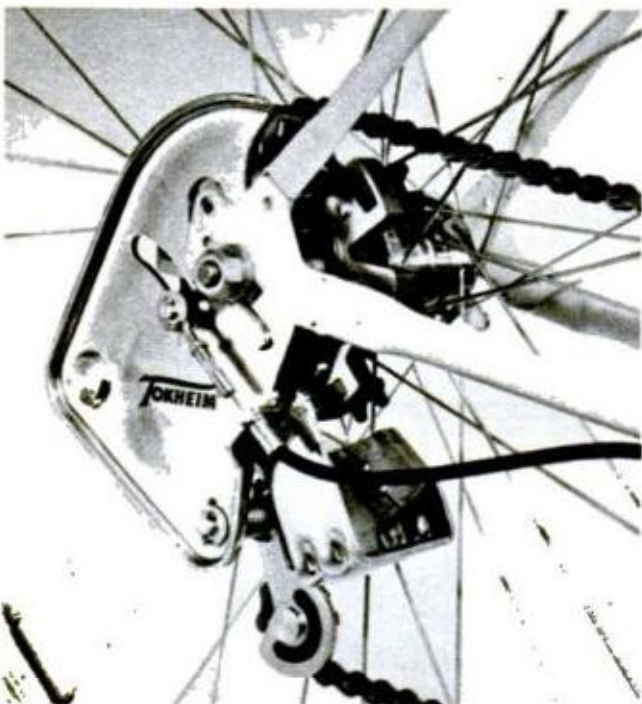
By EUGENE A. SLOANE

This month Gene catches up on some of the many cards and letters from readers and answers their questions about bike repairs, tools and touring

Q. I recently heard that a revolutionary new gearshift for bicycles has been invented and may be on bikes in a year or two. Can you tell me how it works?—*James E. Halpin, Clemson, S.C.*
A. The Tokheim Co., Fort Wayne, Ind., has announced a new bicycle transmission system with revolutionary aspects (see photo, below). Watch this column for more information on this development.

Q. In the June *Bicycle Shop* (page 52B) you note that three-piece cranks are usually better than one piece. It would seem to me that one piece would be better.

Also, don't you think bikemakers should tell



NEW FIVE-SPEED from Tokheim Corp., Fort Wayne, Ind., uses new principle for shifting: Single metal disc contains teeth which move in and out of position forming various size sprockets. The chain does not "derail" and shifting can be done even standing still. A 15-speed version is on the way

customers that only metric wrenches will fit properly? I was always "buggering" up the nuts on my bike until I realized that my "American" bike has Japanese shift, French wheels, and so on.

Do specialist bike mechanics have a jig to test and make sure wheels are as perfect as possible? How do they set spokes at the factory?

And when you mentioned lubrication, you said "once or twice a year" without actually saying how often the bike was used.—*R. Hollar, Philadelphia.*

A. Three-piece cranks are usually better than one piece because they are more precisely machined. An exception are cranks on Schwinn bikes, which though one piece, are quite accurate.

American-made bikes using European and Japanese metric bolts and nuts also use S.A.E. (American) nuts and bolts. It's a good idea to buy a set of metric socket wrenches from 5-mm to 17-mm, for the metric parts. I agree that bikemakers should plainly state that certain parts require metric wrenches, and so note in the buyer's guide attached to a new bike.

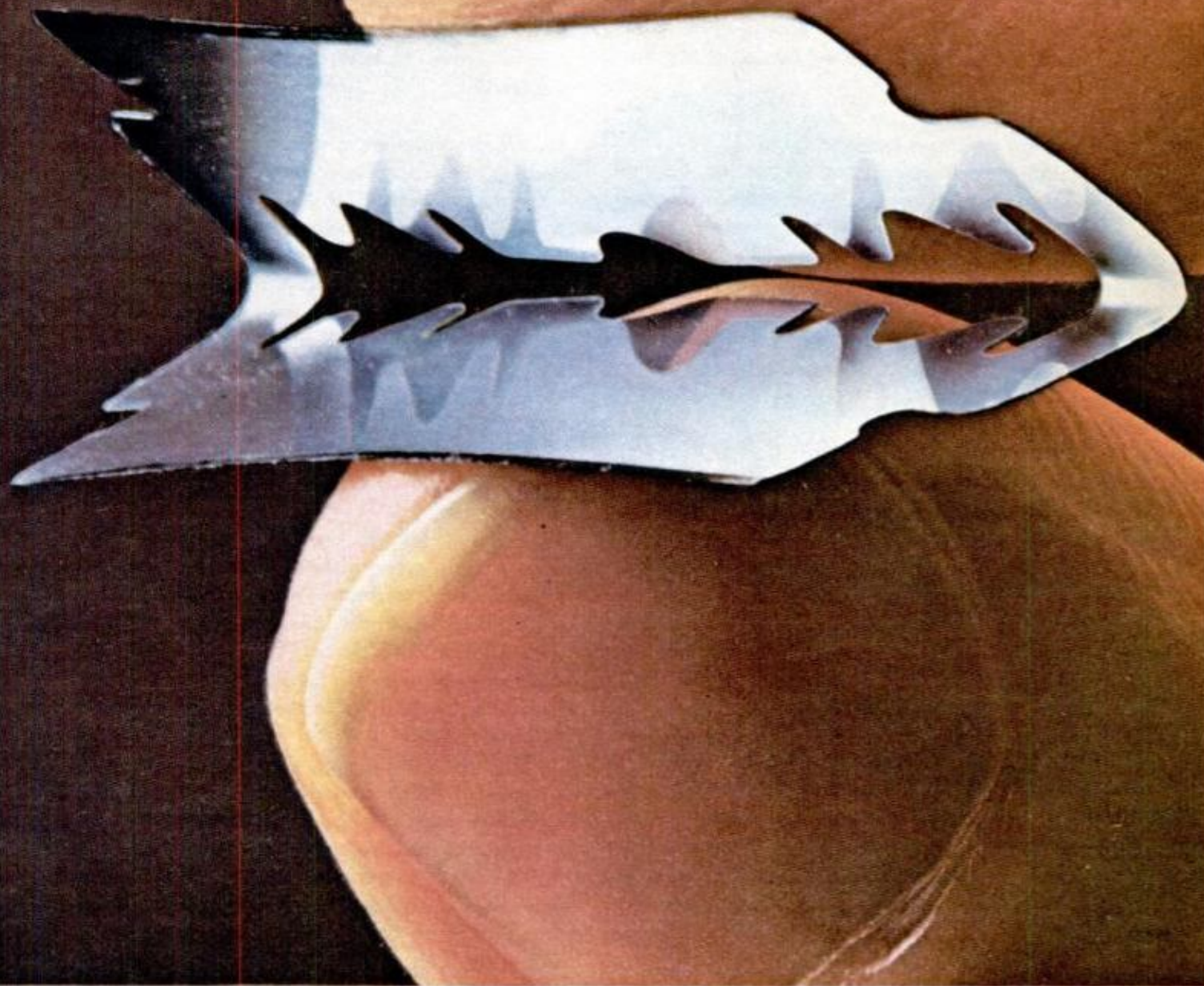
Bike-shop mechanics generally use a special wheel-truing jig which checks for concentricity as well as side-to-side trueness. This jig speeds wheel truing. You can use an old fork for this purpose, however.

Regarding lubrication, unless you ride a lot, hub, bottom bracket, and headset need it only once or twice a year. However, I just rode 900 miles in Vermont, camping in state parks which involved a lot of dirt-road riding. I had to remove the rear hub for disassembly, cleaning and regreasing after the first week due to sand in the bearing making a grinding noise. The chain needs weekly removal, cleaning and relube. Complete disassembly upon arriving home revealed grease about washed out of all bearings (we had a lot of rain). So on every major tour, a total overhaul is indicated, once you get home.

Q. I have a copy of your *Complete Book of Bicycling* and I think it is just great. Your *Bicycle Shop* is equally interesting. On page 78 in your book you mention a Cinelli bike. Is this the full name? And would you tell me the name of the bicycle shown on the back cover of your book? It looks like an Atala Record Model 101.—*Herb Staudinger, Scarborough, Ont.*

A. Cinelli makes two bicycle models, the Special Corsa, a road-racing model which retails for around \$450 in the United States, and a track bike (no gears, no brakes) selling for

(Please turn to page 54)



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THE BICYCLE SHOP

(Continued from page 52)

about \$300. These are limited-production, handmade machines, of which only about 500 per year are produced, for export here. Cinelli & Co. is located at 45 Via Egidio Folli, Milan, Italy 20134. Yes, that's an Atala on my book jacket.

Q. When my five-speed bike is in high gear (small sprocket) the chain jumps off on acceleration. The sprocket seems fine.—*Jeff Kuntz, Westfield, N.J.*

A. The sprocket may seem fine, but check gear teeth for wear. Curved "lands" on the teeth edge will kick the chain off. Also check chain wear by pushing links together. Side play is okay, but fore and aft play should be almost zero. Also check the chainwheel for trueness.

Q. In your May column (page 67), you stated that a large screwdriver will remove a cotterless crankset dust cap. On Stronglight you need a 5-mm Allen wrench. In your book *The Complete Book of Bicycling*, you state that lubricants containing graphite or molybdenum disulfide should not be used on freewheels. I question this since both are excellent lubricants. Your book does not mention freewheel overhaul, yet this is not difficult and can be done for less than the cost of a new one. I read the *Bicycle Shop* regularly and enjoy it.—*James R. Scheip, Alexandria, Va.*

A. You're right about the Stronglight crankset. I was hoping our readers would see this for themselves and use the right tool. The main point is that dust caps screw off. Graphite or moly disulfide lubricants cause buildups on freewheels and can clog and hold up freewheel pawls; hence you should use only light oil on the freewheel. For a freewheel overhaul you need cog clips to hold pawls, a sprocket holder for your vise, sprocket remover and extra shims, all fairly expensive and hard to buy. Freewheels cost around \$6 to \$10, seldom need repair, so it's better to buy a new one. Of course, if pawls are stuck open, you can sometimes remove dirt by dipping or agitating the freewheel in kerosene and relubricating. And no amount of freewheel overhaul can compensate for improperly threaded hubs, some of

which I have seen threaded at an angle, causing transmission alignment problems.

Q. I am interested in cycle racing and would like the address of the Amateur Bicycle League of America.—*Albert Fontanes, New York City.*

A. The ABLA is located at 137 Brunswick Rd., Cedar Grove, N.J. Write c/o President Ernest Seubert.

Q. We are planning a trip to Northern Michigan and would appreciate your help in a route.—*Brenda Chisholm, Flint, Mich.*

A. I would like to help each and every one of my readers who have asked me to plan a route. Unfortunately, time does not permit. I do suggest you select only state or paved county roads, avoid U.S. and Interstate highways, arrange for convenient evening stops at campgrounds or motels beforehand.

Q. On a bike trip, should I use a backpack or bike bag on my bicycle?—*Mark Wilson, Quakertown, Pa.*

A. Let the bike do the work—do use a bike bag. I recommend either quick-attaching Cannondale rear panniers, made by Cannondale Corp., 35 Pulaski Rd., Stamford, Conn. (about \$12 each or \$24 per set of two) or the more elaborate bags made by Touring Cyclist Shop, Box 378, Boulder, Colo. 80302, for about \$45 a pair.

Q. My Bendix coaster brake sticks when I pedal so pedals turn with the wheels. What can I do?—*Steve Hazzard, Lewes, Del.*

A. Your hub needs dismantling, cleaning and regreasing. This is too complicated a job unless you're an ace mechanic. I suggest you let a bike dealer fix it. You might try soaking the hub in kerosene overnight, draining the hub and lubricating with No. 30 oil.

Q. My front axle cone keeps working loose about once a month, even though I've replaced axle, bearings and cones. What should I do?—*Ken Adams, Hillsdale, N.J.*

A. Ask your dealer for a cone locknut. This is a nut that fits over the cone nut. Hold the cone with a thin cone wrench and tighten the cone locknut. If the fork won't accommodate a locknut, use wheel axle nuts with teeth that grip the fork dropout and tighten hard. ★★

GOT A PROBLEM WITH YOUR BIKE? Ask Gene about it. Send your question to *Bicycle Shop, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019*. Letters cannot be answered individually, but problems of general interest will be published in this column.

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APPLIANCE CLINIC

By PAUL MANN

Washer vibration

Our automatic clothes washer vibrates as it runs. Is there anything the average layman can do to correct this condition?—Arch Melrose, Durham, N.C.

The balance of a clothes washer depends on both internal and external factors. Internally, balance is maintained by a system of weights, supports and springs preset at the factory to compensate for a certain amount of unbalance created by external factors.

Vibration is generally caused by external forces greater than the "balance assembly" is set to handle. Of these, an unbalanced load is most common. Always make sure that clothes are loaded loosely in the tub and distributed evenly around the drum. Don't overload the machine.

A machine that loses its level will also vibrate. Most automatic washers are leveled by four knobs called leveling legs or levelers—one under each corner. To make the adjustment, just loosen the locknut on each leveling leg, then turn the appropriate leveling leg(s) to level the machine. After checking side to side and back to back positions with a carpenter's level, tighten the locknuts *securely*—a loose locknut means the machine will lose its level position again.

Perhaps your washer is on a nonlevel, weak or "spongy" floor. If practical, move it to a location where the floor may be stronger, level it and try it out.

If vibration still exists, the cause is probably internal—a damaged part in the "balance assembly."

At the water's edge

Ever since we had a new food waste disposer installed, water has been leaking from the sink when it has been filled. The dealers' mechanic says everything is okay and refuses to do anything. Is there some way of verifying excessive leakage?—George Lipton, Springfield, Mass.

Yes, but what do you mean by "excessive leakage?" If leakage past the stopper

is allowed according to the standard established by the industry, which permits the loss of six quarts of water in one hour, you don't have a leg to stand on.

To determine exactly how much water is leaking, fill the sink with eight quarts, mark the sink bowl at the water line, and add another quart, making the total nine. Wait 10 minutes. If the water level is still above the mark, the leakage rate is less than six quarts per hour. If it is below the mark, the stopper plate and deflector are probably defective and should be replaced.

Sluggish dishwasher detergent

Detergent doesn't always empty out of the detergent cup of our Hotpoint automatic dishwasher. Can you give me some reasons?—Victor Verdon, Scranton, Pa.

Do you let detergent stay in the cup so long that it hardens? Is the cup wet when you pour detergent into it? Are the dishes or utensils so placed in the rack that full movement of the detergent cup's cover is blocked? Does this cover move freely by hand? (If it is warped it could bind against the housing.)

In some models, the cup is tripped electrically by a bimetal at the start of the main wash cycle. As a last resort, the cup should be disassembled to adjust or repair this tripping lever.

Cleaning can opener cutter

The cutting blade of my Can-O-Matic electric can opener is filthy. I've tried cleaning it, but dirt remains. Is there a way to remove the blade without ruining the appliance? I have gotten as far as removing the magnet.—Mrs. David Ferris, Toledo, Ohio.

That's the easy part, because the magnet in many can openers simply pulls straight off; in others, it is held by a screw or two. The cutter is usually held in place by a hinged tooth or cam which can be tripped with an awl or small screwdriver. Don't worry about damaging the appliance. The cutter is not part of the motor. It revolves with the can along with the toothed wheel that holds the can. That wheel is connected to the motor.

After removing the cutter, scrape dirt from it with a knife and then wash it in a detergent solution. Don't try to remove

(Please turn to page 60)

TOM McCAHILL SAYS:

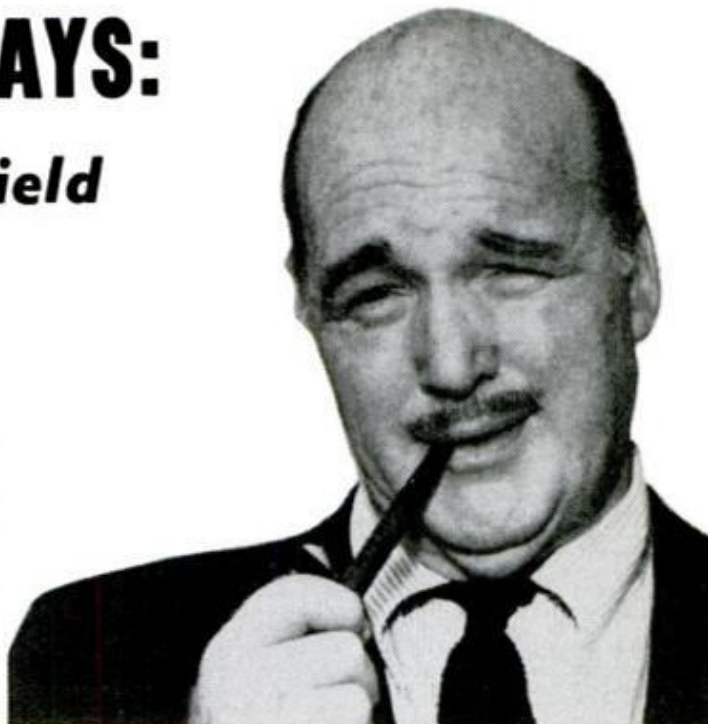
"The appliance repair field is so uncrowded it's almost lonely!"

Someone once said that if you build a better mousetrap, the world will beat a path to your door. In the home appliance business, a lot of enterprising companies have gotten rich peddling a list of handy electrical gadgets for the home longer than Wilt Chamberlain's arm. The trouble is, the dozen or more appliances in the average American home can go on the fritz, and men with the proper training to do repairs are as scarce as knee-length skirts on teen-agers.

Good Appliance Repairmen are a rare breed these days. Those with a little ambition are booked so solidly you can wait days to get somebody to fix a balky refrigerator or cantankerous toaster. Sometimes, you have to settle for a bum job from a guy who had no business calling himself an Appliance Repairman in the first place.

This brings me to my point. If you want to make money in a field that's begging for trained technicians, there's a fine, low-cost home-study plan available that teaches you how to handle every type of Appliance repair in detail—including refrigeration, air conditioners, and even small gas engines. The course was prepared by the instructors at National Radio Institute. This is the oldest and largest home-study school in the Electronics/Electrical fields with more than fifty years' experience training men like yourself for new careers or spare-time or full-time businesses of their own.

A few years ago, NRI recognized the increasing demand for trained Appliance Repairmen. They set about preparing well-illustrated, easy-to-understand lessons that teach you how to repair home, commercial and farm Appliances. NRI even added a professional Appliance Tester that's included in their low tuition. With the Tester and a few basic tools you probably already have,



you're equipped to service most Electrical Appliances. If you aren't making as much as \$4 to \$6 an hour in spare time fixing Appliances for friends and neighbors within a few months after enrolling, my name isn't McCahill.

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The best advice I can give you is to clip the coupon below and send for the NRI Appliance Training Catalog. It's free, and there's no obligation. NRI doesn't employ salesmen, so nobody will be knocking at your door. All it will cost you is a postage stamp. Take it from Uncle Tom, the Appliance Repair field needs good men. Now.

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Nu Find Prod., Dept. HB975, Box 205, Church, N.Y.C. 10008



APPLIANCE CLINIC

(Continued from page 58)

the wheel from the opener; just use a pointed tool to clean dirt between its teeth. It is not important that all this dirt be removed; the wheel is not in contact with food as a can is opened.

Kenmore service manuals

What's with Kenmore? A couple of years ago I was able to buy a technical service manual for a clothes dryer. Now I want one for a clothes washer and can't get it. Does Sears sell manuals or not?—Dan Curtis, Fair Lawn, N.J.

It depends on what you ask for. According to local Sears, Roebuck appliance repair parts departments I contacted, they cannot supply such manuals for machines more than one year old, but for units less than a year old you can get manuals for \$2 each. For the repair parts department in your area, consult your phone book. And get the model and serial numbers from the nomenclature plate on your appliance so you'll order the right manual.

Maintenance tips

● **WATER HAMMER.** If your plumbing system gives a loud thud when the water valve of your automatic dishwasher closes, you are probably the victim of a water-hammer condition. It is caused by water pressure of 160 pounds per square inch or more. This can be damaging, as well as annoying. It might be wise to install a water-pressure reducer.

● **HELP KEEP RESIDUE FROM FORMING** in the tub of a washing machine by wiping out the tub and agitator periodically. This is especially important in hard-water areas where minerals cause this matter to gather.

● **AFTER YOU INSTALL A FOOD WASTE DISPOSER**, you should have your septic tank (if you have one) cleaned out more often than before. According to the General Electric Co., the additional waste from a disposer put into the tank will reduce the time between cleanings by one-third. For example, if you had the tank cleaned every six years before the installation, you should now have it cleaned every four years. ★ ★ ★

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. However, problems of widest interest will be answered in this column.



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WALL DETERGER

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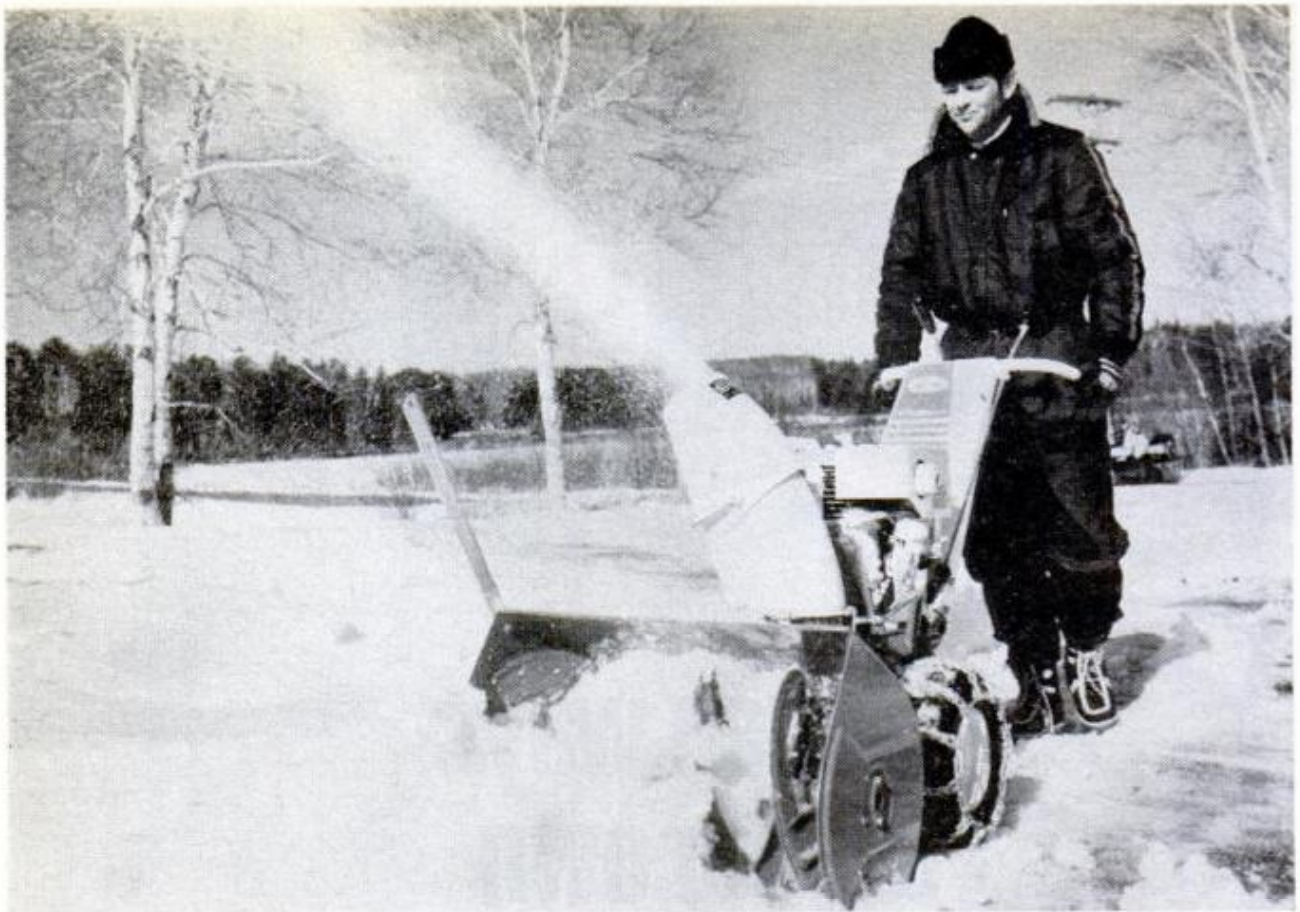
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PLUME OF SNOW ARCS from Gilson Brothers snowthrower, one in line of five models starting at \$279.95

Let the snowthrower do the work

Whether your machine is a few years old or a '73 model, good maintenance pays off

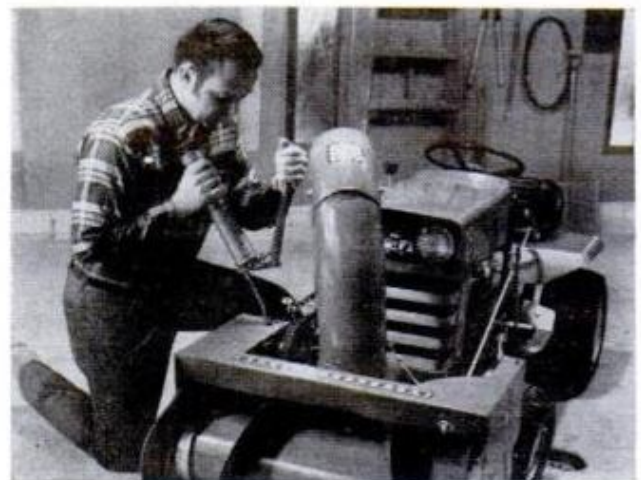
By GERALD KRATSCH

A SNOWTHROWER represents a sizable outlay. To protect that investment—and do your back a favor at the same time—you should give your machine regular maintenance. If it's in good running order when snow begins to fly, you'll find it's almost fun to clean your walk and drive.

If your machine is spanking new, study the owner's manual before you touch the oil can and grease gun. Manufacturers do a good job of spelling out what's required.

But if you've mislaid your manual and

(Please turn to page 64)





















MAINTENANCE INCLUDES greasing and adding lube to worm-gear reservoir. In addition to tractor attachment, Massey-Ferguson offers 7-hp walk-behind unit. Silicone is sprayed on inside of chute of Bolens snowthrower (below). Bolens line includes machines of 5, 7 and 8 hp. Biggest unit takes a 32-inch cut



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 MAKING A HEM?	Elmer's® Fabric Cement	Save on sewing. Use on all natural fibers.	<p>Many plastics may be repaired with either Elmer's Clear Cement, Epoxy, Contact Cement or Heavy Grip.</p> <p>Before using any one of these, we suggest you try it on an inconspicuous part of the plastic to determine that the adhesive will not damage the material.</p> <p>To solve your adhesive problems, stop by your "Ask Elmer" display. At leading retailers everywhere. You'll find an Elmer's glue for any job you do.</p>		
 EMBLEMS OR PATCHES?	Elmer's Fabric Cement	It's laundry and dry-cleaning proof.			
 SCRAPBOOKING?	Elmer's® Rubber Cement	Coat both surfaces and let dry. The non-wrinkling, non-staining paperwork adhesive.			
 LAMINATING?	Elmer's Contact Cement	The waterproof, heat resistant cement for instant laminating without clamping.	<p>*Registered Trademark of Dow Chemical Co.</p> 		

SNOWTHROWERS

(Continued from page 62)

need a quick refresher, here are some tips on maintenance and operation:

First, check the worm-gear reservoir and add lube if needed. Then grease the auger shaft, the discharge chute control crank, crank guides and the chute base ring.

It's a good idea to apply a light coat of wax—a good commercial paste wax or ski wax—to the inside surfaces of the discharge chute and deflector. If you prefer, you can use a silicone spray. A slippery surface will help prevent snow and slush from clogging the chute.

All manufacturers stress the necessity of using a good grade of four-cycle engine oil in the crankcase. It's also important to allow the engine to warm up before you start any snow removal job. You'll find that the best results are obtained when snow is removed as soon as possible after it falls.

The auger speed and blowing distance are directly related to engine speed. Thus, for maximum removal volume, you'll maintain high engine rpm. If your snowthrower is an attachment to your garden tractor, always operate the tractor in low range to insure safe and efficient snow removal. With a walk-behind machine, use a ground speed compatible with snow conditions. The fluffy stuff can be removed at a high speed, while heavy, wet snow requires slower speed settings.

Whenever possible, discharge the snow
(Please turn to page 66)

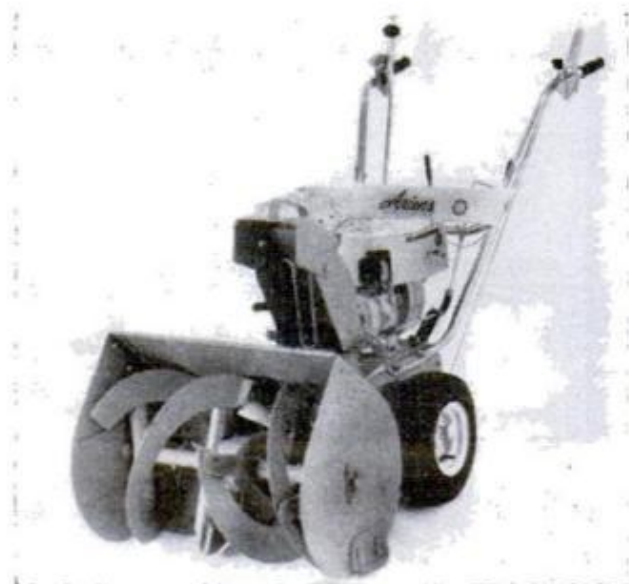


SPOUT ON "TRACKER" turns 270° to permit snow to be thrown with wind. Snowthrowers from Allis-Chalmers include \$290 4-hp unit and \$440 7-hp machine

Some '73 models



THREE WALK-BEHIND MODELS are made by John Deere. Engines range from 5 to 8 hp; prices, \$405 to \$475. All have two-stage auger-blower mechanisms



WHEN WINTER ENDS, this 7-hp Ariens can be fitted with garden attachments: reel or rotary mower, lawn vacuum, shredder-grinder, bagger and sweeper



POLAR BEAR has extra auger above main auger to act as drift breaker. AMF's three models range from 5-hp unit (\$374.95) to 8-hp Polar Bear at \$469.95

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SNOWTHROWERS

(Continued from page 64)



CADET 268—made by International Harvester—has four speeds forward, a power reverse, and takes 26-inch bite. The 8-hp machine retails for \$419.95

downwind. Don't try to remove ice or frozen snow. Do that by hand before the next snowfall.

One accessory that you may want to buy immediately is tire chains. They (and wheel weights for tractors) provide the traction needed for heavy work and slanting walks and drives.

Your snowthrower is a heavy, powerful machine and must be used with care. The Outdoor Power Equipment Institute passes on these safety tips:

- Be sure the machine is in neutral before starting the engine.
- Keep hands, feet and clothing away from power-driven parts.
- Use a grounded three-wire extension cord for all electric units.
- Clear the area of any debris before starting snow removal.
- Don't allow small children in the area while you're working.
- Turn off the engine before attempting to clean discharge chute, make adjustments on the machine or remove obstacles in the work area.
- Adjust height to clear gravel or a crushed-rock surface.

Some '73 models

LIGHTWEIGHT snowthrower priced at \$134.95 is one of six made by the Jacobsen company. It's gasoline powered but not a self-propelled unit. It can be used on steps



LAWN-BOY has entered snowthrower field with three models ranging in price from \$269.95 to \$414.95. Model shown lists at \$344.95, has 5-hp engine and auger that takes a 26-inch cut



- Keep an eye out for passersby. The discharging snow can deliver quite a wallop.
- Be extra careful to avoid losing your footing when operating the machine in reverse.

The snowthrower is quite a boon to those who'll never see 40 again. When that white stuff begins to come down, there's nothing like knowing that the husky machine in the garage is ready and raring to go.

★★★

POPULAR MECHANICS

How to take the luck out of long shots.

Here's how some smart hunters prepare to make the long shots in open or mountainous country. And why they make them with our Model 700 Bolt Action Rifle.

One of the great hunting challenges is to bag a trophy buck, ram, goat or pronghorn in country that requires long-range shooting. It takes practice, plenty of practice, and Remington's experienced designer-hunters suggest that you start by picking one cartridge and sticking with it so you can really learn how it performs. Then start by shooting from a rest at a 100-yard target until you become proficient. Practice other ranges, too, to help yourself learn to judge distances.

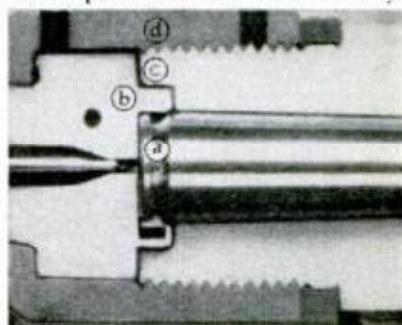
Graduate from a rest to hunter's shooting positions as soon as you can. Practice the sitting position, which is the steadiest and best to use wherever possible (see Photo A), and the offhand or standing position, which is the most difficult, but often your only choice in the field (see Photo B).

If you have the facilities, try shooting at a target that's shaped like a deer from different distances—and different angles. Another good way to practice is to have a friend roll

Out in the field, the most practical way to estimate distance and windage is to touch off a shot and look for the dust to see where it strikes. That should tell you what you have to know to aim properly. But, if the game is 300 yards away or more, the true sportsman thinks twice before he shoots.

Practice with the rifle you'll hunt with. Remington's experts suggest our Model 700 as a wise choice for long-range work. It has enormous capabilities because of the way it's designed and built. For example, it has one of the strongest center fire bolt actions ever made (see Photo C). Each bolt is individually hand-fitted to each rifle and has the serial number of the rifle on it. And before each rifle is shipped, it's proof-tested, then checked for accuracy and functioning. If a Model 700 doesn't measure up, it doesn't leave the factory.

C. Cutaway view of the Model 700 Bolt Action. The cartridge head (a) is completely surrounded by three rings of solid steel—the bolt head (b), the barrel (c), and the receiver (d). Note that there are no extractor cutaways to weaken this critical area.



The 700 is so accurate, its design was used as the basis of our 40XB Bench Rest competition model. And as for versatility, the 700 BDL comes in 17 calibers for every kind of hunting, from varmints to elephants. So you should have no trouble picking a caliber that suits your needs.

You might have trouble choosing between the Model 700 BDL "Custom Deluxe" and the 700 ADL "Deluxe". The BDL, with its handsome Monte Carlo stock protected by Du Pont's tough RK-W finish, black fore-end tip and white line spacers, hinged floor plate, "jeweled" bolt and sling strap with quick-release swivels is a tempting buy, with prices starting at \$174.95*. The ADL has, among other features, a Monte Carlo stock, skip-line checkering, and Du Pont RK-W wood finish, and it's priced from \$154.95*. You should have no trouble choosing ammo to feed the model you select—Remington or Peters cartridges—the ones we use to test it with.

Remington Reports are based on information direct from the "Remington-Peters" experts who design and engineer our products. If you'd like our free full-color catalog, send a postcard to: Remington Arms Company, Inc., Dept. 668, Bridgeport, Conn. 06602.



A. Sitting Position. Note how the hunter's elbows and legs provide a solid support.



B. Standing Position. Bracing yourself against something helps steady your rifle.

targets down a hill for you to shoot at. (Always be sure of your background.) Empty oil drums or discarded tires with a piece of cardboard in their centers, for example, make excellent "action" targets. They not only keep changing distance, but also simulate the bounding path of running game.

Judging distance is only part of the challenge. You also have to allow for the effect of the wind, if any, on your bullet.



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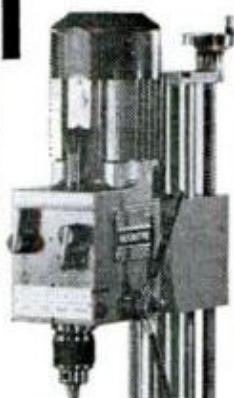
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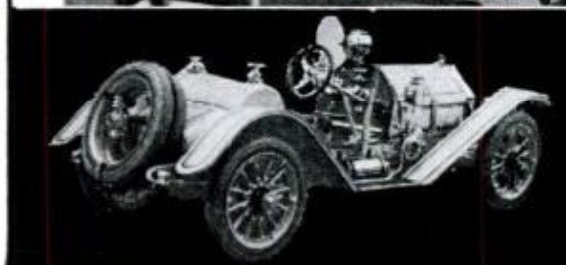
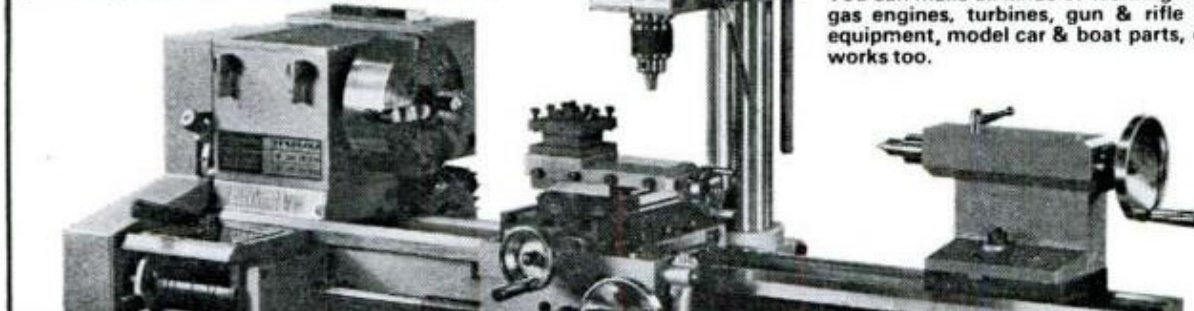
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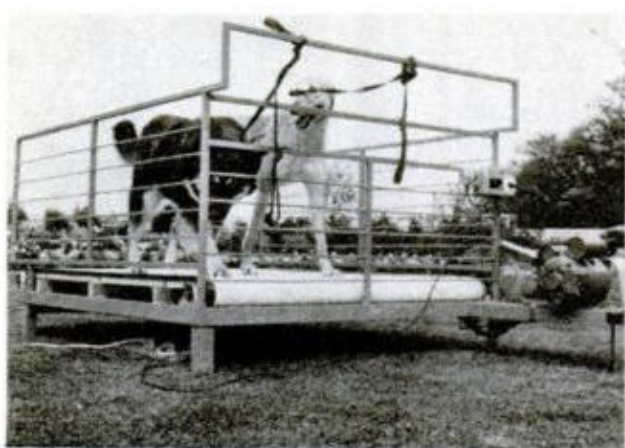
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NEWS BRIEFS



Easy roadwork (for trainer)

Greyhounds, running about 35 mph, are sometimes injured when they take a tumble. To get an injured dog back in shape, the owner must slowly build it up with roadwork. To simplify the roadwork, one English trainer, Tom Unwin, built an electrically powered "dog walker" on which the animals trot over an endless canvas belt. In the photo, a greyhound shows a German shepherd how it's done.



Sorry, wrong airport

Pilots approaching London's Heathrow airport have occasionally mistaken nearby Northolt field for their destination and landed there. Now a big "NO" on a storage tank warns them away from Northolt.



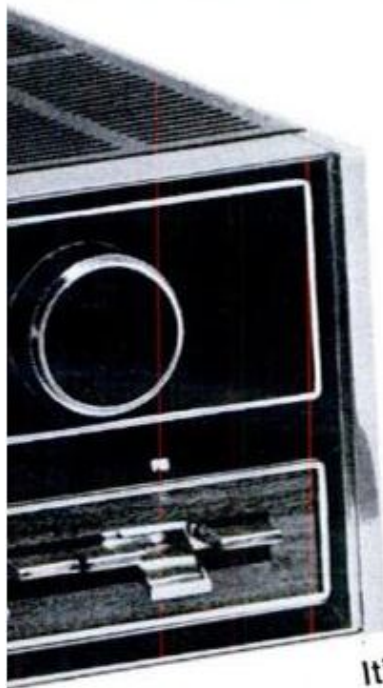
Mud removers for trucks

Several London construction firms use dirt removers (photos, right) to keep trucks from carrying slippery mud onto nearby streets. A truck drives onto the device and spins its wheels on rollers fitted with spiraled metal edges. The mud falls below.



Polaris sub model

A recruiting display sponsored by the British Navy features a model of the Polaris submarine, HMS Renown. It's shown here on view in London.



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If Citizen's Band or shortwave radio has always been a mystery to you, here's your chance to get in on the ground floor and learn what it can do for you.



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POPULAR MECHANICS

There may be a great future in your past.



Think back to that time in your life when you felt like you belonged, had enthusiastic friendships, and a sense of contributing to your country's strength. When you could actually look forward to a secure and comfortable future.

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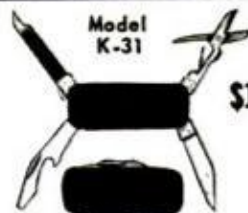


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AN EXPERT ANSWERS YOUR QUESTIONS ABOUT MUSCLES

Our files show that thousands of readers like yourself want to build bulging muscles and achieve real physical power like their favorite athletic champions. How to go about it? We decided to ask an expert, Dave Prowse, 3-times British Weightlifting champion and leading fitness expert. Here are his answers.

Q *What does it take to build muscles?*

A Basically, it takes exercise. Almost any exercise will help to develop at least some of your muscles if you keep at it long enough and hard enough.

Q *Isn't there an easier way?*

A Yes. There is one outstandingly effective training method that is also fast and easy—the Bullworker system.

Q *What's that?*

A The Bullworker is a revolutionary new muscle-building exerciser based on Isometrics, the science that increases strength up to four times faster than conventional methods. In my opinion, it's the most advanced training system in the world today. Many leading athletes use it: World Heavyweight Judo Champion Wim Ruska, and Cycling Champion Eddy Merckx, to name only a few.

Built-in Powermeter

You can actually measure your musclepower g-r-o-w-i-n-g from the very first day.



Q *How long does Bullworker training take?*

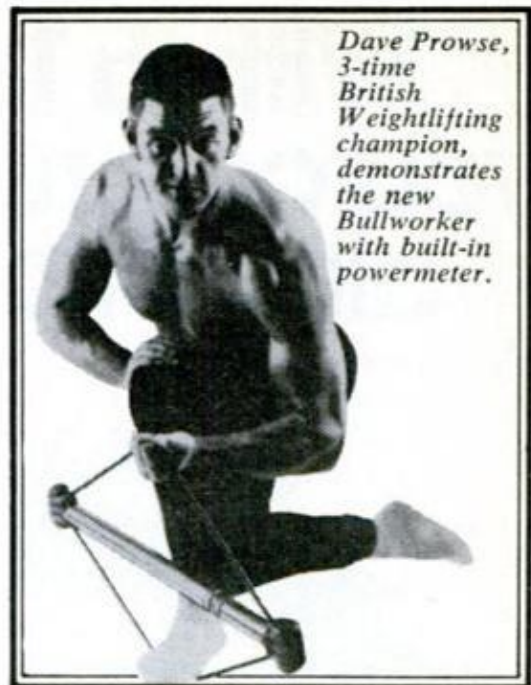
A Bullworker provides absolutely the fastest kind of exercise possible. In fact, an introductory training program takes only 70 seconds a day.

Q *How long does it take before you begin getting results?*

A With the Bullworker, you can actually begin to see and measure the positive results right from the very first day! Isometric Bullworker training can increase your power at the amazing rate of up to 4% per week!

Q *But to get such impressive results, don't you have to work very hard?*

A Absolutely not! That's the outstanding advantage of Isometric training... it's so amazingly easy! Each "Static-power" Isometric exercise takes only 7 seconds, and you barely have to move.



Dave Prowse, 3-time British Weightlifting champion, demonstrates the new Bullworker with built-in powermeter.

Q *Can Bullworker training even develop bodies which are weak and skinny, or fat and flabby?*

A Definitely! Bullworker training helps transform weak, thin arms into rippling, muscular pillars of strength. Helps build broad, powerful shoulders. Turns flat, shallow chests into deep, manly ones. Forges loose stomach flab into steel-hard, well-defined muscle. Helps charge your whole body with new energy and go-power... And all this in record time!

What's more, I've known skinny, shy fellows who, after just a few short weeks with Bullworker, turned into real go-getters... every inch a man... bowling girls over with their dynamism, confidence, and new found power!

Q *How can our readers find out more about the Bullworker?*

A I understand that the Bullworker distributor in the U.S.A. is now making it available—free—on a two week home-trial basis. If your readers are interested in developing their bodies, I suggest that they contact the distributor for full details.

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Giant excavator

Seemingly balanced precariously on the edge of a man-made crater, this huge rotary bucket excavator can fill more than eight railway cars a minute. It's situated at the Rhenish Brown Coal Works, West Germany.



Charlie has a seat belt

Charlie, a 4-year-old alligator, has a seat belt of his own when he rides with his owner, a British lecturer. The belt, stretched across the back seat, has two loops to hold Charlie and his hot-water bottle.



Mosquito for Texas

Recently acquired by the Confederate Air Force, this World War II DeHavilland Mosquito fighter-bomber is shown as it stopped in New York on the way from England to Texas. The all-wood airplane is one of only three that are still flying.

The upland game hunter wants dense pattern and controlled power for quail, partridge, woodcock, squirrel or rabbit.

Winchester and Western pioneered, manufactured, and named new Upland shot shells for superior performance with these great American small game. Upland. Ask for 'em.



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	Shot Sizes
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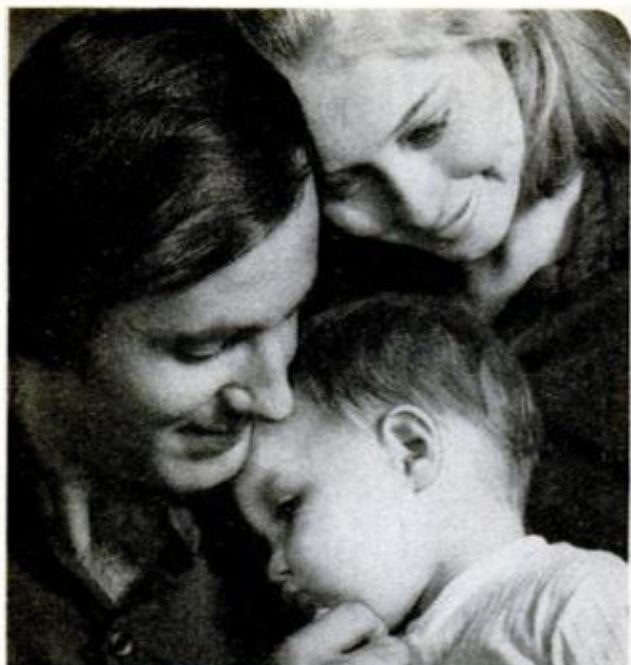
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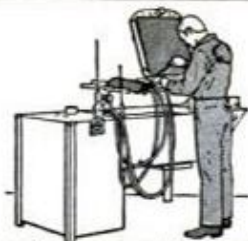
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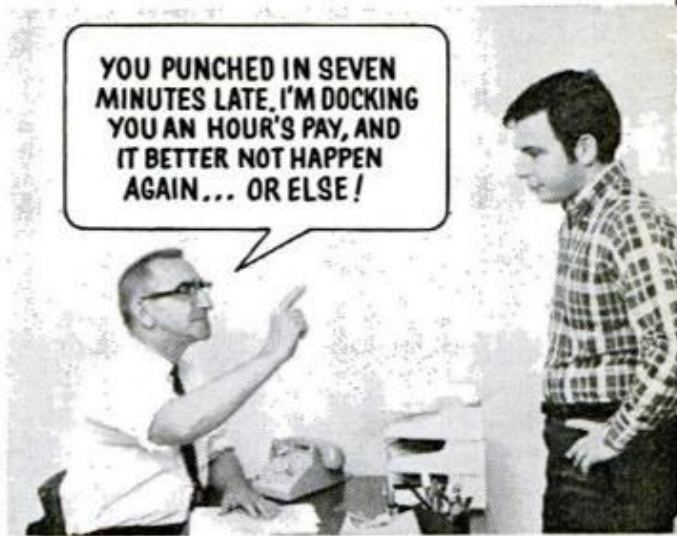
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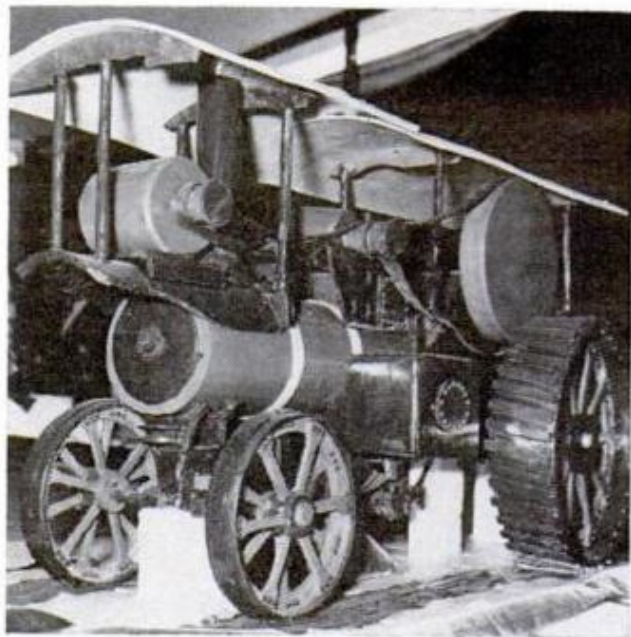
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Butch lives it up

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 (12 Volt Positive Or Negative Ground Only)

Car Year _____ Make _____

Name _____

Address _____

City/State _____ Zip _____

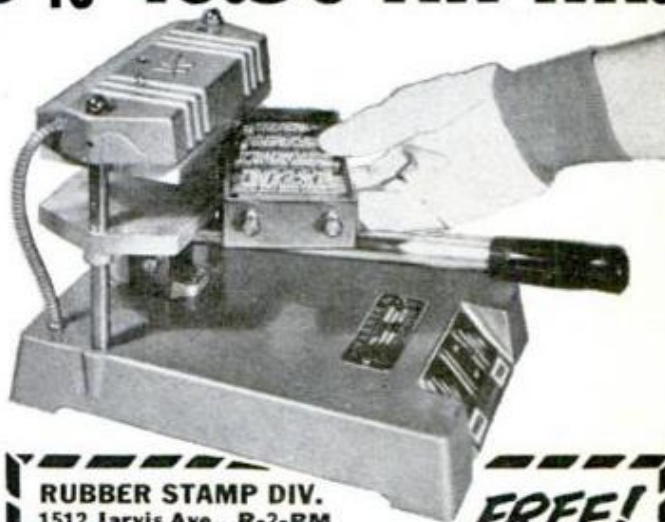
NEW RUBBER STAMP BUSINESS PAYS BEGINNERS UP TO \$16.50 AN HR.

**START AT HOME
IN SPARE TIME**
with Table Top Machine!

**We Help Finance You
... at less than bank rates!**

The multi-million dollar Rubber Stamp business—once controlled by a few big companies—is now being taken over by small operators—one in each community throughout the United States. Men and Women who have this inexpensive machine can turn out huge quantities of Rubber Stamps with special wording that buyers once were forced to buy from big cities. Material costing only 27c makes a stamp that sells for \$2.75. The machine that does the work is simple and easy to operate and it turns out as many as six Rubber Stamps at a time, each with different wording such as names, addresses, notices, stock numbers, prices and other "copy" needed by offices, factories and individuals. Working full capacity, it can earn as much as **\$33.00 an hour for the operator!** Now you can get into the big-pay business yourself, with your own home as headquarters. You don't need experience. We supply everything, including complete instructions and eight ways to get business coming in fast. **We even help finance your start.** Start making up to \$16.50 an hour from the very beginning. Cash in on the profitable Rubber Stamp business in your community, right away. We'll mail full particulars FREE and no salesman will call. Be first in your locality. Rush coupon today or send your name on postcard to:

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Chicago, Illinois 60626

FREE!

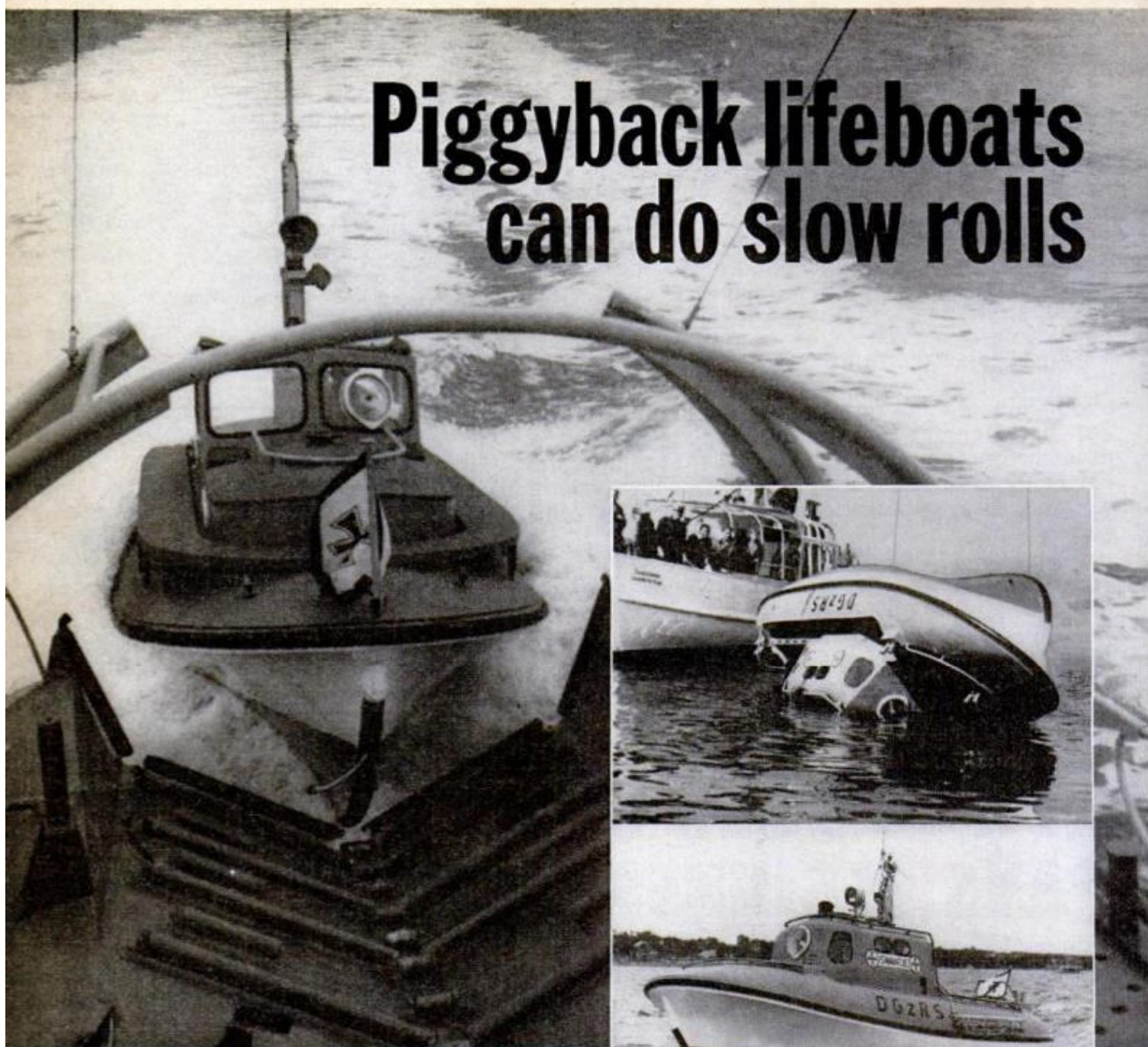
Please rush full particulars about your financing plan and the little machine that can get me started in the profitable Rubber Stamp business at home in spare time. Everything you send me is FREE and no salesman will call.

NAME _____

ADDRESS _____

CITY _____ STATE _____ Zip Code _____

Piggyback lifeboats can do slow rolls



"SAFEST LIFESAVING BOATS in the world" is the way the German rescue service describes its new fleet of boats that will right themselves even if overturned in rough seas.

Now in service are several 87-foot cruisers, each carrying a 22-foot craft piggyback which can be launched into shallow waters the larger boat can't enter.

Three engines in each mother ship drive it at 22 knots. It is equipped with radio, radar, loudspeakers and the like. The smaller boat, launched and recovered from the stern of the larger one, has a crew of two and can hold four others.

The boats are operated by the German Assn. for Saving Shipwrecked Persons (DGzRS), Bremen. ★★★



SMALLER LIFESAVING BOAT, which is launched and recovered from the stern of larger vessel, rights itself within two or three seconds if overturned. It's capable of a 12-knot top speed over a radius of 165 nautical miles. Along with a crew of two, the craft carries food, water and first-aid equipment



LARGER VESSEL has three engines (two of 525 hp, one of 1350), cruises with smaller boat on stern

POPULAR MECHANICS



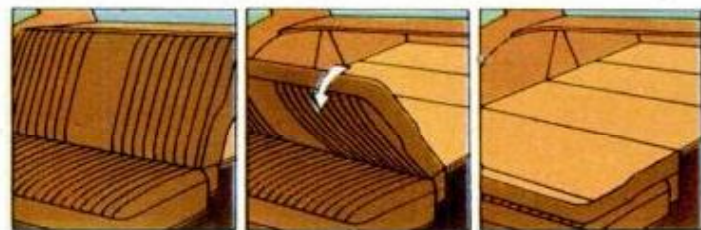
Presenting Space Duster.

You can get more out of it because you can get more into it.

There's nothing so handy as a little car. Except when you want to move some thing big.

That's where our new Space Duster comes in.

First of all, it's the economical Duster Coupe. But with the rear seat flipped forward, it practically transforms itself into a mini moving van.



Here's how the optional fold-down rear seat works.

Fold it forward.

And you have a fully carpeted cargo area 6-1/2 feet long.

And that's the value of the Space Duster. Plenty of extra space. In fact, you even get space in the roof with an optional sliding metal sun roof.

Of course, the Space Duster still gives you all the things people have been buying a regular Duster for. It's small and easy to maneuver. There's plenty of room for five passengers. And its engine is big enough to get you comfortably into and out of freeway traffic.

