

20 In-the-Store Checks for TV Buyers

POPULAR MECHANICS

JAN. 1963
35 CENTS

Test Matching CORVETTE • AVANTI
T-BIRD • RIVIERA

How Service-Free
Are the '63s?



BRASS TRIM
for Tomorrow's Cars?

Ice-Proofing Gutters • Knucklehead Computers

Get Lucky



**the taste
to start with**

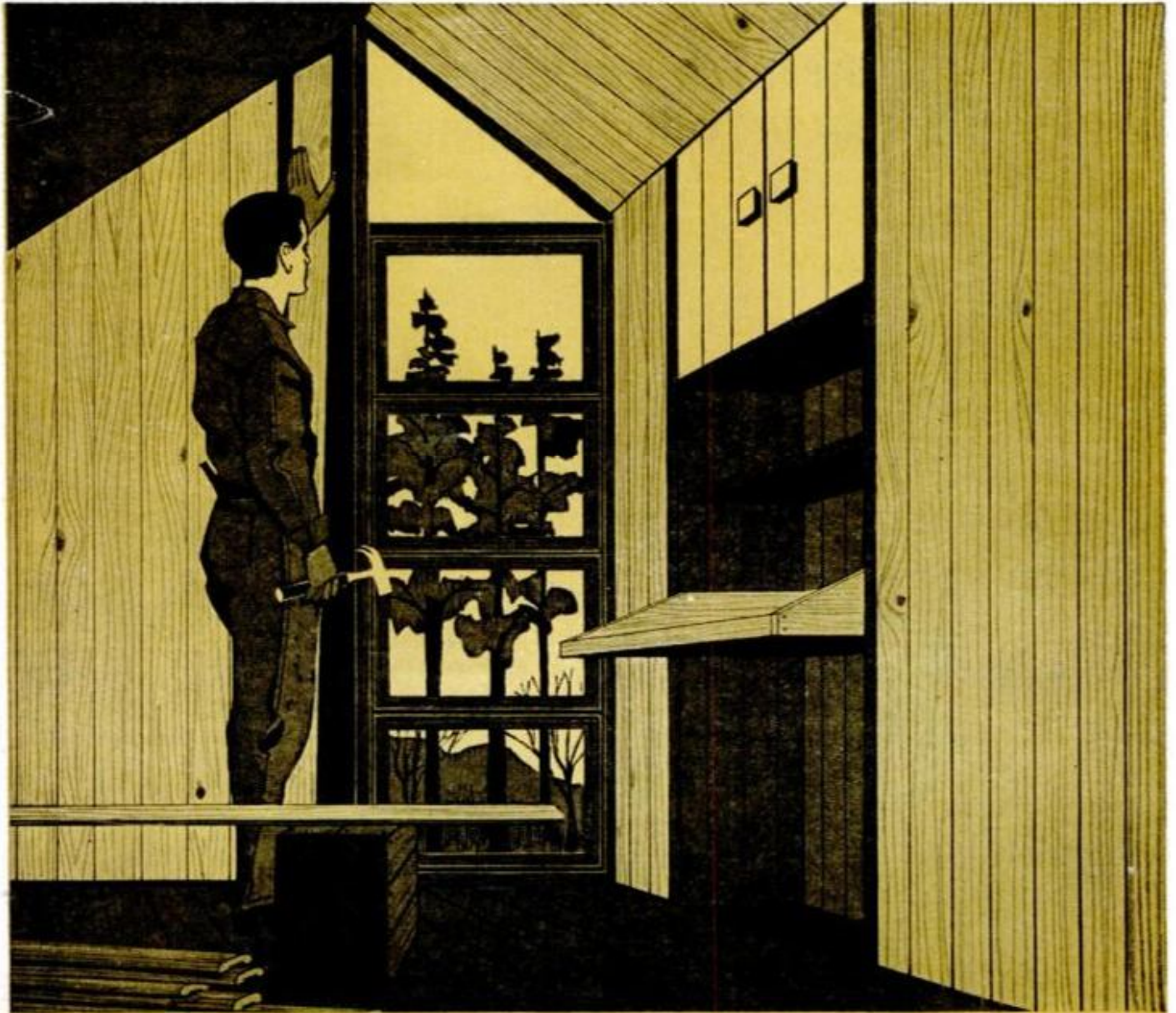
**LUCKY
STRIKE**
IT'S TOASTED™
CIGARETTES

**the taste
to stay with**

The taste of a Lucky spoils you for other cigarettes. This famous taste is the best reason to start with Luckies . . . the big reason why Lucky smokers stay Lucky smokers. How about you? Get the taste you'll stay with. **Get the fine-tobacco taste of Lucky Strike.**



PRE-SEASONED QUALITY LUMBER FROM WESTERN PINE ASSOCIATION MEMBER MILLS



BUILD YOUR NEW ROOM THE EASY WAY!

First, see your lumber dealer for Western Pine Association's free booklet . . . it's full of new room ideas! Then build your new room with pre-seasoned lumber from the Western Pine Region! If you haven't worked with Western Pine Region lumber before, you're in for a new experience. There's something special about these woods! You'll discover it the first time you work with them. You'll actually feel a difference. You drive nails without worrying . . . round corners as if they aren't even there. Sanding? It's satin smooth almost before you start. We said you'd feel a difference—you'll see it, too! Not just on the day you finish . . . but whenever you show it off—ten, twenty, thirty years from now!



If your dealer doesn't have this booklet, send 10c to the address below and the Western Pine Association will mail you one immediately!

**WESTERN
PINE ASSOCIATION**
DEPT. M-12, YEON BLDG.
PORTLAND 4 OREGON

JANUARY 1963

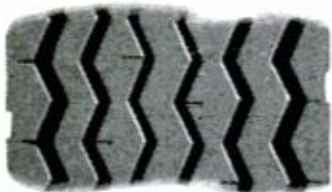


XHB3-L8Q-C634

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yes, outwears! yes, any other!

The new Goodyear Super Hi-Miler outwears any other truck tire of its kind! Here's why:



1. New, wide tread.

Reduces the rate of wear because tread wear is distributed over a much wider area.



2. All ribs continuous.

Not broken into lots of small segments that squirm and scuff away mileage. Wear is smooth and even.



3. New shoulder design.

Open grooves safely dissipate tire-destroying heat — flex easily — resist tearing.



4. All grooves full depth.

Run right down to undertread. Extra-deep outer grooves insure extra traction and extra safety.



5. Dual Compounded tread.

Two treads in one. Resilient inner tread cuts heat buildup. Permits compounding outer tread for maximum wear.



6. And, New "Muted Sound."

Zigzag groove length varies in each quarter of tire. Acoustically engineered to mute high-speed tire noise.

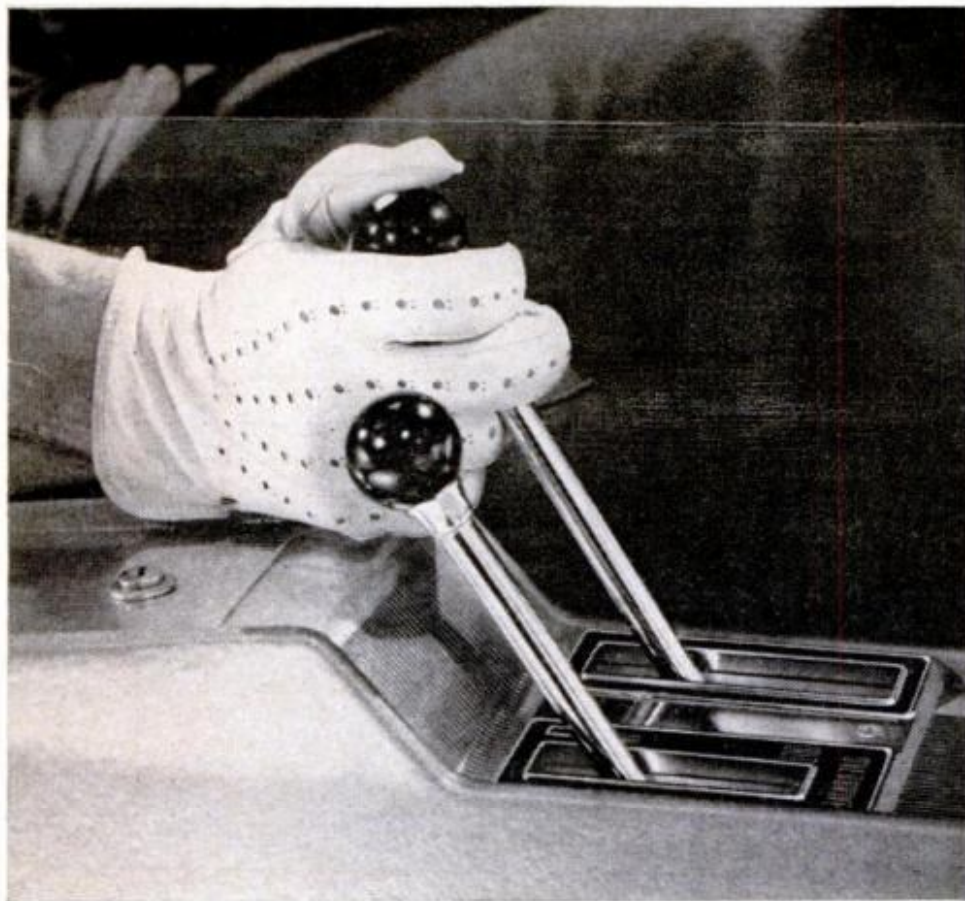
plus Tufsyn

...new Goodyear wonder synthetic... proved in millions of highway miles, the toughest, longest-wearing rubber Goodyear ever developed! • Whether you have 4 wheels or 4,000 on the road, you'll save with the all-new Super Hi-Miler with TUF SYN. Get the full story from your Goodyear Representative, your Goodyear Dealer or Goodyear Service Store. And specify Super Hi-Miler on your next equipment order. Then start saving with Super Hi-Miler. Goodyear, Akron 16, Ohio.

GOOD YEAR

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

NOW FROM RAMBLER—SPORTS-CAR ACTION!



NEW TWIN-STICK FLOOR SHIFT WITH INSTANT OVERTAKE

You call the shots as never before when you operate from the bucket seat of a spanking new '63 Rambler with the new Twin-Stick Floor Shift transmission option.

Both stick shift and overdrive control lever are handsomely mounted on the sporty console, right at your fingertips.

And atop the stick shift you find a button that permits instant kickdown out of cruising gear and into sports-car-like action. In effect, *five* forward speeds can be quickly selected.

And that's only part of the

'63 Rambler story. The exciting new Classic 6 and Ambassador V-8 also incorporate years-ahead Advanced Unit Construction—new curved glass side windows that hush wind noises and contribute to the beauty—dozens of other far-ahead features.

But come see for yourself. Sample the thrill of Rambler's new, exclusive Twin-Stick Floor Shift with Instant Overtake—available in American "440s," Classic "770s," and Ambassador "990s." See them now at your Rambler dealer's!

RAMBLER '63

The New Shape of Quality

JANUARY 1963



INSTANT PASSING ... because you're out of cruising gear and into passing gear at the touch of a button. Real sports-car action!



INSTANT EXTRA ECONOMY ... when you flick the convenient overdrive control lever right next to the gearshift.



INSTANT COMFORT ... when you settle back into the smart Reclining Bucket Seats with sporty console at your side. Optional.

POPULAR MECHANICS®

JANUARY . 1963
VOL. 119 NO. 1

INTERNATIONAL EDITIONS • SPANISH • CARIBBEAN • FRENCH • PORTUGUESE

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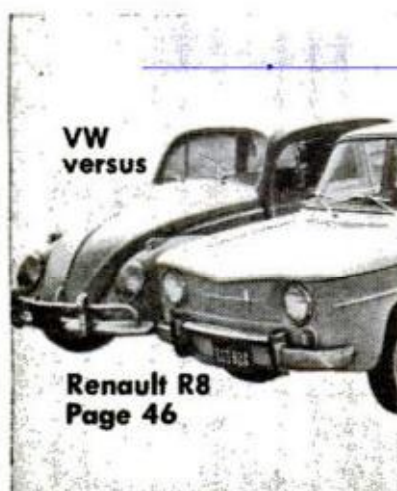
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NEXT MONTH . . .

INSTANT COLOR—all about Polaroid's new color film and how it compares; a rundown on the new towable, fold-wing homebuilt airplanes. You'll dice with the Jeep derby drivers, fly with the "war preventers" on photo recon missions, learn which glues are which—all in February PM

DANISH • SWEDISH • DUTCH

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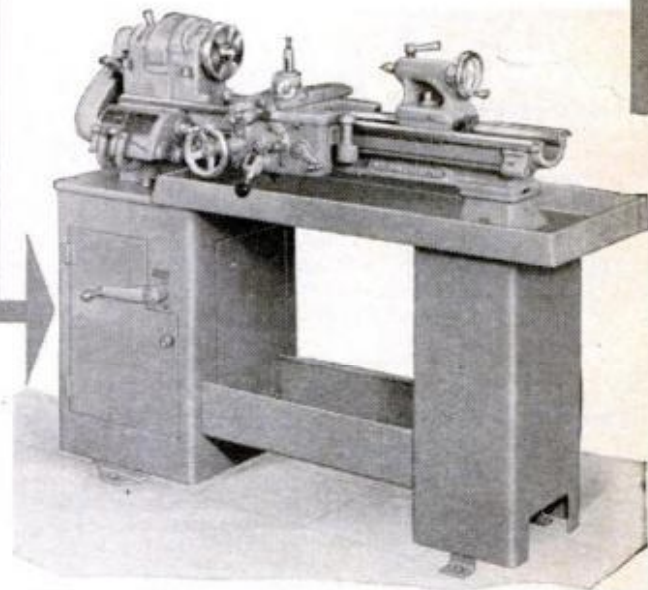
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JANUARY 1963

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10" LATHES

with new
welded steel
floor legs



- New, trim floor legs . . . reinforced construction of welded, heavy gauge steel . . . maximum rigidity with minimum weight . . . no increase in price!
- Famous South Bend dependability.
- Superfinished spindles and bearings for uniform accuracy and fine finishes.
- 70 screw threads (4 to 480 per in.) . . . 70 longitudinal feeds . . . 70 cross feeds.
- Tool room and Engine Lathe models . . . prices start at \$1346 f.o.b. factory.

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South Bend 22, Indiana

Building Better Tools Since 1906

Time payment plan
available. Up to 36
months to pay.



**BUY DIRECT
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SAVE
AS MUCH AS
80%

POWER TOOLS

GUARANTEED TO DO THE WORK OF \$40, \$60, \$100 UNITS

- ★ RUGGED AND VERSATILE
- ★ PROFESSIONAL QUALITY
- ★ LIFETIME ENGINEERED

REVOLUTIONARY PATENTS DECREASE COSTS, INCREASE EFFICIENCY
Top quality full scale power tools of heavy duty 100% cast iron and steel. Streamlined design reduces weight, cuts material and production costs. Special patents provide added efficiency, accuracy, savings. Nothing left out but exp've gingerbread. Parts made, assembled, tested, packed in our own factories, shipped direct. No store profits to add to cost.

**8" TILT ARBOR
POWER SAW
KIT**

\$995
f.o.b. factory

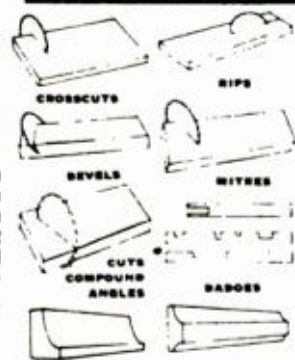
Wt: 12 lbs.
If desired, for easier
work alignment: RIP
FENCE, \$3.50
add'l.



KIT INCLUDES:
• Complete blade carrying mechanism with depth of cut control • Ground spindle with saw flanges • Pre-oiled bearings • Angle of tilt control • Mitre gauge • Motor mount assembly • Attractive steel front control panel • All needed brackets, screws nuts, bolts • ABC assembly plans • Patterns for sturdy base, massive 20" x 24" table • Full instructions

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**GUARANTEED TO DO THE
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MAKES COVE MAKES MOULDING

SAVE BIG MONEY ON HOME IMPROVEMENTS, SHELVES, CLOSETS, FURNITURE, TOYS

Put together in jig time. All you need are household tools, 1/2 sheet 3/8" plywood for table and base. Revolutionary new patents. Table stays level, blade tilts. Motor mount takes standard 1/4 h.p. or larger motor, keeps belt tight: full power, perfect alignment any angle. Blade tilts, locks securely any angle to 50°; raises, lowers 0"-2 1/4". Takes standard 8" blade, dadoe heads, cutters, etc. (not incl.).

IT'S FUN! IT'S EASY! Save big money when you buy, save big money when you use. Use for 10 days. Put through most rugged tests. If not satisfied, return for full refund.

**6" SWING
3-FT. LATHE**

\$985

f.o.b. factory

Optional Faceplate
for turning bowls,
trays, lamp bases,
rosettes, etc.
\$2.50



Complete as shown

DOES THE WORK OF \$40 UNITS—Sturdy all cast iron power tool turns wood or plastics with the precision and speed of machines selling for 4 times as much. Tubular steel bed, ball thrust cup center, spur center, T-Rest assembly, lever action tail stock, 2 speed pulley. Fits any motor.

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**FULL 22" LONG, 4 1/2"
JOINTER-PLANER**

\$1995

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as shown

100%
precision
ground
cast iron
and steel.

**PROVED BY
MORE THAN
500,000
USERS**



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Now, at little more than a hand tool price, a guaranteed professional quality precision machine which does same work as skilled hand planing... much faster, more accurately. Make accurate glue joints; rabbeting cuts for doors, window frames, table drawers; square taper cuts for chair legs; accurate beveling.

• Precision ground cast iron tables, adjustable for depth of cut • Rigid cast iron base • New patent-pending design holds clearance between knives and tables at any depth • Rabbet depth 3/8" • Hardened, ground high speed steel knives • Patent-pending fence adjustable to any position, any angle 0°-50° • Patent pending lift-off guard (nothing to loosen!) • Balanced steel cutter head. **UNCONDITIONAL 10-YEAR GUARANTEE.**

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BALL BEARING
WOOD SHAPER
KIT**

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f.o.b. factory

Complete less
wood parts, motor
Hold-down assembly
optional—\$2.75



**DOES
WORK
OF \$100
UNITS**

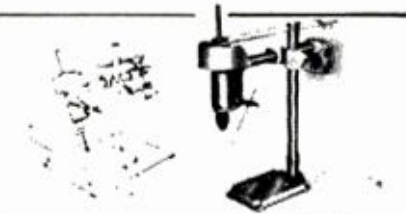
Makes decorator edges on furniture, forms beads, coves, moldings, tongue-in-groove joints, etc. A-B-C plans make assembly a breeze. Everything incl. but plywood for table, skirt. Greased-for-life ball bearings in sealed cast iron housing; fully adjustable, easily accessible cutter height control, fence assembly. Precision-machined for smooth, accurate cuts at high speed. Takes 1/4 h.p. or larger motor, standard cutters avail. at Sears, other retailers. **UNCONDITIONAL 10-YR. GUARANTEE.**

**32" RADIAL
DRILL PRESS**

\$2995

F.O.B. Factory
1/2" Cap Gear Chuck Inc
Shipping Wt 30 lbs.

**DOES WORK
OF \$90
UNITS...
AND A
GREAT
DEAL MORE**



Industrial quality precision machine with all features of standard drill press, many extras. Head raises, lowers. Greatly increased depth of throat. Can be pre-set to any angle or position for on-or-off table drilling... even horizontal drilling. All cast iron and steel. **UNCONDITIONAL 10 YEAR GUARANTEE**

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Please send me the units checked. Payment in full enclosed \$..... or \$3 deposit each item enclosed, balance C.O.D. I must be fully satisfied or will return unit within 10 days for full refund. No questions asked.

- Jointer-Planer \$19.95
- 8" Saw Kit \$9.95
- Lathe \$9.85
- Shaper Kit \$14.95
- 8" Saw Kit & Rip Fence \$13.45
- Lathe & Faceplate \$12.35
- Drill Press \$29.95
- Shaper Kit & Hold-down \$17.70

NAME.....
ADDRESS.....
CITY..... ZONE..... STATE.....

(please print)

10 DAY MONEY BACK GUARANTEE

You must be satisfied or money refunded.

AMERICAN MACHINE & TOOL COMPANY

Dept. PM-13, Royersford, Pa.



Pontiac Motor Division • General Motors Corporation

Can you tell which Tempest is the tiger?

Easy. The Le Mans on the right gets its power from our 4—that's the big 4 that stalks around acting like a V-8. So you have to call it a tiger.

The other Le Mans Sports Coupe has our new 326-cu. in. V-8* tucked away under the hood—all 260 bhp of it. That's good for two tigers. At least. We call it the V-326. It's for people who are willing to admit that our 4 does go around acting like twice life size but still hanker for an heroic V-8. So what's actually with this Two-Tiger V-8 that rates it more than a passing blurb? A weight-to-power ratio of under 12

*Optional at extra cost. †Manufacturer's suggested retail price for specified optional equipment (incl. reimbursement for Federal excise tax). State and local taxes extra.

to 1 that bows only to machines so muscle-bound they can't be driven happily on the street. A whole bunch of nonsense torque—352 lb/ft of it. And the only thing smoother drinks kerosene and carries stewardesses.

Suggestion: Take a Le Mans with a Two-Tiger (we've got to stop calling it that or nobody'll remember its real name), order it with \$6.24† worth of heavy-duty suspension and one of our no-extra-cost performance axle ratios. Then sit back in that left-hand bucket seat, depress the loud pedal, and blissfully contemplate The Good Life.

Wide-Track Pontiac Tempest

SKIPPED ME AGAIN!

POOR BURT! HE MISSED OUT ON THAT PROMOTION AGAIN!



I WAS DETERMINED TO MAKE GOOD IN MY JOB...BUT DETERMINATION, I FOUND, WAS NOT ENOUGH!

I HAD PLENTY OF EXPERIENCE. AND THE BOSS SEEMED TO LIKE ME. I LACKED JUST ONE THING—TRAINING!

SORRY, BURT! I KNOW YOU'VE WORKED HERE LONGER. BUT TED HAS THE SPECIAL TRAINING WE NEED. YOUR CHANCE WILL COME ...SOMEDAY!



I. C. S. IS THE OLDEST AND LARGEST CORRESPONDENCE SCHOOL IN THE WORLD. 256 COURSES. PERSONALIZED INSTRUCTION, CAREER GUIDANCE, EASY-PAY PLAN. DIPLOMA TO GRADUATES.

SIX MONTHS LATER... I.C.S. SENT MY BOSS REGULAR REPORTS OF MY PROGRESS. THEN ONE MORNING...

BURT, I'VE JUST MADE YOU THE ASSISTANT MANAGER OF YOUR DIVISION...AT \$15 MORE A WEEK. AND THE WAY YOU'RE GOING NOW, THIS IS JUST THE BEGINNING.

GOSH! THANKS MR. TAYLOR!



I GOT IT, HONEY! I GOT THE PROMOTION! OUR MONEY WORRIES ARE OVER! TODAY'S OUR LUCKY DAY!

TODAY AND THE DAY YOU MAILED THAT I.C.S. COUPON!



WHY NOT MAKE THIS YOUR LUCKY DAY? LET I.C.S. PUT YOU ON THE ROAD TO MORE PAY, RAPID ADVANCEMENT, REAL JOB SECURITY. HERE'S THE FAMOUS COUPON. MAIL IT NOW!

I WAS TIRED OF WAITING FOR "SOMEDAY."
I MADE UP MY MIND TO ACT! I'D GET THE
TRAINING I NEEDED...SOMEHOW!
JANE HAD A SUGGESTION...

I CAN'T QUIT MY
JOB AND GO BACK TO
SCHOOL! AND I SURE
DON'T WANT THAT
NIGHT CLASS
ROUTINE IN
THE CITY!

WHY NOT STUDY
AT HOME?...THE
WAY DAD DID...
WITH I.C.S.



JANE SHOWED ME AN I.C.S.
ADVERTISEMENT IN A POPULAR
MAGAZINE. THERE WAS THE
FAMOUS COUPON AND THERE WAS
EXACTLY THE COURSE I WANTED..

SAY, THEY'LL SEND ME
A CAREER KIT FREE...
THREE BIG SUCCESS
BOOKS.

DAD SAYS
HE NEVER
WOULD
HAVE BEEN
MANAGER IF IT
WEREN'T
FOR I.C.S.



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- 1 "HOW TO SUCCEED"
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SHOWS I. C. S. METHOD.

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Technician <input type="checkbox"/> Nuclear Energy <input type="checkbox"/> Plastics <input type="checkbox"/> Pulp, Paper <p>CIVIL ENGINEERING</p> <ul style="list-style-type: none"> <input type="checkbox"/> Civil Engineering <input type="checkbox"/> Construction Engr. <input type="checkbox"/> Highway Engineering <input type="checkbox"/> Reading Structural Blueprints <input type="checkbox"/> Sanitary Engineering <input type="checkbox"/> Structural Engineering <input type="checkbox"/> Surveying & Mapping <p>DRAFTING</p> <ul style="list-style-type: none"> <input type="checkbox"/> Architectural <input type="checkbox"/> Electrical and Electronic <input type="checkbox"/> Mechanical <input type="checkbox"/> Sheet Metal <p>ELECTRICAL</p> <ul style="list-style-type: none"> <input type="checkbox"/> Elec. Appliance Servicing <input type="checkbox"/> Electrical Engineering <input type="checkbox"/> Elec. Eng. Technician <input type="checkbox"/> Elec. Motor Repairman <input type="checkbox"/> Industrial Electronic Technician | <ul style="list-style-type: none"> <input type="checkbox"/> Industrial Telemetering <input type="checkbox"/> Instrument Technician <input type="checkbox"/> Practical Electrician <input type="checkbox"/> Practical Lineman <p>ELECTRONICS</p> <ul style="list-style-type: none"> <input type="checkbox"/> Automation <input type="checkbox"/> Basic Electronics <input type="checkbox"/> Electronic Computers <input type="checkbox"/> Electronics Technician <input type="checkbox"/> Hi-Fi Stereo and Sound Systems <input type="checkbox"/> Industrial Electronics <input type="checkbox"/> Ultrasonics <p>ENGINEERING (Professional)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Chemical <input type="checkbox"/> Civil <input type="checkbox"/> Electrical <input type="checkbox"/> Mechanical <p>ENGLISH and WRITING</p> <ul style="list-style-type: none"> <input type="checkbox"/> Better Business Writing <input type="checkbox"/> Introductory Technical Writing <input type="checkbox"/> Short Story Writing | <ul style="list-style-type: none"> <input type="checkbox"/> Practical English <p>HIGH SCHOOL (Diploma)</p> <ul style="list-style-type: none"> <input type="checkbox"/> High School General <input type="checkbox"/> High School Math <input type="checkbox"/> High School Secretarial <input type="checkbox"/> High School Vocational <input type="checkbox"/> College Preparatory <p>MECHANICAL and SHOP</p> <ul style="list-style-type: none"> <input type="checkbox"/> Gas and Electric Welding <input type="checkbox"/> Industrial Engineering <input type="checkbox"/> Industrial Instrumentation <input type="checkbox"/> Machine Design <input type="checkbox"/> Machine Shop Practice <input type="checkbox"/> Mechanical Engineering <input type="checkbox"/> Reading Shop Blueprints <input type="checkbox"/> Tool Design <input type="checkbox"/> Toolmaking <input type="checkbox"/> Safety Engineering <p>SECRETARIAL</p> <ul style="list-style-type: none"> <input type="checkbox"/> Clerk-Typist <input type="checkbox"/> Professional Secretary | <ul style="list-style-type: none"> <input type="checkbox"/> Shorthand <input type="checkbox"/> Stenographic <input type="checkbox"/> Typist <p>STEAM and DIESEL POWER</p> <ul style="list-style-type: none"> <input type="checkbox"/> Boiler Inspector <input type="checkbox"/> Power Plant Engineering <input type="checkbox"/> Stationary Diesel Engineering <input type="checkbox"/> Steam Engineering <p>SUPERVISION</p> <ul style="list-style-type: none"> <input type="checkbox"/> Foremanship-Suprv'n <input type="checkbox"/> Personnel-Lab. Ref'n's <p>TV-RADIO</p> <ul style="list-style-type: none"> <input type="checkbox"/> Radio and TV Servicing <input type="checkbox"/> Radio-Telephone License <input type="checkbox"/> TV Technician <input type="checkbox"/> Practical Radio-TV Engineering <p>MISCELLANEOUS</p> <ul style="list-style-type: none"> <input type="checkbox"/> Railroad <input type="checkbox"/> Textile <input type="checkbox"/> Other (please specify) |
|---|---|---|---|--|--|

Name _____ Age _____ Sex _____

Home Address _____

City _____ Zone _____ State _____

Occupation _____

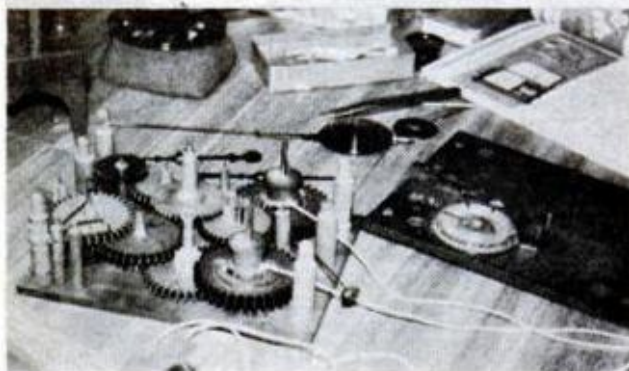
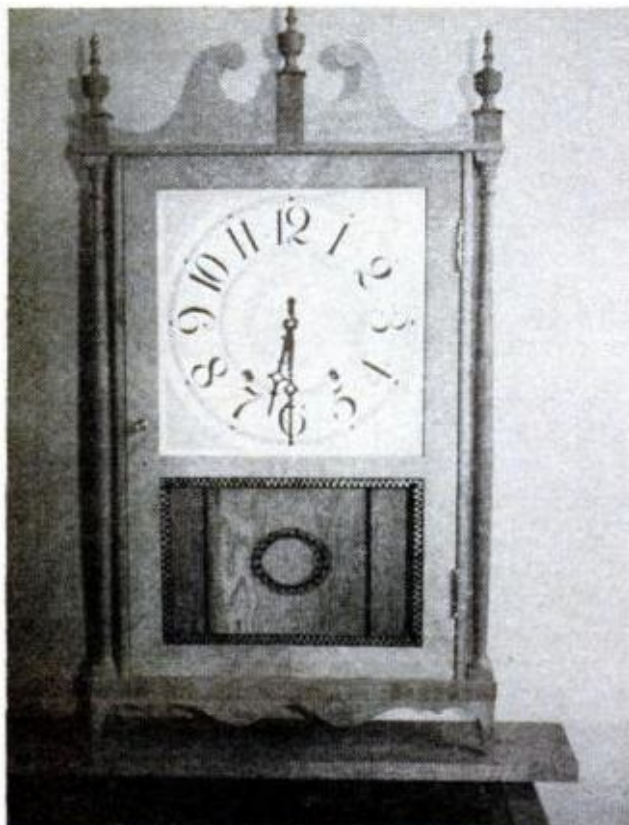
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Over the editor's desk

Wood Workers' Works

I have all but completed the clock (*Early American Clock Has Wooden Works*, page 154, Dec. '59 PM) including the wooden works. I removed the works several times to detect which gears needed more clearance; then the gear was taken out and the



teeth filed so they would run freely. To date, the clock keeps perfect time.

P. S. Have you names of any others who have made wooden works for this clock? G-4339 Beechwood Flint, Mich. **SAMUEL SYMONS**

Offhand, we'll bet you hear from at least a dozen pen pals among craftsmen who did go to the effort of making wooden works.

Toggle for Two?

In the article, *Light—and Power* (page 182, Nov. PM), you say you can control the motor and work light through one toggle switch. This is impossible with the wiring diagram as shown since the switch does not cut the light's circuit.

Philadelphia, Pa. **L. MARSHALL FORD**

You're right—and it wasn't designed to. It's just that—although the drawings were correct—we have an enthusiastic writer who's trying to get us into the push-button age before we're ready.

Radar's Echo

Your magazine is to be commended for informing the public of the truth about radar (*Is Highway Radar Foolproof?* page 92, June PM). Radar has aided in decreasing the number of fatalities in those states in which it is used. However, many people are convicted of speeding, when in fact, they never committed the violation at all. This, of course, is a result of the use of radar equipment by untrained and unqualified police officers. It has been my experience as an attorney that most judges, especially in the lower courts, accept a radar finding as a judicial fact. This, of course, is not justice.

Cortland, N.Y. **FRANK E. VISCO**

Hitches for all Cars?

Why do not automobile manufacturers attach trailer hitches on cars when they are manufactured?

Edwards, Mo. **WALTER H. SCHMIDT**

Mainly because they cost money and not everybody wants them. But it seems to us that it would be relatively cheap and easy to engineer the chassis and predrill holes as well as add a plug for the wiring at the time the car's built. Then dealers could offer a tailored hitch-and-tail-light kit to those who want one.

Lost and Found

To use your watch as a compass, as you have shown on page 146, June PM, is one of the oldest methods of locating direction, but what if the sun isn't visible? Here's a solution that's always available in the forest. The south side of a pine tree is a considerably lighter color than the north side, due to the bleaching effect of the hot sun. Chester, California **NORMAN ISHERWOOD**

If you put a cigarette, match stick or straight twig over the center of the watch and line up the shadow with the hour hand,

[\(Please turn to page 12\)](#)

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REAR
VIEW

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EXCLUSIVE
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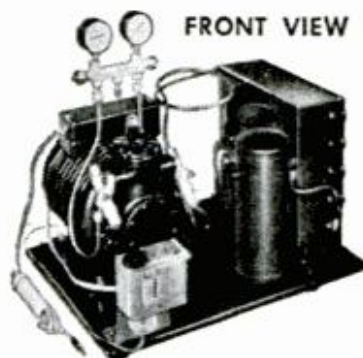
25 KITS—20 SHOP PROJECTS

Illustrated above is a view of the new CTI condensing unit, fully assembled. This is a commercial-type, heavy-duty, 1/4 h.p. unit. You build it from 25 kits of parts (and with tools) that CTI sends without extra cost. In addition, CTI includes 20 Shop Projects, which simulate the kind of problems you are likely to encounter in the field. After assembling your condenser, you may then build an air conditioner, freezer, refrigerator or milk cooler.



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You receive wrenches, tube flaring tools, hammer, tubing, fittings, gauges and many other items used by the experienced mechanic. Everything is of professional quality. Best of all, CTI trains you to use tools with speed and skill.



FRONT VIEW

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Because air conditioning and refrigeration is expanding so rapidly all over the nation, opportunities to go in business are plentiful. Many CTI graduates have accomplished this high aim. Start in a small way, from your own home, and gradually expand. In time you may wish to add a sales division. Manufacturers offer attractive franchises, including merchandising aids, to ambitious, qualified men.

Earn Cash in Spare Time

Soon after enrolling, many CTI students earn money in spare time. Some handle servicing on a monthly fee basis for food stores, restaurants, taverns and office buildings. Many work part time at local dealers. Quite a number of CTI students have a full-time business going by the time they graduate. CTI kit training gives you the practice and experience you need to step from lesson study to actual field work.

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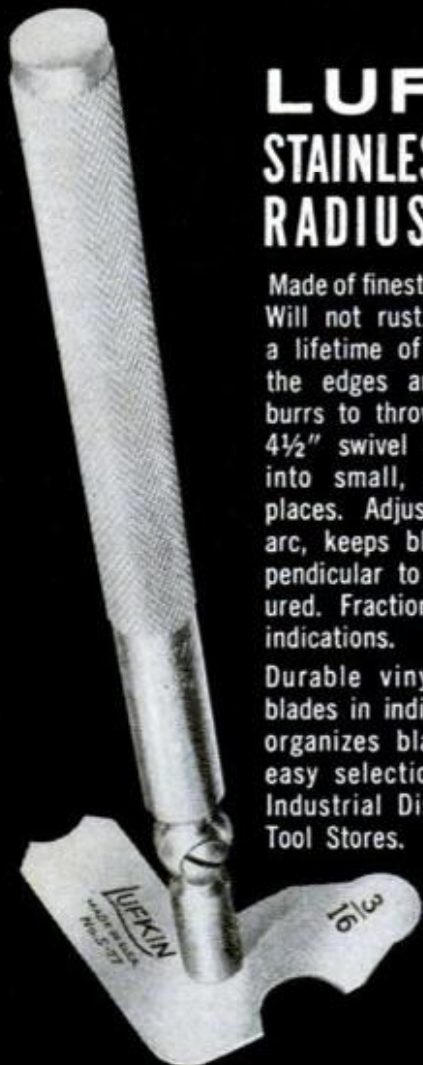
CITY _____ ZONE _____ STATE _____



CHECK ALL

5

- 1 INSIDE CORNER
- 2 OUTSIDE CORNER
- 3 INSIDE ROUND
- 4 OUTSIDE ROUND
- 5 CONVEX SURFACE



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SAGINAW, MICHIGAN

then 12 o'clock will be north. This works as long as the sun is out, even at 12 o'clock.
APO 179, New York, N. Y.

A2C TERRENCE L. BUTLER

Reader Butler's idea of pointing the hour hand directly away from the sun in order to locate north is correct in every step but the last. The principle behind this sundial-compass trick is the earth's rotation in relation to the sun once every 24 hours. Thus, if you were using a 24-hour watch, 12 o'clock would always be north when the hour hand pointed directly away from the sun. However, with a normal 12-hour watch, the interval between hour divisions is twice as great, so north would be halfway between the hour hand and 12 o'clock position on the clock face.

Bouquets

I certainly enjoyed your article, "50 Money-Stretching Tips for Home Buyers" (p. 148, Sept. PM). Will use it as a check list in designing the home I wish to build next summer.

Anchorage, Alaska

GERALD G. MARKEE

I found the Shopping Guide, "Transistor Radios," (p. 119, August PM), very informative in purchasing a transistor radio.
Aurora, Ill.

DAVID WARREN

That's what we're trying to do in every issue—give you information you can use. Wonder what other subjects PM readers would like covered in our Shopper's Guide series of buying tips for consumers.

Tip for the Slant

If the drawing board (p. 172, Sept. PM) is made of basswood (about 90 percent are), the screws holding the handle may pull out of this soft wood. You can stop this by drilling holes about 4 to 6 inches deep and inserting half-inch dowel rods. Glue the dowels in place, and use them for receiving the screws for the handle.

May I add that PM is used faithfully in our shops and is required reading by our students utilizing its many fine projects.
Kennett Public Schools
Kennett, Mo. DAVID R. THOMPSON, Head
Department of Industrial Education

That's a helpful tip and we certainly appreciate receiving it—and the kind words about PM—from someone who really knows his shop lore.

The Editors

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Although you may have 20-20 vision, the chances are that your right eye is more efficient than your left, especially if you're right-handed. In testing the ability of a group of persons to identify drawings on the right and left sides of their visual field, two London researchers found that the right eye could often identify pictures the left eye couldn't. All but one of the subjects were right-handed.

The radio blackout which temporarily breaks communications contact with space craft on re-entry into the atmosphere has been overcome, according to Boeing Co. officials working on the Air Force X-20 (Dyna-Soar). Radio equipment developed by the Radio Corp. of America which will broadcast at frequencies of thousands of megacycles will penetrate the blackout sheath 99 per cent of the time, RCA engineers say.

Ominous note in the Cold War. The Russians are working hard to develop a high energy laser beam capable of destroying the effectiveness of space vehicles, says Air Force Gen. Bernard A. Schriever. Such a beam could knock out a satellite's sensors and telemetry equipment.

Some Australians literally have a spring in their walk. They're testing a new type of shoe heel with built-in steel springs. The inventor says the springs absorb the impact of one step and give a "kick" to the next.

A scientist at Stanford University recently completed a study on the "cocktail party effect"—the ability of people at noisy parties to hear the sound of their own name across the room in spite of the din. Dr. Maurice Rappaport believes this is due to the stereo effect provided by our two ears plus the brain's selectivity. The research may help develop ways of increasing the message load on radio frequencies.

A new material for making false teeth and tooth jackets is composed of glass fiber and diamond dust. Known as "Diamalust," it can be colored to match any tooth shading and is said to be as strong as gold.

Telescopes in the news. Three new telescopes, all described as the world's largest of their kind, have been unveiled. One is the largest movable radio scope at Greenbank, W. Va. With an antenna diameter the length of a football field, the huge instrument went into operation in September. A second radio unit was dedicated by the University of Illinois at Urbana in November. Its parabolic reflector measures 400 by 600 feet. The biggest solar telescope, named for astronomer Robert R. McMath, will study the sun from the Papago Indian Reservation in Arizona. With a focal length of 300 feet, it is twice the size of any previous solar telescope.

A king-sized excavating shovel has been built by a firm in France. It's 38 feet long, 13 feet high, has a lifting power of 12 tons and its basket capacity is 141 cubic feet.

How do Mexican exhibition divers survive high dives of 135 feet from cliffs into the Pacific near Acapulco—hitting the water at speeds up to 60 miles an hour? Scientists say it's because they lock their hands together to break the force of the impact. Also, they keep their spines rigidly straight, the neck slightly extended, with the head looking slightly upward. Powerful muscles of the chest, neck and arms help cushion the shock.

You can get your hearing tested by telephone in Johannesburg, South Africa. You merely dial a certain number and listen to nine recorded signals of different strength. If you miss a tone at any given level, you're advised to consult a doctor.

A homely face may launch a crime wave. University of Kansas scientists recently studied 11,000 photos from crime files, found that 60 percent had facial defects, all correctible by plastic surgery. Further research may prove a theory that a particular feature determines the criminal type.

Dieters who think they can reduce blood cholesterol by following current fad diets may be endangering their health, according to the American Medical Association. It says no specific diet has been proven beneficial in lowering cholesterol and that eliminating certain fats may be harmful.

(Continued on page 16)

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Amazing but true! The Screen Print method requires no expensive Press and can be done in your own home. Start in Kitchen, Spare Room, Garage! Easy! Fascinating!

PRINT BEAUTIFUL SIGNS, POSTERS, BANNERS, FABRICS - anything in hundreds of colors. Use fabulous new "glowing" fluorescent colors. Can be seen for miles. No Art ability needed - we supply everything.

HELP SUPPLY DEMAND IN YOUR AREA! Just about every kind of business (drug, department stores, hardware, liquor stores, gas stations, theaters, jewelers, mortuaries, auto dealers, florists, beauty shops, real estate, etc.) can use Screen Printed things to increase business.

SOME \$100 JOBS USE LESS THAN \$10 WORTH OF MATERIALS. ... you pocket the difference for your labor and know-how. \$400.00 A WEEK EARNINGS POSSIBLE? Yes, some earn less, but Mr. J. T. Anderson reports he earns over \$400.00 a week printing Greeting Cards certain times of year. Get your share Now. Mail Coupon Today!

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Dear Mr. Nowak! I am genuinely interested. Please rush your "FINANCIAL ASSISTANCE PLAN" Revealing Screen Print HOME BUSINESS Details, Real SAMPLES, and "HOW TO" BOOKLET. I am under no obligation now or ever.

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Science Worldwide

(Continued from page 14)

Another astronomical observatory, this one in Chile, will give astronomers a chance to study stellar objects that aren't visible in the northern hemisphere, such as the southern half of the Milky Way and the Magellanic star clouds.

A beam of light called Molite—for Modulated Light Transceiver—carries voice communications 20 miles at the White Sands Missile Range. Two-way voice waves ride the light beam just as in radio frequencies.

Japanese scientists are dropping paper confetti from airplanes to help study snow falls. Each piece of confetti is about half an inch square and is colored red or blue. School children collect the pieces, noting what colors are found where as an aid in determining distribution of snow flakes.

Denmark's horse flies are in for a rough time. Scientists there have invented a fly-repelling varnish called Tugon which contains a phosphorus insecticide. It's diluted in water the day before use and then brushed on the coats of Danish farm animals or other surfaces.

Earth micro-organisms may already have contaminated the moon. Scientists at the recent conference on lunar exploration at Virginia Polytech were told that the Russian's Lunik II and our Ranger IV, both of which crashed on the moon, were incompletely sterilized. Tiny organisms could have been carried in the rockets' fuel and sealed components; they may have dropped through cracks and crevices to multiply in the lunar sub-surface.

Oysters are now being starched to fatten them up. Scientists at the Virginia Institute of Marine Science have been adding starch and other carbohydrates to their oyster troughs and getting oysters nearly a third bigger than those on a normal diet.

If you've ever wondered why it's costing so many billions of taxpayer dollars to finance Project Apollo, the program to put U.S. astronauts on the moon ahead of Russians, think of the real-estate cost of it. NASA is now buying 73,000 acres of land for the project's launching sites on the Florida coast—presumably at Florida prices. That's five times the present size of Cape Canaveral.

John P. McNeel

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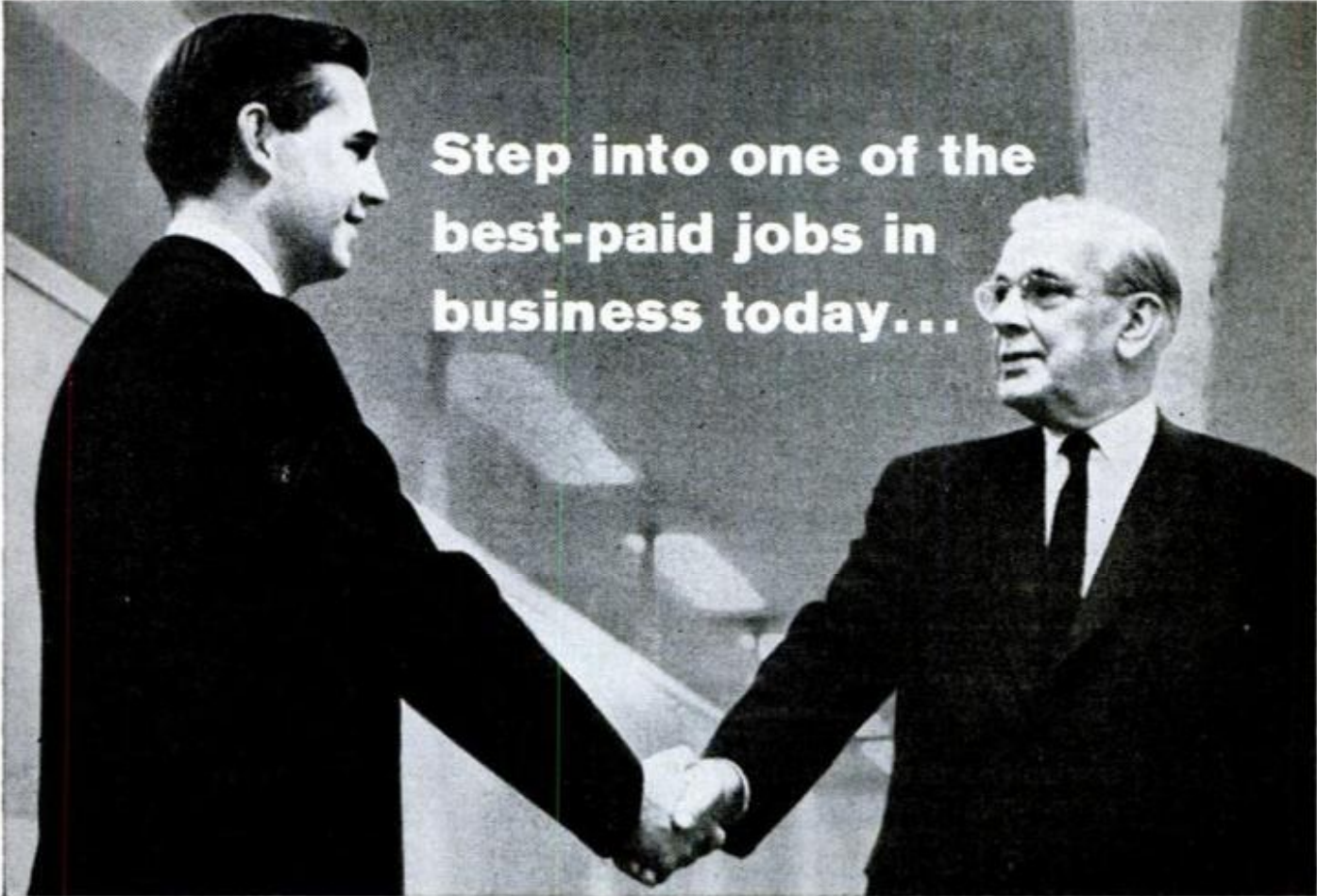
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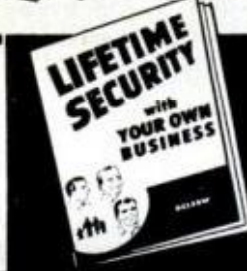
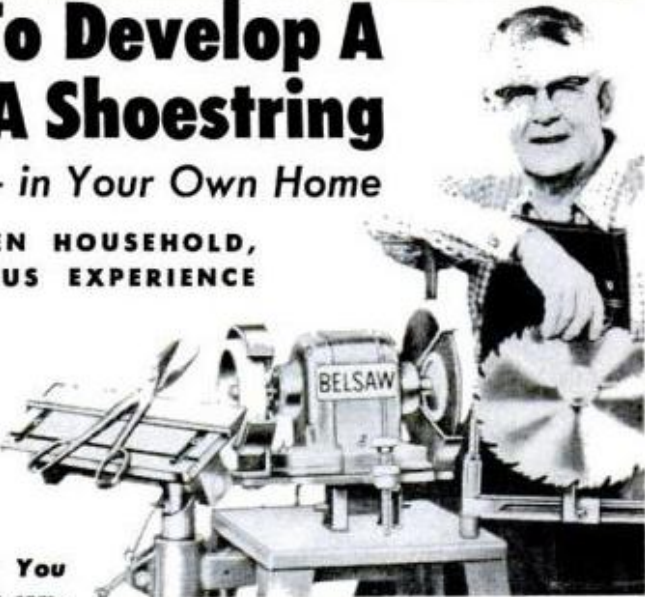
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I want to help you own this profitable business of your own. My company has been doing this for over 30 years, so I know your problems and how to guide you. I'll even finance you while you're getting started. You'll receive complete, easy-to-understand instructions on how to operate your SHARP-ALL, how to get business rolling in, how to handle advertising and direct mail. I'll keep you informed on how hundreds of other SHARP-ALL owners are bringing in extra income every day.



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Without obligation to me, send booklet and letter giving full details. Tell me how I may OWN a growing business of my own built upon satisfied customers.

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Start Now
while
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Are You The Man?

If you have longed for the prestige and financial independence of YOUR OWN business, you can now realize this goal . . . if you can qualify for a Duraclean dealership. We are now enlarging this world-wide chain of independently-owned service dealerships.

You must however be reliable, honest, diligent and able to make a small investment in a business we assist you in establishing. It's a profession we will personally and quickly teach you. We will help finance you. You can build your business

You are Trained in a New Profession . . . to Revive, Clean, Protect Home Furnishings

Duraclean's growth to a worldwide service resulted from the safer, quick-drying ABSORPTION process rendered in-the-home by courteous, trained craftsmen. Aerated foam created by the electric Foamovator vanishes dirt, grease and many unsightly spots.

Customers appreciate upholstery and floor coverings cleaned with a new consideration for life and beauty. No more soaking, harsh scrubbing, or strong soaps. Instead of scrubbing soil down into upholstery or rug pile, it is REMOVED.

Customers tell friends how Duraclean eliminates the customary soaking and breaking of fibers . . . how the mild quick-action foam, lightly applied, revives colors and enlivens fibers . . . how fabrics look fresher, brighter and cleaner . . . how furnishings are back in use in a few hours. Customers become your best salesmen.

You Have 6 Complete Services

DURASHIELD, applied to new or freshly cleaned fabric, retards soil and stains . . . retains the fresh, new look MONTHS longer.

DURAPROOF kills moths and carpet beetles. It makes upholstery, rugs, blankets, clothing repellent to both. 6-YEAR WARRANTY.

DURAGUARD flameproofs . . . prevents fire starting from cigarettes, candles, etc. Reduces fire damage in homes, theaters, hotels.

SPOTCRAFT safely removes most stubborn spots and stains.

TUFTCRAFT enables you to repair cigarette burns, moth damage.

while still employed.

This is a sound, lifetime business that grows from REPEAT ORDERS and customer RECOMMENDATIONS.

Alert dealers, using national price guide, can gross an hourly profit of \$9 on own service plus \$6 on EACH service man.

We want to assure your success. A Duraclean dealer will train and assist you. He'll reveal his successful plan of building customers. He will work with you. This business is easy to learn . . . quickly established. Coupon will bring full details.

What Dealers Say

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

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

John Jaffe: "There's a huge demand for good carpet and upholstery cleaning. If you tell enough people about Duraclean, you have to make good."

Hiram L. Brown: "Made \$105 in one day cleaning sorority house."

Thomas C. Mason: "Cleaned two rooms for a stock broker. He was so impressed he had 7 jobs lined up for me and from those seven came 4 more."

Russel C. Blue: "Customer called a prominent competitor. They said they could not clean her badly soiled furniture . . . to contact me because 'if anyone could get it clean, I could.'"

Ward Whitbeck: "In my fifth year am making as much as \$225 in one day."

L. Broersma: "Have now completed 5 years with Duraclean. We have never had one complaint."

We'll work WITH You . . . Help Finance You . . . No Shop Needed

You'll have a close relationship with our staff and with other dealers. We see our dealers often at regional meetings, training schools and conventions. We all work together . . . exchange ideas and swap experiences. We show you effective ways to bring customers to you.

You will have pre-tested newspaper and yellow-page ads, store display cards, radio and TV commercials, folders, sales materials and a complete mailing program. Magazine ads explain the superior merits of YOUR modern services and develop customer confidence in YOUR business. Your services are backed by Parents' Magazine Seal, the Use-Tested approval of McCall's and recommendations of textile manufacturers.

You not only have the opportunity to quickly increase your income . . . the growing dealership value is increasing your net worth. G. F. Monroe, after 12 months, sold his Texas dealership for 10 times his cost. Leo Lubel after 30 months sold for \$8,308 above cost. If for any reason you should want to sell your dealership, we maintain a resale service.

Almost every building houses a customer. Furniture stores, department stores, interior decorators, upholsterers and carpet stores secure jobs from their customers. Auto dealers have used cars Duracleaned and take orders for you. Some dealers have shops or offices . . . others operate from home with no overhead expense.

We prefer that you have no cleaning experience so you don't have to "unlearn" old scrubbing methods. We and an experienced dealer will show you everything you need to know to succeed and build your dealership.

A few hundred dollars establishes your business . . . pay balance from sales. We furnish electric machines, sales aids, and enough materials to return your TOTAL investment. This may be your life opportunity.

Just mail the convenient coupon today. There is no time like the present to find out whether this is the business that will increase your income and secure your future. We'll send you all the facts with no obligation whatever. Then, if you decide you would like to become a Duraclean dealer, you can mail your application and, if you qualify for acceptance, we'll have you actively operating in a few days.

FREE Booklet . . . Send for it NOW

Our first letter and illustrated booklet will explain everything . . . modern services, waiting market, how business grows, your large profit and territory. Mail coupon today while you can still get a dealership in YOUR location.

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() I have an accordion to trade.

Tune in on the inventors

by J. L. Pugni

An underwater rocket to protect skin divers from dangerous fish has a range of 75 to 100 feet. A propellant is fired with a flash that may be "sufficient to frighten sharks, barracuda, and any other... marine creature," states inventor Louis A. Maretti, Carpentersville, Ill. The rocket won patent 3,060,854.

* * *

Standing rigid Army inspections perhaps provided the incentive for three men to develop a fabric that presents a "suitable appearance after continued wear, pressing and cleaning." The material is a mixed wool and artificial fiber fabric with the same characteristics as an all-wool fabric. Rights to patent 3,060,551 were assigned to—who else?—the U.S. army by inventors Herman Bogaty, Evanstown, Ill., Norman R. S. Hollies, Bethesda, Md., and John C. Hintermaier, Troy, N.Y.

* * *

Left handers will appreciate a can-opener that can be used with equal ease from the left or right side. It has handles which can be reversed and then anchored in place with spring clips. Patent 3,059,333 goes to W. J. Landry, Independence, Mo.

* * *

\$100,000 was voted by Congress to the estate of the late Gregory J. Kessinch who is thought by some to be the sole inventor of the bazooka, the hand-carried rocket launcher. The bill was opposed by the Army which maintains that many contributed ideas to the final design of the bazooka.

* * *

Fishermen can tell when a bait is bitten by the ratchety sound made by a small attachment that can be fitted to fishing poles. Emmett A. Barnes and Robert B. Withington, Cincinnati, Ohio, were awarded patent 3,053,003 on this idea.

* * *

Radiation shielding compounds won patent 3,053,776 for Dr. Lyle B. Borst of New York University. The inorganic metal compounds can be used alone or with other material as iron, lead or stainless steel to provide shielding by absorbing high-energy radiation from nuclear reactors.

POPULAR MECHANICS

Profits That Lie Hidden in America's Mountain of Broken Electrical Appliances

By J. M. Smith *President, National Radio Institute*



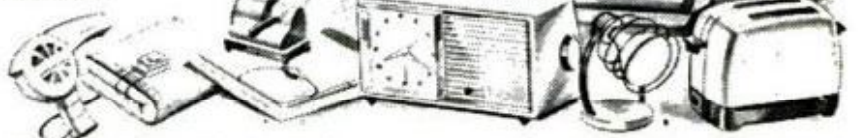
And I mean profits for you — no matter who you are, where you live, or what you are doing now. Do you realize that there are over 400 million electrical appliances in the homes of America today? So it's no wonder that men who know how to service them properly are making \$3 to \$5 an hour — in spare time or full time! I'd like to send you a Free Book telling how you can quickly and easily get into this profitable field.

THE COMING OF THE AUTO created a multi-million dollar service industry, the auto repair business. Now the same thing is happening in the electrical appliance field. But with this important difference: anybody with a few simple tools can get started in appliance repair work. No big investment or expensive equipment is needed.

The appliance repair business is booming — because the *sale* of appliances is booming. One thing naturally follows the other. In addition to the 400,000,000 appliances *already* sold, this year alone will see sales of 76 million *new* appliances. For example, 4,750,000 new coffee makers, almost 2,000,000 new room air conditioners, 1,425,000 new clothes dryers. A nice steady income awaits the man who can service appliances like these. And I want to tell you why that man can be *you* — even if you don't know a volt from an ampere now.

A Few Examples of What I Mean

Now here's a report from Earl Reid, of Thompson, Ohio: "In one month I took in approximately \$648 of which \$510 was clear. I work only part time." And, to take a big jump out to California, here's one from



J. G. Stinson, of Long Beach: "I have opened up a small repair shop. At present I am operating the shop on a spare time basis — but the way business is growing it will be a very short time before I will devote my full time to it."