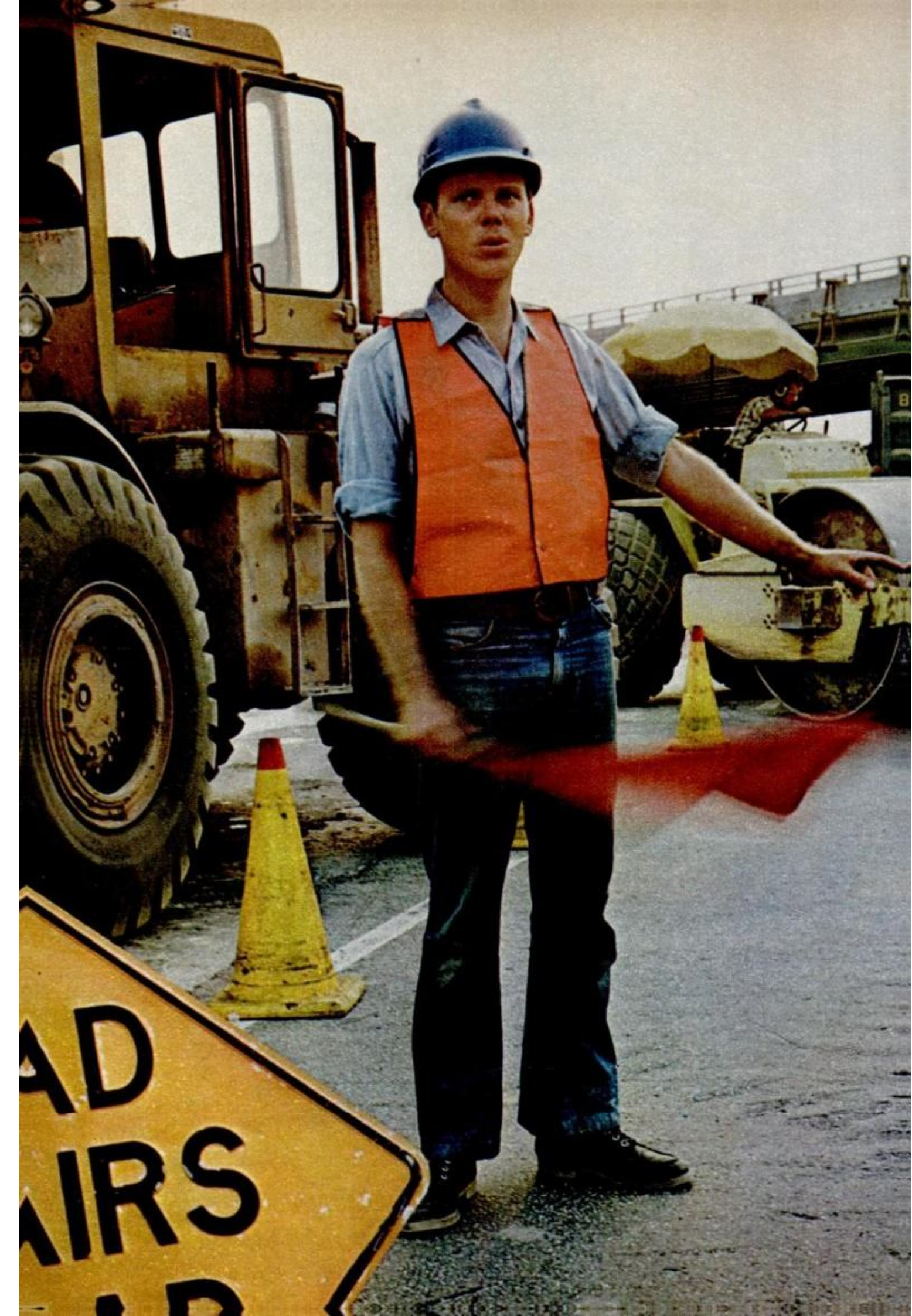
And like every Plymouth, it's built to last. It has a standard Electronic Ignition System with no points or condenser to wear out. Its body is welded into a single, solid unit. And it's treated with layer upon layer of rust preventatives to help it live longer.

In short, you can get a lot more out of the Space Duster, because we put a lot more into it.

Plymouth Duster

Extra care in engineering . . . it makes a difference





If your construction job ended in September, we've got a real one.

We've got a job that lets you build roads. Not merely stand on them. A construction job in today's Army.

If you qualify, we'll put you up top. Up there behind the controls of a 20-ton rig. You'll learn how to operate it. How to maintain it. And how to repair every square inch of it.

And unlike civilian construction schools, you'll be paid for your training. Starting at \$288 a month. Not to mention free meals, free medical and dental care, and 30 days paid vacation each year.

After heavy equipment school you'll start in grading roadbeds, building dams and river basins. And you'll begin to realize why Army trained operators are in such demand when they return to civilian life.

And after your enlistment's over, you can still get up to 36 months financial assistance at the college of your choice.

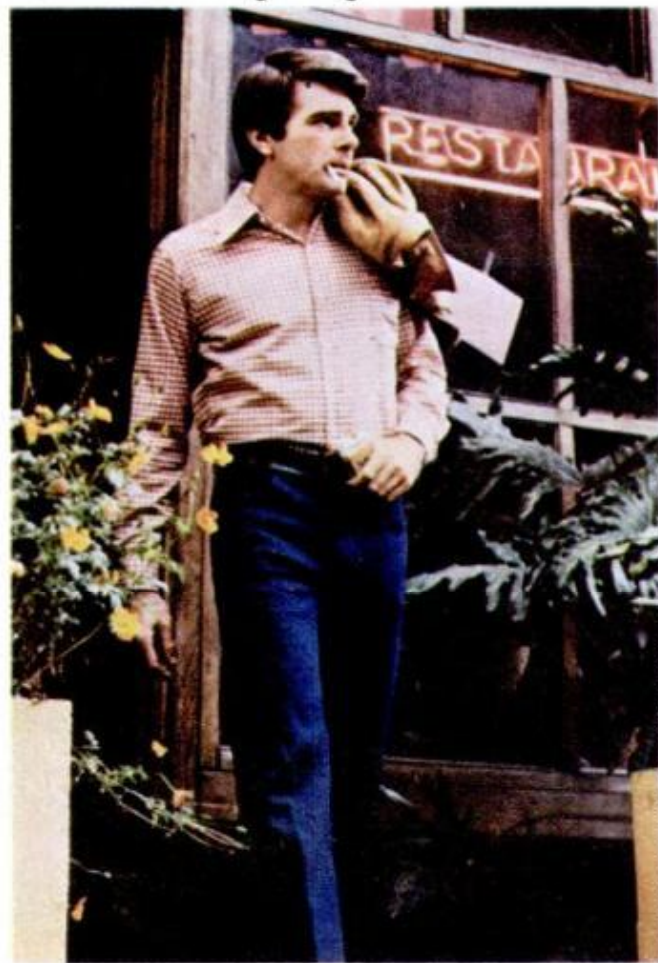
**Today's Army
wants to join you.**

Army Opportunities Dept. 200, Hampton, Va. 23369	Date _____ 2PM 11-72J
I'd like to know more about job-training and promotion in today's Army.	
Name _____	Date of birth _____
Address _____	
City _____	County _____
State _____	Zip _____ Phone _____
Education _____	

With every pair of Mr. Stanley's Hot Pants goes a free pack of short-short filter cigarettes.

Now everybody will be wearing hot pants and smoking short-short filter cigarettes

...almost everybody.



©1972 R. J. Reynolds Tobacco Company, Winston-Salem, N. C.

Camel Filters.
They're not for everybody.
(But then, they don't try to be.)

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

19 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report APR. '72.



Now Surform makes anyone a sculptor

With these tools you can turn out handsome carvings from solid stock and free-form works of art from branches and twigs.

By **HARRY WICKS**
Workshop Editor

Photos by Robert D. Borst
and Lee Michael



AS YOU GUIDE the tool across the wood surface, the cutting action feels different—probably unlike that of any tool you have worked with. You quickly sense that stock removal is by shaving rather than by scraping. And on your first try with one of these tools, you feel a satisfying control—especially as the block of wood takes shape under your hands—that you've never felt with an ordinary plane or file. You are creating your first sculpture with Surform tools.

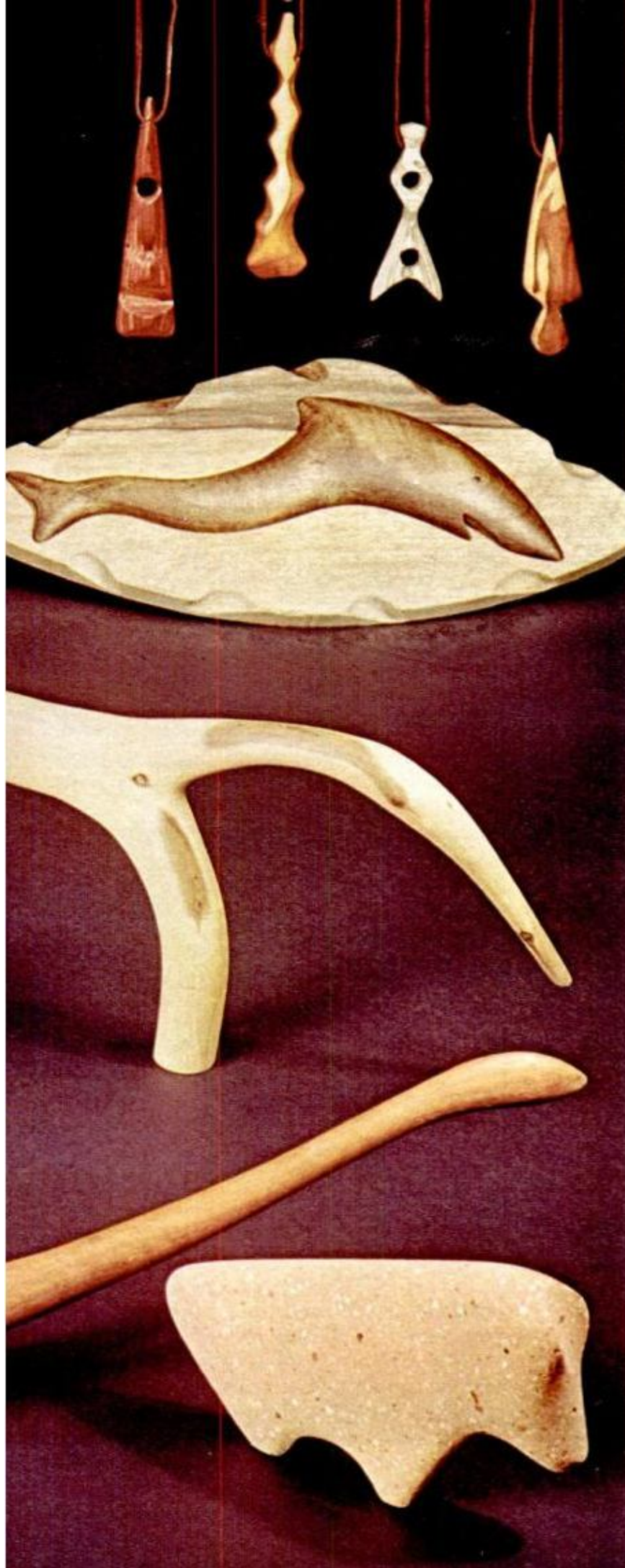
The pieces of sculpture shown in the color photographs are by John Matthews, British sculptor, author and crafts teacher, who developed the techniques described here. Perhaps more than any other indi-

NOVEMBER 1972

vidual, he has championed the use of Surform tools in creative arts. His latest book on the subject is *Sculpture With Surform Tools* (St. Martin's Press, 175 Fifth Ave., New York, N.Y., \$4.95). It will be off the press next month.

The best bet for your first attempt at carving is a relatively simple two-dimensional figure such as the plaque-mounted dolphin on page 83. Because you are concerned with the surface only in two-dimensional carving, you will be able to give greater attention to mastering the tools and techniques. As proficiency increases, you'll automatically graduate to more involved three-dimensional carving—animals, heads and the like. (Strictly





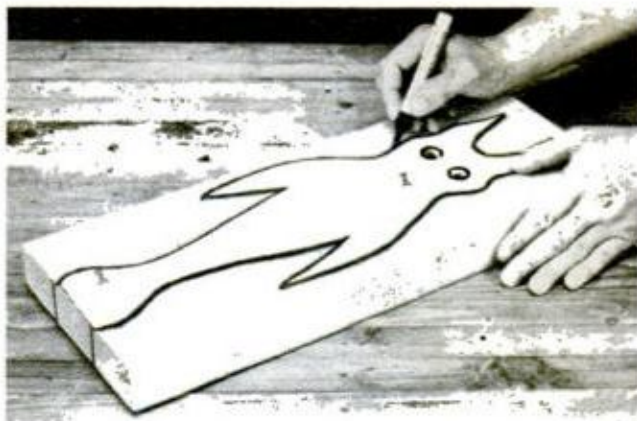
NECKLACES (above and immediately to left) are created by shaping wood pendants in attractive abstract form, then stringing them on leather thongs—laces intended for work boots

speaking, any style of wood-carving is three-dimensional. We are using John Matthews' terms, "two-dimensional" and "three-dimensional," as a simple means of differentiating between flat-on-one-side sculpture and full-round sculpture.)

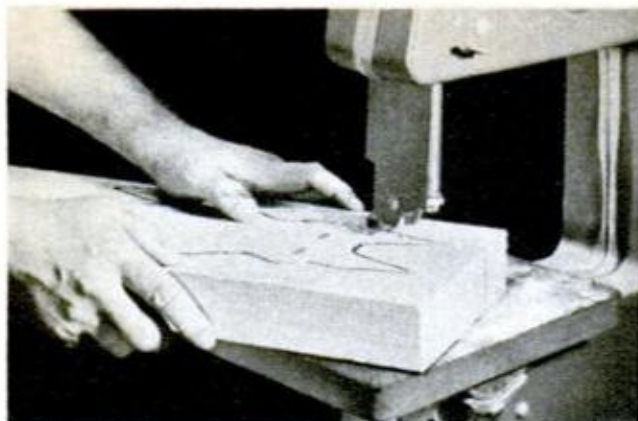
Finally, you will probably yield to the urge to try free-form branch sculpture. Then you'll be hooked for good.

Surform tools can be used on a variety of materials, including stone and some types of soft brick. Wood for a carving should be selected so as to further enhance the subject. The wild grain of fir, for example, can be utilized in overall design, but the material is rather difficult to carve. Matthews' favorite materials are limba, African mahoganies and other exotic woods. These are available from craftsman sup-

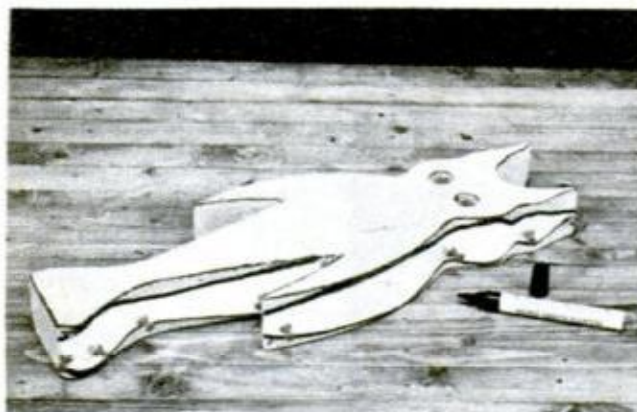
CREATIONS by English sculptor/teacher John Matthews include two and three-dimensional carvings plus abstracts from twigs and a bison in soft stone



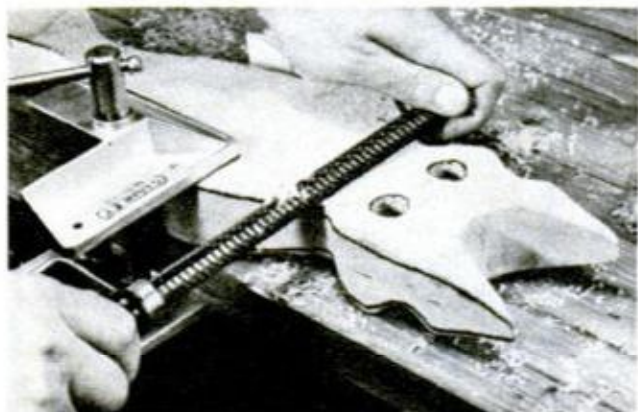
1. OWL SUBJECT is drawn on paper, cut out and pinned to wood. Make outline with a felt-tip pen



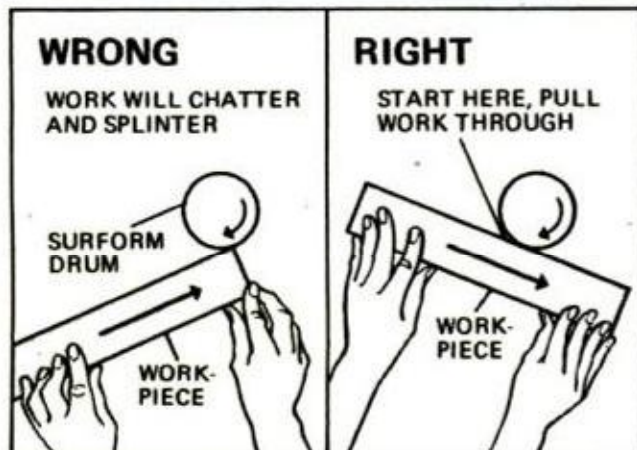
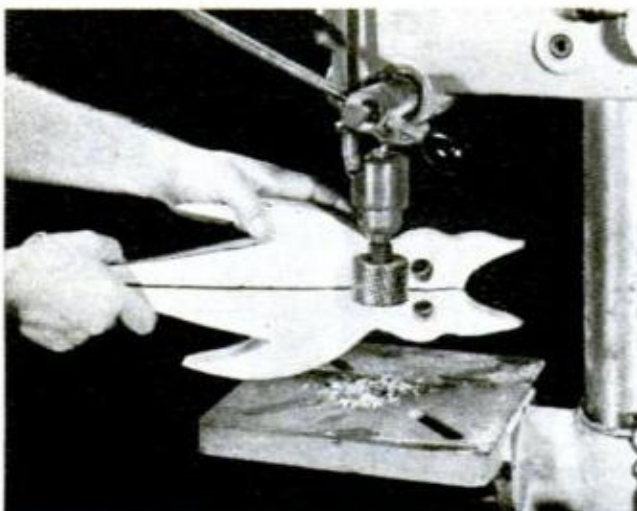
2. FASTEST METHOD of cutting carving block is with a bandsaw. Youngsters should use safer coping saw



3. NEXT STEP is to tack profile pattern to cutout. The wood being used for this carving is a softwood



4. CONCAVE AREAS are cleared using round file. If you have drill press, use drum tool as in sketch



5. MIDLINES are drawn down center of front, back and both sides. Using these for reference, contour the body with a flat blade in either file or plane

ply houses such as Albert Constantine & Son, 2050 Eastchester Rd., Bronx, N.Y.

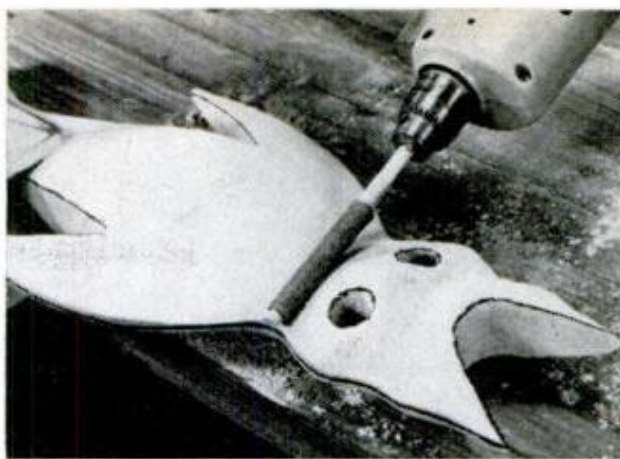
There are a number of sources for subject inspiration: magazine photos, books, paintings or an encyclopedia. After selecting the subject, sketch it to actual size. Cut out this pattern and transfer it to the carving block, as shown in photos 1-3 above.

The owl shown is a typical example of

POPULAR MECHANICS



6. **NEWEST SURFORM** is only one that removes stock by pulling action, works well on convex surfaces



7. **SANDPAPER** wrapped around split-dowel, or commercial sanding drum is used for final smoothing



8. **FINISH** should be selected to suit both subject and wood. A filler-sealer and varnish were used here

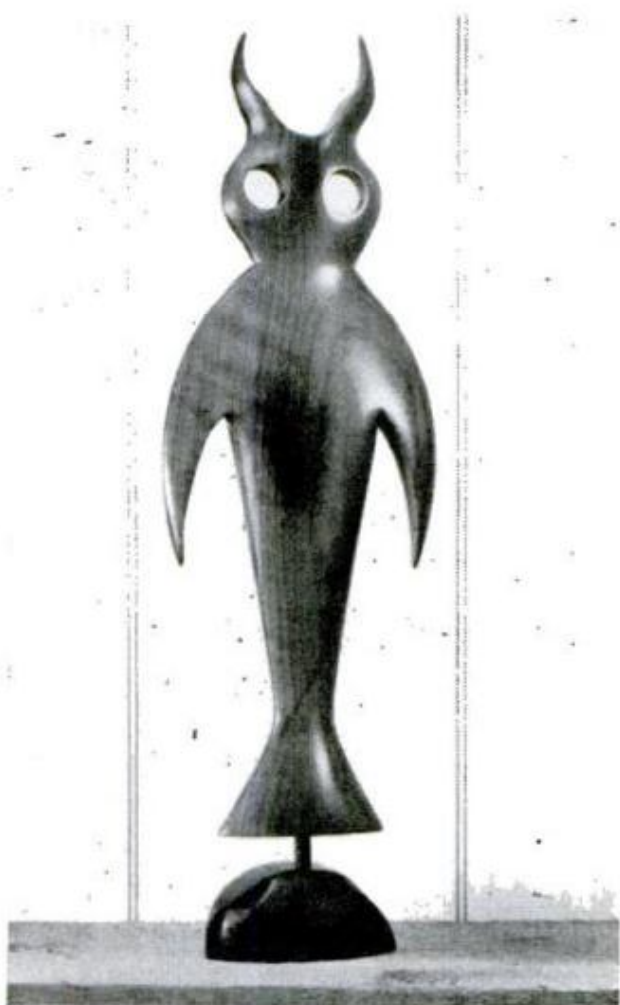
9. **COMPLETED OWL** appears on a fireplace mantel. The base is shaped from a scrap of the same wood owl was carved from, "leg" is simply length of dowel

three-dimensional sculpture. Patterns for front and side views are drawn and cut out. The front profile is traced onto the wood, then cut out with a bandsaw, sabre saw, or—if you're teaching a youngster—a coping saw. The procedure is repeated for the side profile.

Removal of excess material with Surform tools is next. If possible, use the drum tool for large areas and concave surfaces. Or use the round file. (The tools are described later.)

To contour the body, draw midlines down the centers of the sides, front and back. These serve as reference points when you contour the body from high to low points. For this step, use either file or plane—or both. Finally, dress any convex areas with the shaver.

Finishing is a matter of personal preference, but it is dictated somewhat by both subject matter and type of wood. The



owl was sanded smooth, then stained and varnished. Other subjects, in softwoods, are better finished with a textured surface. The crocodile illustrated on page 81, for example, was rough textured with a coarse wire brush chucked into a portable drill. Its finish is a black flat enamel, followed by two coats of a semigloss varnish.

About those Surform (pronounced *sir-form*) tools: There are several reasons why they will quickly be among your



John Matthews' wonderful world of branch sculpture

After starting with two and three-dimensional carving, John Matthews went on to the more challenging forms found in branch sculpture. It's something like cloud gazing, he says. Just as cloud formations appear to take recognizable shapes, so do branches. Matthews "saw" the anteater in the limb he's cutting at left. The beauty of this art form is its purity; nothing is added. In fact, the trick is to know when to stop removing twigs and bark so as not to lose a good, abstract shape. There's no need to cut living branches. Those removed from fallen trees or acquired by routine pruning afford a plentiful supply.

favorites. One of the best reasons is the good control of the tool the user has. Even a beginner will soon be able to remove just the right amount of stock—no more, no less—from where he wants it removed. A scarlike gash in a piece of wood (a common mishap with a gouge in the hands of one unfamiliar with woodgrains) is virtually impossible with a Surform tool.

Carpenters have used these tools since they came on the scene in 1956. Professional sculptors, arts and crafts teachers and hobbyists quickly followed suit when they learned the tools could be used to work wood, stone and metals. Homeowners soon discovered how handy the tools are for household jobs.

The tools are not expensive, need no adjustments and you need not be a sharpening expert either. The long-lasting blades are simply discarded when worn. Replacement blades fall within the \$1 to \$2.25 price range. The tools are safe, too. Youngsters and beginners can use them because they are virtually accidentproof.

Manufactured by Stanley Tools, 195

Lake St., New Britain, Conn. 06050, Surform tools are sold in hardware outlets throughout the United States. Until now, there were five tools in the line. About to be introduced are two new versions. All seven (shown below) have been tested in the *PM* shop.

In the photo, you see for the first time anywhere the **mini-file** and **shaver**. Both have been shop-tested by several *PM* editors. Opinions were unanimous that "the pair are a welcome addition to this versatile line of tools." The first lets you plane right up to a vertical member that butts a horizontal—a decided advantage in cabinetmaking. The shaver greatly simplifies the shaping of convex curves—by pulling rather than pushing action. It also does a fine job of smoothing end grain and plywood edges. These tools will be priced at \$2.69 and \$1.49 respectively.

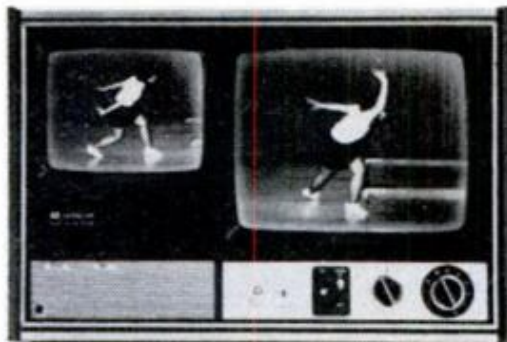
Other tools in the line:

File-type tool. It cuts faster than a metal file or wood rasp. As on all Surform tools, the blade is nonclogging and the tool

(Please turn to page 202)

CURRENT SURFORM LINE consists of five tools at left. Two new types (below) are shown here for the first time. Mini-file (left) lets you get into angle where boards meet; shaver will even smooth off end grain. Both tools will be available in about 30 days





TVs are up to new tricks



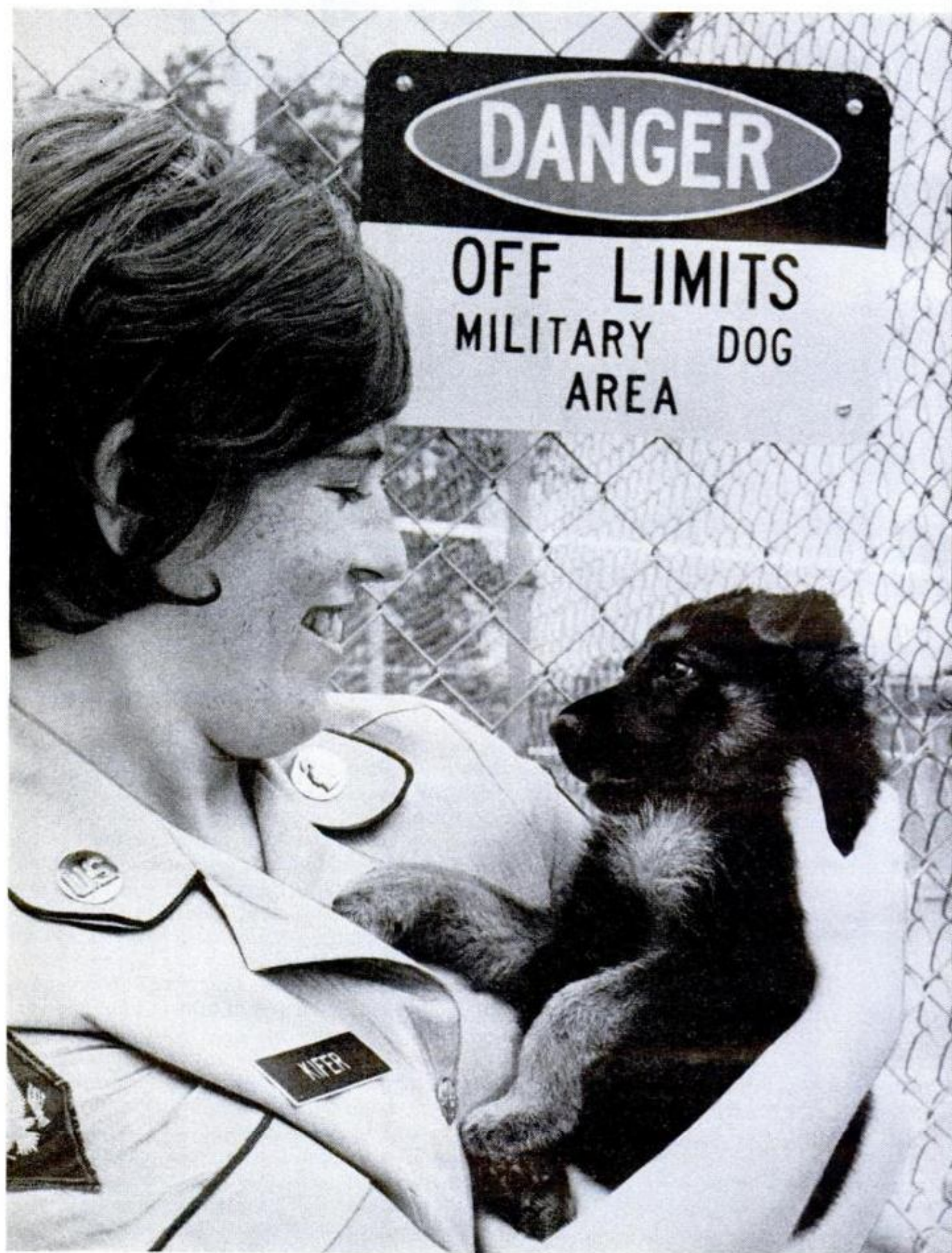
PRESS A BUTTON, and tomorrow's television sets will freeze a single image from the moving stream, or even help you balance your checkbook.

Frame-grabbers seem especially popular. Hitachi's "Memory Vision" prototype (upper left) stores frames on a magnetic disc and displays them on its smaller screen; pushing a button replaces the old frame with whatever is on the main screen at that instant. Sanyo (above) uses a removable magnetic disc that holds six frames, individually selectable. And Panasonic has shown two approaches to frame-grabbing (lower left): "Memory TV" can freeze four small black-and-white frames as shown (main tube is color), or one larger one, can zoom in for a four-times closer look; "Snap-shot TV" delivers a finished, photo-like print, about 2x2¾ inches, 10 seconds after the button is pressed. Other frame-grabbers are under development by GTE, Sylvania, Telebeam and Thomson-Houston, while Tektronix actually makes a TV printer.

The "Calculator TV," another Panasonic prototype (left center), displays its figures, large and in color, on ordinary color TV sets. ★★★

Superdogs are made— not born

By KARL I. OLNAS





FOUR-DAY-OLD PUPS (left) are spun in centrifuge for three minutes as part of stress training. Below, a young recruit is about to be placed in a test room. The dog comes from the dark into brightly lit room where he is subjected to noises and lights. The animal's reactions are observed through peep hole by veterinarians and other team members



A LITTLE-KNOWN PROGRAM at Edgewood Arsenal, Md., has an unusual objective: to produce dogs of superior intelligence and superkeen sense of smell and hearing. Such canines, say Army experts, do a better job in combat, as guard dogs, and as "sniffers" of drugs and explosives.

The first step in the development of a "superdog" was to test various breeds. The German shepherd came out on top. Dog experts combed the country for outstanding recruits, narrowing the final selection to 4 males and 21 females.

Hundreds of dogs were bred from the initial group selected in 1968. After evaluation and training the very best are kept

A SUPERDOG ON DUTY with the U.S. Customs Service gives packages "sniff test" for hidden drugs



for breeding and most of the others are shipped out for active duty when they reach the age of 11 months. Currently, Edgewood has on hand some 250 pups and 50 dogs. About 500 "graduates" are stationed at military posts, and some are assigned to the Customs Service or the Border Patrol.

Though results so far have been good, Army men say that by 1980 the program will have achieved a standard for a "remarkably superior dog."

The development team consists of veterinarians, biologists and expert handlers. In evaluating a pup, the team looks for traits of obedience, alertness and an ability to learn.

They judge a dog's ability to learn by using standard "fetch," "sit" and "come" tests. In addition, the pooch is evaluated on his ability to escape from a maze, his reaction to loud noises and bright lights, his alertness to hidden decoys, his ability to read hand signals and his reaction to strict obedience training.

"We are doing nothing here that hasn't been proven with poultry or livestock," observes the chief of the program. "The only difference is that we're using a domesticated animal, the dog." ★★★

World's mightiest iron mine

A shepherd in the Australian wilds nearly lost his life discovering the biggest iron-ore deposits man has ever known. Here's the exciting account of what he found

By RICHARD DUNLOP

THE TINY PLANE lurched and bucked, battered furiously by gale-force winds and torrential rains. Its pilot was an Australian outbacker, Lang Hancock. For years Hancock grazed his sheep in the forbidding gorges of the Pilbara country in northwestern Australia until the intense heat of summer threatened. Then, each spring, he would leave the torrid wilderness and fly south in his own small plane to the relative coolness of Perth on the southwestern shores of Australia.

This spring Hancock had waited too late to leave the north and was caught in one of the vicious summer cyclones that rage in off the Indian Ocean with winds up to 130 mph. He fought to keep the frail ship under control as he climbed toward the awesome Hamersley Range, among the highest and roughest mountains in western Australia. The steadily falling cloud ceiling forced him to fly lower and lower—at times down to within 25 or 30 feet of the ground. He would not make it over the mountains—his only chance was to try to fly between them. Soon he found himself streaking down deep, twisting mountain gorges, their precipitous cliff walls brushing his wingtips.

Suddenly something strange about those canyon walls caught Hancock's eye. Scoured bright by the driving rains, they glowed a fiery red—the unmistakable red of rusting iron. The

TOWERING CONVEYORS, almost like roller coasters, carry ore from one crushing plant to another—some over three football fields in length



blood-streaked cliffs continued on, almost unbelievably, mile after mile. Could they contain iron-ore deposits of such apparently appalling magnitude? Hancock rode out the storm and eventually made his way safely south to Perth.

Probably nothing to get excited about, he thought. Surely just low-grade ore at best, running only skin-deep in thin surface veins. Intrigued nevertheless, Hancock decided to investigate on his return north the following fall. He found a landing place at the bottom of one of the deep gorges he had flown through and, armed with prospecting tools, began testing the dull-red mounds that towered around him. To his amazement, he found the ore to be not only top grade in quality but virtually limitless in quantity. One vein he personally tracked by plane for more than 70 miles. In his desperate flight to escape the storm, Hancock had stumbled onto literally whole mountains of iron—the mightiest iron-ore deposits the world has ever known.

The year was 1958, and the great Australian iron-ore rush was on—as wild and frenzied as our own Gold Rush of the last century. As news of Hancock's discovery

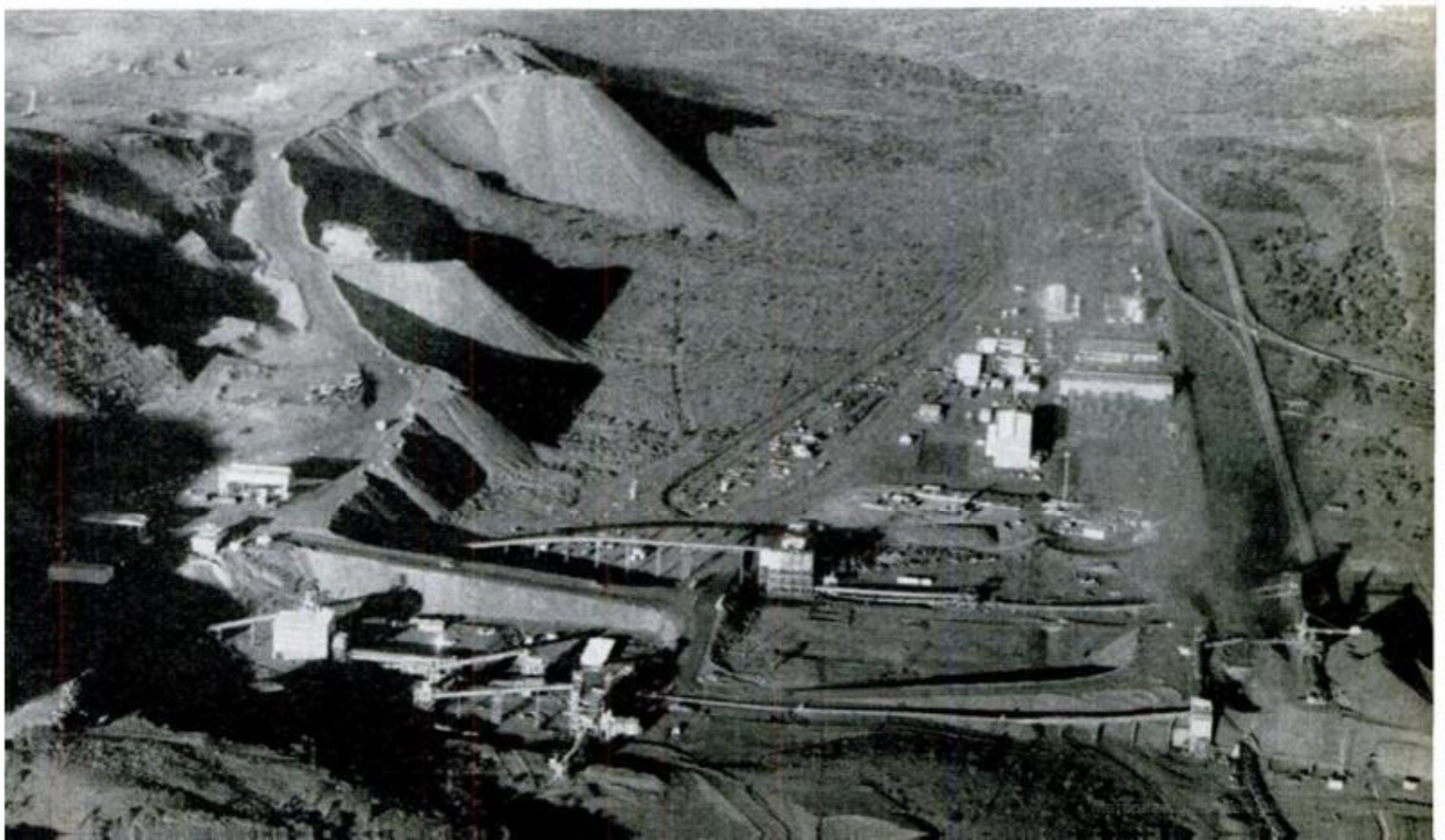


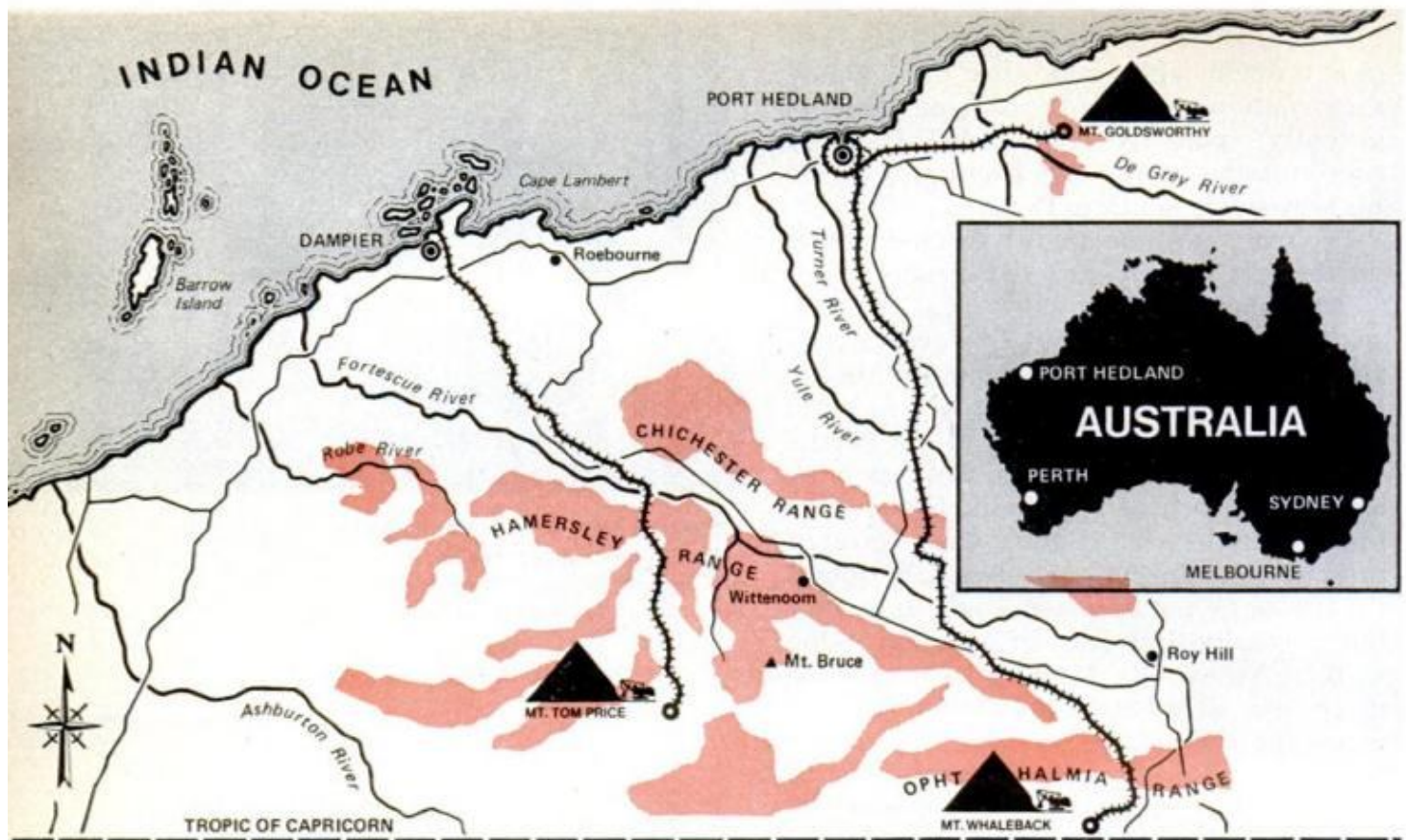
LOOKING LIKE A RAGING INFERNO, fiery clouds of rust-red dust shoot skyward as explosive charges are set off to blast ore-bearing rocks from mountain's side. Each blast removes up to 140,000 tons



AS BLASTING DUST CLEARS AWAY, huge shovels and dump trucks move in to carry out ore rocks loosened by explosive charges, as shown at the right. Trucks haul ore to crushing plants at bottom of mountain

AERIAL VIEW BELOW gives some idea of sprawling size of typical Pilbara mining operation. At left are terraced trails winding up mountain; at right, long conveyors feeding ore-train loading tunnels



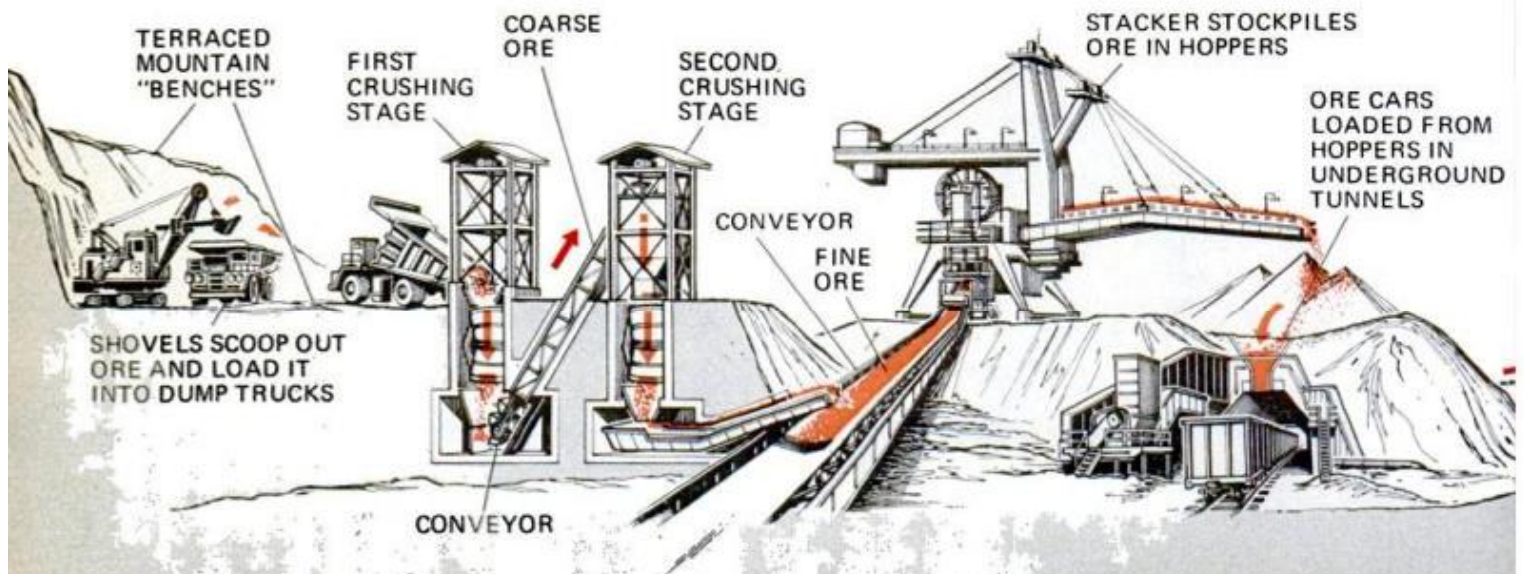


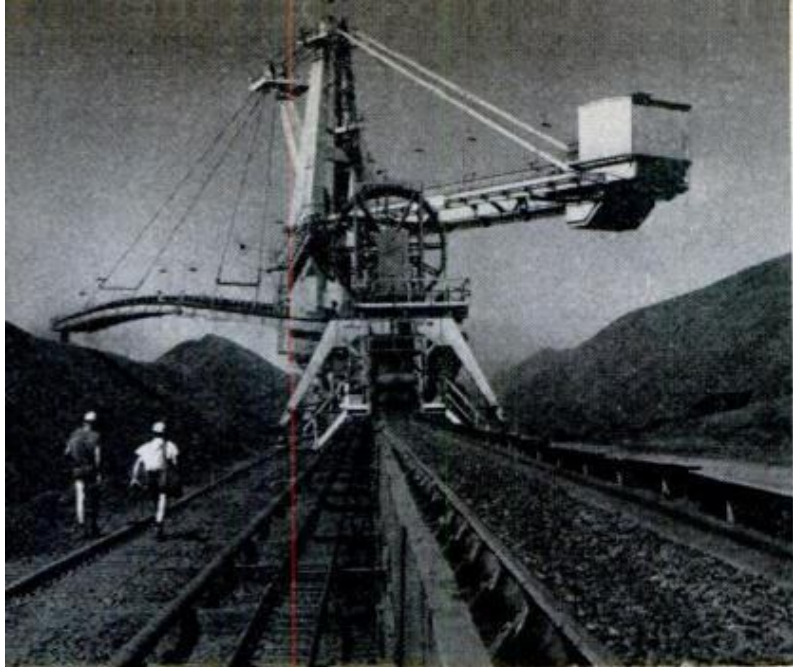
quickly spread, prospectors—called “fos-sickers” in Australia—swarmed in from all over the world. Hancock himself became a millionaire overnight. Eventually, however, the development of the great Pilbara ore fields fell to giant international consortiums of Australian, British, Japanese and American companies using modern technology, armies of men, and machines of unimaginable might. Today, what was a trackless wilderness less than 15 years ago, has been transformed into a bustling, teeming mining complex stretching over hundreds of square miles.

On the basis of known deposits alone, geologists estimate that there are at least 15 billion tons of high-grade iron ore—enough to last all the world’s steel mills

for a century or more. Some ore samples have assayed as high as 64-percent iron—unbelievably rich by normal ore-grade standards. Some ore deposits have been found to extend thousands of feet deep into the earth. Other, still unexplored regions of the vast Pilbara are expected to yield additional reserves sufficient to keep man in steel for another 1500 years!

Of all the mining operations in the Pilbara, the three biggest are Hamersley Iron, Mount Newman Mining and Goldsworthy Mining. Hamersley mines its ore at Mount Tom Price, named after the late president of Kaiser Steel whose foresight helped to promote the colossal development of the Pilbara. Mount Newman Mining is busy nibbling away at Mount Whaleback as if





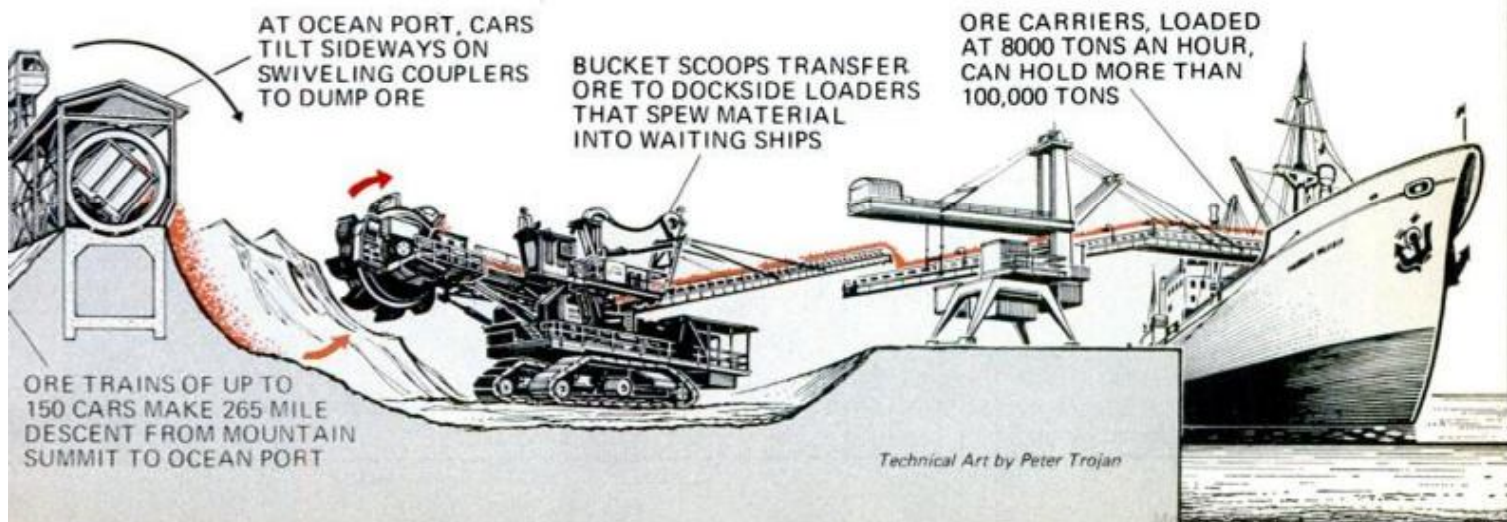
AUTOMATIC FILLING OF ORE CARS is one of most mechanized of Pilbara's mining operations. Giant rail-mounted stacker above spews crushed ore out a 74-foot-long boom, stockpiling it in mounds over underground hoppers. As train passes slowly through loading tunnel (upper right), hoppers automatically open and close, filling 10 cars at a time with 100 tons each. At lower right loaded train of 150 cars—totaling 15,000 tons—starts long, winding downhill journey from mine to sea, powered by three 3900-hp diesel-electric locomotives

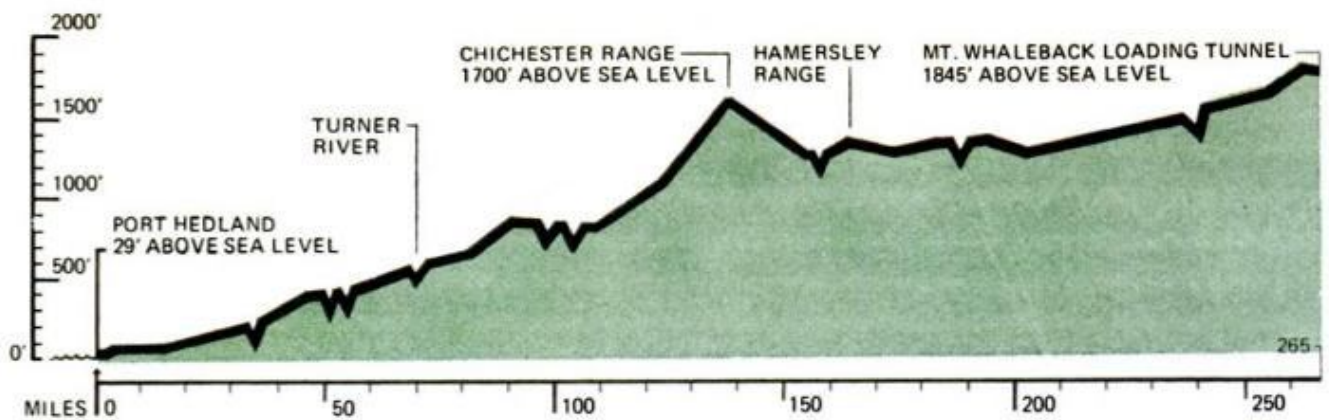
it were a huge red-frosted cake, and Goldsworthy is doing the same at Mount Goldsworthy. All three mining companies send their ore north to the sea down long, winding railways—Hamersley to Dampier on the northwest coast of Australia, and Newman and Goldsworthy to Port Hedland slightly to the east.

The rail lines are laid on rock-hard West Australian jarrah sleepers set only 12 inches apart—probably the sturdiest-built roadbeds in the world carrying some of the longest and most heavily laden trains ever assembled. At the coastal ports of Dampier and Port Hedland, ore from the trains spews into waiting ore carriers at such an enormous rate that one captain, experiencing his first loading, felt the deck



HOW THE ORE GETS FROM MOUNTAIN TOP TO SEAPORT





RAILROAD PROFILE MAP shows tremendous 265-mile, 1845-foot descent that heavy-laden ore trains must make from Newman's Mount Whaleback loading stations down to ore boats at Port Hedland on Indian Ocean

settling beneath him so fast he thought his ship was sinking. He ordered the loading stopped and his men to abandon ship.

Up in the sun-parched summits of the Pilbara mountains, heat waves shimmer on red rocks as temperatures build up to well over 100° F. It is said, perhaps in jest, that you can spit without hitting the ground—it is so hot the moisture burns up before it can land. If this is exaggeration, however, it isn't too much so. Wind devils called willy-willys dance and whirl among the spinifex, a hardy desert shrub, and in the air hangs the ever-present pall of red dust from the mines.

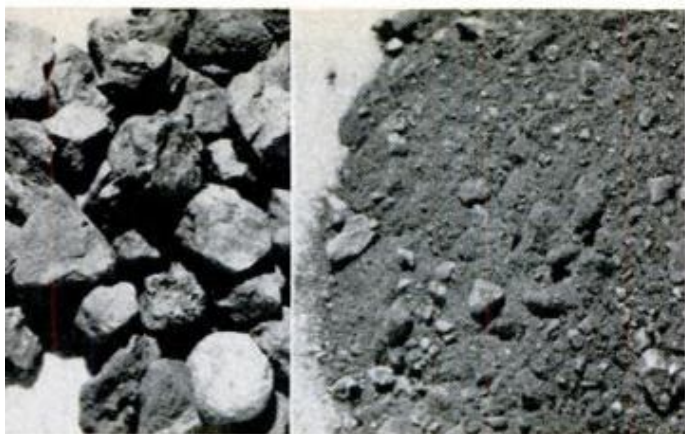
But neither the suffocating heat nor the choking dust stops the Pilbara miners. As incongruous as it may seem, advanced technology has brought to these primeval

wastes something bordering on civilization with many, if not all, of the comforts of home. Great ore crushers, giant traveling stackers, seemingly endless conveyors, 620-foot underground loadout tunnels and mile-and-a-half-long ore trains are all monitored by dials and pushbuttons inside cool, clean production centers with large glass windows resembling airport control towers. Nearby are communities of attractive, well-furnished homes that house the miners' families. They have air-conditioning, swimming pools, modern shopping centers, hospitals, recreational facilities, even television. The Pilbara—if not a garden paradise—has been made at least bearable.

Still, work at the mines proceeds at a grueling pace that's hard to imagine even



DWARFING WORKMEN in foreground, mammoth bucket scoop chews away at iron mounds waiting shipment at coastal ports. Monsters like this one can load material into ore boats at 8000 tons an hour



TWO ORE-CRUSHING STAGES break huge boulders up to five feet across into coarse chunks about eight inches in diameter (at far left), then reduce them to still finer material (at near left) for shipping

with machines to provide the muscle. At Mount Whaleback, for instance, 120,000 tons of ore are removed every day. To do this, the miners must actually move more than twice that amount—or 280,000 tons of material from which the ore is extracted. Every day.

Mount Whaleback, farthest from the sea of the three major mines and situated in one of the highest ranges, has been terraced into 50-foot-high steps called "benches." Powerful drills bore blast holes nearly 10 inches in diameter in the sides of these benches, then the holes are filled with powder charges. When the charges are set off, the explosive force breaks loose up to 140,000 tons of material from the bench face in a single blast. A gigantic crump is heard and felt throughout the mine and neighboring village for miles around. Tall plumes of red dust whoosh up into the sky, then slowly settle back again, taking hours to clear away. The rust-red grit gets into everything—men's hair, women's laundry hanging on backyard clotheslines, anything not carefully covered up. A storekeeper jokes: "We don't care where the dust falls as long as it doesn't fall into our cash registers and gum them up." In the rich, booming Pilbara, even the intolerable becomes tolerable.

After each blast, huge shovels amble in, scooping up 15 tons of ore at a bite to fill waiting dump trucks. The trucks, themselves giants, are capable of hauling 120 tons at a time down the mountainside to the processing plants below. Meanwhile, bulldozers dash about the benches like busy rat terriers clearing away dribbles

MINERS' HOMES are well furnished, have modern conveniences like airconditioning, even TV (top photo at right). To help withstand the blazing summer heat, there's always a cool, refreshing dip in company-provided pools like the one at lower right

left by the mightier machines. The idea in the Pilbara is to use the fewest number of the biggest machines for maximum efficiency.

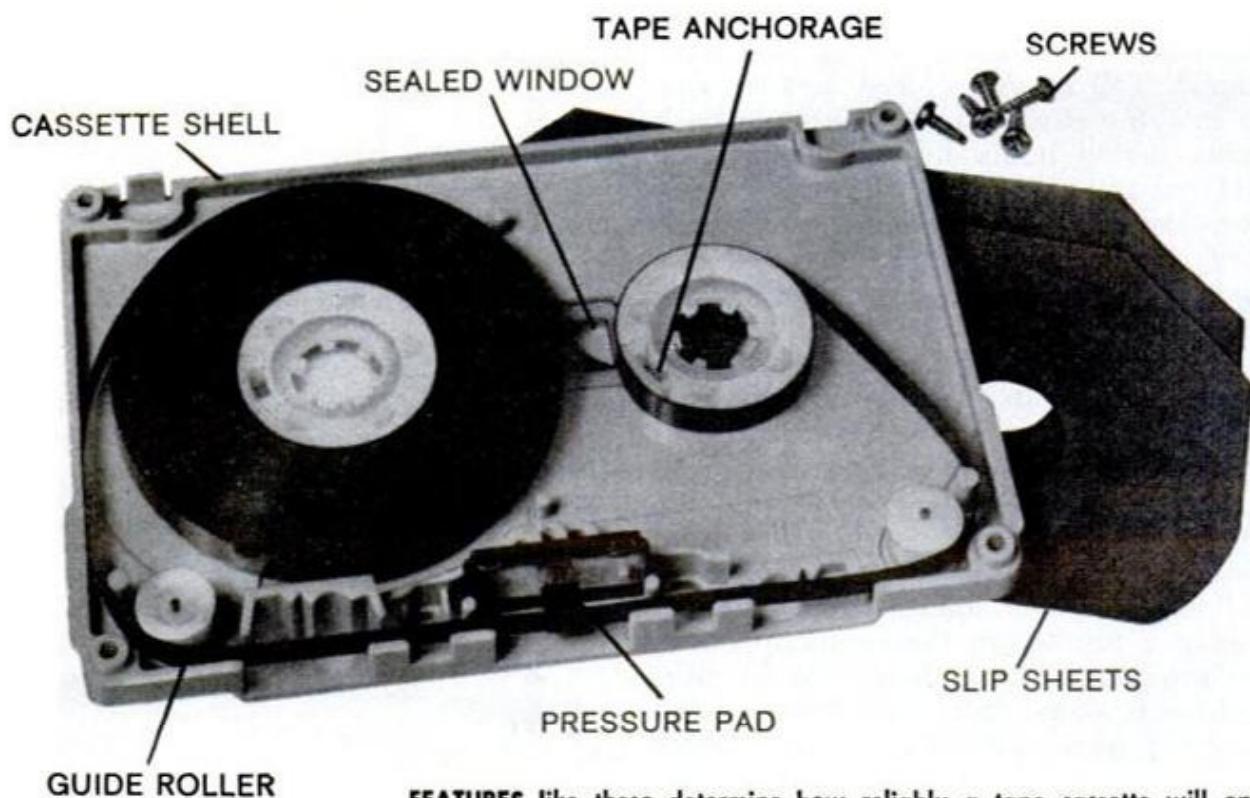
At the foot of Mount Whaleback is a two-stage crushing plant. The primary unit breaks boulders up to five feet across into eight-inch lumps, and the secondary crusher reduces these to four inches and under. The crushers consist of huge rotating cylinders, driven by 700-hp engines, that gyrate as they turn, pulverizing the rock something like a giant mortar and pestle. The ore travels from one crusher to the next on long conveyor belts and then on to mammoth rail-mounted boom stackers that discharge the ore at the rate of 4000 tons an hour. The stackers, traveling along tracks, stockpile the ore in long mounds over underground hoppers. The mounds are big enough to be mountains themselves.

An empty train of ore cars rumbles into a long, dark tunnel under the mountainous ore piles. At the flick of a button, the hoppers open and ore cascades down into the train, 10 cars at a time. When the cars each contain 100 tons, the hoppers automatically close, and the train is moved to

(Please turn to page 202)



Those great-sounding



FEATURES like these determine how reliably a tape cassette will operate. Sealed windows keep out troublesome dust. Guide rollers and slip sheets help the tape move smoothly. Good pressure pads keep the tape snug against the heads. And a well-made cassette shell helps them all work better. If something does go wrong, screws let you in to fix it

POPULAR MECHANICS

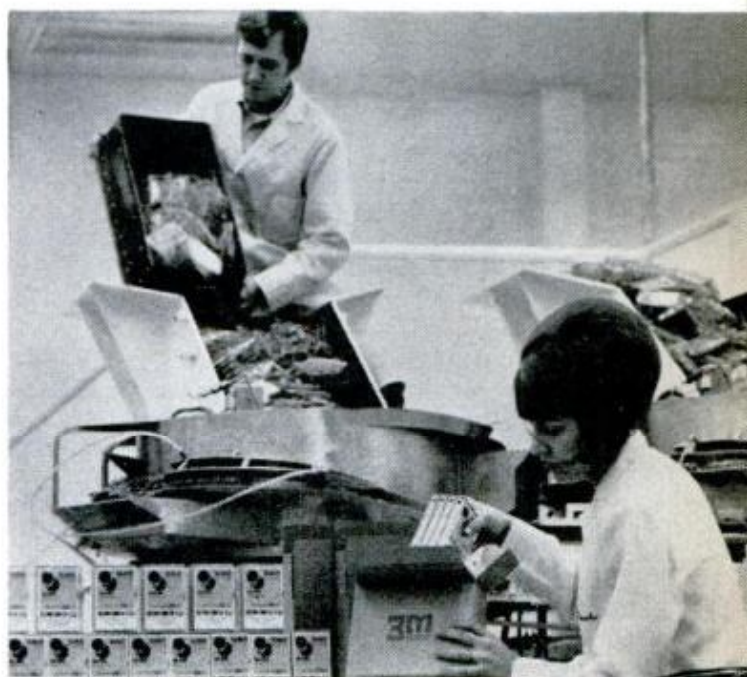
new cassettes and how they got that way

By EUGENE WALTERS

NESTLED IN ITS OWN special room in the center of a sprawling factory complex in Hutchinson, Minn., is a clanking monster that covers several dozen square yards of production space. This monster—unveiled in mid-1971 by 3M to a handful of visiting press—has one purpose in life: the automatic assembly of blank cassette tapes. Until fairly recently, it was generally thought that such automation, while not impossible, was still a few years off. The cassette—unlike its open reel counterpart—contains many small components, each of which must be painstakingly assembled into the final package. Ordinarily all of these operations are done by hand, with the consequent possibility of human error.

But automated assembly of cassette parts is just one of the ways tape manufacturers are improving cassette reliability. They're also improving the parts themselves to engineer out jamming and poor tape-to-head contact, and to keep the tape from breaking or slipping away from the cassette hubs.

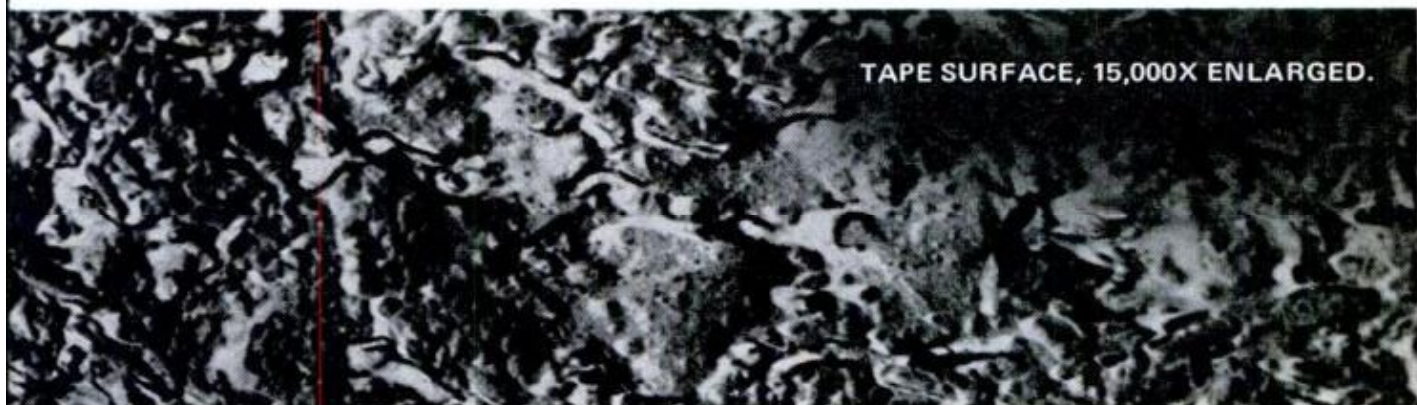
Even points as simple-looking as the guide rollers (see illustration, opposite page) can generate controversy. The earliest cassettes had simple, molded-in plastic guide posts—and today's cheaper cassettes still do. But the friction of the



CASSETTE PARTS are fed into automatic assembler

tape against these posts can cause tape wear or jamming, so most manufacturers use something better—but they don't all agree on what that should be.

Sony, for example, uses a straight roller turning on a plastic axle pin. Memorex uses a similar arrangement, with a flange on the roller to keep the tape from slipping off. So do Mallory and Norelco, but with a flange that's tapered



TAPE SURFACE, 15,000X ENLARGED.



INTERNAL GUIDES in new BASF "Special Mechanics" cassettes (left) have channelled outer edges to keep the tape winding evenly and smoothly. Spring at rear of cassette is an additional feature found on BASF's latest C-120 two-hour cassettes only

INDEXING HOLE next to recording-safety tab on new BASF chromium-dioxide cassettes will allow future recorders to automatically switch bias and equalization for chromium or regular tapes



where it meets the tape to minimize edge wear. Advent, Ampex, BASF, Maxell and TDK use this arrangement, too, but with a steel axle pin instead of plastic.

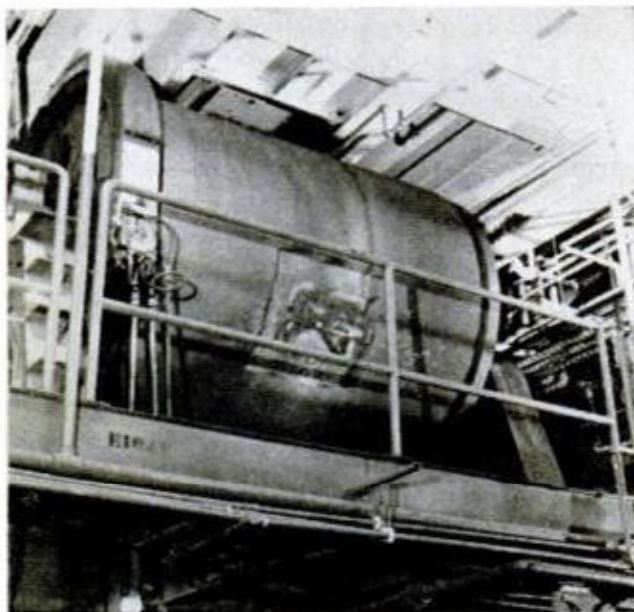
In a departure from this philosophy, 3M uses a stainless-steel post which is pressure-fitted onto a plastic inner post. The idea here is that a roller can jam, can get out of line and be otherwise troublesome. The fixed post, because it is

a smoothly polished metal surface, is said to offer a consistently troublefree guide for the tape. Also important: The fixed post is easier to assemble by machine.

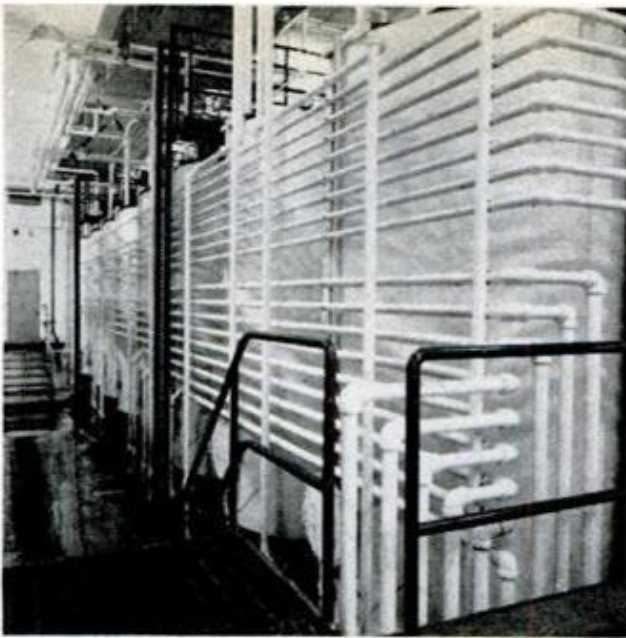
The slip sheets that lie between the tape and the cassette shell also help the tape move smoothly and reliably. The best slip sheets are plastic coated or impregnated with graphite or similar lubricant; the cheapest are merely wax paper.

Cassette manufacturers also disagree on the best ways to anchor the tape to the hubs. Many—Advent, Ampex, Maxell, Memorex and Norelco, for instance—anchor it with a round pin in a round hole. Others (such as BASF, Sony and TDK) anchor it in a slot with a two-point clamp. 3M uses a single-point clamp—again, for easier machine assembly.

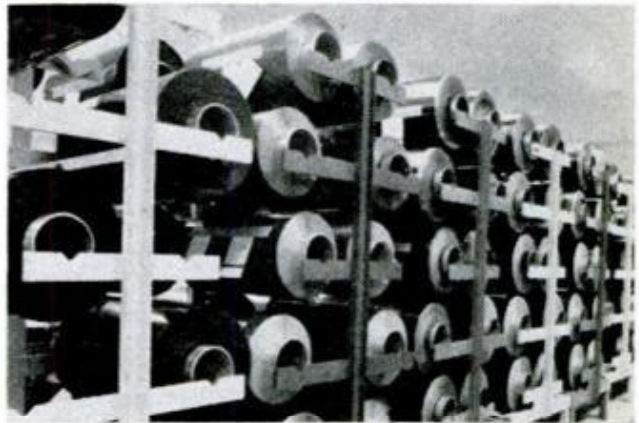
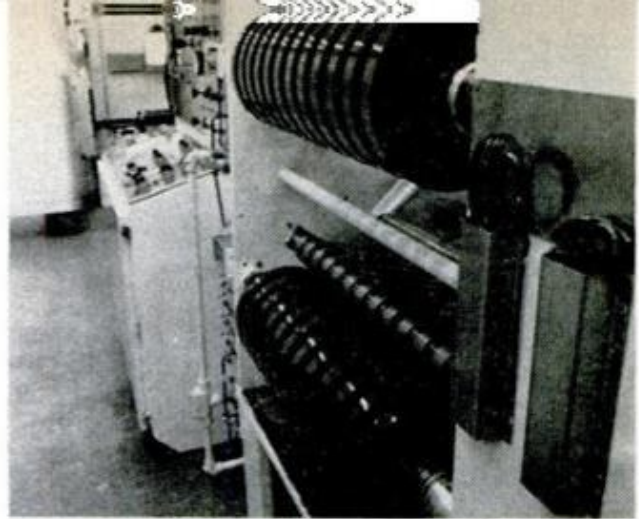
With the tape moving easily and securely past your recorder's heads, it's important that it contact those heads properly—the pressure pad's job. Some manufacturers (TDK, 3M, Sony, BASF and Advent) mount their pads on beryllium-copper springs; others (Memorex, Maxell, Ampex and Norelco) mount them on springy cushions of foam rubber.



BALL MILL uses thousands of steel balls to blend oxide particles and a binder for the tape coating



IN TAPE PLANTS, tanks (above) store binder that holds iron oxide particles in place on the tape. Tape comes from the coating machines in 25-inch widths (lower right) for easier and more uniform manufacture. Precision slitting machines (upper right) cut the bulk tape into the desired widths: two inches (shown here), one inch, one-half inch, one-quarter inch (for reel recorders and cartridges) and .150 inch (about 1/7 inch) for compact cassettes



The first cassettes were screwed together. Now, most cassettes are welded ultrasonically, though TDK, BASF, Advent and Maxell still use screws. Advocates of each method claim the other can create stresses that deform the shell and may cause jamming. However, cassettes that screw together can be taken apart if the tapes jam or break—and if you're *very* careful, you *may* be able to fix the trouble. (If a welded cassette jams, you can pry it open and transfer its tape into a screw-open cassette or into a special, empty cassette that Robins makes for just that purpose.)

Improvements haven't just been confined to the cassettes themselves. Tape-makers have also improved the magnetic oxide coating on their cassette tapes, for better high-frequency response and lower noise.

The commonest coating, as it has been for 25 years, is still ferric oxide, a chemical blood brother of rust. But other oxides are popping up, and even ferric has some new tricks up its sleeve.

The big improvement in ferric oxides is smaller particle size. Until about three years ago, the smallest size possible for such magnetic particles was about one micron (about 0.00004 inch) in length.

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Then along came TDK with its "Super Dynamic" (SD) tape, with a particle size of only 0.4 micron (about .000016 inch) that can be packed more densely and allows more extended high-frequency response. Other manufacturers now have similarly fine-grained, high-density oxides.

Some of the new tapes add cobalt to their iron oxide coatings for improved performance. But opinions differ as to what it does: Mallory claims that the cobalt dispersed through its "cobalt-doped" tape's oxide coating increases high-frequency response and signal-to-noise ratio by increasing output at the higher frequencies. But 3M claims only that the cobalt concentrated near the surface of its High Energy cassettes increases output overall, with no difference in high-frequency response.

Other engineers claim that cobalt's only effect is to increase the signal level that the tape can take without distortion—which, in effect, increases the output of the tape by increasing the level of the signal you can feed into it.

Chromium dioxide (CrO₂) is something else again. Developed by DuPont (which calls it "Crolyn"), CrO₂ tapes can greatly extend high-frequency response

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New Leica M5

First rangefinder camera with through-the-lens metering.



By IVAN BERGER, Photo Editor

ADD BEHIND-THE-LENS exposure metering to a Leica, and what do you get? The Leica M5, one of the quickest, slickest, quietest and most expensive (\$849 with f/2 lens) 35s—and possibly the world's best available-light camera.

Its low-light capability starts with the incredibly bright, fast-focusing Leica finder. On the M5 it goes on to include a built-in meter that can read down to 1/2 second at f/1.2 on Tri-X, and even measure exposures to 30 seconds with slow films.

Your exposure's correct when two needles—one electrically connected to the meter circuit, the other mechanically connected to the extra-big shutter-speed selector—intersect a horizontal finder line at

the same point. Next to the meter scale, a window shows your shutter speed, from 1/2 to 1/1000 second; for slower speeds, you use "B" settings, so numbers from 1 to 30 are prefixed with a "B"—but still linked to the meter.

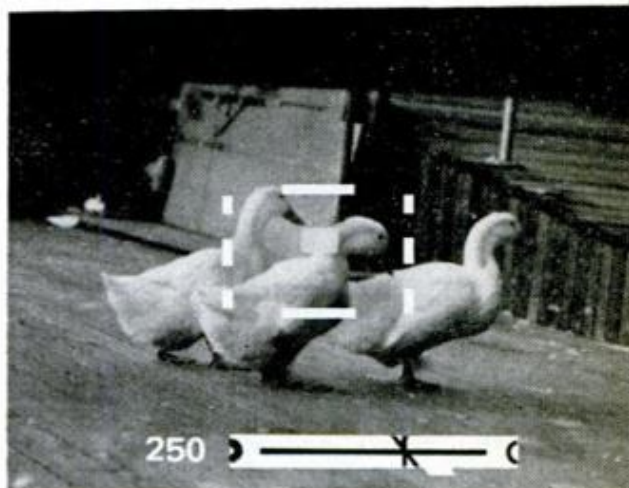
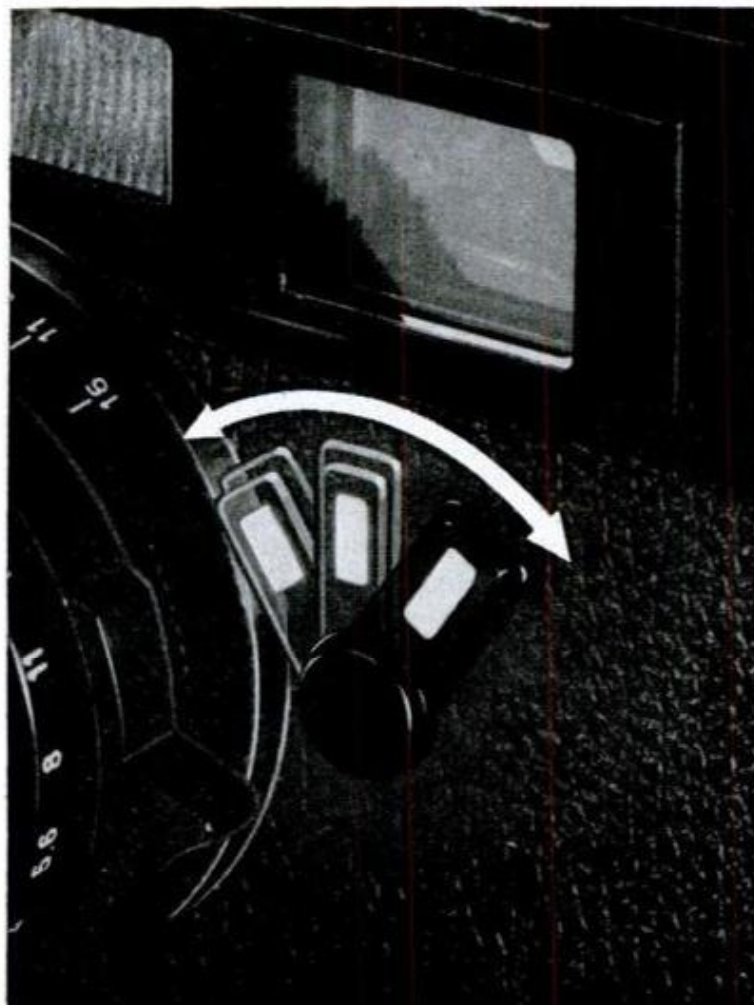
The area covered by the meter is indicated by bright lines or by the rangefinder patch, depending on what lens you're using. Nicely selective, the meter covers only from 15 percent to less than 7 percent of the picture area. Both the meter coverage indicators and the frame lines change automatically to match the lens.

The M5 is a bit bulkier than older Leicas, and I would have preferred a meter that had me chasing one needle, not two. But if you like Leicas, you'll like it. ★★★

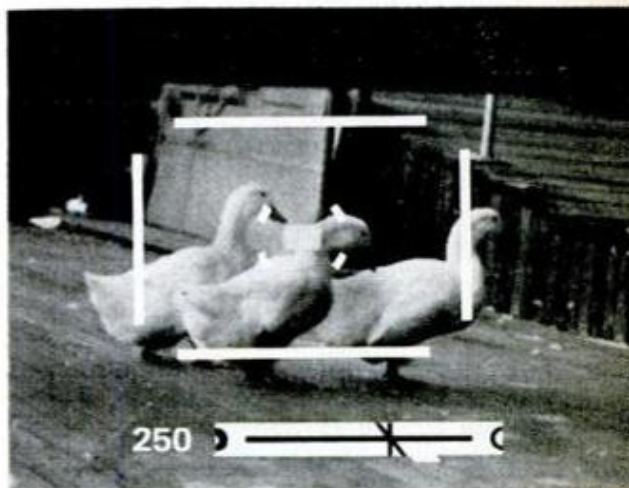


METER CELL pops up when shutter's cocked, to read light through the lens. It retracts again when you press shutter or, for protection, when lens is removed. (To show it, we had to insert adapter ring shown, which permits use of older, screw-mount Leica lenses on the new bayonet-mount Leicas.) But don't telescope the "folding" lenses, to protect the cell

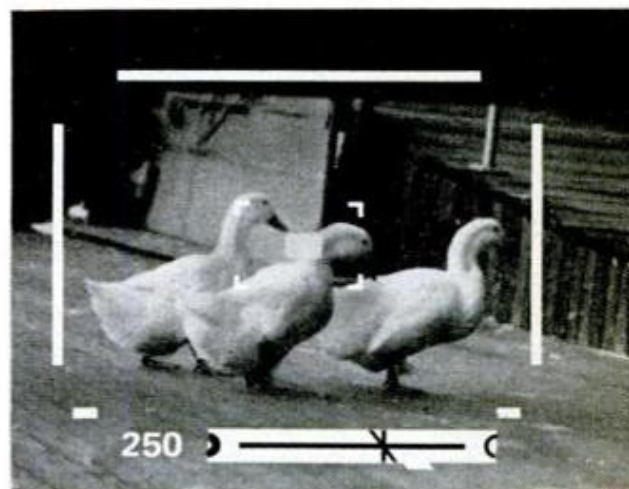
VIEWFINDER FRAMING LEVER lets you preview effect of lenses before mounting them (see photos at right). Dark image shows position for 35-mm and 135-mm lenses; lighter images shows 50-mm (upright) and 90-mm positions. Changing lenses automatically brings the right viewfinder frame into position



WITH 90-MM LENS, finder shows lens field (white frame); meter coverage is a circle just surrounding the central rangefinder spot. Exposure is correct when lines in meter scale cross; shutter speed is shown in window just to left of scale



50-MM FRAME is larger; meter covers area within the four white arcs in the center



35-MM AND 135-MM fields shown together; 135-mm frame is also 35-mm meter field, rangefinder spot shows 135-mm meter area

U.S. automakers inch

Detroit wants to switch to meters and liters at its own pace,

By **ROBERT LUND**, Detroit Auto Editor

THE AUTO COMPANIES are going to change the numbers. They're going to the metric system. Measurements, weights and capacities of cars will be stated in meters, grams and liters, instead of the familiar inches-feet, ounces-pounds, pints-quarts-gallons.

But don't junk your old set of tools just yet. You may have to add a new wrench to the toolbox over the next couple years, but most of the tools you've got now will do the job for 10 years, anyway. Detroit's going metric with about as much zip as a grandpa snail shinnying up a greased pole.

The crusade to put the United States on the metric system has been clomping along for more than 60 years. But only within the past few years have the "let's do it" voices drowned out the "let's not." Legislation has just been passed in the Senate and, as this is written (August), is pending in the House to put the nation on the metric system within a decade.

The automakers and other industries say that's moving too fast. They're willing to convert to metrics but want to make the change in their own sweet time. Still, they may be forced to go metric sooner than they anticipated.

Why the metric system? What's so great about it? What's wrong with our present method of weights and measures? Cars, refrigerators, power saws, tape players and the kitchen sink aren't going to run better, last longer or cost less if we switch to metric measurements. Most products will probably cost more, at least for a few years until manufacturers recoup the cost of converting to metrics. Why bother?

The general idea is to put the United States in step with the rest of the world. It is the only major industrial nation still measuring and weighing in inches and ounces. Other countries still using Anglo-American units of measure are Barbados, Burma, Gambia, Guyana, Jamaica, Liberia, Malawi, Nigeria, Sierra Leone, Tobago and Trinidad. Everybody else has joined the metric club or is in process of joining.

What's so important about the United States falling in line with the rest of the world? Why the push for worldwide conformity in weights and measures when the emphasis in other areas of human activity is on nonconformity and the unorthodox, on getting the job done, rather than on the tools used to do it?

Champions of the metric system will give you a lot of cosmic conversation in reply to that question. Stuff about the balance of payments, the Russians cutting in on world markets for U.S. goods and the horror of having your American car conk out in a Mexican village where the only mechanic within 200 miles says if it isn't metric, he can't fix it.

The big pitch made in favor of going metric is that it will put American companies in a position to sell more merchandise overseas. Other countries supposedly shy away from American products because it presents too many problems to convert American operating manuals, tools and replacement parts from nonmetric to metric numbers. This may be a valid argument for some products, but it doesn't apply to automobiles. The auto companies have plants overseas that produce cars using measuring systems indigenous to those parts of the world. The reason made-in-the-U.S. cars don't sell in volume in foreign countries is that they're too big, too expensive and too costly to repair.

toward the metric system

but it looks like the government will insist it be done in the next 10 years

There are good reasons for going to the metric system without whistling up any phony arguments. The United States should make the change for the same reason that every country in the world uses the same clock to tell time, observes the same rules for the game of chess and recognizes the same signal for ships in distress. It's that simple. The metric system will enable everybody in the world to talk the same language in weights and measures.

What does the change in numbers portend for the auto industry and for you as a car owner?

For Detroit, this is a truly monumental change and that's why the auto companies want to convert to the new math over a period of 20 to 25 years. Chrysler's expert on metrics, John T. Benedict, says even that's too fast a pace. Benedict favors a

long learn-to-live-with-it approach that would take 40 to 50 years. Why so long?

To convert to metrics, the auto firms must first design cars using metric dimensions. They must then backtrack and design machine tools with metric numbers to make the cars. This could involve as many as 10,000 to 12,000 different parts. The changeover would have to be synchronized with a conversion to metrics by the hundreds of small companies supplying car producers with parts.

That's just one link in the chain. Detroit can't begin producing cars with metric measurements until dealers and gas stations have metric tools and machines



to handle service jobs and repairs. Service outlets will also have to be stocked with replacement parts converted to metrics. In the case of a General Motors or Ford, the replacement parts catalog may carry as many as 300,000 parts numbers. Even after Detroit makes the changeover, it will have to continue to supply non-metric replacement parts for something over 100,000,000 cars—or whatever the figure is at the time of the switch—already on the road.

When you consider all the numbers Detroit has to juggle to go metric, you can understand why the auto companies are reluctant to go along with the timetable calling for the United States to be fully metric within 10 years.

It's been suggested that carmakers could make the transition by using the dual dimensioning approach, which consists of using metric and nonmetric measurements simultaneously. As the new numbers become known and people feel comfortable with them, nonmetric measurements are gradually discontinued.

Detroit says this isn't practical because of the complexity of automobiles and the number of people involved in the process. Too many people, too many parts. You can't give the capacity of fuel tanks in liters if gas pumps continue to register in tenths of gallons.

The auto firms favor a system approach to make the change. This means convert-

ing parts of the car to metrics on a when-feasible basis. As a system—say the electric system or brake system—comes up for a major re-do, it would be converted to metric measurements. Car builders say this would give them the breathing space they need to introduce metrics at the different levels of the business and, as a side benefit, an opportunity to work off the billions of dollars worth of nonmetric parts held in inventory.

The transition's already under way in a small way. When Ford begins building the four-cylinder Pinto engine at a new plant in Lima, Ohio, next year, most of the dimensions will be in metrics. Some hang-on equipment, such as the alternator, will continue to be in inches, but the bolts to fasten it down will have metric threads. GM's considered using metric designations for its forthcoming Wankel engine, but the best information available now is that the engine will be inches. In the case of the captive imports—cars made overseas by or for U.S. firms—measurements are in metric units. The list includes Opel, Capri, Colt and Cricket. And if you order a tachometer with certain Chevrolet models, the speedometer readings are in both miles and meters. Another straw in the wind is the availability of metric hand tools. Metric tools for repair shops and do-it-yourselfers long have been on the market. But you had to shop to find them. Now they're available at most tool counters. ★★★

WHAT'S THE DIFFERENCE?

Remember the first time you played poker? What a tough time you had trying to remember if three of a kind top a straight and the difference between a full house and a flush? Then after a couple of rounds you got the value of different combinations of cards sorted out in your mind.

The metric system's something like that. Confusing at first, but once you learn it, it stays with you forever.

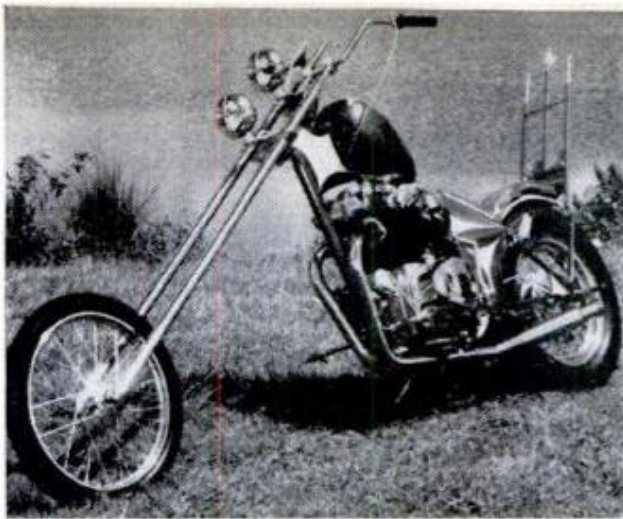
All metric measurements are based on units of 10, just as our monetary system is: Ten pennies in a dime, 10 dimes in a dollar, 10 \$1 bills in a \$10 bill, 10 \$10s in a \$100.

"Most people will need to learn only three measurements," says Dr. John L.

Feirer, director of the nation's first Center for Metric Education at Western Michigan University, Kalamazoo, Mich. "They'll have to know the meter—39.37 inches—for length; the liter—1.057 quarts—for volume and the kilogram—2.205 pounds—for mass."

Here are the numbers in table form:

This U.S. measurement	Converts to this metric measurement
1 inch	2.54 centimeters
1 foot	0.3048 meter
1 yard	0.9144 meter
1 mile	1.609 kilometers
1 ounce	28.350 grams
1 pound	453.592 grams
1 pint	0.473 liter
1 quart	0.946 liter
1 gallon	3.785 liters



Sergeant's chopper

Jim Priest, a career NCO at Moody Air Force Base, built this chopper in about 400 hours. He made the frame of steel tubing, molded the fiberglass, and increased the 450-cc Honda engine to 500.



Bottle cruncher

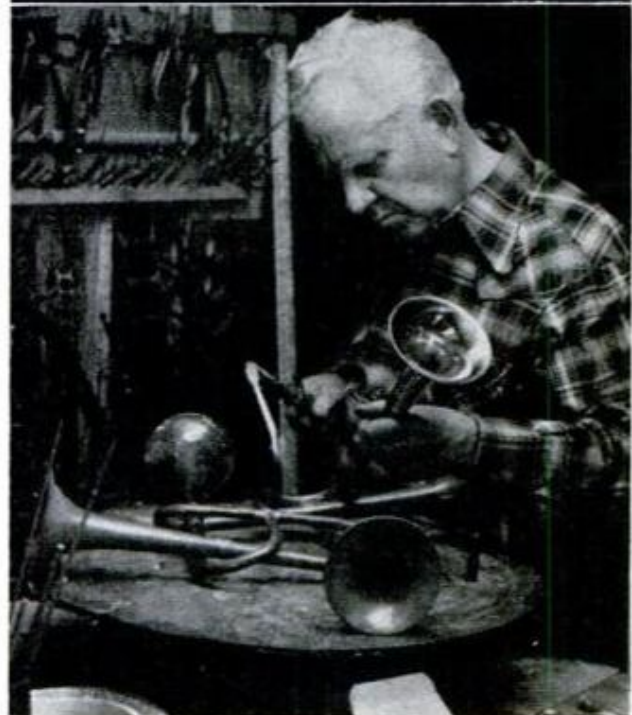
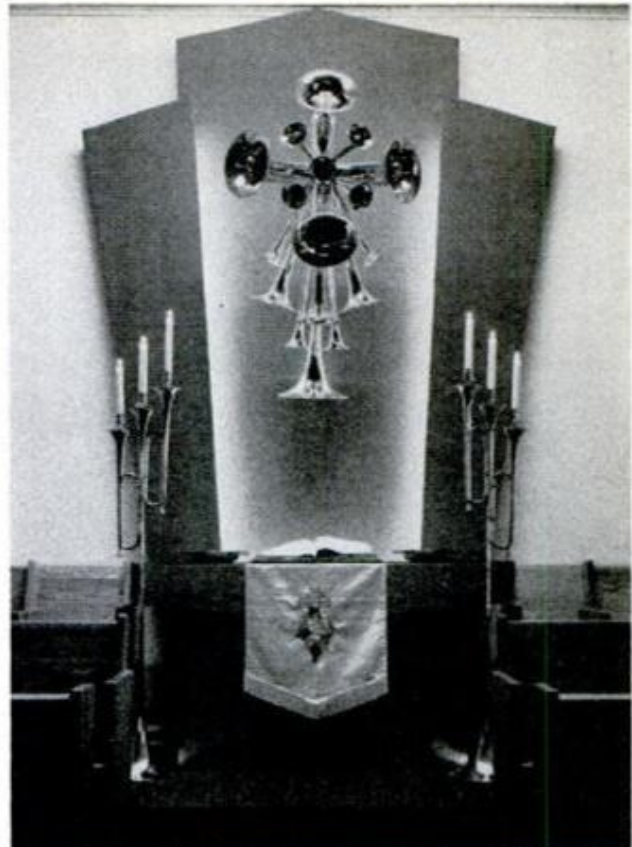
The Beaver "Bottle-Buster" reduces glass bottles to cullet at the rate of 20 to 25 per minute. It's made by Ertel Engineering Co., Kingston, N.Y. 12401.



Lost their heads?

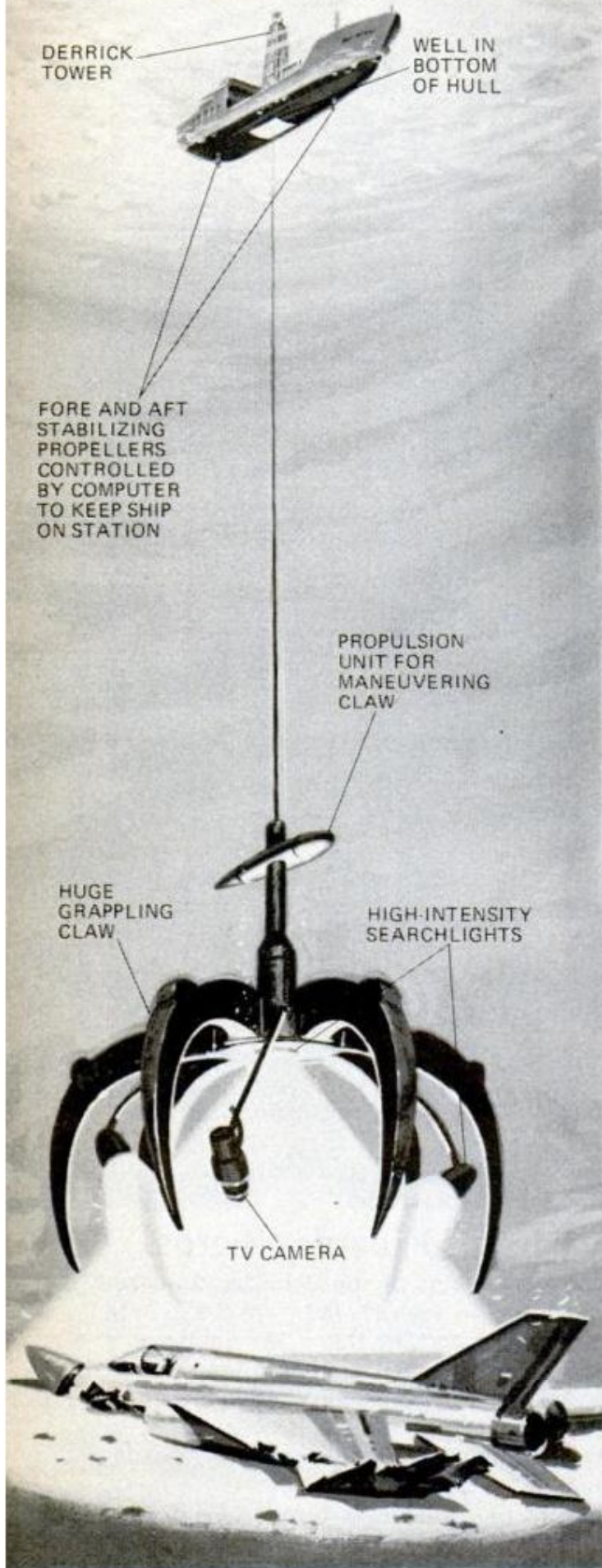
It's not a disaster. The heads are hairdresser's dummies put in a field to scare away birds. The trick works.

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Art from discarded horns

The wastebins of the Conn band instrument plant in Elkhart, Ind., are the source of materials for Dr. Ralph M. Holdeman's unusual sculpture. The giant altar cross in the top photo, for example, is made up of 17 horn bells. The candelabra are also made of musical instruments. Dr. Holdeman, in the bottom photo, solders the metal with an open flame, a technique he mastered to do his sculpting.

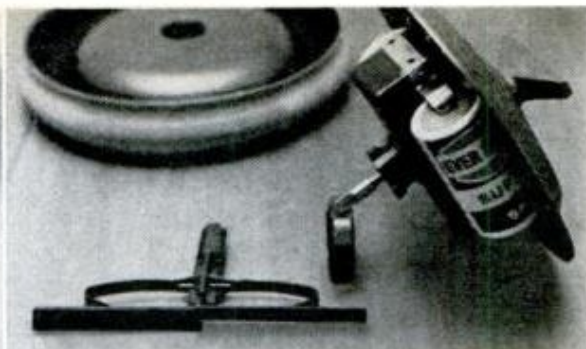


Mechanical 'hand' to probe ocean depths

A GAPING HOLE opens up in the bottom of the hull, like huge bomb-bay doors, and a giant spider-like claw plunges down into the ocean depths to pluck some sunken object off an otherwise unreachable sea floor. Called the Alcoa Seaprobe, the new 243-foot-long, all-aluminum research vessel is designed to do what no man or machine has yet been able to accomplish—to recover lost treasures from antiquity, sunken ships and scientifically valuable ocean-bottom samples lying far below the working range of divers and conventional



underwater salvage equipment. Its 102-foot-tall derrick tower located amidships is capable of lifting 200-ton loads from depths up to 6000 feet—more than a mile. It can also bring up core samples from as far down as 18,000 feet—nearly 3½ miles. The grappling claw is fitted with high-intensity searchlights, TV cameras and a propulsion system that permits it to be accurately maneuvered by remote control from above. The ship has stabilizing propellers fore and aft that enable it to remain precisely in position even in heavy winds and waves. Objects retrieved from the bottom can be pulled directly up into a large center well for close study.



Powered pots stir and time your food for you

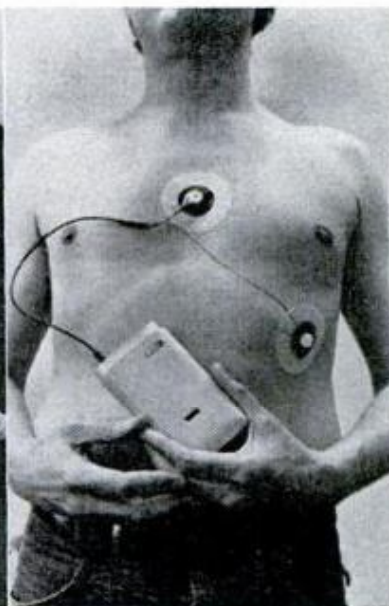
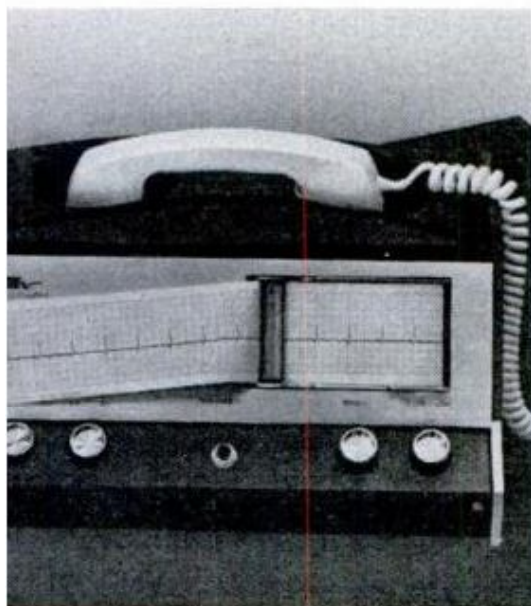
With most kitchen chores already mechanized, it's no wonder a self-stirring cooking pot has finally come along, too. Invented in England by Tower Housewares of Staffordshire, it has a rotating propeller-like

blade (left, above) driven by a small battery-powered motor under the lid (upper right). A companion pot (lower right) has a lid with built-in timer dial for keeping tabs on foods like eggs.

Now a doctor can check your heart by telephone

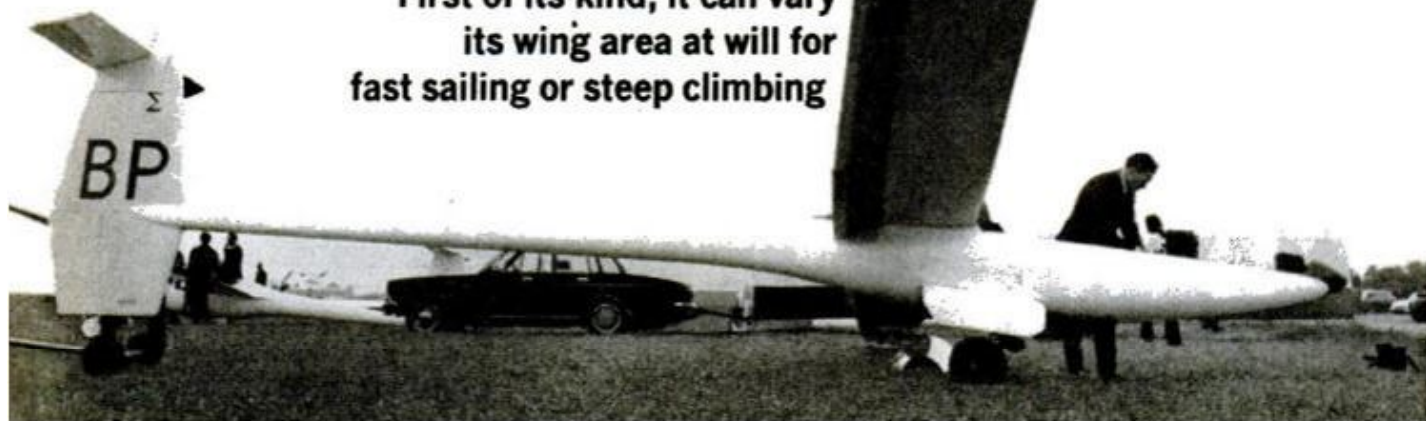
Heart patients get an advance warning of impending trouble from this pocket-sized electrocardiogram recorder. The battery-operated device monitors heartbeat patterns and sounds a telltale buzz if irregularities occur. The patient then calls his doctor,

holds the phone up to the pocket sensor (right, below), and the pulses are recorded on a machine in the doctor's office (left) for quick analysis and medical advice. Maker is Cardiodynamics, Inc., 6990 Village Pkwy., Dublin, Calif.



Trick-wing glider gets a lift when it needs it

First of its kind, it can vary its wing area at will for fast sailing or steep climbing



ESTABLISHING proper wing area for a glider has always been a compromise—you need a broad wing for lift, a narrow one for speed. Go for one and you sacrifice the other. Now a British aircraft expert, Rear Adm. Nick Goodhaert, has come up with a variable-area wing that gives a glider a choice of lift or speed depending on thermal conditions. It has telescoping flaps at the trailing edges that slide in and out to vary the chord or width across the wing. Fully extended (photo above), the pneumatically controlled flaps increase wing area by 35 percent.

The variable wing enables a glider pilot to climb rapidly in a thermal with the flaps extended for maximum lift. Once aloft, he can retract the flaps for high-speed sailing without the drag of a large wing. Speeds up to 165 mph are possible this way. With the flaps extended, the glider can soar lazily at speeds as low as 45 mph, making landings short and gentle. The sailplane has an overall wingspan of just under 70 feet and a slim, needle-nosed cockpit so shallow the pilot must control the ship from an almost prone position (bottom photo at left). The new design is currently being tested by Project Sigma, 47 Queen Ann St., London, England. ★★

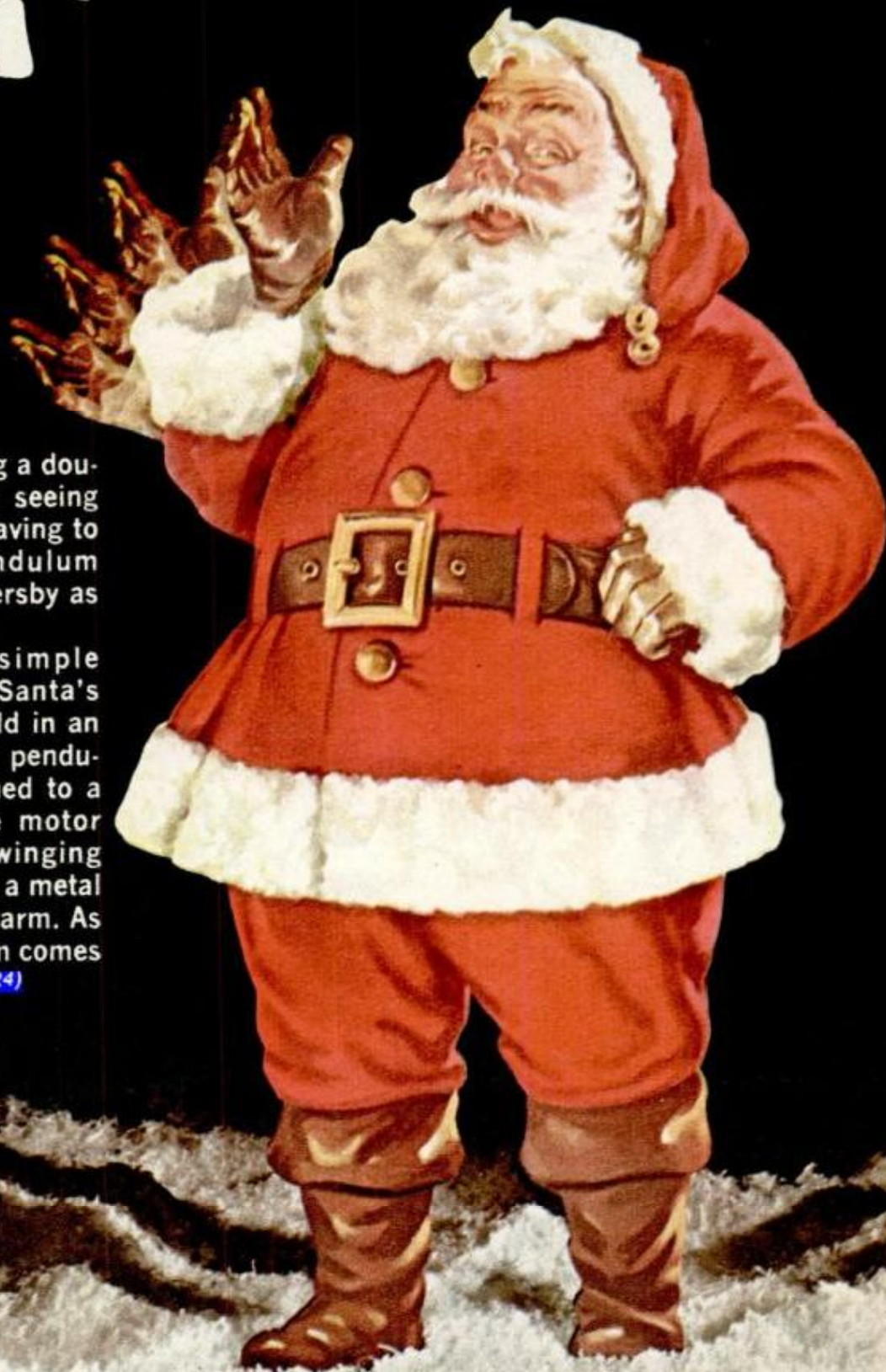


Hi, there!

IF SANTA has you doing a double take, you're not seeing things—he actually *is* waving to you. A motor and pendulum make him wave to passersby as long as he is plugged in.

It's all done by a simple weighted mechanism. Santa's free-swinging arm is held in an upraised position by a pendulum. A crossarm attached to a seven-rpm, gear-drive motor keeps the pendulum swinging continuously by striking a metal bar attached to Santa's arm. As each end of the crossarm comes

(Please turn to page 124)





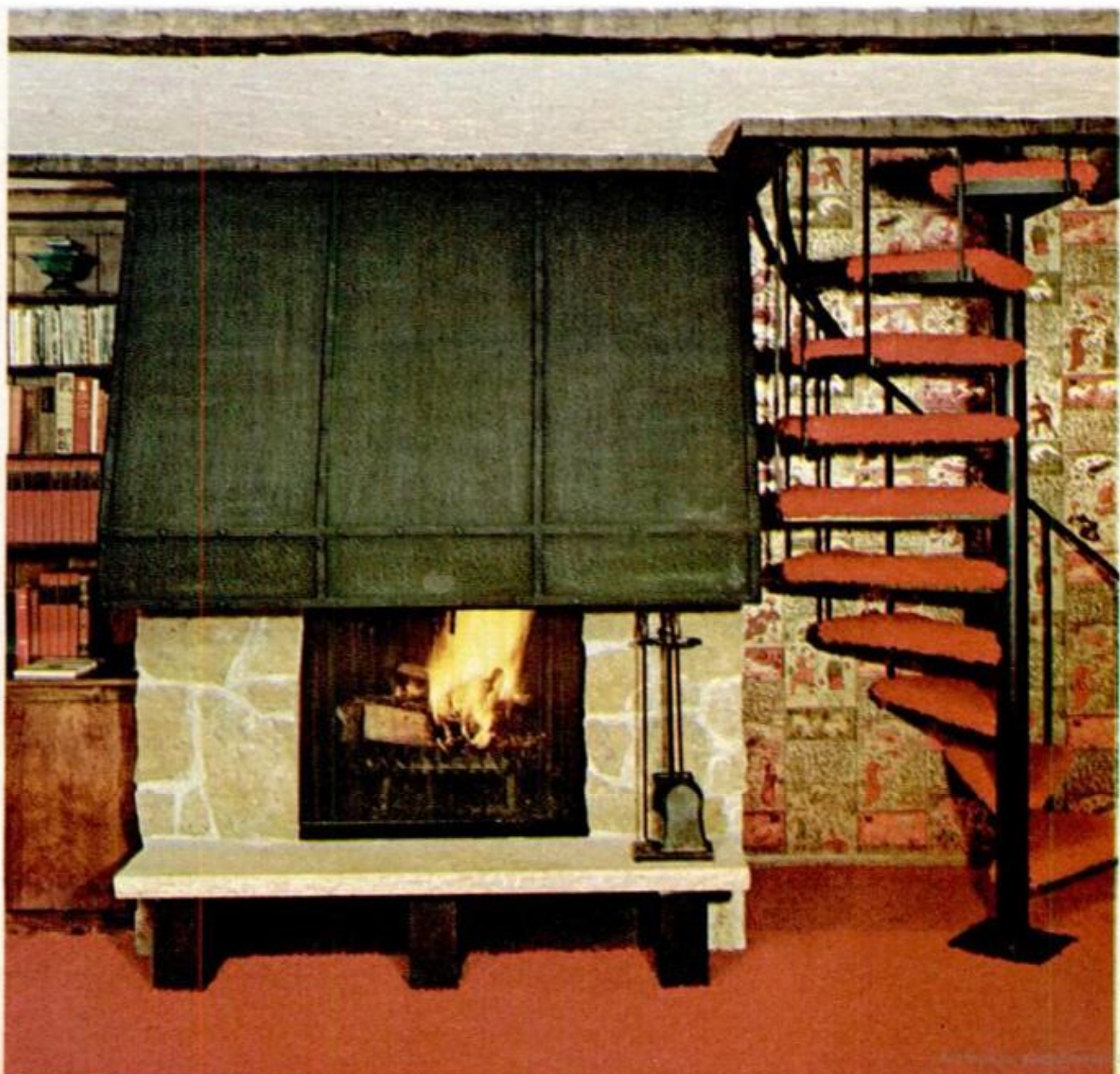
Facelift the fireplace and you remodel the room

Data: Barbara Gorder; photos by Les Turnau

THE SUBJECT IS FIREPLACES—no longer considered by builders to be a luxurious optional extra in most tract houses. Too often, unfortunately, the fireplace is of uninspired design, really not much more than a neat pile of bricks capped by a wood mantel. But, whether or not poorly designed, a fireplace inevitably becomes the focal point of the room in which it stands. Just how well *your* decorating ideas will come off will be determined to a large degree by what your fireplace offers to start with.

The fireplace (facing page) in the Neil Franks' living room in Golden Valley, Minn., was an ordinary masonry, jut-into-the-room type before designer David Peterson,

FIREPLACE REMODELING is really more a task for a decorator than a builder. A touch of luxury was added to living room (opposite) by surrounding fireplace with wallpaper-covered plywood. Rugged-looking family-room fireplace below has "metal" hood built of hammered ¾-in. plywood



Minneapolis, changed the look. To introduce a touch of luxury, his decorating scheme centered around a "new" fireplace to be created by simply paneling the existing one. This plywood skin, in turn, was covered by suitable wall-covering material. The stage for room decor was effectively and handsomely set by starting with a fireplace facelift.

Notice in the drawing below that the fireplace, which actually measures 64 in. wide by 12 in. deep by 8 ft. high—except for an 8-in. reveal surrounding the opening—is beautifully camouflaged by the plywood. A heavy wood molding frames

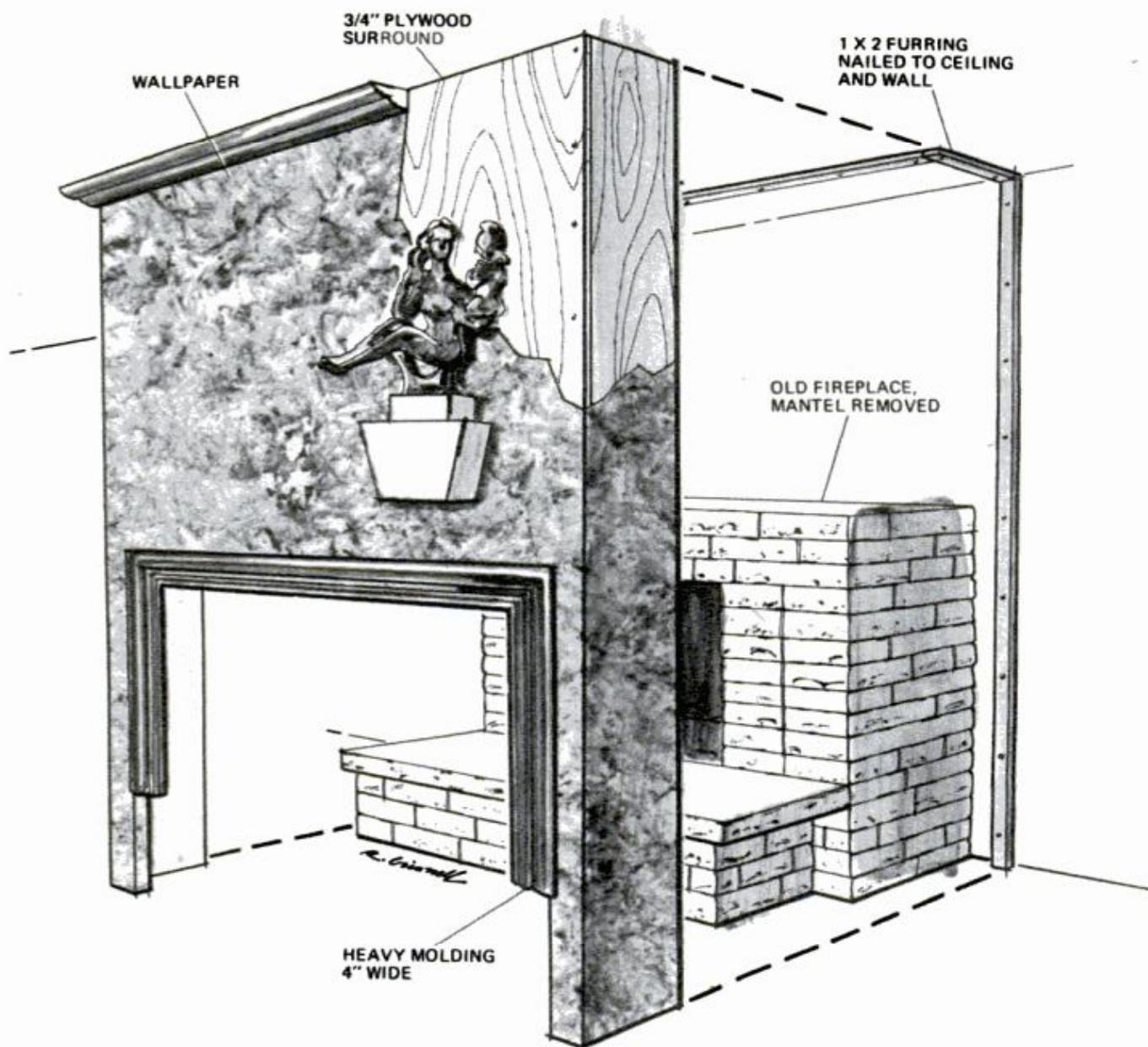
the opening and completes the carpentry.

To finish, Peterson selected an aluminum paper with tortoise-shell pattern. The bracket to the right was placed to display prominently a favorite piece of sculpture.

Since plywood is used to encase the fireplace, it can be fastened directly to the masonry if desired. Simply drill into the mortar lines for masonry anchors and attach the plywood. Or, use furring strips along the wall and ceiling.