Don't worry about how little you may now know about repair work. What John D. Pettis, of Bradley, Illinois wrote to me is this: "I had practically no knowledge of any kind of repair work. Now I am busy almost all my spare time and my day off — and have more and more repair work coming in all along. I have my shop in my basement."

We Tell You Everything You Need to Know

If you'd like to get started in this fascinating, profitable, rapidly growing field — let us give you the home training you need. Here's an excellent opportunity to build up "a business of your own" without big investment — open up an appliance repair shop, become independent. Or you may prefer to keep your present job, turn your spare time into extra money.

You can handle this work anywhere — in a corner of your basement or garage, even

on your kitchen table. No technical experience, or higher education is necessary. We'll train you at home, in your spare time, using methods proven successful for over 45 years. We start from scratch — *tell* you in plain English, and *show* you in clear pictures — everything you need to know. And, you will be glad to know, your training will cost you less than 20¢ a day.

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I'll also send you a Free Sample Lesson. It shows how simple and clearly illustrated our instruction is — how it can quickly prepare you for a profitable future in this big field. Just mail coupon, letter, or postcard to me: *Mr. J. M. Smith, President, National Radio Institute, Dept. AA3, Washington 16, D.C.* (No obligation, of course — and no salesman will call on you.)

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Your NRI Course comes *complete* with all the parts to assemble a sturdy, portable Appliance Tester that helps you earn while you learn. Easy-to-follow manual tells how to assemble and use the Tester *right away*. Locate faulty cords, short circuits, poor connections, etc. in a jiffy; find defects in house wiring, measure electricity used by appliances; many other uses.

With this Tester you save time and make money by doing jobs quicker, making sure appliances operate correctly after repairs.



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TV SERVICING SYSTEMS, Dept. J-171
1038 So. La Brea, Los Angeles 19, Calif.



Sidelights on aviation

BIG JETS, while they have been a genuine boon to commercial aviation, have had an unsettling side effect not anticipated when they made their entrance.

Aviation people were literally stunned at the impact the 707, the DC-8 and the 880 had on the air-traveling public. They thought the big three would have a certain position of prestige among airliners, but the public fought for space on them to such an extent that the huge jets are now the standard, rather than the exception.

Airports have died because of it. The outstanding example is Chicago's Midway. Once the world's busiest (PM, November, 1960), it is now—literally—a ghost airport.

Too small to handle the big jets (its runways are not long enough), it saw this business go to O'Hare International. Then, when the airlines saw the public flock to O'Hare to board the big jets, they slowly, methodically began pulling all their piston-powered airliners out of Midway until all their operations were centralized at O'Hare. The small feeder lines followed.

This pattern has had an effect all the way down the line, with scheduled airlines pulling back from smaller airports and, consequently, from smaller communities, isolating these communities from air travel.

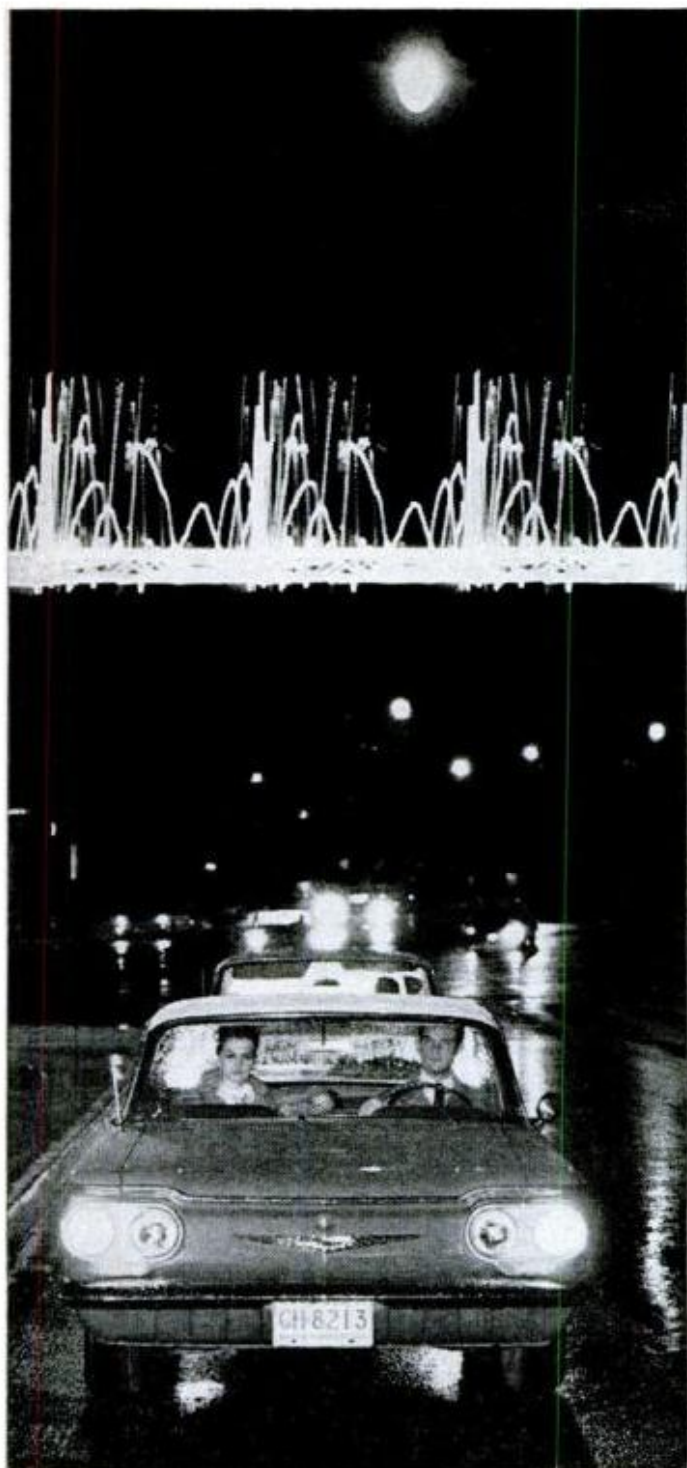
One man who sees a solution is W. T. Piper, president of Piper Aircraft Corp. and often called "the Henry Ford of the Air." Over 80 and still going strong, he has been stumping the country and beating the drums for "community airstrips."

"Every town or village with a population of 500 people or more should have one," he says to anyone who will listen.

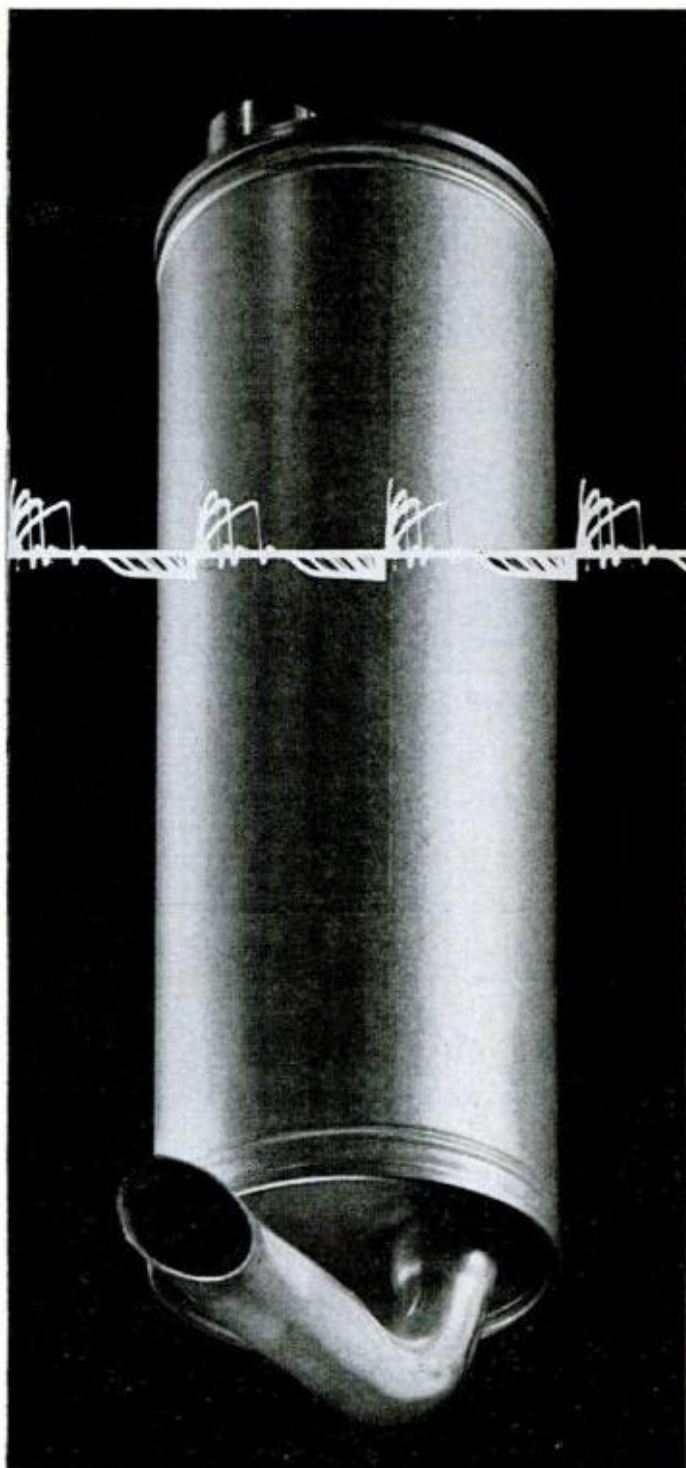
All it will take, he insists, is seven acres of land, runway markers, a windsock and a telephone. The seven acres could accommodate a single strip, 100 feet wide and 250 feet long—enough for light planes. Runway markers and the sock are minimum equipment for landing or taking off. And the telephone eliminates the need for a terminal or permanent personnel. Visiting pilots can call for a taxi. Larger communities, of course, could afford larger strips, but Piper is adamant that any town with a general store, a gas station and a few homes is ready for an air strip.

Kevin V. Brown

POPULAR MECHANICS



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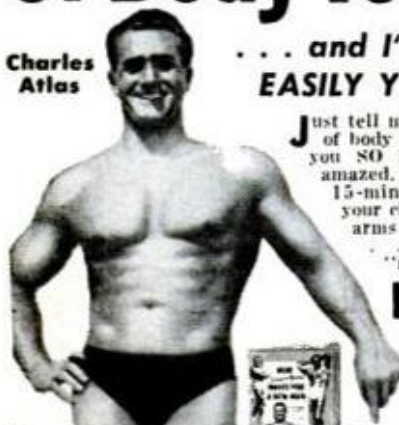
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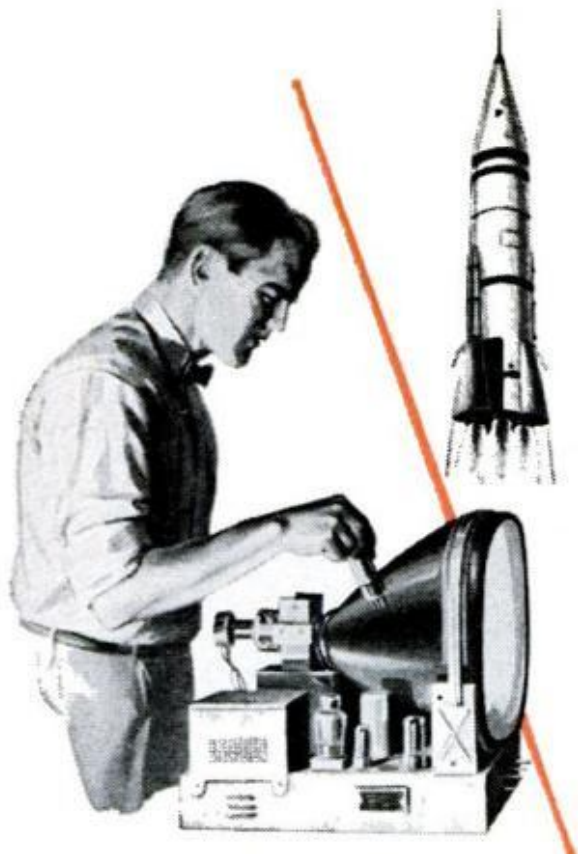
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Items from all outdoors

Biggest problem for ice fishermen is getting through two feet of ice to drop their lines. This was solved by a group of northern Wisconsin anglers who use a post-hole auger powered by a jeep to bore as many holes as they want with ease.



Winter camping in the Virgin Islands has intrigued us for some time, so we induced veteran campers Art and Jan Carduner to make an excursion to the new National Park on St. John Island. A spokesman for the Department of Interior told them not to take along any equipment, that everything could be rented inexpensively from the St. John Development Corp. He also said to take along plenty of insect repellent for the sand flies.

The Carduners complied — and were sorry. Their report: "The most rudimentary of equipment rents for \$50 a week. To get to camp site you must rent a jeep at \$60 a week. There is no ice available, so you must buy food every day; the supply is limited and it is very expensive. The fireplaces at the sites are inadequate. There is plenty of wood, but the climate is so damp and the wood so sodden that it will not burn. They were right about the sand flies." The Carduners did add that it was one of the most beautiful places they have ever seen, but offer this advice to campers: "Leave any extra clothing at home, but take along *all* your equipment, plus fuel for your stove and plenty of canned foods. It won't cost any more to fly it there."

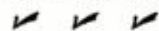


Next month we'll have a feature titled "Coon Fever—Our Favorite Epidemic." This is about one of the zaniest sports in America. In the course of gathering material for the article we came across this story in the *Wildlife Review*. One hunter's spouse accused him of thinking more of his coon hound than he did of her. The man pondered the idea a moment, then said, "Well, now, honey, that ain't true. I think just as much of you—it's just that she's better on coons."



New Mexico has a wildlife program under way that might well be emulated by other states. As an attraction for big-game hunters, the Department of Fish and Game is importing exotic game animals from

other parts of the world and letting them multiply. An example is the Barbary sheep from North Africa. The original stock was 60 animals, and there are now an estimated 3000. Hunting is regulated by special permit. The success with Barbary sheep has instigated a step-up in the program. Three hundred francolin hens have been imported from India, and just recently the State Game Bird Farm reported the hatching of the first clutch of 12 chicks. This past fall the first parent stock of the gemsbok was imported from Africa and turned loose. A genus of the African antelope, the gemsbok is a magnificent trophy animal of great size with three-foot swordlike horns. According to conservationists, there may be a time when Europe and Africa will be importing game animals from the U.S.



New for outdoors. Sterno, Inc., maker of canned heat, has introduced a 10-inch disposable aluminum frying pan. It comes with a chrome holder that supports the pan while in use. DeWitt Plastic of Auburn, N.Y., has a new bait bucket that floats, even when full. It is made of light polyethylene and holds eight quarts. Two styles sell for \$2.95 and \$3.95. Using clotted blood as bait for catfish is an old trick in the South, and now Lazy Ike Corp., Fort Dodge, Iowa, has packaged the idea. Called "Bloody Bait," it is cattle blood held together with a fibrous material. An 11-ounce container sells for 79 cents.

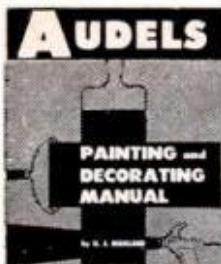
The Canell Co., 60 S. State St., Hackensack, N.J., has a new ski clamp that attaches to a regular auto luggage rack. It is a simple aluminum design, like an "H" on its side, is easily attached and removed. Sells for \$6.98. A pocket-size emergency flare, only 5 inches long and ½ inch in diameter, is being marketed by Scott-Air, Inc., Morton Grove, Ill. Priced at \$15.95, it shoots a signal flare 300 feet into the air, can be seen from 13 miles at night.



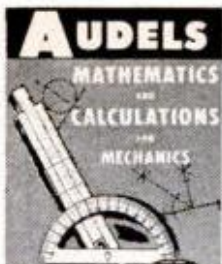
A survey on leisure time was made by the new Outdoor Recreation Commission. It turned out that the average American male has more leisure time, but not enough time for leisure. The survey questioned 2759 male adults, found that they'd mostly like to spend more time fishing, but couldn't seem to make it. With the 40-hour week an accepted part of American life, this seemed like a flimsy excuse. A deeper study showed that the men were indeed busy—doing 7.3 hours of housework a week.

Stuart James

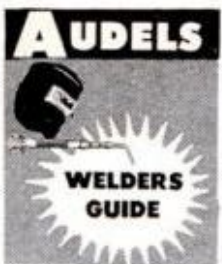
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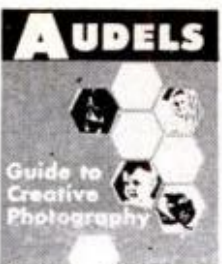
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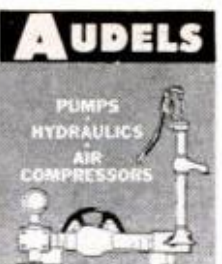
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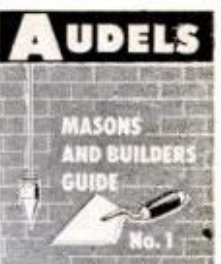
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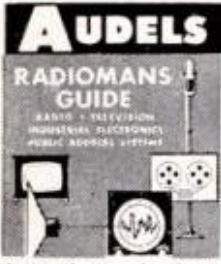
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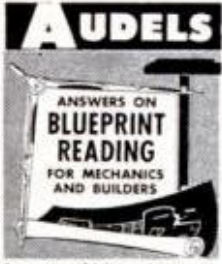
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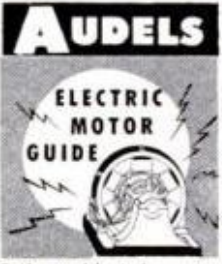
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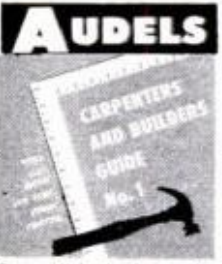
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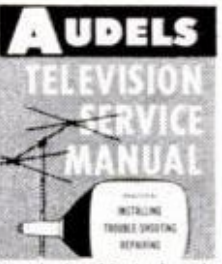
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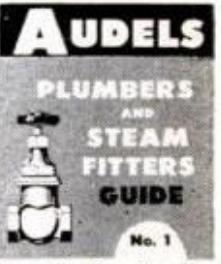
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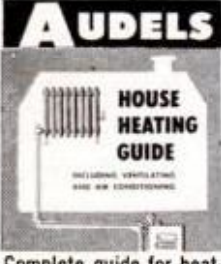
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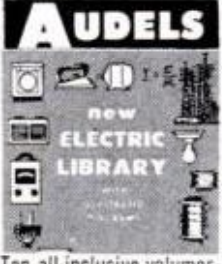
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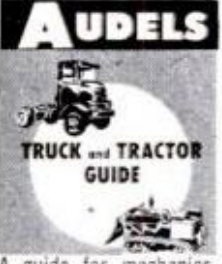
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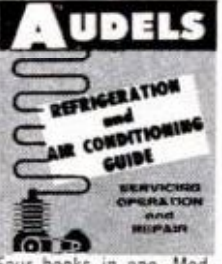
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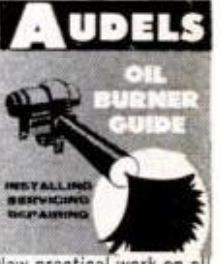
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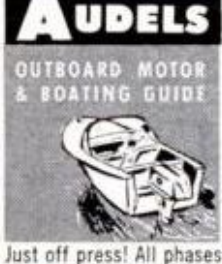
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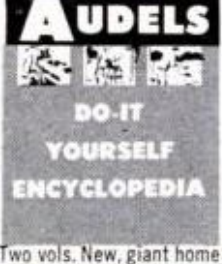
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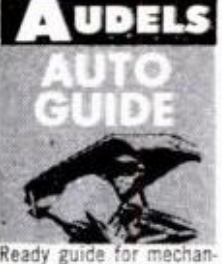
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Pentagon sidelights

By William R. Kreh

Pig bullets. A gun that fires hog bristles has been built by the Naval Research Laboratory to help defeat a death-dealing brain defect—aneurysms, which are blood-filled bubbles that form at a weakened spot in brain artery walls. About 10,000 people a year die in the U.S. from the disorder. The pencil-sized gun injects a hog bristle into the aneurysm. Tiny prongs on the bristle anchor it in the flesh. This causes the blood to clot and the spot ultimately to disappear. The gun works by compressed air and has no recoil. The bristles used are only a quarter of an inch long and five-thousandths of an inch in diameter.

Instant hurricanes. Some of Mother Nature's more violent activities are being studied as possible battlefield weapons of the future. The Office of Naval Research has asked for industrial ideas on research in "geophysical warfare" which is defined as "control, modification or accurate prediction of natural phenomena for gain in a military conflict situation." Far-fetched as it may seem, the Navy apparently wants to see if it's possible to create tidal waves at will, control direction of a hurricane so it will blow over an enemy or set off earthquakes under enemy forces, etc.

Tennis Anyone? A clever Air Force man has come up with a novel way to protect hose couplings when they're not being used for fueling rockets. He cuts holes in tennis balls and then uses them as caps over the hose ends.

A firing range that's the closest thing to actual combat has been opened by the Marine Corps at Camp Pendleton, Calif. Technically known as the "Combat Rifleman Environmental Range," it's the only one of its kind in the Corps and features everything found on a battlefield except an enemy shooting live ammunition. Marine trainees make their way over rugged terrain while instructors in control towers push buttons that control 40 pop-up targets, 16 enemy artillery simulators, and eight mock enemy machine guns. Hits on the targets are automatically recorded in the control tower.

Astronaut Scott Carpenter says he and his fellow Project Mercury spacemen have a suggestion for making sure their booster rockets work every time—build only canvas-covered blockhouses.

Compact converter. A small lightweight power supply for radios is being tested by the Army which may greatly simplify battery problems. With the new power supply, the Army's "walkie-talkies" can be operated on ordinary flashlight batteries. The power supply converts their low voltage—1.5 volts per cell—into the higher voltage needed to operate the radio. The converter is about the size of a package of cigarettes.

Mongrel motor. The Navy has carried out the first full-scale flight test of a hybrid rocket motor—one that combines liquid and solid fuels in a single motor for better performance.

That flu bug is pretty rugged, as anyone who's ever had it knows already. The Air Force recently put an influenza germ in a sealed metal can and gave it a piggy-back ride on a Discoverer satellite. The germ did 33 orbits in four days, was subjected to nine times the force of gravity and great temperature extremes and—you guessed it—came back unharmed.

A television-type device that detects and displays radio waves on all frequencies from 160 to 10,000 megacycles has been developed at the White Sands Missile Range. It's used to examine the airwaves to be sure that none of the radio signals are interfering with a channel being used by a missile system. The new device replaces entire banks of multiple screens that required dozens of operators to keep watch on the hundreds of bands in the radio frequency spectrum.

As easy as tasting soup is a new process of sampling the exotic blends of Army missile rocket fuel. The process, called X-ray emission analysis, yields more information in 15 minutes about fuel in the "soup" stage than the old manual process that took one day to complete. The solid rocket propellant, which looks like fresh concrete when it is first mixed, is poured into the motor case where it hardens to its final, solid form ready for use. The new test consists of taking three random samples from a mix and putting them in an X-ray machine with a standard pellet. Under the X-ray, the samples and the standard give off radiation, and if they match, then the engineers know their "soup" is good.

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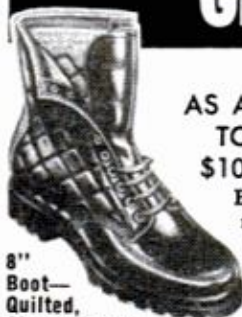
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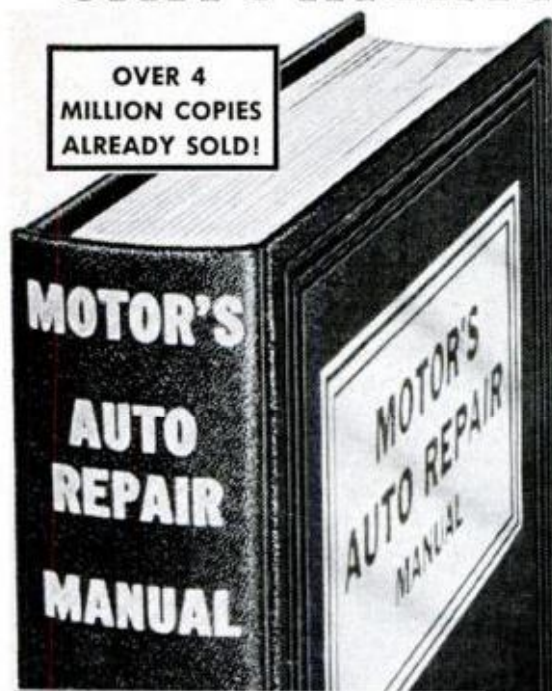
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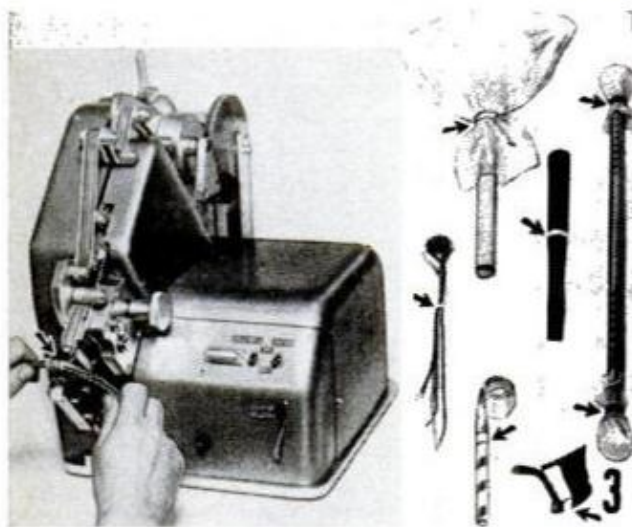
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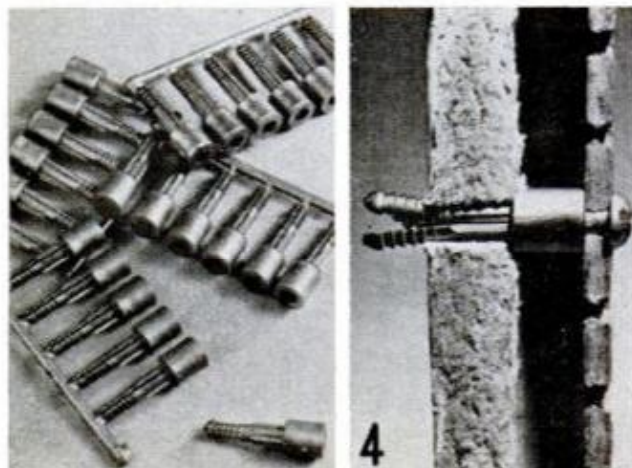


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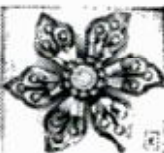
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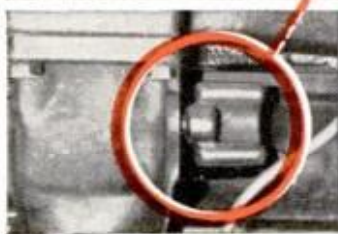
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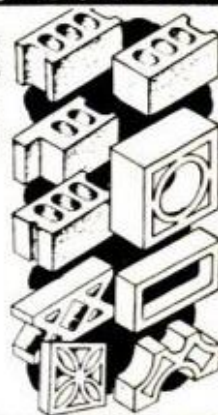
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Electronically minded readers who want to know how long certain TV and radio parts will last will find the "RADC Reliability Notebook," a 407-page revision of the U.S. Air Force notebook, helpful. Electronic tubes, coils, transformers, switches, resistors are some of the parts included in the study; new data is given for factors affecting reliability in design and maintenance. Order PB 161 894-2 from OTS, U.S. Dept. of Commerce, Washington 25, D.C. for \$6.00.

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Craftwork products, from zebra-wood to specialty tools, are described and illustrated in the new "Catalog and Manual for Woodworkers," a 132-page revised annual edition which includes notes on wood finishing, picture framing and a special article on how to make inlay borders. Facts on over 2000 items and their uses provide what it takes to get underway on several pleasurable craft projects. Send 25 cents to Albert Constantine and Son, Inc., 2050 Eastchester Road, New York 61, N.Y.

Boat beauty might be a matter of "cosmetics" for those who own fiberglass craft; it's the surface finish that takes all the weathering. A concise pamphlet, "How to Care For a Fiber Glass Boat," gives tips for keeping your low-maintenance boat like new. The Molded Fiber Glass Boat Co., Union City, Pa., offers it at no cost.



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There's money in an outdoor career, according to James Joseph, free-lance writer for Popular Mechanics and author of a new book, "Careers Outdoors." In it, over 100 case histories of new businesses and job opportunities — from keeping a reindeer herd in Texas to managing a sports lodge — are analyzed in the book providing pertinent information for profitable income close to field, stream or woods. This 230-page book is available from the publisher, Thomas Nelson & Sons, 18 East 41st St., N.Y., 11, N.Y., for \$5.95.

Flag wavers with a bent for history will find notes on various early American flags, the story of the Stars and Stripes and approved flag customs in the 24-page pamphlet, "Our Flag." In addition, a color reproduction of the 50-state flag appears on the cover. It's available for 10 cents from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

Save tax dollars with the compact "Medical Expense Record Book." Its 16 pages provide space for keeping track of doctor, hospital, drug and insurance costs and include a summary of necessary information for filling out your tax form with proof of deductions. Send 10 cents and a stamped, self-addressed envelope to Handi-Facts Booklets, 160 Oak Dr., Syosset, L.I., N.Y.



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Radioactive wastes which have crept into the country's water supplies from nuclear test plants and dumping grounds have been reported by geologists of the American Geophysical Union.

Widely separated areas—Idaho, Washington, Tennessee and South Carolina—contained radioactive chemicals in well and river water. High amounts of tritium, a radioactive tracer, were found more than three miles from underground dumping sources. In one survey, radioactive products were followed many miles down the Columbia River.

A study is underway to trace the radio-nuclides in the Clinch River, Oak Ridge, Tenn., to determine concentrations and proportions that reach downstream locations.

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DR. NORMAN HILBERRY, Director
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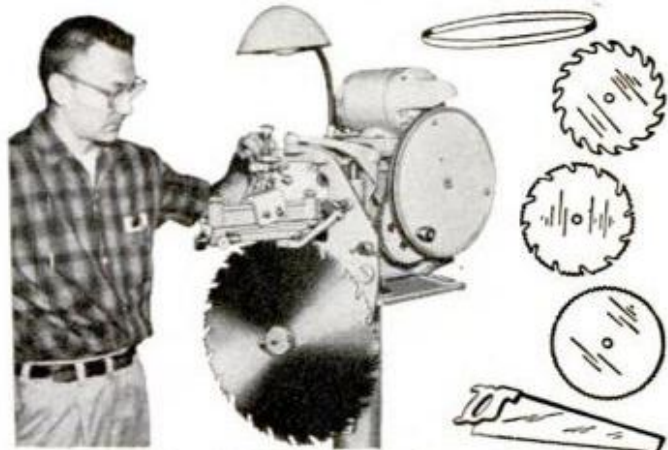
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Spotlight on the

RENAULT R8

How It Compares with Volkswagen

RECENTLY *PM* was given the opportunity to road test Renault of France's new R8 sedan on Puerto Rico's winding mountain roads and traffic-clogged streets.

The R8, senior in size and power to the familiar roll-shaped Dauphine sold in the U.S. for the past five years, has a completely new body with pleasantly squarish lines. It also has a brand new four-cylinder, rear-mounted, water-cooled engine with five main bearings, new front and rear independent suspension and disc brakes. The transmission is the only major component carried over from the Dauphine.

PM chose to compare the Renault R8

with Volkswagen because the VW's virtues (and vices) are known throughout the land. We also feel that the new R8 priced at \$1795 East Coast POE may be very hot competition for the VW selling at \$1665.

R8 Versus VW

Ride: R8 does particularly well on average blacktop roads, although VW's torsion bars handle very rough roads nicely. Body lean on cornering is just about equal. Fore-and-aft pitching seems a bit more pronounced on VW.

Vision: Entirely in favor of R8, both front and rear. VW's windshield is smaller and



SIDE BY SIDE comparison makes 1962 R8 look bigger than '61 Volks although Renault is shorter, narrower and lower

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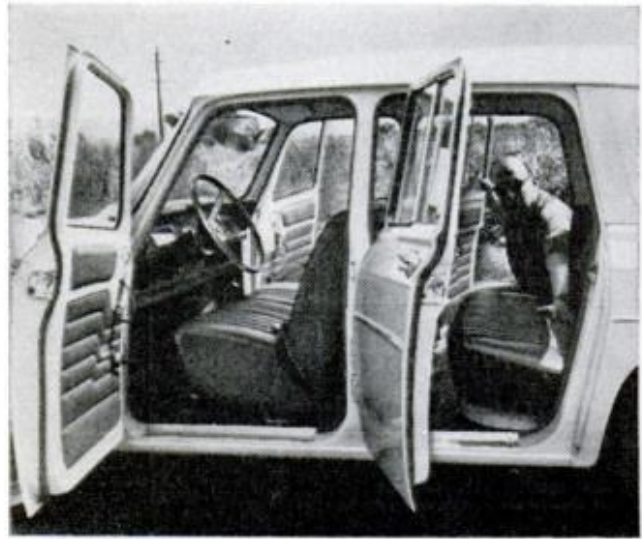
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FAN on R8 engine, left, draws air down through slots in rear deck lid, then forward through sealed cooling radiator and thence to a final exit below car

ULTRA-COMPACT R8 manages to offer easy entry via its four doors and has room for four adults. Both the front seats are adjustable fore and aft



its rear window too high and narrow.

Handling: Either car can be made to spin out on dry pavement, but R8's Michelin tires help it hold on longer. The VW will oversteer (i.e. corkscrew tighter in the direction turned) at lower speeds.

Brakes: R8 disc brakes operated more smoothly, will resist fade longer, proved better in stopping by a small margin.

Clutch Action: Very positive and slightly smoother on the R8. Good on VW.

Gearshifting: Still demonstrably better on the VW which has a crisper, more positive shift. But R8's shift action is so much better than the Dauphine's that owners of the latter car won't believe it possible.

Headroom: Better on VW by a considerable margin in the front seat, and by a fair margin in rear seat.

Seating Comfort: Front seats are about even. VW's front seat backs are adjustable—a plus. R8 rear seat has deeper cushions that are slightly more comfortable.

Entry-Exit Convenience: R8 leads here with four doors to VW's two. R8's rear doors are adequate.

Luggage Space: With its larger front trunk, R8 has a slight edge in capacity and a considerable advantage in convenience of loading over VW's back-of-back-seat luggage space. However, when only two passengers are aboard, the back seat of VW folds down making it a baby station wagon capable of carrying some furniture.

Noise Level: The two cars are about equal here; you must weigh the drone of R8's water-cooled engine against the clatter of VW's air-cooled plant.

Fuel Economy: It looks like a draw; both cars range from 27 to 33 miles per gallon under mixed driving conditions.

Workmanship: VW has slightly better finish on interior paintwork and plastic cloth panels, while seats are about equally good. Both cars are well assembled.

Performance: R8 has the edge here with 48 horsepower to VW's 40, although R8 has an engine of smaller cubic displacement. Top speed is 78 on R8 vs. 72 for VW. In acceleration, R8 did standing quarter mile in 20.3 seconds, VW took 23.1 seconds.

Heating and Ventilation: R8 has clear superiority in this area with fresh air ducts and a hot water heater. Unlike air-heated, unvented VW, warmth in R8 does not depend on engine speed.

Longevity: VW has pretty well proven its long life potential on U.S. roads while the R8 is a brand new, and thus, unproved car. But R8 would seem to have the ingredients of durability such as a five-main-bearing crankshaft, and an oversize cylinder block. However, only time will tell.

MAJOR SPECIFICATIONS

| | Renault R8 | Volkswagen 1200 |
|------------------------|---------------|--------------------|
| Length | 157" | 160.6" |
| Width | 58.5" | 60.6" |
| Height | 56" | 59.1" |
| Wheelbase | 89.2" | 94.5" |
| Curb Weight | 1595 | 1631 |
| Cubic Displacement | 58" | 72.7" |
| Horsepower | 48 | 40 |
| Top Speed (approx.) | 78 | 72 |



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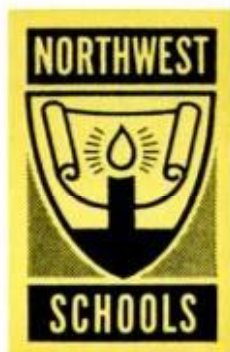
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MOLD Statuary, pottery, tiles, novelties. 5¢ materials makes dollar sellers! Particulars free. Marbleizing Service, Edwardsville, Illinois.

NEW Plastic flashing electric sign 2 1/2 x 2 1/2 ft. First time offered. Interchangeable letters. Free details. Write: Box 1954, Springfield, Ill.

NEED More income? Learn shocard writing! Complete information free. Arcadia, 19-D Corwin St., Dorchester 22, Mass.

MINIMUM Capital self-employment. Amazing facts revealed. Natu-Rex, Yucaipa 10, California.

LEARN Landscaping and plant growing. Start a profitable business part or full time. Free information without obligation. Lifetime Career Schools, Dept. MC-13, 11826 San Vicente Blvd., Los Angeles 49, Calif.

MAKE Durable building plastic easily. Waterproof. Fireproof, economical. Bays Laboratory, Cedaredge, Colorado.

PROFITABLE Opportunity. Operate home mail order business. White, Box 1065, Homestead, Florida.

EXPORT-Import opportunity, profitable, world-wide mail-order business from home, without capital; or travel abroad. Established world trader ships instructions for no-risk examination. Experience unnecessary. Free details. Mellinger, J701, Los Angeles 25.

DRIVING Schools needed. Profitable. Free instruction by trade association. Nothing to sell. Driving School Association, 4935 Foster, Chicago 30, Illinois.

MAIL-ORDER. Secrets! Secrets! Mail order success revealed by internationally famous expert who discovered how to make home business fortunes. Beginners! Get free copy "How to Make Money in Mail Order." Discloses free advertising, profitable product, everything! No obligation. Write Mailco, 1554 Sepulveda, Dept. J701, Los Angeles 25.

MAILORDER Wholesale catalog of folios, manuals, wholesale directories. Dealers profit to 200%. Catalog 25¢. Refundable. Egyptian, Box 168C, Anna, Ill.

INSTALL Burglar alarm systems. Big profit home business. Beginners start spare time, without mechanical experience or costly equipment. Free starter plan. Nasco, Dept. J701, 11071 Massachusetts, Los Angeles 25.

PACKAGE At home for profit! We supply everything. No selling. Free home business details. HPC 2212BD, Jesse Street, Los Angeles 23.

SHARPIT \$39.50. Precision knife, instrument, scissor, tool sharpening machine, 98% profit! Clean, light route or home business. Free circular. Snellenberger, 2502A Ridge Avenue, East St. Louis, Illinois.

OPERATE Restaurant or diner. Free booklet reveals profitable plan. Write Restaurant Business School, Dept. EC-13, 1920 West Sunnyside, Chicago 40, Illinois.

\$10.00 IN An hour spare time at home possible with amazing "Magic Wonder Method" invisible reweaving. Details free. IRI, Dept. P-1, 4411 La Mesa Blvd., La Mesa, Calif.

FREE Advertising for mailorder items. Bransford, 5718 Troost, North Hollywood, California.

\$250.00 WEEK spare time profit possible. Earn at home with new fascinating printing method. \$5.00 starts you. Send no money now. Free confidential facts and valuable sample. Screenprint, Dept. JN-1, Los Angeles 61.

NEW Mail order course shows how to make money at home by mail. Free details. Thacker, 220 South Mission Ridge, Rossville, Georgia.

BIG Profits. Hand crafted jewelry business. Free details. LPS, Dept. 113, 1706 Argon, Mesa, Arizona.

MAKE Extra money. Big steady earnings, repeat business. Sell advertising book matches, full or part time. New 1963 line. Show glamour girls, colorama, tenorama; dozens more. All sizes. Free master outfit, sales helps, leads, no experience necessary, no investment. Write today. Superior Match, Dept. MX-163, 7530 Greenwood, Chicago 19, Ill.

MAILORDER Angles shrewd operators use. \$1.00. Ballard, 1834 Edgeland, Louisville 4, Ky.

OWN Advertising agency. A little gold mine. Quickly, easily learned. Small capital. National, 6426 Regular, Detroit 9, Mich.

IMMEDIATE Profits with no capital or experience. Take orders for all magazine subscriptions. Friends and neighbors are your prospects. Write now for complete, free kit. McGregor Magazine Agency, Dept. AB-3, Mount Morris, Illinois.

PROFITS In mailorder guide. World import drop-ship directory. Manufacturers and wholesalers directory. Write: Snider, Dept. 1A-3702 Aurora, Indianapolis 27, Indiana.

LEARN Professional TV servicing in one week! Fabulous new simplified system. No big expense. No studying. No tools or equipment. Spare, full time. Own your own big profit business! Save Amazing but true! Free! Write TV Systems, Dept. N-1 1038 So. La Brea, Los Angeles 19.

MOLDING Rubber, jewelry supplies. Free information. Chaney's, 5415-A San-Jose Blvd., Jacksonville 7, Fla.

\$50-\$100 WEEK Possible with herbs. Grow inside-outside or gather wild. Free details. Whitlow, Dept. A-10, 726 Fairwood, Dallas 32, Texas.

MAKE Telephone surveys spare time! Free home-business details. No selling, choose your own hours. Telephone Institute, Dept. N-1, 1038 So. La Brea, Los Angeles 19.

\$42.00 PROFIT From 5 gallons water; write for details. Rosecraft Co., Dept.-A, Roseboro, North Carolina.

BECOME Tax consultant. Graduates earn \$1,000-\$3,000 every tax season preparing returns evenings. State approved. Union Institute, Lakewood V-2, N. J.

SELL Products. Mailorder. 400% profit. Work home. Catalogue free. International, 6347 Parnell, Chicago 21, Illinois.

\$15.00 An Hour possible in new home manufacturing business. Spare or full time. Amazing velvet-spray transforms hundreds of old items into money-making products. Write for samples, free "50 Business Opportunities Booklet". Craft Industries, Dept. JN-1, Los Angeles 61.

BECOME A notary public. Easily accomplished. Enjoy extra income, prestige. Free details. Stationers Exchange, Box PM-542, Cleburne, Texas.

"STARTING & managing your own small business." \$1.00. Ward's, 1-PM, 28 East Jackson, Suite 1212, Chicago 4.

AMAZING Manufacturing opportunity. Free list of manufacturing formulas. Presler Oil Company, Fostoria 3, Ohio.

1000 RAISED Business cards \$2.85. L&D, 152 W 42nd, New York City 36.

BOOM! In babies. We furnish-finance complete shoe bronzing setup. Free booklet. Box 5036-A, Inglewood, California.

FROM Sunny Tucson, Arizona. 101 proven ways to make money. Here is your opportunity. \$1.95 postpaid. Proven Methods, Box 12673, Tucson, Ariz.

OPERATE Profitable inexpensive mail-order business! Liberty, 210 Fifth Ave., New York 10, N. Y.

START Home collection agency. Amazing moneymaking opportunity. Success Institute, Box 1133, Boston, Mass.

MURAL Artists needed! No experience required, earn \$10-\$15 per hour! Amazing "Project-A-Mural" method. Project pattern slides, trace-off, paint for color guide. Professional results guaranteed! Huge demand from homes, bars, restaurants, offices, etc. Sell \$100 murals for pennies in paint. Free success plan. Associated Muralists, Dept. EIC, 500 Plumas, Reno, Nevada.

RESEARCH Interviewing. Sparetime employment. No age limit. Proven techniques \$1.00. Box 7462, Dallas, Texas.

SPARETIME Earnings. Typewriter required. Literature, instructions 50¢. Interstate, 37 Besch, Albany 9, N. Y.

MINIMUM \$320 monthly easy. No selling. No competition. County your choice exclusive territory. Pay franchise out of profits. Semi-retired preferred. Franken, 915 S. Grattan, Los Angeles 15, California.

SELL Studio knitting machines from your home. It's profitable. Studio, Dept. P. S., 9045 16 Southwest, Seattle 6, Wash.

MONEYMAKING OPPORTUNITIES

GOOD Income. Be own boss. Be independent. New fantastic system teaches in minutes. 25¢ for instructions. Variety Advertising Company, 1219 Douglas St., Dept. 141, Alton, Illinois.

TEAR Out this ad. and mail with name, address for big box of home needs and cosmetics for free trial, to test in your home. Tell your friends, make money. Rush name. Blair, Dept. 31HA, Lynchburg, Va.

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

POPULAR Advertiser, contains, money making opportunities galore! Copublishers also wanted. Sample copy 10¢. Guerinot, 154 Masseth St., Rochester 6, N. Y.

OPERATE Collection agency, home or downtown. Franklin Credit, Roanoke, Virginia.

IT'S True. You can succeed in mail order our easy way. Details free. World-wide, Box 4026, Station H, Columbus, Ohio.

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

MONEY Short? Need extra income? Get into mail order! Literature 10¢. Conner, 3530 S. Atlanta Road, Smyrna, Georgia.

HOW To write simple magazine fillers for fame and fortune. Send \$1.00 for instructions and markets. Graff, Box 116, Flushing 65, N. Y.

RAISE Redworms. Big demand. Free literature, Hall Redworms, Hilton, Ga.

START Good pay business at home in spare time. No experience needed to operate little table-top machine for bronzing baby shoes. Make \$6.00 profit on every pair. Full particulars free. Send postcard to Warner, 1512 Jarvis, Room CM-2-A, Chicago 26, Illinois.

TREMENDOUS Profits. Foreign bargains. Dropshipped. Write: Roland, 3738-PM2, Wilton, Chicago 13.

HOW To win prize sweepstakes, drawings, contests. Lesson 50¢. Winner, Box 304, Columbia City, Indiana.

10,000 FORMULAS. Trade secrets, 882-page catalog. Details free. P. O. Box 25, Higbee, Missouri.

PIANO Tuning learned at home quickly. Tremendous field! Be independent! Information free. Empire School, Dept. P, Champaign, Ill. (Founded 1935.)

EASY To start rubber stamp business at home in spare time. Make up to \$9.80 an hour without experience. Facts free. Write Roberts, 1512 Jarvis, Room CR-2-A, Chicago 26.

CASH In on booming baby market. Popular baby items ideal for mailorder, door-to-door or party plan selling. Profit-making details and sample envelope stuffers free. Rutward, 108 Bryant, Columbia Station, Ohio

PAINT Signs for yourself, others. Easy with our letter patterns. Also popular raised letters, all sizes. Paulow, Crystal Falls, Michigan.

OPERATE Mailorder home folio bookshop. Ballard, 1834 Edgeland, Louisville 4, Ky.

GREATEST since "hula-hoop," wood materials under dollar. Sample for pattern \$4.95. Spitz, Box 4095, Arlington 4, Va.

SEASHELLS. Shellcraft and jewelry supplies. Wholesale catalog 25¢, refunded on first order. Our 29th year. Florida Supply House, Box 847M, Bradenton, Fla.

BIG Profits raising crawlers, Brownose and hybrids. Garage basement. Three Oaks Ranch, Dresden, Tenn.

I Make money every week by mailorder! Helped others. Will guide you. Webster, 2038-39 Mockingbird, Columbia 4, South Carolina.

LEARN The secrets of repairing junk batteries, generators, starters, profitable, easy, at home. Free particulars. Batteryman, Box 193, Prunedale Station, Salinas, Calif.

MEN - Women! Start money-making plastic laminating business at home in spare time. Material that costs 11¢ brings back \$2.58. No canvassing or selling but mail orders bring in \$20 a day. Write for full particulars free. Rush name on postcard to Warner, Room CL-2-A, 1512 Jarvis, Chicago 26, Ill.

BIG Profits in figurines, lawn ornaments. World's best liquid rubber for molds. Sample and catalogue free. W. Wooley, Peoria, Illinois.

I Made thousands at home. Easy! Telephone, pad, pencil. Learn how. P.O. Box 66, Venetia, Pennsylvania.

DIAMONDS Simulated by Science. Write DeLuxe Sales, Blue Earth, Minn.

OPPORTUNITIES Galore! Details, send dime. Berthoff's, 739-PJ, Sylvania Avenue, Toledo 12, Ohio.

SELL Diamonite gems. More brilliant than diamonds. Catalog 10¢. Diamonite, 2420-M 77th, Oakland 5, California.

MAKE Big easy profits making costume jewelry at home in spare time! Quick, easy to make, easier to sell! Details free; Don-Bar, 2934 W. Fullerton, Dept. A-203, Chicago 47, Illinois.

WE Purchase items you make at home for us. Enclose stamp for details. Wolfe Specialties, Box 171, Center Line, Mich.

\$250,000.00 U.S. Government pays your costs to find gold, silver, uranium—40 more minerals; up to \$250,000.00. Get new, opportunity filled details \$2.00. Treasure House, 3902 Grove, Western Springs, Ill.

AMAZING Catalog of spare time money projects. Details 10¢. Vista Sales Co., 1230 Purcell, Cincinnati 5, Ohio.

FREE Advertising for mailorder items. Branford, 5718 Troost, North Hollywood, California.

HOME Mailorder "manufacturing." Everything supplied. Clenso Products, 184 Oakview, Winnipeg 15, Manitoba.

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

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

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

CIGARETTES—Make 20 plain or filter-tip for 9¢. Facts free. Moberly, Box 4012, Owensboro, Kentucky.

MINK Raising information free. Complete. Lake Superior Mink Farm, Superior, EEl, Wisconsin.

EARN Money raising fishworms for us! Write: Oakhaven—59, Cedar Hill, Texas.

YOUR Own, easy-to-start, home mail-order business, sparetime. Fascinating; profitable! Information free. Alfano, 19-PM Pine, Closter, N. J.

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

FREE Book: "609 Unusual, Successful Businesses." Box 1001-PW, Evanston, Illinois.

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

BECOME A notary public! Win extra income, prestige, business contacts. Details free. Stationers Exchange, Box 552-P, Kermit, Texas.

EXPORT - IMPORT

JAPAN: Mail order catalogue business information, dolls, kimonoes, etc., \$1.00; Trade Directory, 3000 firms listed \$3.00; Japan Tour Guide \$1.00; Send cash. Clarence Yamagata, 814 Togin Bldg., Marunouchi, Tokyo.

SCIENCE & CHEMISTRY

NEW Catalog of scientific materials for students, hobbyists, industry, 25¢. Unusual chemicals, rare metals, rocket components. United Scientific Company, Division C., Waupaca, Wisconsin.

EXPERIMENTER'S Handbook free with bigger catalogue, 25¢. Hagenow Laboratories, Manitowoc, Wisconsin.

CATALOG Only 25¢. Used supplies, books. Laboratory Sales, Box 161-A, Brighton, Mass.

AMAZING New book of science experiments, formulas, and catalogue of laboratory supplies. Only 35¢. National Scientific Co., 13 S. Park Avenue, Dept. PM-1, Lombard, Illinois.

FUTURE System of Mathematics. Guaranteed. \$1.00. Knowledge, 2900-9th Street, Rock Island 17, Illinois.

FREE—Sulfur, Calcium Carbonate, Potassium Chloride, Sodium Phosphate, Aluminum Sulfate, and Boric Acid samples with catalog. Low priced chemicals, biologicals, and apparatus. New illustrated 1963 catalog only 35¢. Dover Chemical, 35-24 31 Street, Astoria 6, New York.

CHEMICALS In small quantities, lab glassware. Catalog 25¢. Winn Chemicals, 124M West 23 Street, New York 11, N. Y.

ROCKET Supplies. 1963 list. 25¢. Mervin Hill Company, R.D. #1, Seward, Pennsylvania.

ROCKETS: New illustrated catalog 25¢. Single and multistage kits, cones, engines, launchers, trackers, technical information, etc. Fast service. Estes Industries, Penrose 7, Colorado.

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 35¢. Dept. M-50, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N. Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 25¢. Tracey Laboratories, Evanston, Illinois.

UNUSUAL Chemistry books, courses, kits! Rare chemicals, cheap! Catalog 25¢. NSC, Box 11133, Palo Alto, Calif.

FREE. 1/4 pound Sulphur or 3 Pyrex test tubes with purchase, \$3.00 or more. Catalogue 25¢. Chemicals, apparatus. Biology. Dept. PM-12, Mid-States Scientific, 7053 N. Clark, Chicago, Ill.

MICROSCOPES, Accessories, prepared slides, supplies, etc. Free brochure. New England Science Service, P.O. Box 315, Peterborough, New Hampshire.

PLASTICS

NEW! Plastic vacuum forming machines. Hobby. Easy. Profitable. Details. Burr, 7645 Oakland, Kalamazoo, Mich.

EMBEDDING, Casting secrets free. Sample, 25¢. Crystal, 4350-B N. Whipple, Chicago 18.

CELLULOID Scrap, assortment gauges, attractive colors. Box 333, Kearny, N. J.

VACUUM Form, easy. Instructions \$1.00. F. Barnes, Box 1971, San Diego 12, Calif.

NEW Liquid casting plastic, clear, colors. Embed real flowers, butterflies, photos, coins. Send 25¢ for two handbooks, "How to Cast Liquid Plastics" and "How to Make Extra Money at Home." Castolite, Dept. A-101, Woodstock, Illinois.

LIFE Lasting fiberglass signs 3¢ square inch up. Boettger, 961, Dorothy, N. J.

BOXES, Plastic, 200 sizes. Free list. Althor, 170 Bay 23 Street, Brooklyn, N. Y.

PLASTIC Meltable granules, reusable, non-toxic. Free brochure. Plastics catalog 25¢. Instruction manual \$1.00. Castacraft Corp., Dept. M-163, Palo Alto, Calif. (Box 555).

FORMULAS, PLANS, ETC.

FORMULAS For latest money-making discoveries. New! Good! Valuable literature free! Miller, Chemist, 1517-D, Tampa, Florida.

FORMULAS—All kinds. Amazing big catalog. 10¢. Kemixal, Park Ridge, Ill.

LATE, Modern manufacturing formulas. List free. Moon Chemical, Martville, New York.

AGENTS WANTED

SELL Greeting cards. Make extra money. All occasion assortments, Easter, valentines; stationery, gifts, wrappings, toys, jewelry. Experience unnecessary. Salable samples on approval. Free catalog. Free gift offer. Bonus plan. Write Hedenkamp, 361 Broadway, Dept. PM-83, New York.

MAKE Most extra cash with world's biggest line everyday greeting card assortments, gifts. Introduce friends, neighbors, to over 150 assortments, 500 big money-makers. Pocket up to 100% profit plus big cash bonus. Free giant color catalog; samples on approval. Write Arrow Greetings, 513 Fourth Ave., S., Dept. 83-Z, Minneapolis, Minn.

WILL You test new items in your home? Surprisingly big pay. Latest conveniences for home, car. Send no money. Just your name. Kristee 129, Akron, Ohio.

AUTOMATIC Bed warming sheet, you sleep on, not under. Outsell electric blankets 10 ways, costs less. Generous profits. Patented Products Corp., Dept. P-M-13, Danville, Ohio.

NEW "Magic knife" slices frozen foods, even bone—pays up to 100% profit! Rush postcard for free double-your-money details, special starting assortment discount offers. Dale, Dept. J-602, 4333 N. Pulaski, Chicago 41, Ill.

SELL Champion, AC, autolite spark plugs. Reconditioned, electroplated, guaranteed 10,000 miles, 100% profit. Free sample. Lee Plugs, 1608-E, Roberts, Houston 3, Texas.

\$2.98 INVENTION Changes black-and-white TV into beautiful colors. Terrific, profitable seller. Write Excellent Buys, Dept. PM-2, 34 E. 12th, New York City.

FREE Information of new imports. Best sellers. Kennedy Import Co., 3692 May Lane, San Jose, Calif.

BUSINESS Kit free! Postcard puts you in business! Complete line 230 shoe styles, jackets! New discoveries pay big commissions. No investment. Send for free kit. Mason, Chippewa Falls K-454, Wisconsin.

ANY Direct seller can make extra money with our new useful fast-selling repeat item. So can factory workers. Johnson Equipment Company, Box 2668P, Lakewood, Ohio.

MEN! Show wife this amazing offer! Famous nationally advertised Hollywood cosmetics pay 60%. Make \$25 day up. Hire others. For free samples, details, write Studio Girl, Glendale, California. Dept. 23731.

DIAMOND-Faceted, bluewhite, fiery gems! Gadienco, 187 Miraloma, Miraloma, California.

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

\$1.00 PAYS \$16.00. Sensational new product discovery—a lifetime opportunity. Details. Rosecraft Co., Roseboro, North Carolina.

\$40.00 STARTS You in name plate business. Samples 50¢. Bonomo-PM, 54 Jefferson St., Brooklyn 6, N. Y.

BE The Popular Mechanics representative in your neighborhood and earn big profits in your spare time. Write Popular Mechanics, Room 1A, 250 West 55th St., New York 19, N. Y.

SHOW Demonstrator shoes on your feet to 10 and 6 will buy on sight because of discount price, beauty, and one year unconditional guarantee. You'll see! From \$1.99 to \$5.59, none higher. Many other discount bargains. Discount clubs spreading like wildfire. You'll actually take business away from discount stores. Rush shoe size. Perfect-World Co., Dept. 203, Cincinnati 12, Ohio.

EXTRAORDINARY Opportunity! Set-up in business for \$2.00. No other investments. No gimmicks. Guaranteed. Complete kit. Start immediately. Send \$2.00. Malard, 1372 Hertel, Buffalo 16, New York.

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

FREE Sample. Beautiful curios! Sell on sight! Apartado 9036, Mexico City.

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

EXOTIC Earrings! Details free. Pair \$1.00. Ohga, PM-401, Sigakenkusatu, Japan.

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WHY Buy retail? 100,000 wholesale bargains, directories, sources, drop-ship! Save in personal buying! Make big money in easy mailorder business! Free, exciting details: Guide, Box 362-W, Yorktown Heights, New York.

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350,000 BARGAINS! Free merchandise! Write: Goldmine, 240-PA, Planetarium Station, New York City 24.

100,000 PRODUCTS Wholesale! Terrific bargains! Wholesalers, 1265-MR Broadway, New York 1, N. Y.

BARGAINS! Jewelry, housewares, wedding gifts. Catalog 25¢. Ronaldo, P.O. Box 295, Allentown, Penna.

AMAZING Wholesale directory available. Details free. Enterprise, 434 Temple, Fredonia, New York.

OVERHEAD Door parts. Wholesale prices. List. Door Supply, 101 County Street, Somerset, Massachusetts.

BARGAINS! Buy wholesale! Save money! Free catalog! Norris, 273-AX Merrick Road, Lynbrook, N. Y.