The second fireplace sets the mood of old England in the David Noyes family room in Deephaven, Minn. Designer Paul Albitz created the atmosphere by using Luma

HOW FIREPLACE WAS MODERNIZED



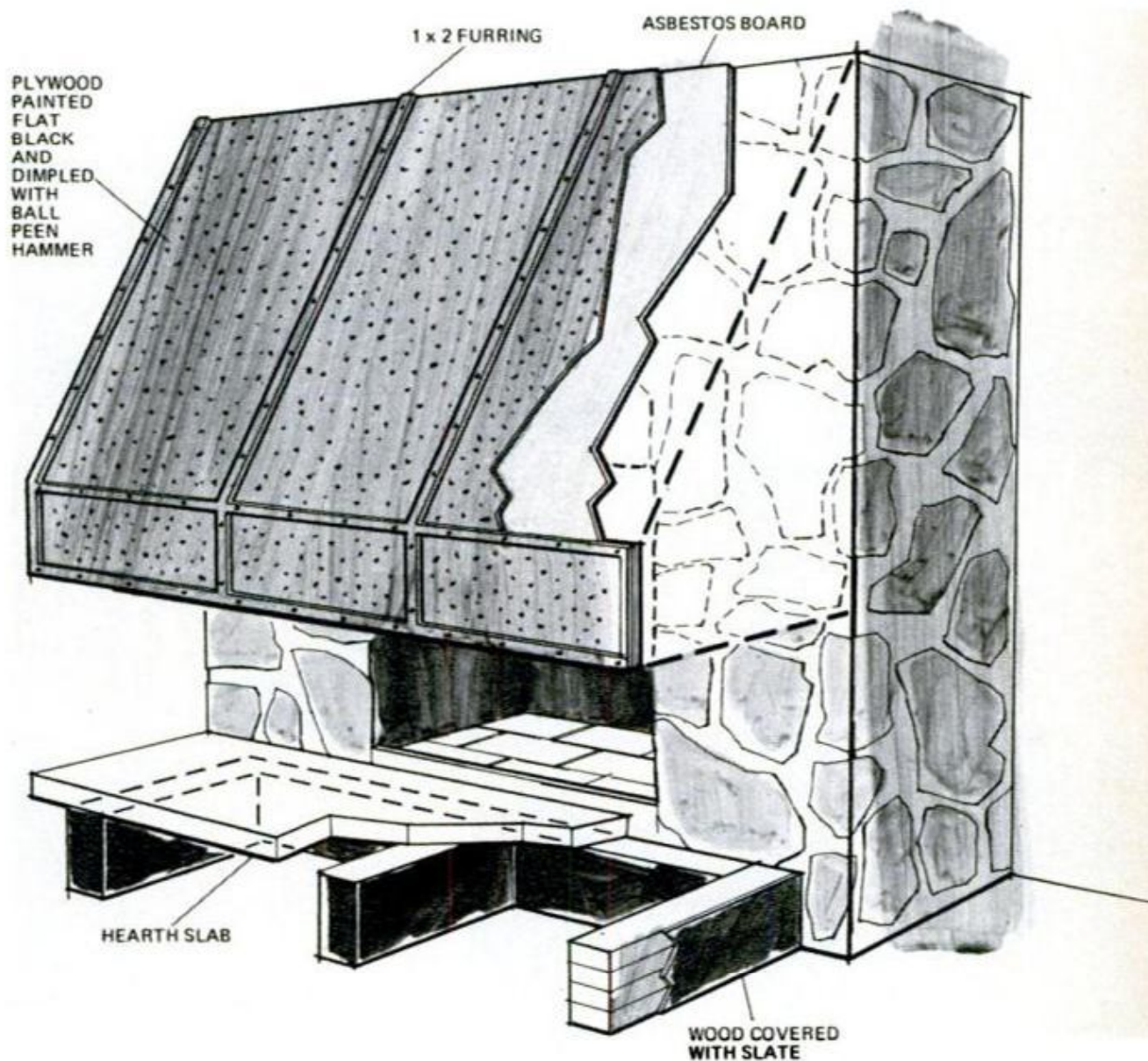
stone on both sides of the fireplace opening and a thick slate for the hearth slab. But more than any other feature, the hammered "metal hood" makes the idea work. And, because it is fashioned of plywood, it cost just a fraction of what a custom-made sheet-metal one would have. For safety, the inside is lined with sheet asbestos.

To add a hood to your fireplace, first install 1x2 furring strips to the face of the fireplace for attaching the plywood. Connections must be solid as the strips provide sole support. Attach plywood to the strips using counterbored screws and conceal the screwheads with dowel plugs.

The rugged look is obtained by hammering the plywood with a ball peen hammer. This is done on the workbench before installation. The "wrought-iron" strips are actually lengths of 1x2 furring.

The fireplace hood shown was finished with a flat black enamel. For safety reasons, you might consider painting your hood with a high-temperature paint (available at most auto supply stores). For a pewter-like finish, apply a coat of aluminum paint, allow it to dry then apply a coat of black. When the black paint is tacky but not yet dry, rub lightly with a lintfree cloth to expose some aluminum. ★★★

HOW OLD ENGLISH LOOK WAS CREATED





Fancy candles: colorful Christmas gifts

By WAYNE C. LECKEY, Home and Shop Editor

Color photos by Robert D. Borst

FANCY CANDLES make perfect Christmas gifts—they're colorful, decorative and useful; they symbolize Christmas, and they're gifts that everyone likes to receive.

What's more, they are homemade gifts that don't look homemade. Cast in fancy reusable molds, they have a ready-made, store-bought look that compares with candles which bring fancy prices in gift shops. Yet they cost pennies to make and anyone can make them. The "tools" required are common household items for the most part, and hobby stores provide a ready source







MELT WAX in a double boiler, never over direct heat. Melted wax should be no hotter than 175-185°F.

for the molds, wax, wicking, scent, coloring and other items. And once you're hooked by this fascinating hobby, you'll soon be making your own molds from Ultra Cal and Silastic RTV compounds. You'll be creating such unique forms as ice candles, whipped-wax candles, sand candles and others. You'll be decorating them in gold, spray painting them in pearl and iridescent tones and adding glitter to make them sparkle. There are many good books on candlemaking which take you beyond the basic steps explained here.

Kinds of molds. Candles can be cast in countless sizes and shapes, and in several kinds of molds. Flexible, rubberlike stretch molds are one-piece molds which you remove from the finished candle by pulling them off like rubber gloves—inside



TWO-PIECE PLASTIC MOLDS consist of matching halves bound and sealed at edges with masking tape



ADD COLORING after wax is completely melted. Stir and allow the coloring to dissolve thoroughly

out. Such molds, like others, can be used over and over.

Vacuum-formed plastic molds are two-part molds of matching halves that are self-aligning but must be sealed at the edges with masking tape.

Metal candle molds, straight and tapered, are available up to 18 in. tall. Handsome one, two and three-wick candles, round, triangular and star-shape, can be cast in metal molds. Price of molds varies anywhere from 80 cents to \$4, depending on size and type.

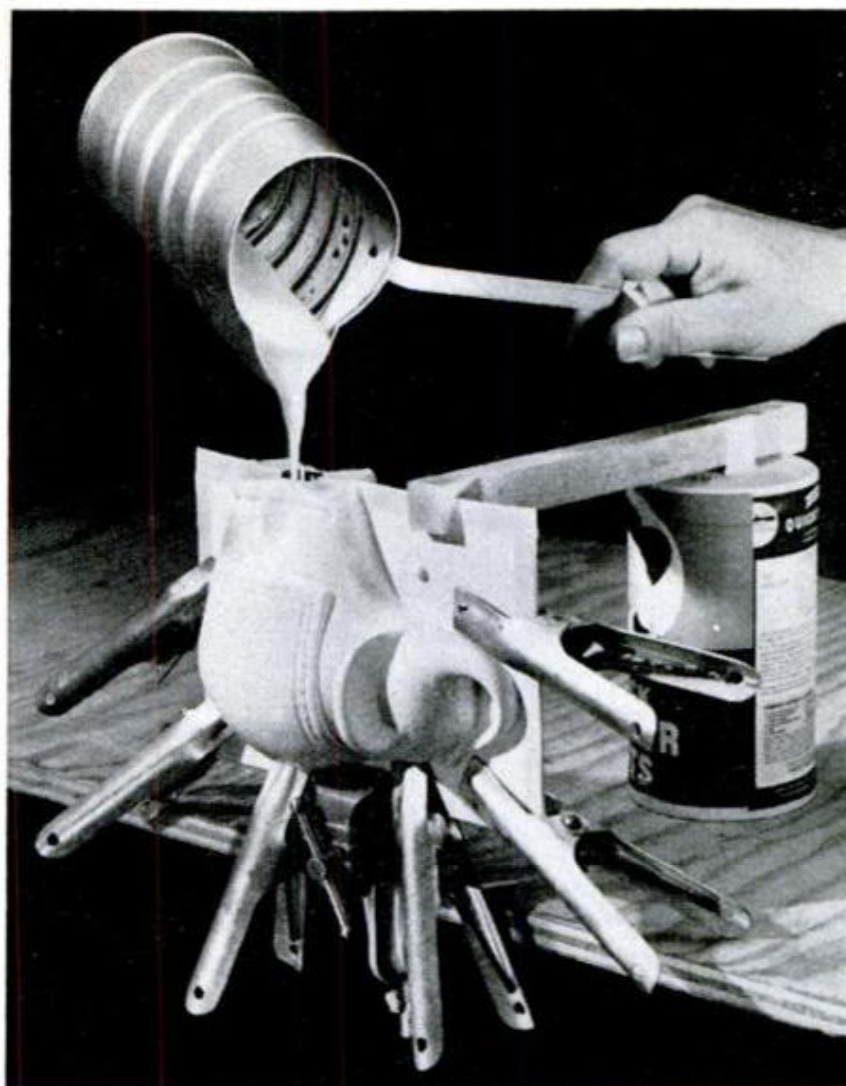
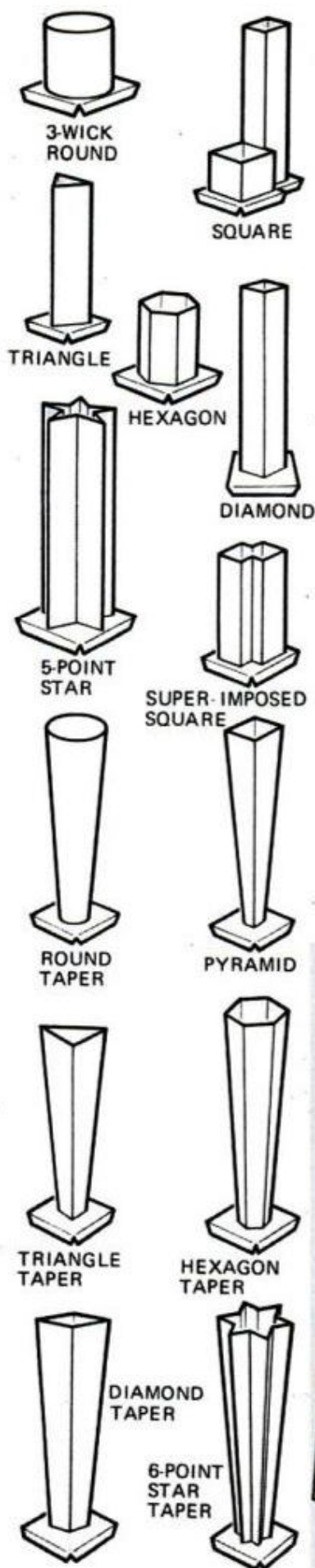
Wax, wick, coloring and scent. Candle wax comes in slab and granular form, and can be melted and remelted again and again. A 10-lb. slab sells for about \$3, a 4-lb. bag about \$1.75.

Wicking comes in spools of 100 and 300



ONE-PIECE STRETCH MOLDS are flexible. To remove from candle, you pull them off like a rubber glove

METAL CANDLE MOLDS



SMALL VISE AND SPRING CLAMPS are handy for holding together the halves of a large plastic mold. A notched brace helps steady it

ft., also in 6 and 12-ft. lengths, braided or cored. Braided wicking is specially made for use with metal molds, whereas core wicking is for nonmetal molds.

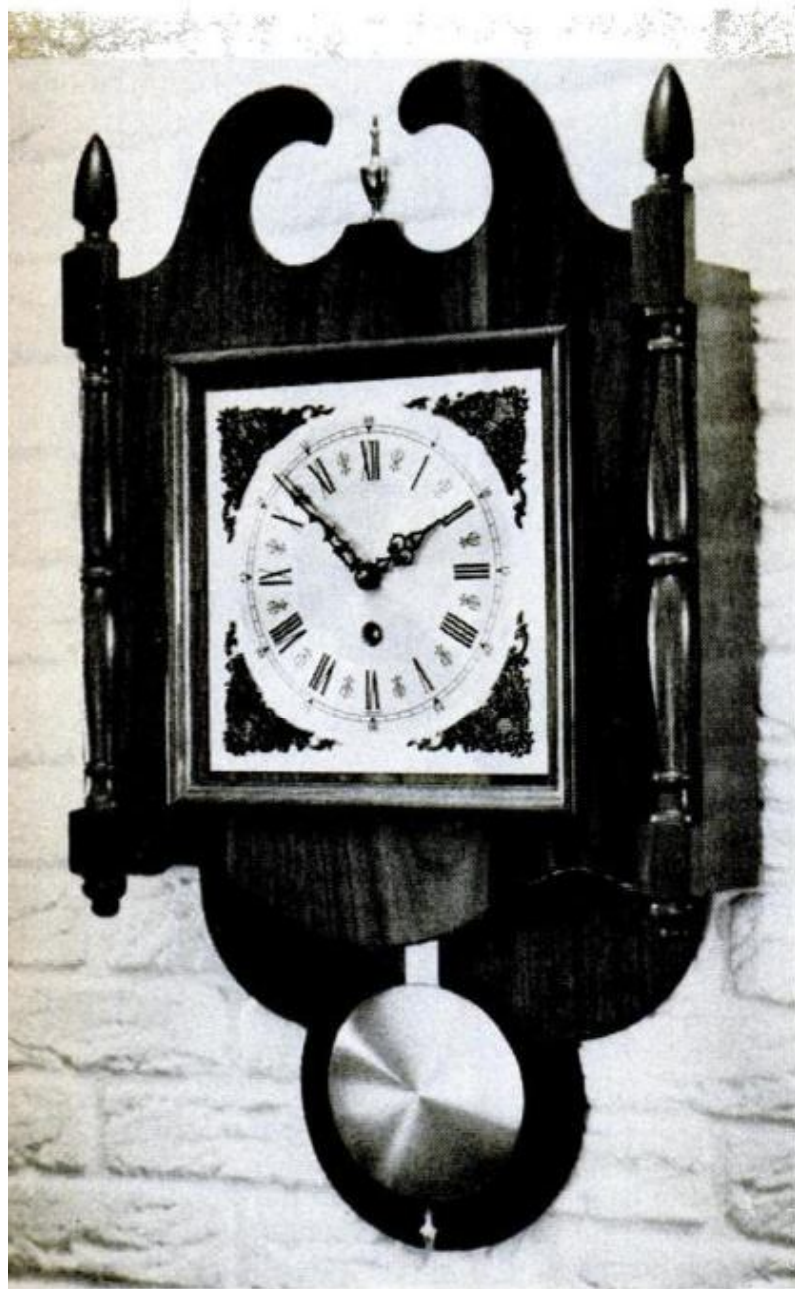
Coloring is sold in square, granular and stick form. It's added to the melted wax before pouring and allowed to dissolve completely. It comes in colors of the rainbow and color is controlled by the amount that's added to the wax. Regular coloring-book crayons also can be used to color candle wax.

Similarly you can add fragrance to your candles. Available in some 17 different scents, it's added to the melted wax after the color and just before pouring. A ¼-oz. bottle will scent 5 lbs. of wax.

Melting the wax. Candle wax is melted in a double boiler, never over direct heat. A fruit-juice can, or a 1-lb. coffee can, fitted with a suitable handle and pinched at the rim to form a pouring lip, makes a good ladle in which to melt wax. It's best

(Please turn to page 198)

Christmas gifts from



'Heirloom' wall clock

If there is someone on your gift list who would like a fine clock, he'll be delighted with this handsome wall model—especially when he knows you made it. Its elegant, etched dial and spun-brass pendulum contrast beautifully with its walnut case.

Other than the 1/4-in. veneer-faced plywood, you'll probably find most of the wood in your scrap box. In the case of the three-sided frame, only the side members need to be walnut since the top piece is not exposed. The two split pilasters are produced from a single square turning by gluing two pieces of wood together with

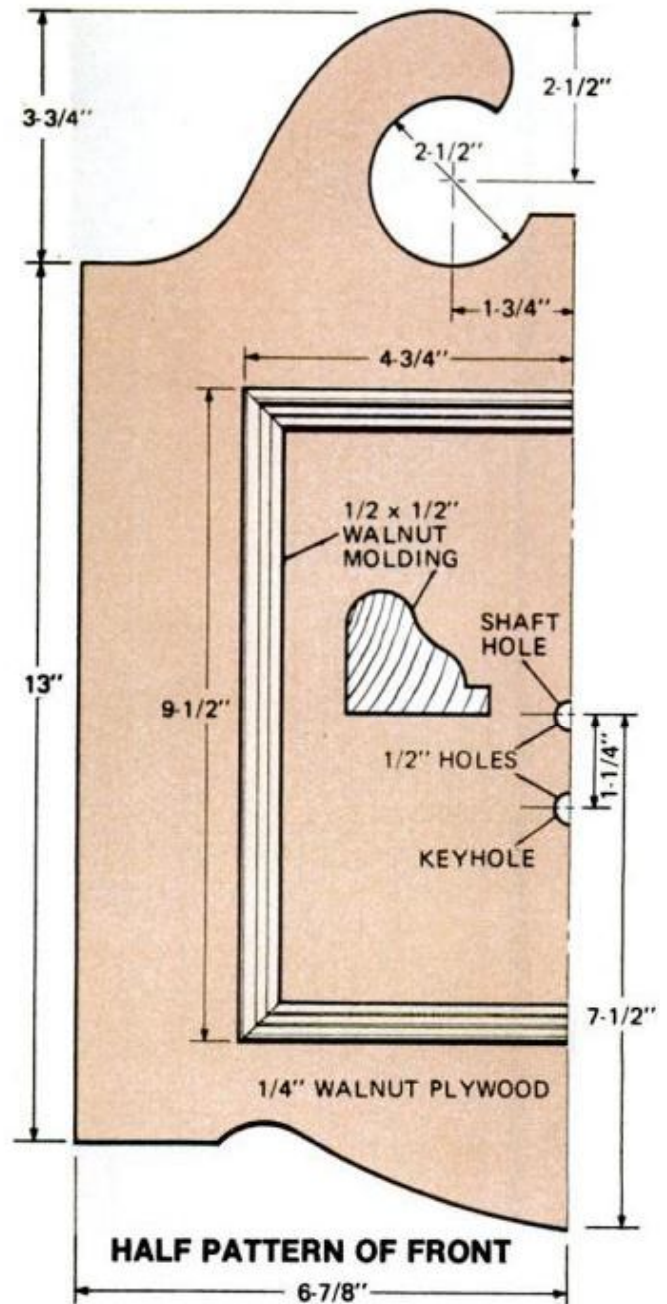


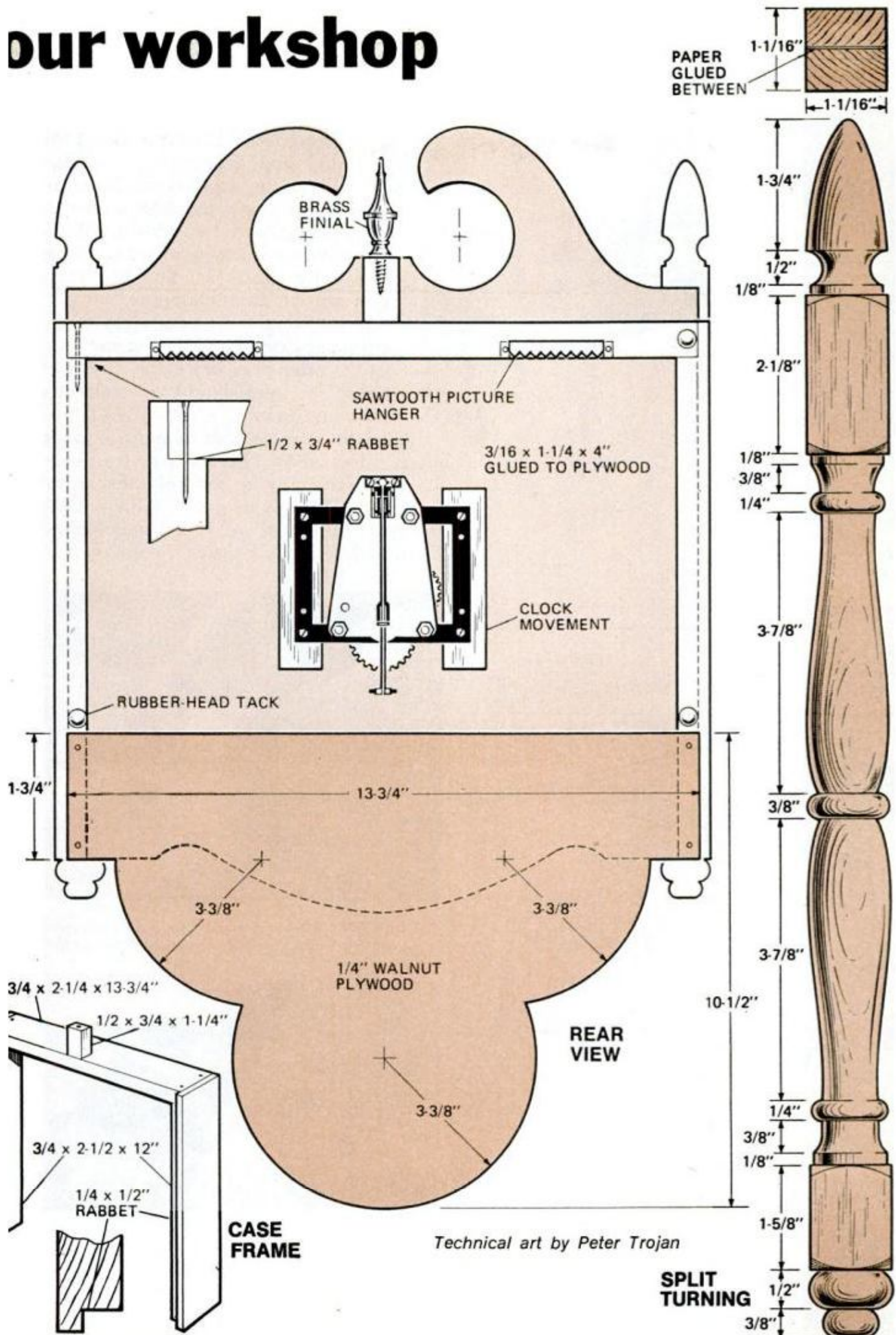
Photo by Robert D. Borst

paper between. Once turned, the two halves are easily pried apart with a knife blade down the paper joint. Use a fine-tooth blade to jigsaw the plywood parts and carefully sand the edges. If you have a router, you can run your own molding, or make use of a suitable stock picture-frame molding.

Gaston Wood Finishes, Box 1246, Bloomington, Ind. 47401, sells the eight-day windup movement, dial and brass finial for \$24 postpaid. You also can buy a kit of partially cut wood parts, including pre-turned pilasters, for \$31.25 postpaid.

POPULAR MECHANICS

our workshop



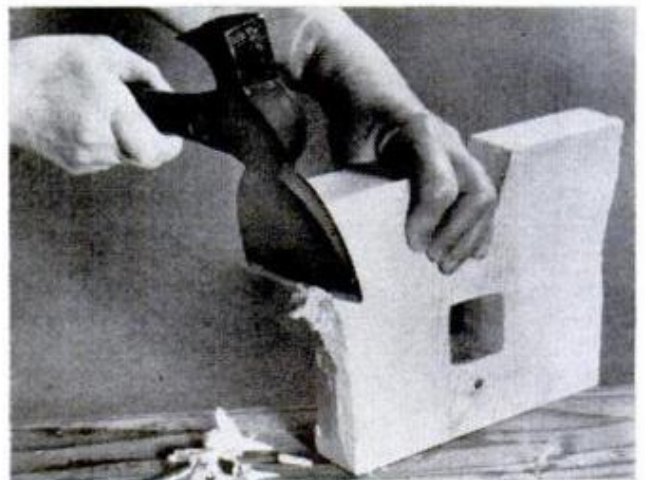
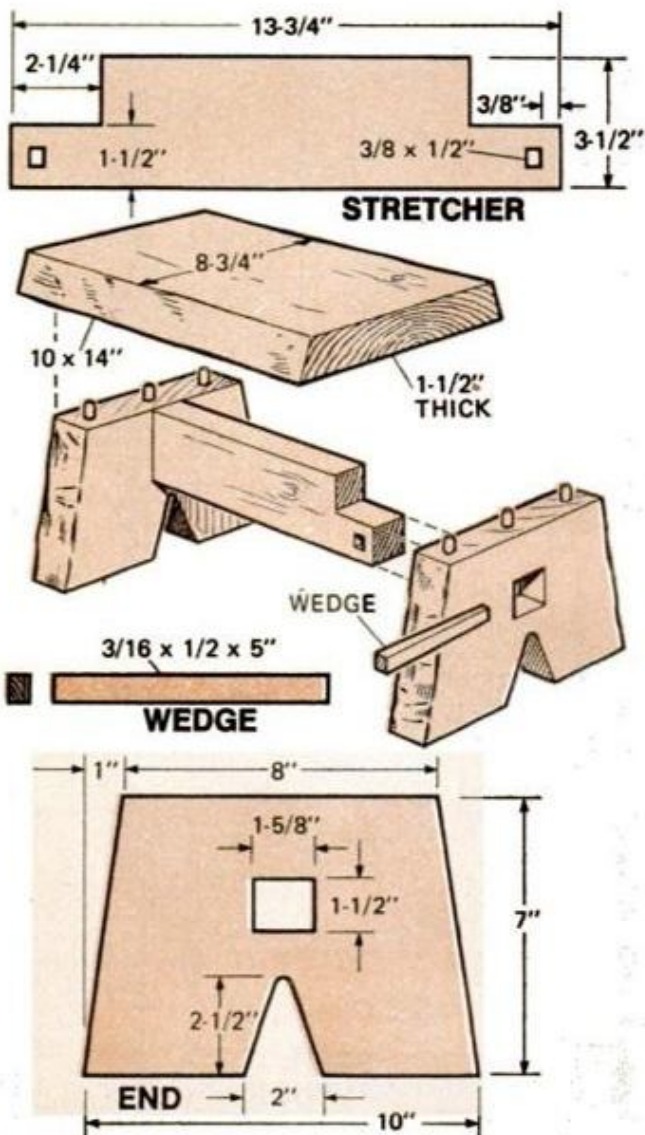
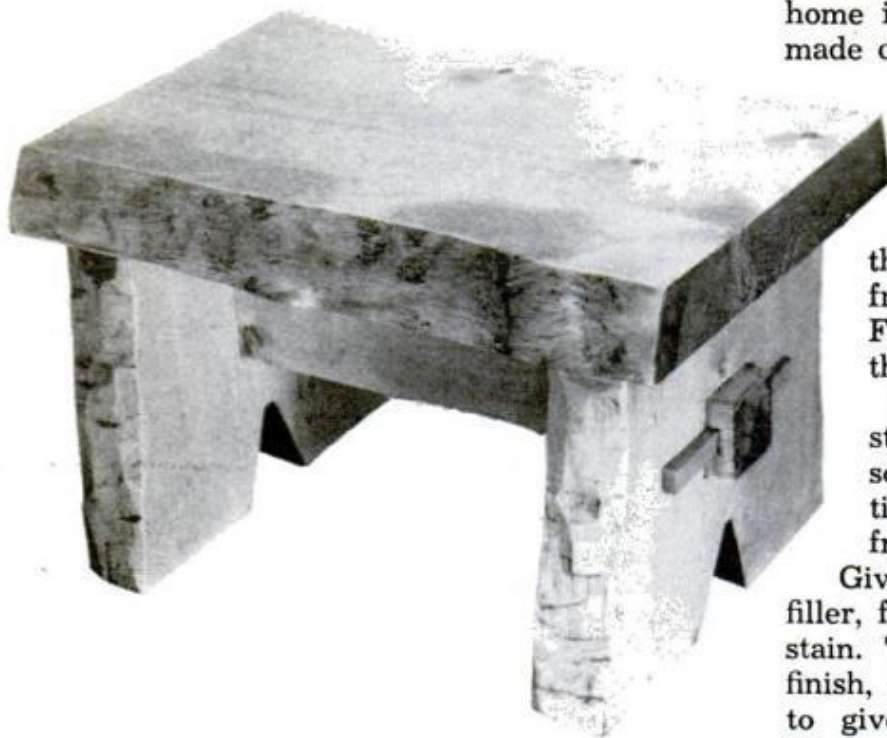
Rustic slab stool

This rough-hewn stool will be right at home in an Early American setting. It's made of 2-in. pine (actually 1 $\frac{5}{8}$ in.) and assembled without nails or screws.

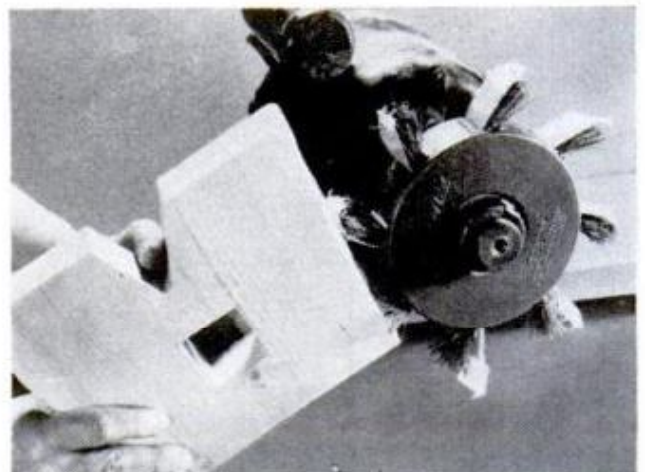
Rough-carving the edges of the top and legs with a hatchet gives the stool rustic look. To save time, saw the legs to shape; then chop them for texture. Work from bottom to top to avoid splitting. Finish by lightly sanding the burrs that are left from chopping.

Notice that the wedge slots in the stretcher extend into the leg openings so that the pegs draw the stretcher tight. The pegs should taper slightly from end to end.

Give the stool a coat of natural wood filler, followed by two coats of fruitwood stain. Then apply a coat of clear satin finish, sand lightly and rub with a cloth to give the stool a well-used look.—*Elma and Willard Waltner, Freeman, S.D.*



HAND-HEWN LOOK is produced by lightly chopping edges of legs and top with hatchet, then sanding



LIGHT SANDING with flap abrasive wheel gives worn look to "adzed" edges, can be done by hand

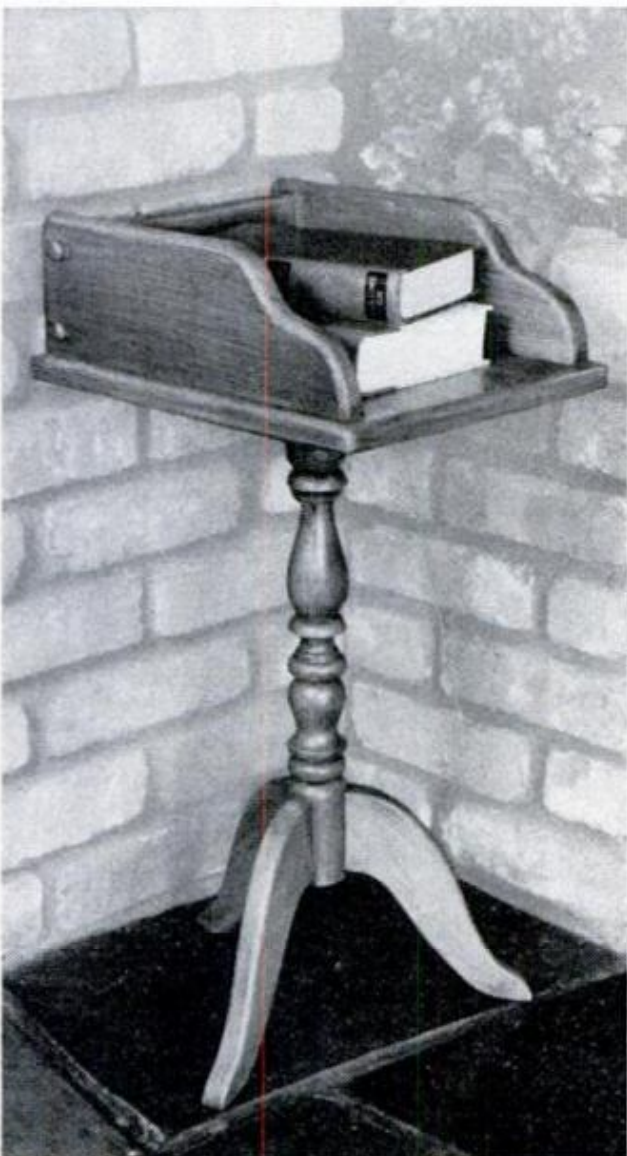
POPULAR MECHANICS

Colonial bookstand

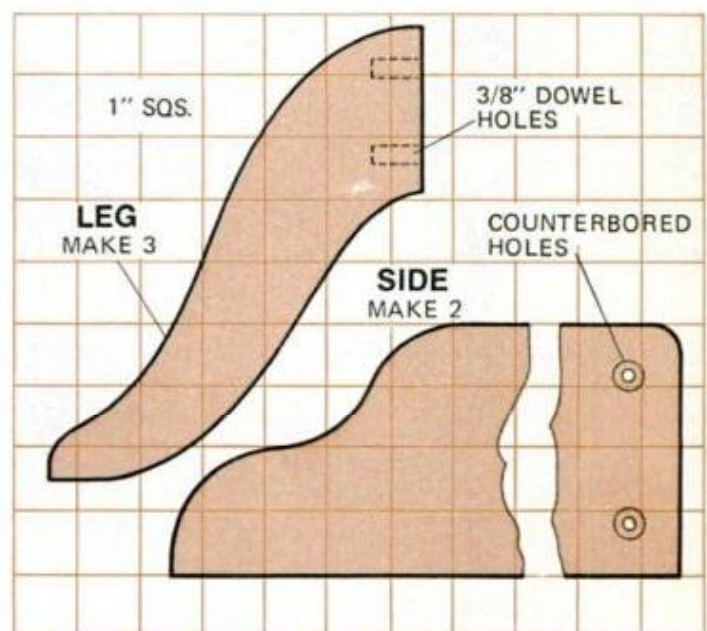
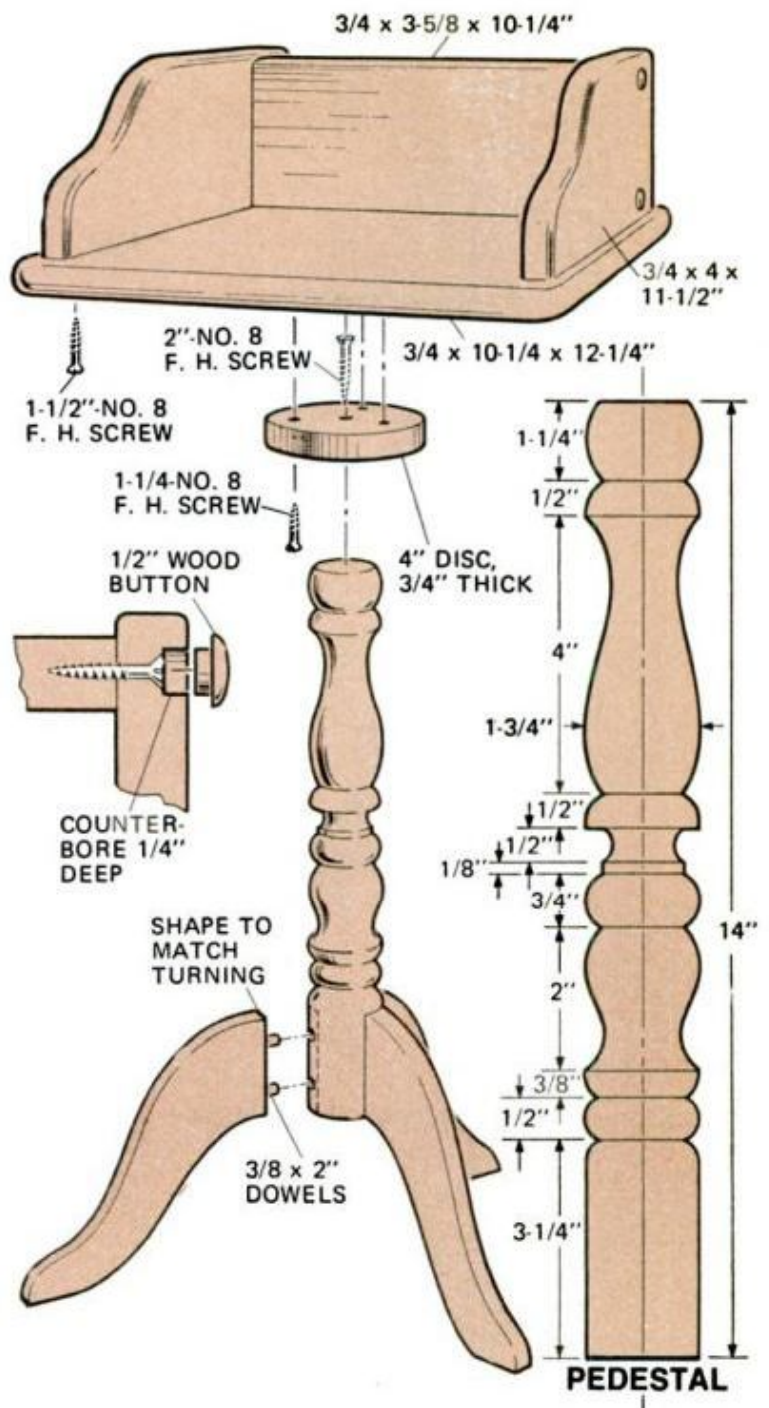
This quaint Early American bookstand will cost less than \$3 to make but as much as \$20 in a store to buy. If you own a lathe, you'll enjoy turning the centerpost, but if not, you can buy it already turned at a lumberyard.

To make it, cut the shaped shelf pieces and legs with a bandsaw, sabre saw or jigsaw, then round off the edges either by hand or with a router.

When drilling the dowel holes in the legs, be sure they are bored straight and true. Then shape the butting edges so they fit the post. This can be done by wrapping sandpaper around the post and using it as a form. Use dowel-locating centers to transfer the leg holes to the post. The center post is attached to the shelf by a 4-in. disc. Screws are used in counterbored holes to attach the sides of the shelf and the holes are capped with decorative wood buttons.—*John Capotosto, Dix Hills, N.Y.*



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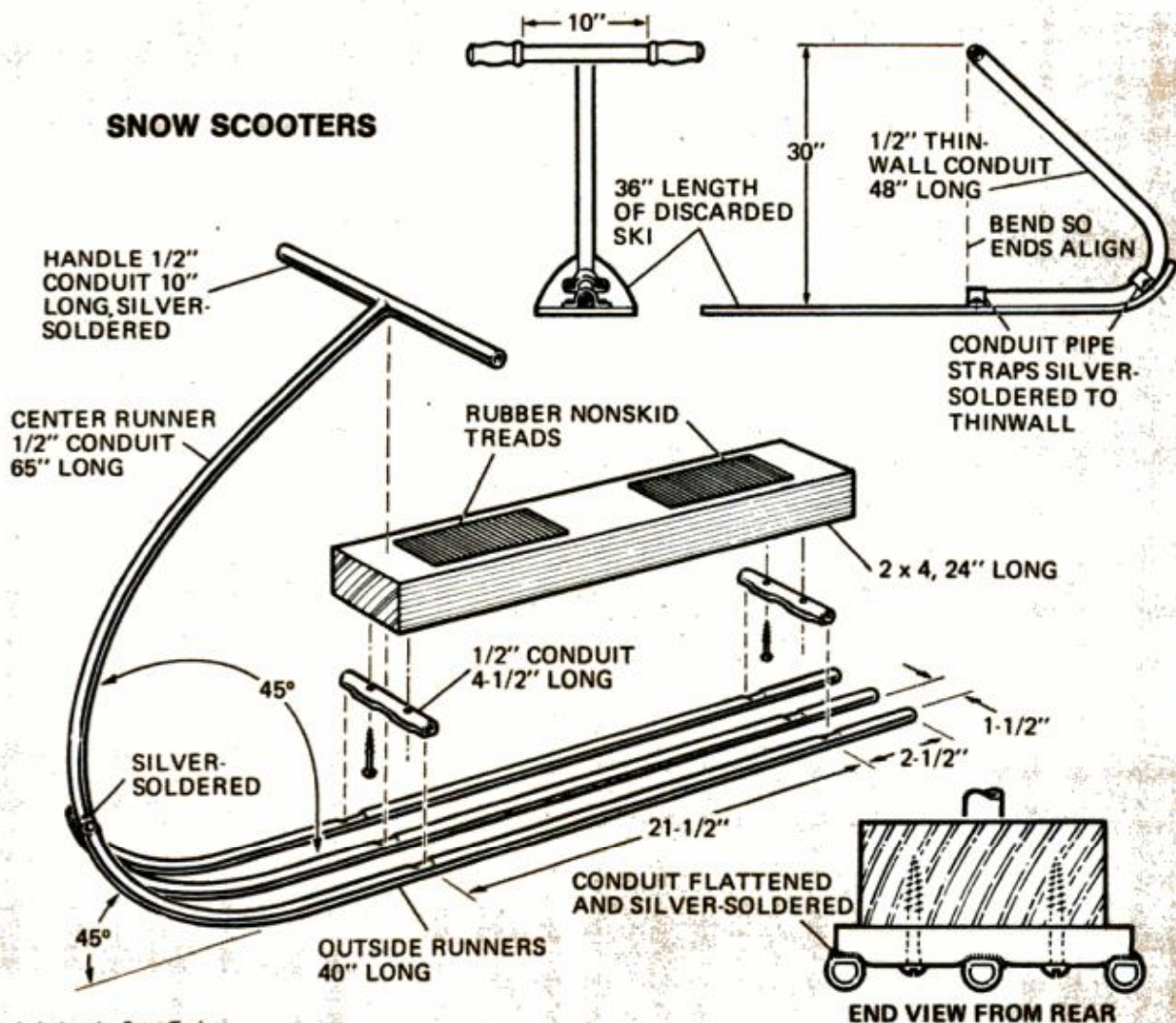
Wild on a hill

By R. S. HEDIN

RACING DOWN A HILL on a sled is tame compared to the fun your kids will have riding a snow scooter. Keeping their balance while leaning into the turns and riding out the bumps on a slick white slope make for an exciting ride.

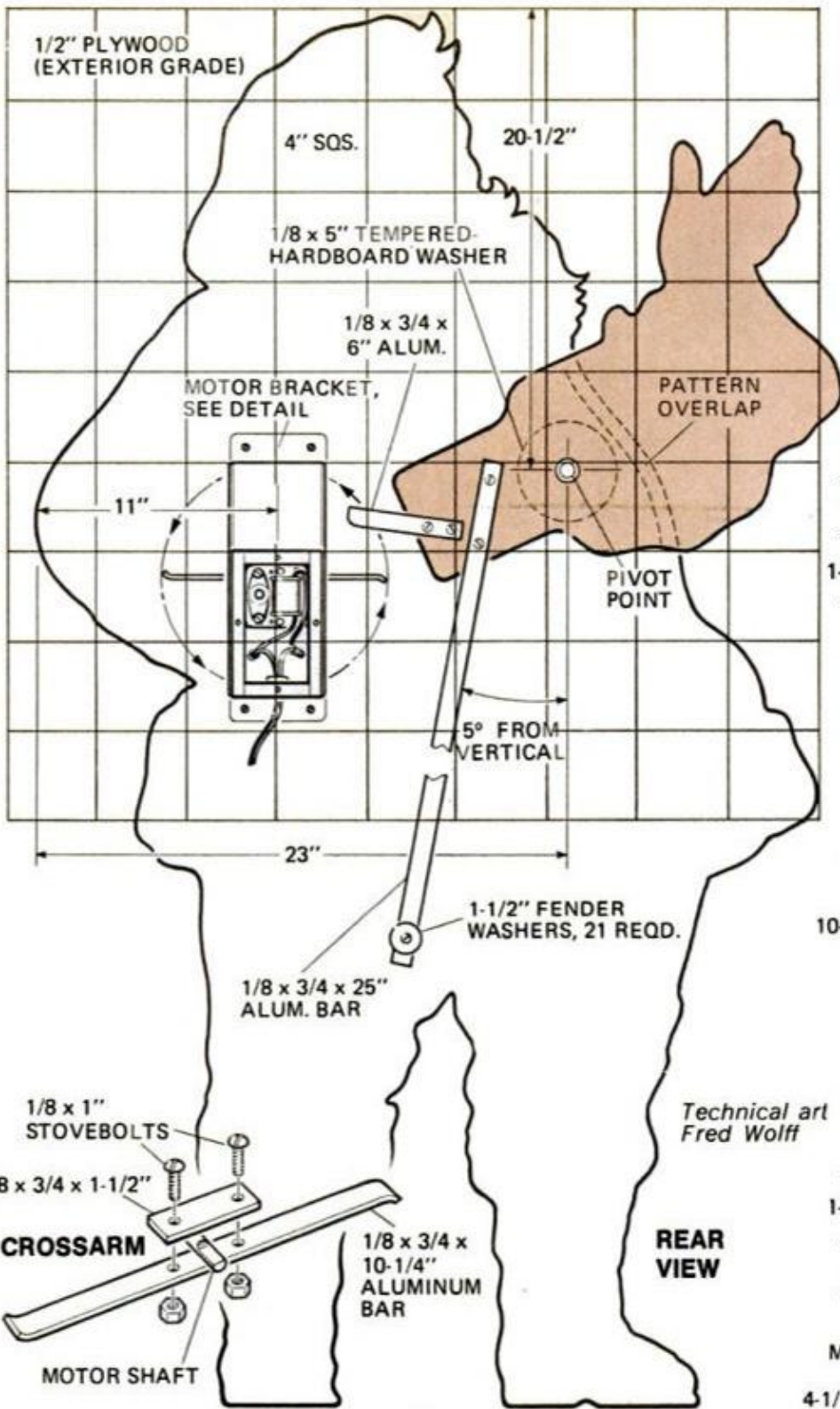
The plans below show two different models. One can be made from a discarded wooden ski, the other from sections of thinwall electrical conduit. The scooter made from a ski is the simplest since it requires only shortening the ski and attaching a handle. The thinwall scooter requires silver-soldering to join the members and an electrician's pipe bender (which you can rent) to bend them. Note that conduit runners are flattened where they are soldered together. ★★★

SNOW SCOOTERS



Technical art by Peter Trojan

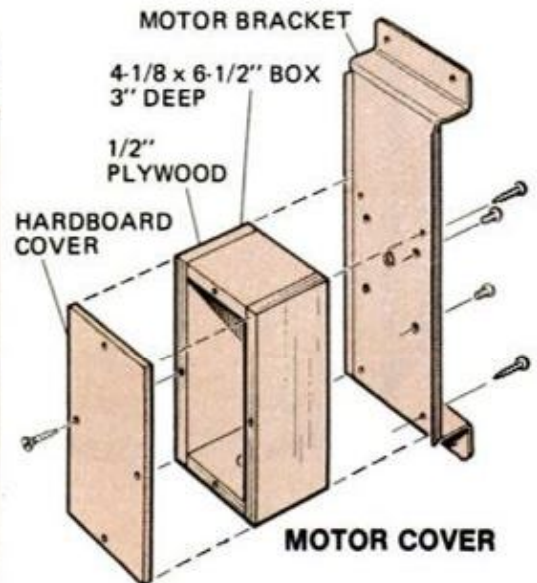
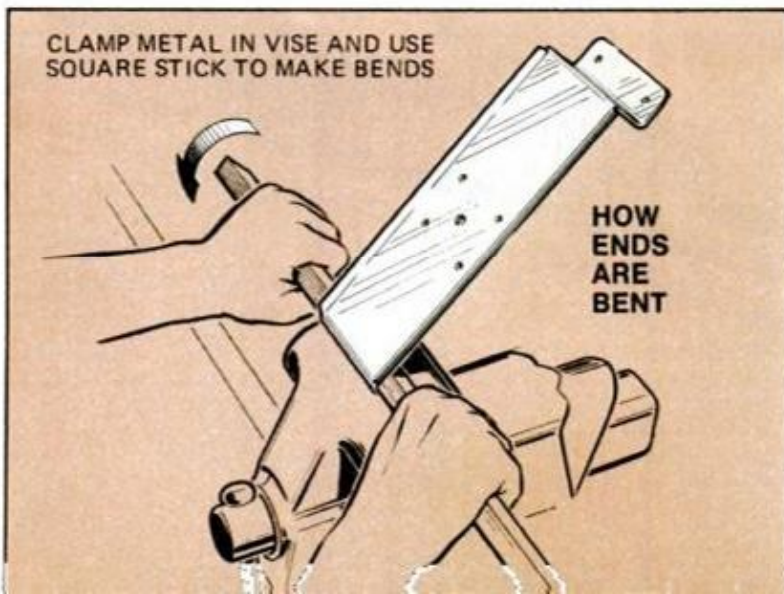
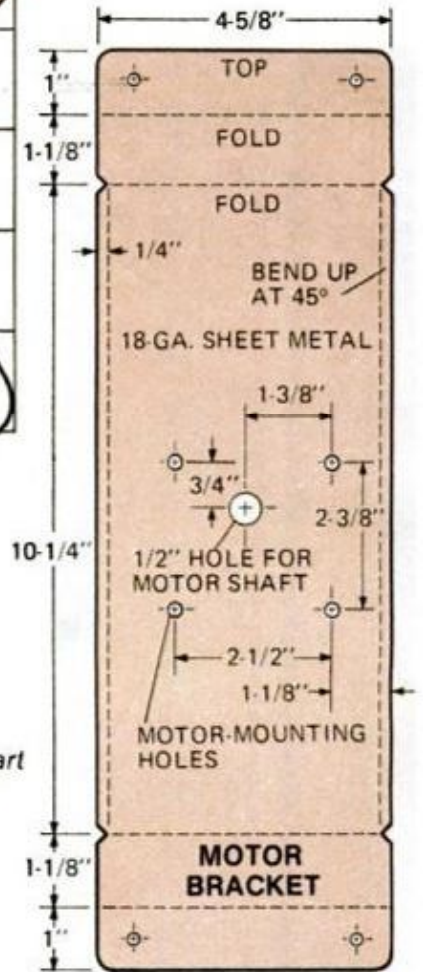




WHERE TO BUY PARTS

Santa Poster
U-Build Enterprises,
Dept. PM, Box 2383
Van Nuys, Calif. 91409
\$2.50 postpaid.

Motor (7 rpm)
The Way-Mar Co.
Box 164
Hartsdale, N.Y. 10530
\$14.95 postpaid.



HI, THERE!

(Continued from page 109)

around, it boosts the pendulum again to keep it swinging and the hand waving.

You can build this colorful animated lawn decoration for about \$35, which includes the price of plywood, paste-on poster, motor, glue, miscellaneous paint, screws and aluminum. Glue Santa to a 4x6-ft. sheet of 1/2-in. exterior plywood, but before gluing, cut off his arm with scissors where it joins the body. Glue this portion of the poster to a second piece of plywood and saw it out separately.

Use a steam iron on the back of the poster to press out creases, then apply a resin water-resistant glue, such as Weldwood, to both the plywood and poster. The poster ink is waterproof, so any excess glue can be removed with a damp cloth. Use a fine-tooth blade in a sabre saw to saw the cutout, and smooth any rough edges with sandpaper. Give the edges and back of the cutout a coat of varnish to seal the wood, then paint.

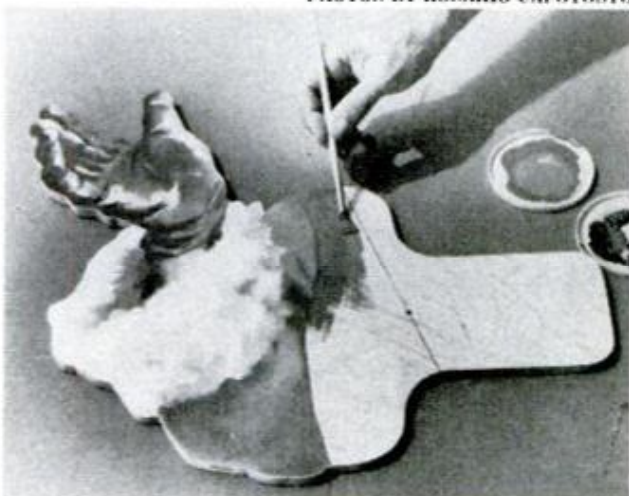
Follow the dimensions given when locating the pivot point for the arm, and cut a 5-in. washer from 1/8-in. hardboard to provide clearance between the arm and body. Although the moving arm will be in its original position on the poster, it is set in 1/2 in. and the exposed bare-wood portion is painted to approximate the color of

(Please turn to page 195)

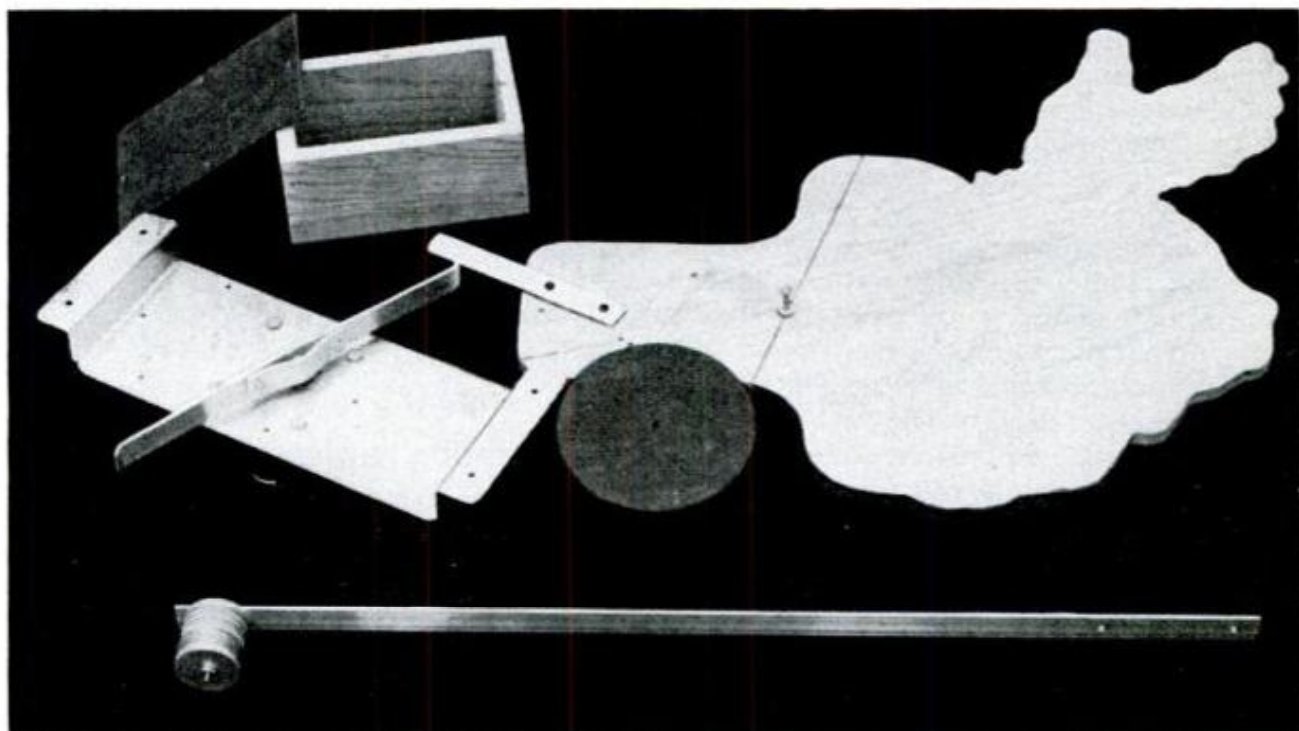


USE SABRE SAW and fine blade to saw out Santa. Let saw glide over the work so as not to mar poster

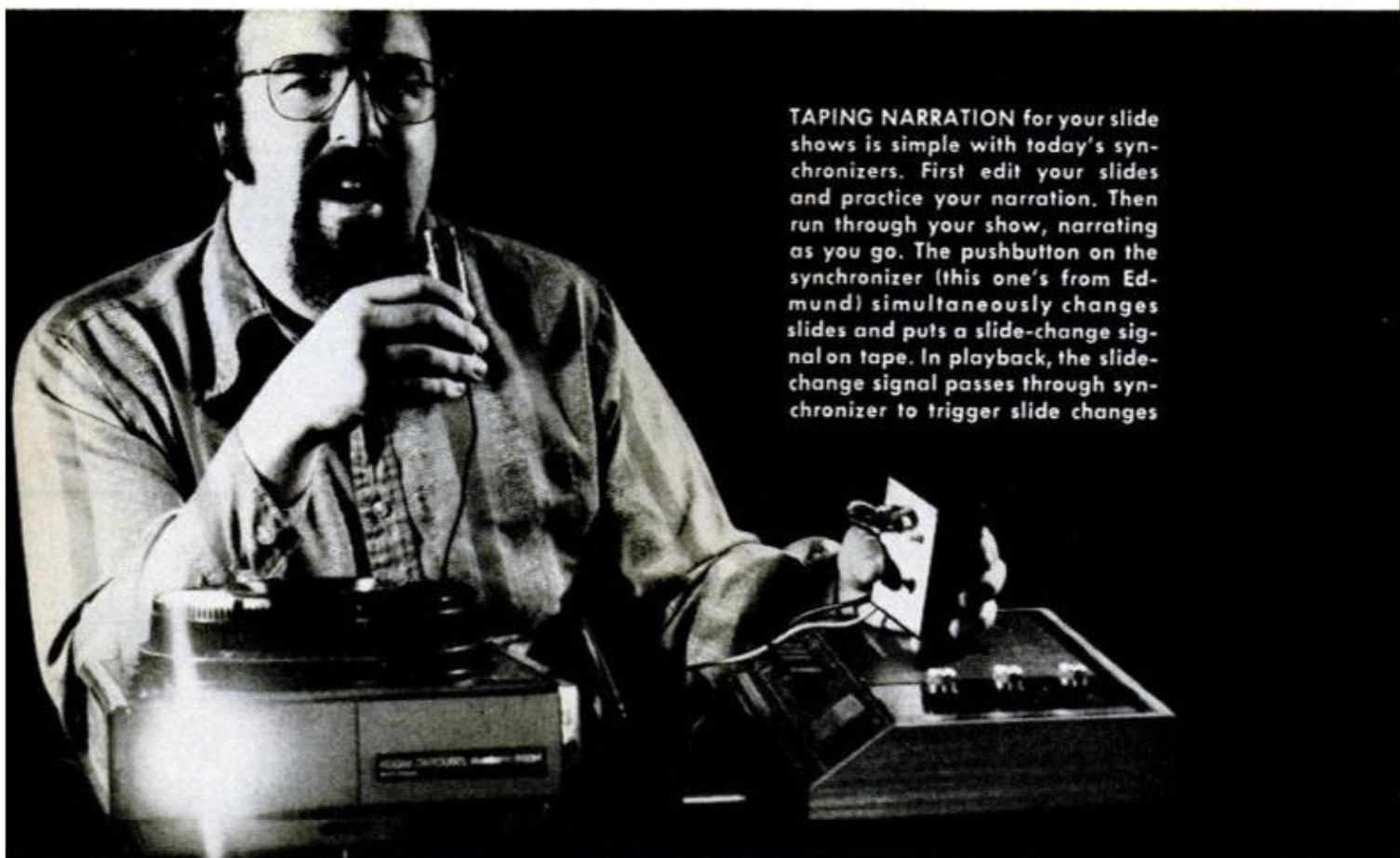
PHOTOS BY ROSARIO CAPOTOSTO



EXPOSED PORTION OF ARM must be painted to extend poster. Red, black and white make perfect match



HERE ARE THE PARTS you have to make in addition to the Santa cutout. Cut off arm on the paper poster, glue it to a piece of exterior plywood and saw it out separately. Use a resin, water-resistant glue



TAPING NARRATION for your slide shows is simple with today's synchronizers. First edit your slides and practice your narration. Then run through your show, narrating as you go. The pushbutton on the synchronizer (this one's from Edmund) simultaneously changes slides and puts a slide-change signal on tape. In playback, the slide-change signal passes through synchronizer to trigger slide changes

SOUND CAN DO almost as much for your slides as it does for movies. And most likely you already own most of the equipment you need to put your sound and slides together: a slide projector with remote-control slide-changing and a stereo tape recorder. The only extra you'll need is a gadget called a slide synchronizer, available for as little as \$12.95. With some synchronizers, you can even use a monophonic tape recorder.