FREE! Name brands catalog! Your own high profit business. Sell name brands, full or part time. No inventory, no investment. More than 2,000 name brand items; lowest wholesale prices. Watches, jewelry, cameras, hi-fi, stereo radios-phonos, appliances, housewares, hardware, power tools, luggage, musical instruments, garden equipment, sporting goods, toys, many others. 8 floors of name brands. Million dollar inventory. Orders shipped complete in 24 hours! Send for free, beautifully illustrated catalog now! Separate wholesale price list. H. B. Davis Corp., Dept. PM. 145 W. 15 St., New York 11, N. Y.

NEW Deluxe below wholesale catalog. Automobile catalog and others. Furniture, clothing, housewares, appliances, refrigerators, freezers, washers, dryers, television, radios, luggage, binoculars, hi-fi, stereo, phonographs, recorders, cameras, projectors, musical instruments, sporting goods, toys, tools, typewriters, watches, jewelry. Huge discounts on thousands of name brand items. For free specimen list of actual factory prices—postcard: Selbyco, Decatur 15, Illinois.

BUY Direct from factories! Appliances, cameras, watches! Free details! Cam Company, 436PA Bloomfield Ave., Verona, N.J.

WORLD'S Largest wholesale supply. Buy from 679 American, European, Japanese wholesalers. Tailormade suits from Hongkong. 123 dropship catalogs. Rockbottom prices. Free details. International Buyers, 216-M Jackson, Chicago 6, Illinois.

USED And new watches \$2 up. Free list. Southern Watches, 5-PM So. Wabash, Chicago 3.

ELECTRIC Guitars, amplifiers, wholesale. Free catalog. Carvin PMW, Covina, Calif.

FREE Lists—less than cost. Surplus electrical, hardware, model train parts at sacrifice prices from manufacturer. Write Kusan, Inc., Dept. WRC, Box 9277, Nashville, Tennessee.

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IF You're interested in making money in selling, see the hundreds of exceptional opportunities in Salesmen's Opportunity Magazine. Send name for your copy, absolutely free. Tell us what you're selling now. Opportunity, 848 N. Dearborn, Dept. 17, Chicago 10, Illinois.

EARN Big commissions full or part time. Show America's largest line low priced business printing and advertising specialties. Big free sales kit samples hundreds items used daily by business people. Build profitable repeat business. Start right now. National Press, Dept. 8, North Chicago, Illinois.

IF You are calling on farmers, specialty growers, golf courses, factories or estates, we can show you how to add big money to your present income. Campbell Company, Rochelle 5, Illinois.

CALENDARS, Novelties. Full or part time. Liberal commissions. Fleming, 6535-A Cottage Grove, Chicago 37.

\$1,000.00 A Month for making dramatic 3-second demonstration of amazing lightweight Presto Fire extinguisher. New chemical used by Airforce snuffs out fires instantly. Only \$4.95. Terrific commissions. Millions want it. Free kit. Merlite, 114 E. 32nd, Dept. P-66C, New York 16.

MAKE More money. Fast selling products. Small investment for merchandise. Protected franchise. Reliable manufacturer. Write today for details. Mugeridge Mfg. Co., Inc., Dept. C, 1712 Kansas Avenue, East St. Louis, Illinois.

MAKE Extra money selling advertising matchbooks. Free catalog and sales outfit. Matchcorp, Dept. PM-13, Chicago 32.

I'LL Send you free stocking sample newest advancement in hosiery since nylon. Patented, full-length. Stays up over-the-knee without supporters, without girdle! Nationally advertised price \$1.95. Make money introducing to friends at \$1.00 pair. American Mills, Dept. 733, Indianapolis, Indiana.

SEEKING New products? Get my outfit 47 money-making specialties. Latest conveniences for home, car. Send no money. Just your name. Kristee 152, Akron, Ohio.

SENSATIONAL New longer-burning light bulb. Amazing free replacement guarantee. Never again buy light bulbs. No competition. Multi-million dollar market yours alone. Make small fortune even spare time. Incredibly quick sales. Free sales kit. Merlite (Bulb Div.), 114 E. 32nd, Dept. C-74C, New York 16.

AUTOMOTIVE Jobbers wanted. Formula T-79 and liquid glass polish are money makers. Reedco, Box 205, Dayton 4, Ohio.

VITAMINS! Yours free plus big profits. Sample free. 2908-P Beverly Boulevard, Los Angeles 57.

SELL Personalized engraved permanent plastic name plates. Big profits. Details free. Ladonco, Box 99, Boston 34, Mass.

HIGH Commission and bonus. Earn \$100 to \$300 weekly. 30 year old company has openings. List delinquent accounts for collection. Experience not necessary. Permanent. Write Merchants Protective Agency, Dept. PM-1, 1015W Walnut, Kansas City, Mo.

FIBRE-GLASS Doghouse sells on sight. Ronk Sales, 15003 Greenleaf, Dept. PM, Sherman Oaks, Calif.

MAKE Up to \$200.00 weekly. Every business has slow accounts. Send us names. We collect. National Credit, Dept. BP-1, 903 McGee, Kansas City 6, Mo.

MAKE Big money taking orders for Stark dwarf fruit trees. Everybody can now grow giant size apples, peaches, pears in their yards. Also shade trees, shrubs, vines, roses, etc. Outfit free. Stark Bro's, Desk-30113, Louisiana, Missouri.

SALESMEN'S Guide. Products, ideas, tips, contacts. \$1.00. J. M. Davis, 165 W. Thornton St., Akron 11, Ohio.

MAKE Extra money. Big steady earnings, repeat business. Sell advertising book matches, full or part time. New 1963 line. Show glamour girls, colorama, tenorama; dozens more. All sizes. Free master outfit, sales helps, leads, no experience necessary, no investment. Write today Superior Match, Dept. M-163, 7530 Greenwood, Chicago 19, Ill.

LONG Needed invention. Men to contact service stations. Huge profits. Cyclo Mfg., 3816 Dahlia, Dept. 101, Denver 1, Colorado.

APOLLO Hearing aids half price. Planned sales. PM Dunne Co., 7707 Chapel, Chicago.

MAKE Extra money selling or distributing amazing new item. Increases closet space many times. Packaged for mail order, retail and premium. Free details. Specialty Co., 5610 Division, Chicago 51.

EMPLOYMENT INFORMATION

TREMENDOUS Opportunities. U.S.A.-overseas. Choose jobs, locations, transportation. Free details. Occupations, International Airport, Box 100C-12, Jamaica 30, N. Y.

MERCHANT Marine: Men and women. Top wages. Travel. Information. Helemco, Box 124-P, Pendleton, Indiana.

FOREIGN Employment. Construction, other work projects. Good paying overseas jobs with extras, travel expenses. Write only: Foreign Service Bureau, Dept. PM, Bradenton Beach, Florida.

JOB On ships \$100.00 weekly. Beginners. Information free. Flagship, Box 111-P, Brooklyn 17, New York.

IMMEDIATE Openings with many overseas employers. Act now. Opportunities for every trade and profession. Men and women! Complete details, directory and applications \$2.00 (\$2.25 Airmail). C.O.D.'s accepted. Satisfaction guaranteed. "Employers Directory", Box 18571, Dallas 18, Texas.

WORK For the U.S. Government. Send \$1.00 for next five monthly issues containing announcements of Federal job examinations. Good pay plus fringe benefits. Civil Service Reporter, 330 Newbury Street, Boston 15, Massachusetts.

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A pavement breaker made in England is said to be much quieter than the familiar pneumatic drill—because its generator stands nearly 60 yards away. The noise of an ordinary jackhammer is almost doubled by its nearby compressor unit. Noise levels at the bit heads are about the same for both hammers.

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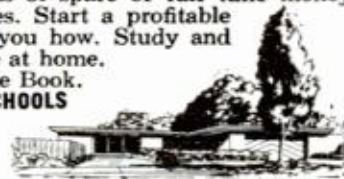
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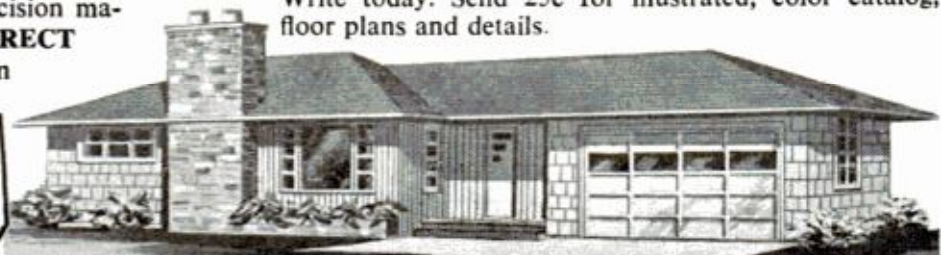
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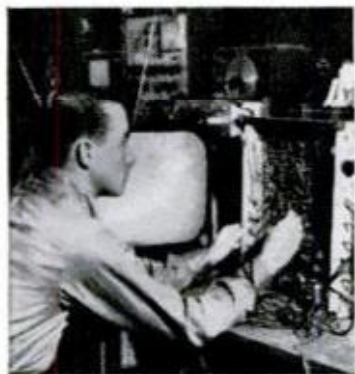


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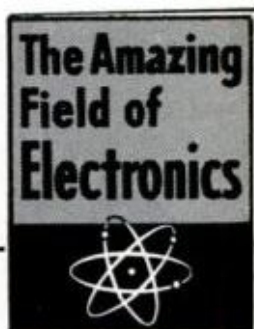
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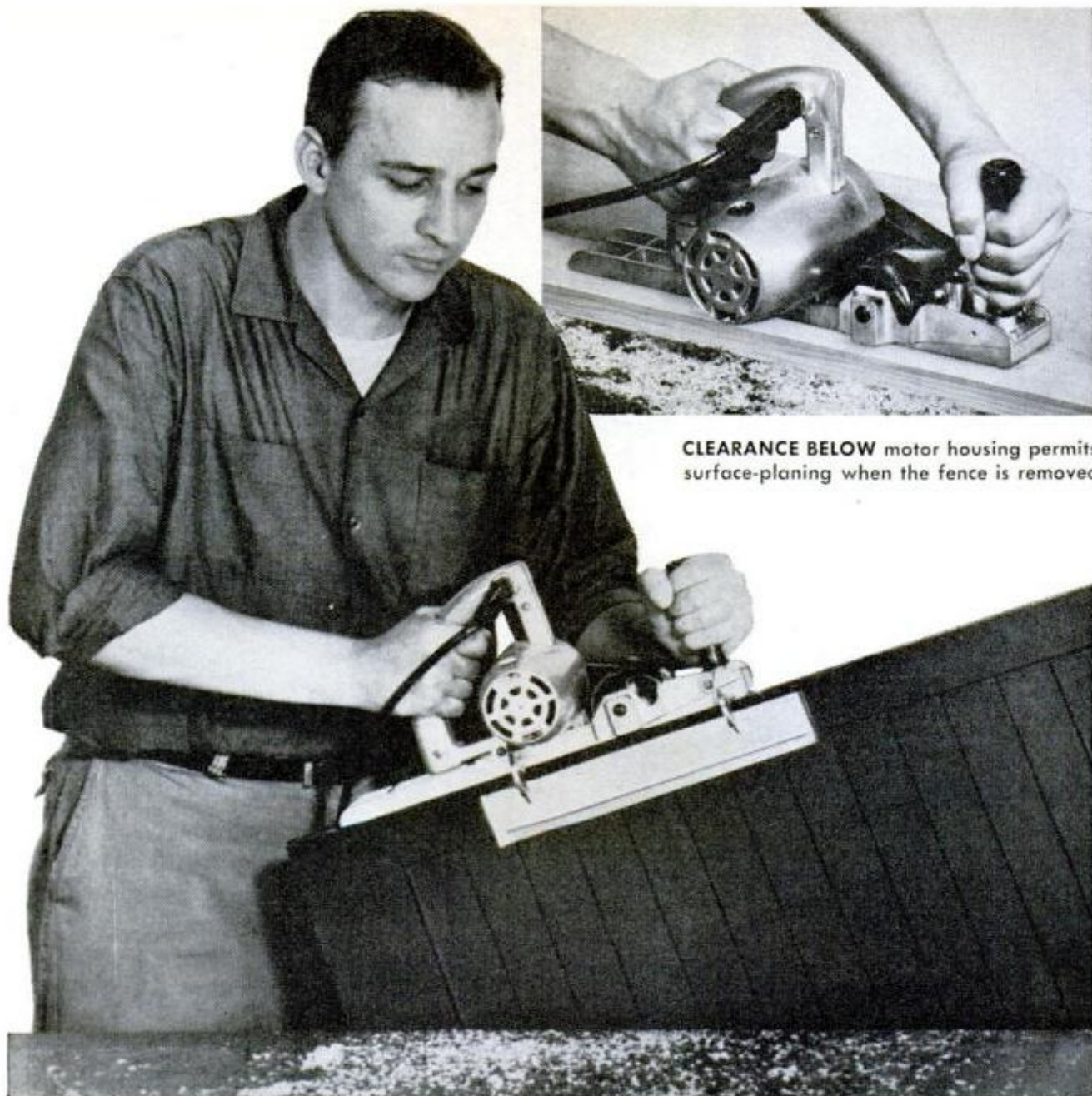
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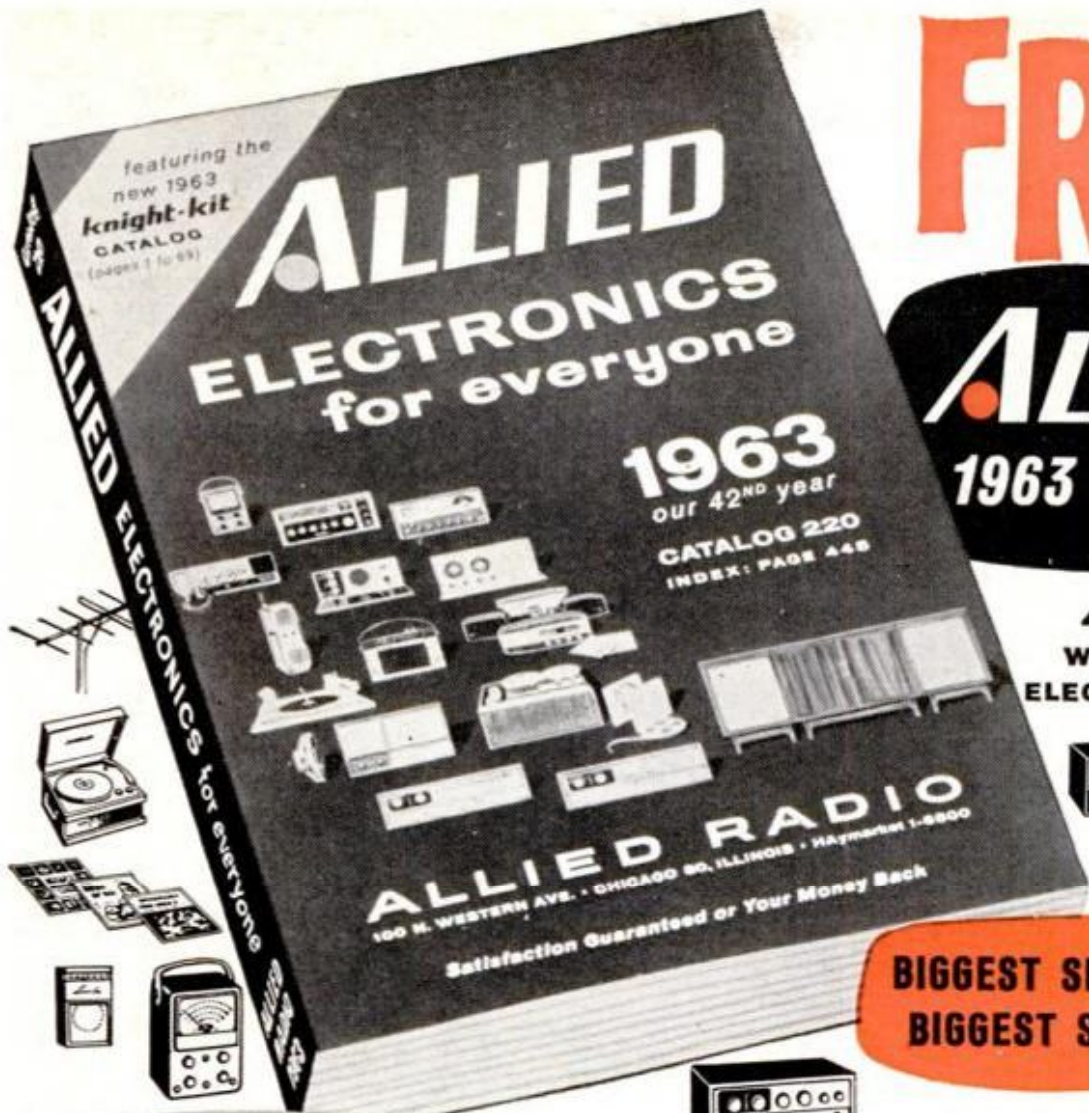
NEW LOW-COST ELECTRIC PLANE

THERE WAS A TIME when you could only do edge planing with an electric plane. Now, as witnessed by PM editors, you can do surface planing as well, thanks to a new low-cost plane recently introduced. Featuring a twin-knife cutterhead rotating at 14,500 r.p.m., this well-balanced tool planes without a ripple and has precision-honed steel cutters which are replacable with new ones when dull. A "dead-man" safety switch is in the handle.

The plane comes with an adjustable fence, or guide plate, for edging a board or a door either square across or at any bevel up to 45 degrees. Take off the fence (inset photo) and you can surface-plane with successive passes to reduce a board to the thickness you require. The full-width cut of the head is $2\frac{1}{8}$ in. and it's adjustable

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The unit is average hand-plane size with a shoe length of 16 in., an overall height of $7\frac{1}{2}$ in., a width of 7 in. Since it's made of aluminum, it weighs only $7\frac{3}{4}$ lb. It has a built-in chip deflector that air-streams the chips to the side and away from your hands and eyes. The 2-in.-diameter planing head is powered by an extra-husky 6-amp., 120-V., $\frac{1}{2}$ -hp. motor with a welded, burnout-proof armature. A cog-belt drive takes anything you can give it in hard or soft wood, without stalling or even slowing down. The plane comes complete with fence and three-wire grounded cord at \$44.95 from your hardware dealer or Wen Products, Inc., 5810 Northwest Highway, Chicago 31.



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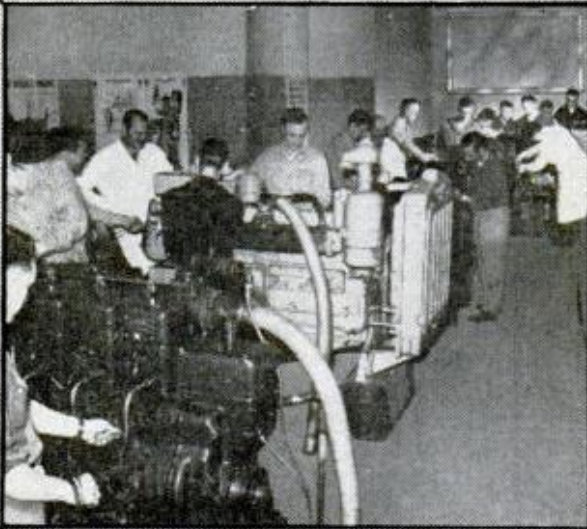
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Garbage May Become Asset

Automatic factories can be built to convert garbage into valuable raw materials or finished products and, at the same time, inexpensively handle the tonnage of rubbish disposed of by the nation's population. Based on the results of tests conducted at a small pilot plant in San Fernando, Calif., the conversion system will offer communities the first total system of refuse disposal ever devised. The plants would be odorless, smog-free, without vermin, noiseless and could handle up to 150 tons of unsorted rubbish daily.

Ordinary methods of disposal—burning, dumping at sea, use in land fills—are all expensive. The conversion system is not free; its operators would be paid to receive rubbish delivered to it. Because the plants are unobjectionable to sight and scent, they could be set up in different parts of a city, so that the maximum hauling radius is about six to eight miles. The savings resulting from the shortened haul to disposal sites and the reduction in gas and maintenance costs, would more than compensate for the initial payment to the plant, tests indicated.

In the pilot plant, all refuse travels through the salvage operation, passes a magnetic separator, and then is diverted either into the naturizer system, the Lantz system or other systems. The naturizer system, after sorting out marketable materials as cardboard, paper, glass, plastics and metals, converts the remaining rubbish into organic compost which is a soil conditioner not now available in quantity. An estimated 50 million acres of unusable land in the U.S. and another 50 million acres approaching infertility, could be reclaimed by using the organic compound. The end products of the Lantz system, a distillation process, are mainly charcoal, methane gas and cresotars.

Chemicals Control Mosquitoes

Four potent chemicals for mosquito control have been announced by Drs. M. S. Mulla and R. L. Metcalf, University of California. Small quantities (5 to 25 grams per acre) of the compounds gave complete control of mosquito larvae in such typical breeding areas as irrigation ditches, irrigated crops, swimming pools and waste water from industrial and residential sources.

The chemicals have distinct advantages over larvae-killers now in use: They are relatively harmless to beneficial forms of wildlife, leave very little residue on crops, and are cheaper and faster to apply in small quantities.



Right Makes Light

Requiring a student to choose among multiple answers to questions, the Teachall machine rewards accuracy with a light and buzzer. The battery-operated teaching machine, complete with learning programs, is sold for \$69.95 by Publishers Co., 1106 Connecticut Ave., N.W., Washington, D.C.

Matching the Sino-Soviets

"It is easy to show that if we are to depend only on sheer numbers of scientists and engineers, that over the long haul we cannot possibly match the combined Sino-Soviet potential. If we assume that an equal percentage of scientists and engineers are trained in each country, then eventually there will be about five communist technologists for every one of ours. Furthermore if we continue to keep women out of the engineering profession, then the unfavorable ratio will double. Our only hope lies in our being extremely efficient by exploiting all of our technical resources and by improving our quality. (Of course, working longer hours would also help considerably.)"

DR. LEONARD S. SHEINGOLD,
Chief Scientist, U.S. Air Force

Loitering Interceptor

"It is now within the state of the art to produce a manned interceptor with an operating radius of 1000 to 1500 miles, ability to loiter or patrol for several hours, carry its own detection, tracking and fire-control system which can operate from the deck to extremely high altitudes and fly at better than mach 3. I know that such a system costs something over \$2,000,000,000 and takes about four years to become operational. I sincerely believe that we must have such a system to close the gap created by the air-to-surface missile in war and to police our own airspace in peace."

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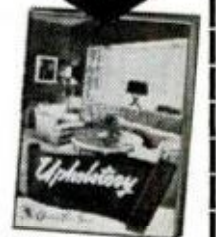
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New Names in Space

There'll be lots of hardware going out into space in the next few years bearing names that are as strange as some of the craft.

Among the names to be watching for are:
Mercury—more one-man shots.

Apollo—in three consecutive stages: Three men in Earth orbit, then three men around the moon and return, then three men on the moon and return.

Ranger—a hard landing on the moon.

Surveyor—soft-landing a 750-pound package on the moon.

Nimbus—follow-on of the present Tiros weather satellites.

Aeros—follow-on of Nimbus.

Dyna-Soar—controlled landing of an Earth satellite.

Prospector—spacecraft for hovering off the moon or traveling on its surface.

OAO—orbiting astronomical observatory.

OGO—orbiting geophysical observatory.

OSO—orbiting solar observatory.

Advent—Army multichannel microwave communication system with fixed satellites.

Relay—something similar by the National Space and Aeronautics Administration for TV and telephone.

Bambi—possible satellites to detect and destroy incoming ICBMs.

Rebound—NASA balloons for bouncing communication signals back to earth.

Slomar—Air Force craft for handling supplies to satellites, engage in rescue and so on.

Syncom—NASA's parallel to Army's Advent.

TSX—commercial communication satellites.

Vela—various satellites for detecting nuclear explosions.

Voyager—follow-on for Mariner that would orbit Mars or Venus.

Suit for Re-Entry Bailouts

Astronauts may be able to make emergency bail-outs from their spacecraft during reentry into the atmosphere by wearing a special new suit and helmet that will protect them from severe heat and wind-blast at hypersonic speeds.

At these speeds the ordinary pressure suits would not protect them and their flesh could easily be torn from the bone.

The new suit has an outer layer of sailcloth over a layer of cotton cloth covering a layer of tightly woven aluminized nylon. Preliminary tests on rocket sleds above 1300 miles per hour have proved its durability.



Can Open Without Can Opener

No can opener is needed to open a new beer can designed by Iron City Brewery, Pittsburgh, Pa. Lifting an aluminum tab on the lid and rolling it off creates a key-hole-shaped opening.

Study Space Collisions

Two hypervelocity impact ranges at the U.S. Air Force's Arnold Engineering Development Center are the site of tests to determine the damage which might result if a small particle of debris were to collide with a vehicle in space. A third, larger range will be placed in service this year.

The two existing ranges are capable of impact studies up to a velocity of 26,000 feet per second at simulated altitudes up to 150,000 feet. A camera, taking pictures at 1,400,000 frames per second, produces a graphic record of crater formation as the projectile slams into the target. The newest range will have altitude simulation capabilities up to 350,000 feet, bi-directional target stress capabilities of 100,000 pounds and target temperatures up to 1500 degrees F.

"Information gained from current and future impact range studies is expected to aid plans for the effective shielding of space vehicles against the possible loss of life or instrumentation," says Mr. Julius Lukasiewicz, of ARO.

● **Entomologists** report that bitter battles occur among bees of different species when one attempts to steal honey from the other. Dead and dying bees are strewn over the battleground, some locked in death grips.

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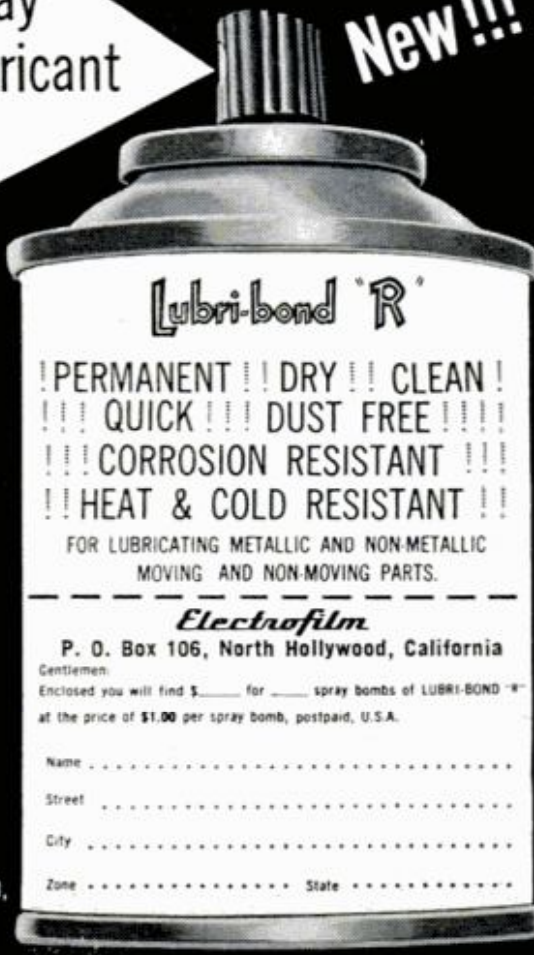
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Antarctic Sanctuary

The Antarctic, the only area in the world uncontaminated by man, must be preserved as an international sanctuary where scientists can study life in connection with the original intent of nature, says Dr. Robert Cushman Murphy, Lamont curator emeritus of birds at the American Museum of Natural History, New York.

Scientific expeditions themselves are changing the uncontaminated situation, Dr. Murphy says: Hundreds of tons of seals have been killed for dog food; penguins and other birds are killed for no reason; dogs have been turned loose to kill animals and birds not accustomed to predators.

Radar Spots Cable Trouble

A British designed Pulse Echo Fault Locator locates problems in underwater cables. The locator sends a pulse along the cable at 100,000 miles per second, and the fault causes an echo to bounce back to the source. A double-beam cathode-ray tube displays the reflected fault echo on the upper trace, which is calibrated against crystal markers on the lower trace, representing nautical miles of distance. The unit can pinpoint faults to within 80 yards in normal undersea conditions.

The system is also feasible for overland cables or for testing cable during manufacturing.

Venus Is Inhospitable Planet

Weather and atmospheric conditions on Venus make it a "completely inhospitable" planet, says Dr. G. H. Pettengill, Massachusetts Institute of Technology.

Since Venus has a slow rotation period, it takes the same length of time to make one revolution around the sun as it does to rotate on its axis. Therefore, the length of a day is the same length as a year. Because of the slow rotation, Venus always keeps one side toward the sun, and the dark side has a measured temperature of 1100 degrees F.

In addition to the extreme temperature, the atmosphere is so much heavier than Earth's that it acts as a shield to prevent bombardment by meteorites. Although Venus' atmosphere contains nitrogen, carbon dioxide and oxygen, the oxygen is not in a free, or gaseous state, and could not be utilized by a human.

● The southernmost town in the world is Puerto Williams, Chile. The island community, inhabited by about 350 people, is located only 680 miles from Antarctica's Palmer Peninsula.

Cities Taking Best Farmland

America's survival may depend on substituting scientific technology for disappearing farmland. Cities are spreading over some of the nation's best farmland, according to Daniel G. Aldrich, Dean of Agriculture, University of California.

Although the U. S. holds the lead in farm production now, American consumers will need 35 to 45 percent more farm products by 1975. The training of scientists to increase the efficiency of growing, harvesting, transporting, processing, distributing and marketing is the key to better, faster farm production at a lower cost.

Life Evidence in Ancient Rocks

Evidence is being uncovered that indicates life on Earth may be 2½ billion years old. Dr. Thomas Hoering of the Carnegie Institution of Washington's Geophysical Laboratory has found compounds of carbon, hydrogen and oxygen—common to all living things—in rocks of that age. Radio-carbon dating was used to establish the age of the rocks.

Definite evidence of life 500 million years ago has been established, according to Dr. Philip Abelson, director of the Geophysical Laboratory. It consists of compounds identical to palmitic and stearic acids, fatty acids found in all forms of life today.

"Epilepsy" Is Space Hazard

Tremendous vibrations and G-forces of rocket boosters may cause astronauts to become temporary epileptics, according to studies at the University of California Brain Research Institute.

Experimental animals were subjected to acceleration and vibrational effects which were comparable to rocket-booster forces. Deep brain wave recordings showed erratic electrical discharges characteristic of epileptic seizures.

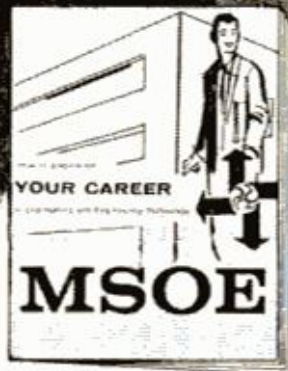
The effect is a temporary, sudden loss of consciousness, but could prove critical in an astronaut's performance in space.

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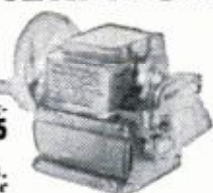
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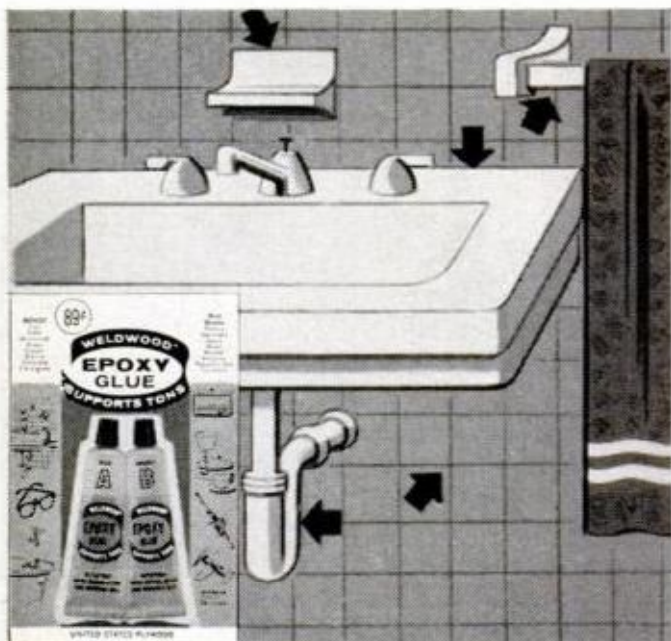
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POPULAR MECHANICS



Sir Edmund Hillary: **THE UNCONQUERED WORLDS ON MY LIST**

THERE IS A BELIEF extant that in our shrinking world the frontiers for adventure are becoming non-existent.

I do not agree with this. I do not believe that one must look only to outer space for new fields to conquer. There remains on the surface of our globe a host of exciting, worthwhile explorations still to be undertaken.

Next year I return to the Himalayas for my seventh expedition into that region. Besides a primary objective of building schools for the Sherpa people, my goal will be to examine the unconquered icy spire of Taweche, a mountain 21,463 ft. high, and to see if we can force a route to its summit.

This will be a challenge and a rewarding one, but it





A JET BOAT trip up one of the turbulent Himalayan rivers, is a future goal for Hillary. If successful, this could open a much needed lifeline into Nepal when monsoons close the inland mountain country to ordinary travel routes

will not be done overnight. As you can see in the rare photo on page 90, used in *World Book Encyclopedia* and in my book *High in the Thin, Cold Air*, plenty of planning will be needed to reach the base of the mountain—let alone climb it. But this isn't the only peak on my agenda. At the request of the editors of *Popular Mechanics*, I will give you some thoughts on adventuring I still want to do.

New Guinea

"A great escarpment . . . 3,000 meters high . . . and quite unclimbable!"

These challenging words by a Dutch bush pilot three years ago first focused my attention on the wild and untamed mountains and jungles in the far west of New Guinea. On this escarpment are many little ledges where trees and plants flourish, he said, and there is a sudden transition from the jungle below to what is almost an alpine height.

I always have my reservations when someone says that something is "unclimbable." I am also thinking of the opportunities in this untouched country for biological and anthropological research.

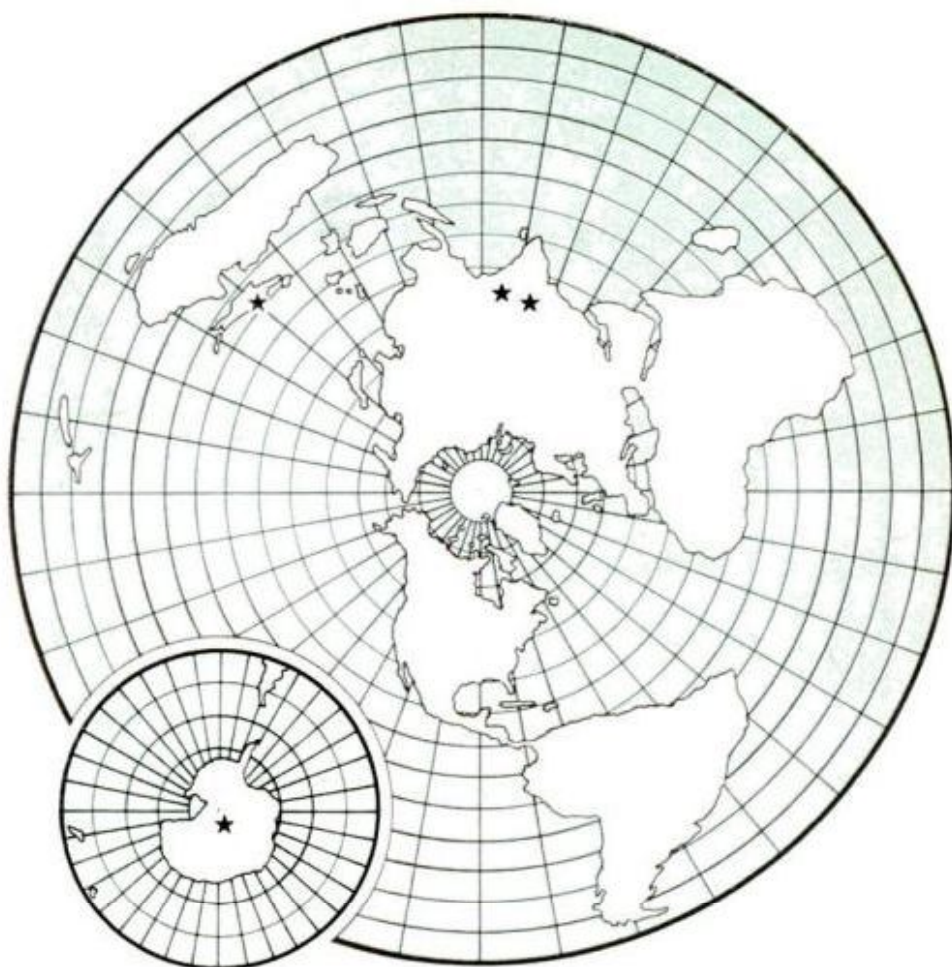
What about a traverse of the escarp-

ment, here where the mountain backbone of the island shoots upward with sheer abruptness? It would involve a journey by canoe or boat up the fetid rivers of the hot, densely forested southern coastal plain; then the challenge of 10,000 feet of "unclimbable" escarpment, and—finally—the battle through dense jungle to the northern coast. It would involve dealing with the primitive local people, most of whom would never have seen a European before.

Here, certainly, are all the ingredients for an exciting and well-balanced expedition in which science and adventure could blend happily.

Himalayan River

From June to September the monsoon rains descend upon the foothills and mountains of Nepal. Traveling becomes a tedious and dangerous business; tracks are washed out, mud avalanches engulf villages, streams become temporarily impassible. A constant low ceiling of heavy cloud formations drapes the ridges and peaks of the mountains, making the area unapproachable by air. And even if aircraft were able to penetrate the cloud



THE WORLD holds four major Hillary goals. There are the unclimbed peaks of Antarctica, an unexplored plateau in New Guinea, the wild rivers of Nepal, a complete circuit of Everest and the Himalayan forests of Bhutan

CLIMBERS IN NEW GUINEA work up the side of an escarpment similar to the "unclimbable" wall described by Hillary as a future challenge he sees

IN ANTARCTICA a climber works his way up through a chimney of solid ice with the aid of anchored ropes. Any South Polar traverse will involve crevasses



HIGH IN THE HIMALAYAS, towering Mt. Ta-weche, an unclimbed spire of 21,463 feet, is a future goal for the conqueror of Mt. Everest



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Explorers have always needed an adventurous spirit, but the desire for adventure is not enough.

Dr. Fairfield Osborn, President of the New York Zoological Society, says: "There is a common delusion about expeditions and the people who qualify to go on them. The fact is that any member of a worthwhile expedition must be so trained that he can carry out some functional or scientific job."

Besides scientists, today's expeditions include technicians such as meteorologists, mechanics, radio operators, car-

tographers, radarmen and photographers. In addition to a particular skill, a potential expedition member must be adaptable to the area where the expedition is headed.

"Adaptability," says Dr. James A. Oliver, Director of the American Museum of Natural History, "is a necessity for the scientist traveling on an expedition. He must adjust to strange living conditions for long periods; extremes in climate and unfamiliar food. He must endure discomforts, and he must be prepared to repair his specialized equipment by himself."

Science, technology, common sense—three necessities of any expedition.

blanket, there are no airstrips in this area on which they might land.

But there are the rivers. Swollen by the rains, the great Himalayan rivers thunder down in a tremendous spate between steep terraced hillsides and through high-walled gorges. I see in these rivers a challenge, and perhaps a new form of transportation—the jet boat!

I have often thought what an adventure it would be to tackle one of the rivers of Nepal and see how far one could penetrate toward the glaciers and snowfields of the Himalayan Divide. I have tested the power and mobility of jet boats in the white water of New Zealand rivers, but never in Nepal. My experience in boating on the Himalayan rivers is limited to

exciting fordings in dugout canoes, and a journey down the mighty Arun for some six or eight miles on air mattresses. That ride ended in near disaster when we were caught up in a gigantic whirlpool. Great logs in the center were being upended and sucked down. We clutched wildly at rocks as we went 'round, and eventually dragged ourselves clear. But it was a frightening thing.

It is impossible to forecast how far a jet boat would get in such waters. Undoubtedly there are waterfalls here and there requiring portage, but this is not a difficult matter. The Nepalese men in the valley of Katmandu used to carry motorcars over steep hill country—36 men to

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

THE SOUTH POLE was Hillary's goal in 1959. The New Zealand expedition leader (below left) whetted his appetite to return for an assault on antarctic peaks. On a Himalayan expedition (below) the explorer examines a crevasse



A ROAD RACING PRO TEST MATCHES



Studebaker

AVANTI

"Solid feeling, but it understeers... neither a true sports car nor up in the luxury league."

Buick
RIVIERA

"Plenty of punch, but only for the road, not track... like Bentley, a gentleman's carriage."



How do they compare? To find out, PM gave these fabulous four to a top racing driver for a two-day series of timed handling, cornering and braking trials on the track, plus a road workout and an economy run

WHAT ARE THEY REALLY LIKE, this fast and presumably furious quartette?

Not only are three of them—Corvette, Avanti and Riviera—new from the wheels up, but they are America's newest kind of car. Call it the sports speedster.

They're so new, in fact, that nobody's exactly sure where they stand. Questions pop into everyone's mind: Is the new Corvette more of a sports car than before? Will it now be able to mop up imported competitors like Ferrari and Maserati? Is the Avanti a true sports car, or just a hot-rod Lark with delusions of grandeur? Will Buick's Riviera take over T-Bird's throne as the Broker's Bucket-Seat Bomb?

Almost everybody wanted to know, so PM decided to find the answers by test-

ing them together, at one time in a single place. Since these four seemed to be a good deal more than average road cars, we felt that they needed more than a normal road test. So we took them to the race track. And, as at least one of them is bone-fide sports car, we looked for a very special driver to evaluate them for us.

Here, then, are the ingredients of PM's Operation Sportstest:

The Cars: *Corvette Sting Ray Coupe* weighing 3150 pounds, with single four-barrel carburetor, 327 cubic-inch 300-horsepower V8 engine, four-speed manual transmission, 17:1 ratio power steering and standard brakes.

Studebaker Avanti weighing 3365 pounds, with single four-barrel carbure-

THE WILDER ONES . . .



Chevrolet

CORVETTE

"Chassis design catching up to engine power . . . a club sports car, not for European races."

Ford T-BIRD

"A high-speed touring car . . . no longer a gold-plated Ford."



tor, a supercharged 289-cubic-inch, 275 horsepower engine, four-speed manual transmission, 16:1 ratio manual steering and front disc brakes.

Buick Riviera weighing 4450 pounds, with single four-barrel carburetor, a 401-cubic-inch, 340-horsepower engine, automatic transmission, 20.5:1 ratio power steering and power brakes.

Thunderbird (hardtop), weighing 4370 pounds, with single four-barrel carburetor, a 392 cubic-inch, 300-horsepower engine, automatic transmission, 20.3:1 ratio power steering and power brakes.

The Track: Lime Rock Park, a 1.6-mile, macadam-surfaced sports car racing circuit sanctioned by the Sports Car Club of America and located at Lime Rock, Connecticut.

The Driver: John Fitch, internationally known sports car driver who has competed in such major world events as Le Mans, Sebring and Nausau, driving Mercedes 300 SLRs, Cunninghams, Jaguars, Ferraris, Porsches and Corvettes.

Fitch is former team driver for Mercedes and Cunningham. He also designed the Sprint, a version of the Corvair Monza specially modified for outstanding performance and handling.

The Tests: A two-day series in which the four cars were driven alternately by Fitch, accompanied at all times by *PM's* Auto Editor Jim Whipple, who was armed with a portable recorder which taped Fitch's running commentary of evaluation. The series consisted of the following tests:

1. To compare steering action, a hard right hand bend was made at 20-30 m.p.h.
2. To measure relative cornering ability under full-power race conditions, timed runs were made through a pylon slalom course (see diagram page 96).
3. To evaluate overall road capability, Fitch drove high-speed runs on the sports racing track. Tires—all inflated to five pounds over recommended pressures—were rolled under to the point where scuff marks ran half way up the sidewalls.



ON THE RAGGED EDGE of controllability at 50-55 mph in hard right bend, Avanti ploughs with overweight front-end causing an understeering problem

4. To evaluate cornering, cars were taken around a sweeping right hand curve at maximum speeds at which effective control could be maintained. Speeds ranged from 50 to 55 for Avanti, Riviera and T-Bird, about 65 for Corvette.

5. Road evaluation. Each of the four cars in turn were taken over a 25-mile route of two-lane blacktop highways selected to permit evaluation of the ride, roadability, handling, braking and acceleration of the car at 35 to 65 m.p.h.

6. To measure fuel consumption, the four cars were driven in convoy across country for 58 miles at approximately 50 miles per hour without floorboarding. Fuel tanks were topped up before and after the run. Mileages per gallon were as follows: Corvette, 17.1; Avanti, 16.4; Riviera, 15.6; T-Bird, 16.2. This was approximately continuous running with only a single traffic stop and moderate hills.

And here is Fitch's hard hitting appraisal of each car, made during and after Test #1, the initial understeer appraisal:

"We noticed on Avanti the vagueness (in response) associated with supercharged engines, however to a remarkably small degree. Steering is heavy and quite slow.

"On this first short run the torque re-

action lifting the inside right rear wheel on a slight right turn is extreme, to be expected from a car with a heavy front end, lots of power and a live rear axle. Inside rear wheel lifts and spins easily on dry pavement. Avanti lifts a bit less on a left hand bend when that is the inside rear wheel.

"On the same understeer curve on T-Bird, a hard right bend stalled out the engine, and the car understeers quite badly. There's less feeling of understeer coming to the Riviera from the T-Bird. We note better throttle response and no stall-out.

"Corvette feels like a car! Suspension, steering, balance, the comparison between over and understeering are all so tremendously better than the other three, it's actually a different category of vehicle . . . Corvette taken through the understeer turn at 28 m.p.h. Others at about 20 m.p.h.

"Corvette's power steering is very satisfactory at low speeds . . . turning circle remarkably good and short, it's about 40 feet but feels shorter . . . I like the grip of the steering wheel, but would like the wheel just a bit further forward. This can be done through under-hood adjustment of the splined shaft."

After each car was taken for a series of

LIKE AVANTI, softly-sprung T-Bird heels on same curve, but shows less tendency for weight to concentrate on front end

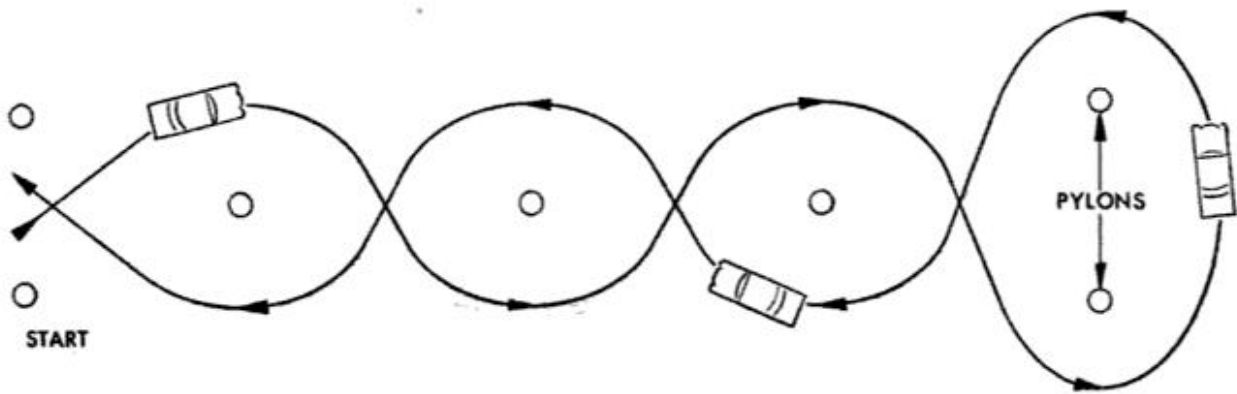


CENTRIFUGAL FORCE claws at Riviera in 55 mph run through the curve. Fitch liked it a bit better here than T-Bird



STING-RAY takes curve at 10 mph faster than other three with better control. After making this comparison Fitch said, "Feels like a real car!"

SLALOM COURSE



ON THE SLALOM COURSE, Corvette made the tortuous, 220-yard run through the pylons at 1.1 seconds faster than best of other three sports speedsters

runs through the slalom handling course, Fitch made these comments:

"Corvette's best time was 20.4 seconds, but our first trip through the pylon slalom course took 20.6 seconds. It seems that when we went to second gear on a right hand turn with Corvette that there was fuel starvation, as if carburetor jets were uncovered.

"Avanti's best time was 21.5 seconds. The understeering of Avanti is very evident in the slalom test . . . the car is not responsive at all. Slow, heavy steering in combination with very heavy front end made steering accuracy very poor. Shift linkage resists quick and easy changes, is not up to par on this four-speed transmission which is the same being made by Warner Gear in Ford, GM and Studebaker cars.

"Thunderbird's best time was 22.5 seconds. Understeer on T-Bird was as bad as on Avanti . . . throttle response was very poor . . . when you open it on a tight turn the engine doesn't take hold for some time. This is precisely at the point where you want power to help the car around . . . generally unsatisfactory for this sort of maneuvering."

Buick Riviera's best time was 21.4 seconds. "On the slalom course there's even more feeling of understeer than with Avanti. That surprised me, as the Buick is actually better balanced with less of a front end weight bias; however, that's the sensation of driving it, and the tires are at respectable pressures . . . so all we can say is that it's a characteristic of the car.

"Undoubtedly Riviera's power steering doesn't keep pace with the driver's wheel movements in tight situations. . . . Don't know that this means much in highway

driving, but there it is.

"If you do turn the wheel very quickly, or possibly in a loss-of-control condition where the car is fishtailing, a fast-responding driver might not be able to get out of it because of this sluggish response where the power steering cannot keep up to the wheel movement. I'm kind of disappointed in the feel of the car; however, the times through the slalom course weren't bad, so I guess it's respectable." (Riviera's automatic transmission was in low.)

After the third and fourth sets of tests, the high-speed and curve runs, Fitch summed up his track impressions in the following taped passage.

"T-Bird may not have been going as fast through the hard, fast right hander, as the other cars (55-60 m.p.h. indicated) because it refused to take the throttle. There was more bottoming of front suspension than in the Riviera on this turn, although it was the same sort of bottoming as on the Riviera. I'd say these cars are similar, although evidences of quality are much more apparent in the Riviera. This also applies to the suspension and handling—they are both the same kind of vehicle, but the Riviera is a highly refined automobile.

"I think it's darned good . . . in considerable contrast to the Avanti which just doesn't make it in this luxury league . . . it acts, feels and sounds like a car that was made in a hurry. It doesn't qualify in the sports car category . . . neither, we hasten to add, does the T-Bird or Riviera . . ."

"We figure the approximate speed of Avanti, Riviera and T-Bird at about 55 m.p.h. coming through the sharp right hand bend or "hook" at the end of the



THE LINEUP: America's most glamorous special-purpose sports and "personal" cars pose at trackside with driver John Fitch before shakedown tests began

main straight. T-Bird was a bit slower because it lost positive fuel feed coming through the curve. This wasn't as bad as Avanti's surges of fuel starvation coming intermittently like dots and dashes of Morse code."

On the second day the four cars were taken out on the highway during a steady rain for over-the-road evaluation. During each identical run of approximately 25 miles, Fitch commented as follows:

Thunderbird on the Road

"First of all in this T-Bird you notice comfort. Seats are deep and soft and there's plenty of room up front, at least. In all these close-coupled cars, the front seat occupants get real stretch-out space whereas the people in the rear seats don't seem to fare so well.

"The car's complex and powerful heating and demisting set-up gives you a feeling of luxury.

"Control is effortless on the road. The understeer and slow response to steering control noted on the track isn't a problem on winding roads at all—you only notice it when you come to sudden sharp curves and turn the wheel too quickly. Power steering is accurate and quick enough to guide the car around these winding, narrow roads at good speeds (50-60 m.p.h.)

"T-Bird is quite well insulated against road and wind noise. Along with the soft, absorbent ride this quiet gives you the feeling of plushness, with very little engine noise or sensation that the mechanical components are working hard.

"On this rippled blacktop, there's a certain amount of tramp and rear axle

hop that we're conscious of—you've got to expect it with a big, unsprung, live axle like this one—but until road surfaces get worse than these high-crowned, secondary blacktop roads the T-Bird's suspension is easy to live with.

"Body shake doesn't seem to be a problem either, although on really rough stretches, you get the sensation of some vibration in the large masses of the doors.

"Brakes are smooth . . . certainly adequate for normal road use. Power assist is properly correlated with amount of pressure you put on the pedal . . . it doesn't panic stop you unless that's the sort of stop that you want.

"T-Bird is much more satisfactory as a road car than its sluggish, understeering performance on the track would have led me to expect . . . in that respect the car

(Please turn to page 226)

ON-THE-SPOT driving impressions and evaluations by driver-designer Fitch (left) were picked up on tape recorder by Auto Editor Jim Whipple, after each run



AN ENGINEER EVALUATES THE '63 CARS



Cures for bowlegged wheels and downshift grind, growth-ready engines and rocker panels that breathe away rust—here's a roundup of little-touted but important 1963 changes

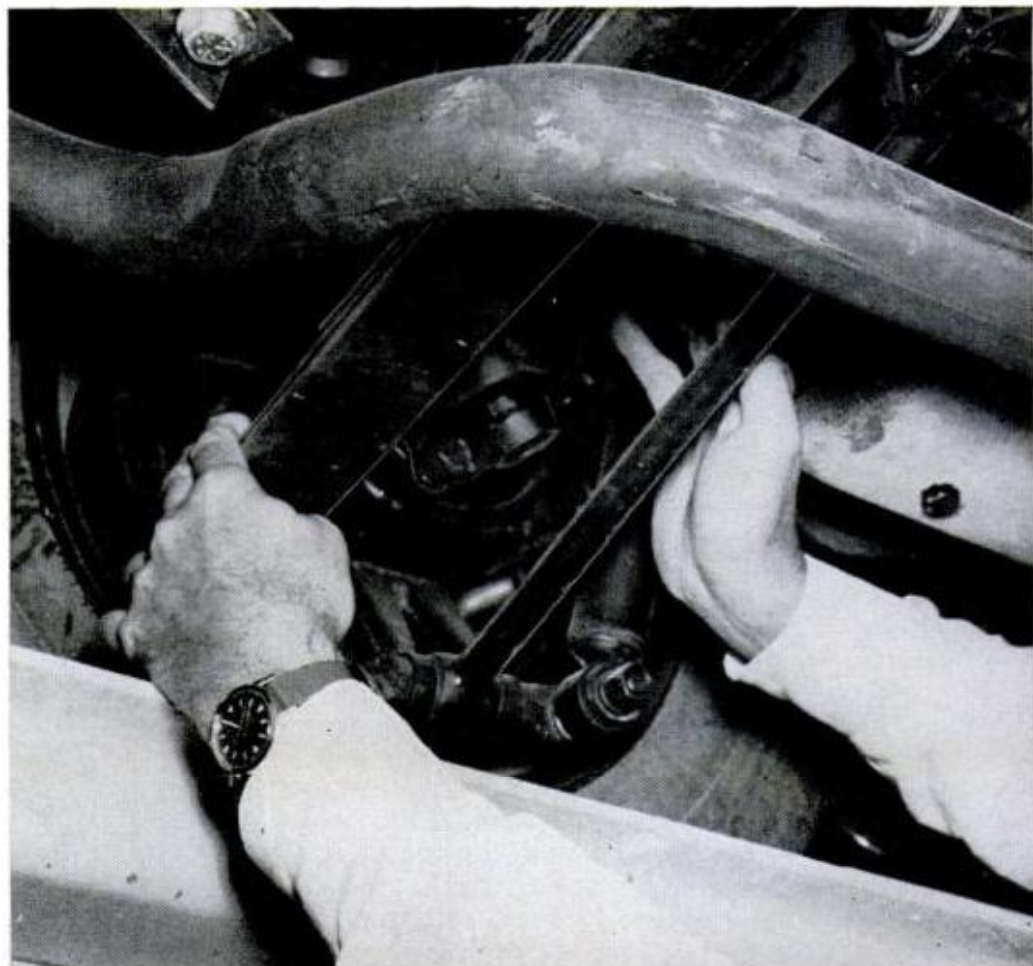
By Roger Huntington, ASAE

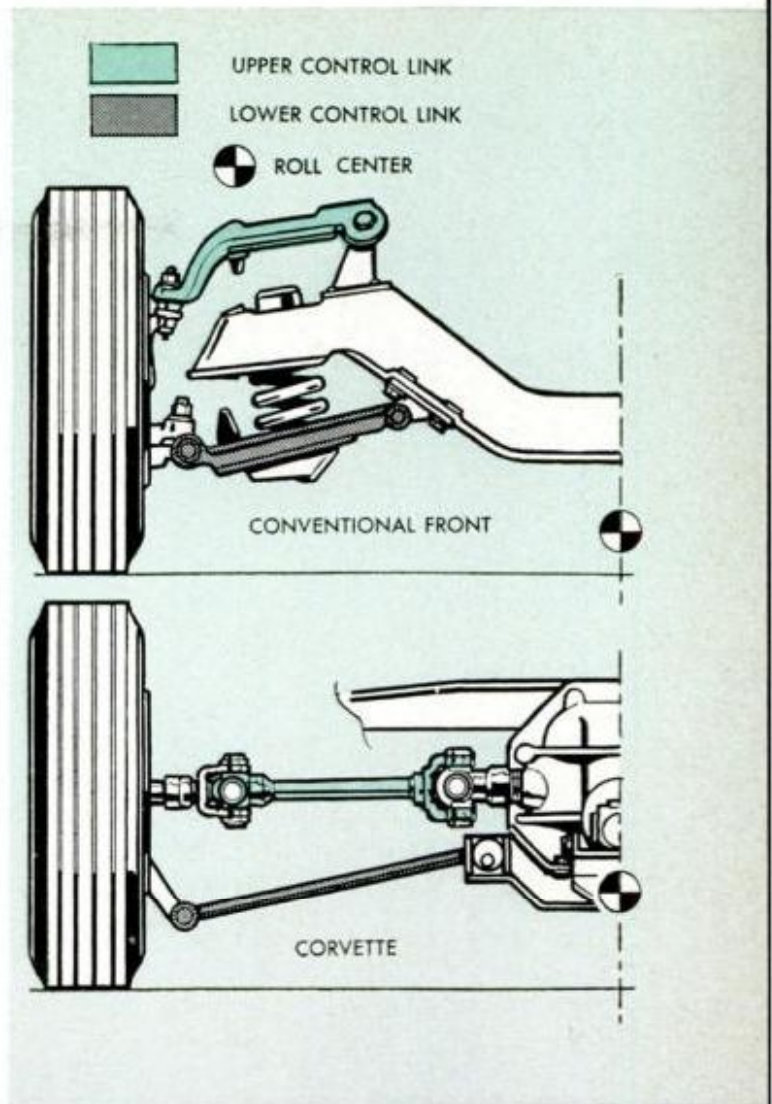
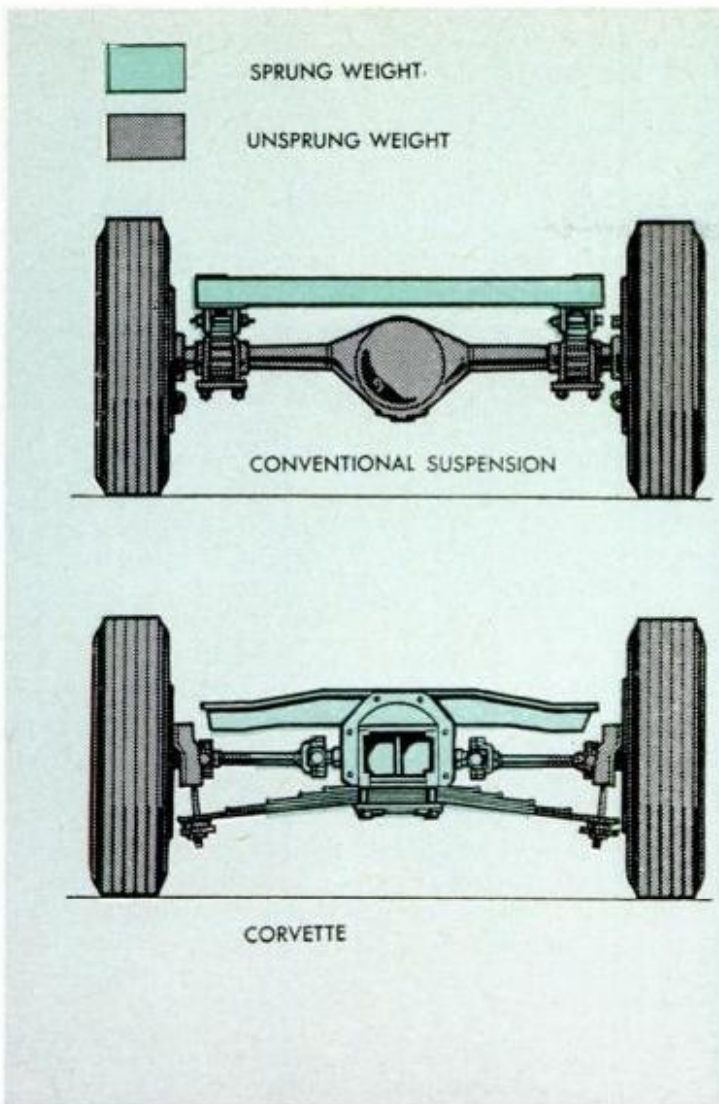
WITH NEW BODY SHELLS on most cars, Detroit's 1963 model year may be remembered more for styling developments than for revolutionary engineering.

But the engineering is there—in solid solutions to old problems and significant—sometimes downright clever—innovations that will probably appear in more and more cars tomorrow.

Take a look at the new Corvette chassis, for example. The problem here was to increase the ride comfort while improving the handling and road-holding—one of the toughest challenges an auto engineer has to face. Usually when you improve the handling, you hurt the ride comfort—and vice versa. Corvette engineers attacked the problem, as European race-car designers

AXLE SHAFT itself forms one of the two parallel links that control the vertical travel of Corvette's rear wheel, preventing excess camber





UNSPRUNG WEIGHT of conventional "live" axle at top is reduced from 301 to 200 pounds on '63 Corvettes by carrying differential and part of axle weight on the car's frame and eliminating axle housings

ACTION OF AXLE as upper control link in parallel with lower link on Corvette, top, is similar to independent front suspension, below. Angle of links locates the roll center higher to produce less roll

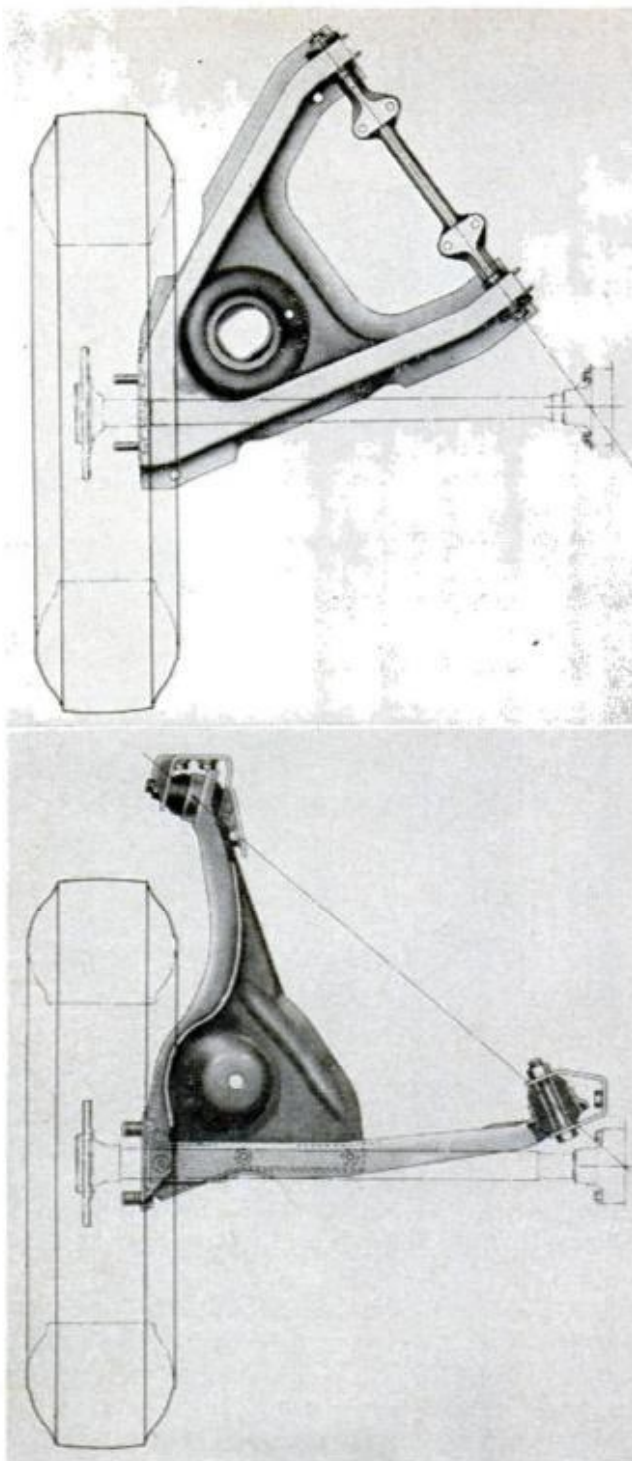
have done, by radically reducing unprung weight. This is the weight that bounces up and down with the wheels as they pass over bumps. On conventional cars, this includes the 150 pounds or so of the massive rear axle. The more unprung weight (in relation to the "sprung" weight supported by the springs), the more shock will be transferred from the road to the passengers, because the heavier unprung mass builds up more momentum as it bounces up and down.

The new Corvette rear suspension has the differential mounted rigidly on the frame, driving the rear wheels through U-jointed half-shafts. A single, leaf spring, running parallel to the axles, supports the load. Wheel movement is controlled by trailing arms and cross links. In fact, the U-jointed axle shafts act as the upper control arms, like the upper "wishbones" on a conventional front suspension—thus doing double duty and saving more weight and cost.

As a result, rear end unprung weight on the new Corvette is reduced from 301 lbs. to about 200 lbs. This greatly improves the ride, and also permits the tires to get a better grip on rough surfaces because there is less bounce. Also, by eliminating the rigid rear axle, the two rear wheels can move up and down independently. Thus one wheel going over a bump doesn't "kick" the opposite wheel, and suspension geometry can be closely controlled by getting just the right lengths and angles on the control links.

Corvette's new suspension has limited excessive camber of the rear wheels. Camber is the inward and outward tilt of the wheels caused by the half-axle shafts' "swing" around the universal joint as the wheels rise and fall in relation to the chassis.

When the wheels "bow-in" or "splay-out," as you've seen them do when traveling behind independently suspended cars (VW, Corvair), they actually steer the rear end of the car just as you steer a bicycle or



PONTIAC TEMPEST'S independent rear suspension for 1963, bottom, has been improved by new control arms that locate the "swing" or pivot point further from the wheel, thus increasing the radius which determines the arc through which wheel must tilt. Shorter control arms on 61-62 model (top, viewed from above), force wheel to tilt more sharply and thus "steer" car

FORD GALAXIE'S new front suspension has lower control arm carried on swinging link at front and flexible pivot at rear. This permits wheel spindle to swing back a fraction of an inch (and then return) when wheel hits bumps. This compliance link smooths out the ride. Car weight returns the link to proper position

a motorcycle by tilting it to one side.

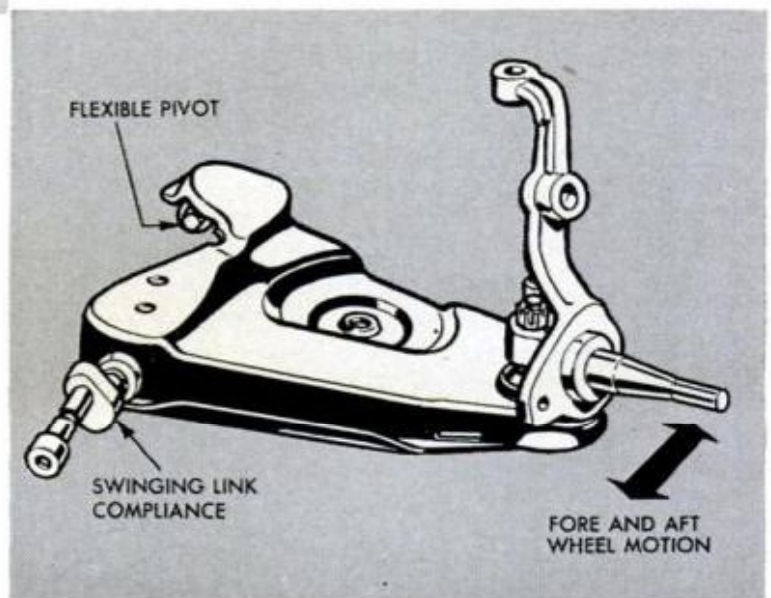
Corvette's independent suspension differs in that it doesn't swing on an arc at the end of a single axle. Instead, it rides up and down in a plane perpendicular to the road at the end of two parallel arms (see drawing page 99). These two arms are formed by the double-U-jointed axle shaft itself and a transverse link.

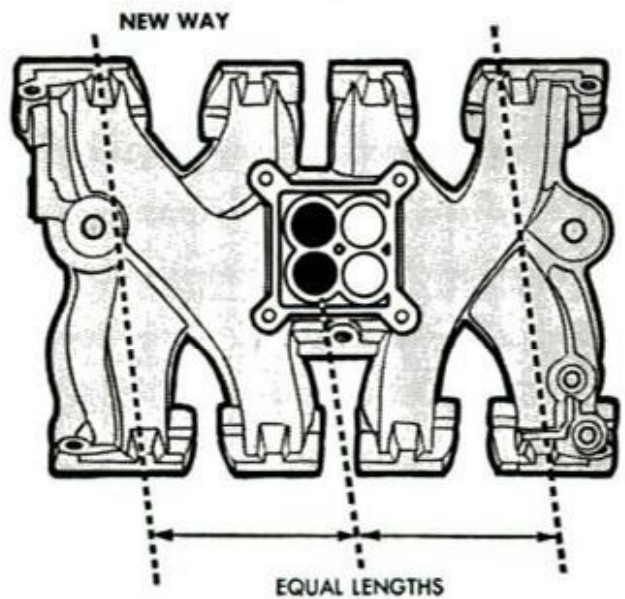
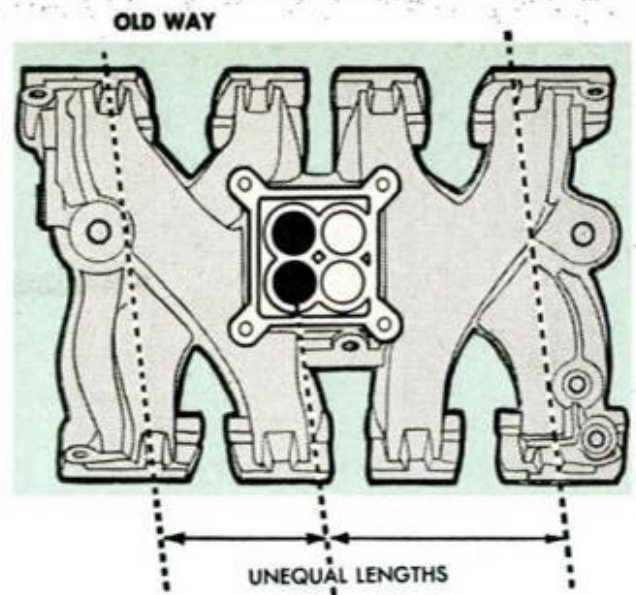
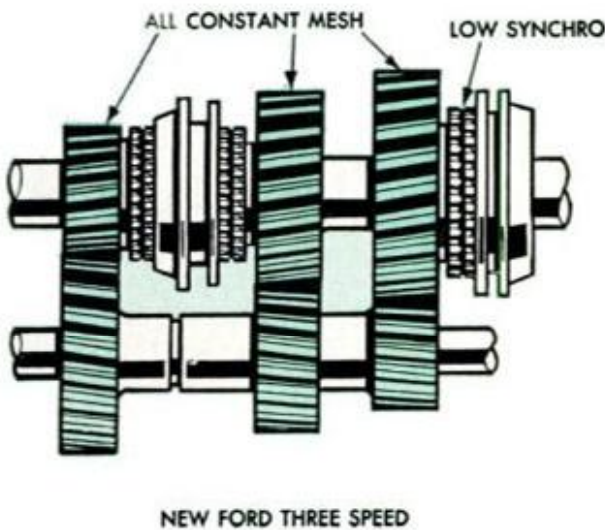
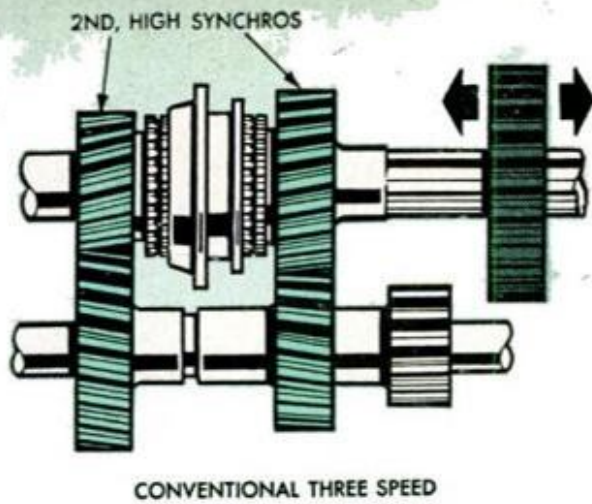
As seen on the Corvette, the independent rear suspension need not be much more expensive than conventional systems where there are four universal joints in the driveshaft, plus four links to locate the solid "live" rear axle. It wouldn't surprise me if Corvette-type independent suspensions turned up on some new conventional sedans. After all that's the route it went in Europe, from sports car to family sedans.

The independent rear suspension on the 1963 Pontiac Tempest was re-engineered for much the same reason. By lengthening the control arm so that its swing radius is much nearer that of the axle shaft itself, the amount of rear wheel camber has been reduced. And with less camber as the car goes over bumps or leans in a corner, there's a marked reduction in the rear wheel "steering" action which made previous Tempests a bit skittish in cornering.

Ford Complies Up Front

Ford has taken a big step forward with the new "compliance-link" front end. Here the front of the lower control arm is actually hung on a small crank lever that allows it to swing back and forth a fraction of an inch when the wheel strikes bumps. The wheel itself then has a slight fore-and-aft movement. The weight of the front end keeps the crank centered at the





THREE-SPEED transmission on all '63 Ford V8's and Galaxie Six has all forward gears in constant mesh, bottom. Extra synchronizer for low gear permits clashless engagement. In conventional three-speed, below, low gear slides on shaft, must engage teeth

LINCOLN'S new manifold for four-barrel carburetor, bottom, locates carburetor's primary barrels (used 95 percent of the time) at equal distance from all eight cylinders to give equal fuel mixture distribution. Old way located primary barrels nearer to front

bottom of its "stroke" under normal conditions. All this gives much added flexibility to the front suspension, so less road shock is transferred to the passengers and to the steering wheel.

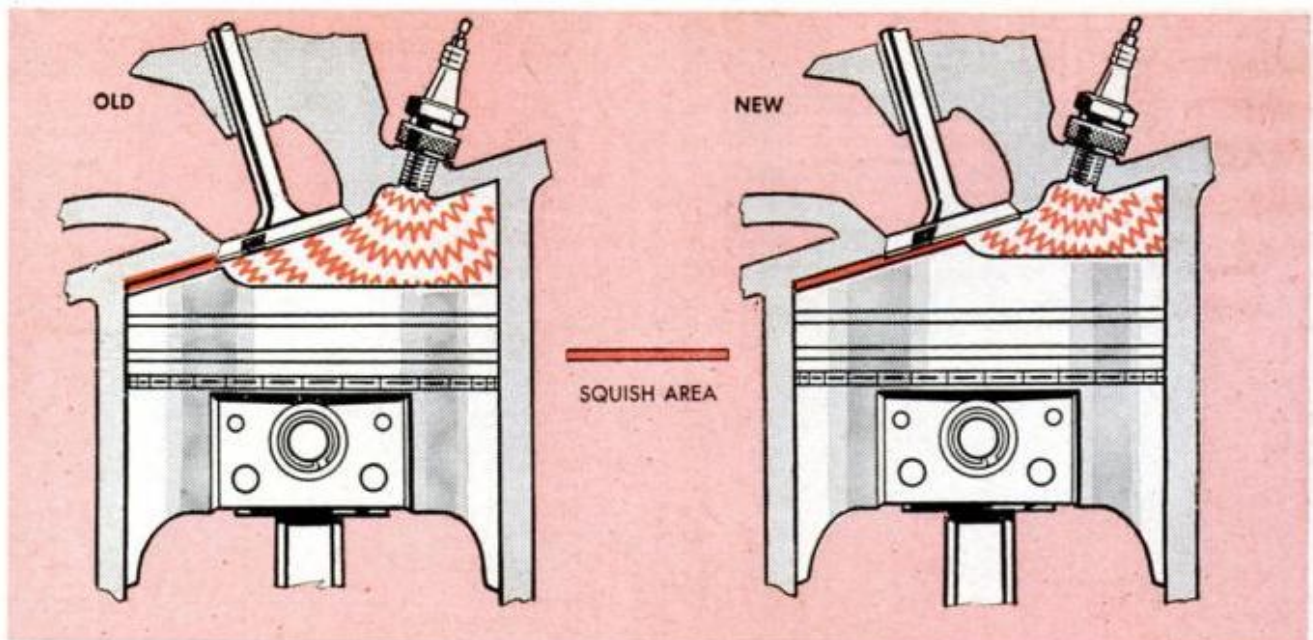
without clashing gears. Now you can really use that low gear. All it was good for before was starting up. When you went around a slow corner in town, and wanted to pull away fast, all you could use was second—and this doesn't give much pep at very low speeds. With a new Ford, you can now yank it down into low, and really jump.

Mercury did the same thing last year (and on their '63s too) with a pivoted linkage working with a coil spring which absorbs the rearward play of the lower suspension arm as it is permitted to move in lateral compliance with a road shock. Ford's new way is better in that it substitutes the car's weight itself for the spring, thus eliminating a moving part.

How did they do it? Simple: Low gear is now in constant mesh with its mating gear (instead of sliding back and forth in and out of mesh), and there is a synchronizer mechanism to match the speeds of the engagement "dogs" as they slide together along their splined shafts. The thing that caused the clashing before was trying to mesh the two large gears that were spinning at different speeds. The se-

Synchromesh Low Gear

Ford has another very important U.S. first in its new all-synchromesh 3-speed manual transmission. This lets you shift into low gear when the car is rolling,



PISTON TOP on '63 Lincoln, right, has tighter "squish" area which squeezes fuel mixture into a high-velocity jet toward the spark plug on compression stroke. This speeds up combustion, gives shorter flame travel and permits the engine to run more smoothly and efficiently on gasolines of lower octane

cret is to put these big gears in constant mesh, and use small synchronizers to engage them.

Why didn't somebody pull this beautiful trick before? Well, up until a couple of years ago the experts were predicting that the manual-shift transmission was a dead issue—that the automatic would gradually replace it 100 percent across the board. Nobody wanted to spend millions tooling for an "obsolete" transmission.

But a solid minority of U.S. car buyers wouldn't play the game Detroit's way. Apparently, the stick is here to stay, so Ford decided to get the jump on competition and give the shift-for-yourself group a better transmission.

New Engines Without Retooling

There are some interesting new engine developments this year, too. After 16 years of minor modifications, Cadillac has updated its V8 engine. What makes the '63 engine so interesting is that the engineers were able to modernize the design without changing too much of the expensive original tooling.

For instance, the top decks of the cylinder banks were lowered half an inch to make the engine more compact—but then the pistons were shortened a like amount so they could use the same connecting rods that were previously in the engine.

The basic block and head casting are unchanged, so machining facilities remain the same. A new crankshaft is cast instead of forged, but it has the same stroke and fits the same bearings.

But all major accessories (water pump, oil pump, distributor, fuel pump, oil filter and power steering pump) have been moved forward onto a new die-cast aluminum front cover assembly. This makes these components much more accessible for repair. The overall result is that the new Cadillac engine is considerably more compact, weighs 52 pounds less, is easier to service—and can still be economically manufactured, for the most part with basic tools that were paid for years ago! That takes real engineering!

More Potent Tempest

Another example of refinement engineering bringing new life to an old part may be seen over at Pontiac. The new, 326-cubic inch V8 engine for the Tempest is actually the big Pontiac mill with a smaller bore. Most of the parts are interchangeable. The small engine has new coring for the block casting that gives thinner walls, so it is quite a bit lighter than the big engine. But now the latest is that the big Pontiac cylinder block casting will soon get thinwall coring. Since the two cylinder blocks have the same mounts and accessories, we wouldn't be surprised if you could soon order a 389 or 421-cu. in. engine in the Tempest!

So we may not have seen the last of big engines used in small cars. Paradoxically there's also a new '63 trend of adapting compact car engines for the big cars. Notice that the new overhead-valve, 6-cylinder engine introduced last year in the

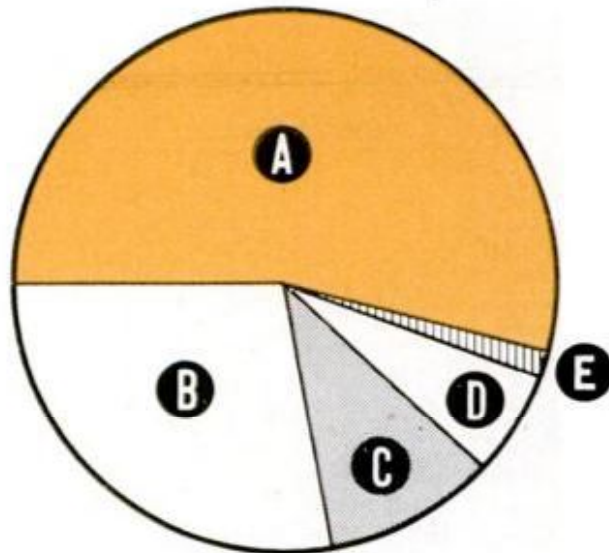
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PRODUCTION BOX SCORE 1962 versus 1961

| Rank | Model | 1962 Models Produced | 1961 Models Produced | % Change |
|------|-------------|----------------------|----------------------|----------|
| 1. | Chevrolet | 1,204,917* | 1,438,546* | (+19.4%) |
| 2. | Ford | 704,775 (-11%) | 791,498 | |
| 3. | Falcon | 414,282 (-15.3%) | 489,323 | |
| 4. | Pontiac | 378,740 (+57.9%) | 239,852 | |
| 5. | Oldsmobile | 353,026 (+45.7%) | 242,323 | |
| 6. | Chevy II | 326,599 | | |
| 7. | Corvair | 306,025 (+2.7%) | 297,881 | |
| 8. | Fairlane | 298,116 | | |
| 9. | Rambler | 280,385 (+25.7%) | 223,057 | |
| 10. | Buick | 245,683 (+29.3%) | 189,982 | |
| 11. | Plymouth | 172,134 (-13.3%) | 198,444 | |
| 12. | Dodge | 165,861* (-8.7%) | 181,710* | |
| 13. | Comet | 165,305 (-16.2%) | 197,263 | |
| 14. | Cadillac | 160,840 (+16.2%) | 138,379 | |
| 15. | Special | 154,467 (-76.6%) | 87,444 | |
| 16. | Valiant | 145,353 (+8.9%) | 133,487 | |
| 17. | Tempest | 143,193 (+41%) | 100,853 | |
| 18. | American | 125,678 (-7.6%) | 136,003 | |
| 19. | Chrysler | 118,539 (-35.7%) | 87,372 | |
| 20. | Mercury | 107,009 (-10.9%) | 120,088* | |
| 21. | F-85 | 94,568 (-23.7%) | 76,446 | |
| 22. | Lark | 85,943 (-39.6%) | 61,552 | |
| 23. | Thunderbird | 78,011 (+6.8%) | 73,051 | |
| 24. | Meteor | 69,052 | | |
| 25. | Lancer | 64,271 (-14.0%) | 74,773 | |
| 26. | Ambassador | 36,163 (-91.9%) | 18,842 | |
| 27. | Lincoln | 31,061 (-23.4%) | 25,164 | |
| 28. | Imperial | 14,337 (-17.0%) | 12,249 | |
| 29. | Hawk | 8,788 (-137.0%) | 3,708 | |

1962 Models Produced
 1961 Models Produced

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- A. General Motors 53.9%**
(Up from 47.7%)
- B. Ford Motor Co. 27.9%**
(Down from 31.4%)
- C. Chrysler Corp. 10.27%**
(Down from 12.7%)
- D. American Motors 6.6%**
(Down from 7.0%)
- E. Studebaker 1.4%**
(Up from 1.2%)

Industry total of 1962 model year: 6,686,750, up 23.6% from 1961 model year production.

*Includes all models

Only General Motors and Studebaker Corporation increased their share of production in the automobile market with their 1962 models (see pie chart). The industry produced 23.63% more cars during the '62 run, compared to the 1961 total of 5,408,625 units, but the shares of the pie going to Ford, Chrysler, and American Motors were trimmed from one to three percentage points. There still are several thousand unsold 1962s around the country, and their sales may not be reported for some time, so final sales figures aren't available. But, since all will be sold eventually, production figures are a good gauge of a given make's success and are used here.

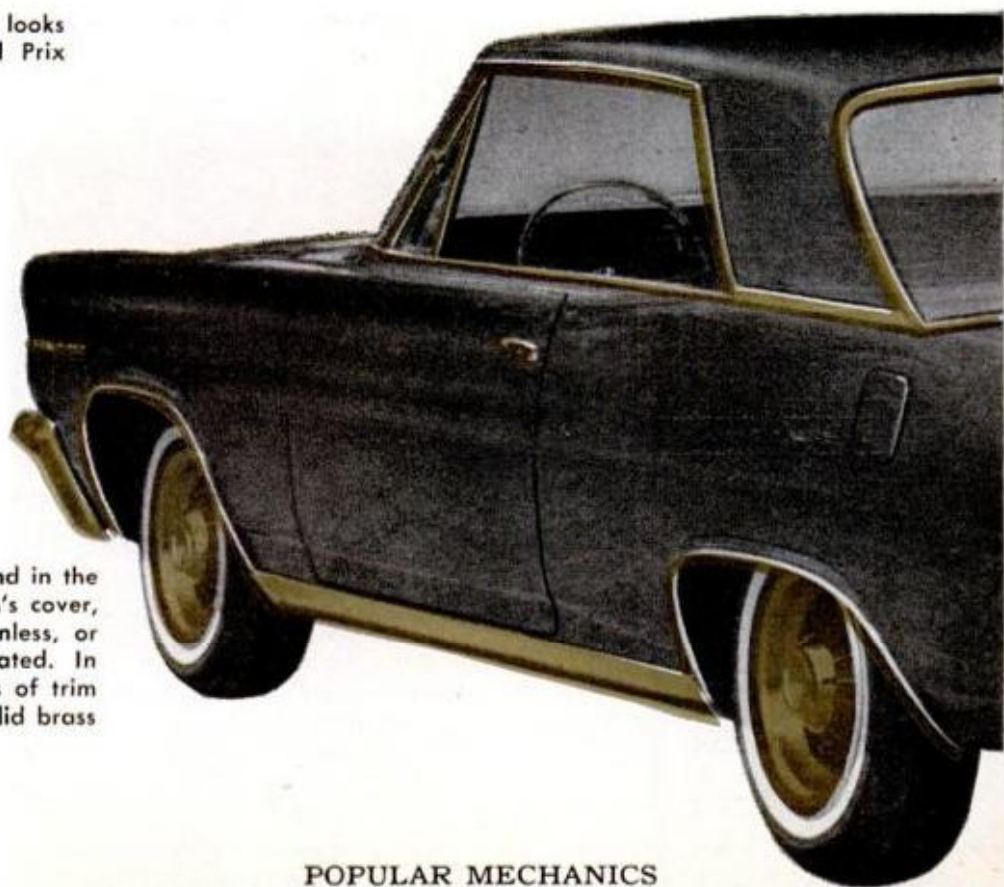
Studebaker's Avanti, on the market since last summer, was produced in too small a quantity to account for the company's gain; Lark increased about 25,000 units and Hawk more than doubled.

Small Thunderbird and Lincoln increases did little to help Ford, whose share of the market declined 3.5%, from 31.4% to 27.9%. In absolute numbers, Ford gained 11%. But the market expanded faster so Ford, relatively, lost ground.

ALL THAT GLITTERS



How total brass trim looks on the 1963 Pontiac Grand Prix



All items of trim shown here and in the unretouched photo on PM's cover, (whether chrome, stainless, or aluminum) were actually brass plated. In production many thin strips of trim would be pressed from solid brass

MIGHT BE BRASS



THERE MAY BE a brass-trimmed car in your future, just as there was in your grandfather's past, 50 years ago. If you don't think that there's a place for it in the Space Age scheme of things, take another look at the glowing gold-like metal trim on that Pontiac Grand Prix on this month's cover. That's not spray on paint or special inks either. It's an unretouched photo of brass-plating over the standard aluminum, stainless and chrome-plated trim. This car was specially plated—at PM's request—to show our readers what brass trim would be like.

Back in the early 1900's brass trim was universal, appearing on the most expensive luxury limousines.

Then almost overnight it was replaced; first by nickle-plate, then by the familiar chrome. Why did brass trim with its warm, golden glow vanish along with sleeve garters and high-button shoes?

Ask your Grandfather, who probably spent part of every weekend with a rag in his hand polishing away the tarnish. People put up with this in the days when cars were rich men's toys and used only in fair summer weather. So it's no wonder that as soon as a substitute less sensitive was found, brass went indoors to stay.

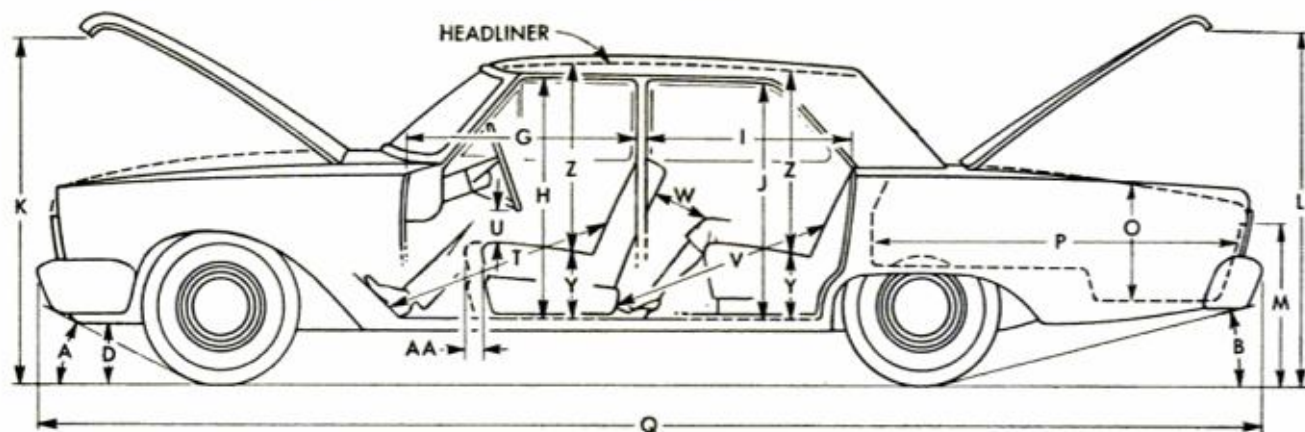
Now, after almost half a century, the brass industry is on the brink of a breakthrough that could put brass (and copper, too) back on the road in a big way. Here's how it'll be done.

Brass cannot be compounded to

[\(Please turn to page 242\)](#)



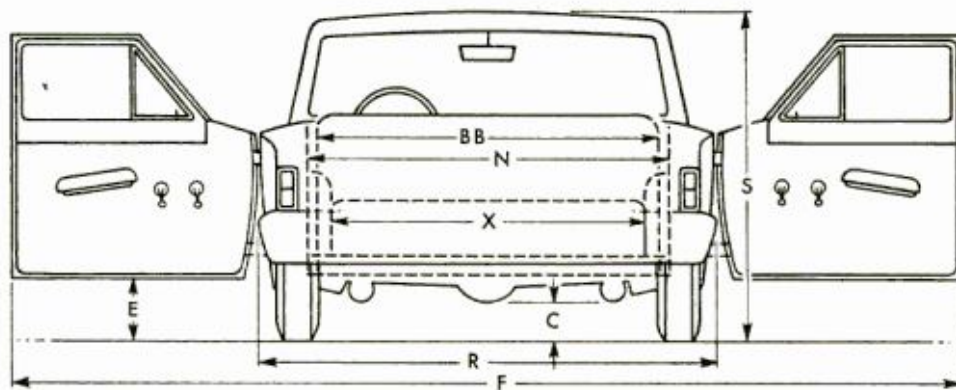
Comfort-Convenience Index



| | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|-------------------|-------------------------------|--------------------------------|-----------------|------------------------------|-----------------------------|------------------------|-------------------------------------|-----------------------------------|------------------------------------|----------------------------------|-------------------------|------------------------------|-------------------------|------------------------|
| | DRIVEWAY AP- PROACH ANGLE* | DRIVEWAY DEPAR- TURE ANGLE* | ROAD CLEARANCE* | FRONT END CURB CLEARANCE* | OPEN DOOR CURB CLEARANCE | OPEN DOOR WINGSREAD | FRONT DOOR OPEN- ING, HORIZONTAL | FRONT DOOR OPEN- ING, VERTICAL | REAR DOOR OPEN- ING, HORIZONTAL | REAR DOOR OPEN- ING, VERTICAL | CLEARANCE UNDER HOOD | CLEARANCE UNDER TRUNK LID | LUGGAGE LIFT HEIGHT* | TRUNK OPENING WIDTH |
| AVANTI | 28° | 22° | 5.8 | 10. | 13. | — | 54.5 | 37. | DNA | DNA | 70. | 56.3 | 24.5 | 42. |
| BUICK | 27° | 13.3° | 5.8 | 10.5 | 15. | 141.6 | 32.7 | 37.1 | 31. | 37.1 | 76.5 | 67.5 | 29.8 | 55.6 |
| CADILLAC "62" | 21.3° | 11.6° | 5.3 | 13.3 | 15. | — | 32.8 | 37. | 33. | 36.3 | 71. | 63. | — | 60. |
| CHEVROLET | 31° | 14° | 6. | 12.3 | 14. | 141.6 | 32. | 37.1 | 30. | 35.1 | 73.1 | 64.2 | 22. | 49.1 |
| CHEVY II | 32° | 17° | 6. | 13.1 | 12.1 | 141.6 | 33.1 | 40. | 32. | 38. | 68.1 | 59.1 | 21. | 49. |
| CHRYSLER | 19.1° | 11.6° | 5.4 | 13.4 | 14.5 | 151.5 | 36. | 38.1 | 34.6 | 37. | 77. | 71. | 24.3 | 52.5 |
| RAMBLER CLASSIC** | 26.8° | 16.4° | 6. | 13. | 13.9 | 140.1 | 35. | 36.3 | 33.3 | 35.8 | 68. | 57.5 | 22.6 | 46.5 |
| COMET | — | — | 5.9 | 12.8 | 13.8 | — | 35. | 37.2 | 32.5 | 36.8 | 68.8 | 72. | — | 49.5 |
| CORVAIR | 27° | 16° | 6. | 12.3 | 12.1 | 130. | 43.1 | 34.4 | DNA | DNA | 63. | 65.1 | 29.5 | 46.1 |
| CORVETTE | 26.7° | 17.4° | 5. | 12.5 | 13.3 | 139.3 | 34. | 32.5 | DNA | DNA | 65.1 | DNA | DNA | DNA |
| DART | 22.2° | 14.4° | 5.7 | 11.8 | 15.2 | 150.5 | 34.8 | 37.5 | 30. | 36.8 | 71. | 61.5 | 22.9 | 46.6 |
| DODGE | 21° | 13.3° | 5.1 | 11.2 | 17.3 | 149.2 | 34. | 38.3 | 31.5 | 37.9 | 74. | 63.5 | 27.3 | 55. |
| DODGE 880 | 24.2° | 11.7° | 5.4 | — | — | 154. | — | — | — | — | — | — | 27. | — |
| FAIRLANE | 26.5° | 12.7° | 5.6 | 11.5 | 13.3 | 138.1 | 41. | 37. | 40.5 | 36.5 | 70.3 | 65.5 | — | 50. |
| FALCON | 27.8° | 16.3° | 5.9 | 12.5 | 15. | 134.4 | 33.5 | 37. | 32. | 36.8 | 69.3 | 63.3 | 27.7 | 44.8 |
| GALAXIE | 23.3° | 11.° | 5.2 | 12.5 | 13.3 | 158.5 | 42. | 39. | 42.5 | 38.3 | 71. | 69.8 | 26.8 | 72.8 |
| HAWK | 20° | 17° | 6.5 | 9.5 | 15.3 | 150. | 41.5 | 39.5 | DNA | DNA | 57. | 67.1 | 20.8 | 56.5 |
| IMPERIAL | 22.1° | 13° | 5.6 | 12. | 18. | 159.7 | 37. | 39. | 27.5 | 37.5 | 82.5 | 68.2 | 26.3 | 58. |
| LARK, CRUISER | 28° | 14.5° | 5.9 | 11.3 | 12.8 | 140. | 26. | 43. | 21. | 41.8 | 72.8 | 63. | 22.5 | 55.5 |
| LINCOLN | — | — | 5.5 | 12.8 | 14.3 | — | 31.8 | 38.5 | 31. | 37. | 78.5 | 69.5 | — | 67. |
| MERCURY | — | — | 5.2 | 12. | 13.3 | — | 40. | 39. | 32. | 38.5 | 70.2 | 76. | — | 56.5 |
| METEOR | — | — | 6.0 | 12.5 | 13.3 | — | 35.5 | 37.8 | 33. | 37.5 | 74.5 | 74.5 | — | 50. |
| OLDS F-85 | 21° | 16.5° | 5.4 | 12. | 13.8 | 135.4 | 33.9 | 34.8 | 26.3 | 34.6 | 59.7 | 66. | 26.7 | 49.7 |
| OLDSMOBILE 88 | 26° | 13.3° | 5.9 | 12.6 | 14.6 | 141.8 | 33. | 36.1 | 31.1 | 37.7 | 73.0 | 67.1 | 27.7 | 55.3 |
| PLYMOUTH | 24° | 12.5° | 5.5 | 11.5 | 14.1 | 142.2 | 33.8 | 38.3 | 31.5 | 38. | 74. | 66.2 | 26.7 | 55. |
| PONTIAC | 21.6° | 13.3° | 6. | — | — | — | 36. | 35.7 | — | 37.4 | 72.4 | 67. | — | 55.1 |
| RAMBLER AMERICAN | 24.3° | 14.5° | 6.3 | 10. | 16. | 139.9 | 31. | 38.5 | 24.5 | 37.5 | 71. | 59.5 | 21.5 | 44.5 |
| RIVIERA (BUICK) | 24.5° | 15.8° | 5.5 | 10. | 13.1 | 155.2 | 44. | 36.7 | DNA | DNA | 74. | 65. | 28.9 | 48.5 |
| SPECIAL | 26.6° | 16.5° | 5.2 | 12. | 13.8 | 135.4 | 34.2 | 34.8 | 26.2 | 34.2 | 67. | 64. | 26.9 | 49.5 |
| TEMPEST | 25.9° | 17.6° | 6. | 13.1 | 14.3 | — | 33. | 34.1 | 26.1 | 34.1 | 64. | 67. | 27.7 | 49.3 |
| THUNDERBIRD | 20.6° | 12.7° | 5.6 | 10.5 | 13.3 | 170.3 | 46. | 37.5 | — | — | 70.8 | 58.8 | 24.2 | 66. |
| VALIANT | 25.9° | 10.5° | 7. | 11.5 | 16. | 139.2 | 34. | 37.8 | 30. | 37. | 70.2 | 65. | 24.6 | 50.1 |

All dimensions refer to four-door sedans (lowest price) where possible and are expressed in inches unless otherwise specified.

to the 1963 Cars



| O | P | Q | R | S | T | U | V | W | X | Y | Z | AA | BB | | |
|---------------------|---------------------|----------------|---------------|----------------|-------------------------|---------------------------|-------------------------|--------------------------|----------------------------|----------------------------|-------------------------|-------------------|-----------------------|------------------------------------|---------------------------|
| TRUNK INSIDE HEIGHT | TRUNK INSIDE LENGTH | OVERALL LENGTH | OVERALL WIDTH | OVERALL HEIGHT | FRONT LEG ROOM (MAX.) † | WHEEL-TO-SEAT CLEARANCE † | MINIMUM REAR LEG ROOM † | MINIMUM REAR KNEE ROOM † | SEAT CUSHION WIDTH (FRONT) | SEAT HEIGHT (FRONT/REAR) † | HEADROOM (FRONT/REAR) † | FRONT SEAT TRAVEL | MINIMUM SHOULDER ROOM | TURNING CIRCLE, CURB-TO-CURB (FT.) | WHEEL TURNS, LOCK-TO-LOCK |
| 16. | 24. | 192.4 | 70.4 | 53.9 | — | — | — | — | Bkts | — | — | 6. | 51.5 | 37. | 5. |
| 22.1 | 34.5 | 215.7 | 78. | 55.9 | 40.3 | 5.5 | 37.5 | 4.4 | 57.6 | 8.6/10.9 | 38.0/37.6 | 4.8 | 58. | 45.9 | 5. |
| 15. | 61. | 223. | 79.7 | 56.4 | 40.5 | 4.1 | 41.2 | 7.4 | 55.6 | 8.5/10.8 | 39.9/38.7 | 4.7 | 57.7 | 43. | 3.7 |
| 24.1 | 61.1 | 210.4 | 79.4 | 55.5 | 41. | 5. | 38. | 5. | 57.5 | 9/12 | 39/38 | 5. | 57.5 | — | 5.8 |
| 18.1 | 49.2 | 183. | 70.8 | 55. | 40.5 | 5.5 | 36.5 | 4. | 53. | 10/11 | 39/38 | 4. | 55.5 | — | 5.8 |
| 21.8 | 59. | 215.3 | 79. | 55. | 41.8 | 4.4 | 39.3 | 6.4 | 57. | 9/10.9 | 38./37.9 | 4.5 | 59.6 | 43.1 | 5.4 |
| 18. | 49. | 188. | 73.8 | 54.6 | 41. | 4.7 | 36.3 | 4.7 | 53.5 | 9.7/10.9 | 36.3/37.8 | 6. | 57.8 | 37. | 6. |
| 15.5 | 53. | 194.8 | 70.4 | 54.5 | 41.5 | — | 34.7 | — | — | 11.3/14 | 38./37.5 | — | 55.1 | — | — |
| 22.3 | 42.1 | 180. | 67. | 51.5 | 40.5 | 5. | 34. | 2. | 50.5 | 7.5/9 | 37.5/37.5 | 4. | 53.5 | — | 4.7 |
| 21. | 36. | 175.3 | 69.6 | 49.8 | 43.7 | 6.4 | DNA | DNA | Bkts | — | — | 4. | — | — | 3.4 |
| 19. | 56. | 195.9 | 69.8 | 54. | 40. | 3.1 | 37.1 | 5.5 | 52. | 8.7/11.6 | 38/37.2 | 4.5 | 54.2 | 38.7 | 5.3 |
| 21. | 58. | 208.1 | 76.5 | 53.9 | 41.9 | 3.9 | 37.9 | 5.9 | 55. | 8.1/11 | 38.1/37.5 | 4.5 | 57.5 | 41.7 | 5.3 |
| — | — | 214.8 | 79. | 55.2 | 41.8 | 4. | 39.3 | 6.4 | 57. | 9/10.9 | 38/37.9 | 4.5 | 59.6 | 43.1 | 5.4 |
| 15.5 | 49.3 | 197.6 | 71.3 | 55.4 | 42.1 | 4.2 | 36.7 | 4.6 | 54. | 9.4/11.4 | 38.8/37.9 | 4. | 56.2 | 40.2 | 4.7 |
| 17.8 | 46. | 181.1 | 70.6 | 54.5 | 41.2 | 3.9 | 34.5 | 2.7 | 53.6 | 9.2/11.3 | 38.7/37.2 | 4. | 55.1 | 38.8 | 4.6 |
| 15.3 | 63. | 209.9 | 79.9 | 55.5 | 41.7 | 3.8 | 38.8 | 7.2 | 58.8 | 8.9/11.5 | 38.7/38.4 | 5.5 | 59.9 | 41. | 5.5 |
| 15.3 | 51.3 | 204. | 71. | 54.7 | 42.6 | 4.7 | 22.1 | 3.5 | 52.3 | 9.4/8.5 | 41.5/41.3 | 5.9 | 52.4 | 42.5 | 4.6 |
| 34.5 | 63.5 | 227.8 | 81.7 | 56.8 | 42.3 | 4.6 | 41.1 | 7.9 | 57. | 8.4/11.3 | 39.3/38.5 | 5. | 64. | 47.5 | 3.5 |
| 19. | 47.8 | 188. | 71.3 | 55.8 | 39.3 | 7.7 | 27.5 | 8.8 | 56. | 8.1/— | 43.7/41.9 | 5.9 | 54.9 | 39. | 4.7 |
| 18. | 54. | 213.3 | 78.6 | 53.7 | 41.4 | — | 37.8 | — | — | 11.7/13.1 | 37.7/38.1 | — | 59.1 | — | 3.8 |
| 18. | 61.8 | 215. | 80. | 55.5 | 41.6 | — | 38.4 | — | — | — | 38.8/38.2 | — | — | 44.3 | — |
| 18.3 | 61.5 | 203.8 | 71.3 | 55.8 | 42.4 | — | 34.7 | — | — | — | 38.2/38. | — | — | — | 4.7 |
| 20.1 | 53.8 | 192.2 | 73.7 | 52.6 | 40.4 | 5. | 46.5 | 4.2 | 50.7 | 8.5/11. | 38./36.9 | 4. | 54.5 | 37. | 5.2 |
| 23.5 | 33.3 | 214.5 | 77.9 | 56.3 | 40.6 | 5.4 | 38.7 | 5.2 | 57.6 | 9.5/11.3 | 38.8/— | 4.8 | 57.9 | 42.8 | 6.1 |
| 20. | 59. | 205. | 75.6 | 53.9 | 40. | 3.9 | 36.4 | 4.4 | 55. | 8.1/11 | 38.1/37.5 | 4.5 | 57.5 | 48.8 | 5.3 |
| 19. | 64. | 212.1 | 78.7 | 55.8 | — | — | — | — | — | — | — | 4.8 | — | 42.8 | 5.5 |
| 19. | 30. | 173.1 | 69.9 | 56.1 | 41.8 | 4.5 | 35.6 | 2.9 | 53.3 | 8.6/12.4 | 37.9/35.5 | 6. | 49.8 | 36. | 5.5 |
| 17.9 | 57.1 | 218. | 76.6 | 53.2 | 40. | 4. | 35.2 | 3.5 | Bkts | 8.1/— | 37.6/— | 4.8 | 55.8 | 43.6 | 3.5 |
| 19. | 52. | 192.1 | 70.2 | 54. | 40.8 | 4.2 | 36.2 | 3.5 | 50.7 | 8.8/10.9 | 37.7/36.9 | 4. | 54.6 | 38.1 | 5. |
| 20. | 57.3 | 194.3 | 74.2 | 53.5 | — | 4.5 | — | — | — | — | — | 4. | — | 22.7 | 4.3 |
| 13.3 | 42. | 205. | 76.5 | 52.5 | 40.6 | 3.9 | 32.2 | 2.2 | Bkts | 10.2/9.5 | 37.5/37.5 | 4.4 | 55.6 | 40.2 | 3.6 |
| 18.2 | 52.1 | 186.2 | 69.8 | 53.4 | 40. | 3.1 | 35.5 | 4.2 | 52. | 8.7/11.6 | 38.1/37.2 | 4.5 | 54.2 | 37.3 | 5.3 |

* Dimensions with car loaded, 300 pounds in front and 450 pounds in rear.

† Dimensions taken from approved 150-pound manikin in seat.

** Rambler Classic and Ambassador dimensions are the same.

DNA, Does Not Apply.
—, Dimension not available.



By Jim Whipple



The Guesses Cost Millions But Which Ones Will Be Right in 1963?

Detroit is waiting for the other shoe to drop. After laying the blue chips on the board to the tune of a couple of hundred million dollars, the big executives and the medium-sized engineers are waiting to see if they've come up with the winning combinations.

As a model year, 1963 won't go down in the record books as one jam-packed with exciting mechanical innovations. There's nothing wildly new like fuel injection or an air-cooled rear engine. There are no slanted engines of aluminum making a debut; no transaxles, four-speed gear boxes, or ram-manifold engines.

Nevertheless, 1963 represents a big gamble for a lot of divisions (and even whole companies) in the industry. A number of executives laid their reputations for good judgment on the line when they presented their products to the public last Fall.

Strangely, it's not always the biggest company that takes the biggest gamble either. Look at Studebaker, having a tough time keeping the public interested in their worthy Lark; up they pop with a brand new car made of still new material—the fiberglass Avanti—a bucket-seater much the same as the Hawk, so that to an extent Studebaker competes with itself in its own showrooms, usually a risky procedure.

At the moment nobody has a clue as to how the problem will work out for Studebaker.

Next, look what happened to good, grey Rambler. Having earned an enviable reputation as a sensible car for sensible people, and styled to look pretty sensible too, it now turns up with styling that's a happy combination of good GM, Lincoln Continental and Italian modern. The good, grey lady has switched from tweeds to Capri pants and become one of the slick chicks on the block. The big question still in the air in Kenosha is can the new Rambler win appeal to a new type of buyer without losing the loyalty of the old Rambler's fans?

Over at Ford, they gamble in a different way. They're betting that Falcon can win new friends with the same old face, as it is the only compact, barring Rambler of

years past, to continue four straight years with little more than grille changes. If so, many Americans really believe it when they tell the market researchers that they want a sensible, no-nonsense car with little money spent on heavy annual changes. Falcon offers them a chance to put their money where their mouths have been.

Some breaths are being held over at Plymouth division too, after three years in succession of offering what the public seemed to judge was a bad face on a good car. Buyer reaction to the '63 Plymouth is just about uppermost in everybody's mind. We intend to get out on a limb with some of our Chrysler Corporation friends and predict that the new Valiant will go like ice cream cones on the Fourth of July.

There's a certain amount of anxious pacing over at Dodge Division, too, as they wait to see if their longer wheelbase Dodge with its sensibly squared off lines will repeat the performance of 1960 when the Plymouth-sized Dart walked off with a big chunk of the low-priced buyers.

Chrysler Division would seem to have a shoo-in with their newly styled product to repeat the uptrend of the 1962 year.

After the somewhat amazing feat of selling slightly more than one out of every two cars last year, General Motors' worries are understandably little ones. Their big adventure of the year stems from Buick Division with the launching of the Riviera.

As usual, each GM Division manager is more concerned with the play that his own corporate team-mates may take away from him than he is about outside competition. For instance Ed Warner at Cadillac wonders if Ed Rollert's Riviera will cut into his sales, while Rollert in turn may perspire a mite as he looks at the sleek Olds Starfire. Over at Oldsmobile General Manager Jack Wolfram probably shudders slightly when he hears the words Grand Prix. Meanwhile at Pontiac, Pete Estes wonders if the Grand Prix will lose some sales to the sassy new Impala hardtops, or the Space-Age silhouette of the '63 Corvette.

And so, away we go, once again to watch the most fascinating horse race of all, the one between the new horseless carriages.

A RENOWNED DESIGNER ANALYZES

Car Designs: 63

Now that we've all had more than a first glimpse of all the new cars and can spot them a block away, let's *really look* at them, find out if they really deserve that backward glance you gave them when they first rolled down Main Street.

Which 1963 styling ideas—inside as well as outside—could become worthwhile new trends in automotive design, as opposed to a purposeless reshaping of sheet metal or trim? Which changes in design detail best reflect their functions, the jobs they are supposed to perform?

To answer these questions, PM asked famed automotive designer Count Alexis de Sakhnoffsky to select and illustrate what he felt were the most meaningful new design features on the '63 cars. For over 30 years, Count de Sakhnoffsky's designs have been synonymous with excitement and innovation in automotive styling, and his clients have ranged from the down-to-earth White Motor Company truck to special-bodied sportsters and the sky blue dream of the Preston Tucker car.

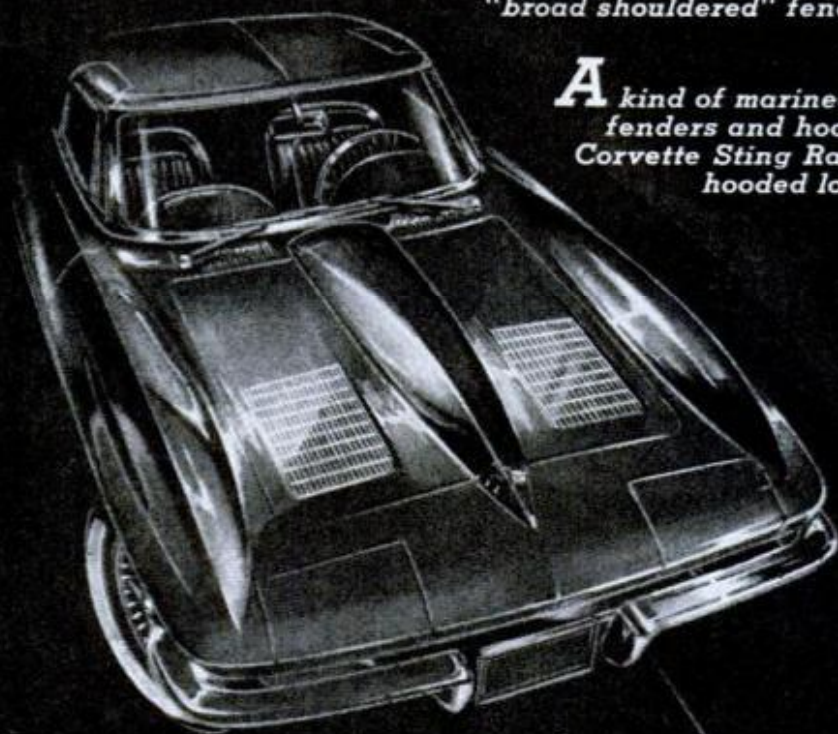
"Pick out," we told Count de Sakhnoffsky, "the most significant new elements in styling you can find in the '63s."

He has done this on the following pages. See if you agree with his choices.

THE HOODS GROW LONGER . . .