With a synchronizer, you can put slide-changing signals on tape, together with commentary, sound effects and background music. Play it all back, and you can relax while the tape automatically changes your slides at precisely the right points in your narration.

You're not the only one who'll relax. Your audience will, too. They won't have to suffer through the missed slide changes, or the pauses while you try to remember whether this slide was shot at sundown or sunset, and whether that castle is in Disneyland or Bavaria. And the musical and other effects you can add make the whole show smoother and more professional.

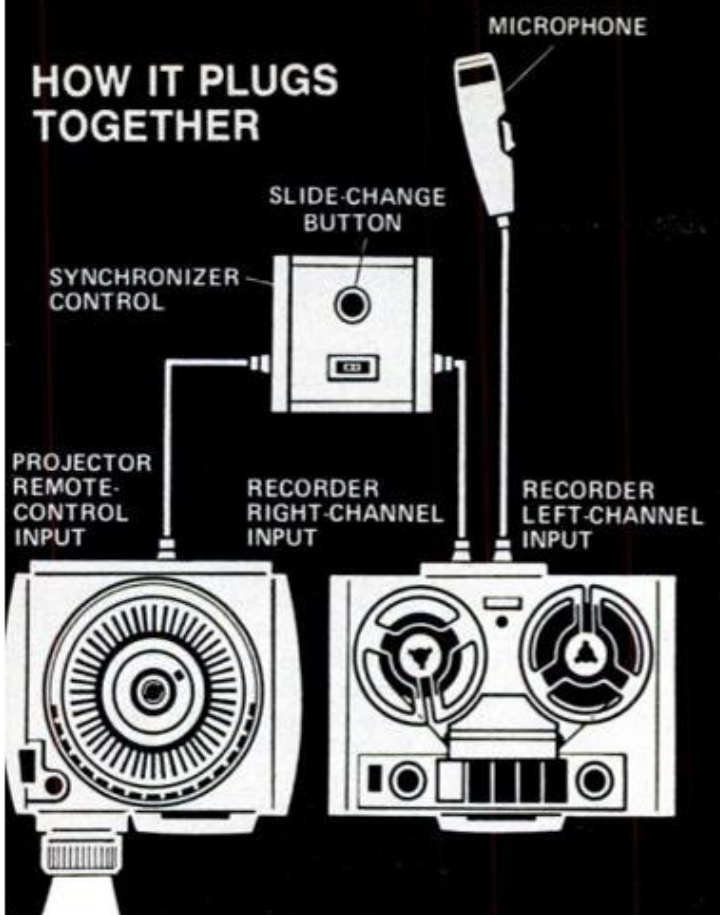
Most synchronizers have two leads: One connects to your tape recorder, the other to your projector's remote-control socket.

Liven up your slide shows with sound

Let your tape deck run your slide show, and you'll be free to relax with your guests while the tape gives your narration flawlessly.

By **BURT MURPHY**

HOW IT PLUGS TOGETHER



ATTACHE CASE holds a complete slide show: Kodak Pocket Carousel 200 projector and slide tray, an Edmund tape-slide synchronizer, a Sony cassette recorder and all necessary cables. A stereo recorder would allow completely automatic operation; but for greater portability, a monophonic machine (like the one shown) can be used, and the slides can be changed manually when beeps are heard (see text)

In recording, the synchronizer is connected to the tape deck's input, recording a beep each time you press the slide-change button; in playback, it's connected to the recorder's output and changes slides each time the tape plays the recorded beep.

With a stereo open-reel recorder, you can record and edit the sound track till it's perfect, then add the slide-change signals. With a stereo cassette recorder, which usually doesn't let you record one channel at a time, you'll have to record both sound-track and slide-change signals simultaneously, which is a little trickier. Only the sound-track channel is fed to your speakers—you don't hear the beeps that trigger the slide changes.

There are several variations on this basic type. For example, while most synchronizers (such as the \$29.95 Airequipt) have their own slide-change buttons, Kodak's Carousel synchronizer (\$39.50) has just a socket for the projector's own remote control unit. This lets you override the recorded slide-change signals, skipping ahead or turning back at will. (If you're not planning to override the signals, you don't have to use the remote cord at all on playback.) One model of Bell & Howell's \$34.50 Audio Cube synchronizer comes with a special plug that

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KODAK SYNCHRONIZER, unlike others, has no slide-changing buttons of its own. When making tapes, you advance the slides with the projector's own remote control cord, which plugs into the synchronizer. In playback, you can omit the remote cord—or use it to override the taped slide-change signals

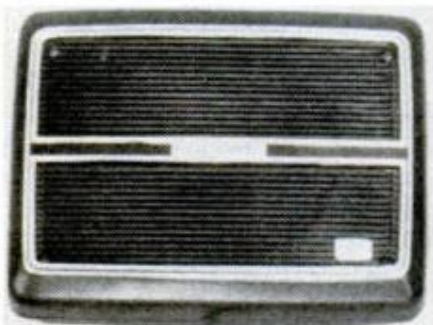
simultaneously fits both record and playback outlets of B&H's Model 450 Film-sound recorders, so you don't have to change plugs when switching from recording to playback (the other has normal connections for standard stereo recorders). Edmund's Tape-Slide Synchronizer (\$19.95) also has separate recorder input and output connections. And Honeywell's synchronizer (\$34.50) fits compactly on the projector itself, with no trailing cords.

Synchronizers are available for mono-

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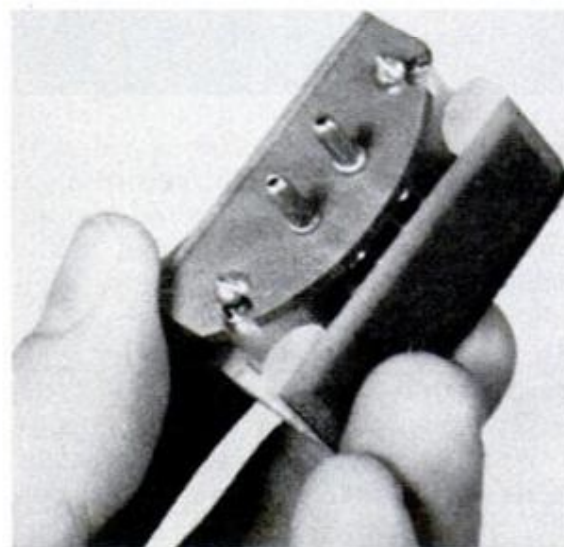
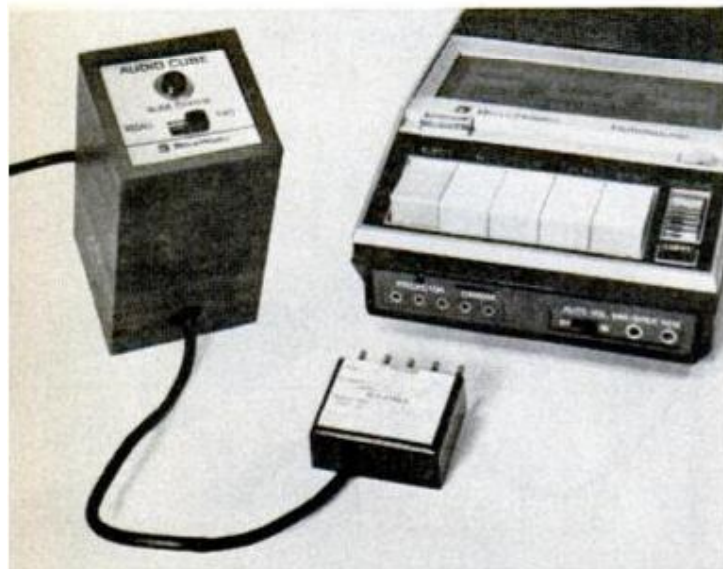


SAUNDERS SM-2 works with mono as well as stereo recorders. For recording, it has a built-in mixer to put voice, recorded music and slide-change signals on the same tape track. For playback a speaker is built in, whose bass response is limited to frequencies above the 75-Hz slide-change signal



BELL & HOWELL Audio Cube (lower left) has special, five-pin jack that simultaneously makes all connections with B&H's Filmosound recorder; there's no need to change connections when switching from recording to playback. Another, similar model is available for use with all conventional stereo recorders

MESTON-MATIC fastens to top plate of open-reel recorders, mono or stereo; the tape passes through the slot shown. You mount adhesive foil strips to the back of the tape to trigger slide changes (except on recorders which stop or reverse on foil-strip signals). But there's a shock hazard (see text)



phonic tape recorders, too—but they're nowhere near as standardized in their design as synchronizers for stereo recorders are. And most of them are pretty expensive. The Saunders Mentor Mk IV SM-2, for instance, costs a hefty \$130. But it offers some interesting extra features for the money. Though it can be used with nearly any tape machine (including stereo recorders), it's specifically designed to overcome the problems involved when using monophonic portables, such as the small cassette machines so popular today. Because the speakers in such portables usually cut off when you plug anything into their earphone outlet (usually the only outlet on the machine), the Saunders has its own built-in speaker. Its trigger sig-

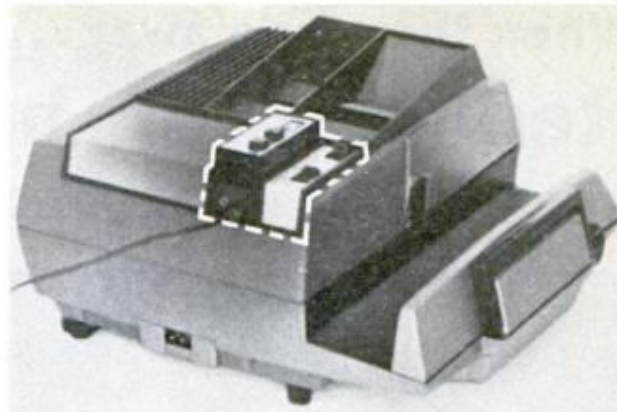
nal is 75 Hz—too low to be heard through either the Mentor's own speaker or through most speakers used with tape recorders, and low enough not to be annoying if it is heard. And to keep musical tones from accidentally triggering slide changes, the Saunders only triggers on pulses three-quarters of a second long. Because few monophonic recorders have built-in mixing facilities, the Saunders also has inputs for both microphone and the output from another tape recorder, with provision for monitoring the recorder's output through the Saunders speaker. Cables are available to adapt the Saunders to Kodak Carousel, GAF and Sawyer projectors.

Kodak's Carousel Programmer Model 1

is about the same price as the Saunders (\$132.50), and has even more elaborate mixing facilities. But it's not really designed for cassette recorders, since it requires fairly good high-frequency response (its trigger tone is 6500 Hz, filtered out again in playback) and higher impedance than most transistor recorders can supply without an accessory transformer.

The Meston-Matic, at \$12.95, is far less expensive, and in a way, even more ingenious than the Saunders or Kodak units; but it's also the only one we found with a potential (if easily avoidable) shock hazard. The unit itself is a bracket with a slot and two switch contacts, designed to mount on the surface of an open-reel tape recorder, with the tape running through the slot. Then connect the Meston-Matic to your projector's remote-control socket and put a strip of adhesive foil on the back of the tape at every point where you want to trigger a slide change. The foil strip bridges the Meston-Matic's contacts, closing the slide-change circuit just as the projector's own remote switch would. Any open-reel recorder, mono or stereo, can be used, and the adhesive foil strips can be moved at will.

The potential hazard isn't in the synchronizer itself, but in its instructions. It's suggested that you cut your remote-control cord, install a regular a.c. plug on each cut end, connect a TV "cheater" cord with a.c. plug to the Meston-Matic's terminals, and connect all three plugs in parallel to a three-tap a.c. receptacle (not connected to your 117-volt a.c. power line, of course!). The danger is that someone may plug one of those normal-look-



ON HONEYWELL remote-control projectors, the remote-control cord nestles in to double as the non-remote slide-change button. Honeywell synchronizer (dotted line) replaces the remote cord either for remote slide-changing or as an on-projector control

ing a.c. cords into a wall. Use any other kind of plug and the hazard vanishes.

But it takes thought, as well as equipment, to make a good slide-show. Be sure your slides are in logical order, and you know just what you want to say about each one. Rehearse a few times before taping, or, better yet, make practice tapes and listen to them objectively. For good, clear sound, don't hold your mike too close—8 inches to a foot is about right—and be sure your microphone isn't picking up the noise of the projector fan.

As to the synchronizers themselves, for information on models for specific projectors, you can write to the following (or to the manufacturers of your own model): Airequipt, Inc., 20 Jones St., New Rochelle, N.Y. 10802; Bell & Howell Consumer Products Div., 7235 North Linder Ave., Skokie, Ill. 60076; Eastman Kodak Co., 343 State St., Rochester, N.Y. 14650; Honeywell, Box 1010, Littleton, Colo. 80120; and Saunders Associates (for Kodak and GAF projectors), Old Boston Rd., Wilton, Conn. 06897.

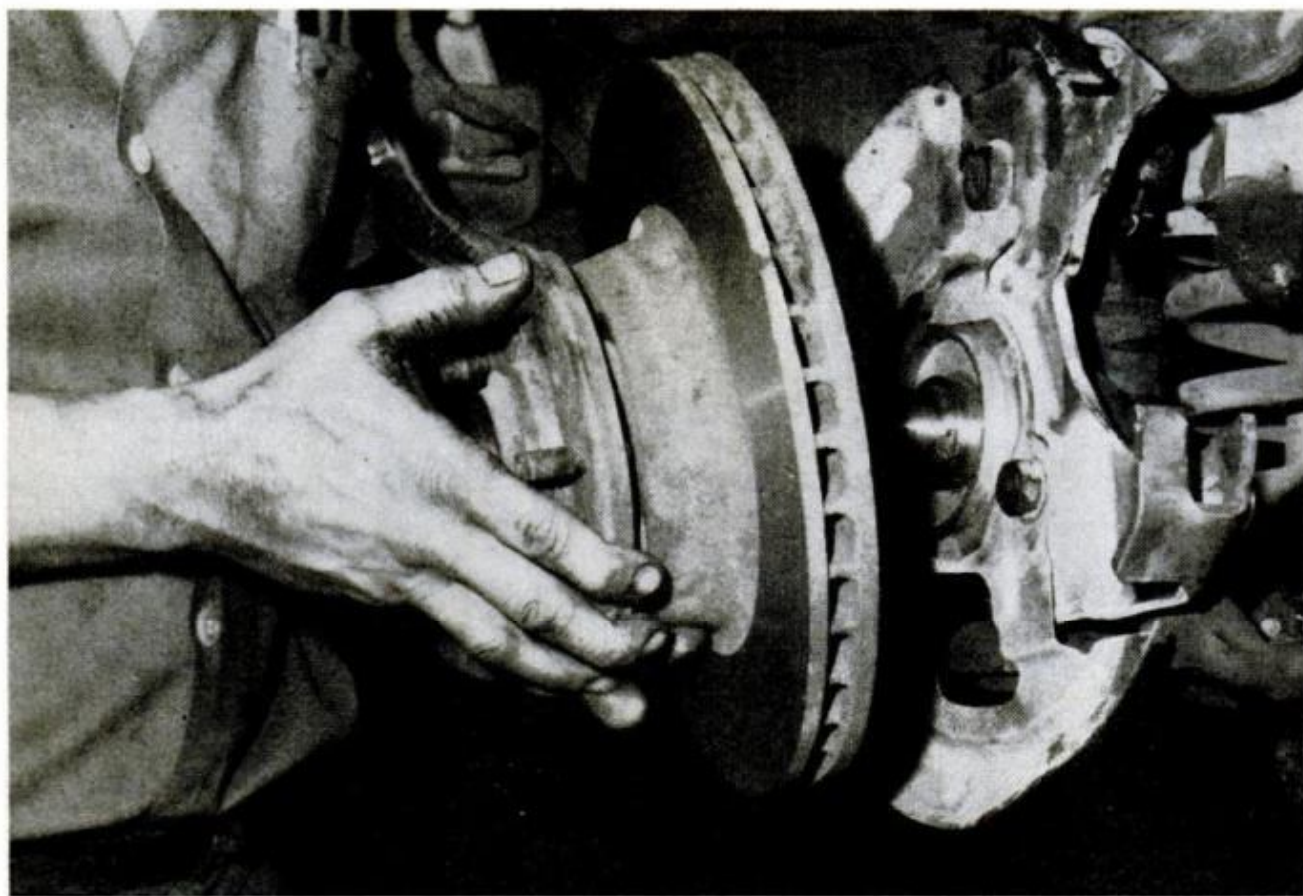
For information on universal synchronizers to fit all remote-control projectors, contact Edmund Scientific Co., 101 East Gloucester Pike, Barrington, N.J. 08007, and Meston's Travels, Inc., 3801 North Piedras St., El Paso, Tex. 79930. ★★★



KODAK CAROUSEL PROGRAMMER, for monophonic tape recorders, incorporates a simple mixer to control relative voice and background-music levels. Its 6500-Hz trigger signal is stronger than most audio signals at that frequency, so musical tones won't trigger it. In playback the circuit that generated the tone filters it out again, so you don't hear it. Portable case included. Requires 117-v.a.c. power

When they fade away...

Replace drum brakes with discs!



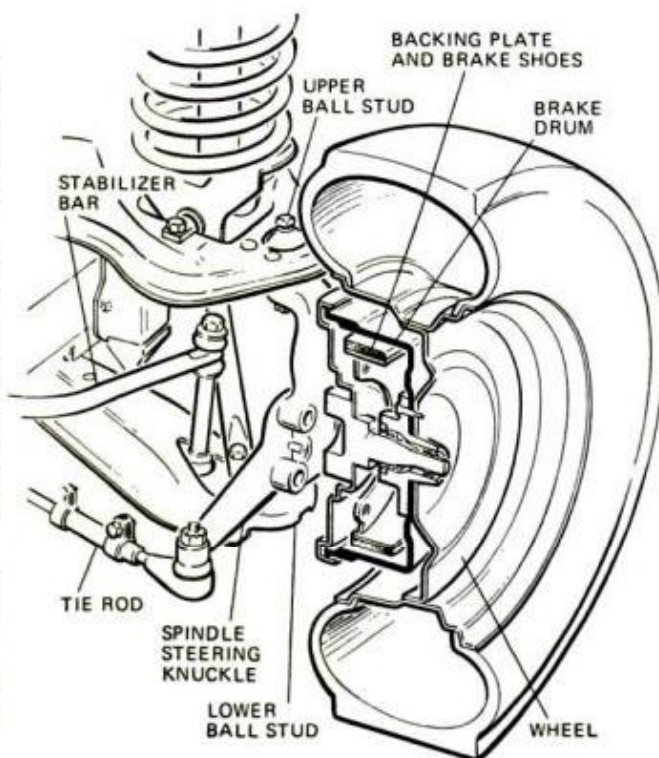
By MICHAEL LAMM, West Coast Editor

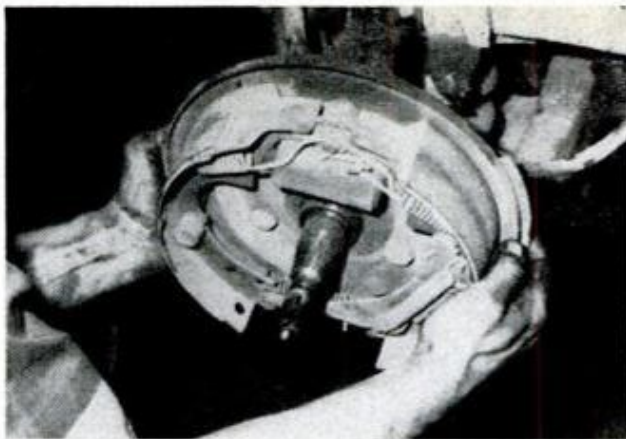
FRONT WHEEL, brake drum and suspension components are shown to visualize setup before disassembly

EVER WISH you had disc brakes instead of those borderline drums you've been putting up with? I had marginal drum brakes on my 1967 Camaro and I finally did something about it. Wish I'd done it long ago.

My Camaro's original brakes were a set of 9½-inch drums—same as used by the old Chevy II. I'd noticed several times that at upper-limit freeway speeds (65-70 mph), one hard stop would fade them; in fact, shoving down the pedal at 70 mph, the drums pulled the car down fine to about 55, and from there to zero it felt as if I'd stepped on the accelerator again.

So about a month ago I decided to have a set of front discs put on. It's an easy conversion, although I wouldn't recommend a novice tackling it. Better do what I did—let a good brake shop handle the swap.





TIRE AND WHEEL are pulled, then entire front brake assembly is unbolted at upper, lower ball studs

Initially, I went to my local Chevy dealer and priced out a set of brand-new discs. With all the needed hardware, the total cost came to something over \$350. This didn't include installation charges. Labor was quoted at about \$85, bringing the total conversion to well over \$400. I wasn't about to go that route.

So I began phoning auto wrecking yards to find out whether any of them had a set of discs in stock. The first wrecker I called didn't have the brakes but did do me one great favor—he looked into his interchange manual and told me all the various discs that would fit my 1967 Camaro. These included Camaro units 1967-69, Chevelle 1967-70, Buick Special (Skylark) 1967-68-70 (not 1969), and Chevy II 1969-70. This knowledge turned out to be a big help in the search.

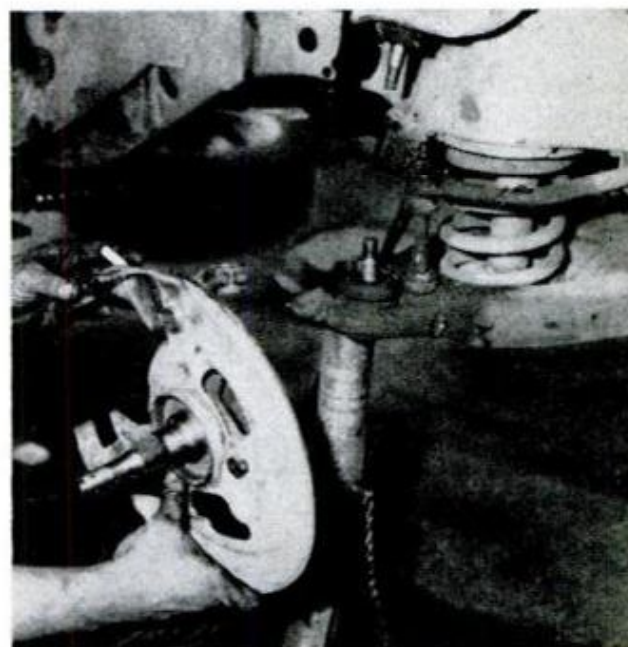
It took me two weeks to locate a good set of 1970 Chevelle discs. They were muddy and slightly rusty but perfect otherwise. The wrecked car showed low mileage. These discs cost me \$80, which was about \$30 more than I had expected to pay. I've heard since that Ford discs run about \$50 a set, because they're more plentiful, but \$60-\$75 is a good price for Chrysler, AMC, or GM discs. Much depends on condition, and I do recommend that you get some sort of written warranty from the wrecking yard owner so you have the option of bringing the discs back in case you find the rotors untrue or some other vital part bad.

As I bought them, my particular discs came complete—spindles, support arms, backing plates, rotors, calipers, all lines, master cylinder with vacuum booster, plus the equalizer valve. I had to buy only a vacuum hose, one tee, and a valve between the brake booster and my intake manifold.

I didn't attempt the swap myself. Jerry



UNBOLT SUPPORT ARM from new disc-brake backing plate and replace with those from drum-brake plate



DISC-BRAKE BACKING PLATE is installed on upper, lower ball studs (a good time to check ball joints)



DISC ROTORS are then turned to clean them and check trueness. Here, new bearing seals are being installed. Rotor can then be installed on spindle as shown in the photograph on the opposite page

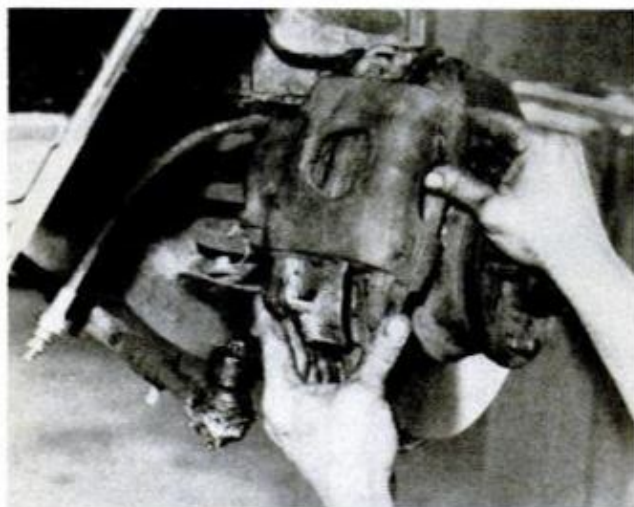
West, co-owner of Wilson Way Alignment & Brake shop here in Stockton, Calif., did the job for me.

He worked one side at a time, and his first step was to remove the tire/wheel/drum unit. This pulled right off after he undid the spindle nut.

Next he took off the drum backing plate by disconnecting the brake hose at the frame, undoing and breaking loose the spindle arm and tie rod. The entire shoe/backing plate unit now came off.

This particular conversion—1970 Chevelle discs to 1967 Camaro—has a peculiarity that we didn't expect, and most likely when you convert your car you won't be bothered by this, but let me go into it here anyway. Jerry soon found out that if we tried to put the Chevelle's right disc backing plate on the right side of the Camaro, the caliper would be at about 2:00 o'clock and would hit the Camaro's stabilizer bar whenever the wheels are turned.

Jerry promptly figured out that the caliper would have to be toward the back of the rotor—at 10:00 o'clock—to clear the



INSTALL CALIPERS on the backing plate, and then attach brake hose. Repeat for other side of the car

stabilizer. This meant installing the Chevelle's right-hand braking unit on the left side of the Camaro and vice versa. To do this, Jerry had to remove the support arm from the old Camaro drum backing plate and put it on the Chevelle disc backing plate. It's a simple swap—just two bolts and nuts—but this piece of figuring out actually made the conversion possible.

After installing the disc backing plate,
(Please turn to page 194)

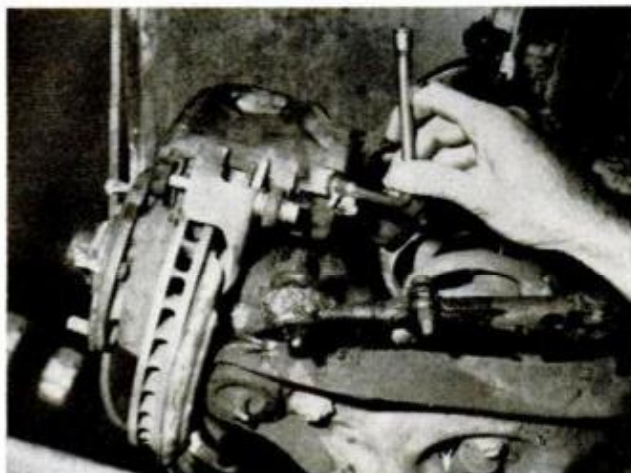
COSTS—Disc brake conversion

To whom paid	Item	Amount
Charter Way Auto Parts	One set 1970 Chevelle disc brakes, including spindles, backing plates, rotors, pads, master cylinder, vacuum booster, equalizer valve, and all lines	\$80.00
Wilson Way Alignment	Turn 2 rotors	20.00
Wilson Way Alignment	Labor to remove old drum brakes, install new discs plus equalizer valve and power master cylinder	75.00
Wilson Way Alignment	2 seals, brake fluid ...	5.00
Chase Chevrolet	Valve, tee, vac hose ..	4.12
Kennedy Auto Co.	2 used 14-inch deep-dish wheels	10.00
State of Calif.	Misc. taxes	4.25
	Total	\$198.37

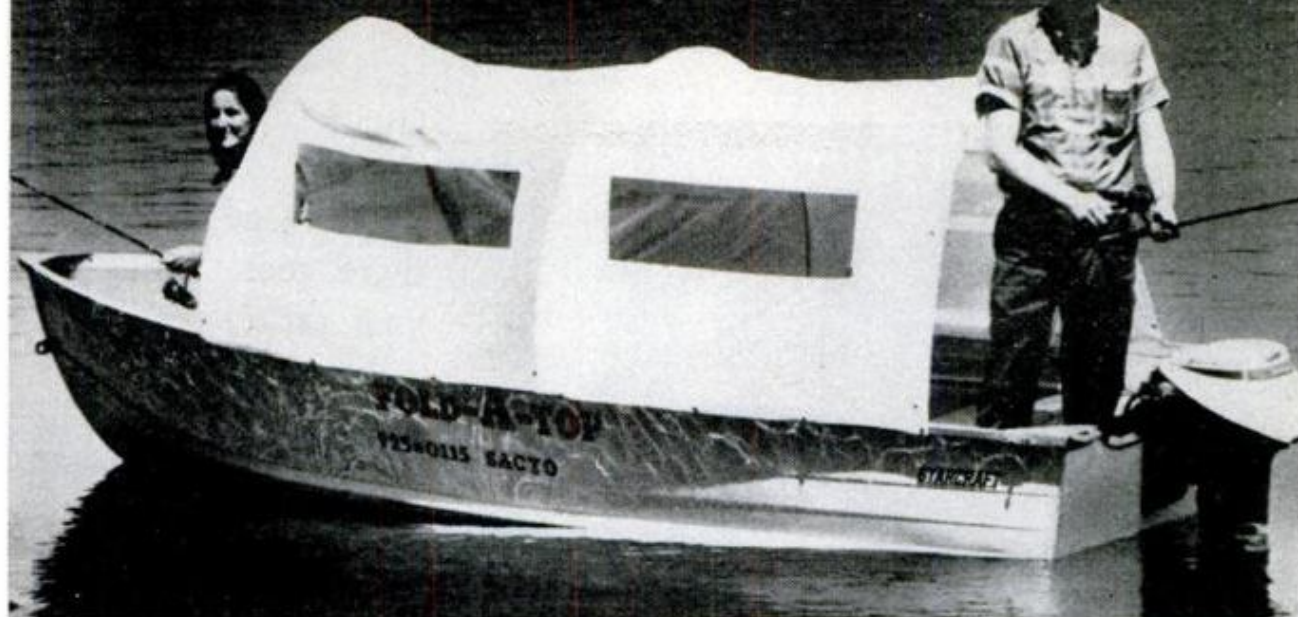


VACUUM BOOSTER with master cylinder integral is installed next. Connect all brake lines carefully

BLEED BRAKE LINES to finish job. Make sure wheels clear brake discs and that everything is tight



Especially for fishermen



COVERED-WAGON convertible-top shelter afloat comes from Fold-A-Top, 1827 Los Robles, Sacramento, Calif.

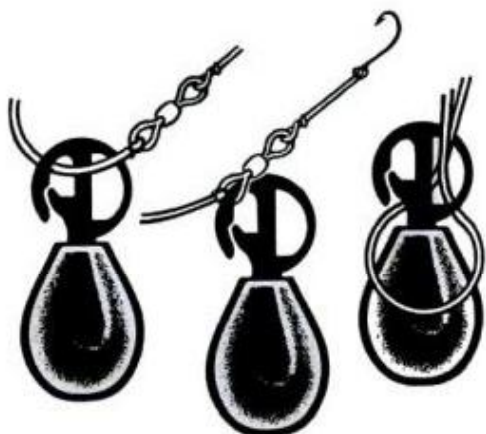
IF FISHERMEN aren't always smarter than fish, at least they are better inventors. New gadgetry includes convertible tops for skiffs and catterpillars, midget motors for bass boats, and innumerable lures for longer-life rods and reels. Besides the new twin motor, Electra Pal also has a piggyback electric that clamps onto gas outboards.

SIDE-BY-SIDE (right) from Electra Pal, 1133 Barranca, El Paso, Tex., doubles power for \$150

ONE HP from 8½ lbs. (far right) is Aquabug by Seaborne Systems, Island Park, N.Y. \$100

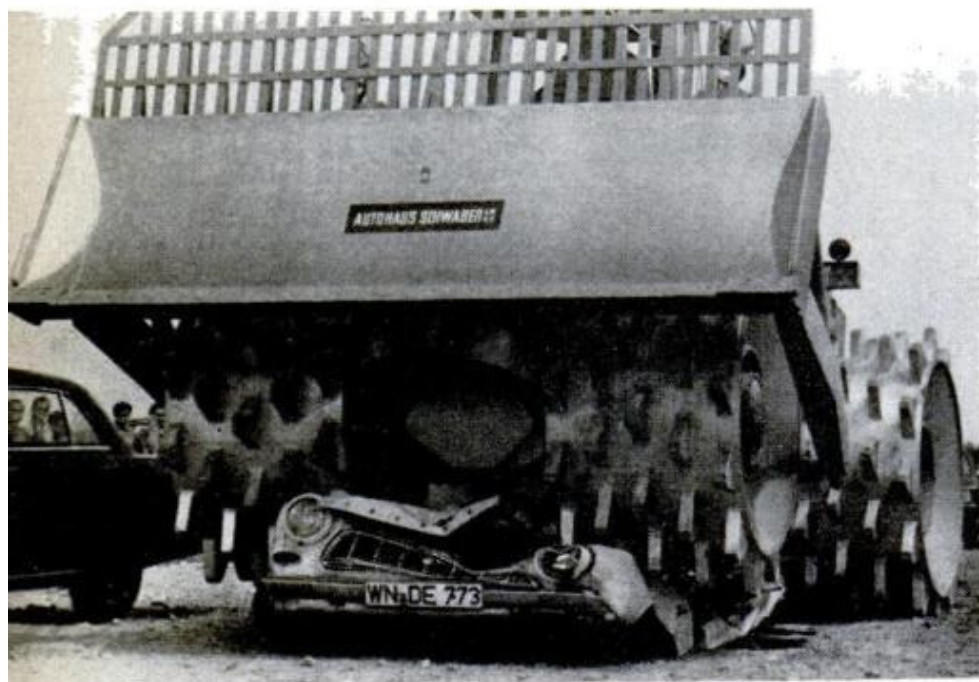
SINKER (below) to slide, snap, loop is Snap-Loc by Water Gremlin, White Bear Lake, Minn.

SMOKED FILLETS in seven minutes by Swedish Smoker. \$25. Ipco, 541 West 79th, Minneapolis



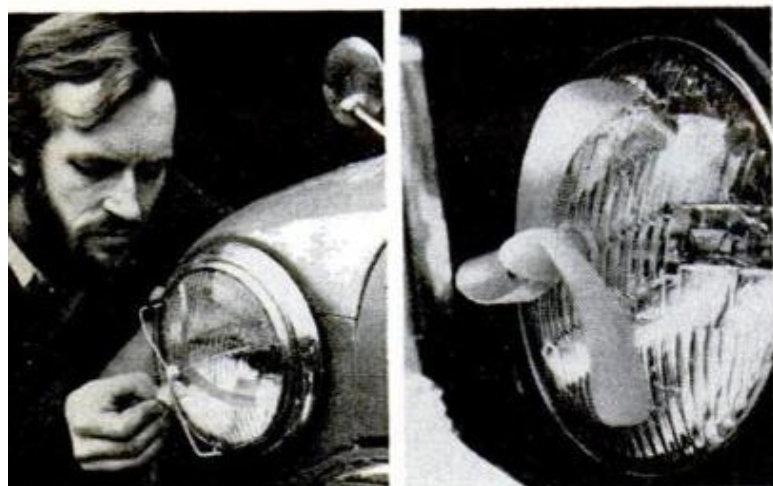
It's New NOW

The latest products and developments



Crunch, crackle, squash—and there goes your car

It looks like a bulldozer, but it doesn't push—it squashes. When the 22½-ton machine rolls over an object like a car, it crushes it almost literally into a pancake. Designed in West Germany to compact junk for disposal, this metal masher has huge spiked rollers powered by a 200-hp diesel engine. Spikes help to break up its victim for easier flattening.

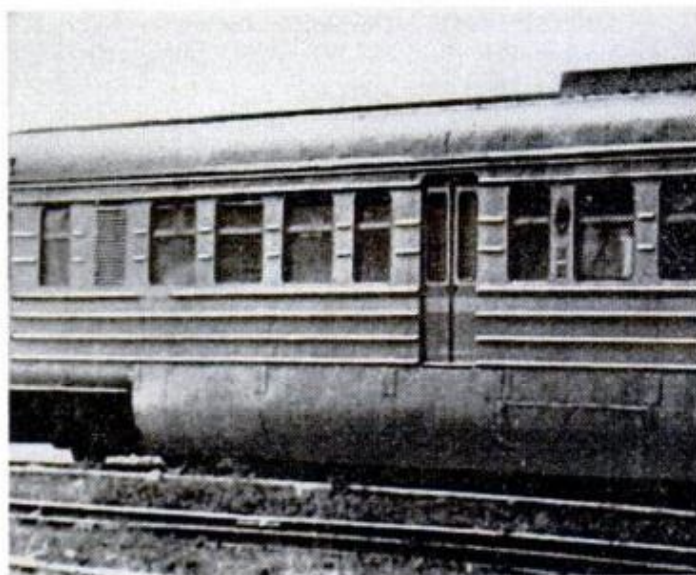


For better night vision: Now it's wipers for headlights

Two answers to the dirty-headlight problem are brightening the way for night drivers. At near left, a small plastic propeller, cemented to the headlight, is spun by air as the car moves, wiping the lens clean with tiny brushes attached to the blades. It's made by Wharton Engineering of Elstree, England. At far left, British inventor Douglas Finch uses a similar wind-driven propeller, but adds a stream of water from the windshield-washer supply.

Flying low: New jet-powered Russian train is like a plane without wings

Those two earlike pods at far right on the opposite page are real jet engines normally used to power Russia's YAK-40 airliner. Soviet engineers mounted the engines on this experimental rail car and came up with a jet-powered train that's already hit 155 mph in tests and is said to be capable of higher speeds on better roadbeds. Only problem: The jets, originally designed for high-altitude operation, had to be modified for sea-level use.





Hear-through headphones let in a little of the outside world

If you like to listen to hi-fi with earphones but find your family communicating with you by hand signals, here's an answer. Koss has come out with what it calls its "hear-through" headset that provides just enough venting to eliminate that deaf-to-the-world feeling. HV-1 stereo phones let you hear some outside sounds while still enjoying private listening. \$39.95. Koss Corp., 4129 North Port Washington Ave., Milwaukee, Wis. 53212.



Easy-to-use engine cleaner sprays right into your antismog valve

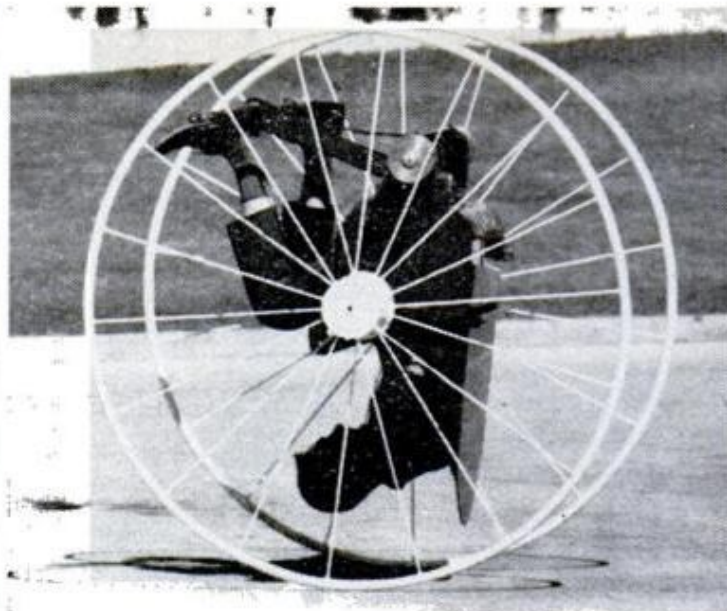
Want a cleaner, smoother-running engine? That's the object of Cyclo UpTune, an aerosol cleaner made for late-model cars with PCV antismog systems. It's sprayed into the PCV valve line, circulates through engine and is said to stop rough idling, reduce oil and fuel consumption, improve engine breathing. \$1.49. Estes Corp., Box 565, Minden, Nev.



You get a parking ticket even before you get a parking ticket

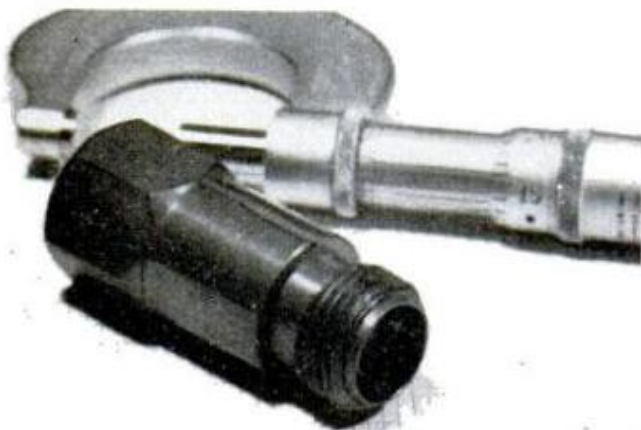
They have a new parking system in Paris. To save the cost of individual meters, there's one big meter at each lot. You put in your money and out comes a ticket stamped with your arrival time and amount of parking time paid for. This is displayed inside your windshield for easy checking by passing gendarmes. If overparked, you get another ticket.





Radar eyes may 'see' cars you can't in fog or dark

If you approach a car ahead too fast, a warning buzzer sounds and a light flashes in this experimental radar system designed by RCA to prevent rear-end collisions. Radar transmitter sends out signals reflected back by car ahead, indicating distance between the two. Closing rate shows on a dial and, if too fast, triggers alarm.



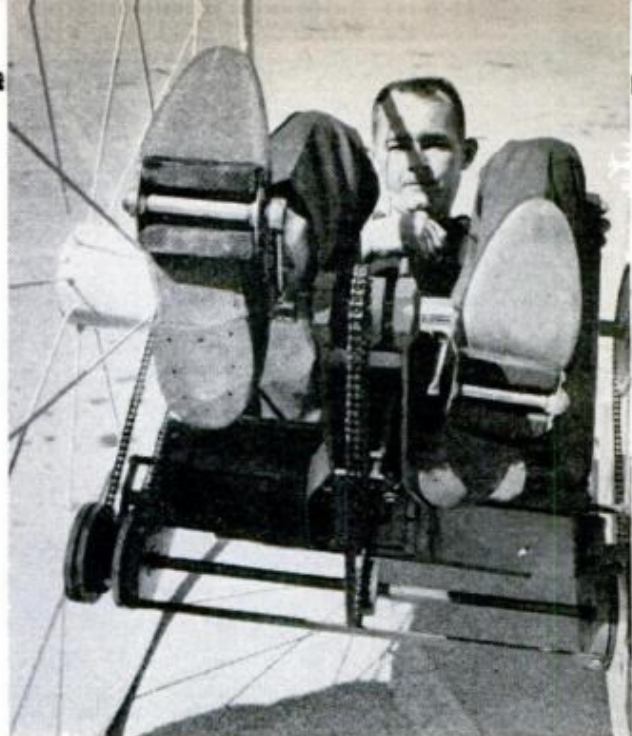
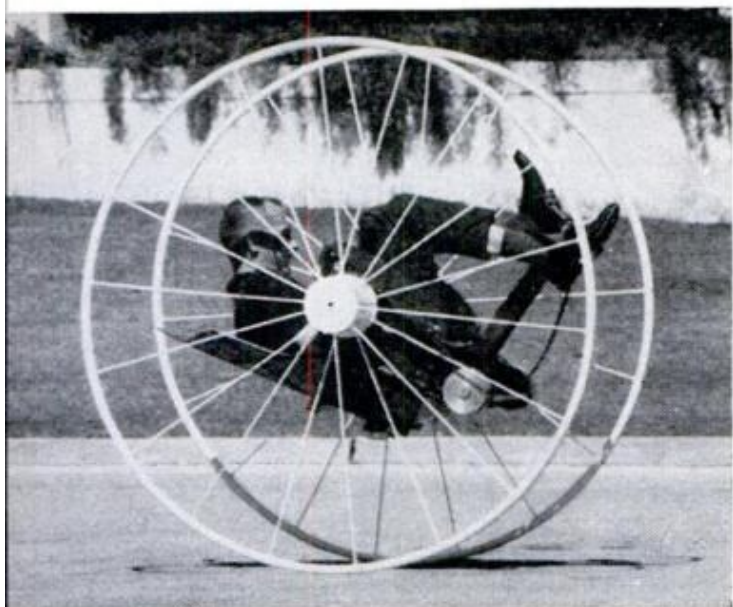
Sparkplug insert protects small gasoline engines

You can protect small engines when storing them with this handy device that simply replaces the sparkplug. It slowly releases chemical vapors said to keep rust, acid, varnish and lead from forming. In 14 and 18-mm sizes for use in mowers, snowblowers, trail bikes and similar equipment. \$1.49, or \$2.49 for two. Northern Instruments, 34 North Oaks Rd., St. Paul, Minn.

New stainless-steel prop: More speed for your stern drive

If you own an OMC stern drive, you can now get a Teflon-coated, stainless-steel prop for it that's said to increase speed up to 3 mph over conventional bronze and aluminum props and to be up to five times stronger. The new SST three-blader is available for \$79.50 from Outboard Marine, Evinrude and Johnson dealers.





Want a wild ride on wheels? Try this one for kicks!

Inventor Albert Hawver of Tampa, Fla., used to like to roll down hills in a tire as a kid. From that came this unusual machine he calls his "orbit cycle." The seat is slung between two huge 5-foot-diameter wheels,

powered like a bike through pedals, chains and sprockets. When you hit the brakes, the wheels stop, but seat continues to loop for added thrills (photos on facing page). Wheels can be independently powered for steering.



Outboard lever takes strain out of tilting heavy engines

Tilting up a heavy outboard when coming into shore often takes a lot of muscle. Foldable lifting bar at left eases the job by giving you extra leverage. A rod hooks into the engine's handhold, and the rubber-tipped, Y-shaped lower end rests against shroud, forming a fulcrum as you pull the handle. \$11.95. Bremer Mfg. Co., Box 548, Elkhart Lake, Wis.

Well, it's one way to take a bath: A 'washing machine' for people yet!

Bathtubs of the future may look like this egg-shaped model developed by Sanyo Electric Co. of Tokyo. Its action is as automatic as that of a washing machine except it's for people, not clothes. You climb in and devices inside scrub, massage and dry you—in less time that it takes to do a load of clothes.



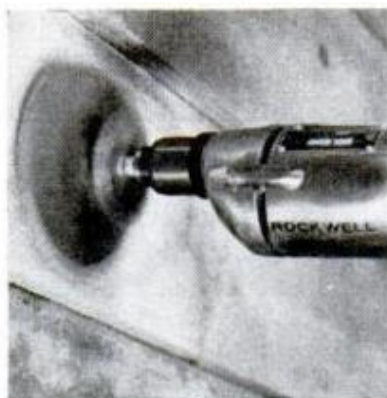
Light, roomy tent for four

It sleeps four, yet weighs under 10 pounds—handy for families who want to go tent camping without toting a backbreaking backpack. Another bonus: The nylon tent breaks down into three separate packs so no person has to do all the lugging. Floor area is 8x7 feet; headroom, 6 feet. White Stag, 5203 S. E. Johnson Creek Blvd., Portland, Ore. 97206.



Garage-sale kit includes tips galore for trading junk for cash

All you need for organizing and conducting a successful garage sale comes in this kit. It includes 4 large colorful "Garage Sale" signs, 300 assorted price tags and self-stick labels, 2 price and sign-marking pens and a detailed instruction booklet that tells you how to plan and announce your sale, price and arrange items, best time to have it. \$3.95 postpaid from Discovery Products, Dept. PM, Box 8, Miamisburg, Ohio 45342.



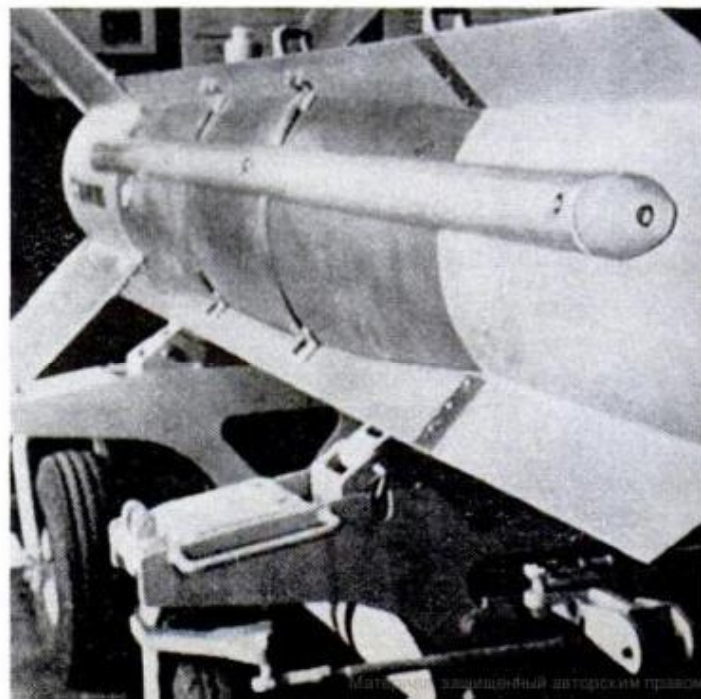
Sander goes round-and-round and back-and-forth

Counterrotating sander called the Miracle Imp converts the rotary action of a $\frac{1}{4}$ -in. drill to an oscillating motion that produces a supersmooth, swirl-free finish. Makes use of standard 5-in. sandpaper discs, accepts lamb's wool bonnet for mark-free polishing. \$4.95 at hardware dealers or \$5.45 postpaid from Haigh Mackay, Box 701, Rye, N.Y. 10580.

'Smart' bomb has built-in TV eye to spot its target

They call it a "smart" bomb because it can actually see where it's going and rarely misses. Its supersophisticated guidance system, already tested in Vietnam, is based on a television camera in its nose (far right, opposite page). The camera relays a picture of the target to the bomber pilot who, watching a TV screen, can guide the self-propelled missile to a direct hit. Developed by North American Rockwell, the bombs cost \$13,000 each.

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Frills to the gills: Fancy boats for fun-bound fishermen

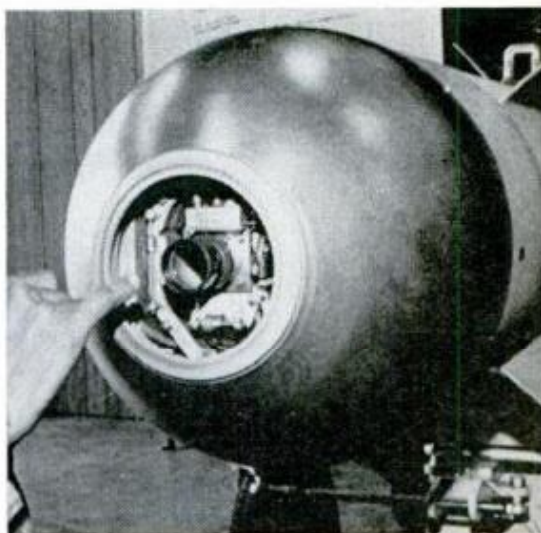
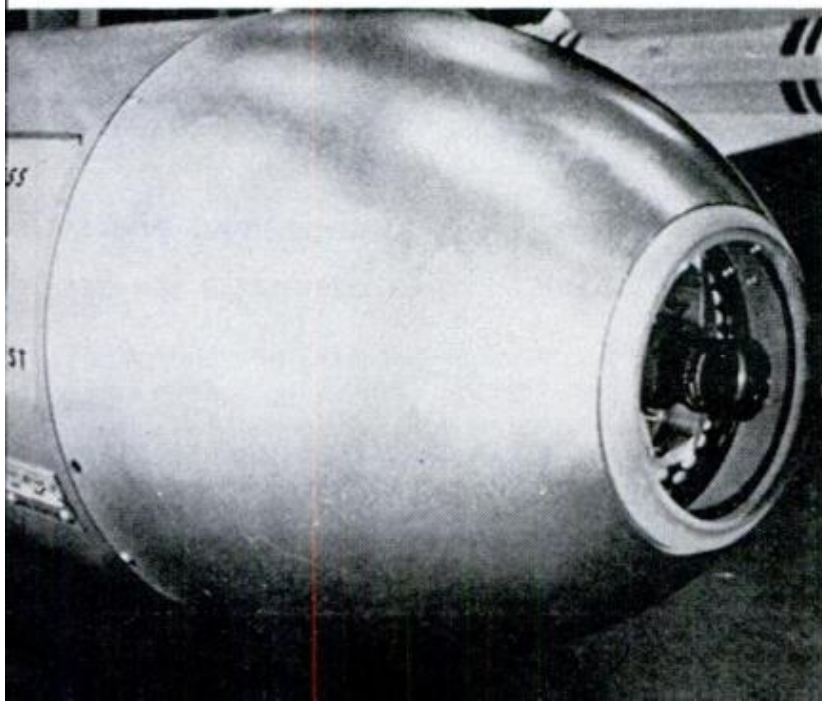
Newest fleet of Beaujack fishing boats from Glastron features a recirculating bait well along with such other conveniences as swivel seats, rod racks, lure trays and drink

holders. You have a choice of forward stick steering or conventional console. From \$929 for 14-foot models to \$1179 for 16-footers. Glastron Boat Co., Box 9447, Austin, Tex.



A car tape player you can make louder . . . and louder . . . and louder . . . and . . .

If this car stereo isn't loud enough for you as it is, you can make it even louder. The novel two-part system includes a basic 8-track player (lower left) that puts out 25 watts per channel. By adding a booster unit (upper left), you can double output to 50 watts. Price not yet announced. Metro Sound, 11144 Weddington St., North Hollywood, Calif. 91601.



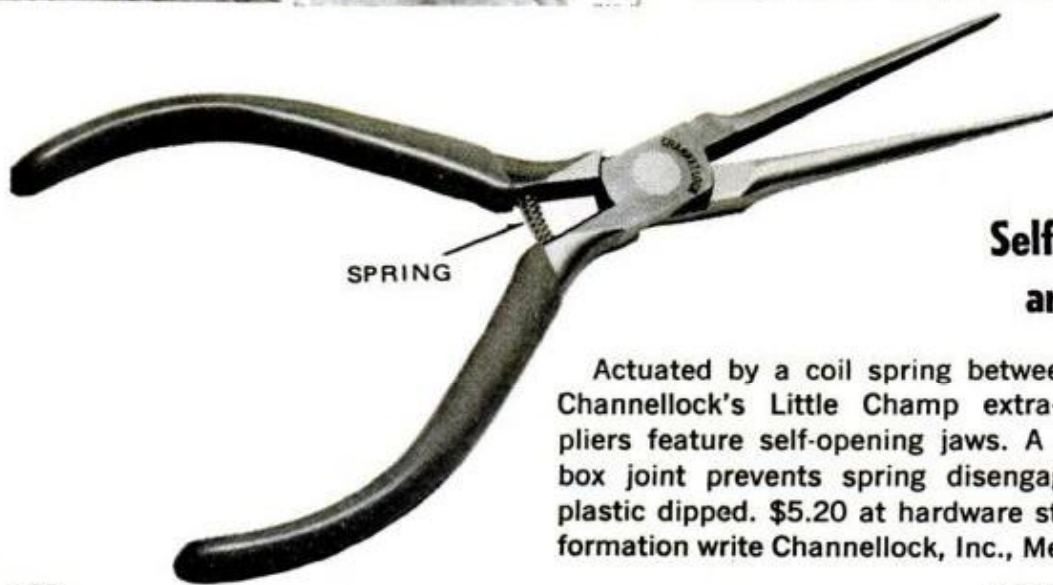
Hoseless sprayer you pressurize yourself

When a Sure Shot liquid sprayer is empty, you refill it, recharge it with an air pump, and use it again and again to apply stains, insecticides, lubricants, disinfectants, light-viscosity paints. Rated 200 lbs. air pressure. Quart-size, \$22; 6-oz., \$6.90. Milwaukee Sprayer Mfg. Co., 2437 West Fond du Lac Ave., Milwaukee, Wis.



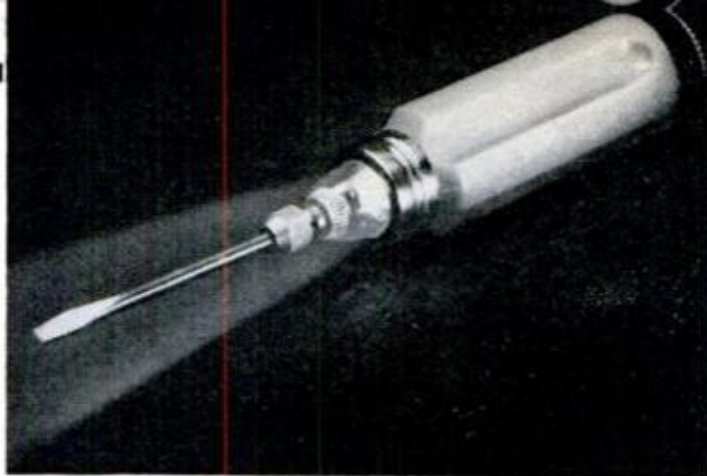
Now anyone can drill straight with an electric drill

Every hole you drill with your portable drill will be straight and on the mark with Stanley's new drill guide. You simply rotate the dial for the right-size drill, align the pointer with the mark and drill away. Guide accommodates 13 drill sizes up to $\frac{1}{4}$ in. Drill can't walk so there's no need to centerpunch, and rubber base protects surfaces. Extra drills store in handle. \$2.98 at hardware stores. Stanley Tools, 195 Lake St., New Britain, Conn. 06050.