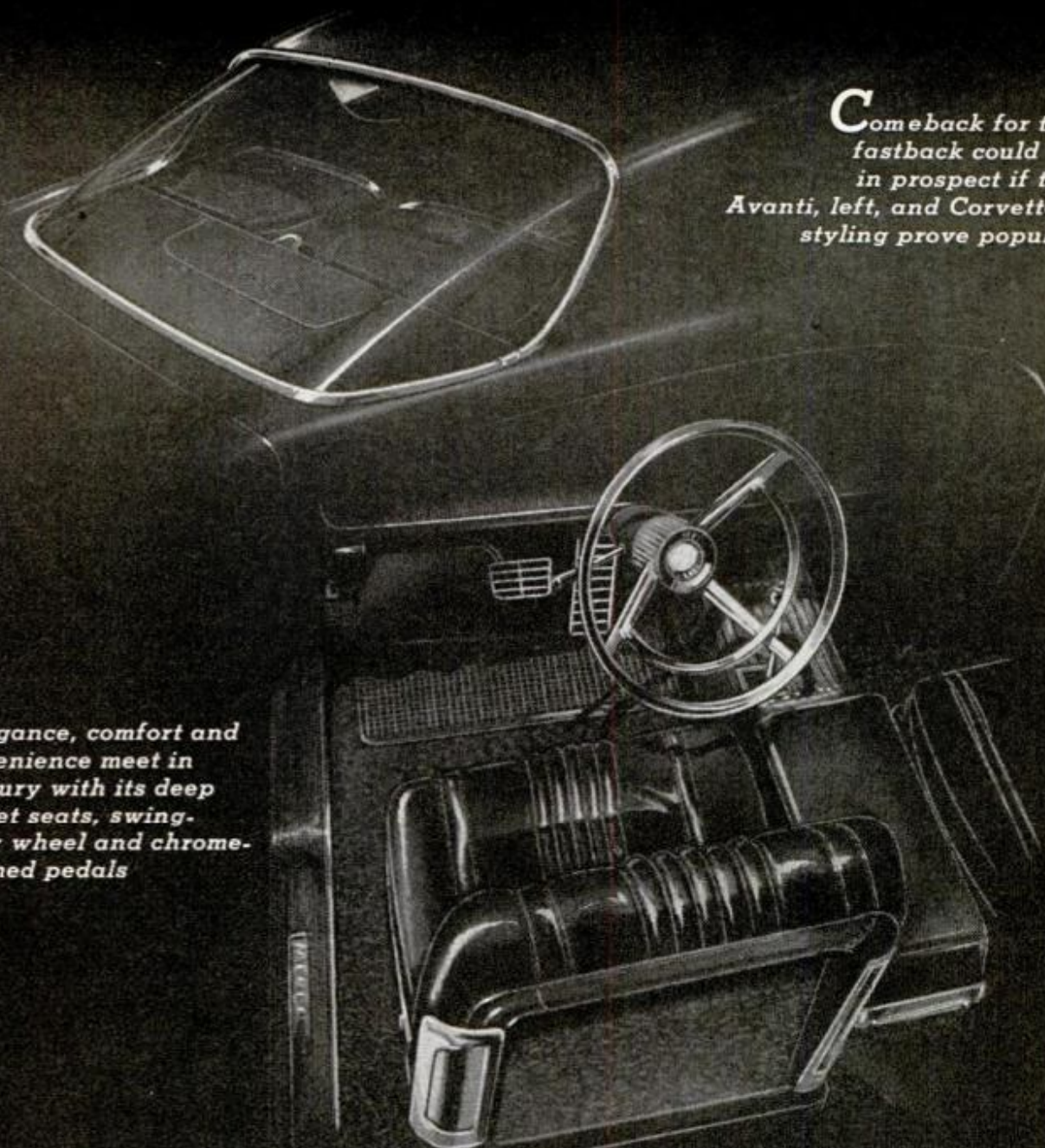
Emphasis presses forward in '63 as Riviera's long look ahead and "broad shouldered" fenders demonstrate



A kind of marine-life curvature to fenders and hood center accents Corvette Sting Ray's classic, long-hooded look of the 1930's

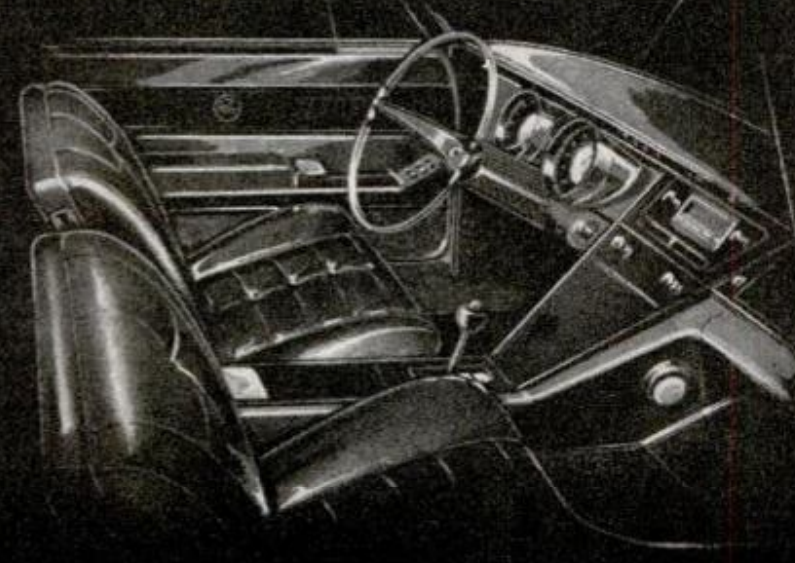


Avanti's sleek, clean hood is a perfect symbol of the powerful, sporty car. Its single, wide-rim headlamps link it to heroic sports cars of the past

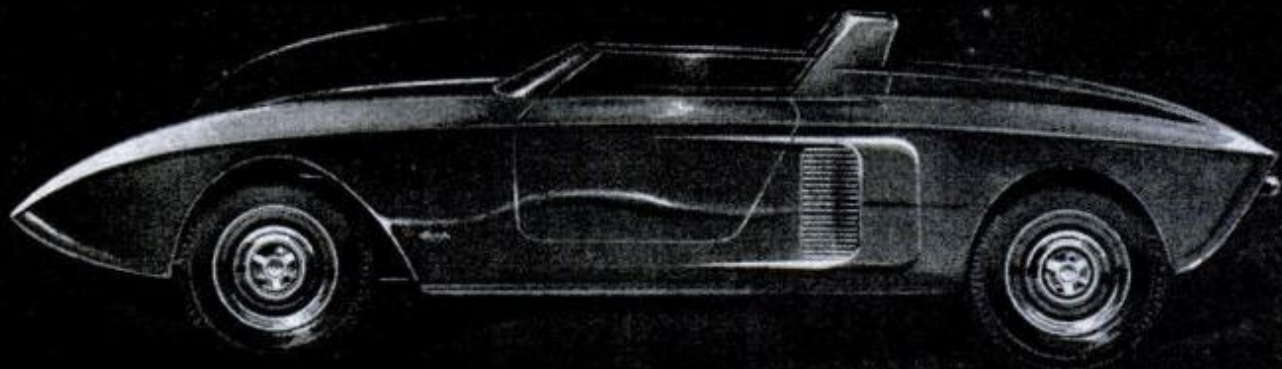


Comeback for the fastback could be in prospect if the Avanti, left, and Corvette's styling prove popular

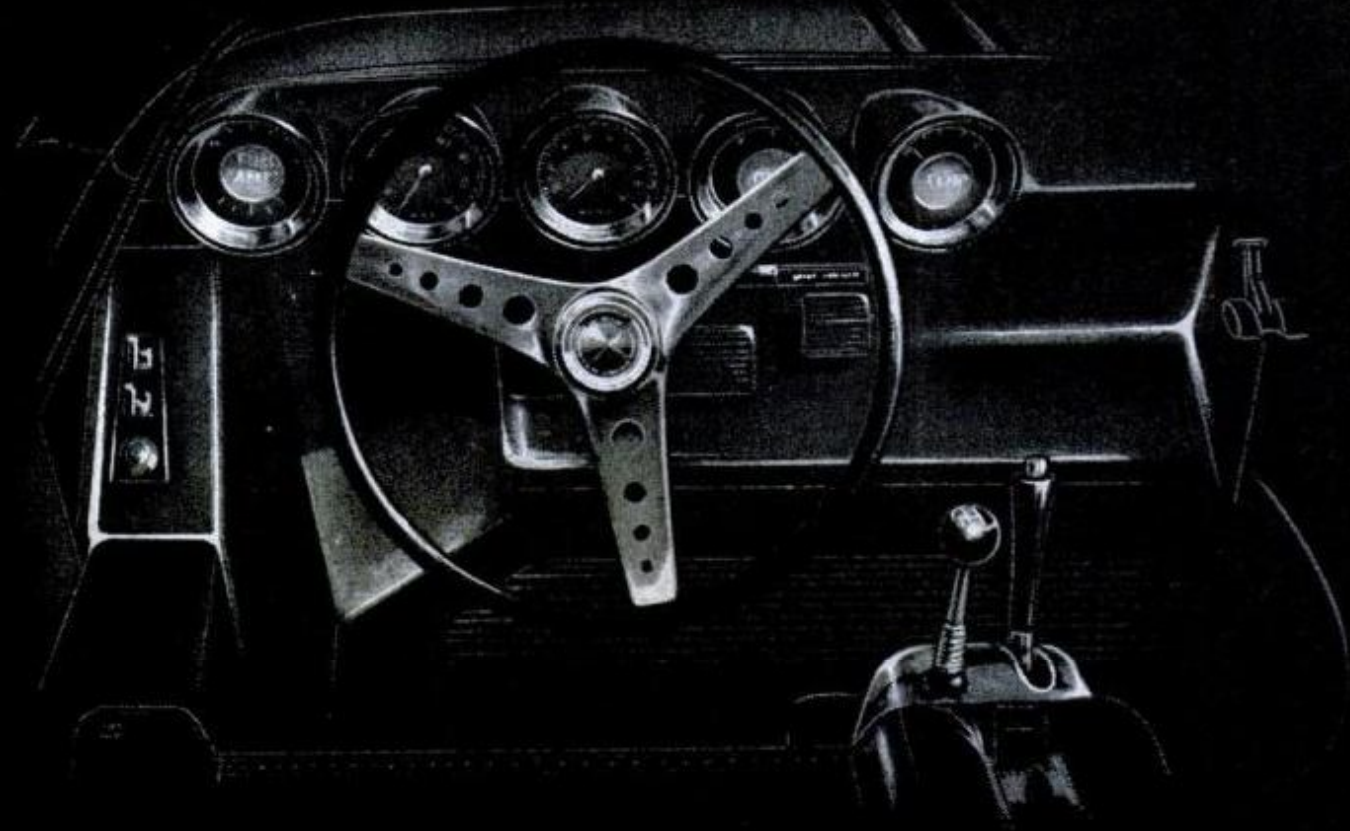
Elegance, comfort and convenience meet in Mercury with its deep bucket seats, swing-away wheel and chrome-trimmed pedals

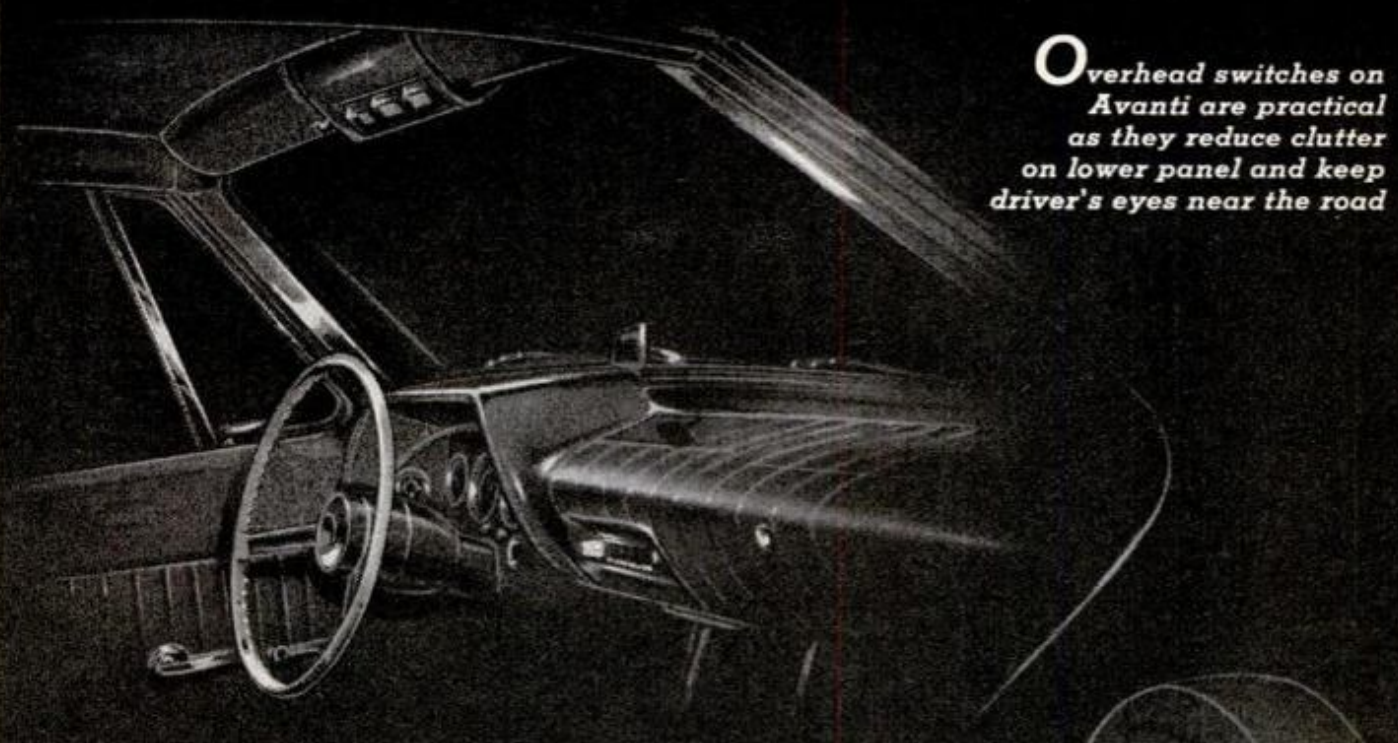


Buick Riviera's transmission tunnel has a purpose in life, to house ash trays and courtesy lights as well as cover up the car's drive line

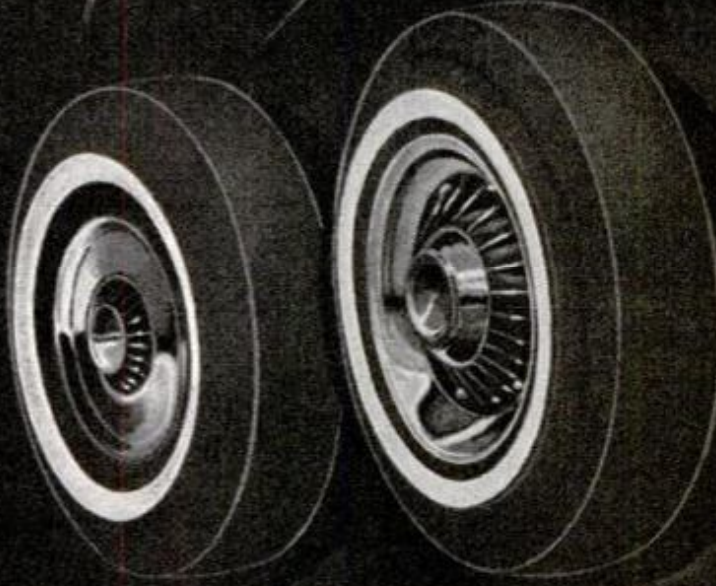


Ford's experimental Mustang could be a trend setter in sports car styling with its engine behind driver's seat and needle-nosed, snub-tailed lines. Instrument panels like Valiant's left, Mustang's below, prove that useful layouts can be beautiful as well as readable

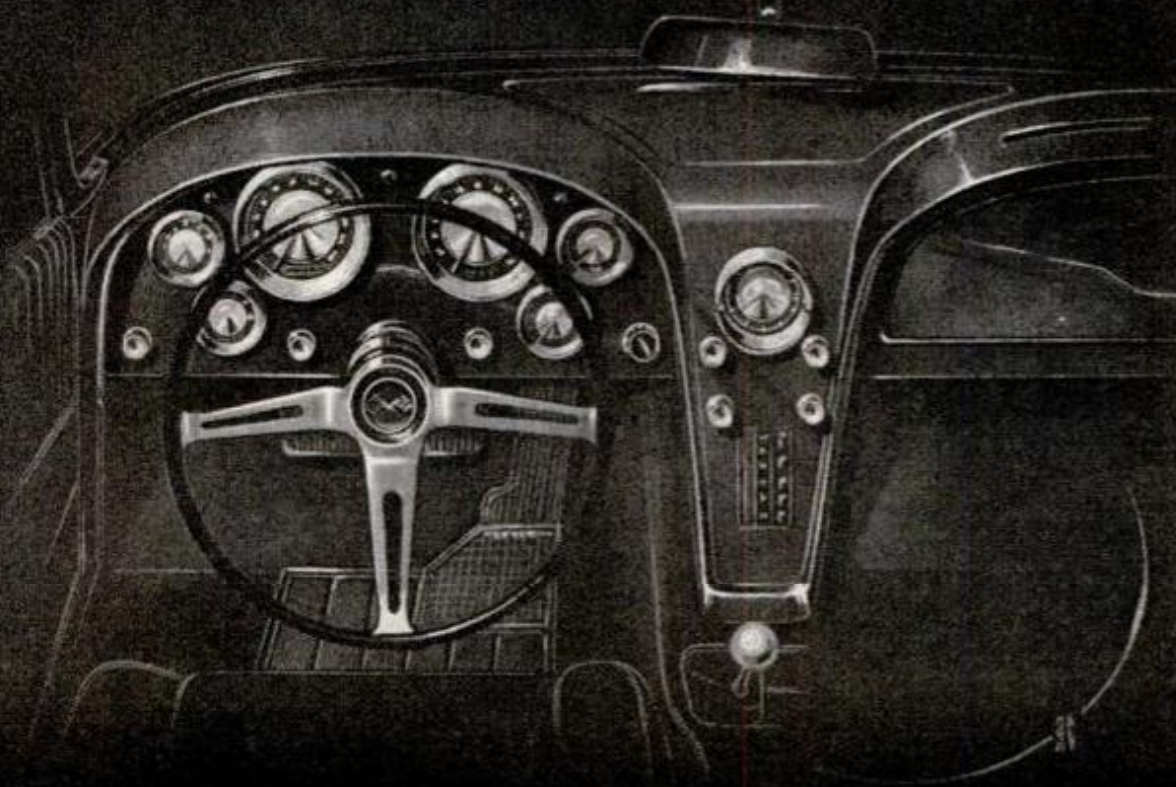


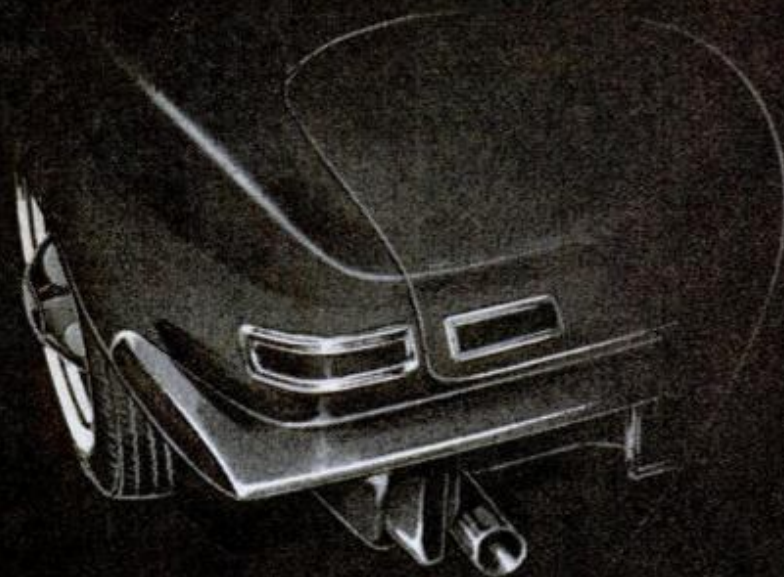


Overhead switches on Avanti are practical as they reduce clutter on lower panel and keep driver's eyes near the road

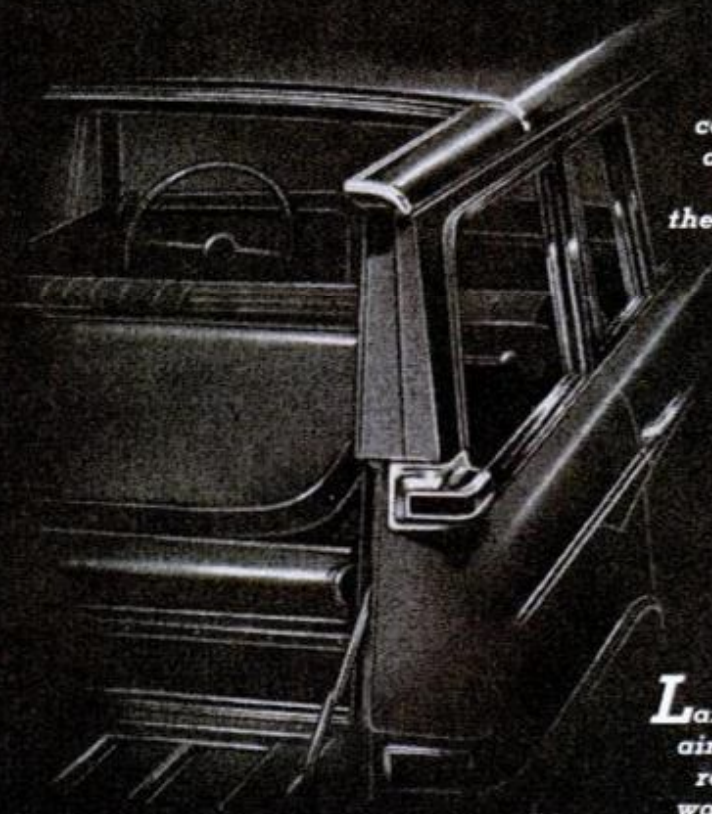


Deep-dished massive wheels as on Plymouth Fury and Pontiac are functional symbols of speed and power. Corvette's panel below is as practical as it is handsome

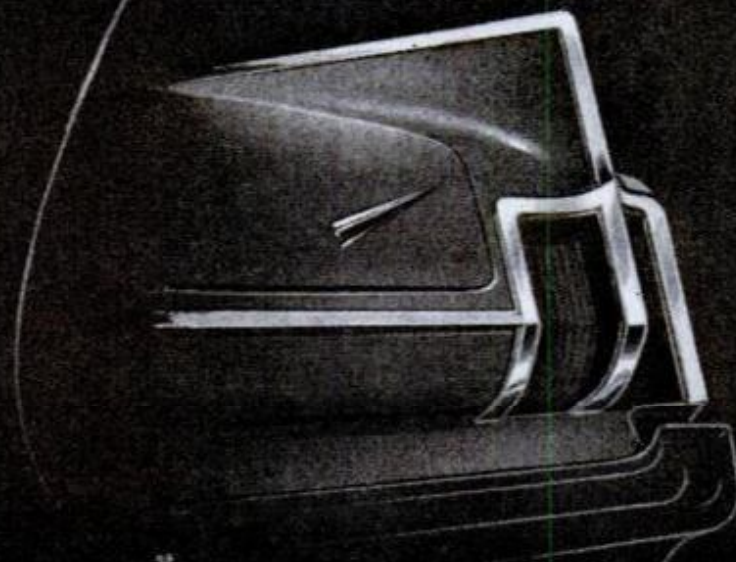


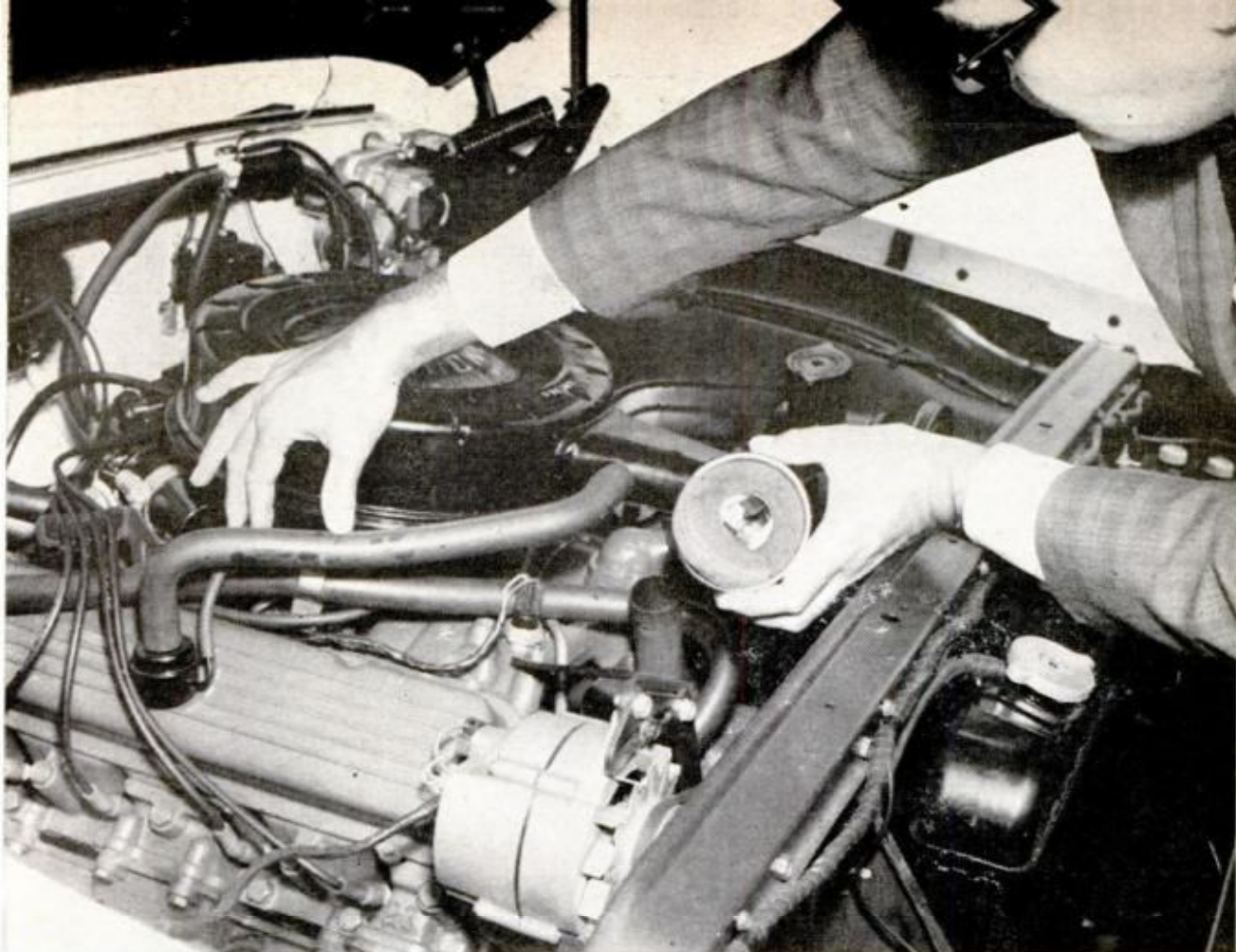


Safety combines with style in tail lamps of four new cars, Avanti, left, Lincoln, above, Mercury and Olds, bottom left and right, as they are visible from side as well as the rear



Lark's Wagonaire offers the airiness of a convertible for rear seat passengers of its wagons thanks to ingenious sliding roof panel





NEW POLYURETHANE filter on Oldsmobile's crankcase breather cap is much easier than metal to keep clean



HOW SERVICE-FREE ARE the '63s?

An expert look under the hood and upward from an all-but-deserted grease rack . . .

TO READ THE glowing claims for trouble-free operation of the new cars, you might get the idea that the nation's service garages were headed for mothballs. Or that the Saturday mechanic would have to find another hobby.

Self-adjusting brakes standard throughout the industry . . . chassis lube and oil change intervals extended still further by most makes . . . liberalized new car warranties for almost every car buyer.

It all sounds very encouraging. And in many ways it is, for it indicates the manufacturers' awareness of a rising public concern over car servicing costs.

But how well have the manufacturers succeeded in eliminating maintenance headaches on the new cars? Are their extended lubrication recommendations work-

ing out to the benefit of the average car owner's pocketbook? And have any *new* service headaches been introduced in the 1963 models?

To answer the last question first, there is one big obstacle in the path toward service-free cars—a relatively simple device incorporated in every 1963 car as a result of industry-wide agreement.

It is called positive crankcase ventilation (PCV) and its worthwhile purpose is to reduce crankcase fumes which contribute to smog formation. When working properly, it does an effective job, but it does require frequent servicing. If it is neglected, sludge builds up rapidly inside the engine, oil may be forced out of the breather cap and air pollution will actually be increased.

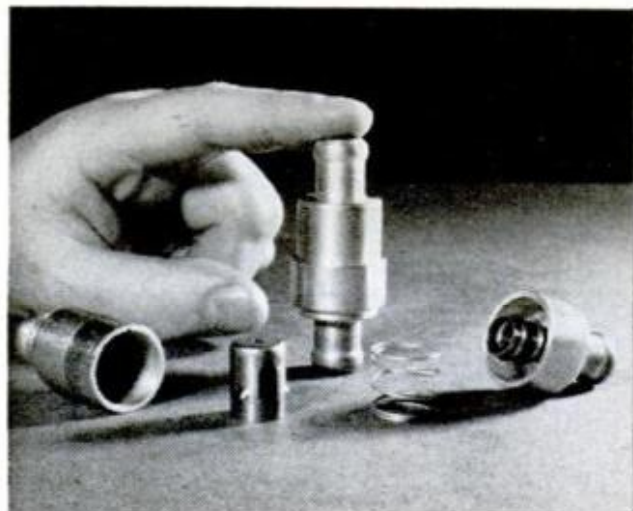
Crankcase ventilation is an old problem

| MAKE | OIL CHANGE | FILTER CHANGE | FRONT SUSP. LUBE | STRG. LINK LUBE | UNIV. JOINT LUBE |
|---|--|--|---|--|--|
| American Motors Rambler American Rambler Classic and Ambassador | 4000 4000 | 4000 4000 | 2000 33000 | 2000 33000 | NR NR |
| Chrysler Corporation All Models | 4000-2 Mo. | 6 Mo. | 32000 | NR | NR |
| Ford Motor Company Falcon, Comet, Fairlane, Meteor, Galaxie 6 Fairlane, Meteor, Galaxie, Monterey V-8 Thunderbird Lincoln Continental | 6000-6 Mo. 6000-6 Mo. 6000-6 Mo. 6000-6 Mo. | 6000-6 Mo. 6000-6 Mo. 6000-6 Mo. 6000-6 Mo. | 36000 36000 100,000-3 Yr. 30000 | 36000 36000 100,000-3 Yr. 30000 | 36000 36000 100,000-3 Yr. 30000 |
| General Motors Corporation Buick Special Buick, All Other Models Cadillac Chevrolet, All Models Oldsmobile F-85 Oldsmobile, Other Models Pontiac Tempest Pontiac, Other Models | 6000-2 Mo. 6000-2 Mo. 6000-2 Mo. 6000-2 Mo. 6000-2 Mo. 6000-2 Mo. 6000-2 Mo. 6000-2 Mo. | 6000-2 Mo. 6000-2 Mo. 6000-6 Mo. 6000-6 Mo. 6000-2 Mo. 6000-2 Mo. 6000-2 Mo. 6000-6 Mo. | 6000-6 Mo. 6000-6 Mo. NR 6000-6 Mo. 6000-6 Mo. 30000 12000-6 Mo. 30000 | 6000-6 Mo. 6000-6 Mo. NR 6000-6 Mo. 6000-6 Mo. 6000-6 Mo. 12000-6 Mo. 30000 | 12000 6000 NR 30000 NR NR NR NR |
| Studebaker Corporation Lark, Hawk Avanti | 4000-2 Mo. 4000-2 Mo. | 4000 4000 | 1000 1000 | 1000 1000 | 20000 20000 |

NR—Lubrication not required unless unit is disassembled for repairs.
NS—Not specified.

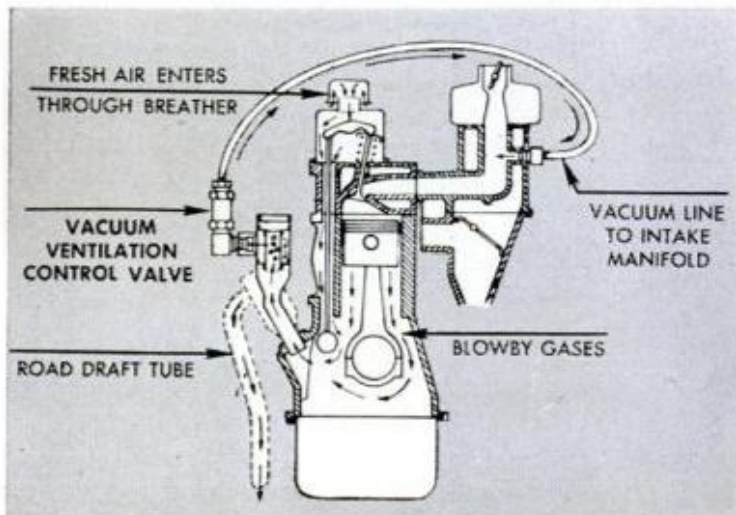
with a rather curious history. Long ago, engineers recognized the importance of getting rid of blowby gases that leaked past the piston rings and collected in the crankcase. They provided a breather at the top of the crankcase and an outlet, or road draft tube, at the bottom. The beveled lower end of the tube projected into the stream of air passing under the car. A vacuum at the end of the tube drew fumes out of the crankcase into the atmosphere. This same design was on most cars until last year.

VACUUM VALVE shown disassembled, has precision fitted piston that's easily clogged by gummy vapors



As long as the car was moving, this system worked well, but it just didn't do the job for city delivery trucks, taxicabs and other vehicles that operated at idle or slow speed for prolonged periods. To prevent excessive sludge formation in these engines, the positive system (PCV) was developed. Since manifold vacuum is high at light load and slow speed, it was used to draw fumes from the crankcase into the intake manifold, where they mixed with the incoming fuel charge, then passed

DIAGRAM shows how positive crankcase ventilation system draws blowby from crankcase to manifold



SERVICE CHECK LIST

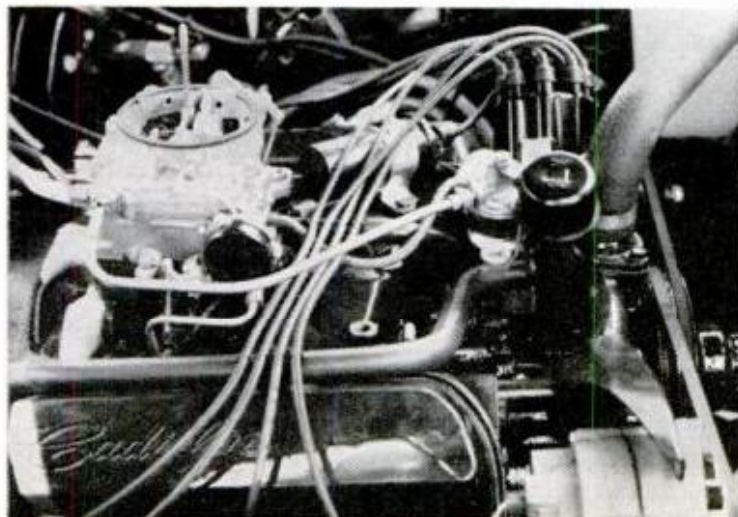
| AUTO. TRANS. DRAIN | MAN. TRANS. DRAIN | WHEEL BRG. PACK | CLEAN AIR CLEANER | REPLACE AIR CLEANER | SERVICE POSITIVE CRANKCASE VENT. | FUEL FILTER | COOLANT |
|--|---|---|--|--|--|--|--|
| NR NR | NR NR | 25000 25000 | 4000 12000 | — — | 8000 8000 | 12000 12000 | 2 Yr. 2 Yr. |
| NR | NR | NR | 8000 | 32000 | 6 Mo. | 16000 | Seasonal |
| NR NR NR NR | NR NR — — | 24000 24000 24000 30000 | 6000-6 Mo. 6000-6 Mo. 6000-6 Mo. 6000-6 Mo. | 24000 30000 30000 30000 | 12000 6000-6 Mo. 6000-6 Mo. 6000-6 Mo. | 36000 36000 36000 12000 | 36000-2 Yr. 36000-2 Yr. 36000-2 Yr. 36000-2 Yr. |
| 24000 24000 30000 NR 24000 24000 NR 30000 | NR NR — NR NR NR NR NR | NR NR NR 30000 NR NR NR NR | 12000 12000 — 12000 12000 — 6000 6000 | — — 30000 — — 18000 — — | 6000-6 Mo. 6000-6 Mo. 6000-2 Mo. 6000-2 Mo. 12000 12000 12000 12000 | 12000 24000 6 Mo. 12000 NS NS 12000 12000 | 1 Yr. Seasonal 1 Yr. Seasonal 1 Yr. 1 Yr. Seasonal Seasonal |
| 15000 15000 | 10000 10000 | 10000 10000 | 10000 4000 | — 20000 | 10000 10000 | 10000 10000 | Seasonal Seasonal |

Rear axle drain is not required for any of these cars.

into the cylinders to be burned.

General Motors engineers working on the industry-wide program to cut air pollution discovered that PCV also substantially reduced the volume of unburned hydrocarbons released to the atmosphere. So car manufacturers subsequently agreed to install PCV on automobiles destined for sale in California. Then, under increasing pressure from other parts of the country, they decided to install the system on all 1963 cars across the board.

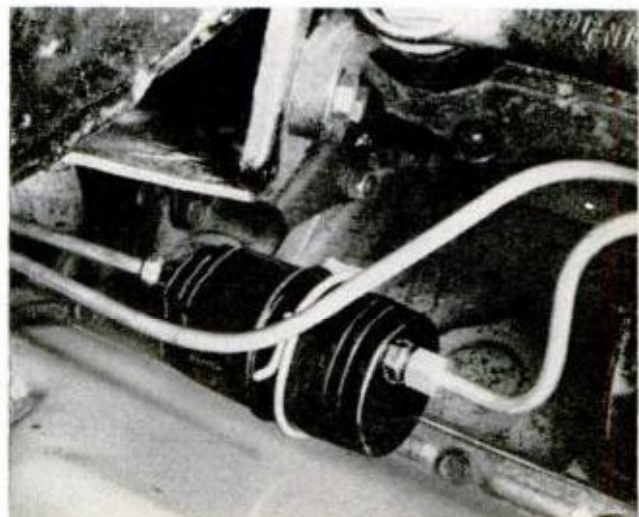
CADILLAC'S redesigned engine locates items requiring periodic attention in convenient cluster on top

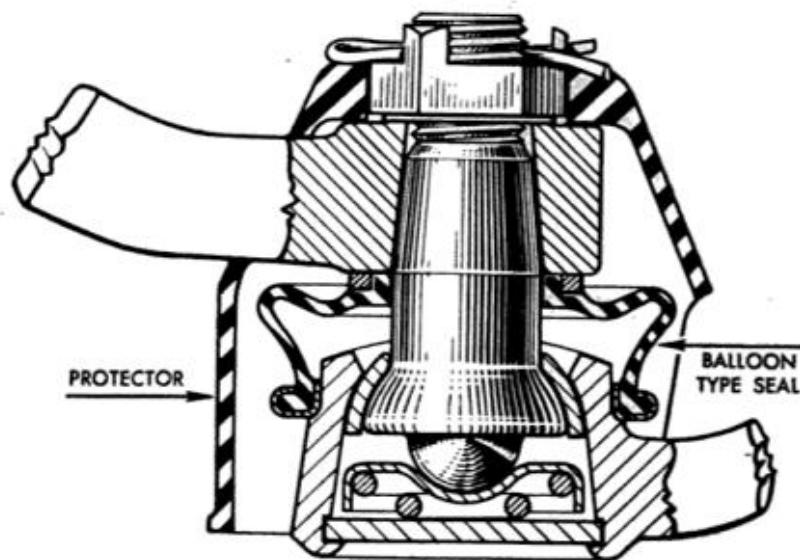


Thumb-size Trouble Maker

The critical part of PCV is a valve about the size of a man's thumb. At light load and low speed, manifold vacuum holds the valve closed, restricting the flow of ventilating air and fumes to the volume that can pass through a small orifice in the center of the plunger. As the throttle is opened, manifold vacuum drops and a spring forces the valve off its seat, permitting increased flow from the crankcase to the intake manifold. The valve is necessary because the

TROUBLESOME gumming of automatic transmission's tiny valve ports is prevented by Chrysler Corp's filter





EXTENDED LUBE interval on the Chrysler Corporation cars' steering and suspension is made possible by the balloon-type inner seal that's protected by tough outer cover so that it can retain grease grit-free indefinitely. Even though not serviced, these sealed fittings should be checked periodically to see that they are in good condition

volume of air entering the manifold at idle must be limited to keep it from upsetting the engine's fuel/air ratio.

Unfortunately, fumes passing through the valve are loaded with oil, water, carbon and unburned particles of fuel—all the ingredients of sludge. Sooner or later, the valve either sticks or gets completely clogged. When it sticks in the open position, the idling mixture becomes too lean and the engine shakes on its mountings and stalls frequently. If the valve sticks closed, not enough ventilating air can pass through the crankcase and internal pressure builds up, forcing fumes out the breather cap or pushing oil past seals and gaskets. If the valve gets completely clogged, the engine idles roughly because of a rich mixture, crankcase pressure builds up even higher and sludge forms rapidly.

Once-a-Week Cleaning

At frequent intervals, the valve must be removed and cleaned in solvent. Most manufacturers have tied this operation in with the oil change period, but this recommendation may be overly optimistic. Because of frequent clogging of the valve in stop-and-go city operation, one major truck manufacturer has already found it necessary to make a drastic reduction in the PCV service interval. Taxicab fleets in New York City have adopted a once-a-week schedule for cleaning the valve and tubing.

Several cars employ a system in which blowby fumes are fed to the air cleaner, instead of the intake manifold. Here, the air cleaner filters out materials that might cause sludge or gum to form in the carburetor. Because of the tenacious character of these substances, ordinary cleaning methods won't get rid of them. On Ford six-cylinder engines using this system, the prescribed method of cleaning the element

is to mount it in a special fixture, then spin it at high speed with an electric drill. Centrifugal force pulls the sticky particles out of the filter.

The Dirty Oil Syndrome

Crankcase ventilation, regardless of type, is just one method of getting rid of the motley assortment of foreign matter that contaminates oil. Filters help too, but the only sure way of maintaining a supply of clean oil for the lubrication system is to drain the crankcase at regular intervals. Car owners may wonder how oil gets dirty when the modern engine is equipped with an air cleaner, oil filter and fuel filter. Of course, none of these is 100% efficient, so a certain amount of dirt slips through.

The most important source of contamination is, of course, the engine itself. For every gallon of gasoline burned, more than a gallon of water is formed. Some of this water vapor blows by the piston rings and condenses in the crankcase, where it mixes with other by-products of combustion to form corrosive acids and sludge. During cold-weather driving, unburned fuel flows down the cylinder walls to dilute the oil. A poorly adjusted carburetor or fouled spark plugs will aggravate fuel dilution.

Still another source of contamination is oxidation of the oil. When hot oil is exposed to oxygen in the presence of metals acting as catalysts, it undergoes a chemical reaction that results in the formation of sludge and varnish.

Oil refiners have developed additives to combat the bad effects of this contamination. Detergents clean metal surfaces inside the engine, removing some existing deposits and preventing the formation of new ones. Dispersants hold foreign matter in suspension until it is picked up by the

[\(Please turn to page 230\)](#)

BALLOONS:


LONG ARM OF SCIENCE

By William R. Kreh

ONE DAY LAST SUMMER, scientists watched with unconcealed excitement as a new type of plastic balloon lifted gently off the runway at Kindley Air Force Base in Bermuda.

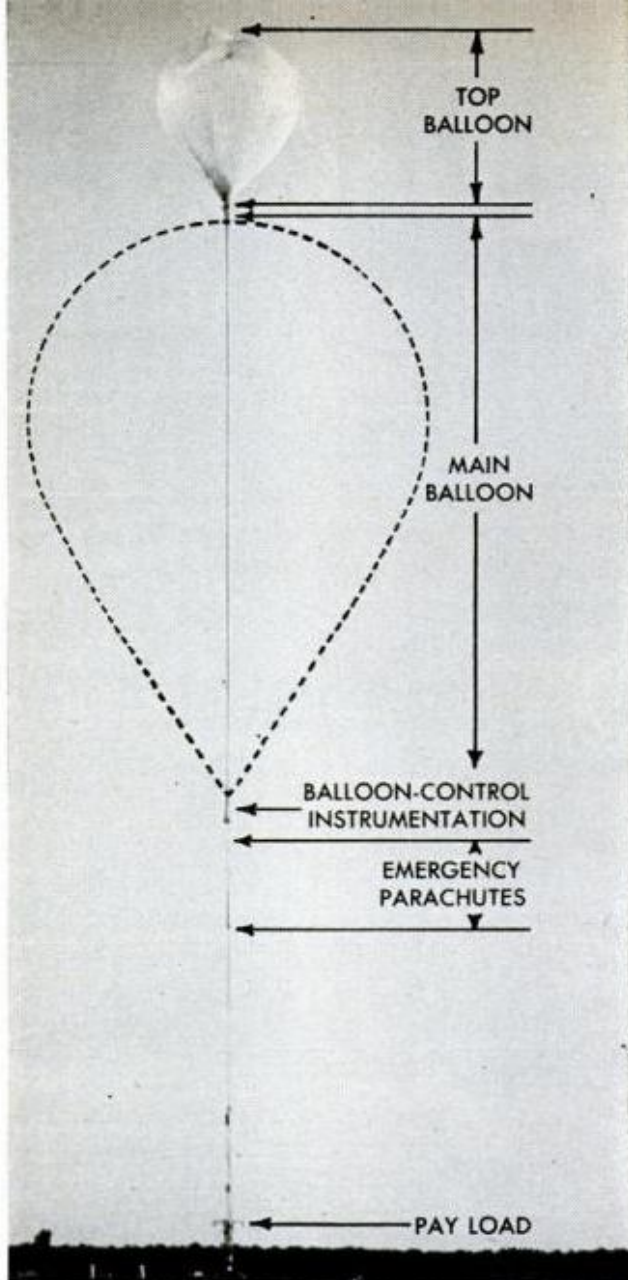
It rose rapidly as the bubble of helium within it expanded and the folds of the balloon's tissue-thin skin filled out. A 50-pound box of instruments that was suspended beneath it swayed gently during the ascent.

At 66,000 feet the balloon stopped rising. It had filled out into a perfect sphere and was drifting westward. A network



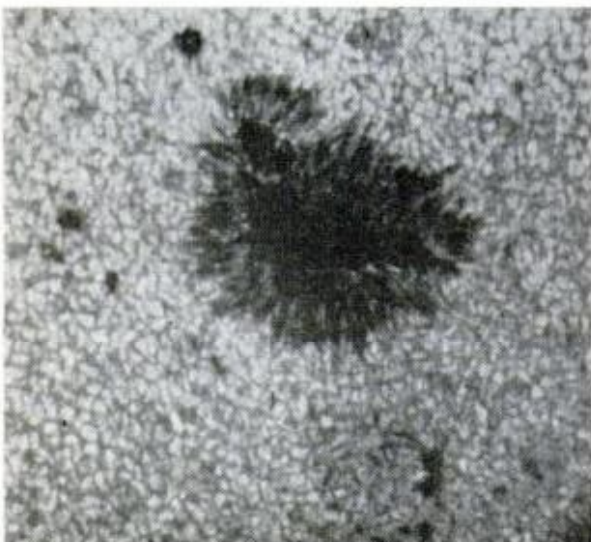
The huge balloons used in the Navy's Skyhook program are launched from aircraft carriers, such as the Valley Forge. Because carriers aren't always available, a new technique is being tried. In Project Wetfoot, balloons are launched from the water by smaller ships, below





STRATOSCOPE II's main balloon, protected by a plastic sheath from low-level winds, is inflated during the ascent by expanding helium from top balloon. Parachutes are for emergency use only

SUNSPOT photographed in the 1959 Stratoscope I program shows the sharp definition attainable in pictures taken above the atmosphere. Dark area is the umbra, surrounded by lighter penumbra



of tracking stations put it under continual surveillance.

Thirty days later, scientists sent a radio signal from the ground that brought the 34-foot-diameter balloon down into the Pacific Ocean, about 1200 miles northwest of Honolulu. It had traveled halfway around the world and could have drifted longer, perhaps indefinitely.

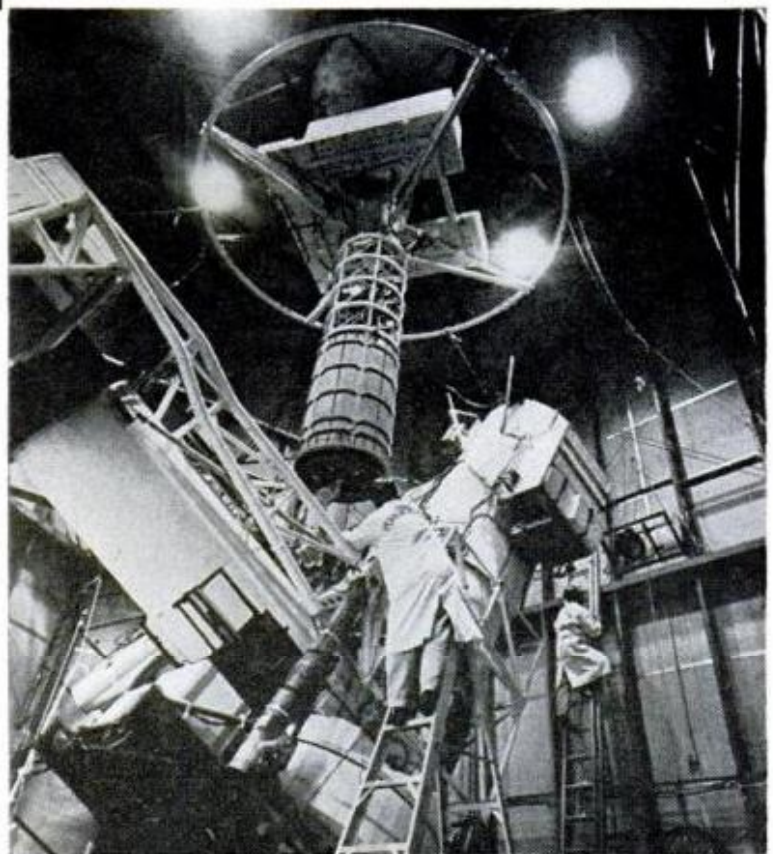
Air Force scientists were elated. Not only had the balloon set a new record by staying aloft for a month, but for the first time a new technique called superpressurization had worked and the balloon had stayed at a constant altitude both day and night during its entire journey without using an ounce of ballast.

It was a breakthrough in the age-old science of ballooning and one of several new developments in this field—a field that has proven itself a vital and valuable instrument for research.

There have also been these developments:

- Both the Air Force and the Navy have separate programs involving perhaps the most complicated and ambitious balloon experiments ever undertaken—the lifting of huge telescopes high into the stratosphere to give man a clear look into space and perhaps unravel some of the mystery surrounding the moon, Mars and Venus.
- So frequent and important have balloon

TELESCOPE for Stratoscope II, being checked out by technicians, will be locked on its heavenly targets by telemetry signals sent from a ground station



flights become, the National Science Foundation is setting up the nation's first scientific balloon flight station in Texas.

- The Navy, eyeing the uncrowded air spaces over the oceans, is developing a new technique of launching large balloons by spreading them out over the sea behind a ship.

- The Army has developed a new weather balloon which soars aloft nearly twice as fast as old types, allowing artillerymen to get speedier, more accurate meteorological information.

Right now from spots around the globe, scientists—both military and civilian—are sending balloons of varied shapes and sizes aloft in attempts to learn more about the mysterious conditions of the atmosphere.

So important have balloons become to the Air Force that a special Balloon Research Group has been set up at the Air Force's Cambridge Research Laboratory to handle all of that service's experimental balloon work.

It was this group that developed the record-breaking superpressurized balloon.

Why is this such an important development in ballooning?

Because a conventional balloon loses altitude after sundown when the gas within it cools and shrinks, decreasing the balloon's volume. As volume changes, so does

altitude. This means that at night the weight of the balloon must be decreased to keep it at the desired altitude. This is done by dropping sand or fine steel dust from the gondola. Then, when the sun again heats the balloon's gas, it expands the balloon's volume and causes it to rise. Helium has to be vented from the balloon to keep it from rising higher than desired.

The longer the flight then, the more ballast is needed and this cuts down on the size and weight of instruments.

To lick the problem of fluctuating altitudes, the scientists needed a balloon that would remain at a fixed volume (or size) whether internal pressures went up or down. They had to design a balloon that could hold enough extra helium so that decreasing pressures during the night wouldn't affect its volume; and one strong enough so that it could contain the enormous pressures of expanding helium in sunlight—without increasing in size.

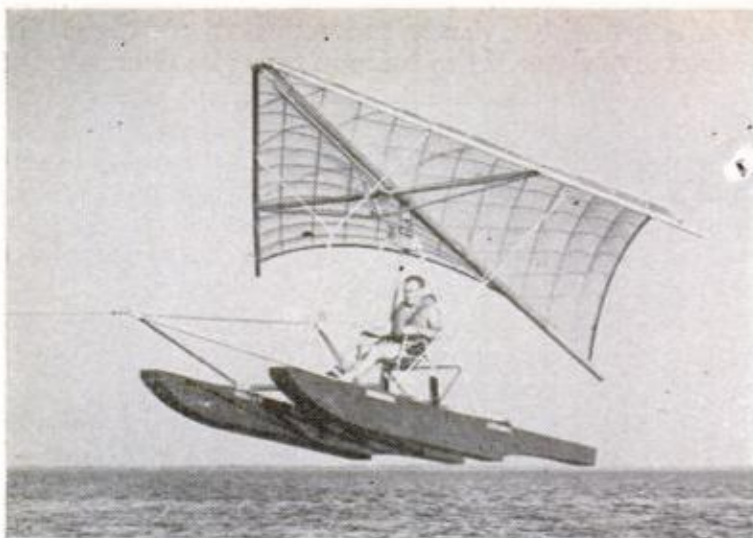
The solution came with the development of an extra-tough bonding material to seal the seams of a super-thin, super-strong plastic film called mylar polyester. With these materials, it was simple to build balloons strong enough to withstand the tremendous strains of superpressure at high altitudes—up to at least 8500 psi..

(Continued on page 202)

IN THE UPCOMING Air Force Star Gazer program, two men and a 12½-inch telescope will ride an aluminum gondola 16½ miles up for a clear view of stars

SUPERPRESSURE BALLOON, designed to stay at a fixed volume and shape, can remain aloft indefinitely. One traveled halfway around the world in 30 days





Space Wing for Sport

Sportsmen are now skimming over land and water on a flexible wing similar to one that may some day bring spacecraft to a gentle landing on earth. (See "I Flew the Flex-Wing," Nov. '61 PM.)

Named *Flightsail*, the craft is an adaptation to sport of the flexible wing developed for the National Aeronautics and Space Administration. Capable of taking off from land or water, *Flightsail* is controlled in flight by an aircraft-type control stick that regulates the tilt of the wing. By simply tilting the wing at a sharp perpendicular, *Flightsail* is converted on water to a catamaran.

The unique craft is towed by auto or motorboat. According to the designers, Flight Dynamics, Inc., Raleigh, N. C., it is easily flown behind 40 to 50-horsepower outboards. Flying is best in a light breeze, about five miles per hour, and lift-off is between 25 and 30 miles per hour water speed.

The experimental model shown here was built at a total cost of \$250, including wheels and floats. The wing is a polyethylene covering on an airframe of commercial aluminum tubing and angle stock.



Turn of the Screw: Now It's a Way to Repair Tires

Hard as steel when frozen, a flexible synthetic-rubber screw has cut the repair time on a punctured earthmover tire from a full day to less than an hour.

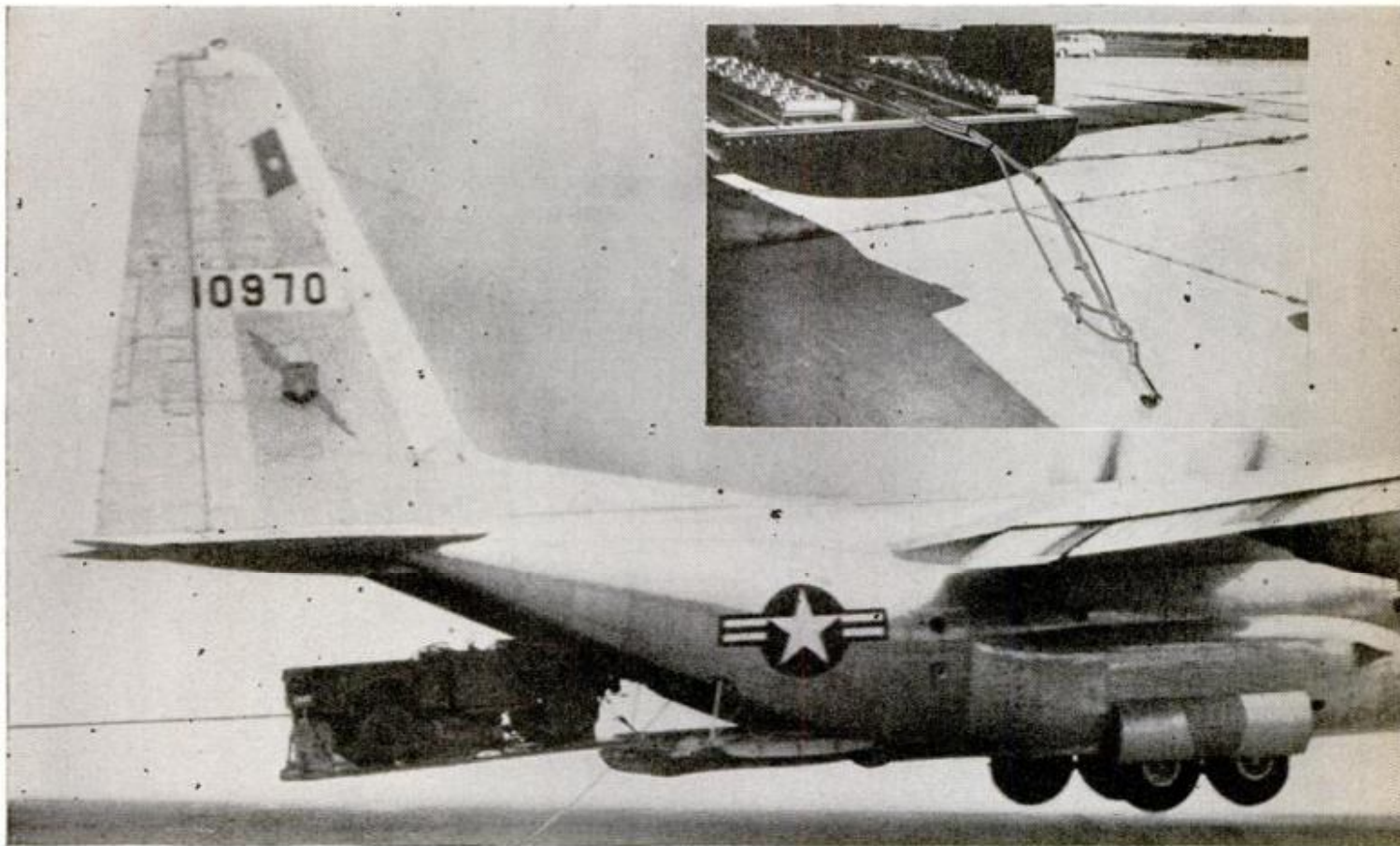
The screw, an enlarged version of the

steel lag screws used in wood, is frozen with dry ice or a CO₂ fire extinguisher, then turned into the puncture with a wrench. The head is cut off, and when the screw thaws it becomes a part of the tire.

Arresting Hook Tugs Cargo from Low-Flying Plane

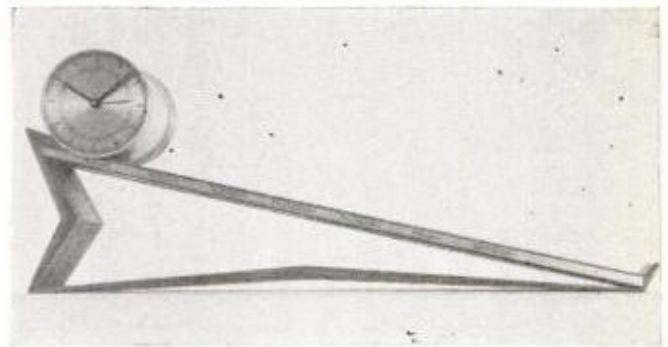
Using equipment similar to runway arresting gear, cargo planes can now unload pay loads of up to 13,000 pounds (a 2½-ton truck) while skimming along three to six feet off the ground. A cargo hook dangling from the open tail door is snared by a

ground cable, which pulls cargo out of plane. A braking mechanism developed by the All American Engineering Co. cushions the shock. Known as Ground Proximity Cargo Delivery, the system is expected to deliver supplies to remote guerrilla areas.



Time Rolls On

Just right for a collector's mantel is a Swiss clock which tells the time, date and day of the week while rolling down an inclined three-foot plane. The clock moves forward to a position marked on the plane for each day of the week by a system similar to that of a cog railway. Available at \$1500 to \$2000 from Cubelin, Inc., 3 West 57th St., New York, N.Y.



Automatic Dialer

Punched cards do your telephone dialing in a method developed by a Japanese firm. The two-part system consists of a punching machine and a card dialing instrument. Punched cards are inserted into the dialing instrument and you are automatically connected with the number on the card. If the line is busy, the machine will continue ringing until the connection goes through.

The manufacturer is the Takachiho Tsushinki Co., Rakuta, Inuyamashi, Aichi-ken, Japan.



PHOTO FUN



BRISTLING BEARD is really just bristles—but only his hair-dresser knows. Brush handle forms his head and crown of his hat

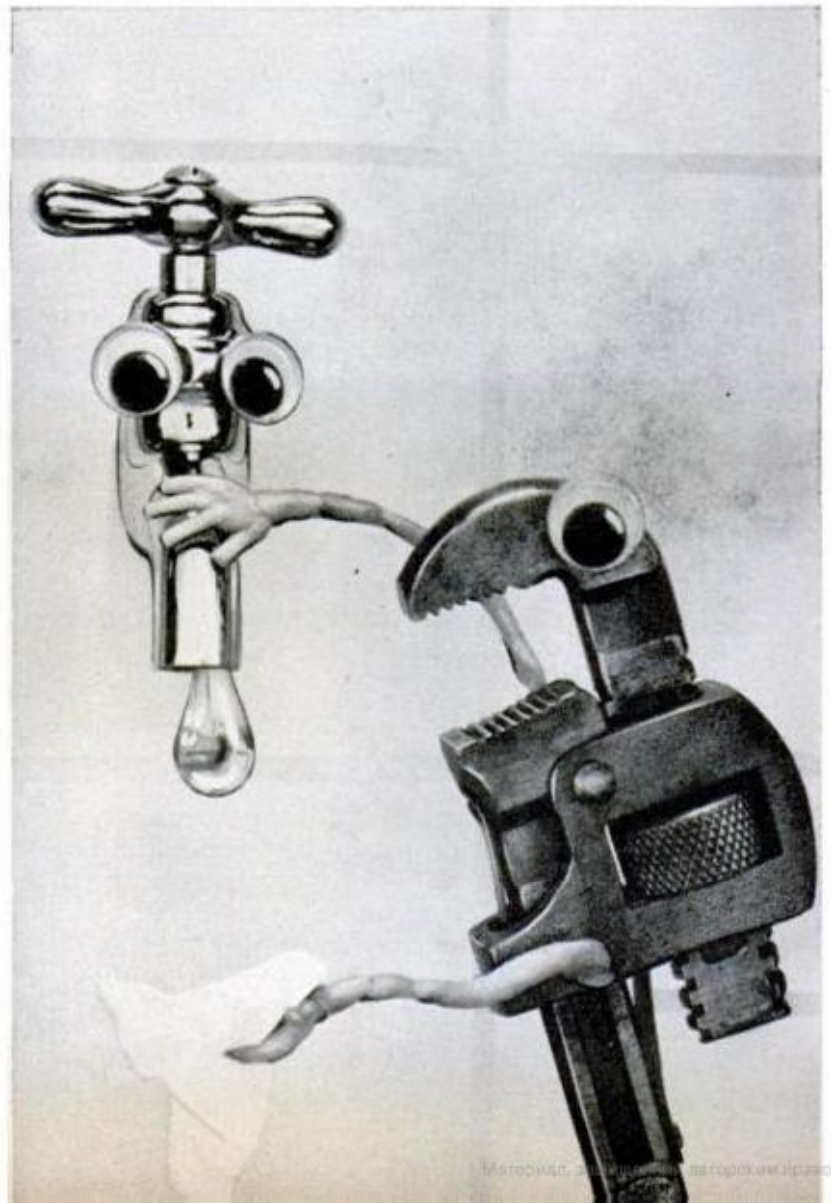
"OKAY, SON, NOW BLOW." Solicitous pipe wrench takes care of runny little faucet. Wax arms, toy eyes add life to hardware

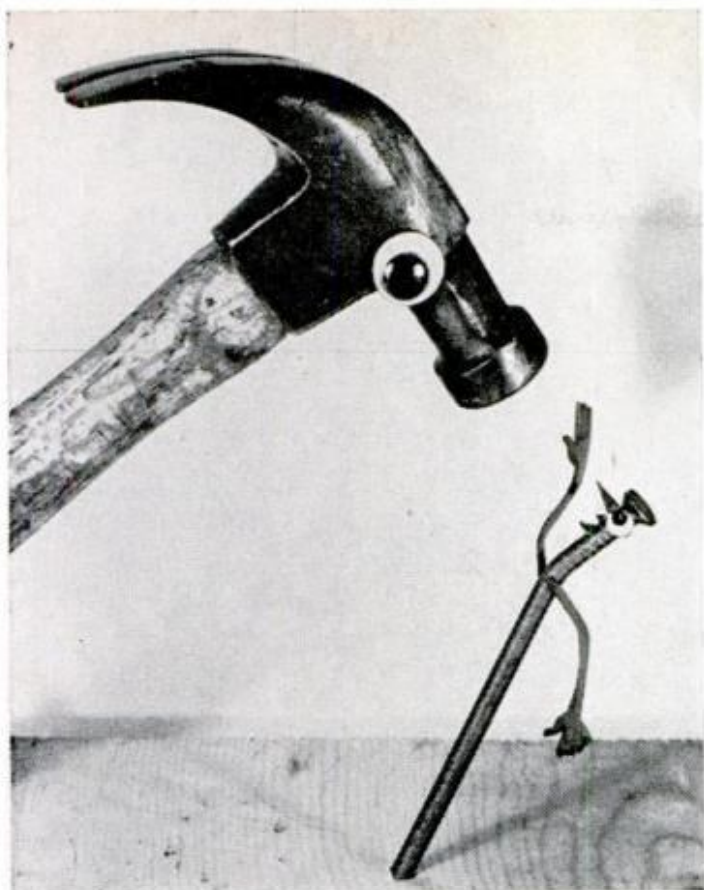
TOOLS AND UTENSILS can be very photogenic "people." Just select them with imagination, add a few missing details—and you'll come up with endless comic models for your camera, says Jack Eisner, artist-photographer.

Eisner adds such parts as eyes salvaged from dolls or stuffed toys. Arms and legs are generally made of wax, though he sometimes uses modeling clay or paper tubes (made by rolling paper around a dowel).

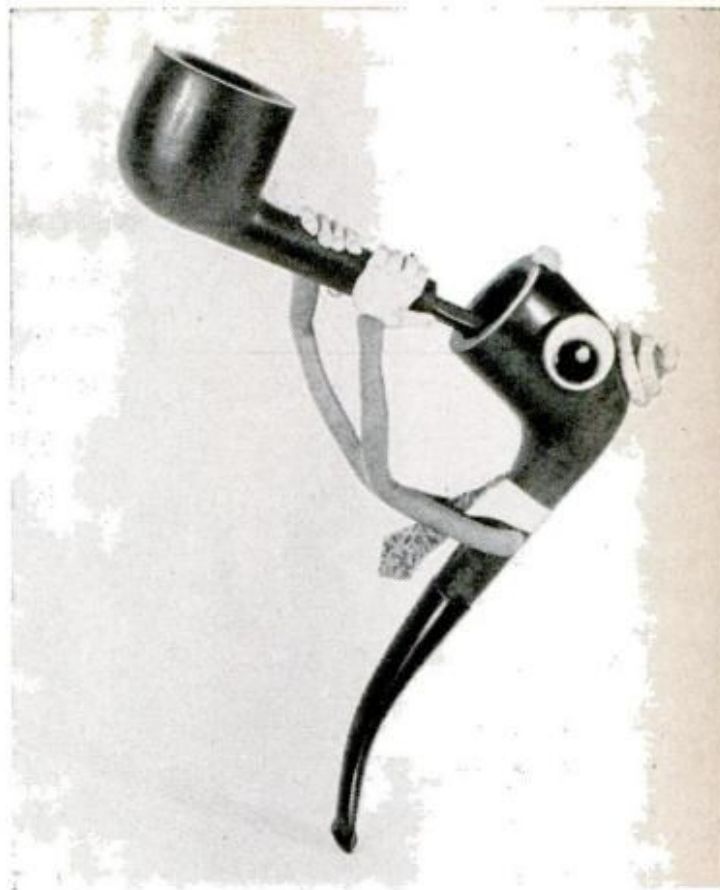
For photography, the figures are suspended from a crossbar by lightweight transparent fishing line. He builds a white paper tent around the subjects and illuminates them with two lights. The bounce light inside the tent softens shadows and provides even illumination.

Most of Eisner's close-up work is done with a 4 by 5 Graphic View camera loaded with Panatomic X film, though occasionally he uses a Rolleiflex.



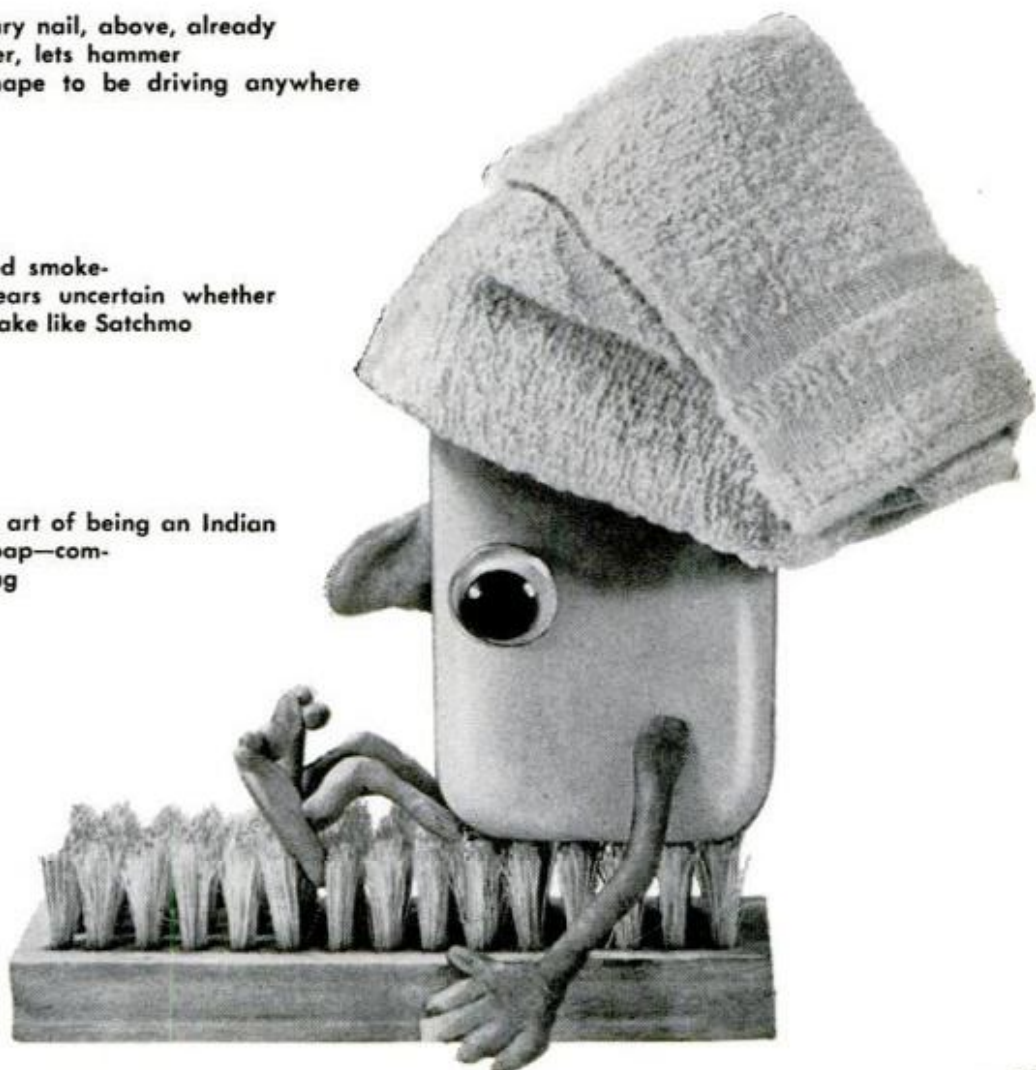


"HEADS UP, FRIEND!" Wary nail, above, already suffering from a bum steer, lets hammer know that he's in no shape to be driving anywhere



HEY, PIPE THIS! Wide-eyed smoke-maker, above right, appears uncertain whether he should take a puff or make like Satchmo

BRUSH-UP COURSE in the art of being an Indian fakir results in a bar of soap—complete with turban—reposing on a simple scrub brush

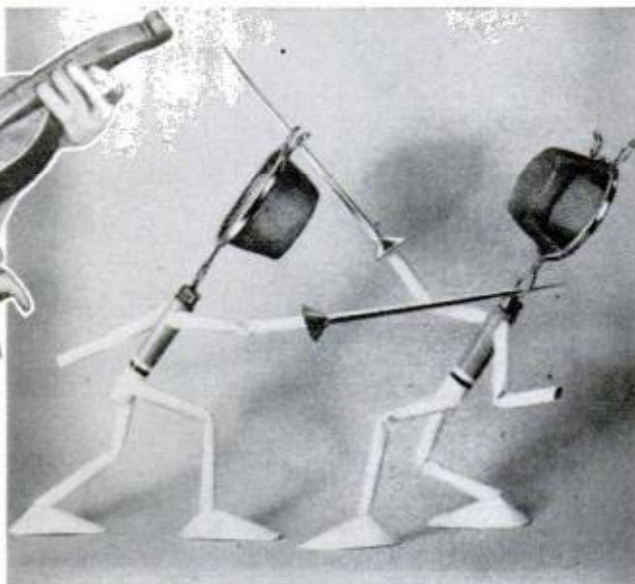




SWEPT UP in his music, long-hair musician happily fiddles. He and all other models were made and photographed by Jack Eisner



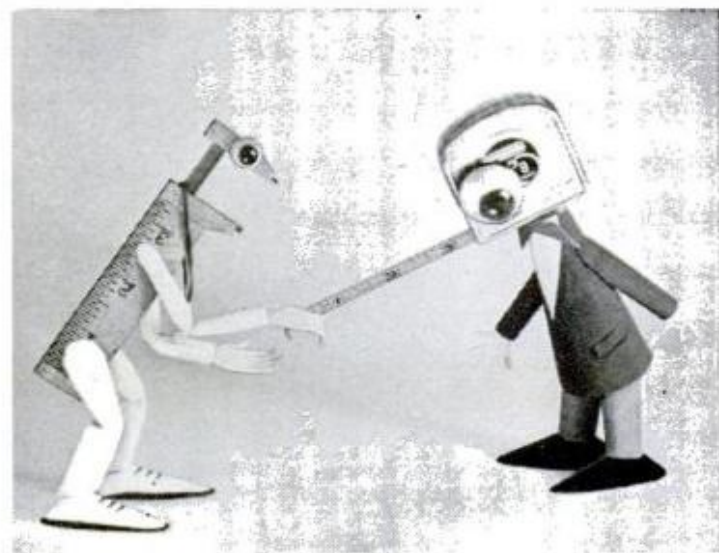
"OKAY, FORK OVER." Kitchen crime scene has stir-crazy spoon about to rob a most unhappy fork



STRAINED RELATIONS in the kitchen finally led to this tragedy. Arms and legs are made of paper



THEY'RE GIVING BOOK REPORTS? Or maybe these paper-toothed paperbacks are paging each other



AS A RULE, they speak only in measured syllables. But that long stogie has started conversation flowing

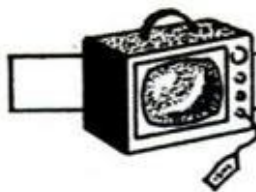
REMOTE CONTROL MOVIES



CLOSE-UPS OF WILD LIFE, using a 25-ft. remote control cord accessory (above), as well as continuous run exposures enabling the movie-maker to get into family scenes (right), are easy to produce with a new automatic 8mm movie camera. Featuring "aim-and-shoot" simplicity, the camera requires no winding, no conventional threading and no exposure settings or focusing. Automatic exposure control of an ultra-fast, factory-focused f:1.6 lens assures correctly exposed scenes under almost any lighting condition.

An electric motor uses four AA-size batteries, enough to wind up to ten 25-ft. rolls of standard 8 mm. film before replacement. The drop-in cassette, loaded by the user, (lower left) further simplifies operation. A sensing device in the cassette shuts off the camera after the first side of the roll has been exposed. The cassette is then turned over to expose the second side. A battery-check signal (above right), lens opening, and a low-light indicator are all visible in the view finder. The price is under \$100 without batteries. A Sun Gun Movie Light (far right) costs \$22. Eastman Kodak, Rochester, N. Y.





PM SHOPPING GUIDE

TV SETS

WIGGLE THE ANTENNA or else the antenna terminals. The set which exhibits the least change in picture stability as a result of this has best AGC, and is the most stable as well



WHAT CAN YOU DO to make sure you are getting the best TV set for your purpose and your dollar? Most dealers have numerous floor samples on display. When you have made a choice, check the carton to see if a small window has been cut in it and the serial number of the set removed. If it has been, the dealer bought up sets from over-supplied stores. Such sets usually are marked down. You needn't pass up such a buy, but you may be forfeiting your warranty—a subject covered later in this survey.

Have the salesman open the carton and operate the set before you buy it. If the set is being delivered, make a note of the serial number on your cash receipt, or mark the set so you can identify it when it arrives at your home.

Basic Things To Look For

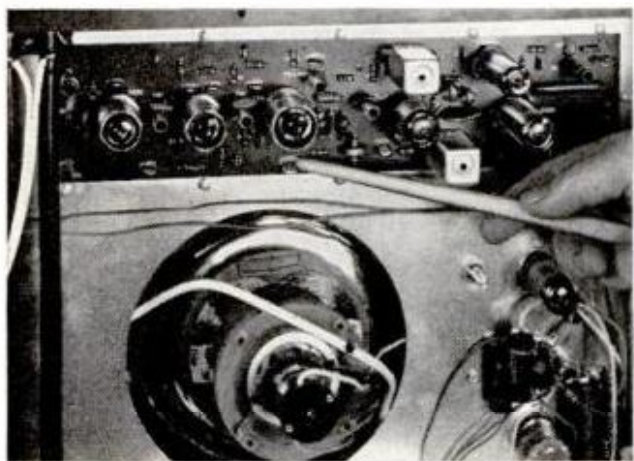
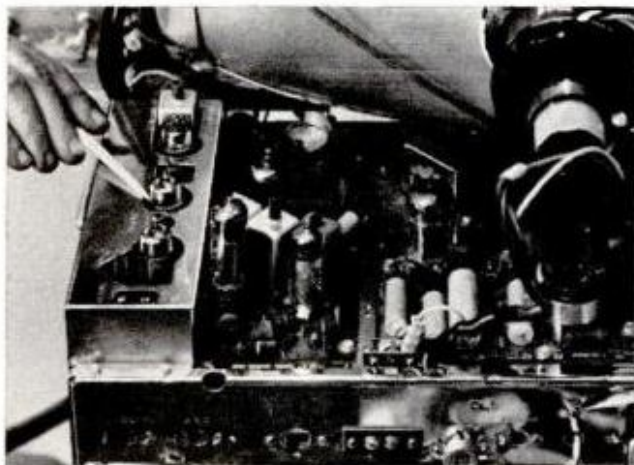
- *How good is picture quality?* Outline of objects must be sharp and free from "smear." Examine for fine detail like the texture of clothing. Actors should not change size when moving across the screen. View the picture tube at a few inches to see horizontal lines. These should be in sharp focus.
- *Is the set approved by Underwriter's Labs?* Check for the presence of a U.L. seal. Most manufacturers whose products have been approved, either display the seal on the set or specify the Lab's approval in their sales literature.
- *Does the set have a power transformer?* If your house current is DC, this item will not be available to you. It's easy to spot a set with a power transformer, for near the power cord you will see the words "AC ONLY." The AC-DC models do not have power transformers.
- *Does the set have an interlock system?* This is a safety device that provides automatic power cut-off when the back of the set is

removed. It's standard on all domestic sets, but some of the imports don't have it. The manufacturer's pamphlet should mention the interlock, usually located on the back of the set. If you have any doubts, remove the back with the set turned on. All power to the set should cut off completely when the back is removed.

● *Where are the seldom-used controls?* If things like vertical and horizontal hold, linearity adjustments, etc., are on the rear of the set, you will need a mirror and chair to see the screen when such adjustments become necessary. Hidden controls keep the kids from tinkering. But if they are located up front (usually under a decorative panel) you can make adjustments quickly and easily after the set is in home.

● *Is the set equipped with fuses or circuit breaker?* Often the only thing wrong with a dead set is a blown fuse. If your set is equipped with a circuit breaker, merely pressing a little button will put you back in business. If fuses are used, they should be easily accessible. Some manufacturers wire the fuses into the chassis. Often, these

HORIZONTAL CHASSIS is difficult to service unless you remove chassis from cabinet. It would be difficult, for example, to orient those tubes properly



VERTICAL CHASSIS has tubes pointing right at you when back is removed. It's easy to align the tube properly in the socket when replacing

don't even look like fuses. Changing these can become a major soldering operation.

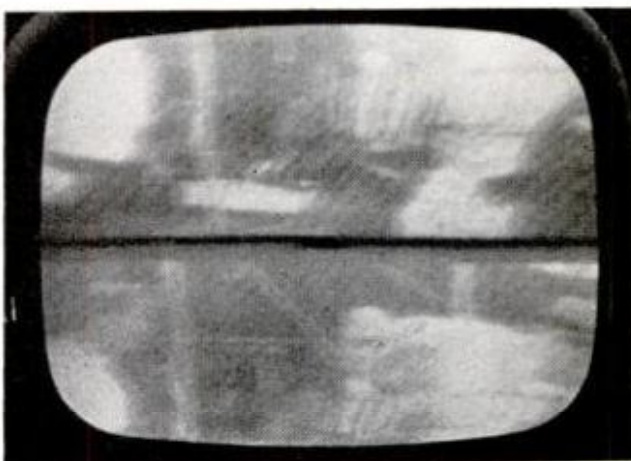
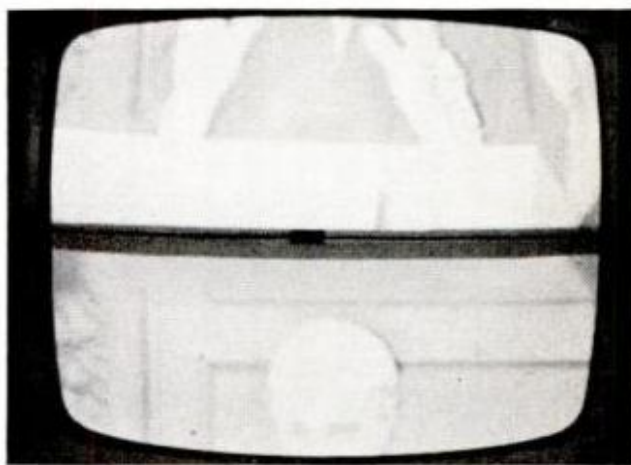
● *Where does the sound come from?* In general, a speaker up front will provide better sound than one at the top or sides. If you can, get a look at the speaker itself. Most run from four to eight inches. In general, larger diameter provides better sound. A large decorative mass of grille cloth can hide a peanut whistle speaker. A speaker that is large enough will play clearly at all room levels.

Unipole Versus Rabbit Ear

● *How's the antenna?* Extend the antenna to its full length. When fully extended, you should be able to tip or tilt the antenna. The old "rabbit ear" type is rapidly giving way to the single "unipole". While either one is adequate in a strong signal area, you can adjust the rabbit ear to tune out ghosts.

● *How many I.F. stages are there?* The intermediate frequency stages are a built-in feature. They determine the amount of selectivity of your set, bringing in each channel without interference from others.

SYNC PULSE tells the vertical stability story. The more pulse height (black rectangle between frames) the more stable and roll-free the picture will be



SMALL SYNC PULSE (narrow black rectangle between frames) is likely to mean poor vertical stability, could also indicate short-changing elsewhere in set

PM SHOPPING GUIDE - TV SETS

ADVANTAGES

DISADVANTAGES

THOSE SLIM SETS

The slim set fits close against the wall, taking little floor space. Generally, these sets are lighter.

Some "slim" sets have long projection at rear to accommodate back of picture tube. Such sets won't fit close against wall.

PORTABLES

The portable has a handle which facilitates movement. Some operate from a self-contained battery-powered source which permits their use in the field.

Try lifting your "portable." Some are so heavy that the handle seems like pure optimism. Not all have rechargeable packs, thus are portable only from room to room.

TV KITS

A kit can provide fun for some. You can buy the kit in separate parts packages. With care, you may wind up with a better set than an assembled unit.

The TV kit must be wired and soldered. It calls for an advanced hobbyist. It is not an over-the-weekend job. You can buy a wired set (of lesser quality) for less money.

TV-HI-FI COMBINATION SETS

The combination set is built into a large, decorative piece of furniture. Usually the TV uses the same amplifier-speaker system that the hi-fi does, which may result in a considerable saving.

What happens when one component in this type of system needs service? You lose ALL your home entertainment until the one bad piece is repaired.

Most sets have at least three I.F. stages. The dealer can inform you on this.

● *What's the channel selector like?* If the channel markings are painted, printed or screened on the knob, you can almost depend on their wearing away before long. If they are deeply engraved, they will last longer. The trend today is toward illuminated markers, and in a dimly-lit room, these are real eye-savers. Make sure they are readable from a distance.

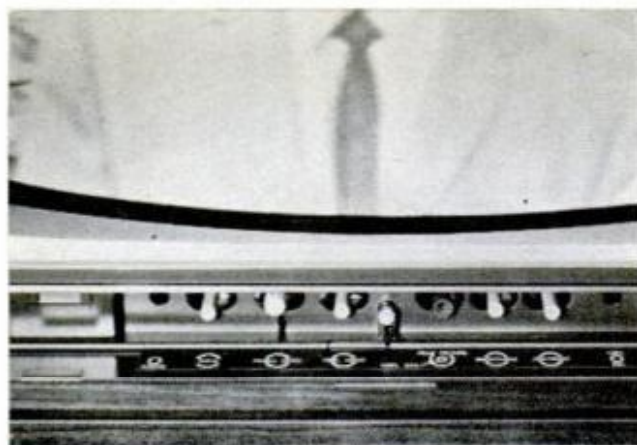
Tests You Can Make On the Set

● *Check the automatic gain control.* This is not a control unit. It is the built-in stability of signal reception that every set should have. You don't need to know the circuitry, but you can check for it. Explain

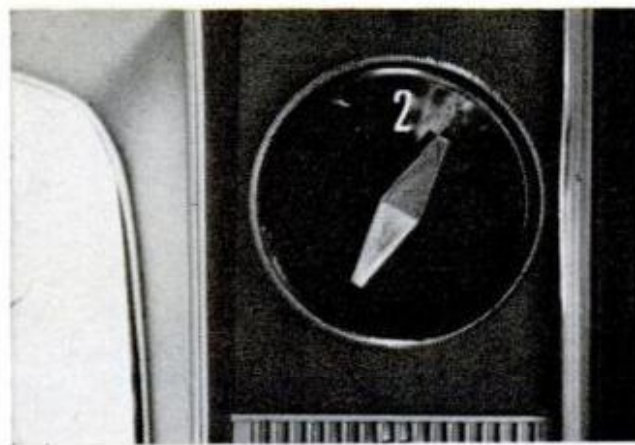
to the salesman that you'd like to make some tests with the set's built-in antenna. He may have to hook it up—a simple change-over that any cooperative salesman can make. With a good picture tuned in, touch the antenna terminals with your finger. The set that exhibits least reaction to this will be most stable. "Keyed AGC" is best.

● *Check for interference.* Plug an electric razor into the same outlet as the TV set. Hold the razor near the antenna and look for small black and white horizontal lines. This test covers both line filtering and noise rejection. The set which is least susceptible to this interference will scarcely notice a car idling outside the house.

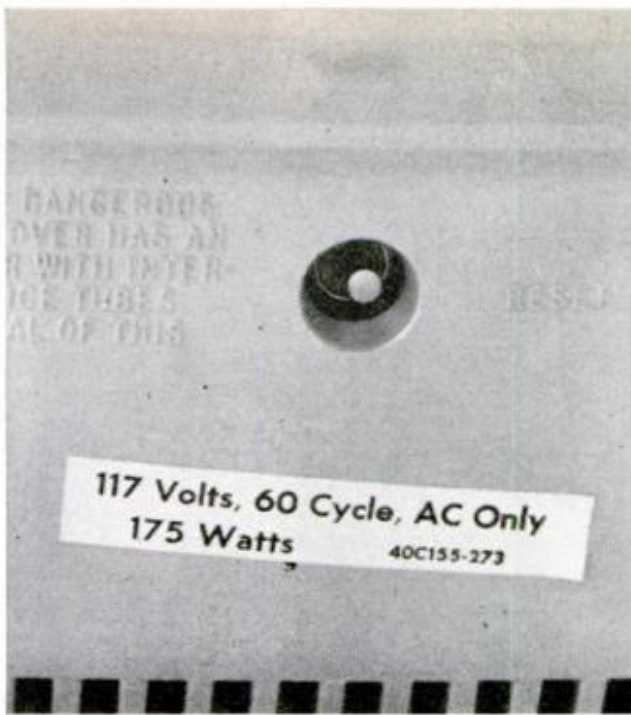
● *Check for sufficient sync power.* It is



CONTROLS UP FRONT are not used frequently, but are easy to operate when needed. If seldom-used controls are on rear, mirror may be needed for adjustments



ILLUMINATED CHANNEL SELECTOR is a real bonus in a dimly lit room. Painted numbers wear away quickly. Engraved lines last longer



SERIAL NUMBER should be intact on set you buy. A removed serial number may mean that your guarantee is void. Check with the dealer to make sure



ELECTRIC RAZOR measures interference rejection. Razor should be plugged in same outlet as set, using indoor antenna. Watch for interference lines

easy — and worthwhile — to see the sync pulses on most television sets. Increase the brightness and decrease the contrast. Use the vertical hold control to rotate the picture until the bottom of the frame is at the center of the screen. You will see the black sync pulse at the center of the frame line (see photo). Look for lots of amplitude (height) in the pulse. The more, the better. This determines the vertical stability of the set.

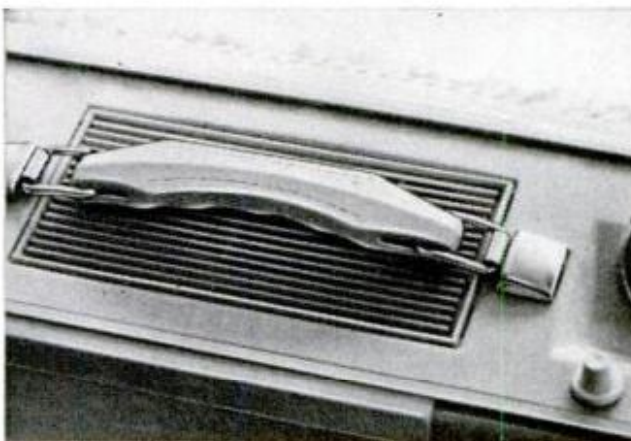
Tests for Checking the Controls

● **Volume control, on-off switch.** If the set uses a “pull-on-push-off” switch, try to pull a little harder. The control knob just might come off in your hand and, when you replace it, you will turn the set off. Rotate

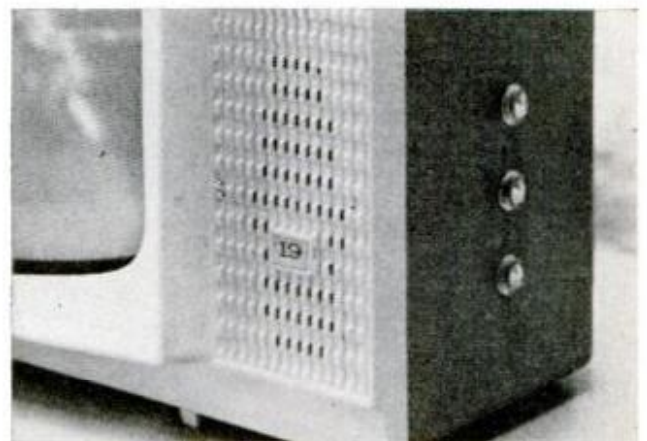
the volume control and listen for distortion. At good room levels, the sound should be free of speaker rattles or other noises.

● **Channel selector.** Action from channel to channel should be free of backlash or whip. Adjust the fine tuner for the best sound without looking at the picture. Then, watch the picture. Is it free of distortion? Does the sound have an effect on the picture? Must you compromise one for the other? If this is the case, the set may need realignment before you get it home. Check this on each channel.

● **Contrast control.** This makes the blacks blacker. When it is set, make sure there is some additional picture stability on both sides of the best position. Beware of a set with contrast control that can drive the



SPEAKER ON TOP may be most convenient place if space is a problem. However, directing sound upward and into handle is not good for the best audio results



SPEAKER ON FRONT directs sound toward listener, is more efficient. Other sets have speaker on side, may direct maximum volume into other rooms or wall

PM SHOPPING GUIDE - TV SETS

picture negative (make the blacks white). Control should vary contrast gradually.

- **Brightness control.** This is used in conjunction with the contrast control. When the best possible picture is obtained, you should have ample play for adjustment on both sides of this position. Picture should not grow larger ("bloom") with added brightness.

- **Horizontal hold (or lock).** Be sure that there is ample play at both sides of the best position. Don't be concerned, however, if you can't make the picture "tear" or lose horizontal synchronization at either side. In fact, it's a better control if you can't.

- **Vertical size (height and vertical linearity).** These operate together. One adjusts picture height, the other compensates to keep the pictures in proportion. Neither of these controls should be at their extreme when the best adjustment is reached.

- **Vertical Hold.** This keeps the picture from rolling. There should be ample play at both sides of the best setting, but the control should not be so delicate that the least touch causes a roll.

On all controls, test audio against video, and try several channels.

- **The warrant-tease.** A TV tube is some-

what like an electric bulb. A brand new one can quit after a few minutes of operation, or it can work for years. Your protection is in the warranty-guaranty. Find out how long the set is protected and what the protection covers. Frequently, large mass distributors "farm-out" the service on the sets they sell, while the local shopkeeper covers this himself.

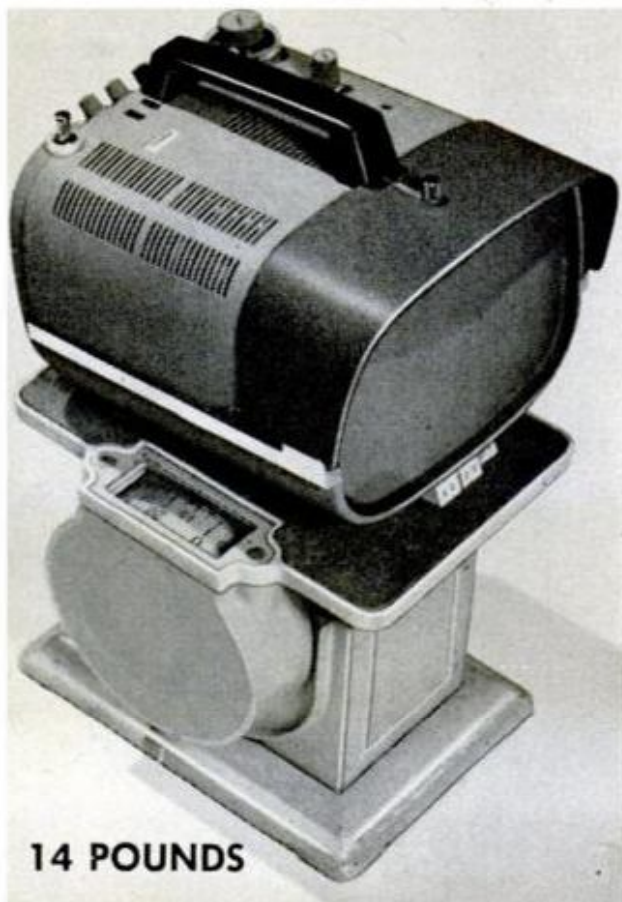
Find out how far authorized service is from your home. Cartage fees can add up.

- **How about UHF?** The ultra high frequency television bands were approved by the Federal Communications Commission long ago. They were not popular because these frequencies required many technical changeovers on the part of the telecasters and set manufacturers. Now that the UHF bill has been passed into law, however, all new sets soon will have UHF tuner facilities as well as the usual VHF. (See December, 1962, **Popular Mechanics**.)

While special UHF sets will soon begin to make their appearance in the stores, there is no need to wait for them. The rush to UHF won't take place overnight. What's more, adaptor units already are available, so that VHF set owners will be able to convert with little difficulty. ★ ★ ★

HOW PORTABLE? Transistorized set below weighs in at a mere fourteen pounds. Set has accessory power pack permitting it to be used away from AC outlets

ANOTHER PORTABLE. (Note handle) This thirty-eight pounder is also portable, but only from room to room or house to house. Requires 115 volts to operate



14 POUNDS



38 POUNDS

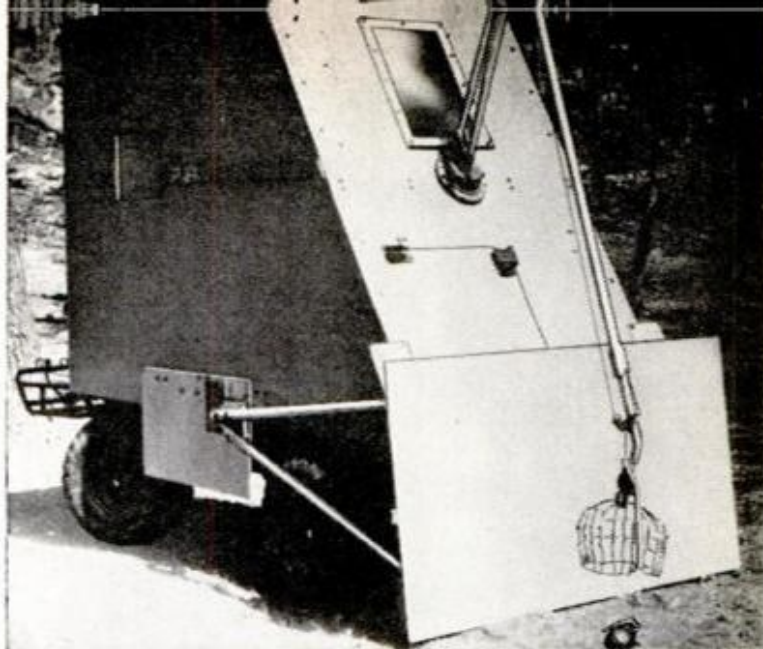
POPULAR MECHANICS

Dud Snatcher

Hand grenades and other small explosives that do not explode on cue can be safely snatched from the ground by an armored retriever designed by the Army.

In need of a safer, more reliable method of recovering duds—so that they can be analyzed to see what went wrong—the two men mounted an aluminum “cab” on an Army weapon carrier.

The dud is picked from the ground by an arm which accommodates a variety of “fingers” or scoops; the one shown is a drawstring basket.



Motorized Miscellany

“Mobile scrap pile” is the way the makers of a do-it-yourself run-about describe it.

Beginning with a Crosley engine, the small two-seater grew out of a Tennessee manufacturer's scrap pile. The vehicle is a conglomeration of sheet metal, plywood, angle iron, canvas for the top and plexiglass for the windshield.

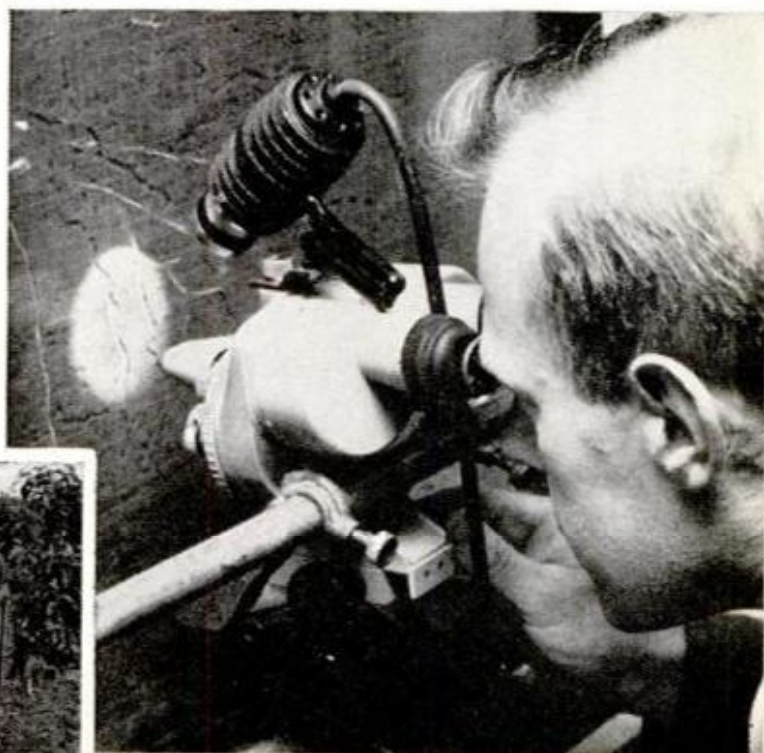
Parts of the body are riveted, some are held together with nuts, bolts and screws, and others are welded together.



Watch Roots Grow

Scientists at the East Malling Research Station in Kent, the center of English fruit production, have an underground laboratory to study apple, plum and black currant root systems.

Plate-glass windows along the 96-foot inside walls permit microscopic study of roots and the action of soil fauna, such as worms and insects, and pruning effects.





Sports Car From Israel

A sleek fiberglass shell encloses the new Sabra Israeli sports car from Haifa. The Sabra Sport, with a four-cylinder, in-line, OHV engine, turns out 67 horsepower at 7800 rpms for a rated 26.1 pounds per horsepower. The manufacturer says the Sport has reached 100.3 miles an hour in tests.

Engine displacement is 103.9 cubic inches; compression ratio is 7.8:1. The East Coast POE price is \$2995.



Portable Steam Cleaner

Utilizing the exhaust from the piece of equipment being cleaned, a portable steam cleaner can degrease machinery in the field on location.

Working on the syphon principle, the hot exhaust travels through the gun and creates suction which draws the cleaning agent from almost any kind of container (bucket shown), forcing it out the nozzle at pressures up to 300 pounds psi.

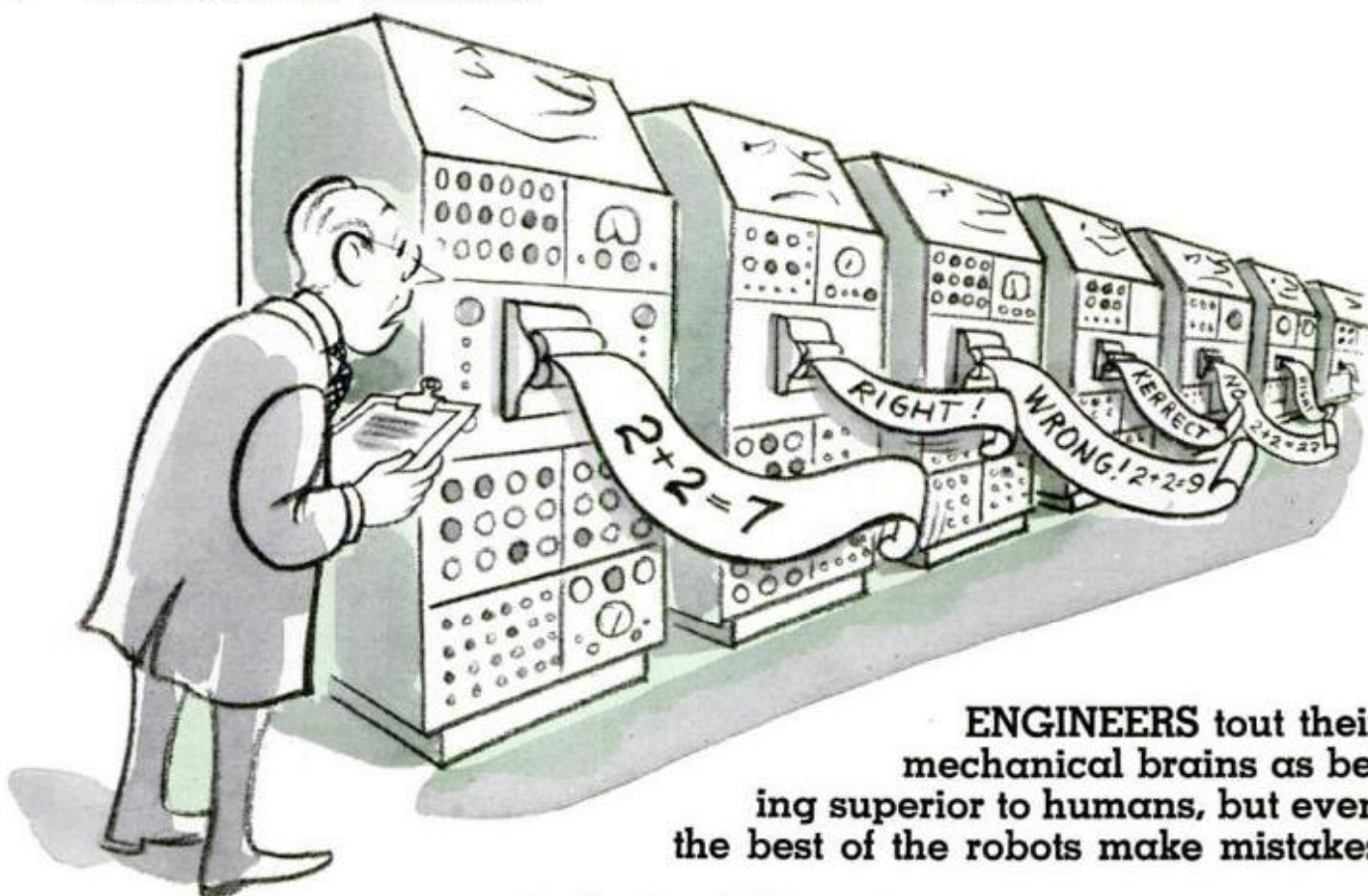


Emergency Call Box

Drivers can radio police for help by pushing a button on a solar-powered emergency call box. An officer can open a lock and dial for special services. Developed by Hoffman Electronics, El Monte, Calif., it's in use in Los Angeles.

LOOK WHAT THOSE KNUCKLE-HEADS ARE DOING!

(MACHINES, THAT IS)



ENGINEERS tout their mechanical brains as being superior to humans, but even the best of the robots make mistakes

By S. David Pursglove

IF YOU ENVISION a world free of human error, a society that is regulated by the calm clicking of an infallible computer, you are in for a disappointment.

Like us obsolescent mortals, the mechanical brains are showing signs of nervousness, whimsy, intoxication, indecisiveness—and many are running completely amuck.

In short, some of the thinking machines have flipped their wafers!

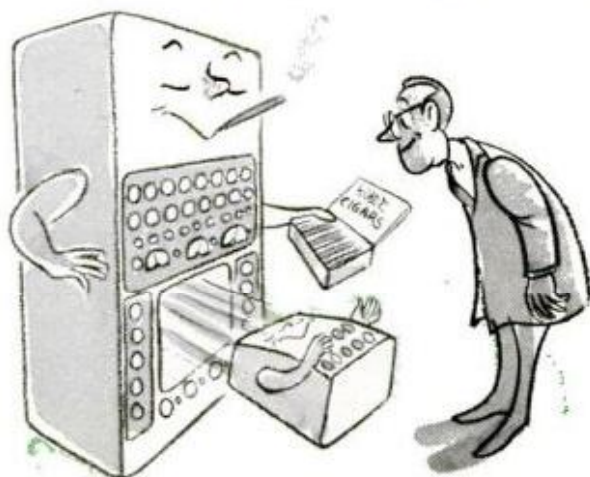
For many years, the machines have been threatening to run the world. They already have us in hand from birth to death. They judge our intelligence, choose our careers, prepare our food, figure our taxes, mail our letters, make up our payrolls, write our pay checks, and generally reduce us to numbers neatly packed away in magnetic memory wafers.

But there is hope for us. In taking over human skills, the machines also have taken over human frailties.

The machines are becoming so human, in fact, that robots are producing little robots. One of the first computer offspring is now a strapping youngster on Ascension Island in

the South Atlantic where he tracks missiles for the Defense Department's Advanced Research Projects Agency. His mother is a Bell Telephone Laboratories computer who was told only what kind of job Junior would have to do; she studied the problem and produced the perfect child.

MECHANICAL BRAINS are not content with thinking like humans; now they have babies





NERVES have taken their toll of the computers. At MIT a dozen sensitive mechanical brains have already flipped their disks and are currently under care of computer doctors

Remington Rand's famous Univac I designed its own first child, Larc. Engineers told Univac what was needed, offered some suggestions, and in 50 hours of whirring and clacking, Univac produced the best possible wiring diagram for Larc. She pinpointed over 60,000 connections and specified which wires should be shielded. An IBM 704 designed an improved version of herself, and then predicted all the possible ailments that might crop up in her child, giving computer doctors a complete list.

A computer designed to exhibit personality recently joined the ranks of humanlike machines bent on turning man into a machinelike human. Named "Aldous," the computer is the creation of Dr. John C. Loehlin, University of Nebraska, who programmed the computer so that it would be able to forget, love, be afraid and be angry. The face that Aldous shows the world at any given time depends partly on his current mood (the persistence of his emotions from the immediately preceding situation) and partly on memories of what happened in related past situations.

With this trend toward producing a truly "human" machine, it was inevitable that a machine should succumb to romance. IBM's William Dersch designed a computer with ears and christened her "Shoebbox," because of her size and shape. She responds to carefully spoken numbers with a regulated "clack-click," but one day she became enamored of a movie-camera spring that was being wound within her hearing, and went into a rhapsodic hysteria of clickety-clacks. She returned to normal, but repeated the performance as soon as she again heard the spring being wound.

For a dozen years there have been several mentally unbalanced robots at

Massachusetts Institute of Technology and at the Burden Neurological Institute in England. From time to time these thinking machines go completely wacky, sometimes going into catatonic states. They not only refuse to follow orders, but seem totally unaware that orders have been given.

These robots were designed to hunger for heat or light to satisfy thermocouples or photocells. Others were given goals, such as traveling to certain points. They become intoxicated from too much heat or light, become desperate when there is too little, and waver (cannot make up their minds) between too much and too little. They exhibit realistic frustration when routes to goal accomplishment are blocked, and they break down in throes of agonizing indecision when circumstances make two routes equally feasible.

Physicians have seen these machines demonstrate various forms of ataxia and "intention tremor." Although they are far from a man's age of senility, they often fall into fits that respected neurologists have diagnosed as Parkinsonianism—the shak- ing palsy often encountered in old men.

ONE ROBOT at IBM research labs became so human that it flipped over a camera spring





CLOAK AND DAGGER work has entered the robot world. Every computer on priority defense work has another computer checking on all decisions it makes, to report anything suspicious

Several large computers have suffered genuine nervous breakdowns that were not planned. The classic was a very human kind of breakdown suffered by a machine who worked too hard at an impossible job. All night long she clicked and clacked wildly, and as dawn approached she was whirring angrily and gnashing her gear teeth in frustration. Finally, she blew her tubes and fuses and collapsed in a state of shock. She had been trying to divide by zero. Didn't know any better.

Staunch advocates of a tidy computer-run world stand firm in their conviction that all computer mistakes are actually perpetrated by inept humans. While it is true that humans often feed the machines the wrong information or ask them to do the wrong things with the right dope, manufacturers admit that the machines are not infallible; that a big computer can be expected to make a mistake about once a month. Mistakes stem from such things as blown or worn-out tubes, loose connections, foreign matter in the machine or overheating. And when a computer makes a blooper, the results resemble a Mack Sennett comedy.

One day last year a computer that bosses the U. S. Army supply office at Orleans, France, forgot its 'rithmetic and minused when it should have plussed.

Army clerks looked at the minus signs heralding a critical shortage of axles, transmissions and differentials, realized that a mammoth transportation system was about to be crippled, and pushed the panic button. Trans-Atlantic cables hummed. The Pentagon reacted with military calm and precision; more machines went into action and an order for \$7,400,000 worth of parts was processed. More than \$4000 worth had been

shipped before a curious *human* from the General Accounting Office fingered the culprit—faulty wiring.

The Navy had to drum one robot supply system out of the service with a bad conduct discharge. Part of the problem was human: the Navy changed stock numbers of items faster than human programmers could change instructions to the machine. But the major reason, said Rear Adm. Hugh C. Haynsworth, commander of the Naval Supply Center, Norfolk, Va., was breakdowns. A robot would often be out of action for a full day at a time—a day when it was expected to process 20,000 orders.

In theory, robot mistakes can be prevented by using two robots, one to check on the work of the other. This is supposed to eliminate machine-made mistakes since it is unlikely that two machines will suffer identical breakdowns at the same time. It is supposed to cut down human errors since the second machine contains logic circuits that analyze the first machine's work to see if it makes sense. A wonderful idea, except that it doesn't always work in practice.

THE NAVY, troubled with a neurotic computer, drummed it out of the military service





CURED of sending Christmas checks to former employees, a machine sent turkeys instead

An Army robot and robot-checker were assigned to keep supplies flowing to Europe. A supply officer approached the robot one day and suggested that 300 foot lockers be ordered for a unit in Europe. The machine's operator — admittedly a human—made the error of punching out a card for 300,000 and fed it to the machine.

The robot shrugged its tape reels and ordered 300,000 foot lockers without question. The order went to the robot-checker, and the red flag went up. The machine knew immediately that the order would seriously deplete the Stateside supply of foot lockers. So it automatically clacked out an order to Army supply officers to purchase 300,000 foot lockers—to replenish Stateside stocks.

Few people knew about that little blooper, but almost everyone is familiar with the classic—and almost tragic—error of a computer-checks-the-computer system that happened a year ago. The highly automated Ballistic Missile Early Warning System (BMEWS) notified the Strategic Air Command that the U.S. was under missile attack. Gen. Thomas S. Power, SAC boss, tended to doubt it, but the original signal and four confirmation signals all indicated an attack. He ordered dozens of B-52s loaded with H-bombs to taxi out onto their runways. (Contrary to first newspaper reports, the President was *not* notified, and a missile countdown was *not* started.) Just when General Power could wait no longer to order his brood of lethal birds into the air, word came from BMEWS that everything was all right, that a flaw in the system had been located.

What could possibly go wrong simultaneously with an alert circuit and four confirming circuits? Through some colossal goof of design, all five circuits travelled the same cable for a short distance. Something went wrong with the cable, and all cir-

cuits responded to the signal accordingly.

In a lighter vein there is the story of an IBM machine designed to process classification records of newly enlisted soldiers. Veterans of World War II are familiar with the old classification system: a truck driver in civilian life will naturally make a good army cook. The machine with its punched cards was going to eliminate all that. It did nicely until it came to the card of a hapless recruit named Bugler, and automatically sent him off to join an Army band in Texas. Needless to say, Bugler could not bugle.

The military has its automated problems, but it is the civilian population that is fighting back—winning a little, losing a little.

The almost fully automated post office in Providence, R.I., has become the butt of national jokes and the object of Congressional ire. Many a letter has been mailed from there with foreign stamps. One lady sneaked trading stamps past the robot canceler. At Christmas the post office all but throws in the towel. The would-be ruler of a machine-governed world cannot tell the difference between a postage stamp and a Christmas seal.

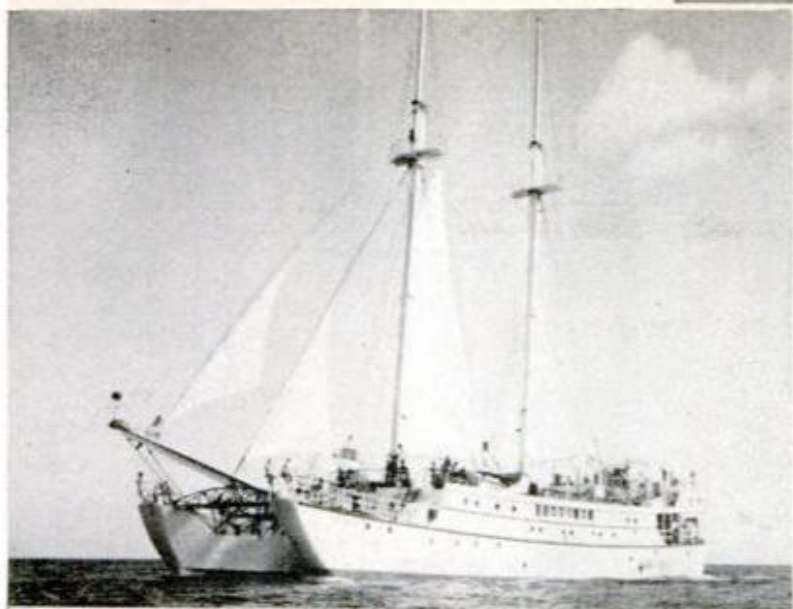
The Rhode Island folks were having fun, but the people of Seattle, Wash., have a serious gripe against the robots, particularly a double-crossing computer in the King County tax assessor's office. This wily machine counted one taxable property subtotal card twice and reported probable county income \$28,000,000 too high. On the basis of this rosy picture, gleeful county leaders went on a spending binge and started buying everything that the county had long needed or wanted.