Self-opening pliers are extra handy

Actuated by a coil spring between the hand grips, Channellock's Little Champ extra-long, needle-nose pliers feature self-opening jaws. A specially designed box joint prevents spring disengagement; grips are plastic dipped. \$5.20 at hardware stores. For more information write Channellock, Inc., Meadville, Pa. 16335.



Screwdriver lights the way

You can see what you're doing when working in dimly lit places with this screwdriver that has its own built-in light. Particularly handy in appliance-repair work. Penlight battery fits handle; turnbutton works light. \$1.50 post-paid from J.J. Welky, Dept. PM, 3550 West 120th St., Cleveland, Ohio 44111.

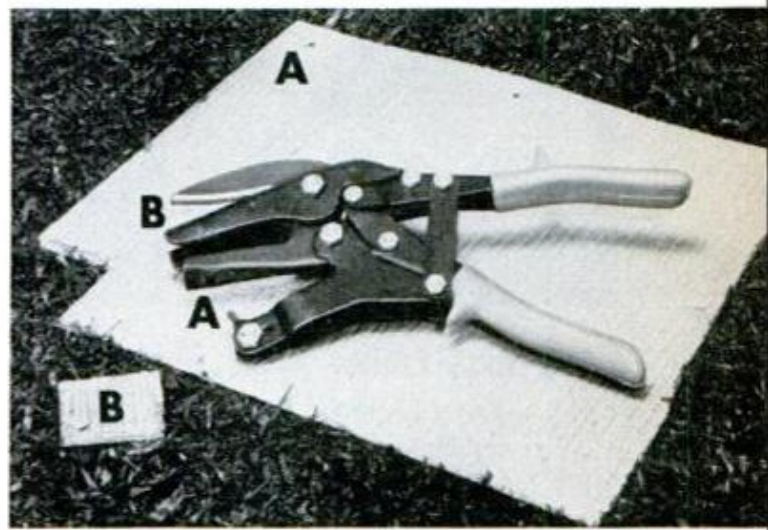


Economical CB radio for cars covers emergency channel only

Now you can call for highway emergency help without a complex, expensive, multichannel Citizens Band radio. This simple, economical CB set covers only CB channel nine, set aside for emergency use, and monitored by official agencies (including fire and police) and volunteers. The set transmits five watts, the legal maximum, sells for about \$60, complete with antenna. For further information, write: Tenna Corp., 19201 Cranwood Pkwy., Cleveland, Ohio 44128.

Portable tool punches and cuts through asbestos and slate shingles in a hurry

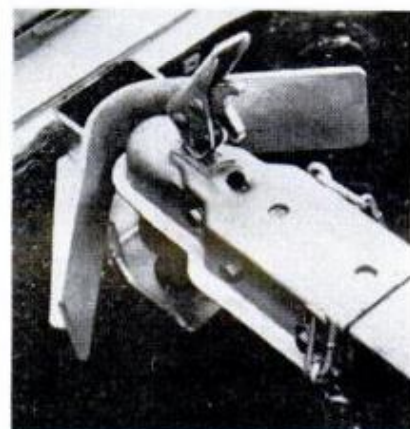
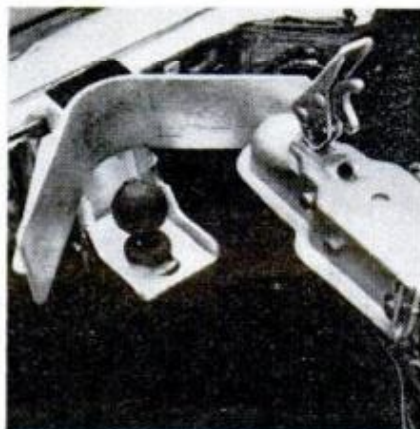
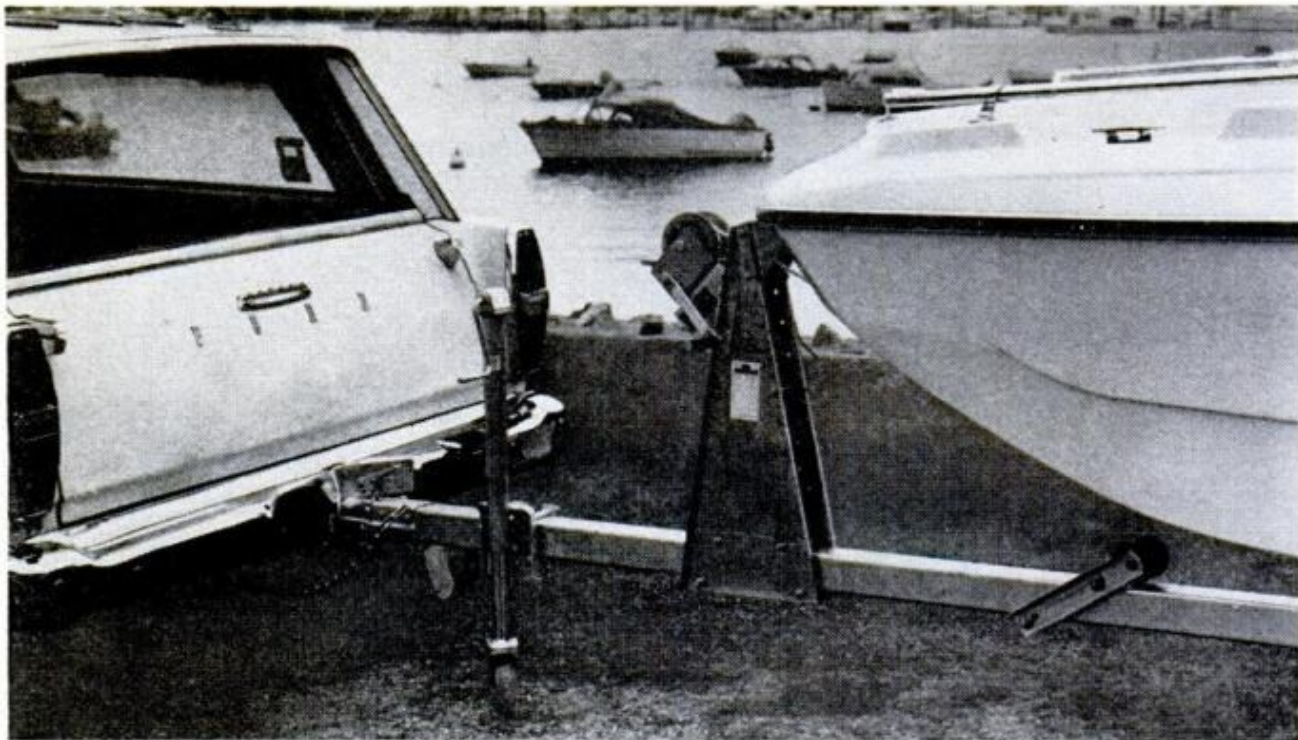
This dual-purpose shingle cutter is efficient enough to earn a spot in a journeyman's toolbox, yet it's priced to appeal to do-it-yourselfers. It boasts a punch (A) for making new nail holes, and nonadjusting jaws (B) that make short work of cutting notches in shingle. Tool features a specially designed, easy-grip, spring-back handle intended to cut down tiring aspect of shingling chores. Model K-7, \$10. Karl Klenk, Inc., Wilmington, Del. 19804.



Space-age engineering comes up with a 'welder' that even the beginner can use

Using a standard cylinder of propane gas and oxygen sticks, the Pyro 5 torch makes it easy and safe for the do-it-yourselfer to weld, braze and silver-solder. You drop an ignited oxygen stick into rear canister, screw down cap, open valve and light. Produces heat over 5000° F. \$39.95. Pryonetics, Inc., 10025 Shoemaker Ave., Santa Fe Springs, Calif.





Kant-Miss trailer hitch guide just can't miss

It's called Kant-Miss—and it doesn't. When you're backing up to hook onto a trailer, you don't have to worry about exact alignment with this handy guide. The V-shaped metal bracket automatically steers the trailer tongue

directly over the hitch ball with no annoying misses, mashed fingers or dents in the car. The accessory guide fits most standard ball hitches, sells for \$19.95. Kant-Miss Div., MFG Metal Fabricating Co., Ashtabula, Ohio 44004.

Versatile treasure finder spots nonmagnetic metals, magnetic metals, even minerals

You can use this versatile treasure finder either on land or in water, making it ideal for combing sandbars and river beds from a boat. The electronic detector will spot nonmagnetic metals such as gold and silver, magnetic metals and ore minerals. Goldmaster Forty-Niner, \$139.50. White's Electronics, 1012 Pleasant Valley Rd., Sweet Home, Ore. 97386.



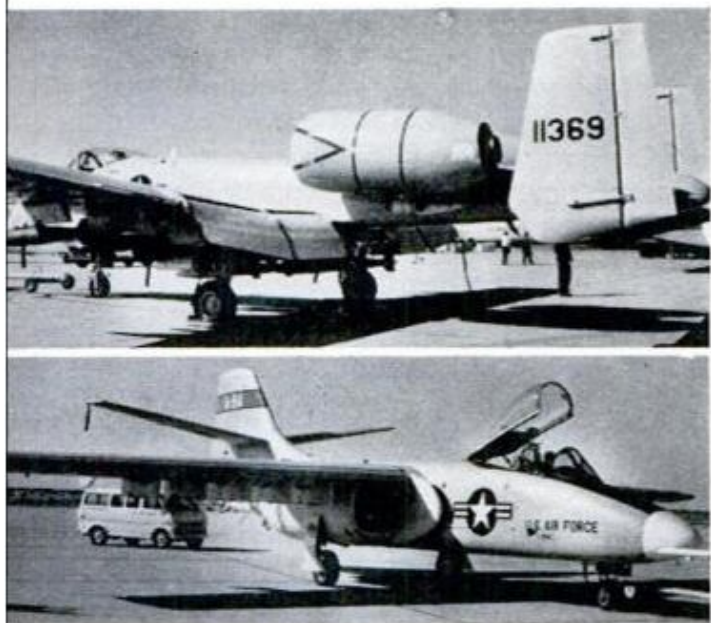


An automotive timing light you can build from a kit

It takes only about two hours to assemble this low-cost, kit-built timing light for automotive tune-ups. The pistol-style light is trigger-operated and said to produce flashes



bright enough to be visible even in direct sunlight. Solid-state CI-1020 kit has built-in shock and reverse-polarity protection, \$19.95. Heath Co., Benton Harbor, Mich. 49022.



Two tough new jungle fighters

The Air Force is looking for a tough new breed of ground-support aircraft for close-in jungle fighting. The planes are to be designated A-X for Attack Experimental. Two entries in the running for Air Force consideration are Fairchild-Hiller's twin-tailed, turboprop A-10-A (top photo above) and Northrop's single-tailed A-9-A version (lower photo), also powered by turboprop engines. Both ships can carry virtually any armament, have short landing and takeoff characteristics, can fly at low speeds and altitudes, and are heavily armored for protection against ground fire.

NOVEMBER 1972



Pump for all purposes

This handy all-purpose pump can drain a flooded cellar or serve equally well as a circulator for a decorative garden waterfall. The 7½-pound portable Geyser submersible pump takes in water through a screened bottom inlet and handles 20 gallons a minute. It has an outlet connection for ordinary garden hose or 1-inch pipe and comes with 8-foot grounded cord. Price is \$39.95, plus \$2 postage. J. W. Holst, Inc., 1005 East Bay St., East Tawas, Mich. 48730.

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Build a kit, catch a fish

Locating fish by knowing water temperatures at various depths is fast becoming the scientific way to come home with a good catch. This Heathkit Thermo Spotter records temperatures electronically from a sensor on

a 100-foot line. By noting temperatures and depths, you can plot thermal patterns where fish are feeding. Kit is \$24.95, includes fish temperature charts. Heath Co., Benton Harbor, Mich. 49022.

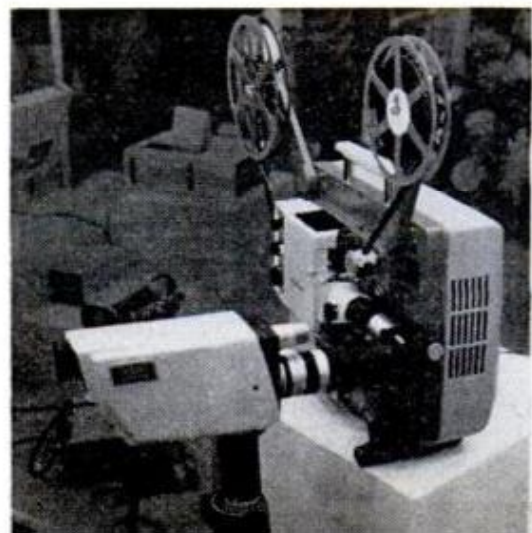
New shapes in home electronics

Experimental home electronic consoles seen at the 1972 Consumer Electronics trade show, left to right: Cantilevered Sanyo VTC-4100 has TV, AM-FM stereo receiver, EIAJ-standard $\frac{1}{2}$ -inch video cartridge recorder. Panasonic SE-1 four-channel consolette has pull-out front speaker storage, matching rear speakers. Dokorder 9000 has phono, tape, AM-FM stereo receiver in professional-looking cabinet. Can you buy them? Maybe in a year or two—but don't hold your breath.



Coming in January: Home movies on your TV

Hook Akai's new Telecine attachment (available in January) between your home movie projector and an Akai video camera, and you can show your movies on TV—or put them on videotape. The \$149.95 Telecine fits Akai's new \$2850 color camera (shown) or black-and-white video cameras from \$695. Matching video recorders available. For information, write Akai America, Inc., 2139 East Del Amo Blvd., Compton, Calif. 90220.





It's only a model, but it flies like a real plane

This strange-looking craft is actually a 3/4-scale prototype of a utility bush and cargo plane designed by David Lockspeiser. It has stubby wings for unobstructed visibility, huge tail surfaces for stability and four landing wheels that enable it to straddle detachable cargo pods for pickup. The "model" is 22 feet long and flies at 85 mph; the production version will be 30 feet long and is expected to hit up to 150 mph.



Tool stalls keep order in shop

A place for everything and everything in its place best describes this new patented system for storing hand tools. These unique wall racks have 30 assorted interchangeable separators to provide individual stalls for every screwdriver, chisel, plier, drill bit you own. Each Tool-Stal sells for \$15.20 postpaid. Lee and Camp, Box 32, Latham, N.Y. 12110.

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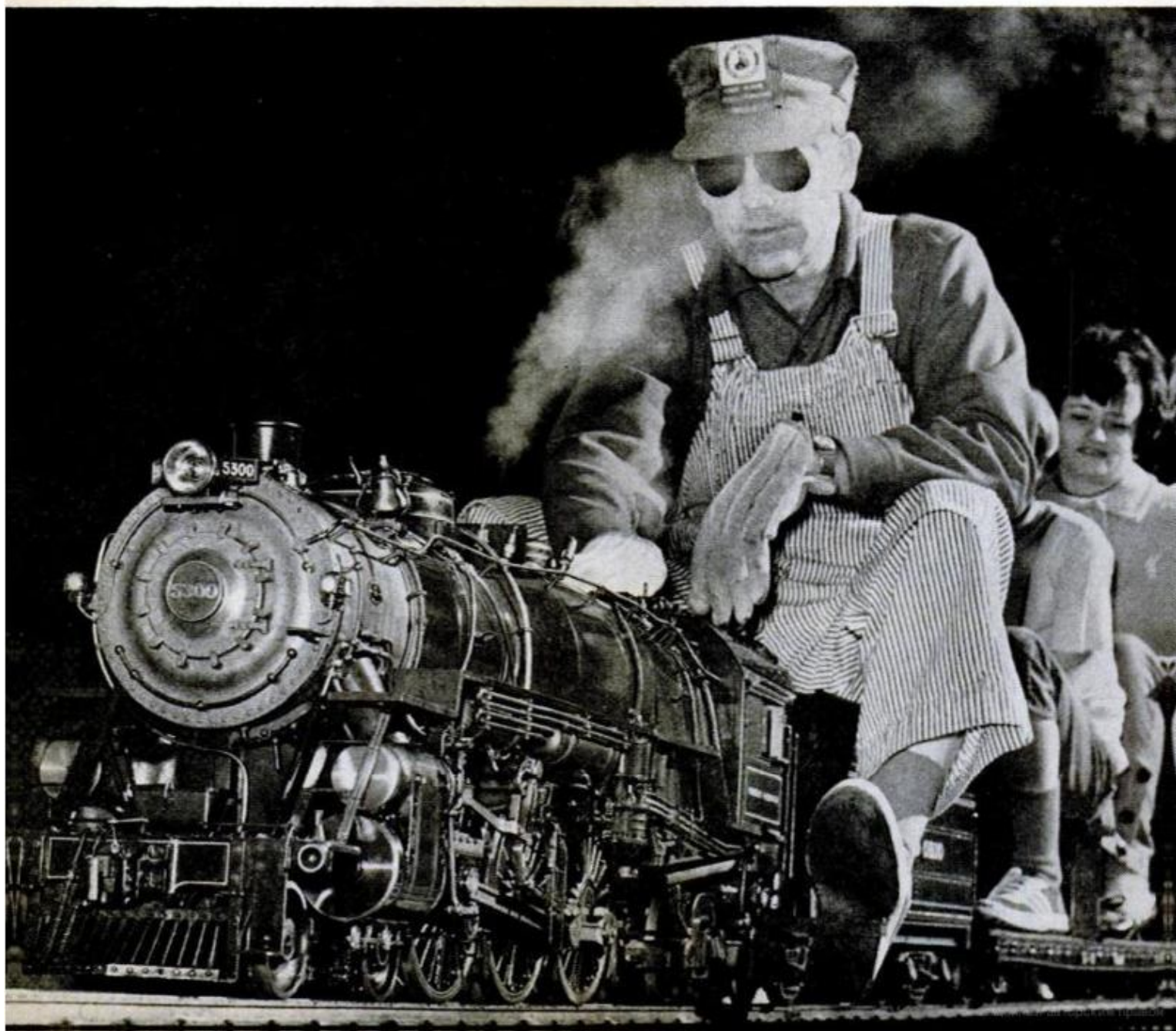


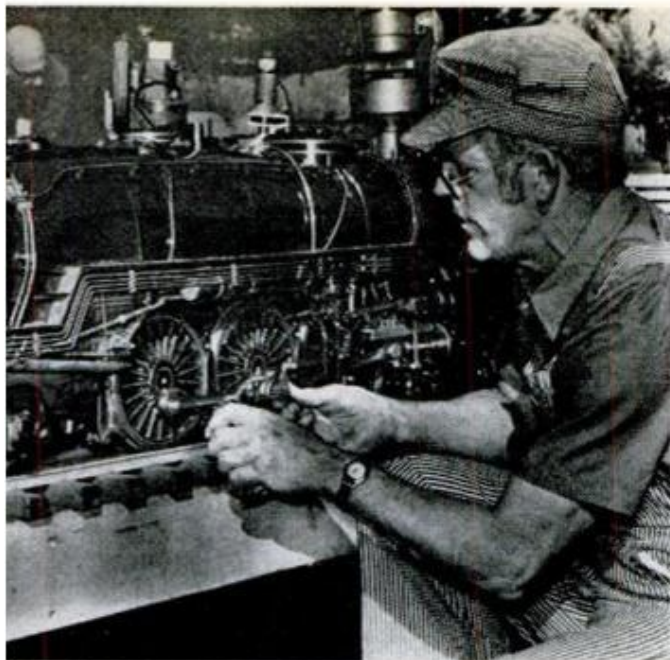
BITE-SIZE CHUNKS of soft coal go into firebox of the President Washington. The 250-pound replica has a top speed of 7 mph and can pull as many as 10 passengers on flatcars



Old 5300 rolls again

Photos by Ralph L. Emerson





DOUG ALKIRE OILS locomotive before making run. Plugged into smokestack (seen next to Doug's head) is electric blower for creating draft in firebox after Doug "lights off"



TENDER IS A GEM of authenticity with its green paint, gold lettering and 3200 rivets

IT TOOK DOUG ALKIRE seven and a half years—13,600 hours, he figures—to build the one-twelfth scale model of the President Washington. Old 5300 was one of the "presidential" series of locomotives that hauled passengers for the Baltimore & Ohio when steam was king of the road.

Many of the parts were fashioned from scrap—blocks of aluminum, steel, brass and cast iron. Some pieces of steel were welded, then shaped with a file. Careful filing made parts look like castings.

A Southern California mechanical engineer, Alkire used hand tools, an old lathe and an arc welder for most of the work. Side rods and gears were machined from hot-rolled steel bar stock, finished, polished and case-hardened.

Like the locomotive, the tender was constructed with economy in mind. It was fashioned from scrap and surplus stock.

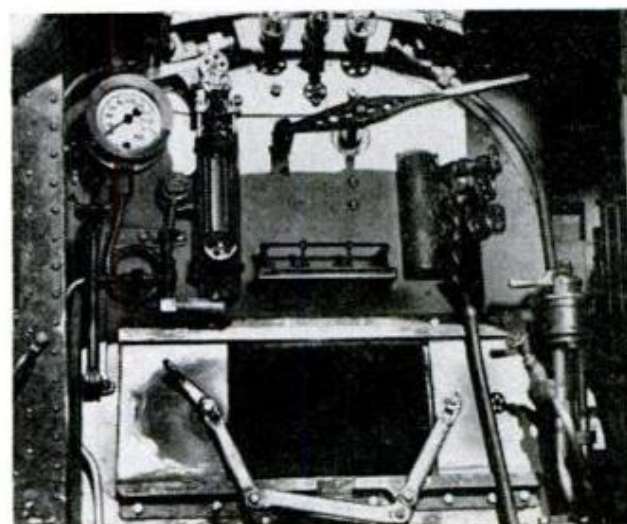
Its palmetto green paint and gold leaf lettering add to the authenticity. In addition to a coal compartment, the tender contains a welded stainless-steel tank that holds enough distilled water to keep the President Washington rolling for an hour and a half.

Alkire runs his engine in a public park that has track and other facilities for replica railroading. That's where he spends many an afternoon with fellow enthusiasts. It's a great way to let off steam. ★★★

NOVEMBER 1972



THREE SAFETY VALVES bleed off steam when the pressure in the boiler tops 140 pounds

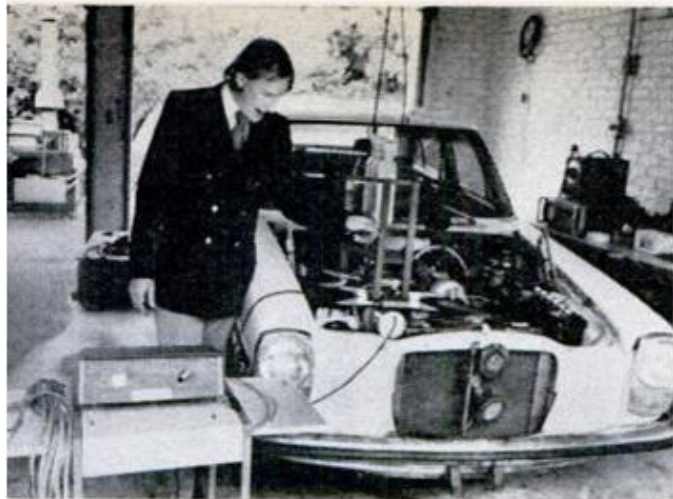


MORE PRECISE DETAIL is seen inside cab. Lever next to the sight glass is the throttle

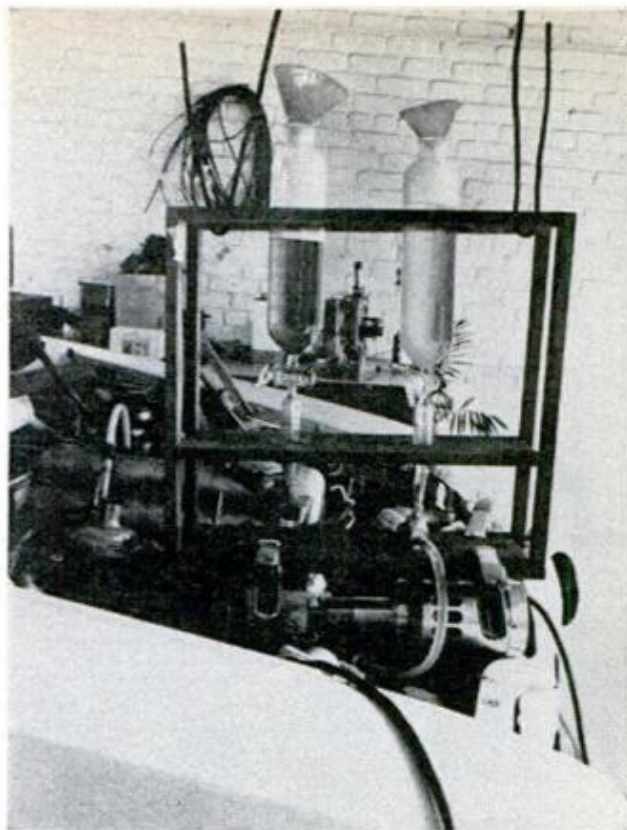
A furnace that 'burns' water

A revolutionary combustion system makes it possible to 'burn' emulsions of fuel and water. It works in a car engine as well as an oil furnace—and cuts pollutants, too.





INVENTOR ERIC COTTELL runs auto engine on mix of 85 percent gasoline and 15 percent water. Liquids (right) flow from glass graduates into reactor, next to fender, and from there to the carburetor



By **JOHN F. PEARSON**, Science Editor

IT'S IMPOSSIBLE. An oil burner simply can't run on a fuel that is one-third water—tap water, at that. But I recently saw it done.

The demonstration was at the Bayville, N.Y., home of Eric C. Cottell, a British-born engineer and inventor. The gadget that made the "impossible" happen is a Cottell invention called the Ultrasonic Reactor—a device resembling a long, slim electric motor. It contains a crystal stack at one end and a mixing chamber at the other.

When a 60-cycle current is applied, the crystals vibrate at 20,000 cycles per second, turning the reactor into a "super-blender." As shown in the diagram, oil and water (70 percent oil, 30 percent water) flow into the reactor, where a terrific "vibrating" force causes water and oil molecules to rupture. The two liquids form an emulsion in which tiny particles of water are dispersed throughout the oil. When this happens, says the inventor, the surface area of the water is increased millions of times. Thus, when the emulsion hits the furnace's combustion chamber, the water "explodes" into superheated steam, adding to the energy output of the oil.

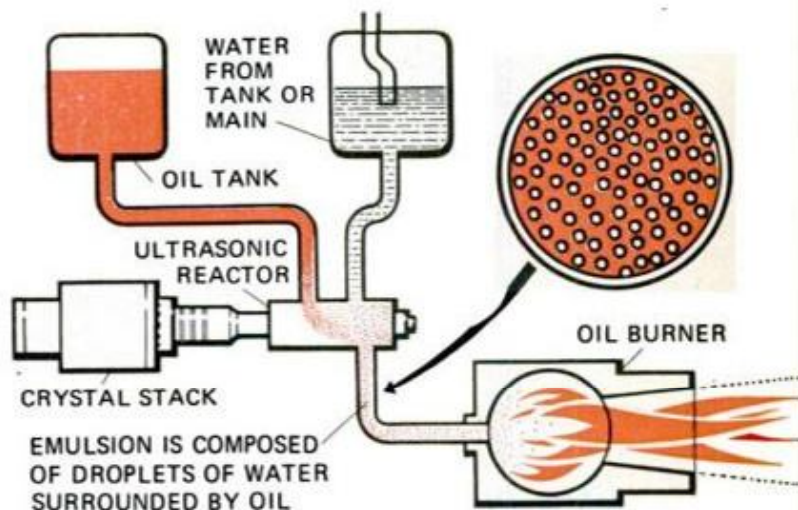
In hundreds of tests of his system, Cottell has found that ordinary boilers run at efficiencies close to 100 percent—an astounding result that neither he nor leading combustion experts can explain. In the

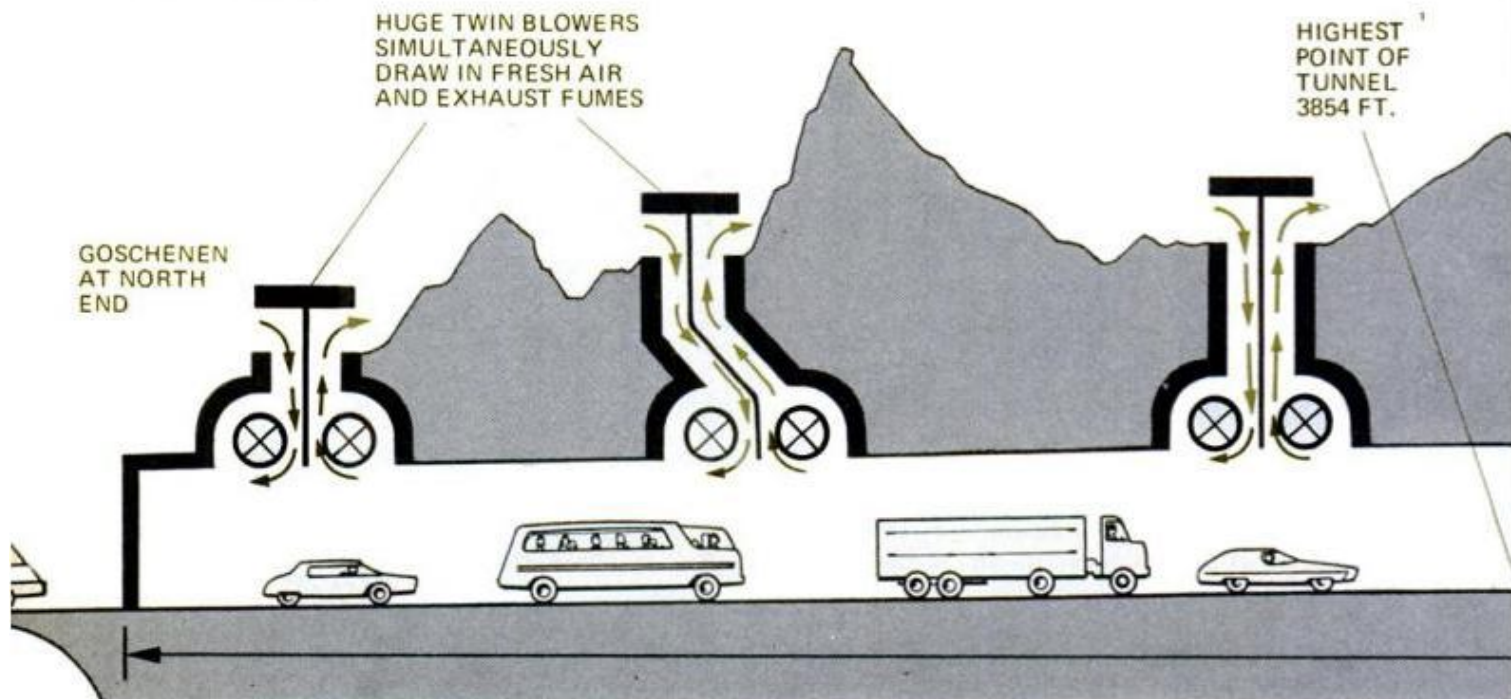
demonstration I saw, gauges indicated that the emulsion produced the same amount of heat as a 100-percent oil fuel.

In addition to stretching fuel, the system reportedly produces fewer pollutants than standard oil combustion. The fact that one-third less oil is burned is a key anti-pollution factor.

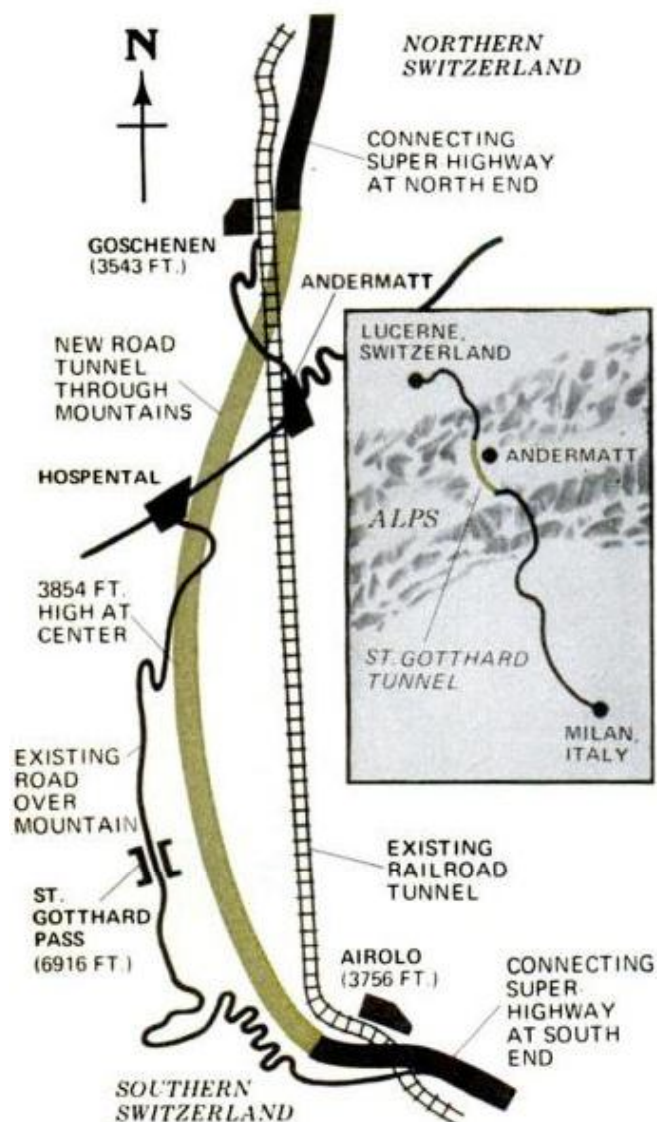
Though Cottell sees many potential applications for the reactor—in auto, ship and plane engines, for example—he thinks the best immediate application is in heating plants of large apartment buildings.

"This is by far my most exciting invention," says Cottell, who holds patents in the fields of ultrasonics, hydraulics and chemistry. ★★★





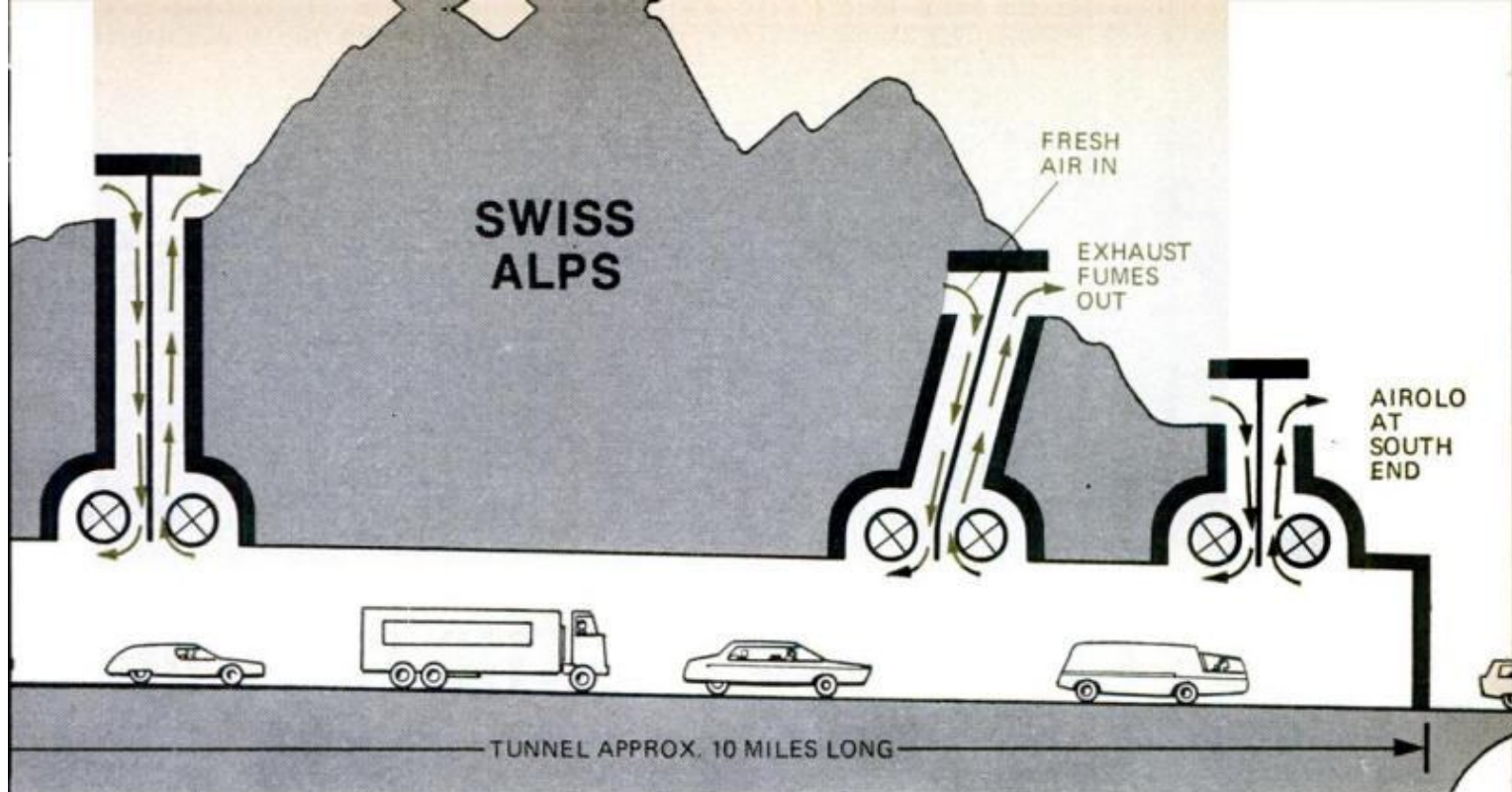
The tunnel they said



SOMETIME IN 1978 cars will start rolling through the world's longest vehicular tunnel—a tunnel once thought to be an engineering impossibility. Extending 10 miles through solid rock in one of the most mountainous regions of the Swiss Alps, it will run from Goschenen in the north to Airolo in the south. It will be called the St. Gotthard Tunnel because it will be bored under famous St. Gotthard Pass, one of the highest and most awesome passes in the Alps.

Though seemingly short, the tunnel will have the effect of piercing a barrier that has divided Europe for centuries. With connecting superhighways, it will open the way to greater trade and travel between France, Belgium and other northern countries and Italy and the Mediterranean to the south. Except for a rail link, the only way through this part of the Alps at present is over a steep, twisting mountain road—slow, treacherous and impassable in winter snows.

Engineers have studied the St. Gotthard project for decades, but other, much shorter tunnels proved so costly in loss of life as well as time and money that one of St. Gotthard's length seemed beyond all hope. Fierce heat, poisonous fumes, sudden cave-ins and flash flooding make such a tunnel a perilous undertaking. Still, modern technology is now pushing the tunnel through—and at a speed undreamed of a few years ago. Working around the clock, tunnellers are advancing at the rate of 34½ feet a day and eventually hope to up



couldn't be built!

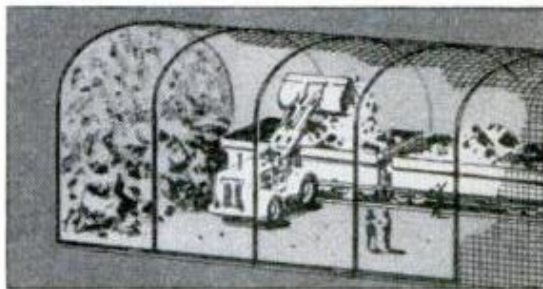
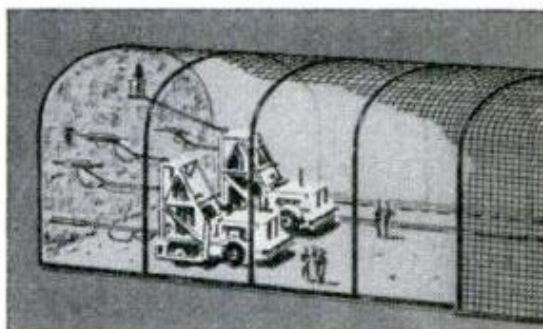
By F. C. LIVINGSTONE

this to 46 feet. Early tunnellers took as much as a month to move the same distance.

Two huge drilling rigs, working side by side, move slowly forward, their boom-mounted, hydraulically operated drills boring blast holes in the rock face. The holes are then filled with explosive charges, the drilling rigs back away, and the charges are set off. As the dust clears, rails are already being laid for a train of mining-type ore cars to roll in on. Diesel-powered bucket loaders quickly fill the cars with blasted rock, the train pulls out, and the drilling rigs move in again to repeat the process.

When completed, the tunnel will have six huge ventilation shafts extending to the surface. Powerful blowers will simultaneously pull in fresh air while exhausting engine fumes. The roadway curves slightly upward at the center to provide natural drainage toward either end. There will be fire, police and repair facilities along the way to aid motorists, plus emergency escape tunnels branching off to the sides. The vast project will cost an estimated \$82.5 million and involve the removal of more than two million cubic yards of rock. In all, the St. Gotthard Tunnel will represent the greatest single achievement of its kind in engineering history. ★★★

BOOM-MOUNTED DRILLS bore blast holes as mammoth mobile rigs move along tunnel side by side (lower right). Drawings at upper right depict drilling of rock face and loading of rail cars. Cagelike screening protects men from falling rock
NOVEMBER 1972





HELICOPTERS SPOT ACCIDENT SCENES

TV CAMERA IN
COPTER RELAYS
PICTURE OF
TROUBLE AREA
BACK TO
CONTROL CENTER

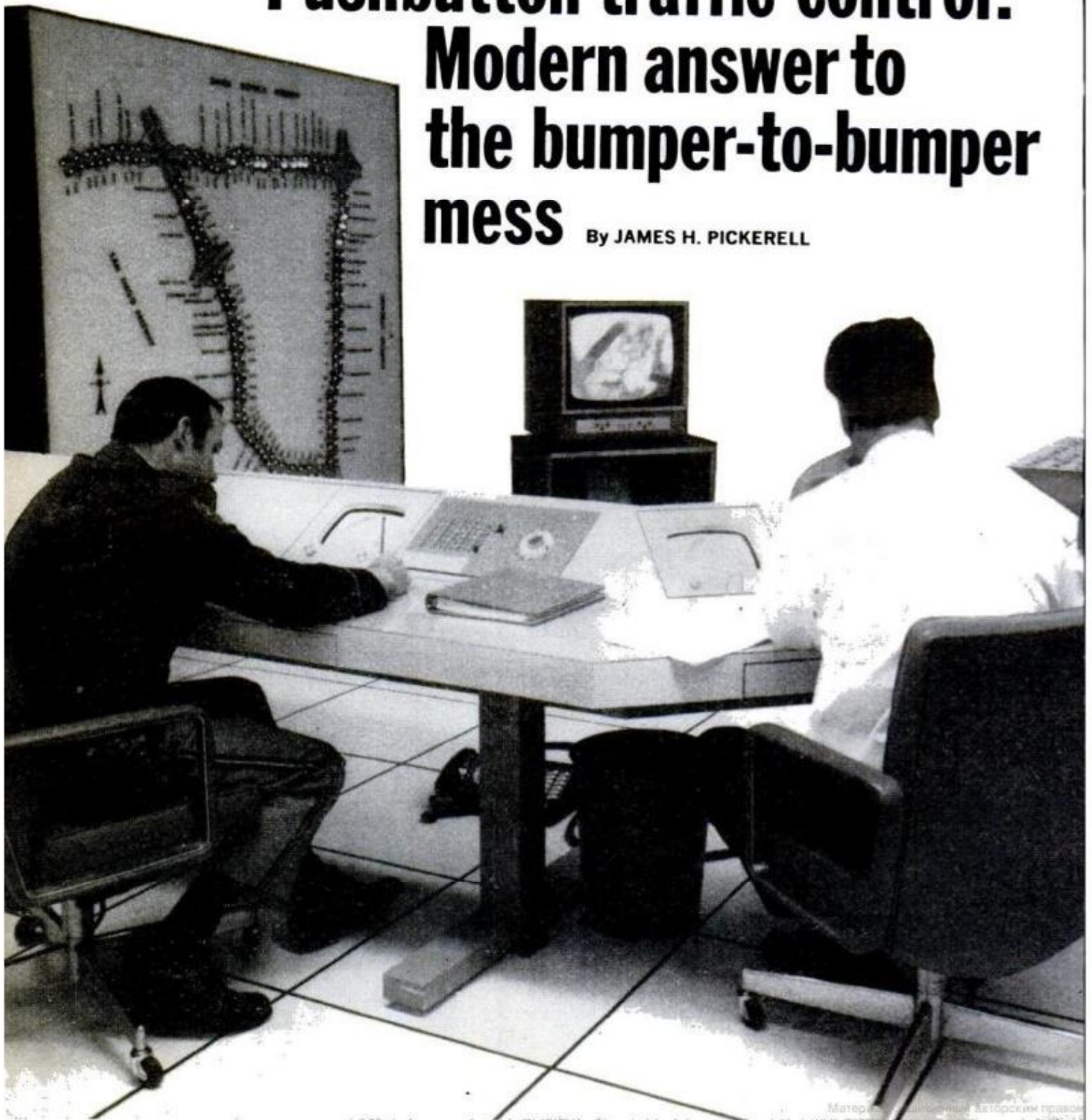


ACCIDENT BLOCKING
TRAFFIC



Pushbutton traffic control: Modern answer to the bumper-to-bumper mess

By JAMES H. PICKERELL



ROADSIDE RADIO ALERT BULLETINS



CHANGEABLE HIGHWAY WARNING SIGNS

SIGNS CHANGE
AUTOMATICALLY
ACCORDING
TO ROAD
CONDITIONS
AHEAD



LITTLE LIGHTS start blinking on a wall-size road map. A traffic-control officer sitting at a console looks up, grabs a mike and begins barking orders. The lights mean trouble. Out on a major California freeway there's something wrong.

Watching the lights, the traffic controller radios the location of the trouble to a cruising police helicopter, and within seconds the pilot is over the area, aiming a TV camera at the scene below. A picture on a monitor screen in the controller's console shows a jackknifed trailer truck, several wrecked cars and possible injury victims. Traffic is rapidly coming to a stop.

Punching a battery of pushbuttons and issuing a quick series of commands, the controller dispatches police, ambulance and wrecking equipment to the crash scene. Another controller sends patrol cars to interchanges preceding the area to warn motorists and divert them off the freeway. Within minutes, the crash area is completely sealed off, the wreckage is being cleared away, and traffic is being rerouted to keep it moving—all done by a few men in a control room miles away.

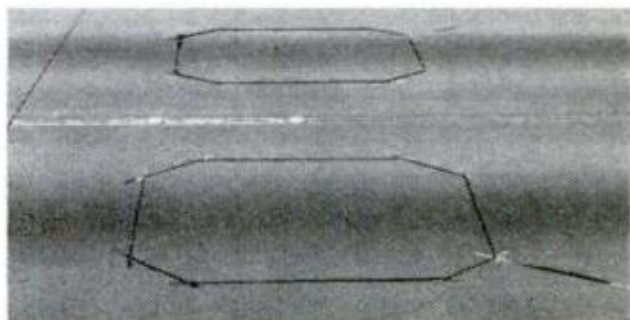
The system is part of a bold new plan by the California Highway Dept. to automate traffic control to speed help to motorists and avoid the kind of monumental bumper-to-bumper jams that can bring traffic to a standstill. The plan at present involves a 42-mile "loop" where the Santa Monica, San Diego and Harbor freeways all come together in Los Angeles—three of the most heavily traveled highways in the world. In front of the controllers is a huge map of this loop with its 56 interchanges, dotted with dozens of tiny different-colored lights. The entire

42-mile stretch is "wired" with electrical sensors embedded in the roadway. The sensors are tied in with a computer programmed to indicate normal traffic speeds and densities for any given time of day.

The minute cars rolling over the sensors slow to speeds below the preset normal limits, lights on the map start to flash. The color, position and number of lights that go on all help to indicate the possible cause. If they flash on briefly, it's probably just a temporary slowing of the traffic flow. But if they stay on, it's almost certainly the beginning of major trouble.

The illuminated map board and TV monitoring facilities are only the first step in a far-reaching traffic automation program including other highly sophisticated aids. One proposal is for the installation of electrically operated roadside warning signs that can be changed remotely by traffic controllers to advise motorists of road conditions ahead. Another is for radio bulletins broadcast over underground cables that could be picked up only by cars in the immediate vicinity to warn them of approaching dangers. ★ ★ ★

METALLIC SENSORS in road record traffic speed and density as cars roll over them. There are 700 such sensors, spaced a half mile apart, in the 42-mile Los Angeles automated traffic control system



The simple way to adjust VW valves

With these step-by-step instructions, you can adjust the valves on a '71 Beetle. This article is an excerpt from a new book offered by PM; other books in the series enable you to tune up '64 through '71 VWs.

THE PROCEDURE shown here for adjusting 1971 Volkswagen valves is condensed from a new booklet in a series now available from *Popular Mechanics*.

The booklet shows how to do the major maintenance jobs on the '71 Volkswagen Beetle. Included are step-by-step instructions for servicing the air cleaner, generator belt, sparkplugs, ignition timing and carburetor and emission-control unit.

Other booklets are available for complete tune-up instructions for Volkswagen models 1964 through 1971. You can order them individually—by year—at \$1.99 each.

Popular Mechanics also offers an en-

larged booklet covering tune-up instructions for all VW models 1965 through 1971 for just \$2.95.

To order, send a check or money order to *Popular Mechanics*, Dept. XYZ, Box 1014, Radio City, N.Y. 10019. Be sure to tell which booklets you want—and include your complete mailing address with your zip code.

Next month, *Saturday Mechanic* will cover the simple way to check and adjust the distributor points on 1970-71 Toyota Coronas with the 8R-C engine. Again, this will be just one section of the Toyota booklet available from *Popular Mechanics*.

RECOMMENDED TOOLS AND SUPPLIES

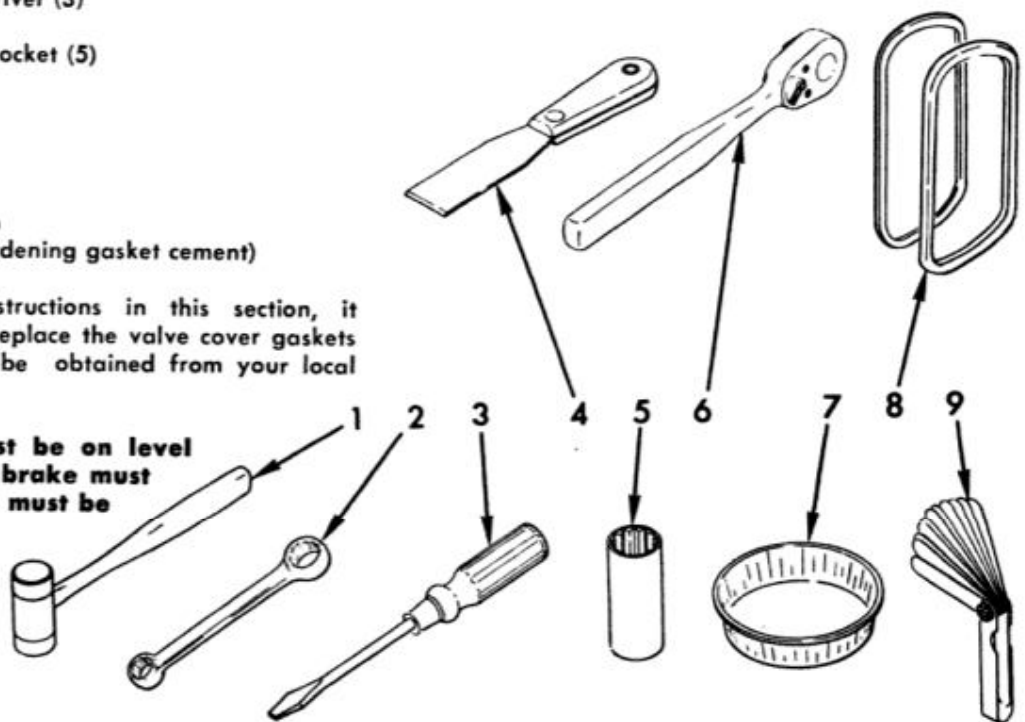
- Rubber or plastic mallet (1)
- 13-mm wrench (2)
- 6-inch common screwdriver (3)
- Putty knife (4)
- 13/16-inch deep well socket (5)
- Ratchet handle (6)
- Drip pan (7)
- Feeler gauge (9)
- Clean cloths
- Nonflammable solvent
- Chalk, pencil or crayon
- Gasket shellac (nonhardening gasket cement)

While performing instructions in this section, it may be necessary to replace the valve cover gaskets (8). The gaskets may be obtained from your local parts dealer.

WARNING: Car must be on level ground. Emergency brake must be on. Transmission must be in neutral.

Be sure engine has been allowed to cool overnight or a minimum of four hours before performing the valve adjustment.

Factory-recommended valve settings are based on ambient temperature of 79°F.

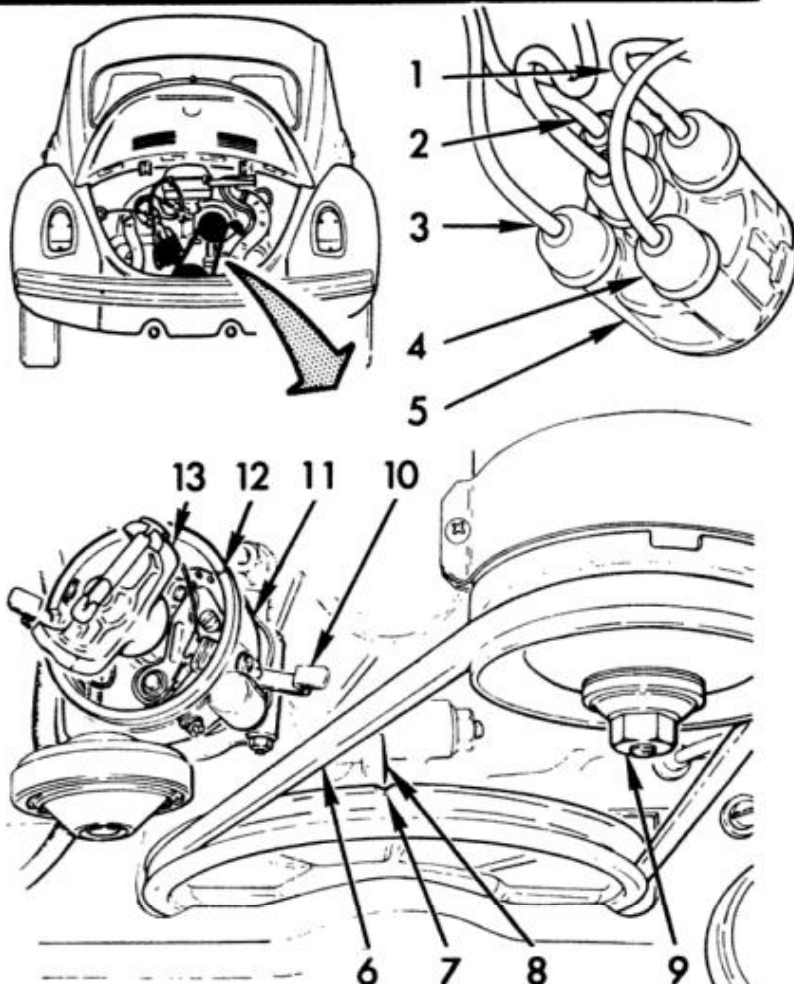


1. Mark a vertical line (12) on distributor body (11) directly under wire for number 1 sparkplug (1).
2. Repeat step 1 for number 2 sparkplug wire (2), number 3 sparkplug wire (3) and number 4 sparkplug wire (4).
3. Carefully unsnap two clips (10). Pull distributor cap (5) straight up. Place cap aside.

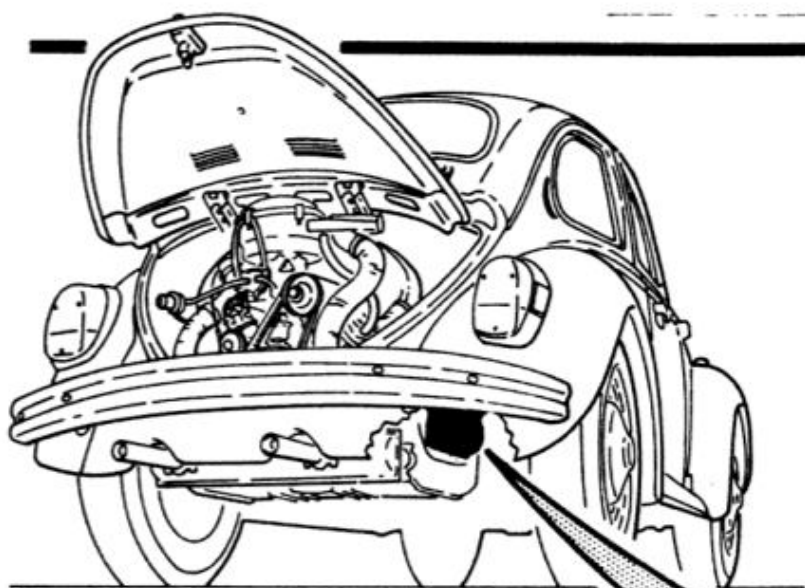
WARNING

Be sure not to place fingers on underside of generator belt (6) while rotating 13/16 inch nut (9). Injury to fingers may result.

4. While pressing in on belt (6) rotate 13/16-inch nut (9) counterclockwise until contact end of rotor (13) points to vertical line (12) for number 1 sparkplug and large timing notch (7) is aligned with centerline (8) of block.



PART 2

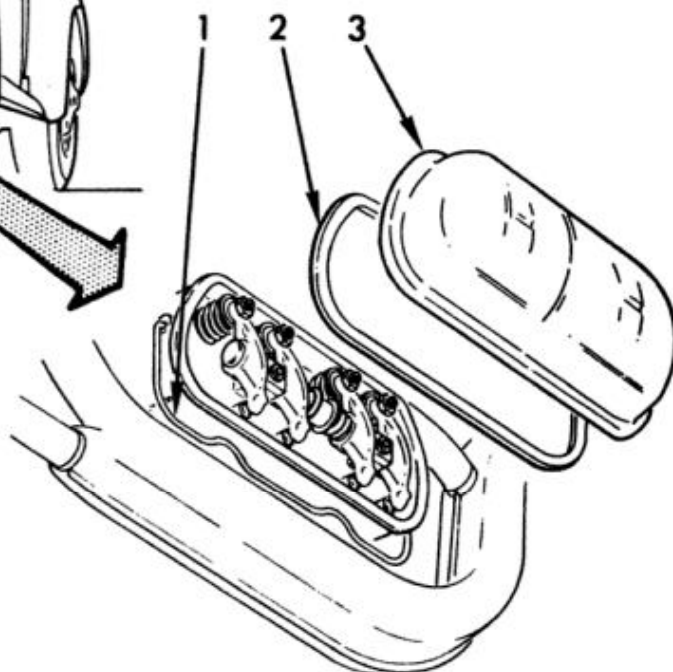


Slide under right side of car to perform following steps.

1. Place drip pan under valve cover (3).
2. Carefully pry retaining clip (1) down. Swing clip clear of cover (3).

In next step, if cover (3) does not come off easily, carefully tap edges.