Considerable nonexistent income had been spent before someone discovered the

(Continued on page 214)

HUMAN BEINGS are being replaced daily, but there are jobs the machines do not want

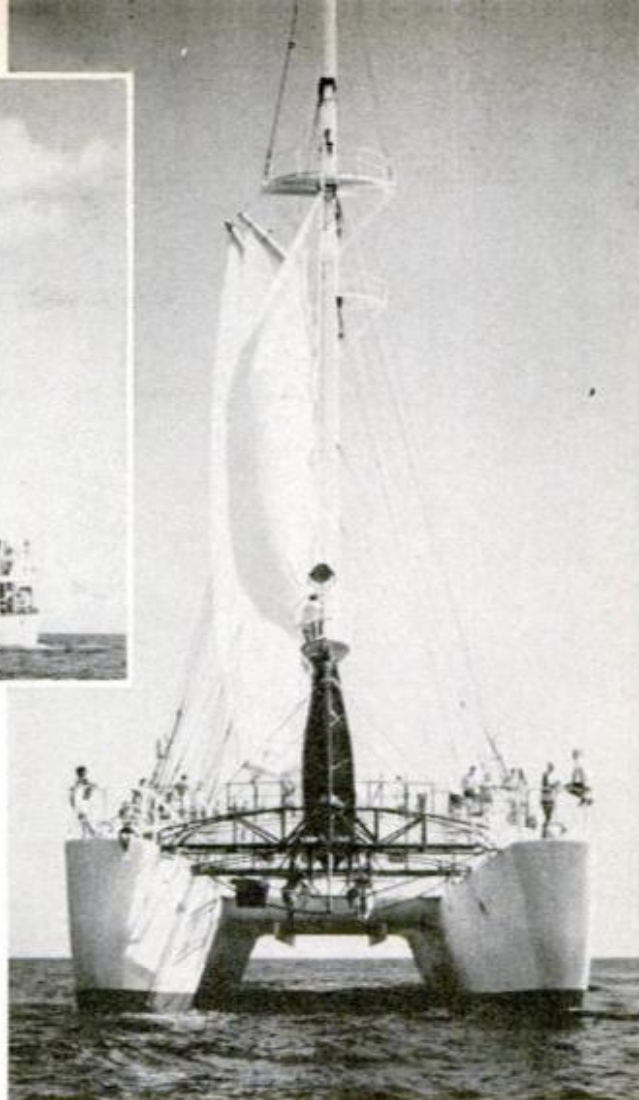




Giant Cat Goes to Sea

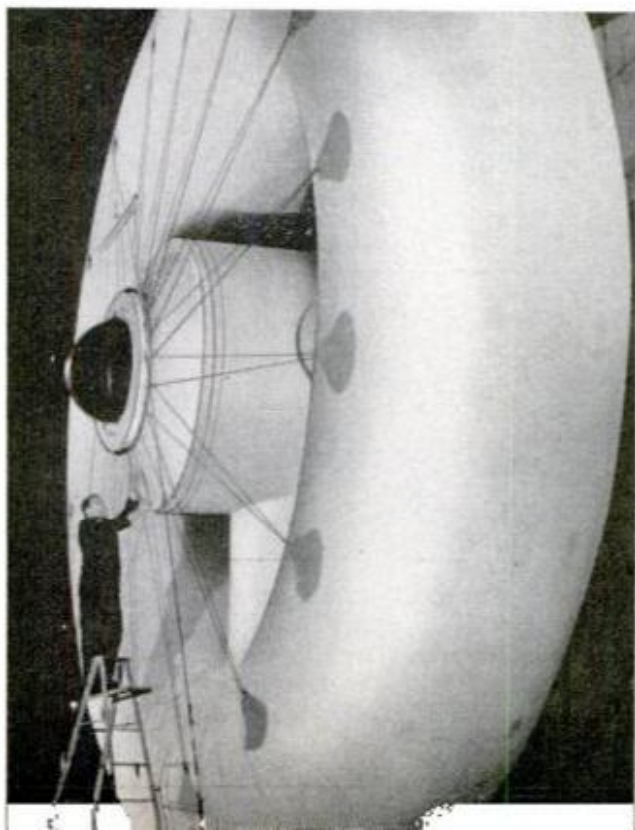
Flying 10,000 square feet of sail, the world's largest catamaran runs before the wind on her maiden voyage.

Designed and built by Sid Hartshorne of Fort Lauderdale, Fla., the 145-foot *Tropic Rover* carries 66 passengers and a crew of 15. Two schooner-rigged masts tower 135 feet above the water. The big "cat" is built of plywood, fiberglass and laminated wood, and has two auxiliary 270-hp. diesels.



Rubber Space Station

Designed to spin horizontally while in orbit to give the three-man crew artificial gravity from centrifugal force, a space station made of a rubberized fabric is three stories in diameter when inflated. Deflated, it fits into a nose cone.

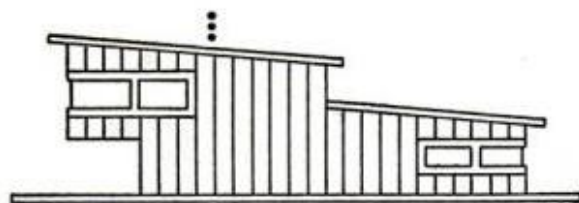


Chair Helps Disabled Stand

Disabled people, who can walk but cannot rise unaided are able to elevate themselves to a standing position with an automatic chair that is electrically operated.

Adjustable to any height, it's made by Wilhelm Meyer Co., Vlotho, Germany.





NEW FOR YOUR HOME

REVOLVING VANITY for bathroom or bedroom is mounted on adjustable-height chromium poles that attach to ceiling and floor. The unit includes a full-length mirror, tilt-out, removable hamper and three shelves. A flick of the hand revolves the vanity for access to hamper, mirror or shelves. The unit has fruit-wood sides and white interior. The shelf area is 12 by 11 $\frac{3}{8}$ inches; mirror dimensions are 12 $\frac{3}{8}$ inches by 48 $\frac{3}{8}$ inches. The vanity costs \$44.95 and is made by Wolff Products Co., 1150 Broadway, New York



THERMOMETER FOR BABY BOTTLE eliminates guesswork in warming milk. The thermometer is inserted into a sterile plastic sheath that also serves as cap. The price, \$2.98, includes six sheaths; made by Steril-Temp, Inc., Box 211, Encino, Calif.

140



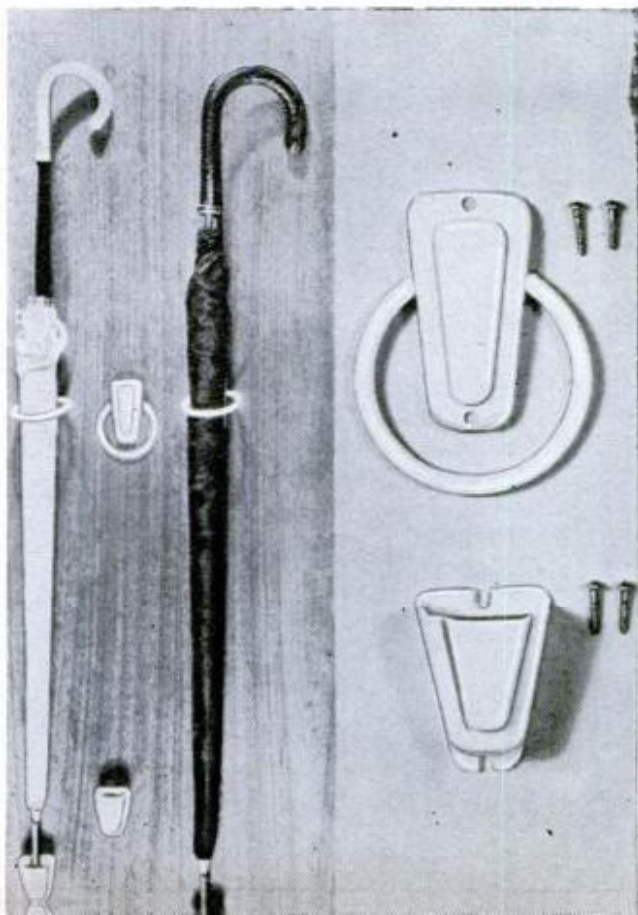
PLASTIC PET FEEDER is shaped to fit snugly into corners. Finlike mounts at the base help reduce skidding and elevate the tray to a comfortable feeding height. The tray costs about \$1; it's made by Westland Plastics, 800 N. Mitchell Rd., Newbury Park, Calif.

POPULAR MECHANICS



PORTABLE RADIANT HEATER for indoors or outdoors operates on propane gas. Cost: under \$30 with two cylinders. It's made by Otto Bernz Co., Rochester, N. Y.

UMBRELLA HOLDER keeps any size umbrellas neatly stored. The holder at bottom catches drippings. Costs \$1; made by Hollis Co., 1133 Broadway, New York 10



PORTABLE ELECTRIC CAN OPENER also sharpens knives, mixes and whips. Costs \$29.50 with attachments. Ronson Corp., 1 Ronson Rd., Woodbridge, N. J.

RAIN GAUGE has outside receptacle to catch rain water which passes through tube to graduated vial indoors. \$1.99; Pride Products, Box 4505, Austin 51, Tex.



STEAM ENGINE

PART I

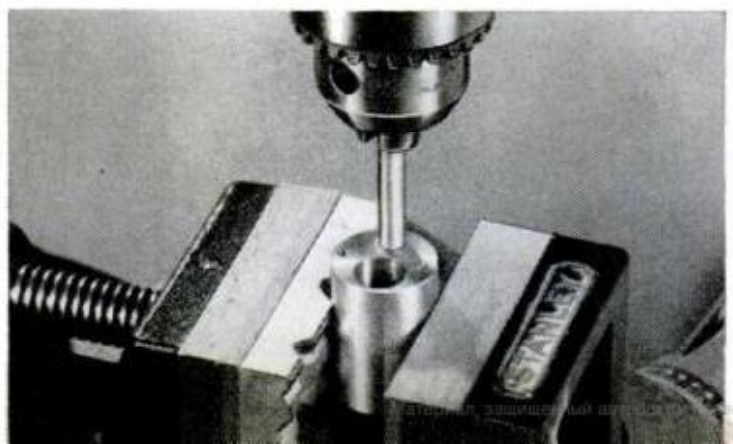


You needn't be a skilled machinist to make this perky little one-lunger from the detailed plans on the following pages. Part II will cover the blowtorch-fired boiler

By Manly Banister

MOUNT ENGINE BLOCK off-center in four-jaw chuck to bore cylinder on metal lathe. Use succession of drills from $\frac{1}{8}$ to $\frac{3}{8}$ in. and finish with boring tool as shown

TO LAP STEAM-CHEST BORE, block is held in vise that's secured to drill-press table. Final lapping rod is converted into valve piston for perfect fit



IF YOU HAVE ACCESS to a six-inch model-maker's lathe, a drill press and a jig saw, you can have a lot of fun making this midget powerhouse. It's a single-acting, piston-valve-type reciprocating steam engine with a $\frac{1}{2}$ -in. bore and $\frac{5}{8}$ -in. stroke. Machining has been kept to minimum—and the boiler (detailed next month) is literally a "pipe" to assemble: it's made of standard plumbing fittings. Fired with a blowtorch, it generates enough steam in two minutes to set the pistons whirring.

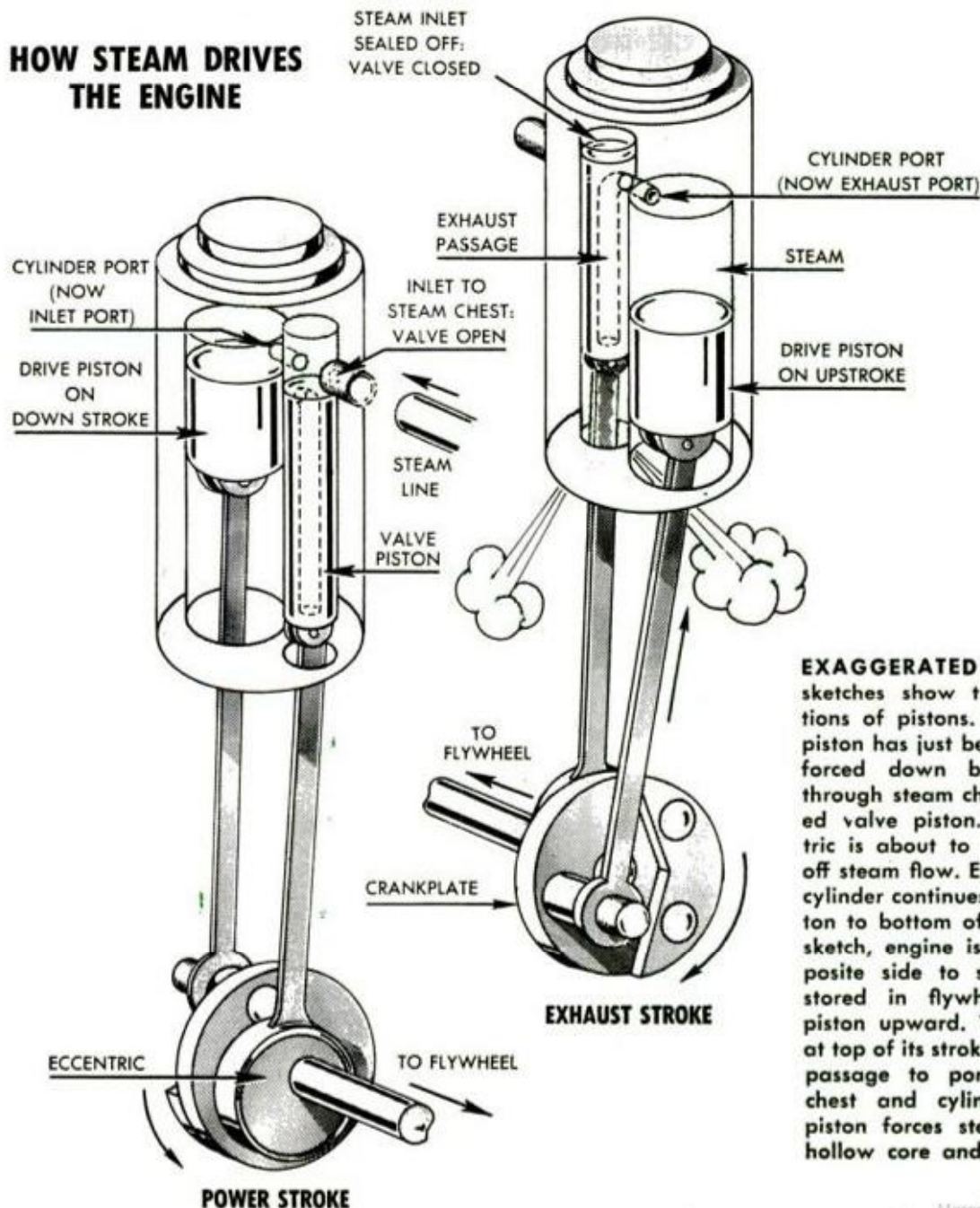
Engine Block

The trickiest machining is boring the two holes—for cylinder and steam chest—in a piece of bronze bearing stock. After cutting the rod to approximate length, face both ends and scribe a diameter across what will be the lower end. Prick-punch centers for the two bores. Bore the cylinder as shown on the opposite page, drilling $1\frac{1}{16}$ in. deep with a $\frac{1}{8}$ -in. drill; then enlarge to that depth with successively-larger drills,

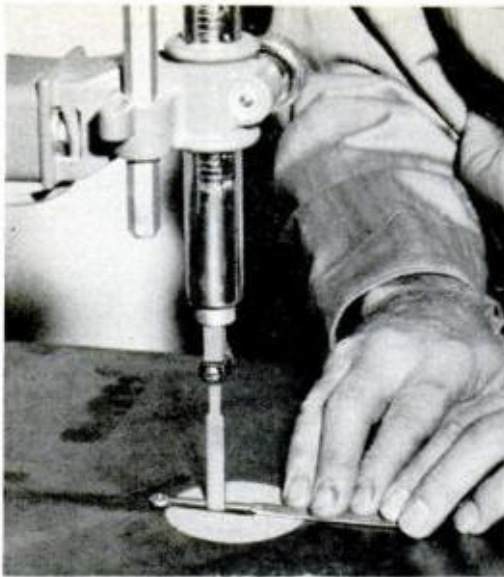


CRANKSHAFT ASSEMBLY, detached from engine block, shows how connecting rods link pistons to crankplate. Both plate and eccentric are soldered to flywheel shaft

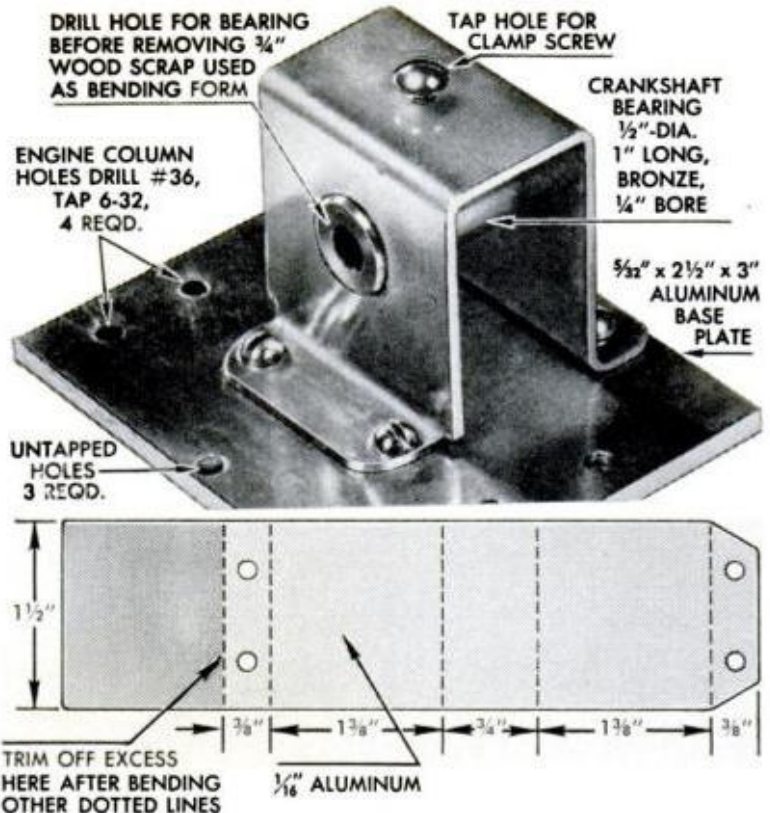
HOW STEAM DRIVES THE ENGINE



EXAGGERATED SEE-THROUGH sketches show two extreme positions of pistons. At far left, drive piston has just begun power stroke, forced down by steam rushing through steam chest, above retracted valve piston. Revolving eccentric is about to raise valve to cut off steam flow. Expanding steam in cylinder continues to push drive piston to bottom of stroke. In second sketch, engine is viewed from opposite side to show how energy stored in flywheel thrusts drive piston upward. Valve piston, now at top of its stroke, presents exhaust passage to port between steam chest and cylinder. Rising drive piston forces steam down valve's hollow core and out base of bore



IGNITION-POINT FILE is chucked in jig saw to finish off connecting rod. For easy handling, piece is worked while still attached to parent strip of sheet metal. After filing, cut rod free. Use same setup to file connecting-rod slots in pistons. Bearing block details are shown at right



switching to a boring tool for a finish diameter of $\frac{1}{2}$ in. Exact diameter isn't critical; the piston will be machined to fit.

Remount the block so the steam-chest punch is centered, and drill $1\frac{1}{4}$ in. deep with a $\frac{1}{4}$ -in drill. Transfer the work to the drillpress vise and with a No. 41 drill, bore into the side, passing through the steam chest and into the cylinder. Switch to a $\frac{1}{4}$ -in drill and enlarge the hole into the steam chest only, to provide a seat for the steam-inlet nipple. Machine this nipple from a $\frac{3}{4}$ -in. length of brass rod and insert it until it butts the far wall of the steam chest. Anchor it with 20-80 solder.

This solder is 20 percent tin and 80 percent lead, and melts at a temperature of 532 deg., F. Don't use ordinary 50-50 solder as it has a much lower melting point that can't withstand the heat of the engine block. You can't get 20-80 solder commercially, so make your own by melting together 1 oz. of 50-50 bar solder and $1\frac{1}{2}$ ozs. of lead (fishing sinkers are fine). Stir the molten mixture and pour it into a simple mold, such as a blind saw kerf in the face of a board. Later, when you sweat the steam line to the nipple, buy 40-60 solder to avoid the risk of melting.

Now, with a $\frac{17}{64}$ -in. drill, drill out the steam-chest bore, right through the soldered-in nipple, to the full $1\frac{1}{4}$ -in. depth. Since a drilled-out bore is far from perfect, you must finish it to size. A better method than reaming is to *lap* the bore.. First, machine from $\frac{3}{8}$ -in. drill rod a $1\frac{1}{2}$ -in. long cylinder that just fits—without looseness—to the full depth of the bore. Using the

drill press setup shown on the first page of this article, smear the rod with oil and dental pumice (available at drug stores) and run it up and down in the bore with the drill press set for 600-800 r.p.m. After a couple of minutes, replace this first rod with one machined a few thousandths larger—big enough to stick when you try to insert it in the bore. Apply oil and pumice as before, but lap *only* until the rod can be run down the full depth of the bore. Back off immediately and flush out the bore with kerosene or paint thinner. This final lapping rod is then made into the valve piston.

Valve Piston

Cut the rod to length and mount it in a three-jaw lathe chuck. Face the cut end and center-drill to within $\frac{3}{32}$ in. of the opposite end, to provide an exhaust passage. Machine the bottom to shape and hacksaw the connecting-rod slot. File this slot to an easy slip fit, then drill for the wrist pin, which can be a 3-penny finishing nail. Note that the slot aligns with the exhaust passage, forming its mouth.

With the rod in a drill press vise, drill into the side (at right angles to the slot) to connect with the center hole. This provides the port which will mate with the cylinder exhaust port when the valve piston is at the top of its stroke. Since the valve continues to rise slightly during this exhaust operation, you must elongate its exhaust port by drilling a second hole overlapping the first, but not deep enough to meet the core hole. Grind out metal between these holes to form the stepped recess shown at right.

Drive Piston

This is machined from $\frac{5}{8}$ -in. cold-rolled steel rod. To get a good fit (without resorting to a small hole gauge) requires slow, careful machining; toward the end, take the diameter down half a thousandth at a time. That's half the space between adjacent marks on the numbered crossfeed thimble. For top performance, the final fit should be so tight that the piston must be lapped into the bore.

Shape and slot the bottom as with the valve piston, then trim to the length shown in the detail and face the cut surface.

Connecting Rods

Lay out the drive-piston rod and the flat section of the valve-piston rod on $\frac{3}{8}$ -in.-wide strips of 16-ga. sheet metal. Rough-

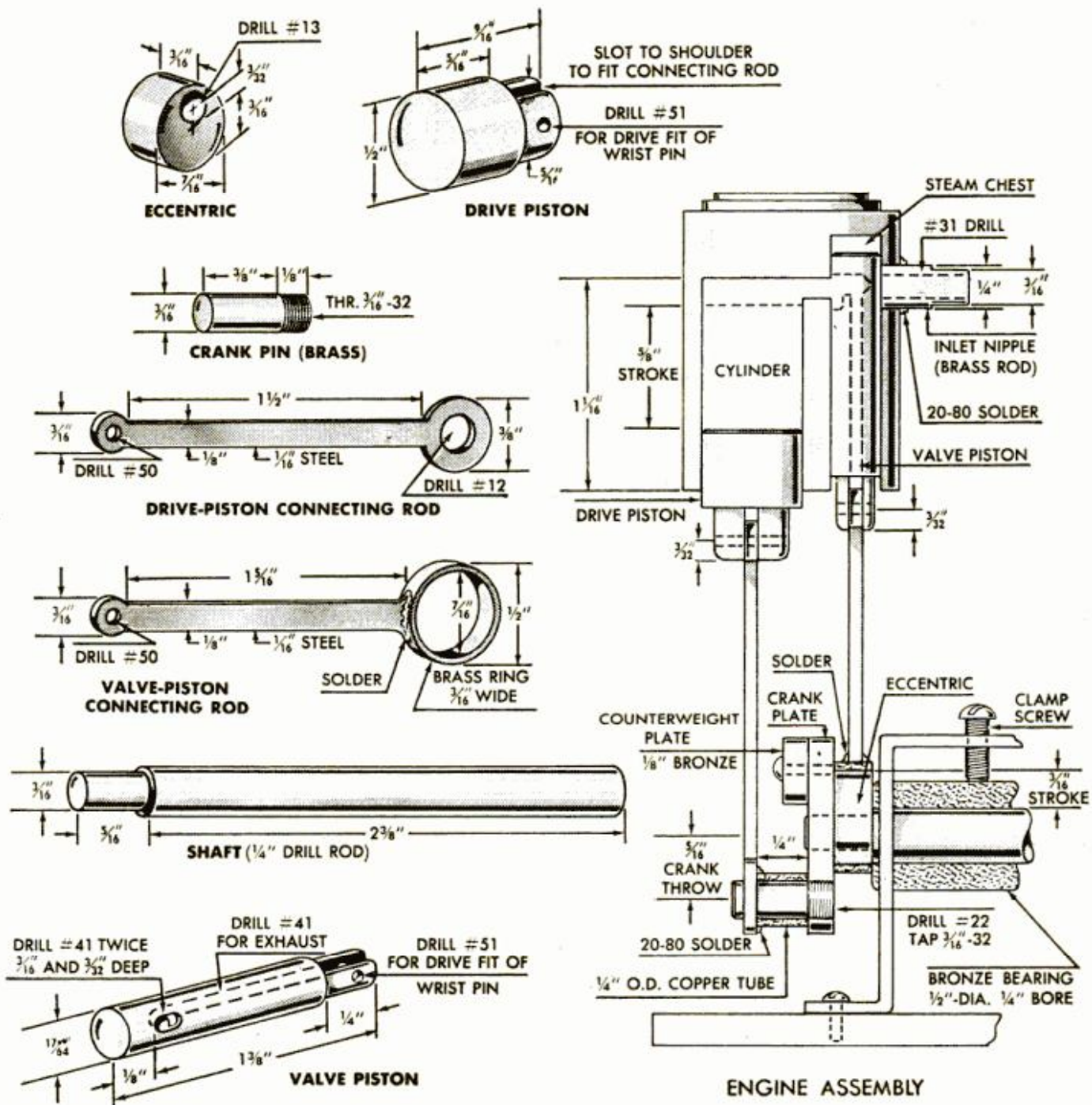
shape with a coarse file, then do final shaping with an ignition-point file chucked in a jigsaw. Smooth with emery followed by crocus cloth, and polish on a buffing wheel.

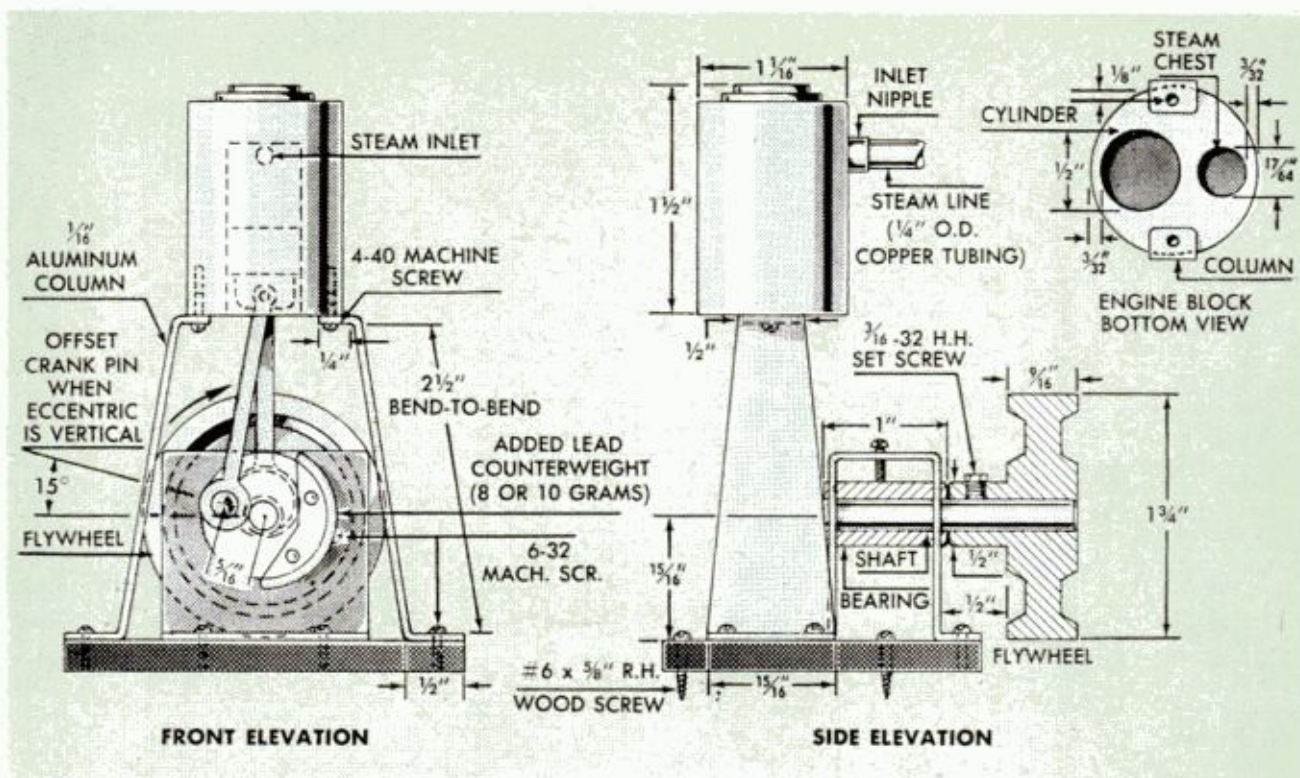
The brass eccentric ring for the valve rod is formed by hollowing out $\frac{1}{2}$ -in. brass rod, then cutting off a $\frac{3}{16}$ -in. width.

Crankshaft Assembly

To make the eccentric, machine the end of $\frac{1}{2}$ -in. drill rod, remove from the lathe and drill to accept the reduced end of the shaft. Then return to the lathe and cut the eccentric to width. It must be a smooth, sliding fit inside the valve rod's brass ring.

The crankplate is turned to a 1-in. dia. from the same bronze stock as the engine block, and cut off $\frac{1}{8}$ in. thick. Cut off a second disk, trim off a segment for the coun-





weights, and rivet this to the crankplate, filing the rivets flush with the rear surface.

Thread the brass crankpin tightly into the socket tapped near the opposite edge of the crankplate. This, too, should be filed flush at the back—after punching several points around the edge of the socket to prevent unscrewing. To provide for an additional counterweight, drill and tap the counter-weighted edge for a 6-32 screw.

Assemble the connecting rods to their respective pistons by cutting off the point of a 3-penny finishing nail and driving it through piston and rod; cut off the nail head close to the piston, and peen both ends. The rod should swing freely.

The main bearing can be made from oilite bearing stock, or can be purchased as a stock-size bearing. In either case, lap the shaft into an easy-turning fit.

Once the crankshaft assembly is complete, insert the two pistons into the engine block, and the shaft through its bearing. With the columns attached only to the underside of the engine block, position the feet on the base plate by trial, holding them down while turning the shaft to check piston function. Then tap for screws.

The engine at this initial-assembly stage is shown in the inset on the opening page. There is still an additional counterweight to add. For satisfactory operation, the counterweight on the crankplate of a vertical engine must balance the weight of the drive piston and connecting rod. The bronze segment so far added does little more than balance the weight of the crankpin. If possible, weigh the drive-piston assembly on a gram scale; the lead to be

added can weigh a gram or two less. Use sheet lead, or melt a fishing sinker and mold it in a saw kerf. Drill the lead strip at the center and attach it to the counterweight side of the crankplate with a single screw. Wrap it around, trim both ends slightly beyond the counterweight and clinch these ends around the bronze.

Engine Adjustment

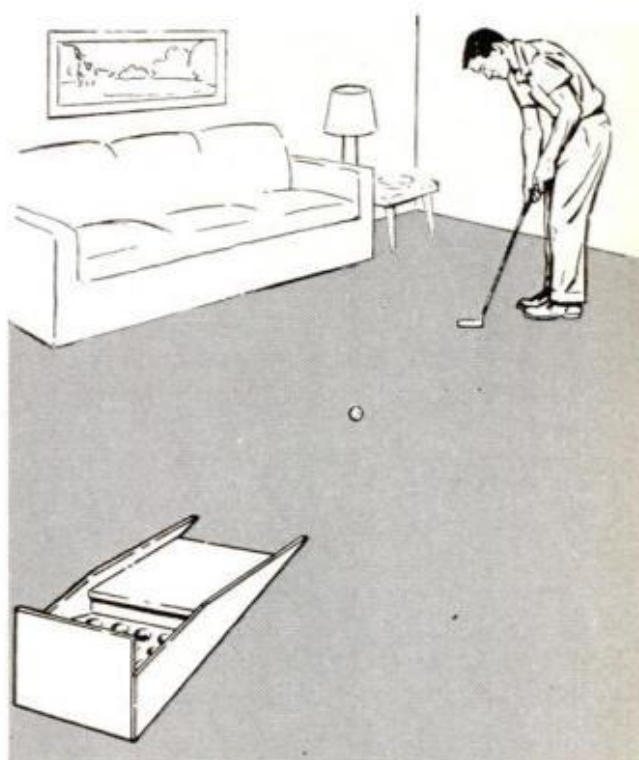
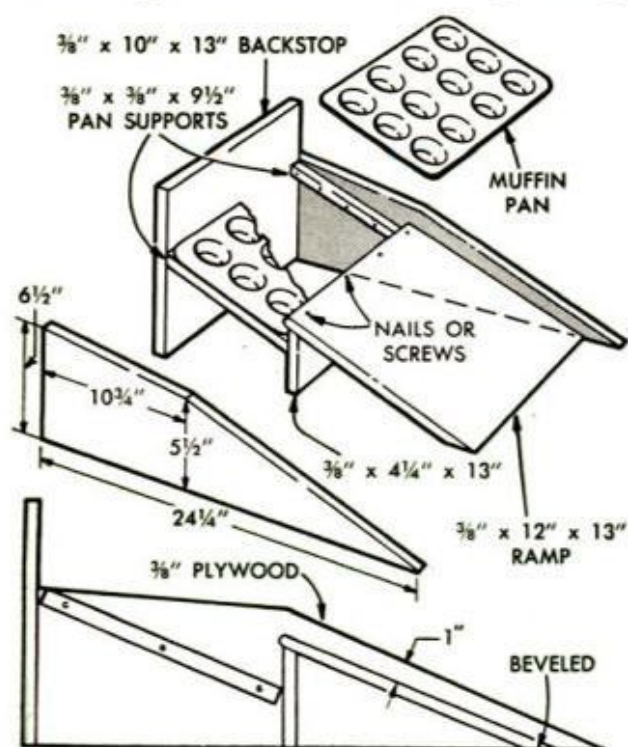
To keep the piston connecting rod riding straight on the crankpin, its lower end has a projecting sleeve. The nominal length of this is given (in the Engine Assembly drawing) as 1/4 in.—which does to start with. In the final assembly, file the free end of the sleeve to give the piston a smooth fit in its bore, without binding.

Use 50-50 solder to join the eccentric to the shaft; then grip the shaft vertically in a vise and push the crankplate on, adjusting the pin position to the 15 deg. offset shown in the front elevation. Apply a drop of 50-50 solder to sweat the plate to the shaft.

If any further adjustment of the valve and piston relationship is needed, it can best be determined by operating the engine. To adjust at this stage, you must melt the solder joint between shaft and crankplate, using the tiniest possible blowtorch flame, and shift the crankplate as required. (That's why high-temperature solder is used on the rod sleeve—to keep it from coming loose when the crankplate is heated.) Keep the eccentric straight up, so the valve is at the top of its stroke, while you tap the crankpin with a small screwdriver.

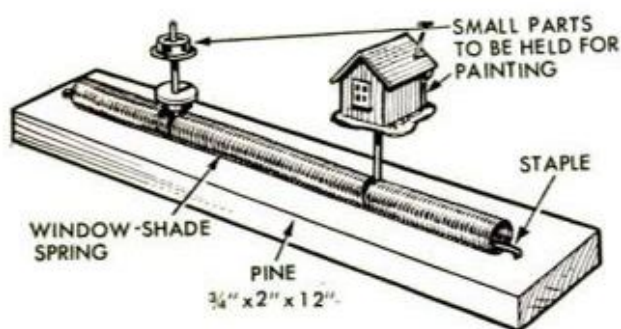
(Concluded next month)

Living-Room Putting Cup Makes You a Winter Pro



You can sharpen your putting eye through the winter and have fun at the same time with this muffin-pan golf game. Par for the hole can be any number of strokes you may decide, and to make par or under depends upon your putting skill (or sheer luck) since each cup of the pan is numbered. In putting the ball up the

ramp, it's anybody's guess into which cup it may fall. Lowest score among a twosome or foursome wins. The assembly detail shows how the affair is made. Cleats support the muffin pan at a slant 2 in. below the end of the ramp. The backstop, the cross brace and the ramp fit between the two side members.—*John Mihalick*



Holder for Small Parts

A coil spring, salvaged from a discarded window-shade roller and attached to a board with heavy staples, makes an ideal holder for small parts that are to be painted or held in readiness for assembly. The spring, which is usually about 8 in. long, should be extended slightly before attaching it to the board so it will be easy to insert the parts.—*H. A. Fluchere*



"Recaps" for Crutch Tips

Because of the slipping hazard when using crutches (or a cane) which have worn rubber tips, they should be replaced as soon as possible. However, until such time as new ones can be obtained, you can renew their grip by filing grooves crisscross in the smooth rubber. Like a tire tread, the V-grooves made by the file will form sharp edges which will grip a wet surface rather than slide over it. If a file isn't handy, suitable grooves can be cut in the rubber with a sharp knife, making the cuts at a 45-degree angle.—*Walter E. Burton*

Solving HOME PROBLEMS

1. REARRANGING furniture? Use an extension curtain rod to measure the front of that heavy desk or bookcase before moving it all the way across the room. The rod makes a clever measuring stick to be sure the piece will fit in its new location

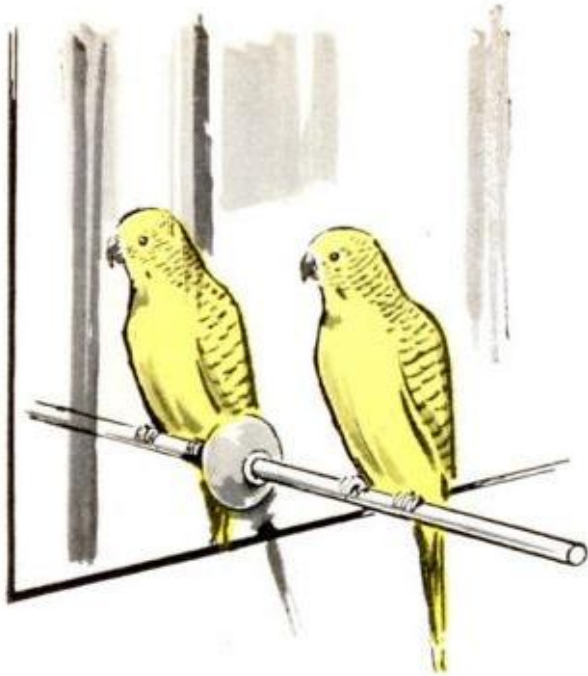


2. SQUEAKING floors are caused by loose boards rubbing against each other when stepped on, and the only permanent cure for this is tightening the boards. However, you can stop squeaks temporarily by lubricating with talcum powder



3. NOVEL TOY BOX can be made by cutting a section out of the side of a fiberboard drum and mounting the drum on two legs cut from 1 x 4s. Finish with at least two coats of enamel, and decorate with colorful nursery-rhyme decals

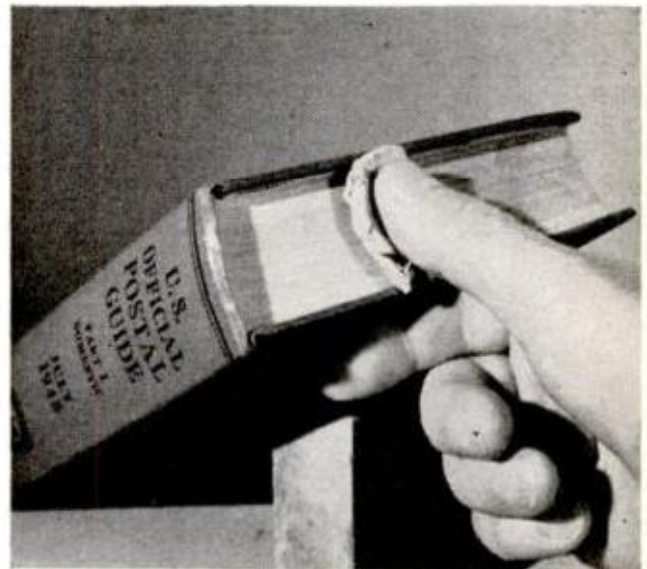




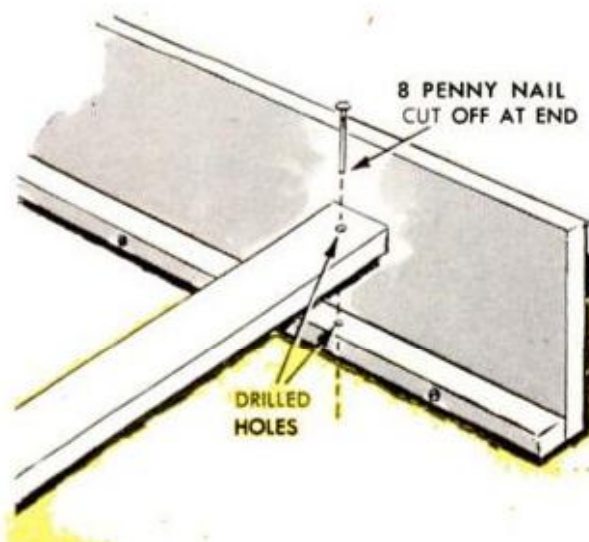
4. PARAKEETS tame enough to have the run of the house will appreciate a portable perch, and you'll find that a suction-cup dart from a child's target game makes an ideal perch. Stick it on a mirror, and your pet will spend hours admiring himself

5. MODELING CLAY is a perfect material for cleaning the soiled edges of seldom-used books. Simply press a lump of clay repeatedly over the same spot, kneading it frequently to present a fresh surface. Clean one small area at a time, and be careful not to rub

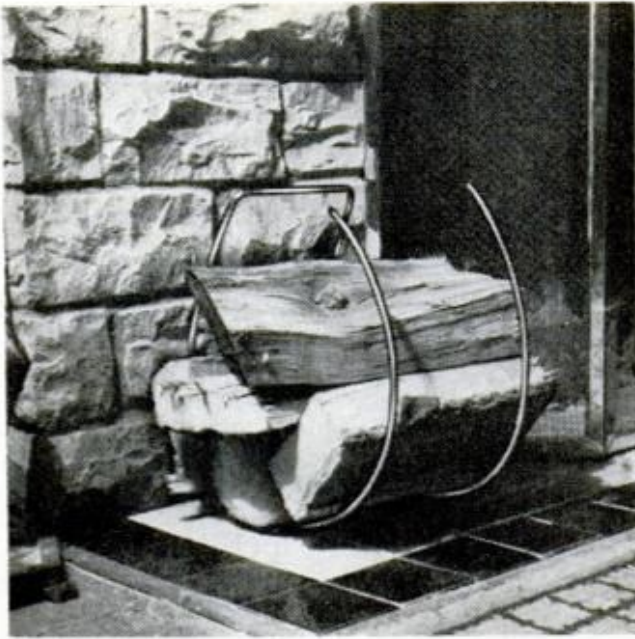
7. SOFT-DRINK CARTON makes a dandy shoeshine kit, complete with separate compartments for brushes, polish, cloths and daubers. It's easy to store, easy to carry and provides a safe place to put that open polish bottle where it won't tip over and spill



6. BED SLATS will often work into a diagonal position if the bed is moved often for cleaning, and if not straightened, they'll drop right out. To stop this shifting, drill an oversize hole through the end of each slat and into the rail cleat and drop in an 8d nail

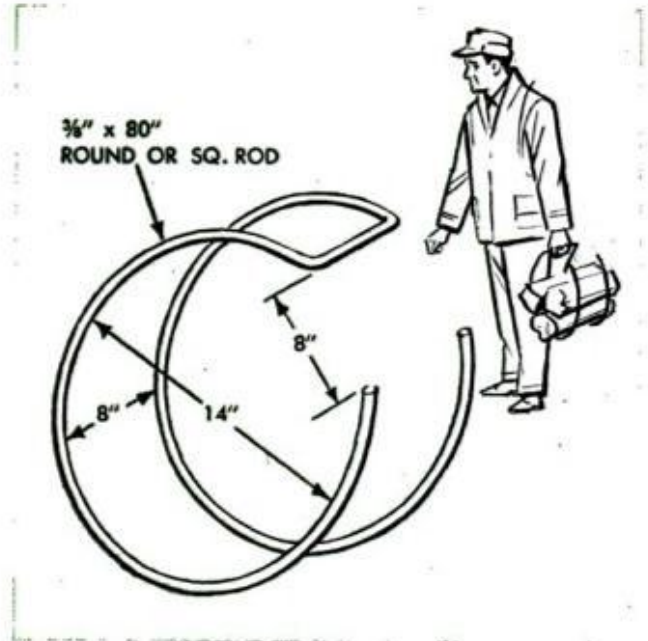


8. IF YOU CAN'T get a "plant-sitter" to water your house plants while you're away, just fill a large bottle with water, drop one end of a ½-in. strip of cloth in the bottle and bury the other end in the dirt. Capillary attraction will carry water to the plant

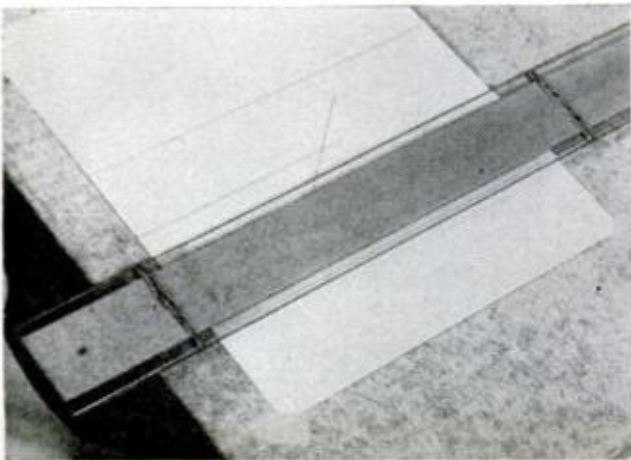


Log Carrier Doubles as Wood Rack at the Fireplace

Dirt and sawdust are more likely to be left at the woodpile instead of being carried into the house when you use this double-duty, sling-type log carrier which continues to serve as a "woodbox" at the fireplace. It is formed from an 8-ft. length of $\frac{3}{8}$ -in. cold-rolled steel rod. To make it, first measure 36 in. from each end of the rod

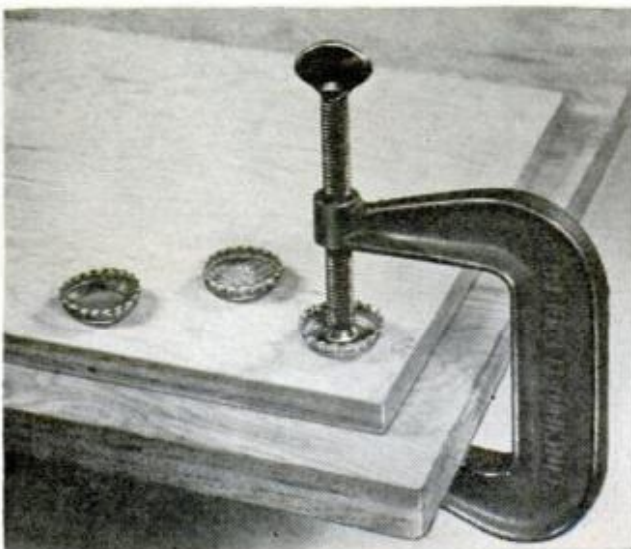


and make a right-angle bend at the two points to form a large 8-in. staple 36 in. long. Then form the legs of the staple in 14-in. open circles by bending and hammering the rod around a suitable round object, such as a barrel or the trunk of a tree. That's all there is to it. Give the rack a coat of flat-black paint.—G. Allen Burrows



Brakes for Your T-Square

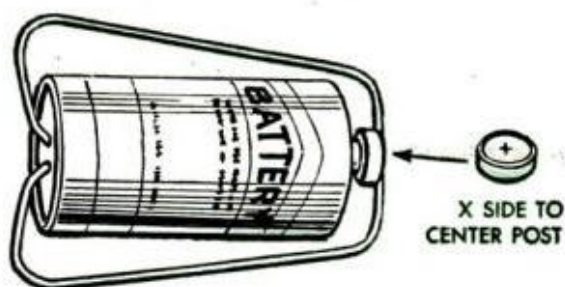
What's a good simple way to keep a T-square from sliding off an inclined drawing board? Wrap a couple of rubber bands around the blade. The rubber will grip the slanting board and make the T-square stay wherever you leave it. It's especially handy when ruling a series of parallel lines where the T-square is apt to slip unless held firmly. When working with a triangle the right-hand band can be moved out of the way toward the end of the blade where it will still grip the board.—Richard Hanscom



C-Clamp Pads for Free

You've had it happen. You loosened that C-clamp and there under the pad was a mark, or "print", on the surface of the work you had spent so much time sanding smooth. Why, you ask yourself, didn't I think to pad that clamp? Too late now, but remember this trick next time: Save several bottle caps, keep them handy to slip under the screw pads of C-clamps. The caps are smooth, have cork inserts and are just the right size to take the swiveling screw pad of most small C-clamps in an easy, inside fit. Using these bottle-cap pads, you can turn a C-clamp down hard on a finished surface without a mark.

Hearing-Aid Battery Charger Extends Cell Life



Owners of hearing-aids using mercury-cell batteries will welcome this "booster" which extends the life of the cells by as much as 75 percent, provided the cells are not allowed to become completely dead. Dead cells cannot be charged when the chemicals have dried out, but weak cells can be partially rejuvenated. There is no danger of damaging the hearing aid with this booster, as the voltages of the mercury cell and the booster are equal. The booster merely drains current from a high-capacity flashlight cell into the smaller mercury cell.

Purchase an ordinary flashlight cell, size "D" No. 950 or its equal, and make a wire holder, as shown in the drawing. Use brass or bronze wire or $\frac{3}{32}$ -in. brazing rod. Adjust the wire legs of the holder so a mercury cell will fit snugly between the wire and the center (positive) post of the flashlight cell. The mercury cells have a number and an "X" on one side and it is important to insert the cell so that the "X" side is in contact with the center post. If your mercury cell is not marked, try one side on the post at a time until you can determine which side takes the charge. Mercury cells 312, 400, 520, 625, 630 and 675, as well as



others, can all be recharged by this method.

For best results, start with a new flashlight cell and two new mercury cells. Use one cell in the hearing aid for one day only. Remove it and apply the booster for four hours while you wear the second cell. If you alternately change and use the cells every other day, they will last about two months, by which time the flashlight cell will also have to be replaced. Should you notice a slight hum or whistle after charging and can't tune it out with the volume control of the hearing aid, just put the cell aside for a few hours before using it again and the objectionable noise will in most cases disappear.—Phillip Wilson

Damp Sand Lets You Break Clay Tile Right to the Line

If you score clay tile, such as drain tiles, sump tiles and chimney liners, with a chisel and then tap along the score you may, with luck, get a fairly good break, and then again maybe not. The sure way is to fill the tile with damp sand, packed tightly. Then place in a tub or other container filled with sand as pictured and chalk-mark the point where you want the break. Pack sand around the end of the tile almost up to the chalk mark. Then score the tile along the line with the chisel. Tap lightly along the score until the tile breaks all the way around. By using this method you can cut, or break, tiles square across or at any angle up to 30 deg. or so without shattering. You can also cut openings in flue tile.—Ralph S. Wilkes





HERE COMES THE SNOW BOAT

By Ron Anderson

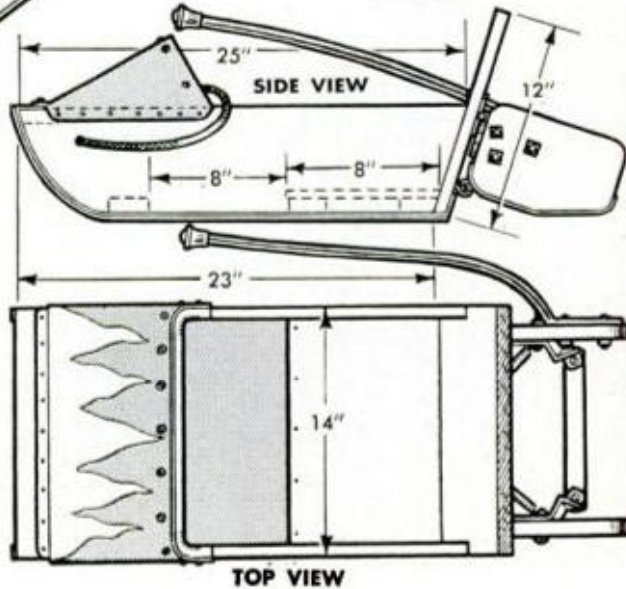
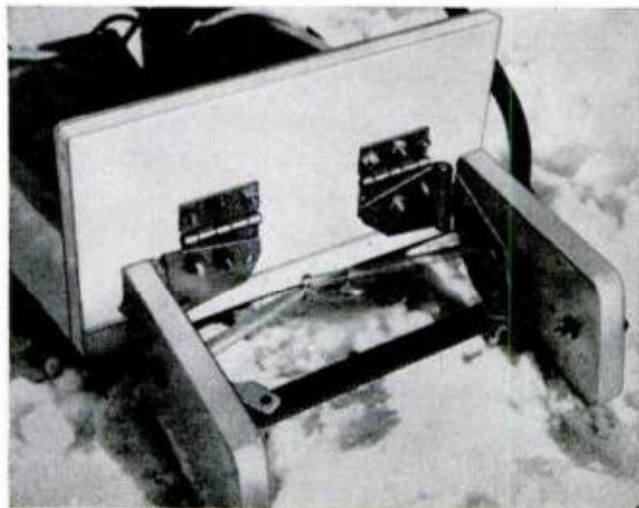
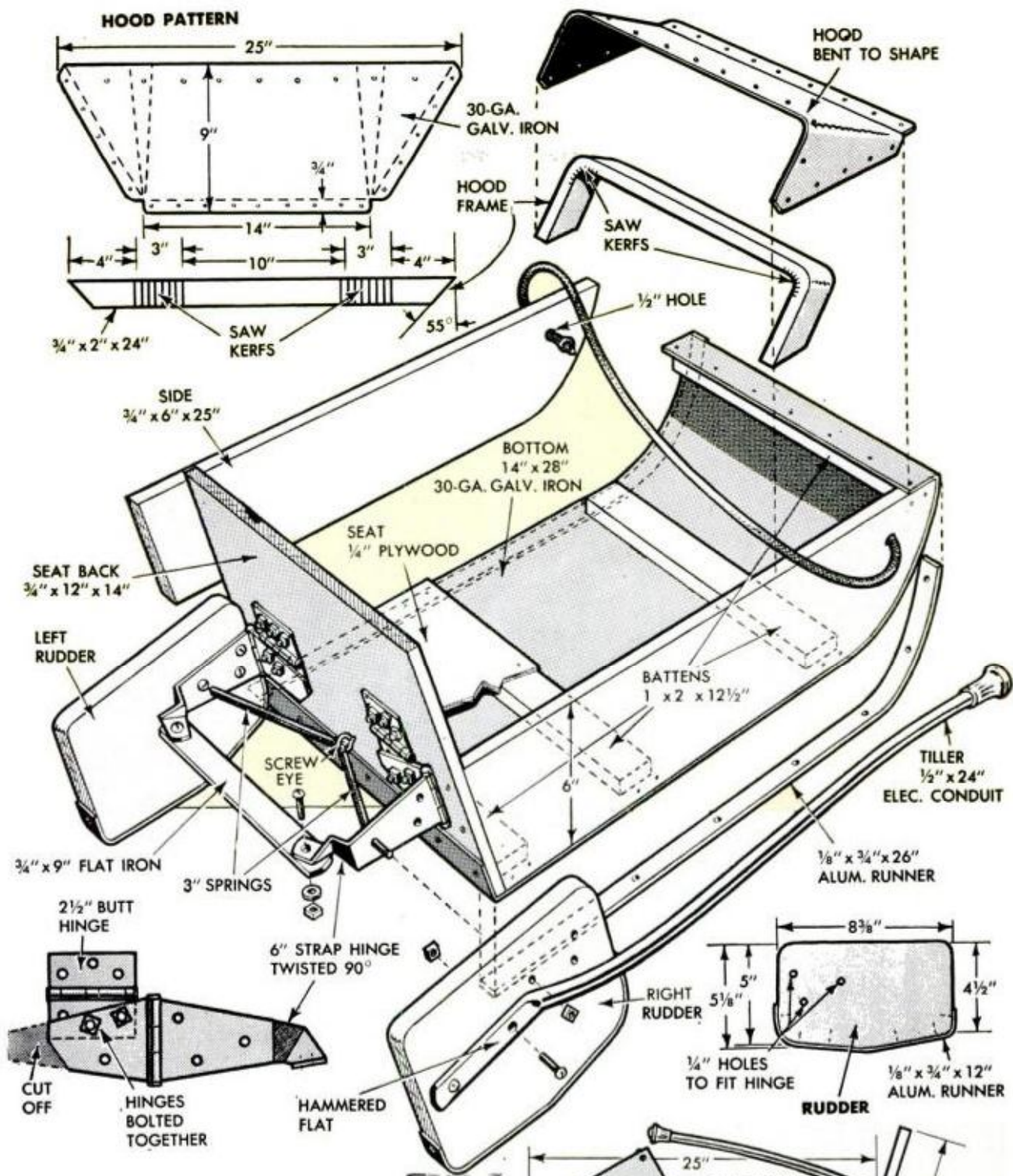
SMALL AND LIGHT enough for small fry to pull up a snow-covered hill, this steerable toboggan-like sled will provide them with thrilling rides in deep or packed snow. With its twin rudders and tiller it is truly a "snow boat."

Start by cutting out the sides of the body. The four 1 x 2 cross battens are installed between the sides at the points indicated, using flat-headed nails. The seat is simply an 8 x 12½-in. piece of ¼-in. plywood nailed in place to the two rear cross battens. The seat back measures ¾ x 12 x 14 in. in size and is glued and nailed to ends of the side members. The bottom is covered with a sheet of 30-ga. galvanized steel, bent sharply at the ends to fit over the body, front and back, and nailed in place. Strips of ⅛ x ¾-in. aluminum, fastened with flat-head wood screws in countersunk holes, cover the nail heads in the sheet metal and serve as keel-runners to keep the sled on course over the snow.

The short hood is supported by a frame made of a 24-in. length of ¾ x 2-in. pine. Bend the frame to shape after making a series of saw cuts at the points indicated and soaking in hot water. When the wood is dry fill in the saw kerfs with wood putty before nailing and gluing the frame to the body. Add the hood itself, cutting and bending it according to the pattern from 30-ga. galvanized sheet metal. The icicle effect on the hood is created by using white enamel paint, together with a masking tape pattern.

The most interesting feature of the snow boat is its twin-rudder steering mechanism which does double duty as a stabilizer for the small craft. Cut to the shape and size indicated, the two rudders are made of ¾-in. pine. Strips of ⅛-in. aluminum are attached to the bottom edges of the rudders with countersunk wood screws. The aluminum strips not only strengthen the rudders but also serve as runners. The rudders are mounted on 6-in. strap hinges which, in turn, are bolted to a pair of 2½-in. butt hinges screwed to the back of the seat. This dual mounting provides both lateral and up-and-down action of the rudders so that they remain in firm contact with the snow under all terrain conditions. Note that the ends of the strap hinges are given a 90-deg. twist and then linked together with a piece of flat iron. A pair of 3-in. springs hooked to a large screw eye near the bottom of the seat back maintains a constant downward pull to keep the twin rudders in contact with the snow.