3. Pull top edge of cover (3) away from engine. Remove cover and gasket (2).



PART 3

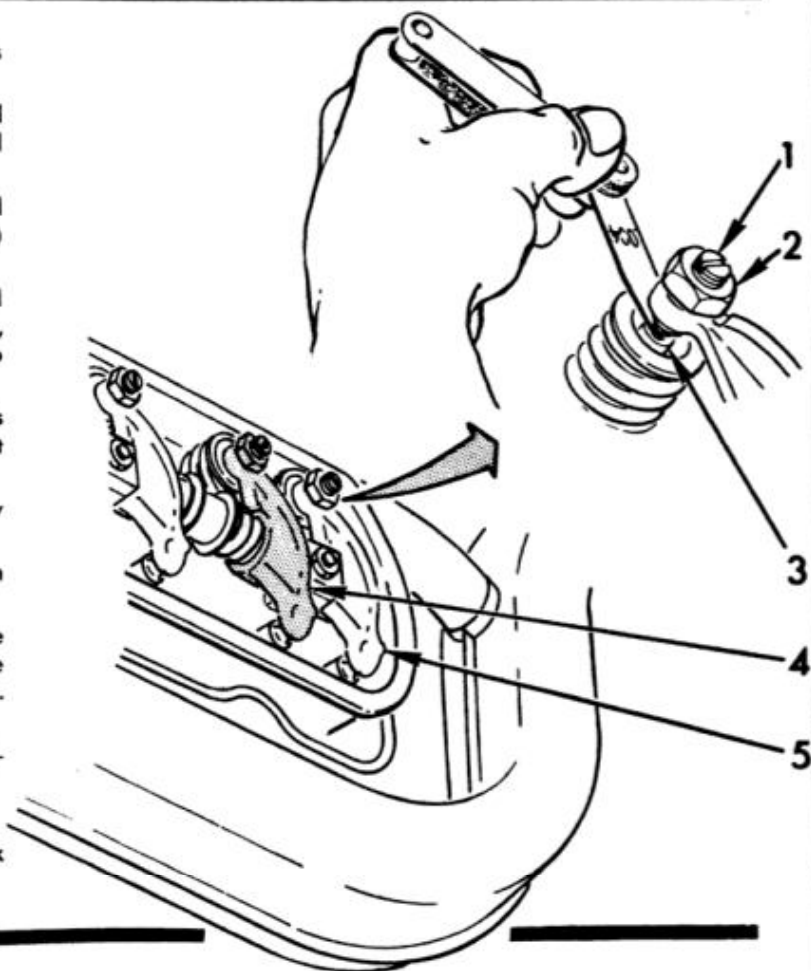
Steps 1 through 8 apply to two rocker arms (4,5).

1. Check that 0.006-inch feeler gauge will easily fit between valve stem (3) and bottom of adjustment screw (1).
2. Check that 0.008-inch feeler gauge will not easily fit between valve stem (3) and bottom of screw (1).

If 0.006-inch feeler gauge will fit easily and 0.008-inch feeler gauge will not fit easily, valve rocker arm is properly adjusted. Go to Step 8.

WARNING: In next step, use both hands when loosening 13-mm locknut (2) to prevent injury to fingers.

3. Loosen 13-mm locknut (2). Loosen screw (1).
4. Place 0.006-inch feeler gauge between bottom of screw (1) and valve stem (3).
5. While moving 0.006-inch feeler gauge back and forth, rotate screw (1) clockwise until a slight pull on gauge can be felt. Remove gauge.
6. While holding screw (1), tighten locknut (2).
7. Repeat Steps 1 and 2.
8. Repeat this part of instruction to check and adjust adjacent rocker arm (5).



PART 4

WARNING: Be sure not to place fingers on underside of generator belt (6) while rotating 13/16-inch nut (8). Injury to fingers may result.

1. While pressing in on generator belt (6), rotate 13/16-inch nut (8) counterclockwise until contact end of rotor (7) points to mark for number 2 sparkplug.

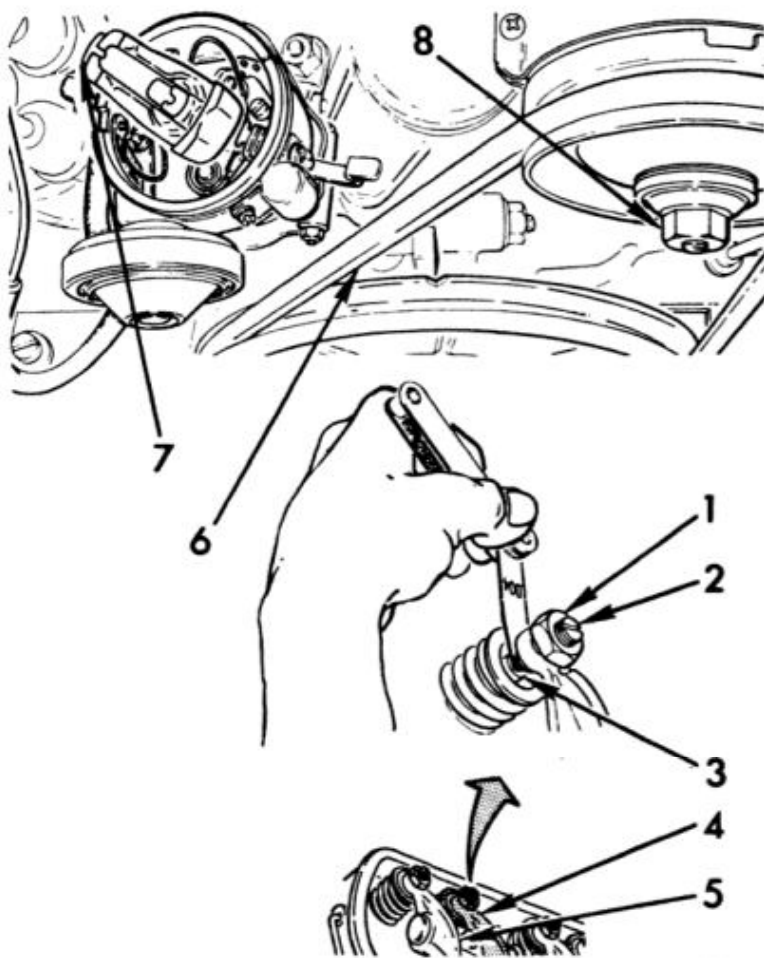
Steps 2-9 apply to two rocker arms (4,5).

2. Check that 0.006-inch feeler gauge will easily fit between valve stem (3) and bottom of adjustment screw (2).
3. Check that 0.008-inch feeler gauge will not easily fit between valve stem (3) and bottom of screw (2).

If 0.006-inch feeler gauge will fit easily and 0.008-inch feeler gauge will not fit easily, valve rocker arm is properly adjusted. Go to Step 9.

WARNING: In next step, use both hands when loosening 13-mm locknut (1) to prevent injury to fingers.

4. Loosen 13-mm locknut (1). Loosen screw (2).
5. Place 0.006-inch feeler gauge between bottom of screw (2) and valve stem (3).
6. While moving 0.006-inch feeler gauge back and forth, rotate screw (2) clockwise until a slight pull on gauge can be felt. Remove gauge.
7. While holding screw, tighten locknut (1).
8. Repeat Steps 2 and 3.
9. Repeat Steps 2 through 9 to check and adjust rocker arm (5).



PART 5

1. Check that gasket (2) is not chipped or broken.

If gasket is not chipped or broken it may be reused. If reusing gasket, go to Step 5

WARNING

In next step, do not use gasoline or other inflammable solvents for cleaning.

Be sure that area is adequately ventilated when using solvent.

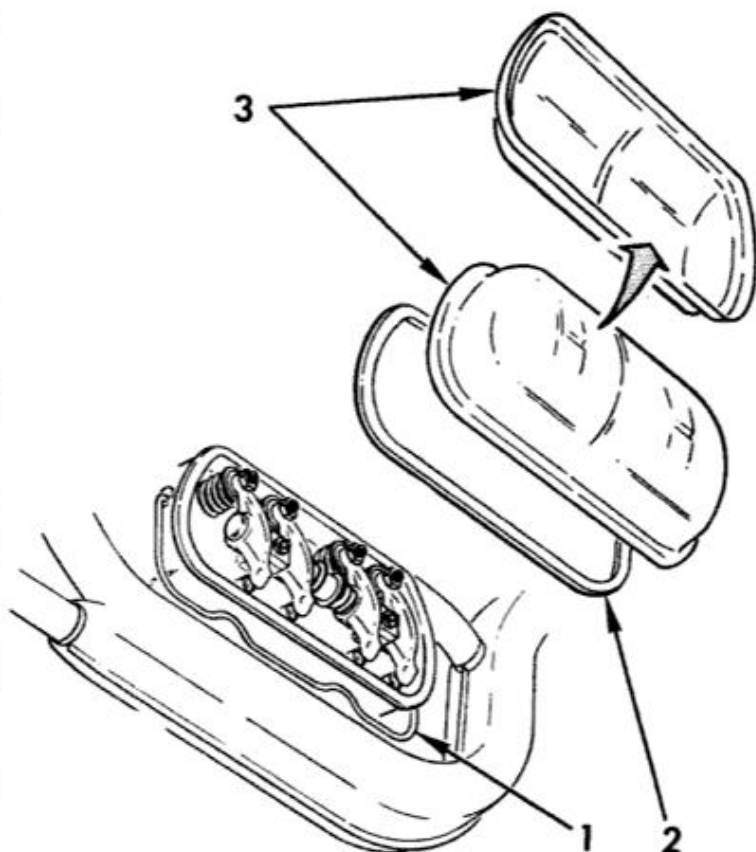
3. Using solvent, clean valve cover (3). Using clean cloth, wipe area where valve cover mates with engine.

4. Using gasket shellac, lightly coat side of gasket (2) that mates with cover (3). Place gasket with shellacked side against cover.

CAUTION

In next step, be sure valve cover (3) and gasket (2) fit properly so that oil will not leak from cover.

5. Place and hold cover (3) at installed position. Pry clip (1) up until clip snaps into valve cover slots.

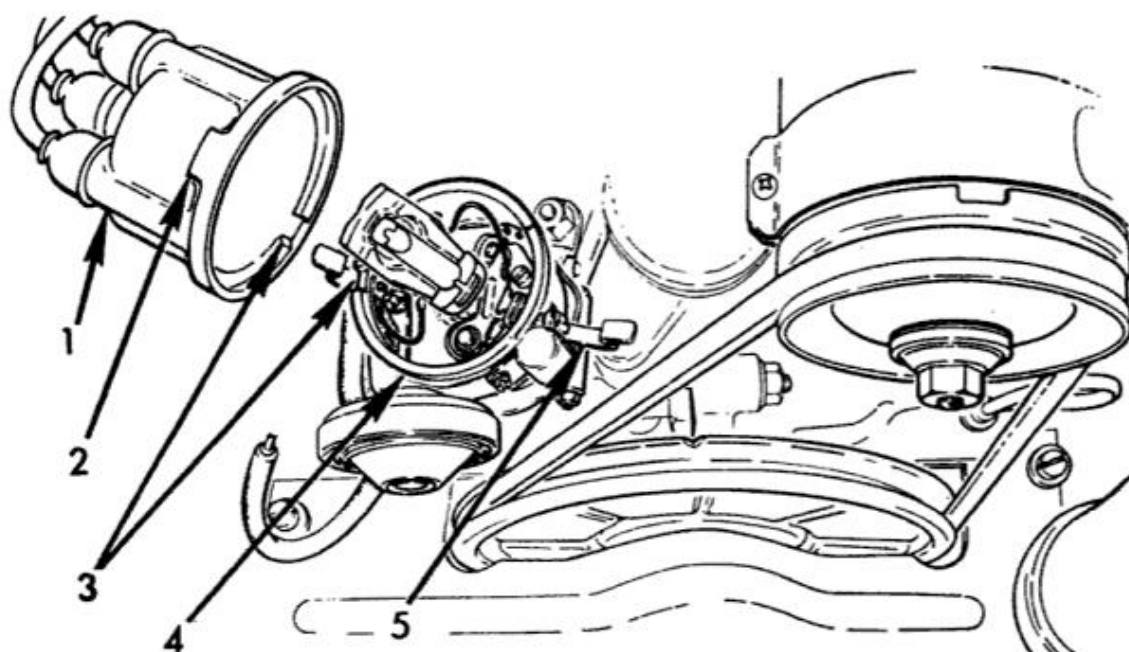


PART 6

Repeat the above procedure for the left side of the engine—cylinders 3 and 4. (The PM book does re-

peat the entire procedure, which has been eliminated here to conserve space.)

PART 7



CAUTION

In next task, align two keys (3) before attaching clips (5).

6. Place distributor cap (1) at installed position
- NOVEMBER 1972

on distributor body (4). Attach two clips (5) by snapping clips into notches (2) on distributor cap.

ADJUSTMENT OF VALVES ENDS HERE

Navy's deep-diving sea lions

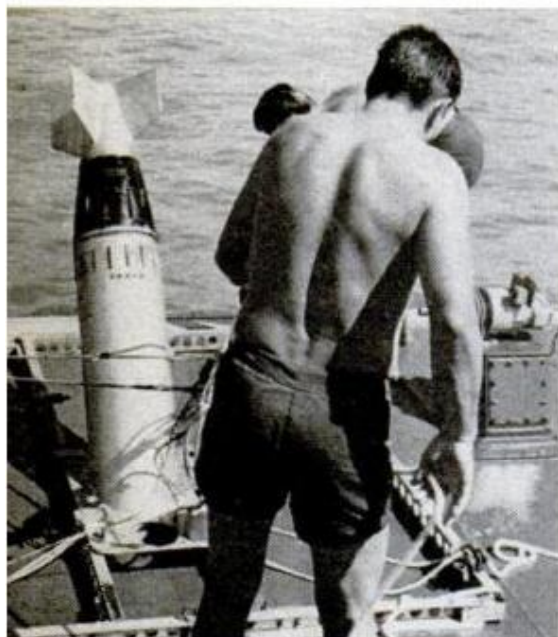


TURK, pictured here wearing a grabber device, recently recovered instrument pack from a missile fired from the USS *Orleck*. Retrieval was made 60 miles away from the ship, off the San Nicolas islands

DESPITE their superstar role as U.S. Navy divers, two California sea lions are still crazy about being thrown a couple of raw fish for performing. Fatman and Turk are an essential part of "Quick Find," the Navy's retrieval system being developed at the Naval Undersea Research and Development Center Laboratory, Hawaii.

Sea lions can be trained within two to three weeks to locate targets—such as test missiles—at depths down to 500 feet, says Martin E. Conboy, project director. They home in on an acoustic pinger built into the target and also rely on their dark-adapted eyesight. The animal dives into water wearing a snout-operated grabber and presses against the target. Encircling it, the grabber locks fast, coming away from the sea lion's snout. The sea lion then swims back to the boat as the grabber line raises the object. ★★

WHOLE OPERATION requires two or three men, a rubber boat, a reel of nylon line, a pinger receiver, a grabber and one sea lion. Recovery is possible for any underwater object with a signaling pinger



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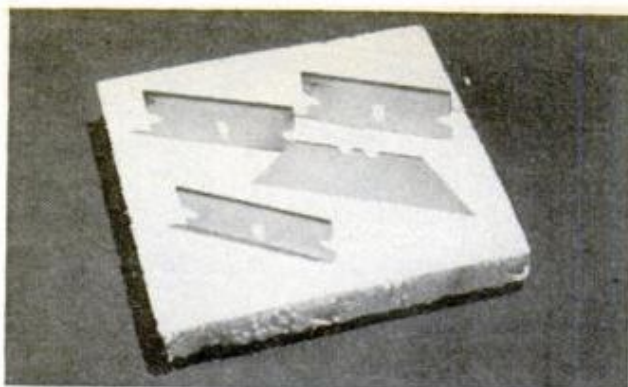
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Hints from

Safer razor-blade storage

When you store spare knives or razor blades of any type, don't just toss them in your toolbox. To prevent damage to blade edges and, more important, to your fingers, simply jab loose blades into a scrap of foam urethane. If you desire portability, cut the foam to fit within a small box equipped with a lid.

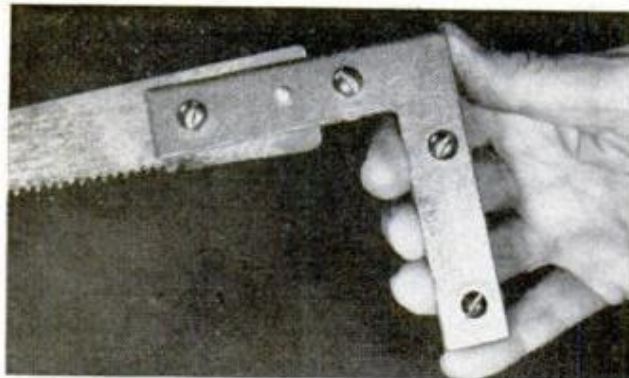
—M. Capotosto, Greenlawn, N.Y.



Grabber for keyhole-saw blade

Two large, flat corner plates can serve as an emergency handle for a keyhole-saw blade. Use four bolts to clamp plates together as shown, passing one bolt through the blade's slot. If the slot is not long enough to reach the second bolt, secure the blade with a Pop-Rivet through plates. For comfort, pad the handle with tape.

—W.B. May, Oak Park, Ill.



Help from the kitchen

The next time your wife has an empty food jar with dispenser pump, don't let her throw it away. It makes a handy vessel for storing and distributing light grease or heavy oils to shop equipment parts and home appliances. Wash out the jar thoroughly. If you're using more than one, make labels for contents.

—Parry C. Yob, Fair Oaks, Calif.



Quickie repair keeps file going

A hose clamp will serve handily as an emergency "ferrule" on a file handle to prevent splitting or minimize the chance of an existing split spreading. The clamp can be left in place as a permanent ferrule as long as you don't mind the protruding bolt. To prevent scratches on the work surface, wrap tape around the bolt.

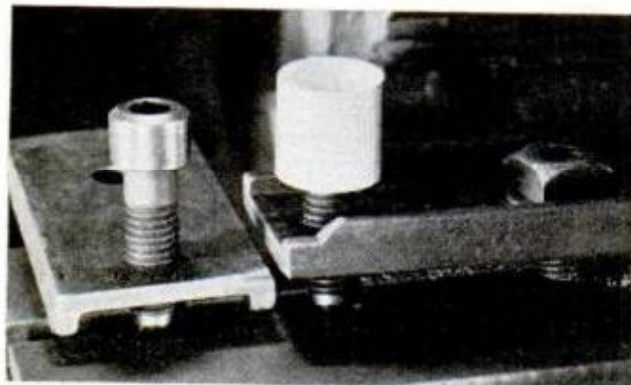
—B.W. Ervin, Kent, Ohio



Bottle caps keep screws covered

Recently, to help prevent accidental bumping of hollow-head capscrews on my milling-machine table clamps, I slipped light-colored, plastic bottle caps over them. Caps also kept chips from filling screw-head sockets. If you go through a collection of plastic caps, chances are you'll find some to fit screwheads snugly.

—Tom Wray, Utica, N.Y.



readers

Improvised funnel aids pouring

It is often hard to pour small amounts of liquids from a screw-top container—especially if the can is full. A piece of aluminum foil, formed into a tube and pressed around the neck of the opening, makes this an easy job. Use a hefty rubber band to hold the temporary spout in place and eliminate any dribble.

—William Swallow, Brooklyn, N.Y.

Lug wrench for sparkplugs

Some car owners may not know it's often possible to use a four-way lug wrench to drive a sparkplug wrench socket. If the socket has a hexagonal outer end, it's likely it will fit a socket in the lug wrench. The wrench's crossarm makes it possible to exert sufficient force to back out a tight plug.

—Walter E. Burton, Akron, Ohio.

Rivetmaking tool

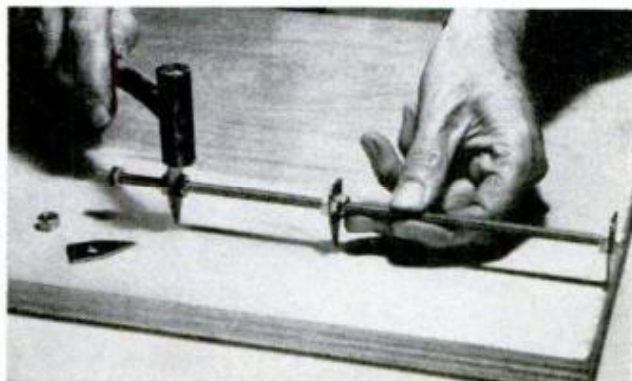
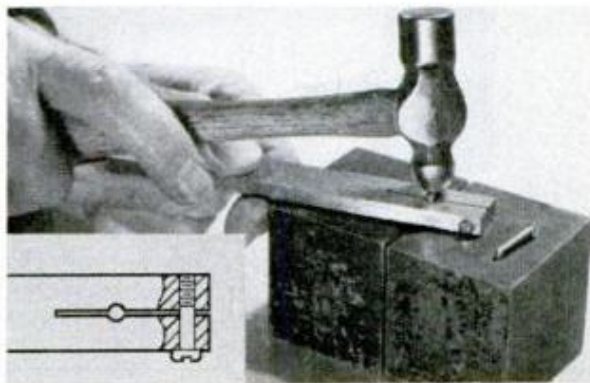
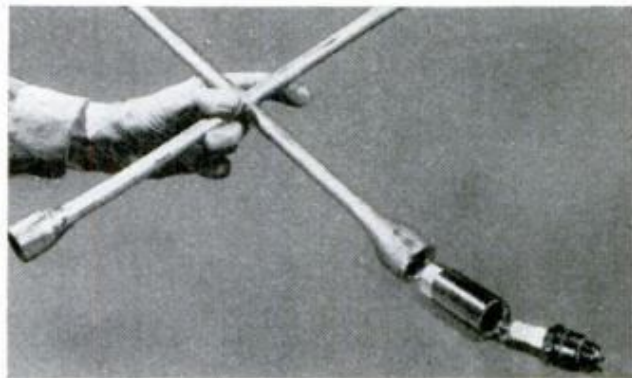
A tool for making rivets from copper or aluminum wire consists of a $\frac{1}{4}$ by 1-in. steel bar having a drilled hole intersected by a saw slot cut in from one end. The hole is the same diameter as the rivet stock; it's positioned about 1 in. from the bar end. The saw slot is about $1\frac{3}{4}$ in. long, and a 6-32 bolt draws the prongs together.—W.B. May, Oak Park, Ill.

Shop wipers from onion bags

A net-type plastic bag like the kind in which onions, vegetables and fruit come, can be folded into a useful pad for shop rubbing operations when a coarse-mesh material is desirable. The bags work fine for wiping a powdery deposit from a surface or when removing paste filler from wood. After using, simply throw mesh away.—B.W. Ervin, Kent, Ohio.

Trammel-punch

A handy tool to make uniformly spaced layout marks, or to scribe large single or multiple circles, can be assembled from a length of threaded rod, several punches fashioned from flat steel and twice as many nuts as punches. For tool shown, a 12-in. $\frac{1}{4}$ -20 rod, hex nuts and $\frac{3}{4}$ x $1\frac{3}{8}$ -in. punches made from $\frac{1}{16}$ -in. steel were used.—Stewart Pedd, Chicago





PRACTICAL COMPACTOR is filled by tilting open removable door and placing trash in the bag above. Author leaves his masher out by garbage cans for use primarily on bottles and paper



DOOR IS LOCKED before the pressure foot is pushed down. Silicone spray, or wax, is recommended on bag-space surfaces to reduce friction and to give waterproofing in case of trash leakage

Homebuilt masher puts the

It's not as fancy as a commercial unit, but this \$15 version

By R. S. HEDIN

WHEN I LEARNED that commercial trash compactors cost something like \$200, I decided to make my own and pocket the savings. It's not as fancy as the manufactured models, but it does the job for less money. In fact, my out-of-pocket expenses for building it were about \$15.

The masher is designed to be kept near the garbage cans, and its operating cost is low because ordinary supermarket bags are used, not special ones. The masher even crushes cans and light bottles if they're laid on their sides.

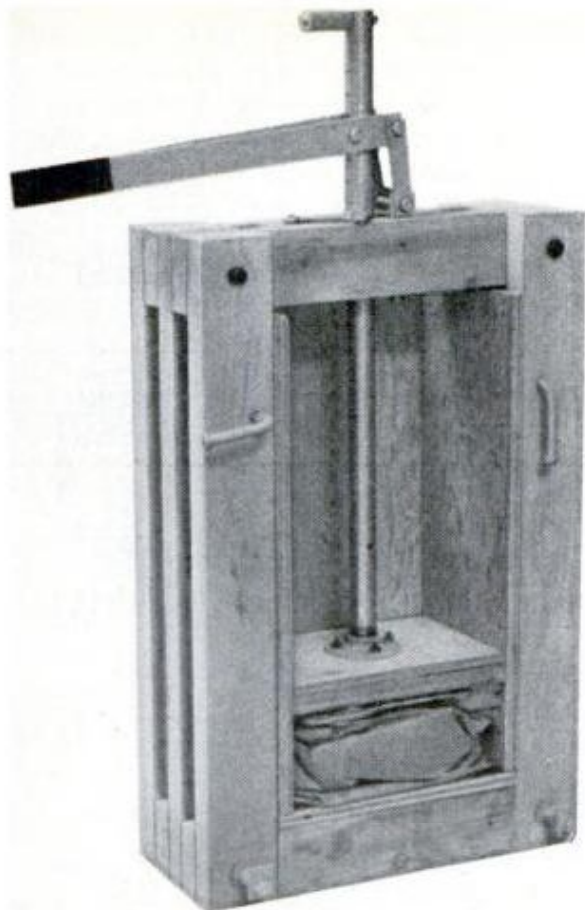
The force multiplication is about seven

times from the handle to the pressure foot, so a 200-pound man can exert quite a bit of force on the trash that has been placed inside.

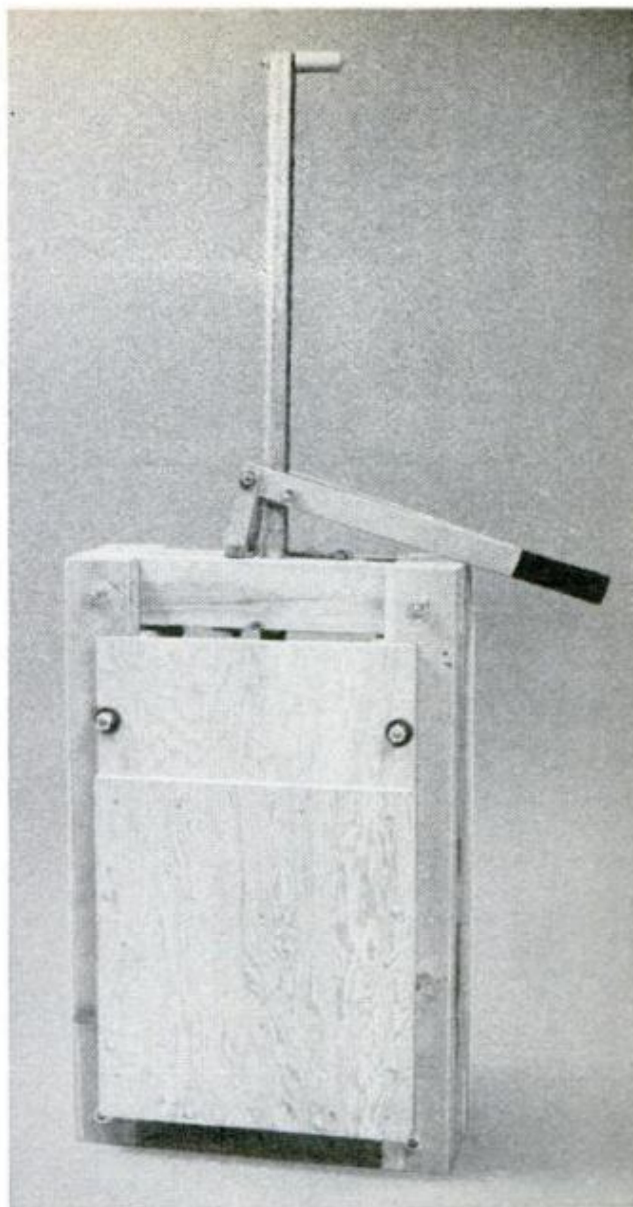
The frame is easy to assemble if the corresponding 2x4 parts are cut accurately to length, then drilled with a fixture in a drill press to make all the hole locations exactly the same. Stack the pieces on 1/2-in. bolts, gluing each joint. After stacking, square up the frame and tighten the bolts, then you can glue and nail the plywood in place.

Use ample grease on the pivot bolts and make certain that the pawl pivots freely

POPULAR MECHANICS



TYPICAL LOAD of trash after squeezing by author. Door and paint were left off prototype masher for the photo. Builders are advised to complete mashers by painting with quality exterior paint



HOW BACK is attached can be seen in rear-view photo of masher. Below is close-up view of the pressure mechanism assembly; notice gate-hook used to hold the pressure foot up. Masher shown utilizes typical supermarket bag—not costly commercial types that are required for use in manufactured compactors

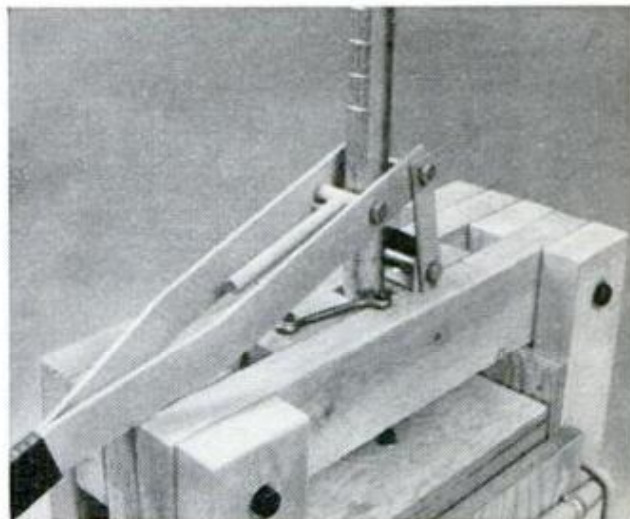
squeeze on trash

does the job when you supply power

when you're assembling the linkage. And finally, apply a silicone spray or a paste wax on all surfaces of the bag space to reduce friction.

To use the squasher, simply put in the trash bag and lock the door. Pull the gate hook and push the pressure foot down. As you push the handle it causes the pawl to engage one of the notches in the pipe. You raise the handle to release the pressure and raise the pawl in position so you can catch a higher pipe-notch. Pump the handle several times to compress the trash and hold down on the lifting handle when raising the pressure handle because there

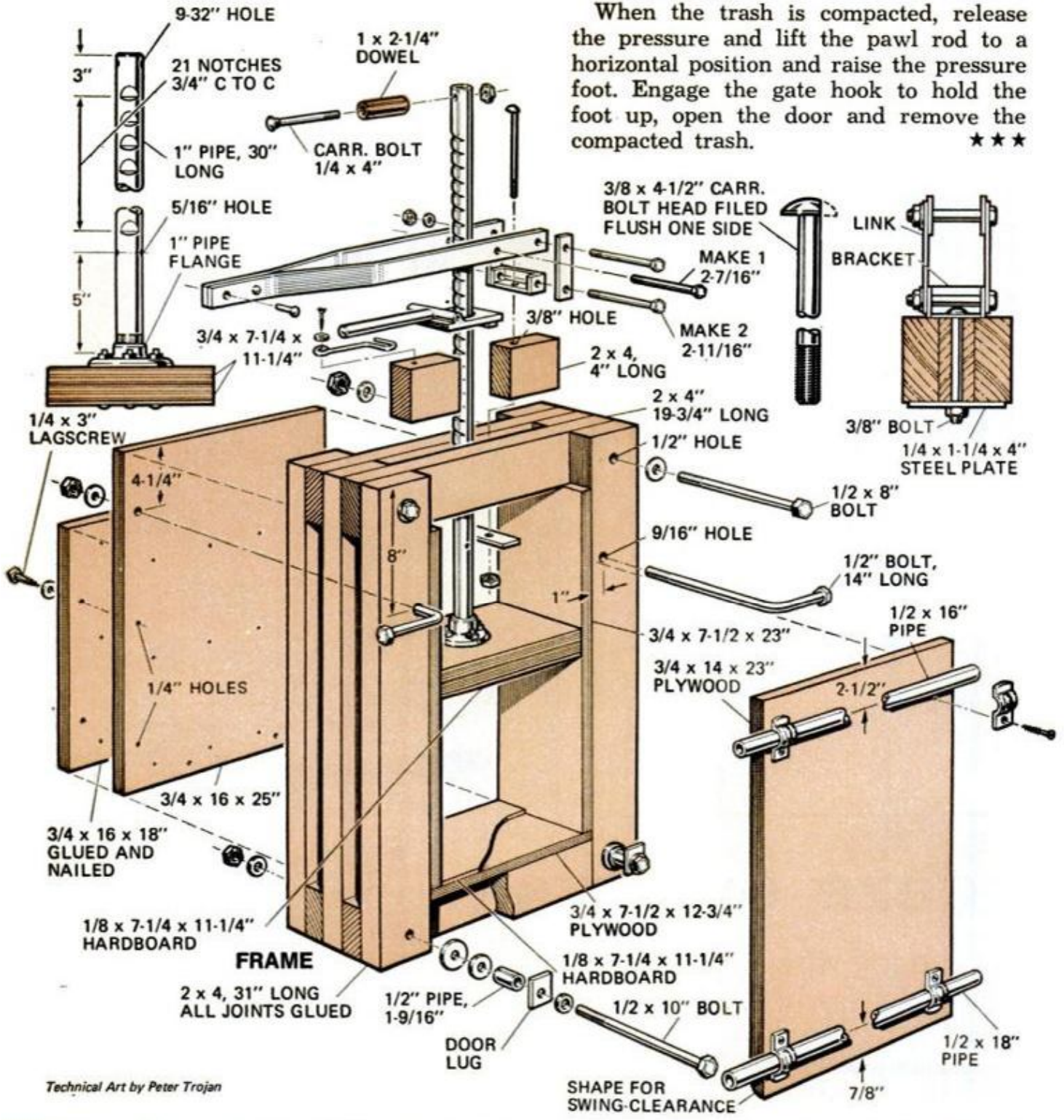
NOVEMBER 1972



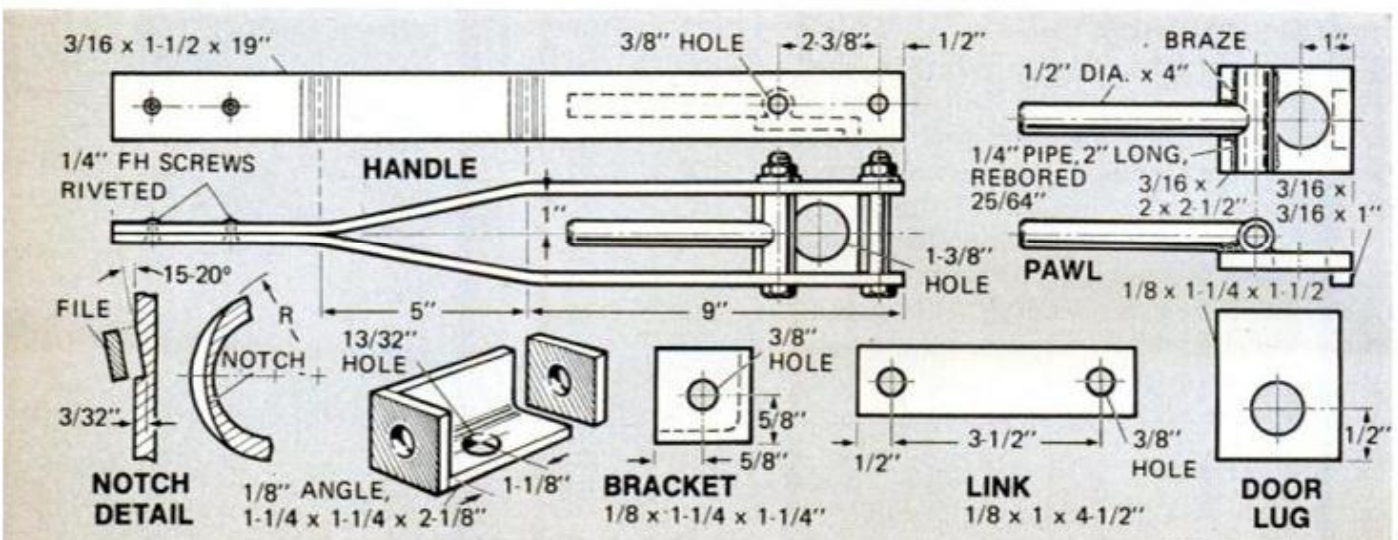
163

will usually be some spring-back in the compressed trash.

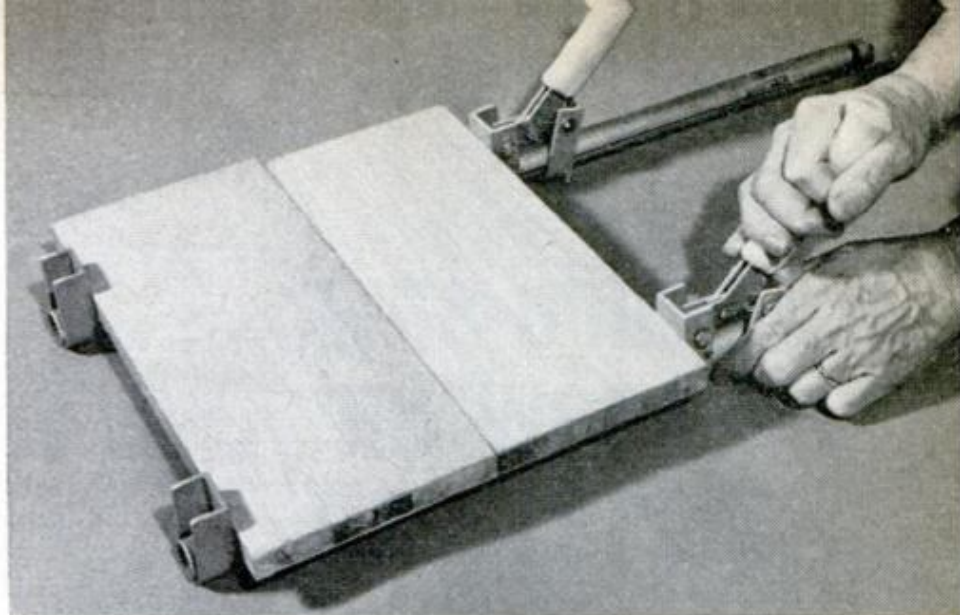
When the trash is compacted, release the pressure and lift the pawl rod to a horizontal position and raise the pressure foot. Engage the gate hook to hold the foot up, open the door and remove the compacted trash. ★ ★ ★



Technical Art by Peter Trojan



Make your own bar clamps

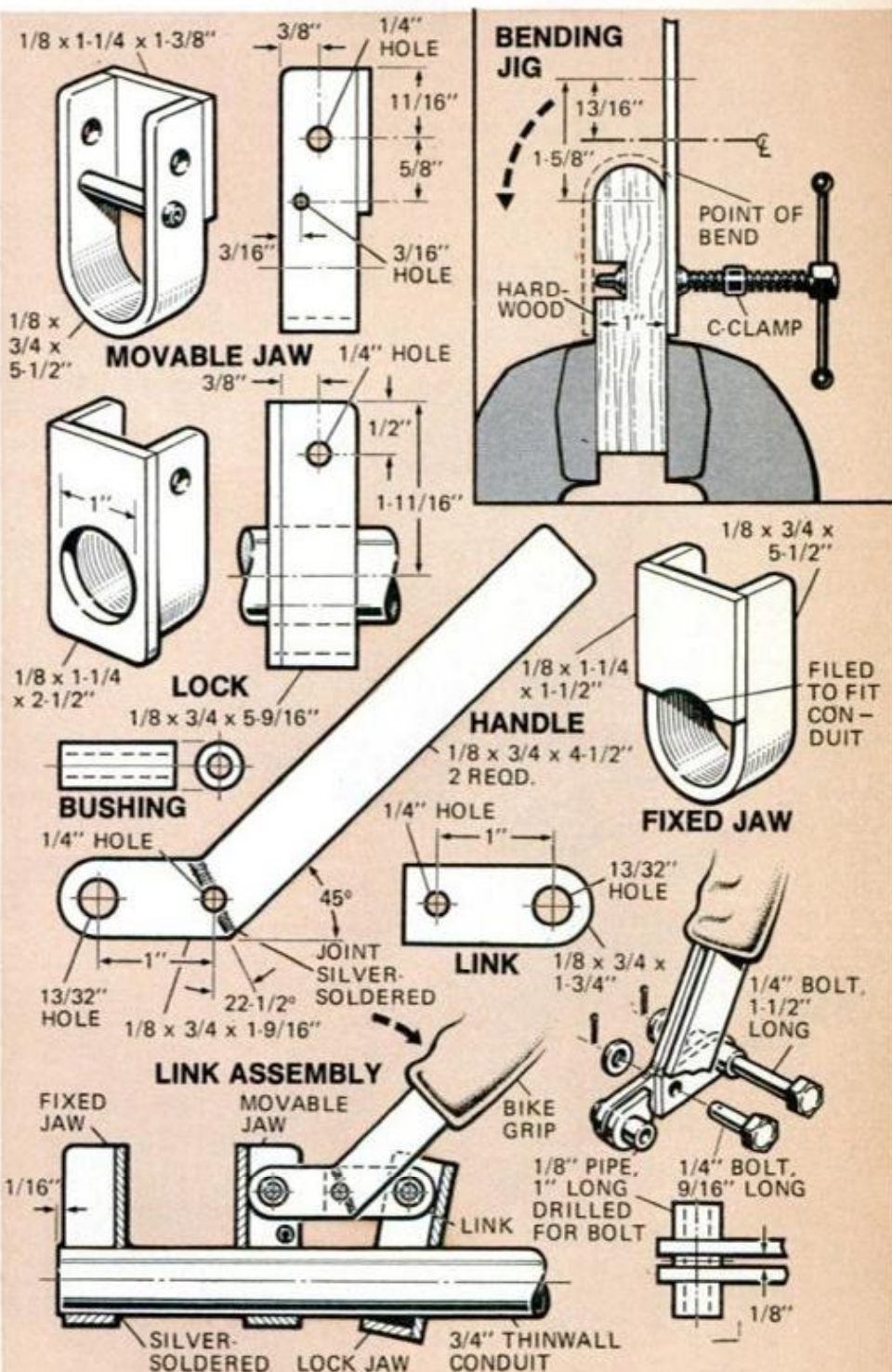


THESE lightweight, quick-acting bar clamps are ideal for wood-working where only moderate pressure is needed to hold the joint. The clamping action is produced by a toggle linkage which snaps past center to exert force. To operate the clamp you bring the handle forward and slide the movable jaw against the work. Then you pull the handle back and adjust the locking jaw with the other until sufficient force is applied to the work. Finally, you pull the handle all the way back to lock the clamp. This causes the locking jaw to bite into the bar.

The three jaws required for each clamp (movable, fixed and locking) are formed from hot-rolled strip steel and are bent around a hardwood form clamped in a vise. The steel strip is clamped to the block with a C-clamp and bent by hand around the end. Notice that the bending point is $1\frac{5}{8}$ in. from the center point of the strip. I used a tension pin in the movable jaw, but a No. 10 machine screw will do. I also silver-soldered the parts with a butane torch, but they could be welded.

Common $\frac{3}{4}$ -in. thinwall conduit is used for the bars and they can be made any length you want up to 10 ft. The fixed jaw is silver-soldered to the end of the bar, while the others are free to slide along it. Bike handlebar grips can be added to clamp handles.

R. S. Hedin, Minneapolis.



A sabre-saw 'table saw' for those small jobs

By **WALTER E. BURTON**

Photos by the author

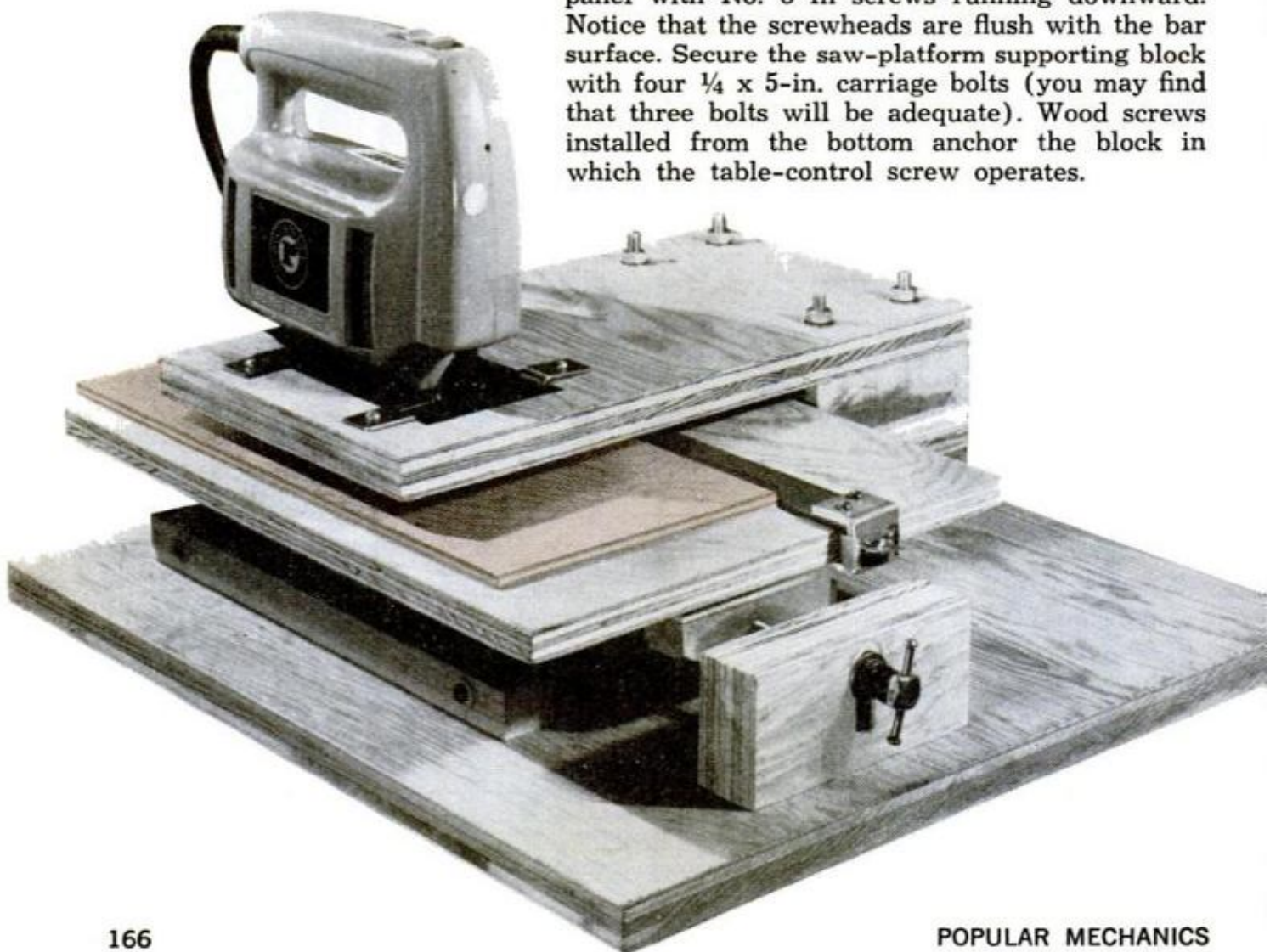
NUMEROUS SMALL SAWING JOBS often create handling problems that are as large as those you face when you're single-handedly maneuvering a 4x8 sheet of $\frac{3}{4}$ -inch particleboard. From time to time, many woodworkers are challenged with the task of sabre-saw cutting a piece of board that's just too small to be clamped or to be held securely by hand. And for such small jobs as cutting thin strips from veneers and plywoods less than $\frac{1}{2}$ -inch thick a table saw is actually too big. One way to overcome such irritating challenges is with the use of the shop-built sabre-saw table shown below.

While this fixture was designed to accommodate a Model 68 Rockwell tool, you can alter the dimensions to suit any make and model of sabre saw (also known as a portable jigsaw).

Because a portable jigsaw cuts on its upstroke, the material being sawed must be held firmly against the saw platform. This is accomplished by a screw (bolt) that operates a parallel-bar arrangement, and through "cushioning" by a coil spring.

This ingenious table is built mostly of plywood. You'll find it easy to assemble if you follow the construction details shown on page 169.

First, attach the parallel-bar unit to the base panel with No. 8 fh screws running downward. Notice that the screwheads are flush with the bar surface. Secure the saw-platform supporting block with four $\frac{1}{4}$ x 5-in. carriage bolts (you may find that three bolts will be adequate). Wood screws installed from the bottom anchor the block in which the table-control screw operates.



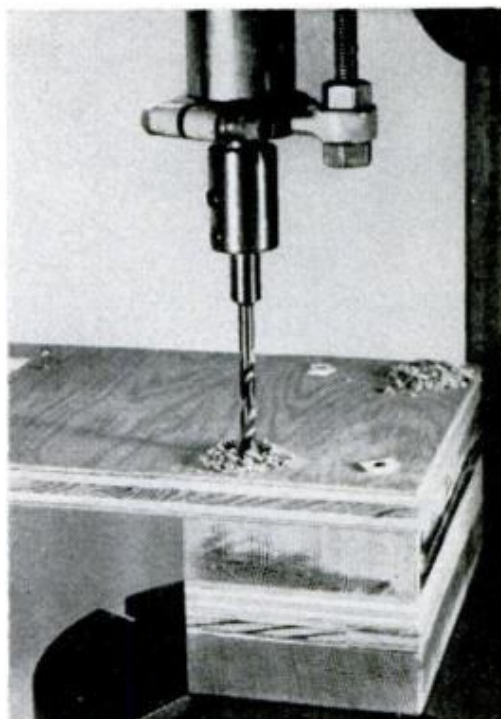
The size of the saw cleanout opening is not critical; a 4x6-in. aperture will be adequate. The table is supported on furniture glide "feet," thus there is no need to countersink the screwheads into the bottom.

Glue together several $3\frac{7}{8}$ x 7-in. pieces to form a platform supporting block that is about $3\frac{1}{16}$ in. high. You'll find that a little testing will be in order to determine the height preferable for you. (When the table is at maximum height, it can be no closer than the thickness of the work-guide bar: on the stand shown, $\frac{1}{8}$ in.)

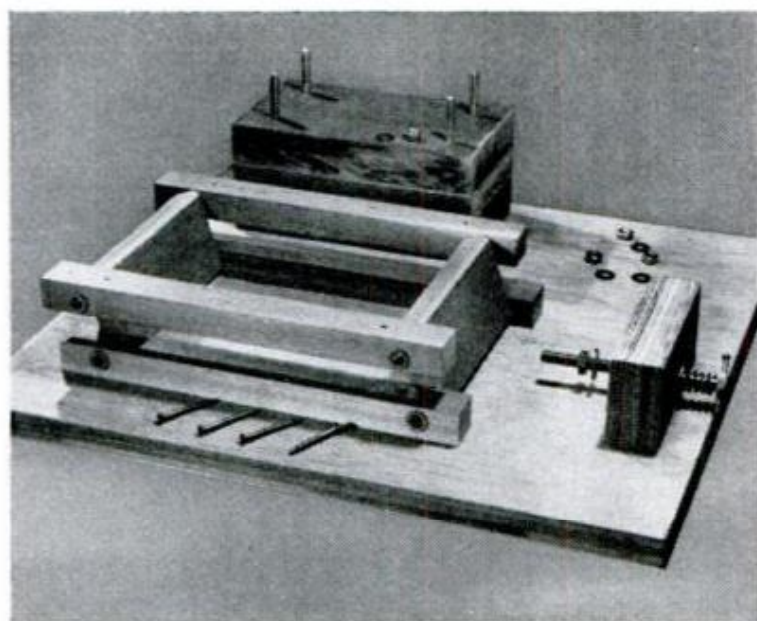
Attach the four 10-in.-long bars to two pivot blocks with four wood screws. It's important to space these screws uniformly to assure accurate movement of the parallel bars. Fasten the work-support table to the parallel-bar unit with screws that run upward through the top bars, but not through the tabletop. The saw slot should be positioned after the stand has been assembled with the sabre saw in place.

The saw rests in a rectangular opening and is supported by a thin metal plate. Cut the plate slightly longer than the width of the plywood platform so that the front and rear edges can be bent slightly upward. Then you can anchor the saw in its recess with four L-shape clips secured with screws. The shorter ends of the clips will press downward on top of the saw base when the screws are tightened.

The table-height control was made from a $\frac{5}{16}$ -18 x 4-in. bolt, with a rod crosswise through the head for easier turning without a wrench. The coil spring between the head and the block enables



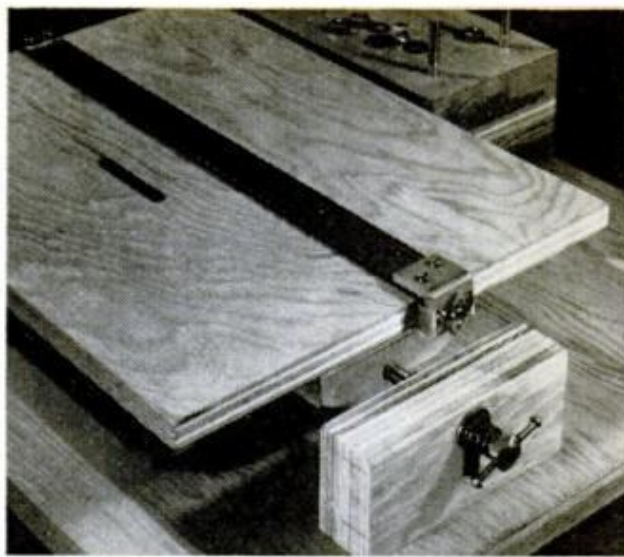
HOLES ARE BORED simultaneously through saw platform and supporting block. Platform is secured temporarily with two nails



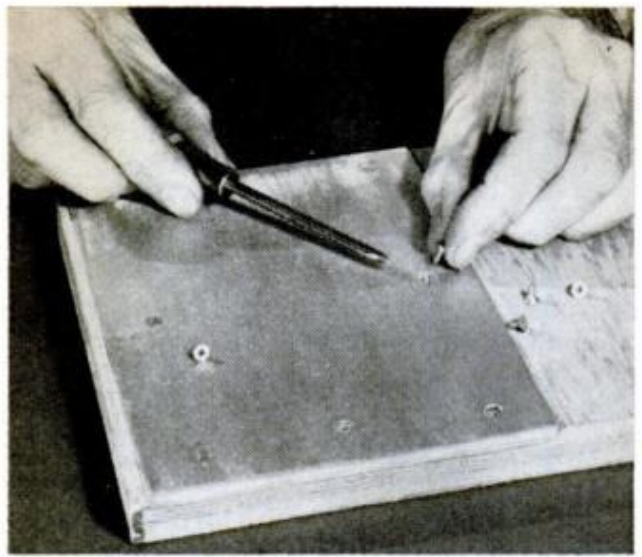
COMPONENT PARTS, parallel-bar unit, saw-platform-supporting block and adjusting-screw block are attached to the baseboard
NOVEMBER 1972



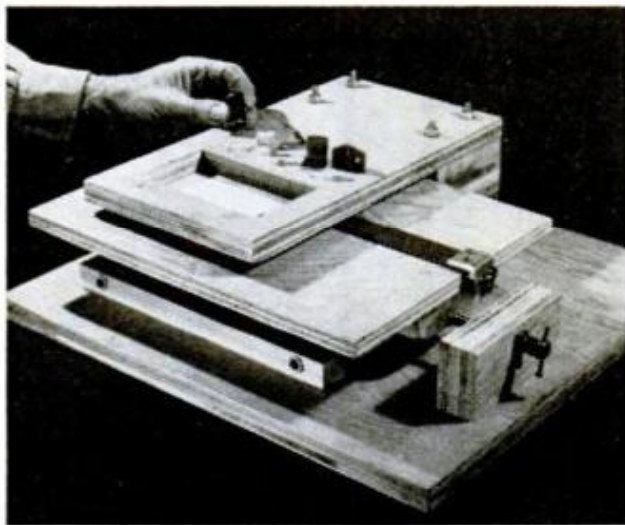
BY REMOVING two pivot screws from the parallel bar unit, upper bars can be swung up for installation or removal of the table



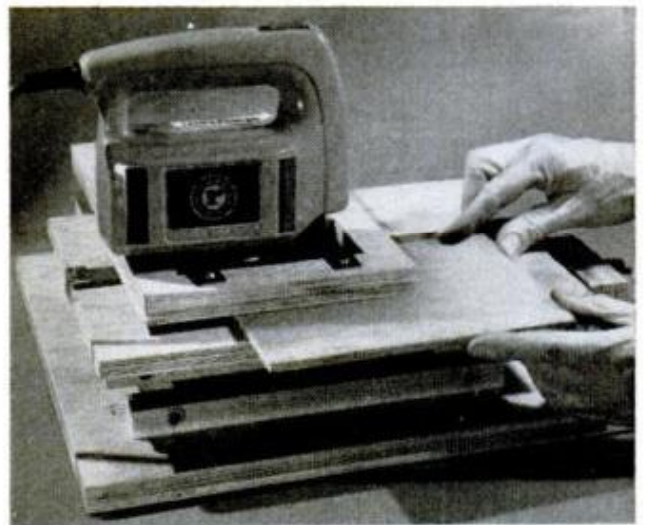
WORK GUIDE BAR is adjustable across table and is locked in position with a special wingbolt which presses against front edge of table when tightened



SHEET-ALUMINUM PLATE that supports the sabre saw is fastened to bottom of the saw platform with eight tiny fh screws turned into countersunk holes



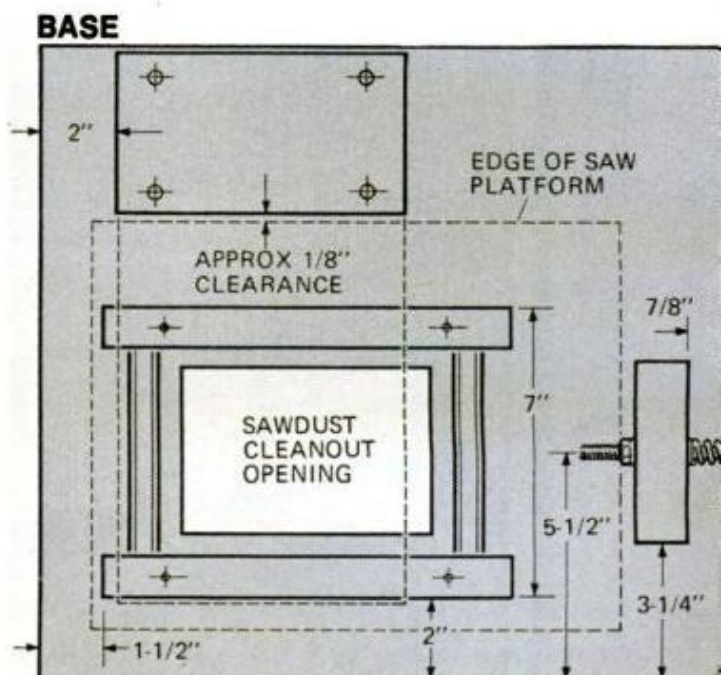
SABRE-SAW BASE is anchored to platform with four L-shaped metal clips spaced along sides of the rectangular recess. Clips are attached with rh screws



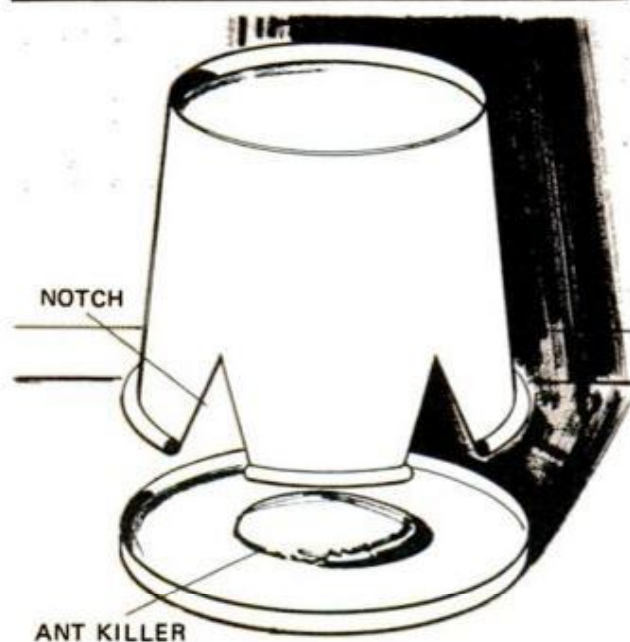
HERE'S HOW WORK IS FED into saw by passing it under saw-supporting platform and along guide bar. Saw handles work to 1/2 in. thick and 6 in. wide

the table to "give" slightly and serves as an aid in preventing binding. A dab of oil or grease will lubricate the bolt in the threaded hole of the maple block. By turning the bolt in or out, you can raise or lower the table. The bolt moves up or down with the table and automatically adjusts itself in the slot of the block that's fixed to the base.

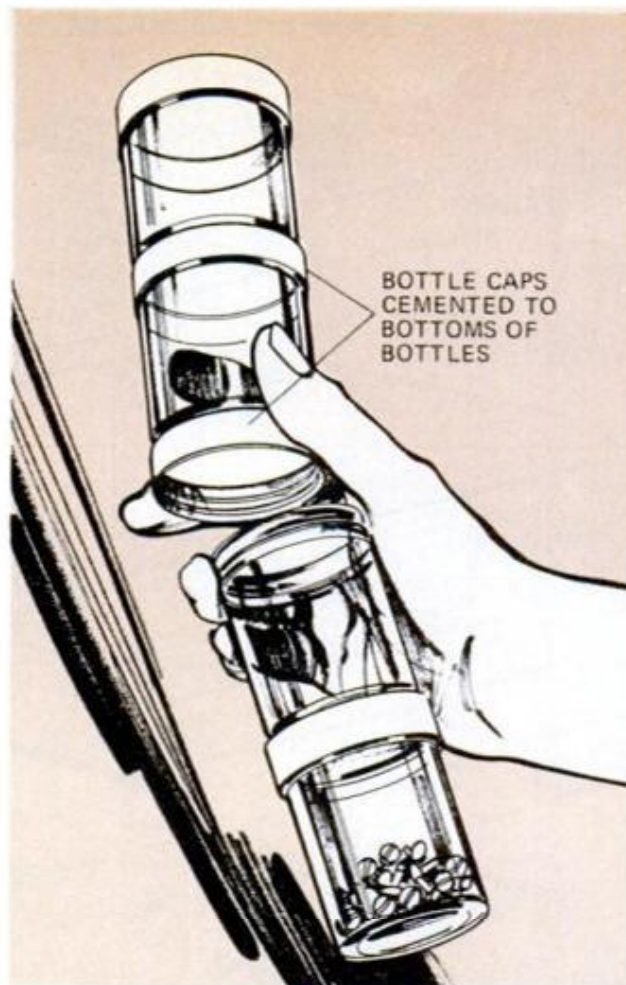
To use the stand, push material past the saw blade much the same as on a conventional table saw. Overhang of the saw platform and the table helps to shield the blade, while pusher sticks are used to move the work past the blade and out the rear of the opening between table and saw platform. The work-guide bar must be clamped securely enough not to yield under pressure applied to workpiece. ★★



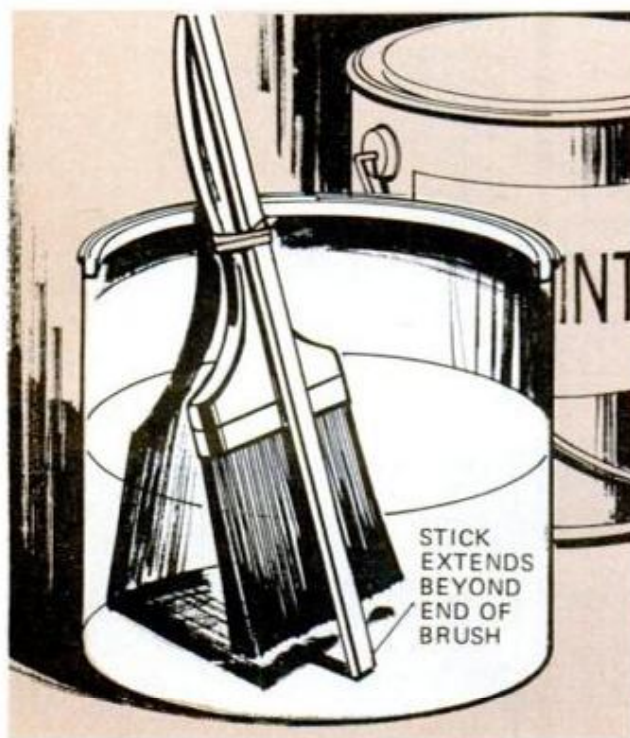
BETTER WAYS TO DO IT!



SAFE WAY to rid your house of insects—without endangering household pets—is to place bait in a notched yogurt container and then tightly replace the lid.—*Stephen N. Stresnic, Fort Lauderdale, Fla.*



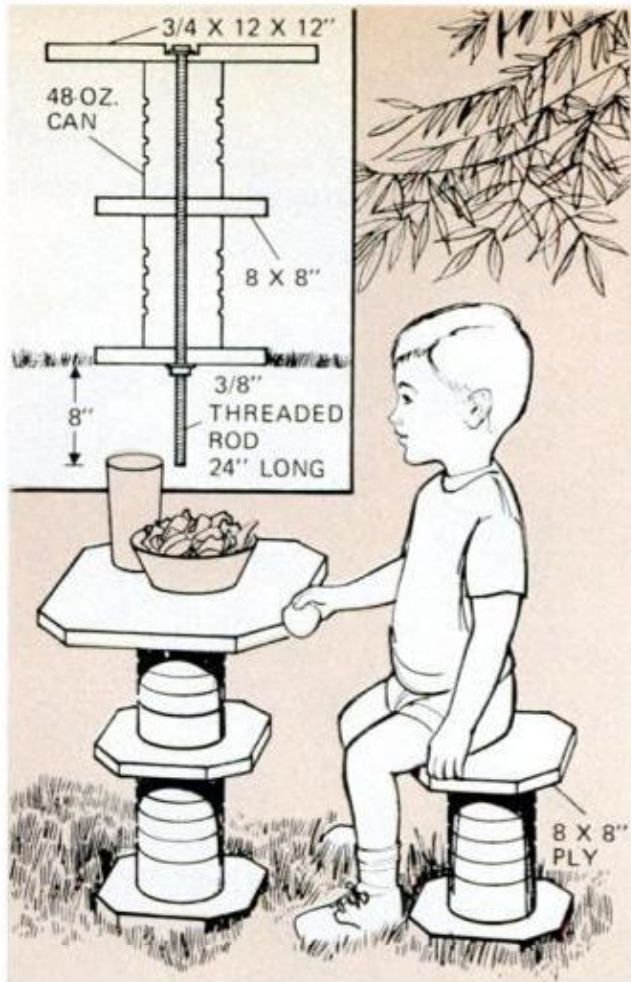
GANGED CONTAINERS are merely used plastic pill bottles glued in a row. Simply apply a dab of hot-melt glue to a bottle cap and affix it to the bottom of the second bottle.—*Paul Schwotzer, Atlanta, Ga.*



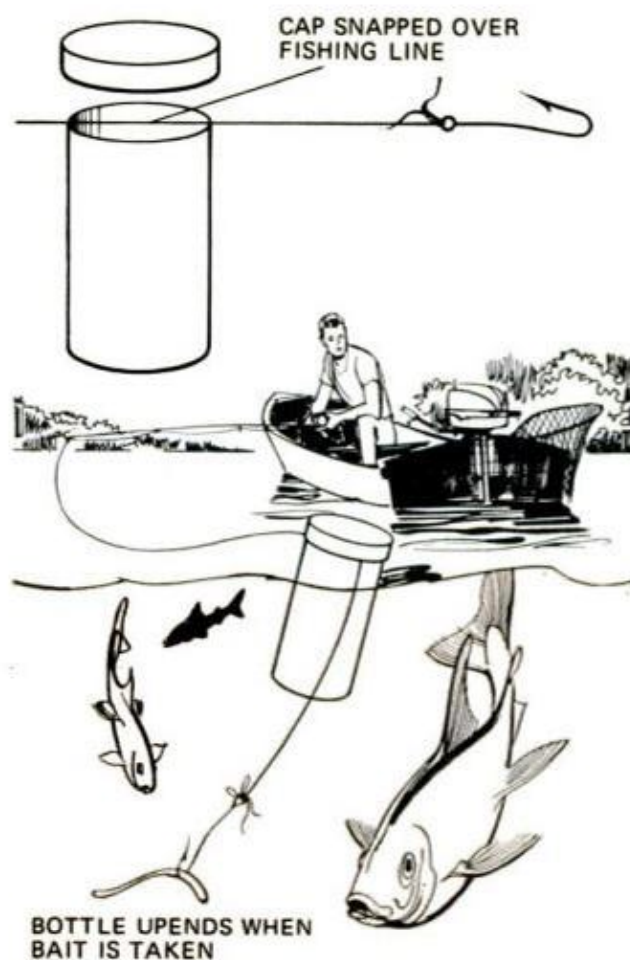
WHEN STORING PAINTBRUSH overnight in mineral spirits, secure it to a wood stick—slightly longer than the paintbrush—with a rubber band. This keeps the bristles from curling.—*John Krill, North Lima, Ohio.*



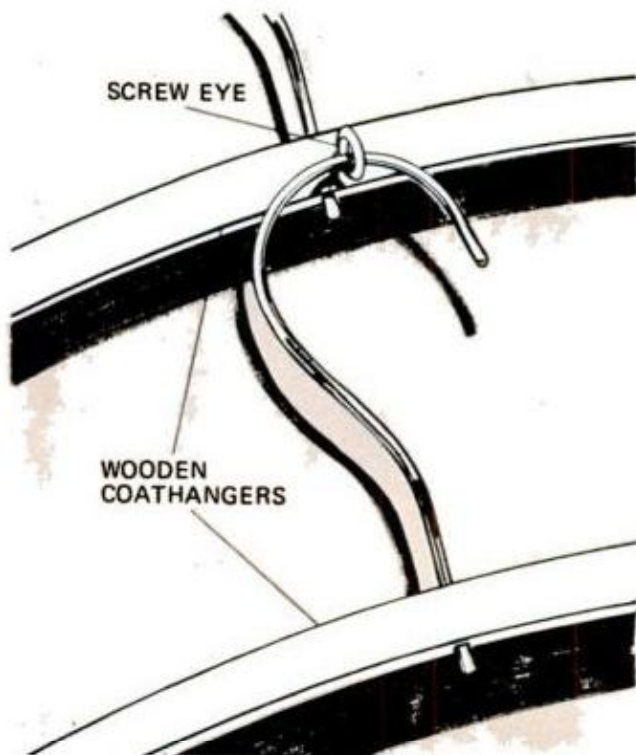
OLD DUSTING BRUSH from your vacuum cleaner can be used as a car-wash brush. If necessary, wrap plastic tape around threads on the garden hose to assure a tight fit.—*Joe Braunstein, New York City.*



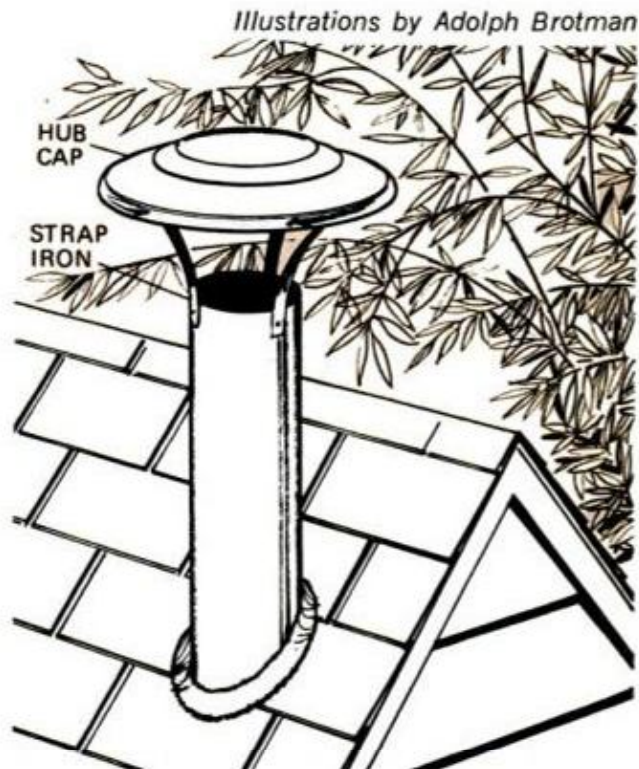
TODDLER'S PATIO TABLE and stool, scaled to suit your youngster, can be created by assembling a pair of large juice cans (for the table) or one can (for stool) and plywood scraps.—Fred Bryce, Weston, Ont.



PLASTIC PILL BOTTLE with snap-on lid makes a dandy fish bobber. Trapped air keeps the bobber afloat. When fish strikes, the bottom of the bottle jerks up to alert you.—John Krill, North Lima, Ohio.

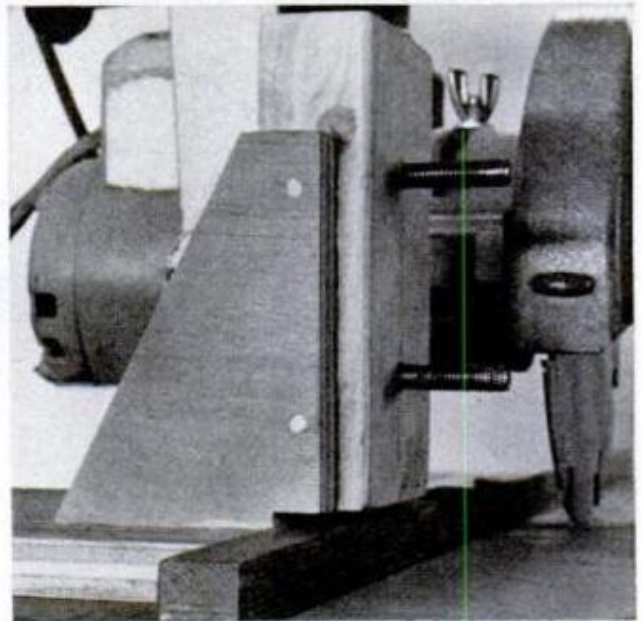
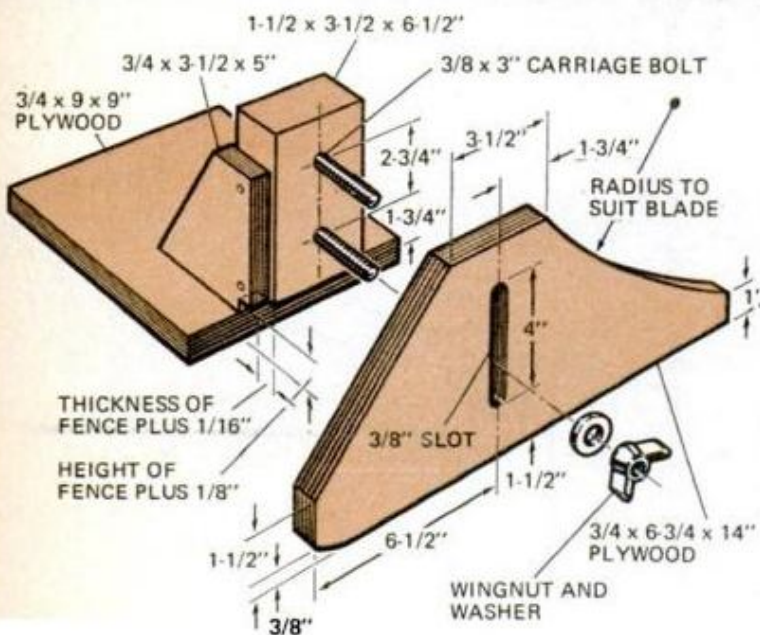
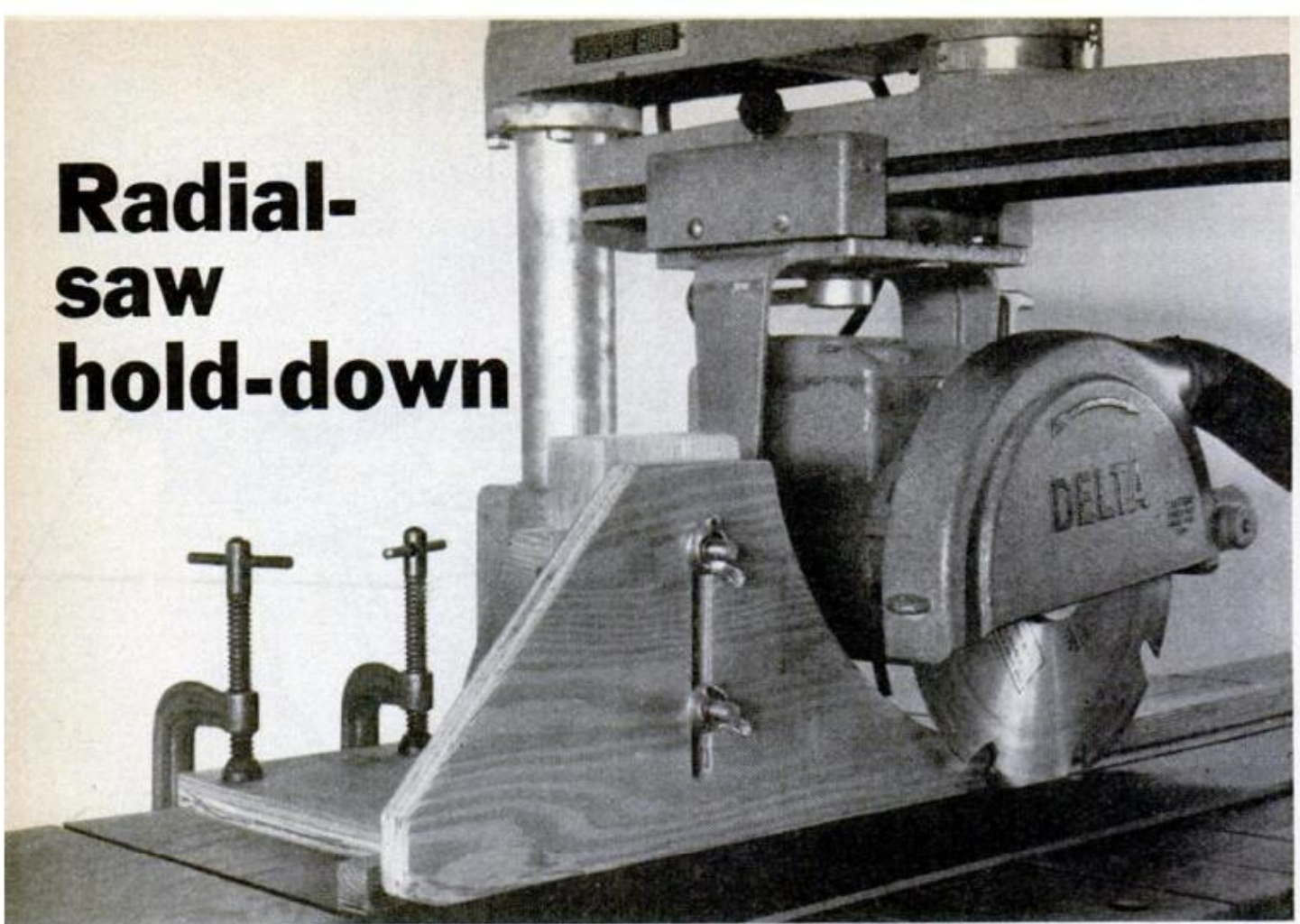


THIN OUT CROWDED CLOSETS by hanging several light garments in space normally occupied by one. To do it, you'll need wood hangers and screw eyes fastened as shown.—William Swallow, Brooklyn, N.Y.



NEAT CHIMNEY RAIN CAP can be improvised from an old auto hubcap. Use hefty sheet-metal screws through strap iron to hold it securely in place over the chimney.—Harry Hammelman, Sheboygan, Wis.

Radial-saw hold-down



RIPPING thin material into narrow strips on a radial-arm saw is not easy; the saw blade has a tendency to pick up the work and throw it back or break it. To prevent this you need a hold-down. This one, which has a $\frac{3}{4}$ -in.-thick shoe, will let you rip strips as narrow as $\frac{3}{4}$ in. Where the job calls for strips less than $\frac{3}{4}$ in., the shoe is cut from thinner stock.

The hold-down is adaptable to any make

saw since it merely clamps to the rear edge of the table and rests on the fence, slightly beyond the front edge. The slotted shoe clears the fence and adjusts up or down to suit thickness of the work. It's a good idea to wax the bottom of the shoe so the work will slide under it freely. Two wingnuts and washers lock the shoe in place and keep it parallel with the work.

—R.S. Hedin, Minneapolis.

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BD-5: Bullet-nosed beauty

By JOHN F. PEARSON and HOWARD LEVY

Jim Bede's new Micro is a pocket-sized wonder, according to its specs. It's stressed for aerobatics, can soar like a bird—and do over 200 mph.

THE BD-5 MICRO could be the greatest small plane ever to roll down a runway.

This pocket-sized single-seater is as streamlined as a bullet and has specs to match. It's a high-performance, fully aerobatic plane that's designed to do over 200 mph with a powerplant of only 45 hp. And it's convertible. With a switch of wing it becomes an easygoing, high-flying sailplane.

Best of all, it's available as a kit at a basic price of \$2100.

The Micro is the latest creation of Jim Bede, the innovative Cleveland designer whose BD-4 (*Build This New 4-Place Cabin Plane for \$3500*, page 112, May '69 PM) has become a favorite among homebuilders. Some 580 are under construction, according to Bede, and a number are flying.

In the Micro, Bede may have another



SLEEK LINES are maintained by split-type canopy which incorporates a preformed plexiglass section and a slanted windshield. The homebuilder fabricates framework to which the canopy is attached

SIX-FOOT-THREE PILOT tries the cockpit for size. His right hand grips the control handle, his left works the throttle. Control levers for flaps and landing gear are on console between his legs



winner. In its standard version (BD-5A) it has a wingspan of only 14.3 feet, is 13.3 feet long and stands 4.2 feet high. Empty, it weighs barely more than some football tackles—310 pounds—and can carry a load of 290 pounds. With a 45-hp engine it gets about 50 miles to the gallon of fuel.

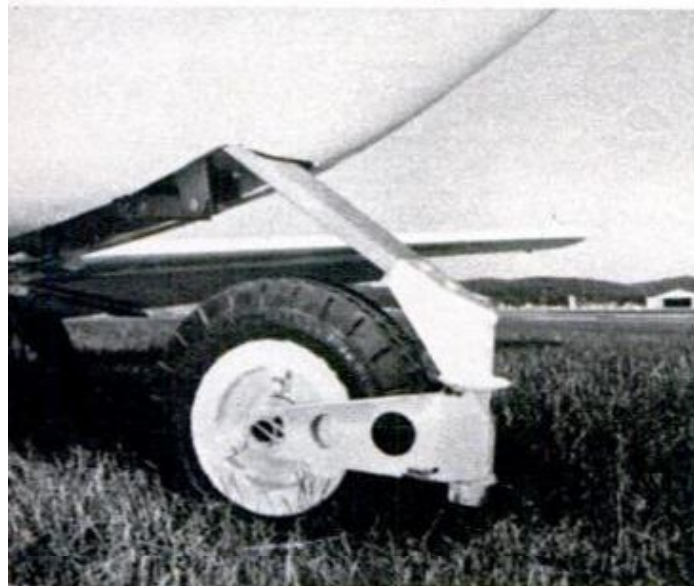
It has a cruising speed of about 190 mph, a range of approximately 1000 miles and an estimated service ceiling of 14,000 feet. The BD-5A requires 650 feet for takeoff and 500 for landing.

Design of the Micro was started in 1969, and a prototype was ready for flight tests in October, 1971. The results of ground and air tests sent Bede back to the drawing board. The most obvious change made was in the tail. The prototype's V-tail was eliminated in favor of a conventional vertical fin and swept horizontal stabilizer. The result, according to Bede, was improved directional stability.

The prototype's fuselage had a bolted metal frame with a fiberglass shell covering. The final design has an all-aluminum shell that is very light and exceptionally strong. It comes in eight preformed sections that are bonded and riveted together by the builder.

The choice of engine created more than

you can build yourself

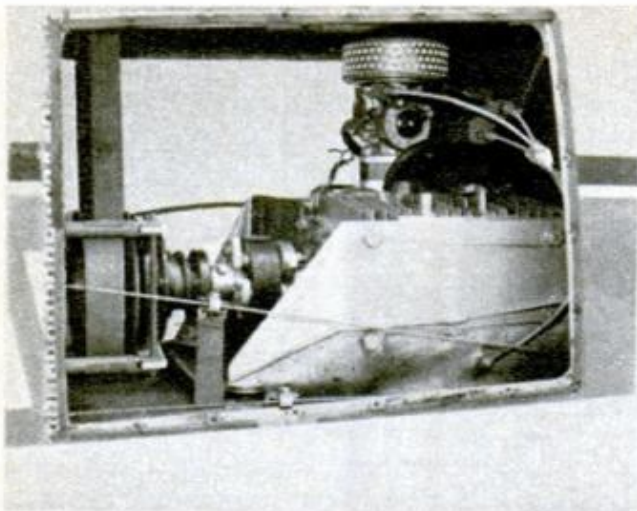


TRICYCLE LANDING GEAR is mechanically actuated from cockpit. Nosewheel casters freely for taxiing, permitting plane to turn within own length. Disc brakes on main wheels provide control for steering

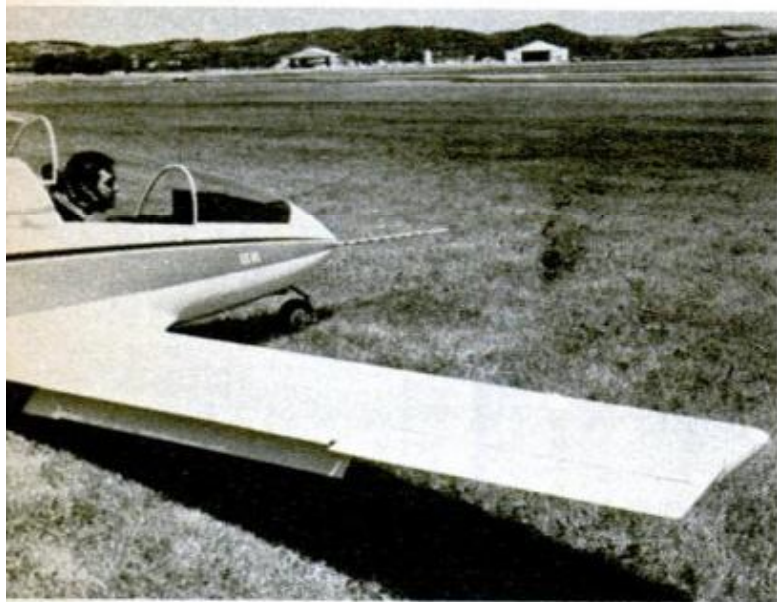
one headache for Bede and his colleagues. Bede originally intended to use a Japanese-built 32-hp snowmobile engine that has an outstanding reputation for dependability. Then he switched to an engine manufactured by Kiekhaefer Aeromarine, a division of the firm in Fond du Lac, Wis., that developed the Mercury outboard engine.

But when delivery snags developed, Bede switched again—this time to the Hirth, a West German snowmobile engine. It reportedly will be available in 45 and 55-hp versions.

Bede's talent for coming up with interesting and useful wrinkles is apparent in the Micro's sailplane option. By putting on a wing with a 21.5-foot span, the homebuilder has a plane with a glide ratio of 20 to 1. Thus, he can fly under power until he's found thermals to his liking. He soars with the engine turned off and



PUSHER PROP gets power from 45-hp engine located aft of cockpit. Hirth engine is a German make



EXTRA-LONG WING makes it possible to use Micro as a sailplane. When plane soars, prop freewheels

with the clutch disengaged to permit the prop to freewheel. When the time comes to head for home, it's just a matter of starting the engine and re-engaging the propeller.

The long-winged version—designated the BD-5B—is said to be able to fly at 120 mph at only 6 hp but still be capable of flying more than 200 mph on its full 45 hp.

As with all aircraft classified in the homebuilt category, the builder must perform at least 51 percent of the construction. However, he won't be called on to do any difficult forming—that's all done at the Bede plant. The builder must cut, drill and join parts, but most of these operations, says Bede, can be accom-

plished with standard home-workshop tools, including an electric drill and sabre saw. There are a few welded parts that may require the services of an outside welding shop.

Bede reports that assembly has been simplified, doing away with the need for jigs and other special equipment. The plane's small size makes it possible to construct it in the average one-car garage. Step-by-step instructions come with the plans and parts kit. Construction time is estimated at between 300 and 400 man-hours.

The kit for the BD-5A is priced at \$2100; the BD-5B, \$2150. As an extra, a pair of long wings costs \$200; standard wings, \$150. The 45-hp powerplant is included in the price of the kit. When it's available, the beefed-up engine will cost extra.

The Micro was designed with economy in mind. Bede figures that the cost of operating the plane will be about 1.5 cents per mile, including fuel, oil, maintenance and insurance.

Needless to say, Bede thinks highly of his latest bird. He's proud of its design, performance and strength. "You'd have to put a blow torch to it to hurt it," he claims. One of his brochures states that the BD-5 "represents an aerodynamic configuration having efficiency not exceeded by any other modern aircraft." Could be.

An information package is available for \$5 from Bede Aircraft, Inc., Cuyahoga County Airport, 355 Richmond Road, Cleveland, Ohio 44143. ★★★



DESIGNER JIM BEDE poses with prototype. After a series of test flights, the V-tail was changed

POPULAR MECHANICS

New 1973 Chevrolet Suburban. For people who need more than a wagon. Seats up to nine. Moves up to 14,000 lbs.

Chevy's new four-door Suburban. You can order seats for as many as nine. And with available equipment you can move up to 14,000 lbs. of trailer, luggage, people and Suburban. It looks like a station wagon. Rides easy like a wagon. But it's much more. Underneath it's a tough truck. With power front disc brakes standard. And you can specify a new 454 V8, double unit air conditioning or 4-wheel drive, among other things.



Wagon-type tailgate available with crank-down rear window. Electric power window also available.



Two-part folding second seat, available Series 10, standard 20. Access to rear. Folds flat to cargo deck.



Building a better way to see the U.S.A.

Pint-size formula racing



HUDDLED IN FULL GEAR in the cockpits of their sleek cars, young English racing drivers—the average age is 8—look for all the world like their larger, older counterparts who compete in powerful formula racers.

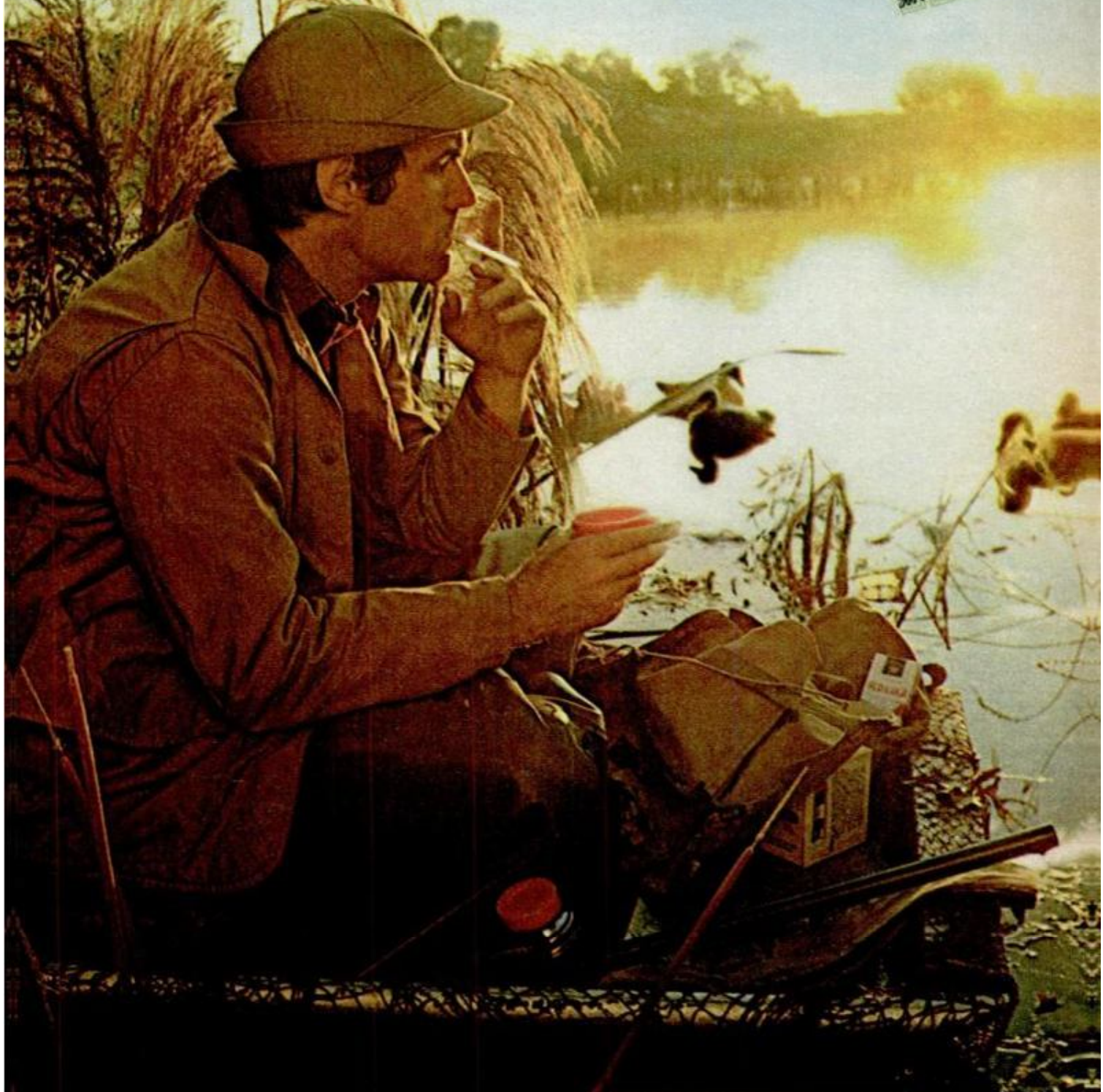
Principal differences are that the midget machines top out at 28½ mph, a limit held by engine governors, and 10 years is the age limit for drivers.

The idea for pint-size formula racing came from Reg Manester, father of 7-year-old Carl, one of the drivers. The elder Manester formed a company of skilled mechanics and engineers to design and build the cars. The 180-pound machines are powered by 158-cc Italian-built Aspera engines. They have a 62-inch wheelbase, wide track (40 inches in front, 42 in the rear) and welded-steel chassis covered with a fiberglass body.

The cars are built in Alton and raced at a nearby Royal Engineers track. Enthusiasts are now planning to set up nationwide Junior Formula competition. ★★

IN A QUICK PIT STOP (upper left) Russel Thorn's crew members check his front wheels and top his fuel tank. Russel, described as one of the most talented of the young drivers, had been at it only three months when the photo was taken. At lower left, the midget formula cars are lined up at the start, awaiting the flag. And directly above, 7-year-old Carl Manester receives the traditional winner's cup and a kiss from pretty Karin Wood, 5. Carl's father, Reg, is the originator of midget formula racing and also heads the plant in which the cars are built

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More go for snowmos

By **BILL MCKEOWN**, *Outdoors Editor*

SNOWMOBILE CHANGES for this coming winter," one manufacturer has claimed, "are improvements you can't see or hear."

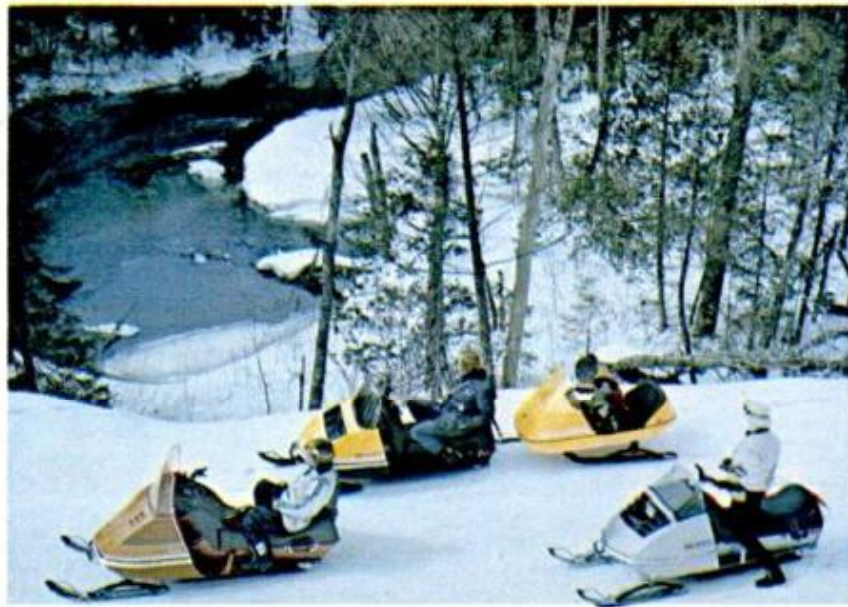
He was referring to his new engines and new silencing, but much under-the-cowl upgrading by all manufacturers will give snowtime shoppers a lot more machine (for more money).

This winter is going to see some flashy exterior switches as well. What company offers the largest variety of snowmos in any color you want—as long as it's yellow? Not any more. That tradition is broken, and you'll no longer know it's a Ski-Doo by its paint job. Silver and bronze machines have joined Bombardier's

(Please turn to page 184)



MORE COLOR is coming to this year's snowscapes. Skiroule (top) heads down slope in green and silver. Scorpion (above) now offers red as one of four color options. Ski-Doo (right) has added silver and bronze to its familiar yellow and black. And racers rival a rainbow as they line up (bottom) for another annual go at Yellowstone



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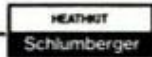


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PERFORMANCE is the password for '73 models. Yamaha (upper left) has been using racing results to improve handling and ride. Massey-Ferguson Ski-Whiz (left) offers 399 and 440-cc models on wide 18-inch tracks. John Deere is introducing new JDX series (above) in black; JDX8 with 438 cc is rated 40 hp, mounts speedometer, tach, shocks as standard. At lower left: Rupp (background) and Nitro 400 machines show off new power

MORE GO FOR THE SNOWMOS

(Continued from page 180)

yellow and black. Scorpion is moving toward a rainbow assortment. Mercury has split with basic black and added two-tone ebony-and-silver combinations. Styled-up machines, with sporty cold-weather clothes to match, are here to stay.

And you'll have to look quick. They'll be going past faster, though unmuffled noise will no longer give away the speed of a machine. The horsepower race isn't over, but already you can buy so much sled that it's hard to hold wide open on any but the smoothest snow.

Modifications have made snowmobiles safer and they have even survived a Nader study, although statistics seem to show it's not the machines that cause the accidents. Fewer companies are in the business this fall, but those that are growing look like they're here to stay.

Among the bigger producers, here's what the new look will be like this winter:

Ski-Doo still offers the most models and has added some more beside. Its 23rd is the Elite, a side-by-side seater with twin tracks underneath, white and black with burnt orange above, a 440-cc engine and even a roll bar. Price is a luxurious





\$2200. Silver with black trim is the color for the new basic T'NT series, while the top-of-the-line Nordic 640-ER has electric start, reverse, disc brakes, chrome skis and full instrumentation. All 1973 models are reported to be down to 82 decibels on the A scale (dbA) noise-level requirement, and have high-low headlights, brake light, emergency cutoff switch, steering-handle padding and reflective stripe around cabs among other safety features. Special new high-performance "free air" T'NT (track 'n' trail) machines are black with yellow stripes.

Though Ski-Doo no longer sponsors factory racing teams, the firm produces for qualified drivers some of the hottest machines on the cold circuits. A Blizzard model we tested last spring was tuned for exotic fuel and rated for a possible 100 mph. After driving it we believe we could have hit that magic number with a little more flat straightaway to run—and a little more courage.

Arctic Cats, the sleek machines from Thief River Falls, Minn., hold the world's record for speed over the snow with Boss Cat II, a 500-hp alcohol-burning research rocket we gave a test run recently. Lessons in high-speed steering and suspension have been passed down through the 13 models in the regular line. In addition to the

SPEED makes racing a popular spectator sport; Indy driver Al Unser leads the pack (top) at 85 mph on pace Polaris in Hodog Marathon, Rhinelander, Wis. Silencing to 73 dbA is claim of new Evinrude and Johnson snowmobiles (l. and r., above) when tested on sound machines at required 50 feet. Both makes report quietest rigs available for '73, also offer RC models with rotary combustion engines. Hurricane Mark I (below), one of the four Mercury models, uses a special version of Merc outboard motor with tuned mufflers for exhausts. Rear-mounted spring shock absorbers are reported to smooth the ride





BRUT, from Brutanza, has the only liquid-cooled powerplant



MUSTANG, a wide-track Polaris, will mount a 30 or 42-hp powerplant



MOTO-SKI's Sport 440-cc is one of 11 performance models



PANTHER ARCTIC CAT is line leader from the popular brand



SUPER STINGER 400TX from Scorpion has Para-Rail slide suspension system



RAIDER twin-track with rear engine is new machine for '73



ELITE, newest from Ski-Doo, features side-by-side seating



DRAGSTERS for both grass and snow from Chaparral have 80 or 120 hp



SKIROULE RTX claims 17 new safety features for 11 models

Cheetah, Puma, Panther and Lynx, a new series called El Tigre has been announced for '73. It has been modeled after Arctic Cat's EXT racing series, and provides a narrower track, free-air induction and twin carburetors, tuned exhausts, and engine options up to 440-cc. For four years a Wankel rotary combustion engine has been offered, and now the same engine is reported to be installed in some of Arctic's General Leisure Products lawn mowers as well.

Ten Polaris models will offer a choice of engines from 175 up to a husky 530-cc at prices up from \$650 for a light-weight (286-lb.) Colt. The bigger engines are available in the bigger Charger and Mustang machines. Improved lighting, ignition and disc brakes are among

changes for this coming year. Double-action shock absorbers are reported to give a smoother ride.

Scorpions will appear in a choice of four colors: red fleck, magenta fleck, white and yellow. Power will range from 290 to 428-cc, or 290 to 399-cc in Sting-erette models for women drivers. Scorpion's new Para-Rail slide rail suspension is provided for most models, and better lighting capacity plus ski shocks for most models are also supplied. We would also add our own award for Scorpion's owner manual with its excellent illustrations and explicit instructions.

Up from two models last year, John Deere snowmobiles now come in a selection of five machines and from 292-cc en-

(Please turn to page 196)



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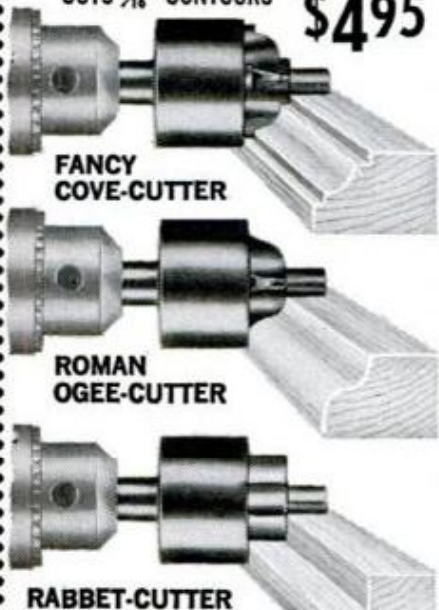
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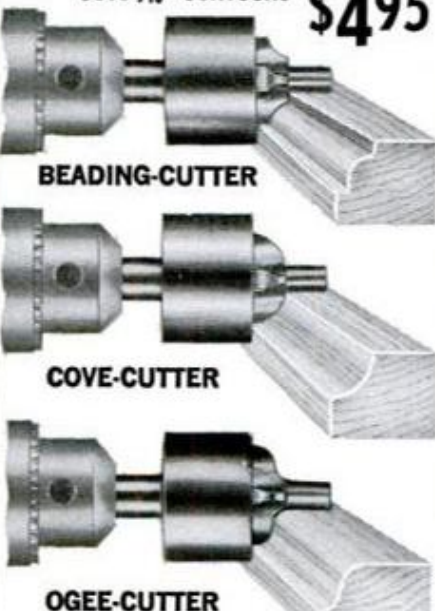
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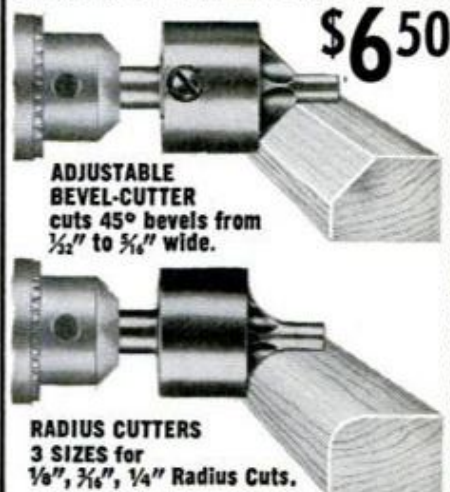
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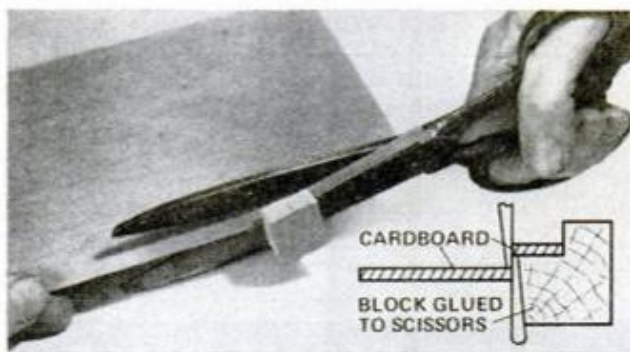
HINTS FROM READERS



See what you saw

When you make a scroll cut, it is often necessary to do a lot of the cutting in the shadow of the sabre saw. To eliminate eyestrain, and the chance of cutting off of the line, I temporarily attach my pocket penlight to the front of the saw with a wide strip of adhesive tape. Make certain tape doesn't cover the saw's vent holes.

—Andrew Vena, Philadelphia.



Shear ingenuity

Recently, when I had to cut a lot of like strips from cardboard, I did it without having to draw repeat guidelines. A block of wood of the same thickness as desired strips was glued on the outside of the blade with household cement. After the gauge block had done its work, I pried it loose and cleaned the blade with solvent.

—Walter E. Burton, Akron, Ohio.



Tip for steel-wool users

An excellent holder for steel-wool pads can be made with a large crutch tip. It provides good grip, and when you desire to work with a small portion only, you can pack most of the wadded-up wool inside the crutch tip. If desired, two or three tips can be color-coded and kept for various grades of steel wool.

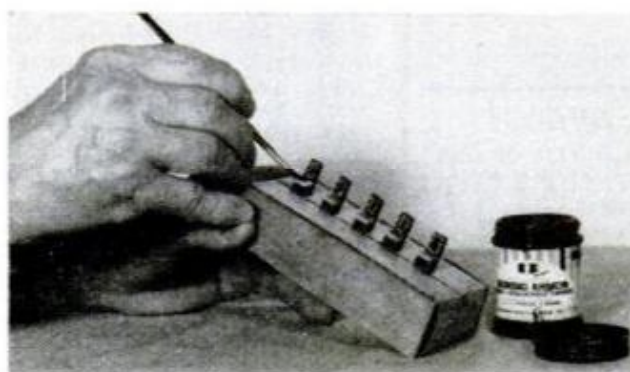
—William Swallow, Brooklyn.



Faucet handle turns tap

A hand "chuck" for turning drills or taps in a cramped space where a power drill or hand drill will not fit can be made by threading a faucet handle to fit the threaded stud on a removable chuck from your power drill or drill press. Lacking an old faucet in your junk box, you can probably find one at a fix-it shop.

—Marshall Lincoln, Wickenburg, Ariz.



Tape holds miniatures

Fragile items like these five tiny chairs can be safely painted using this setup. Simply wrap masking tape around a wood block sticky side out. Lightly press pieces into place, paint the miniatures and when they're dry, shift and reposition the pieces to expose the unpainted areas on the bottoms. Then complete the job.

—Harold T. Bodkin, Jr., Wyandotte, Mich.

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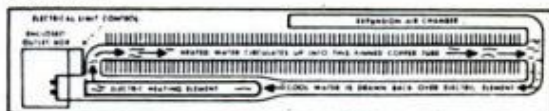
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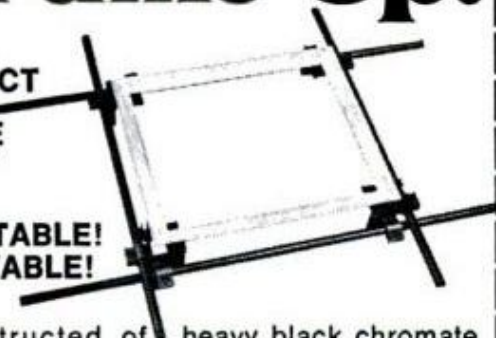
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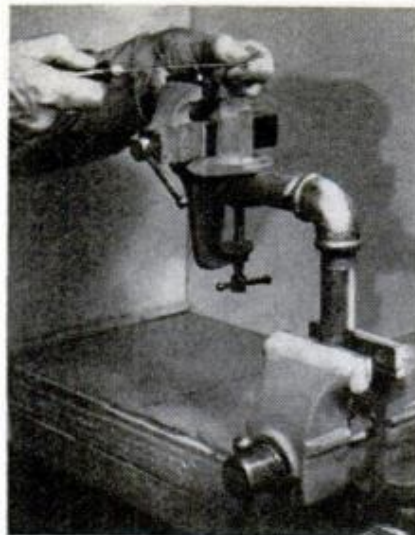
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HINTS FROM READERS



Hold that light

A magnet from an old speaker makes a handy work-light holder when you do auto repairs. Form a bracket of scrap aluminum to suit socket, attach it to magnet with machine screw.—*Marshall Lincoln, Wickenburg, Ariz.*



Raising work saves back

Using pipe fittings or flat steel and a small vise, you can fashion this setup to save stooping over tedious filing chores. File flats on the top horizontal pipe for clamping and to prevent swinging.—*Charles H. Hardy, Whittier, Calif.*



Plane shaving 'bag'

Often when you plane overhead, as when fitting a hung door, shavings will drop in your face. To prevent this, slip a plastic bread bag over top of the plane iron and tape it in position.—*Walter E. Burton, Akron, Ohio.*

Wooden dowel aids soldering copper water pipe

Recently, I wanted to tie a new line into a vertical run of copper water pipe, but after cutting the pipe, water standing in the section below prevented me from getting the pipe hot enough to sweat-solder the fitting. I was stumped until I took a

long 1/2-in. dowel and inserted it into the water-filled pipe. The dowel displaced the standing water and, when it was withdrawn, the upper end of the pipe was empty and ready for soldering.—*James P. Marshall, Barrington, R. I.*

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HOLIDAY DECORATIONS THAT COST PRACTICALLY NOTHING. They're pretty to look at and do-it-yourself fun for the entire family. We've rounded up some unusual decorations: "stained-glass" figures for windows, a pair of handsome wreaths, rope garland for stairways—even delicate tree ornaments fashioned from old soda cans.

CHRISTMAS CIRCUS TRAIN. If you have a toddler in the family and are wondering what to make him for Christmas, wait until you see this colorful pull-toy circus train. Consisting of five cars, an engine and 10 "wild" animals, it's a gift that will cost you very little since it can be made from waste wood in your scrap box.

THE BOTTLE-CUTTING CRAZE. Like candlemaking, bottle cutting has caught on like wildfire. Bottle-cutting kits have now made it easy for anyone to convert throwaway jugs, beer and wine bottles into attractive and colorful candleholders, fruit bowls, ashtrays, wind chimes, candy dishes and countless other useful items. It's a real fun-hobby and one that helps get rid of trash and clutter.

SHORT COURSE IN USING A ROUTER. With minimum practice a portable router lets you put finishing touches on a project that will elevate its looks to professional status like no other tool. You can shape and rabbet edges, run grooves, make decorative cuts, follow templates and more with this most versatile workshop tool. If you don't already own it, you'll be eager to buy one after reading this illustrated two-part story.

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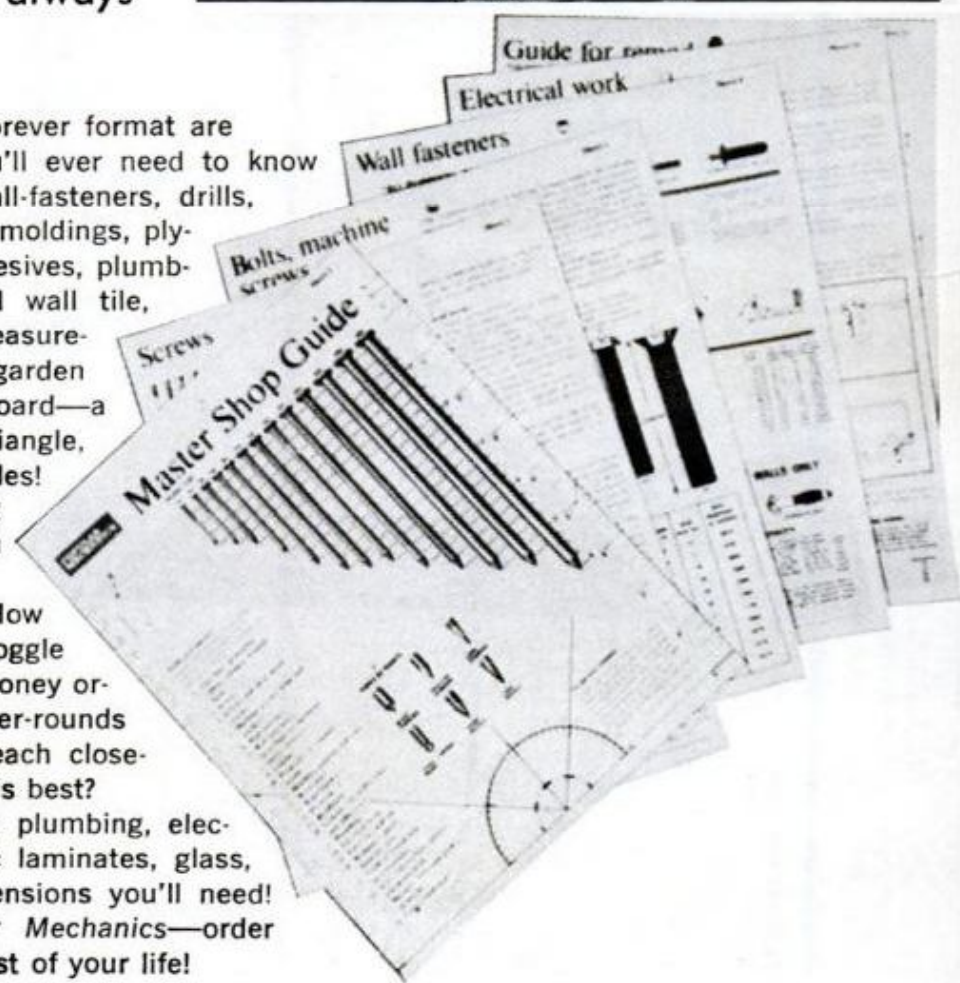


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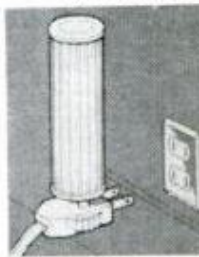
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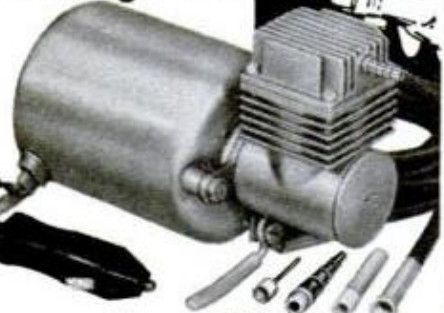
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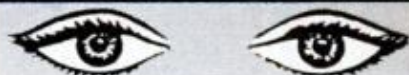
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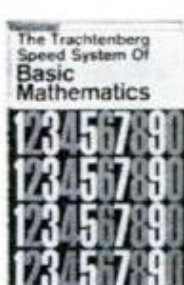
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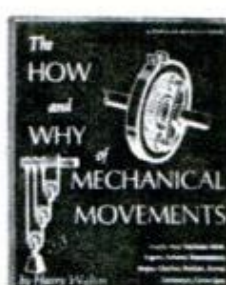
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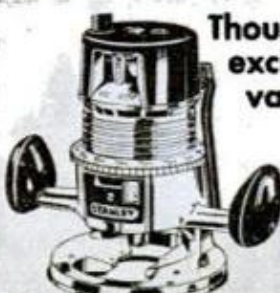
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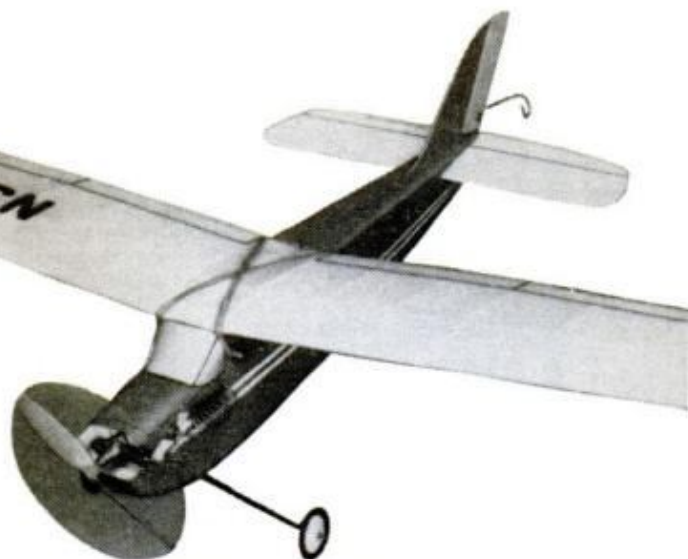


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