The tiller is a 2-ft. length of ½-in. thin-walled electrical conduit, flattened and bolted to the right rudder, then bent to clear the seat back. A rubber crutch tip or bicycle handbar grip can be added. After thorough sanding to remove any rough edges, give your snow boat a coat of primer followed by one or two coats of durable high-gloss enamel. Do not paint the bottom. The seat and back can be fitted with a padded cushion. ★ ★ ★

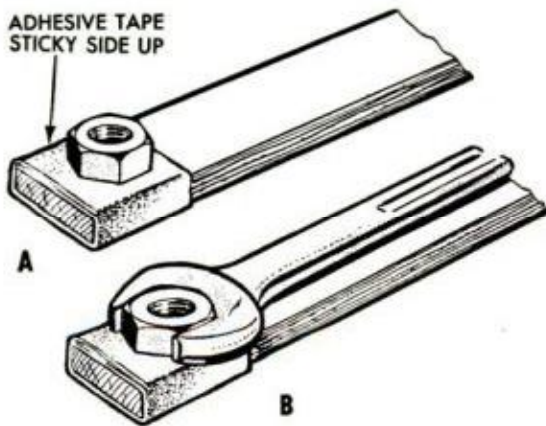




3-2-1 Blast Off

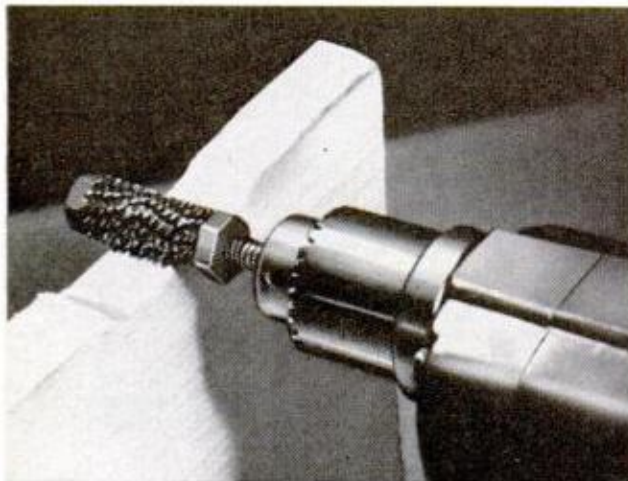
Young astronauts can be first to the moon with this toy rocket launcher which is powered by carbon-dioxide gas. Count down begins when drops of vinegar are added to baking soda placed in a plastic medicine bottle. To make it, drill two holes in a tight-fitting cork, one straight through to take an eye-dropper and the other at a slight angle for a 1/8-in. plastic launching tube. The rocket is just two pieces of balsa. Fill the bottle 1/4 full of baking soda, place the rocket in the launching tube, fill the eyedropper with vinegar and squeeze it slightly. Carbon-dioxide gas produced will send rocket streaking into "orbit." Bottle cork is a safety valve.—*T. F. Brinkman, Jr.*

ADHESIVE TAPE
STICKY SIDE UP



Nut Starter for Tight Spots

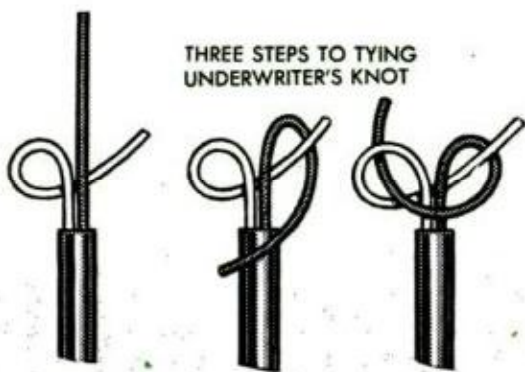
How many times have you had the frustrating experience of trying to start a nut on a bolt located in a spot where there wasn't room to use your fingers? The next time you run into this problem wrap a piece of adhesive tape around the end of a thin length of wood with the sticky side out and press the nut into the adhesive. If the threads of the bolt are nicked, making it difficult to start the nut, you can use a flat wrench with the starter, as shown in the drawing at left.—*R. L. Sargisson*



Rotary Wood Rasp

A rotary rasp really takes off the wood in a hurry. Lacking a factory-made rasp you can make a serviceable substitute from some steel external lock washers, a 5/16-in. machine bolt 4 in. long and some 7/16-in. o. d. flat washers. Load the bolt with the lock washers, placing a flat washer between every two lock washers. Then compress the combination of washers on the bolt by adding a nut and tightening it securely. File down the bolt so it fits your 1/4-in. drill chuck.—*R. Micals.*

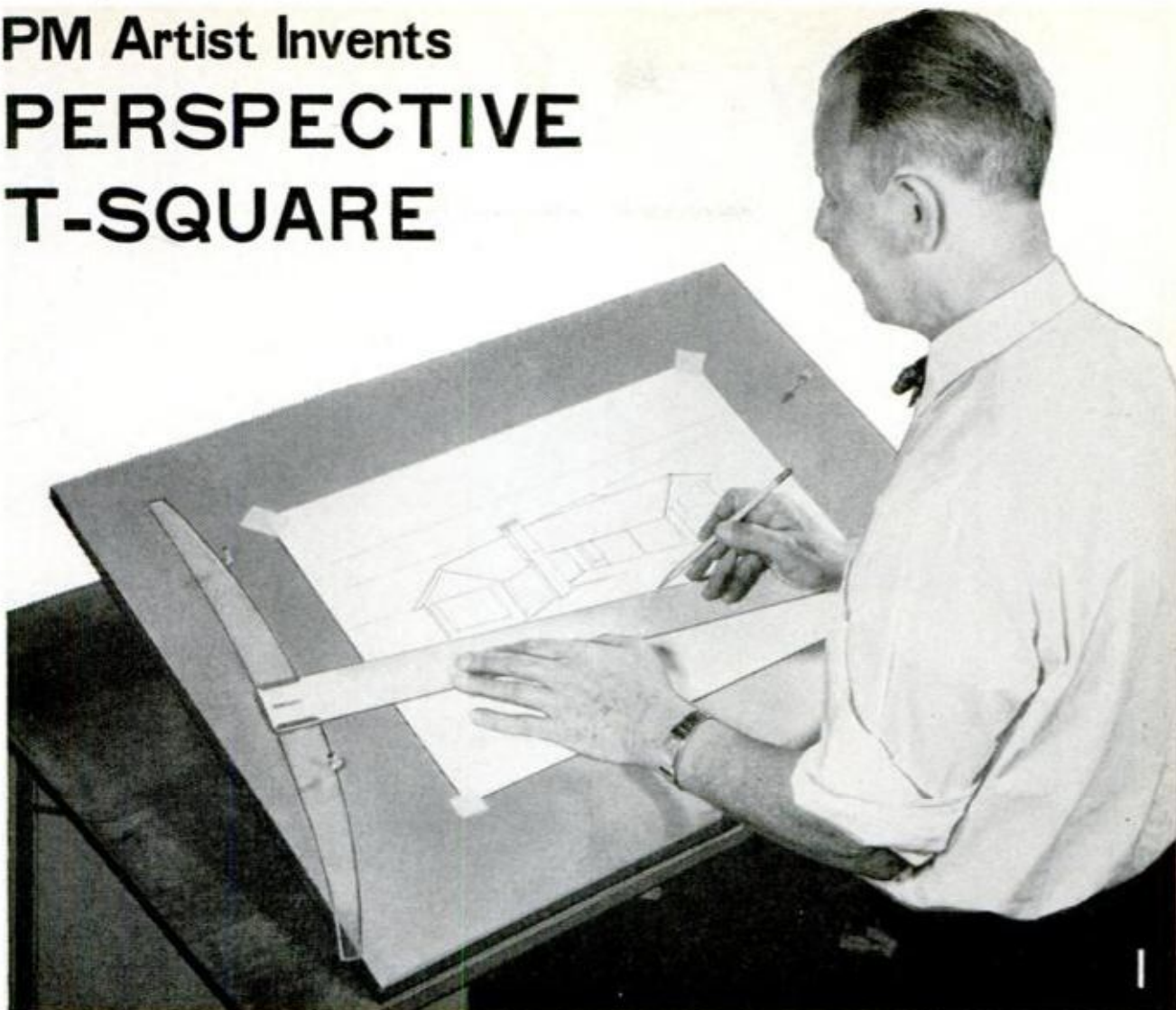
THREE STEPS TO TYING
UNDERWRITER'S KNOT



Guide for Underwriter's Knot

Most homeowners who only occasionally do electrical work find it difficult to remember exactly how the Underwriter's knot should be tied. Since this knot should be used on all connections (plugs, sockets, etc.), it's a good idea to make a small chart showing the procedure. Even better, mount three lengths of wire on a piece of cardboard and use as a reference in following the three basic steps involved in tying this common knot.—*Harry Hanscom*

PM Artist Invents PERSPECTIVE T-SQUARE

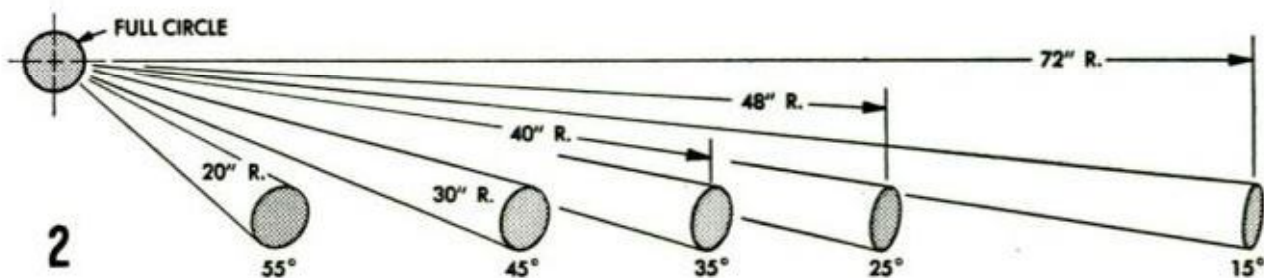


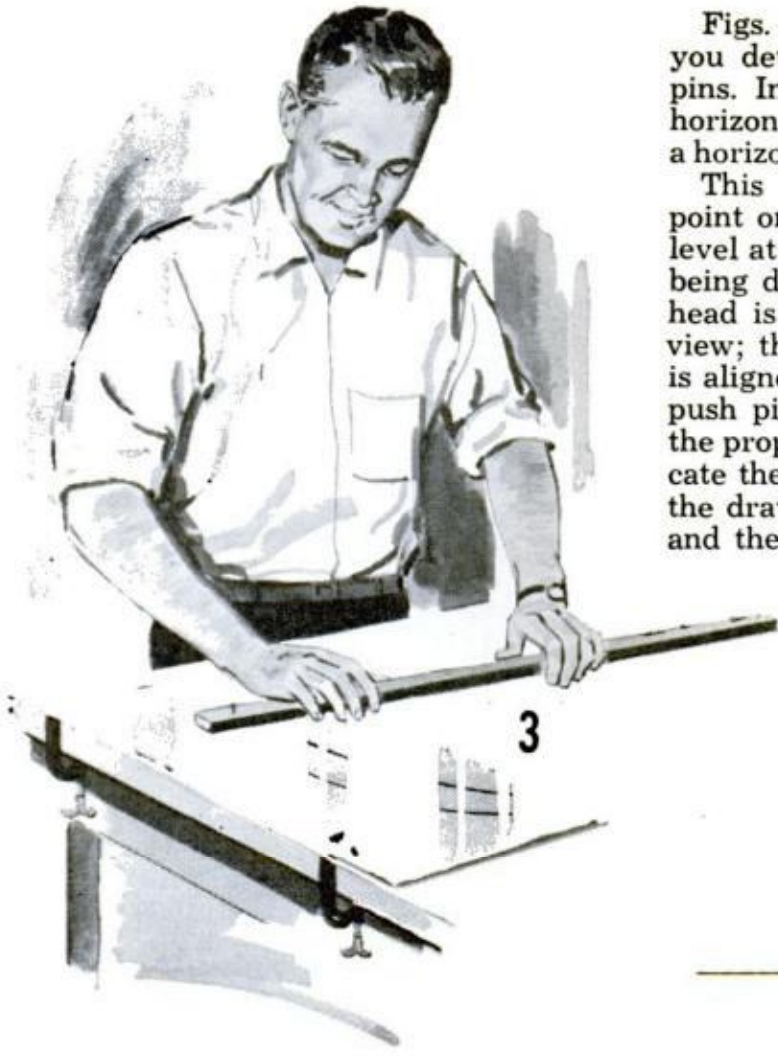
THE IMPRACTICALITY of working from vanishing points some six feet beyond the edges of the board has led many artists to make perspective drawings by eye, and while some have become good at it, the eye method is not an accurate method. But now, thanks to a curved-head T-square, off-the-board vanishing points can be brought to within the convenient working surface of the average-size drawing board, making third-dimensional perspective drawing as easy as can be.

This simple answer to perspective drawing was developed by Arthur Bargquist, veteran PM artist, who for years used this unique T-square in making the many excellent perspective drawings you have seen in our shop and craft pages.

This perspective T-square differs from a regular T-square in that it has interchangeable curved heads, each head having two radii for making drawings at different angles and at different planes. As shown in Fig. 1, the curved head rides against two guide pins which are placed on each side of the drawing. The side of the curved head on which the pins are located is determined by the particular angle you have selected to make your drawing.

Fig. 2 shows how angle of view decreases as distance from vanishing point increases. Hence the radius of the curved head is selected accordingly; with the two interchangeable heads detailed in Fig. 6, you have a choice of four different radii—30, 40, 48 and 72 in.—with which to work.

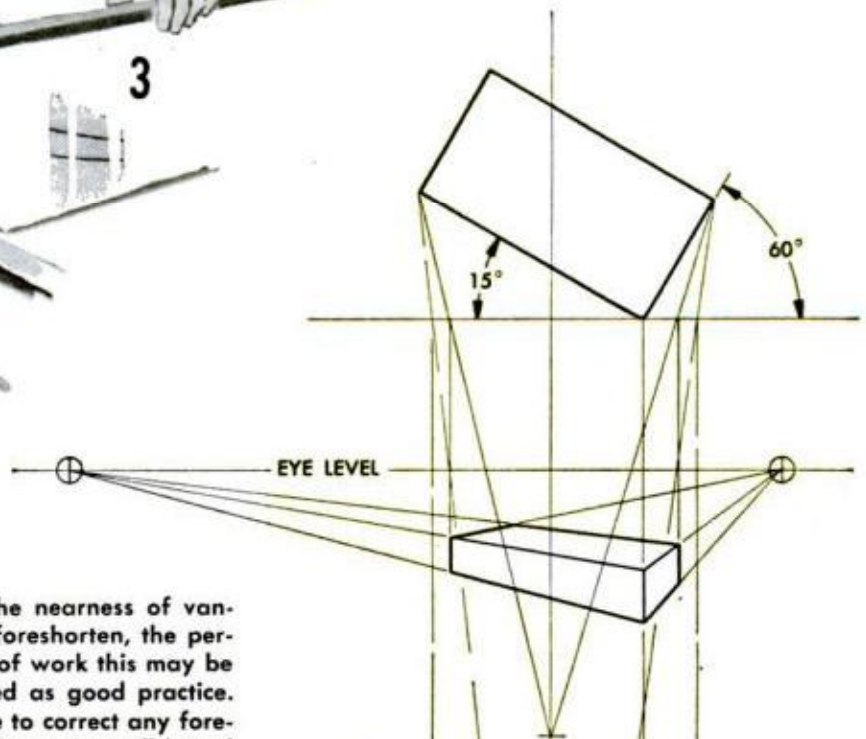




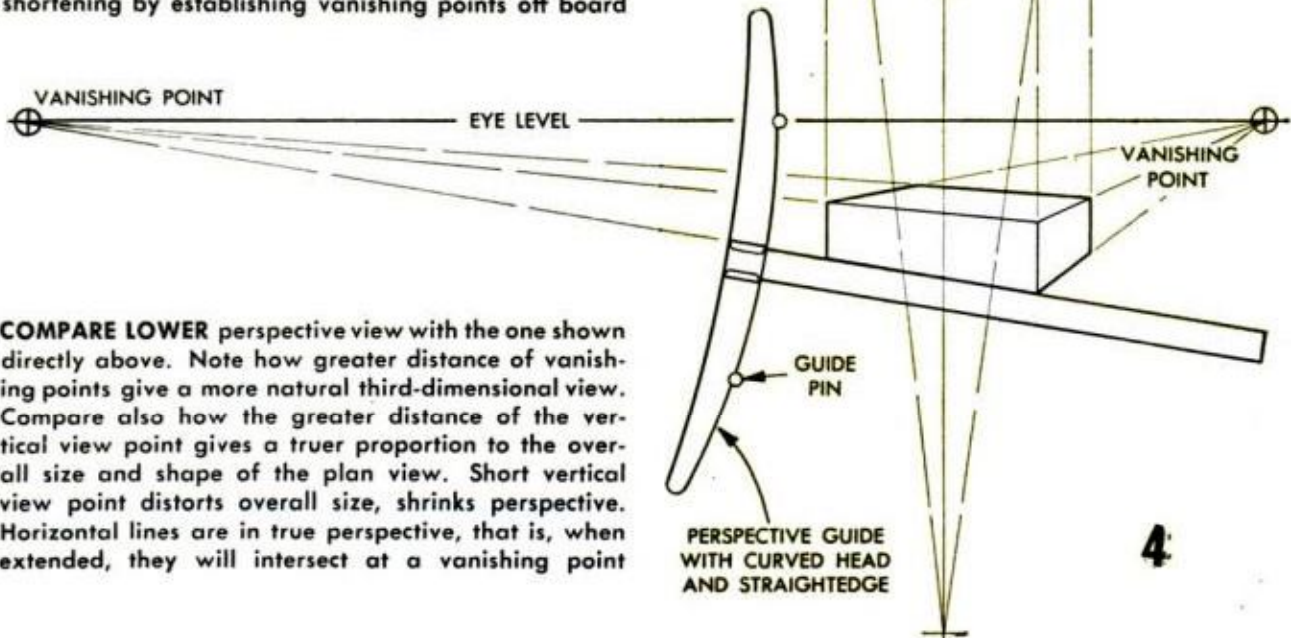
Figs. 4 and 5 give two examples of how you determine the location of the guide pins. In both examples, an eye level, or horizon line, is established first by drawing a horizontal line across the drawing.

This is an arbitrary line drawn at a point on the drawing which suits the eye level at which you want to view the object being drawn. The selection of the curved head is made consistent with the desired view; the beam of the perspective T-square is aligned with the eye-level line, and two push pins are stuck in the board against the proper edge of the curved head. To locate the guide pins on the opposite side of the drawing, the T-square is flopped over and the step repeated. From here correct

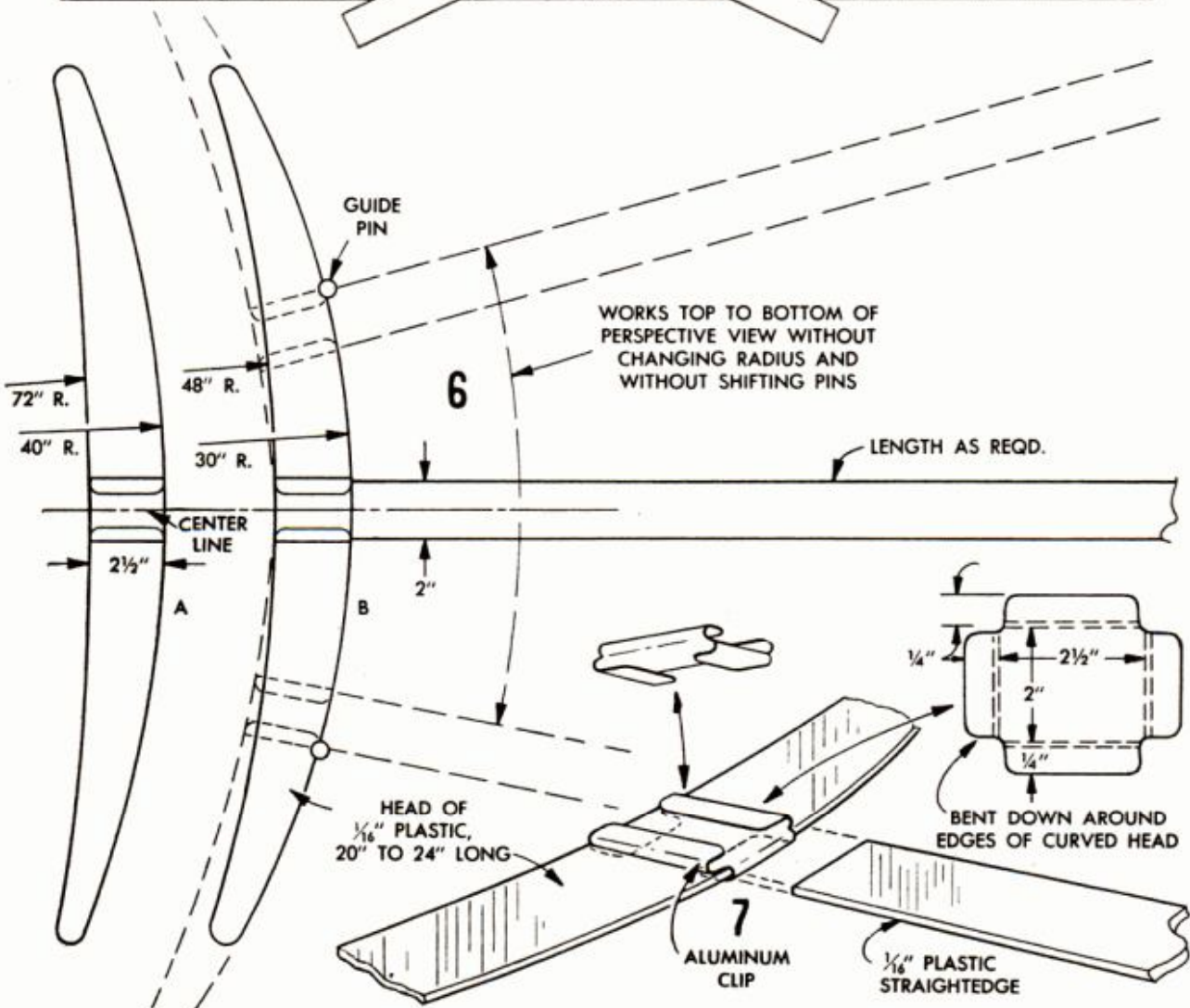
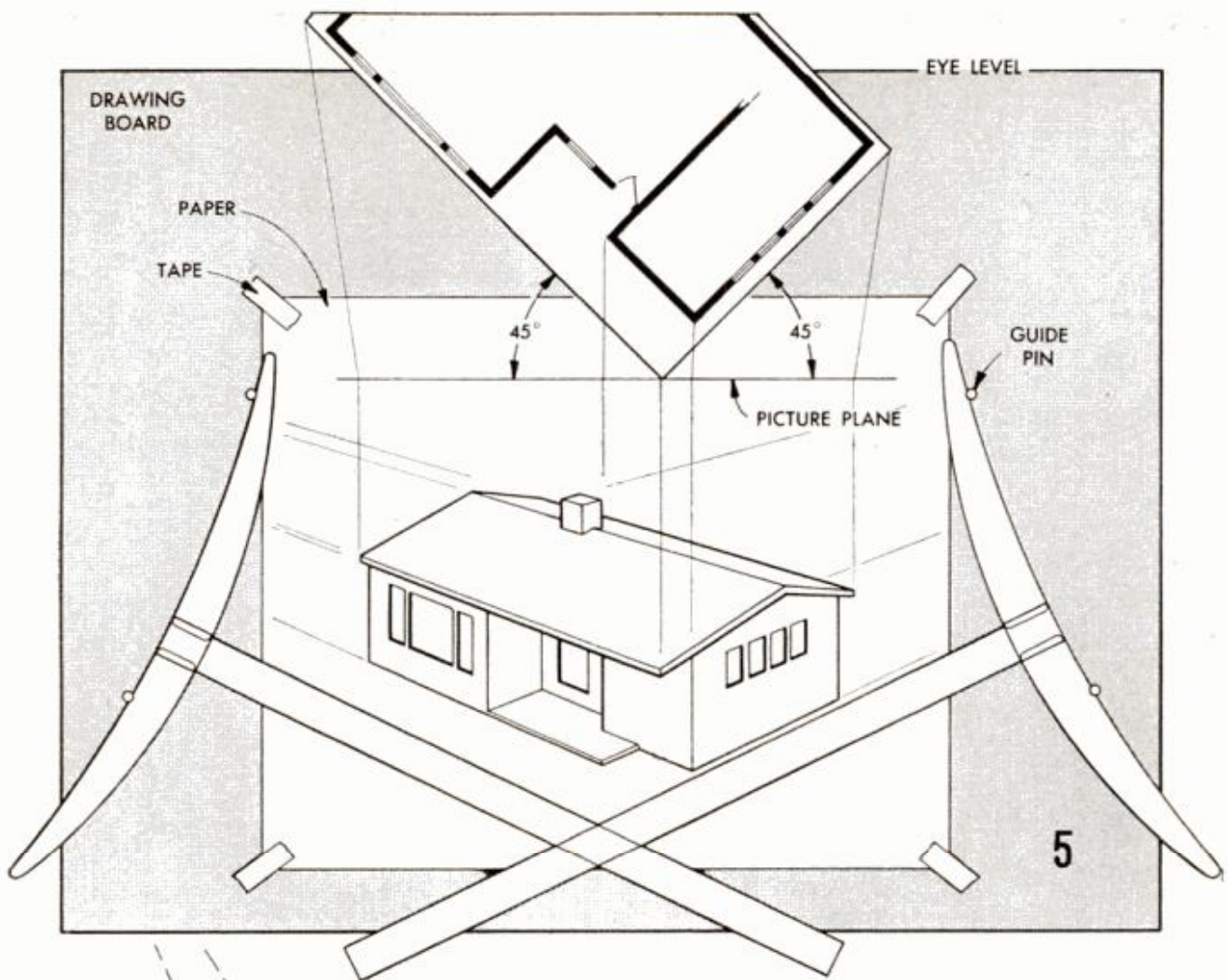
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NOTE IN DETAIL at right how the nearness of vanishing points tends to distort, or foreshorten, the perspective drawing. In some types of work this may be permissible, but it is not regarded as good practice. Special T-square makes it possible to correct any foreshortening by establishing vanishing points off board

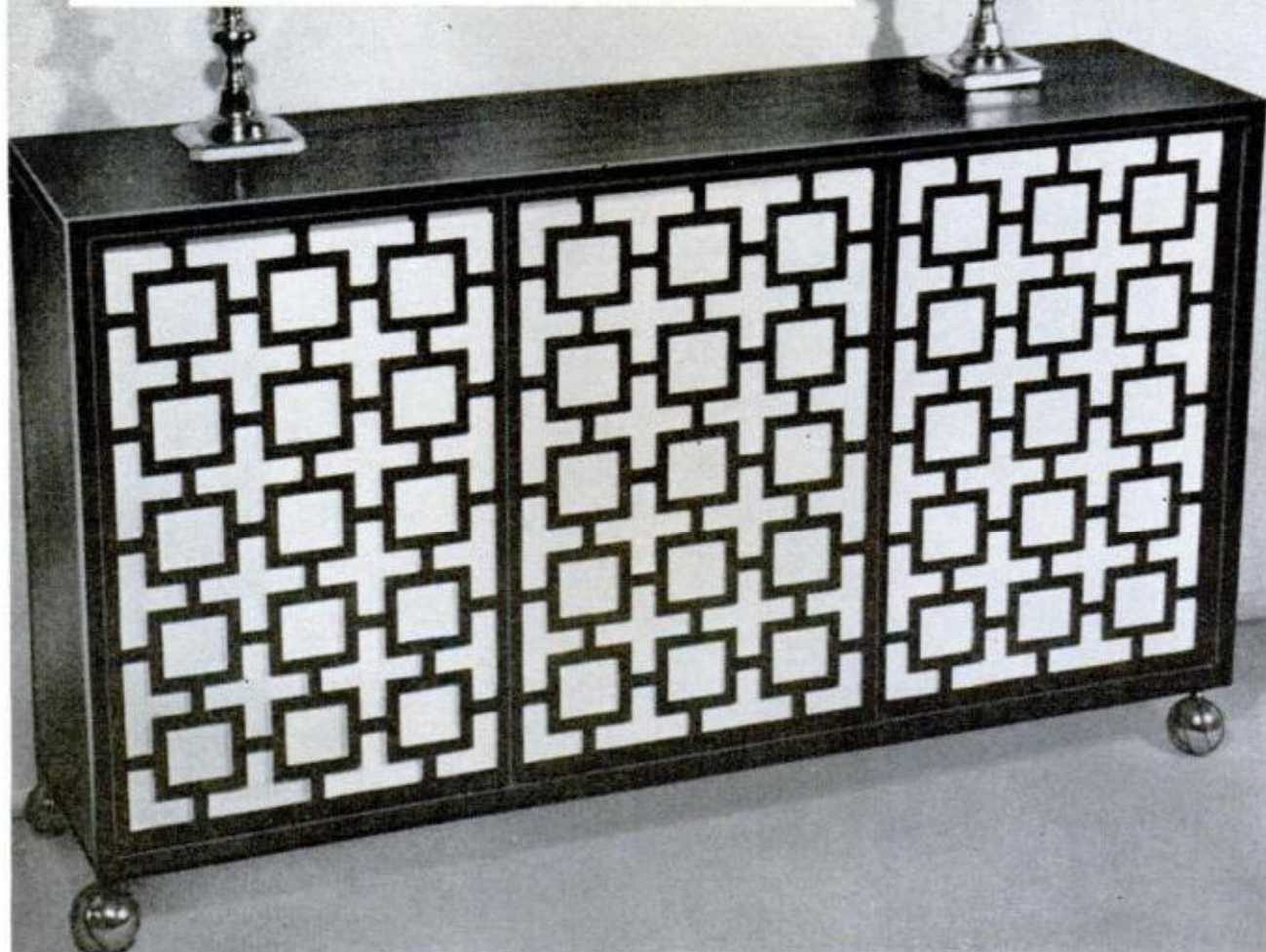


COMPARE LOWER perspective view with the one shown directly above. Note how greater distance of vanishing points give a more natural third-dimensional view. Compare also how the greater distance of the vertical view point gives a truer proportion to the overall size and shape of the plan view. Short vertical view point distorts overall size, shrinks perspective. Horizontal lines are in true perspective, that is, when extended, they will intersect at a vanishing point



GRILLE-DOOR CABINET

By Geo. Daniels



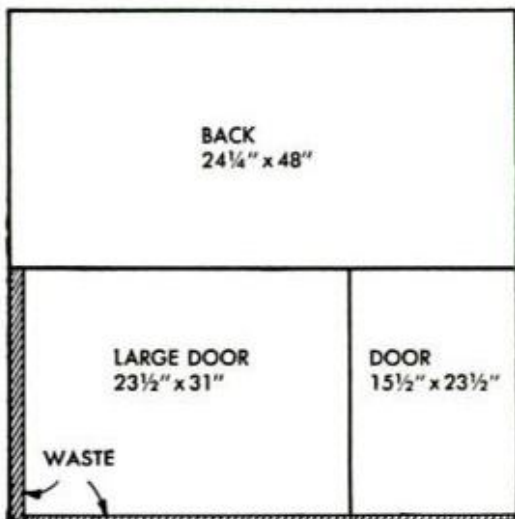
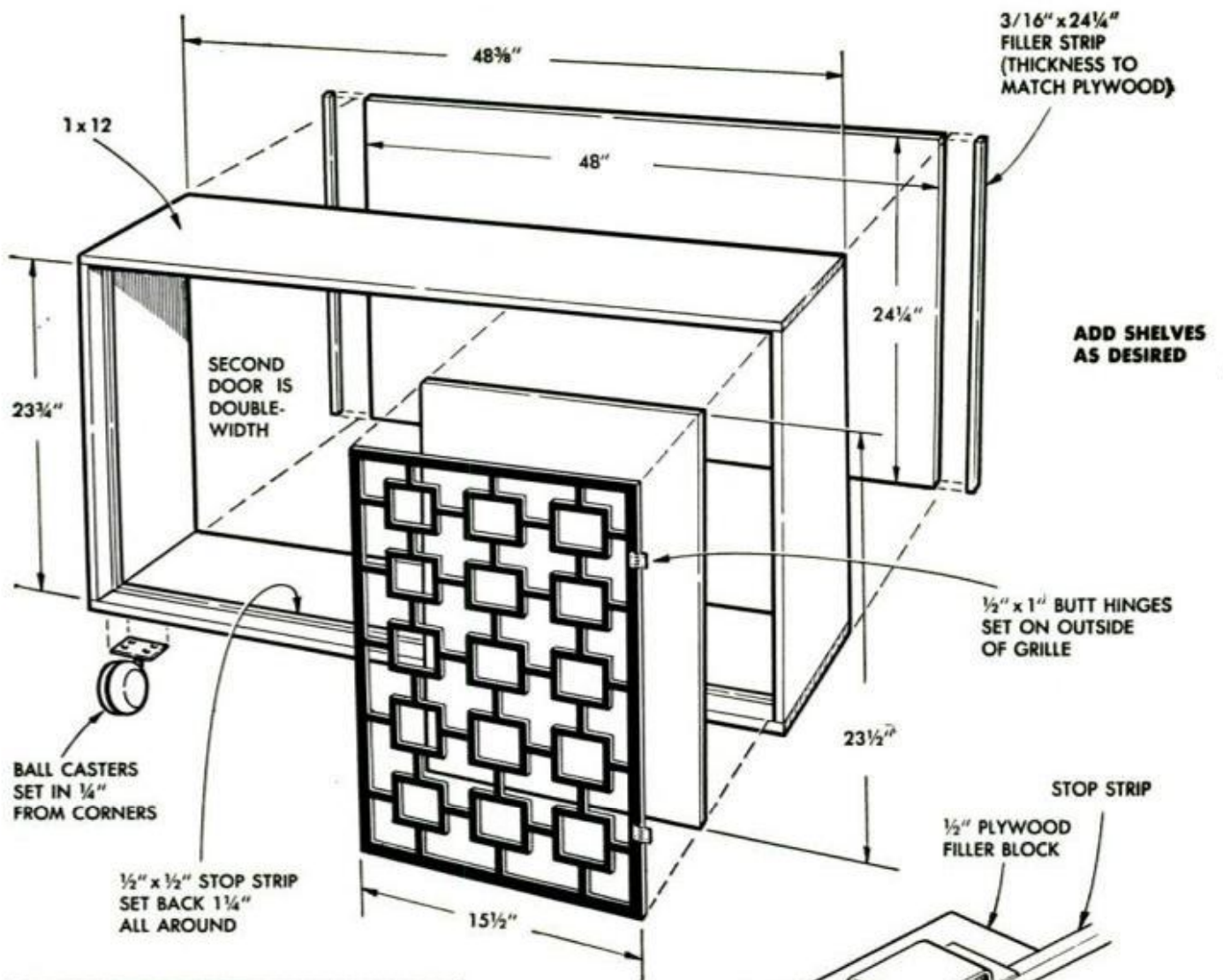
THIS CLEAN-LINED modern buffet is a striking example of the styling miracles you can perform by adding a few unusual "extras" to a common project. Basically just a simple box-type cabinet made from inexpensive materials, the addition of ball casters and three low-cost, die-cut plywood door grilles to the buffet transforms it into a smart decorator's piece.

Though the $\frac{1}{8}$ -in. plywood grilles are available in a number of sizes and designs, a $15\frac{1}{2} \times 23\frac{1}{2}$ -in. panel in a square pattern was chosen because it would yield the desired proportions and seemed best suited to the straight lines of the piece. Since the total grille area determines the overall size of the cabinet, and in turn the amount of $\frac{3}{8}$ -in. plywood required for the doors and back, the use of three grilles of this size allows you to cut these pieces from a half sheet of plywood leaving almost no waste.

If you wish to make the shelves deeper, substitute $\frac{3}{4}$ -in. plywood for the 1 x 12 pine.

To make the unit as illustrated in the drawing on the opposite page, begin by cutting the 1 x 12 top, bottom and side pieces to the lengths indicated. Then assemble these, using six countersunk 8d. finishing nails at each corner, Fig. 1. These nails, plus the added rigidity supplied by the back panel, will be sufficient to hold the cabinet in square under normal conditions of use. However, if it must support especially heavy loads (large plants on top, a great deal of china inside, hi-fi equipment, etc.), you might add further reinforcement by installing corner irons or cleats at the corners on the inside.

Next, cut the doors and back from half of a 4 x 8-ft. sheet of $\frac{3}{8}$ -in. plywood, following the cutting diagram on the opposite page. You will note that the back panel is



CUTTING DIAGRAM for the back and both doors of the cabinet fits these three large pieces into a 4 x 4-ft. panel

ARRANGEMENT OF DOORS and shelf of buffet shown at right is just one of many possible plans, the only limitation being the dimensions of the grilles. You might wish to design the interior as an equipment cabinet for your stereo set. If so, extra shelves would be needed and should be strongly braced. With deeper sides, this cabinet would be fine for records



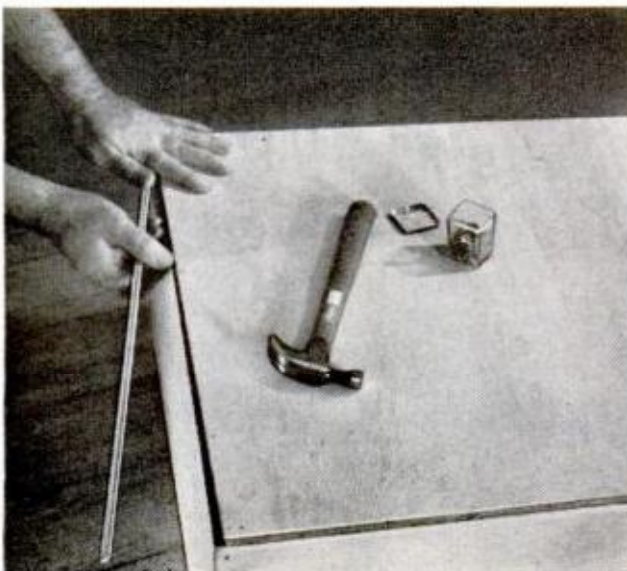


1. SIX FINISHING NAILS at each corner will provide a joint of sufficient strength for this cabinet, provided you don't plan to use it for heavy storage



2. TO SEAL END GRAIN, try applying a thin coat of cellulose cement with a spatula, then scraping off excess. It dries in a hurry and is a real timesaver

3. USE BRADS to mount the two 3/16-in. filler strips on the rear corners. These are required to bring the corners of the rear panel out square with the sides



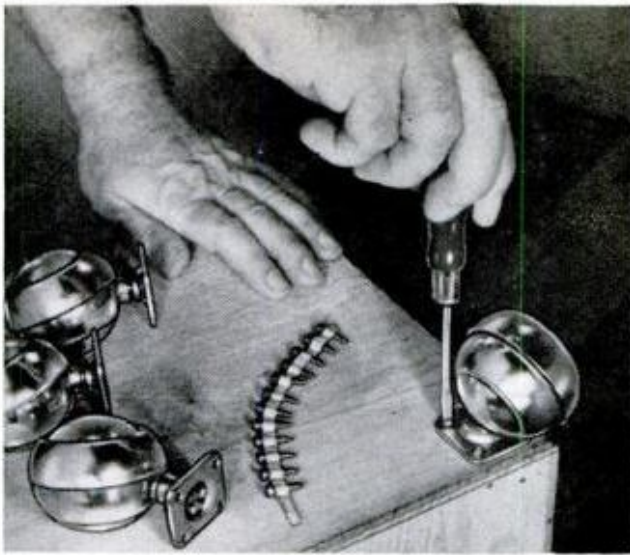
only 48 in. long, while the outside length of the cabinet must be 48 $\frac{3}{8}$ in. in order to provide clearance for the doors, so it will be necessary to add a $\frac{3}{16}$ -in. filler strip to the back panel at each rear corner, Fig. 3. Fasten the back panel to the top, sides and bottom with 1-in. No. 16 wire nails, mounting it with the factory-cut edge at the top so that you can use the plywood corners as a guide to square up the cabinet. After adding the $\frac{3}{16}$ -in. filler strips at either end, attach the $\frac{1}{2}$ x $\frac{1}{2}$ -in. stop strips just inside the front of the cabinet, setting them back $1\frac{1}{4}$ in. from the edge. This completes the cabinet assembly.

Before mounting the $\frac{1}{8}$ -in. plywood grilles on the door panels, you'll have to remove the cut-out sections since these will still be in place when you purchase the grilles. The side from which the die entered is the one which will be exposed, so punch out the scraps from this side to assure that any splintering will occur on the concealed rear surface, Fig. 5. You'll find that these sections will come out easily if you start at a corner and press firmly just inside the cut.

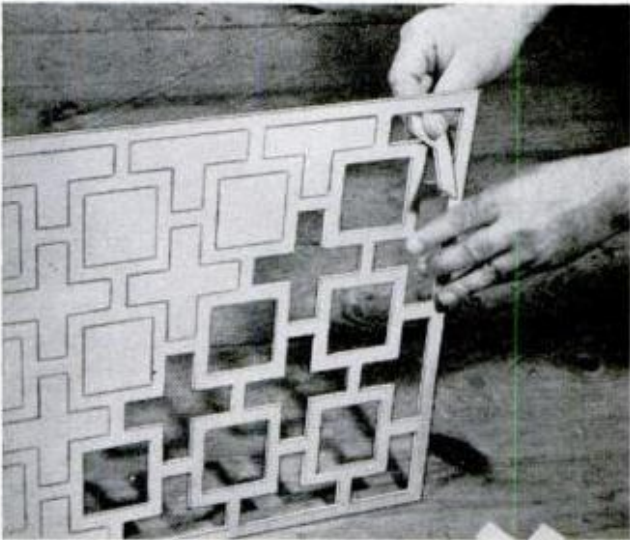
As the grilles and door panels must be painted separately before being assembled, this is a good time to finish the entire cabinet. Fill nail holes and ill-fitting joints with wood putty, then sand all surfaces smooth. After sealing the end grain, Fig. 2, give the cabinet and door panels a coat of plywood primer-sealer. The buffet shown here was painted black and white—black semi-gloss enamel on the grilles and cabinet, and white flat enamel on the door panels as a background color. However, any two colors which contrast well could be used. You may even wish to use three colors, painting the grille doors black and white and the rest of the cabinet in a bright enamel (blue, red, green, etc.). After the paint dries, turn the cabinet over and attach the ball casters, Fig. 4.

Use brads to mount the grilles on the door panels, so that you will be able to remove them without damage if you should wish to change the color scheme sometime in the future. Then attach $\frac{1}{2}$ x 1-in. butt hinges to the assembled doors by driving screws through the grille overlay and into the panel. Mount small wooden drawer pulls in the doors in the same way. Next, slip the doors into the cabinet, one at a time, supporting them at the proper height against the stop strips with a couple of pieces of waste from the grilles, and attach the hinges to the sides of the cabinet.

To complete the buffet, paint the hinges drawer pulls and brad heads to match the grille color. Finally, install magnetic catches to hold the doors closed. ★ ★ ★

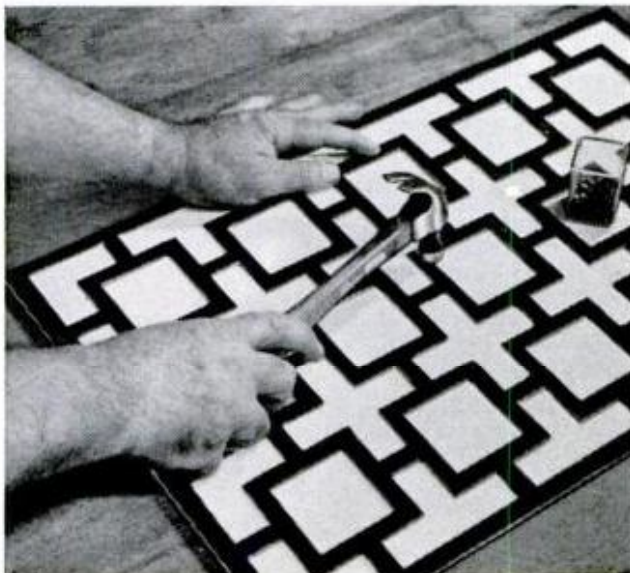


4. BALL CASTERS should be mounted with their plates set $\frac{1}{4}$ in. in from the edges. Besides being decorative, they make it easier to clean under the cabinet



5. DIE-CUT GRILLES are sold with the cut-out sections still in place. Push these out from the side which the die entered and mount on doors with this side out

6. MOUNT GRILLES on $\frac{3}{8}$ -in. plywood door panels with brads at each corner, in the center of each side and at several points around the center section



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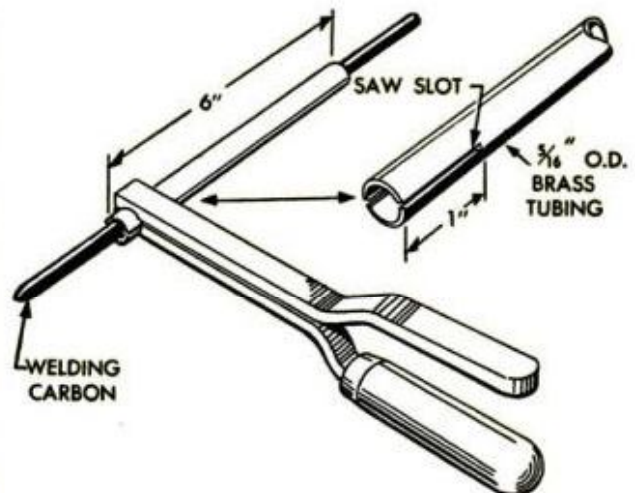


New Use for Old Handbag

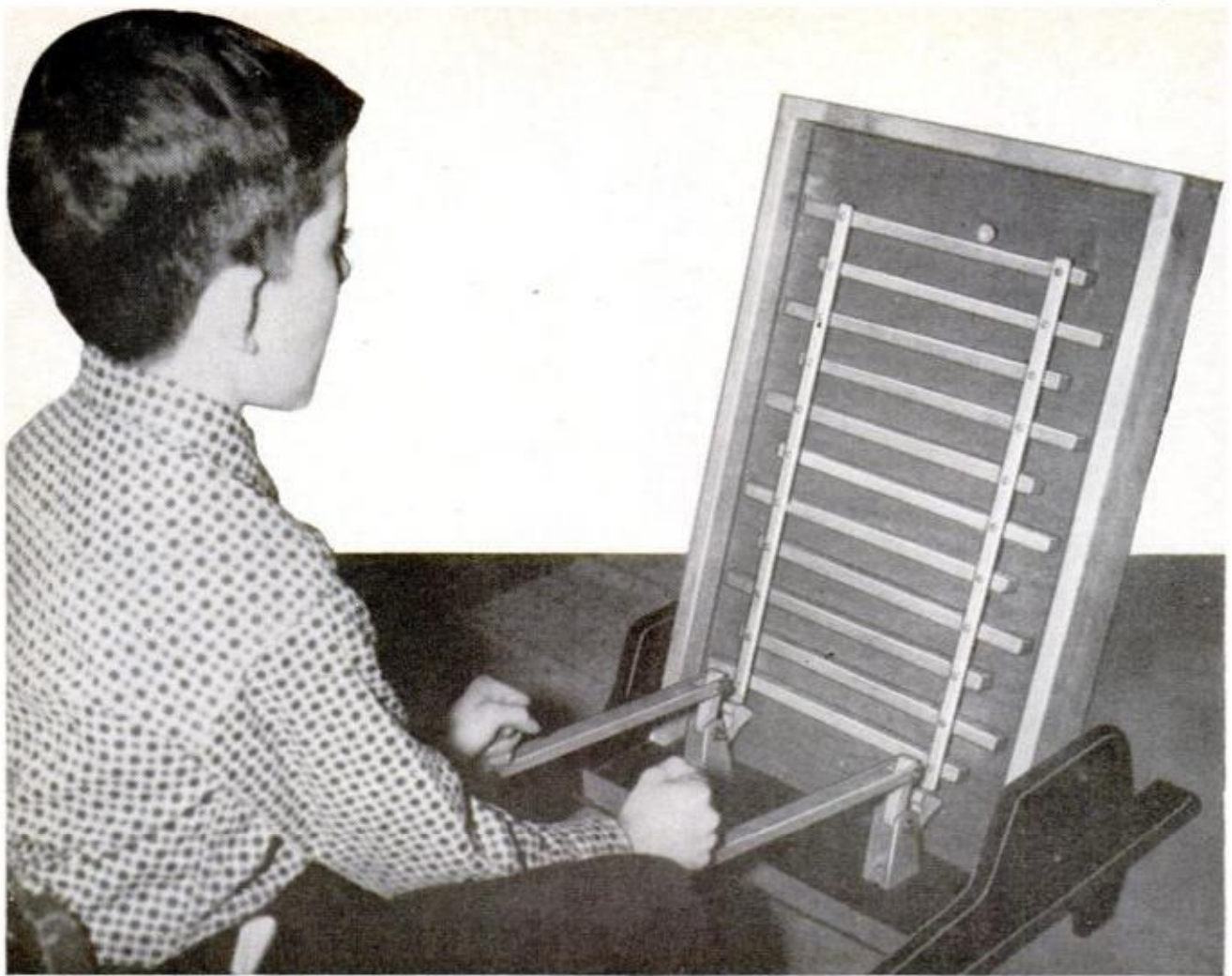
Tell your wife not to throw away her old handbag. She can cut off the straps and mount it on the side of her favorite porch chair with upholstery tacks to hold knitting, sewing or that current magazine within easy reach.—*Grace Arnold*

Sleeve Protects Welding Carbons

After buying a light carbon welder, one craftsman found that he often broke the upper part of the carbons by accidentally knocking them against something while working. To protect them, he made a holder from a 6-in. length of brass tubing large enough to hold the $\frac{1}{4}$ -in. carbons. Slots cut in one end converted it into a chuck when gripped in the holder. As the carbon is used up, it feeds down through the sleeve leaving upper end protected.—*Peter Legan*



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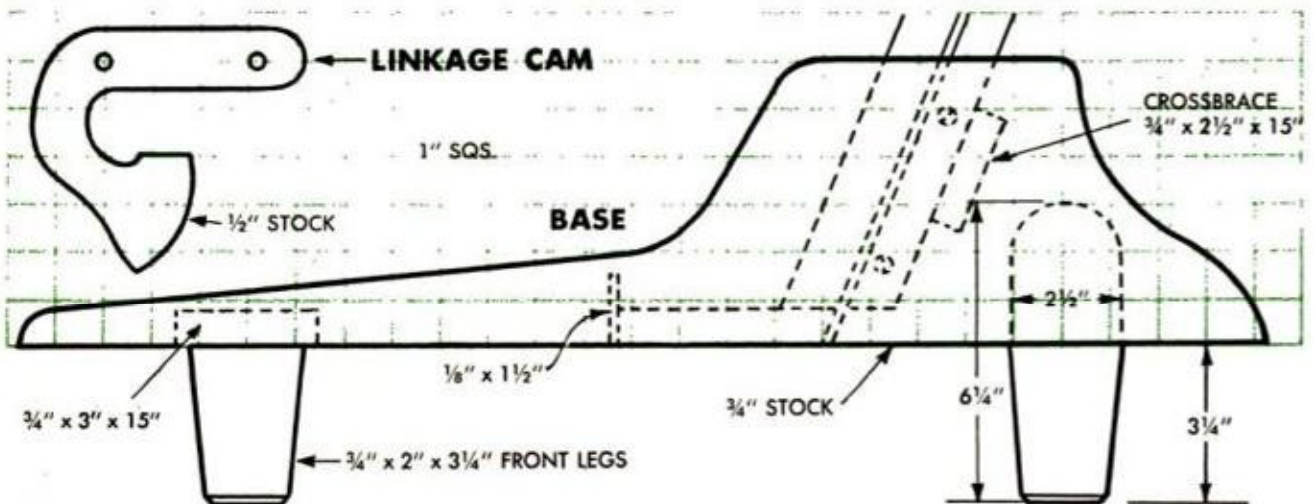
ROLL-A-BALL

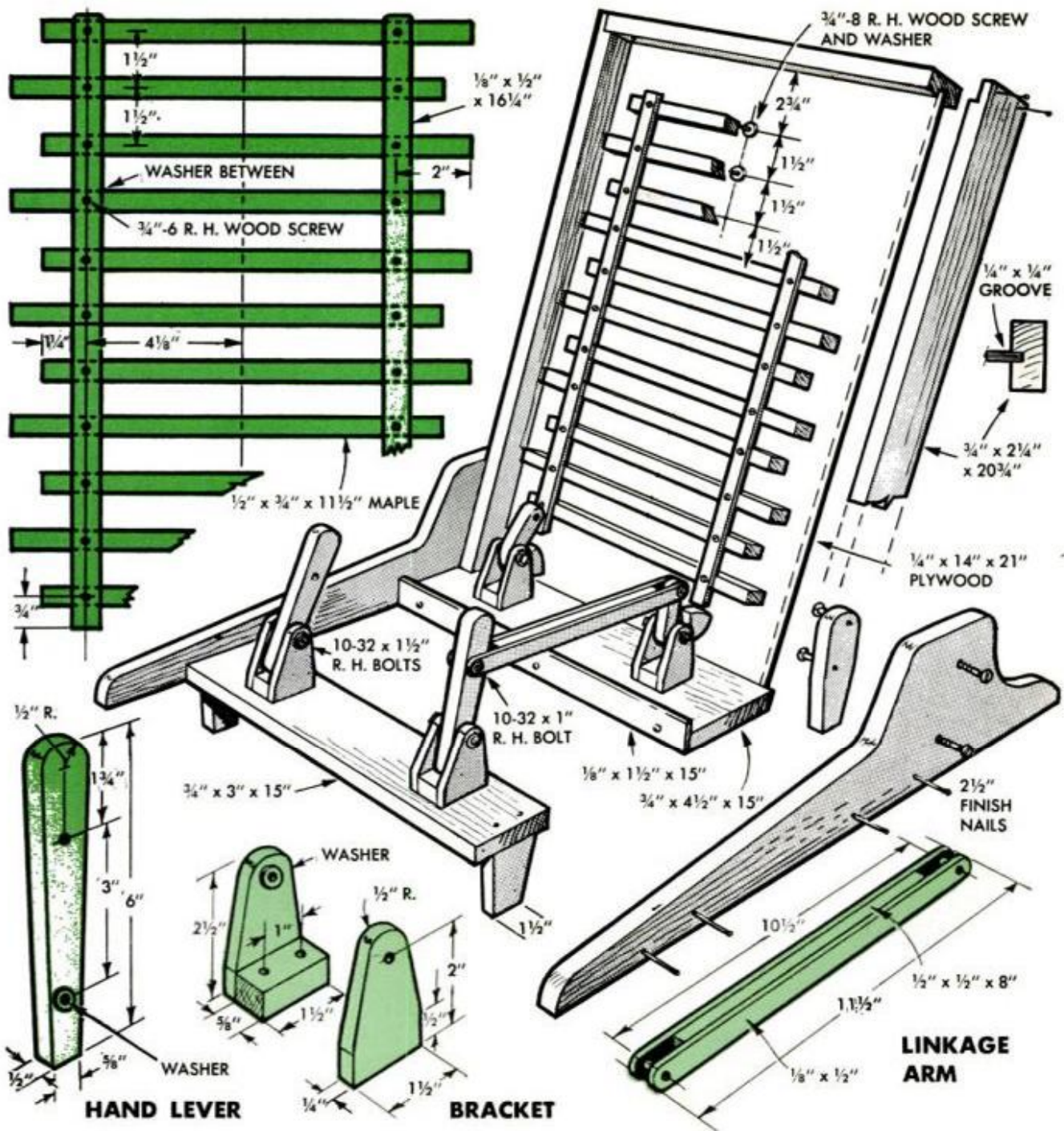
YOUNGSTERS worn out by the "creative" toys and push-button monsters they got for Christmas will find *this* game a welcome relief. It's plain fun, with emphasis on coordination, not education.

It's as simple to construct (mostly from scraps) as it is to play. The principle is to zigzag a large marble or steel ball from the starting position shown above through the pivoting parallel bars to the base.

You've got to manipulate the levers skillfully to avoid inclining the bars so much that the marble shoots past the projecting catch-end of the next-lower bar. And even when you master this, you must reverse the pitch at just the right moment to send the caught ball in a new direction. If you see-saw the bars too much, the ball just rocks back and forth at the center.

To protect the pivoting mechanism, the panel on which the bars are mounted is set in a grooved frame. Softwood can be used for this frame and for all base members, but the bars, pivot strips, levers and link-

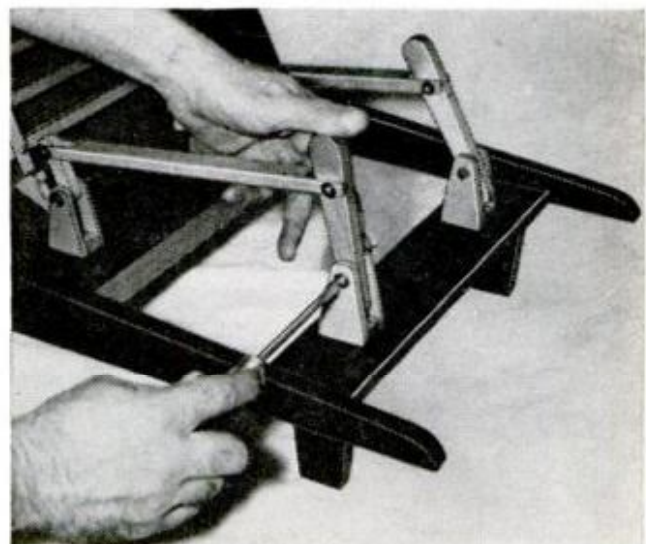




age should be cut from maple. Finishing of the bars is important, since the ball must roll freely. Apply linseed oil, then two coats of shellac, rubbing each with steel wool. Then brush on flat varnish and rub it smooth when dry.

When you fasten the bars to the back panel, place washers between them and the plywood—and don't draw the screws snug. The screw holes in the plywood should let them turn freely. Attach the pivot strips so the entire assembly will respond freely to any movement of the cams. A playing tip: When you grasp the levers, keep the cams in constant pressure against the lower ends of the pivot strips. Apply wax to these contact points to cut down friction and make the parts move freely.—C. L. Widdicombe

ASSEMBLE ACTIVATING LINKAGE with steel washers between moving parts and under peened-over bolts





CORNHUSK DOLLS

HERE'S A DOLL that can trace its ancestry back beyond the *Mayflower*. Long before the first colonists arrived in America, Indians of the Penobscot and other tribes were making cornhusk dolls. The art of making these dolls was passed on to the settlers, and almost every little frontier girl had her own cornhusk family.

Today, many mountain women in the highlands of Kentucky, Tennessee and Virginia still make cornhusk dolls for their children. Down through the years, some families have become famous for special designs, peculiarly their own. The Tennessee *Mollie* doll shown here is made by the descendants of Mrs. Mollie Rogers.

1. TO PREPARE HUSKS, first trim off the thick woody base, then soak the leaves in water for a short time to make them more pliable and easier to shape

2. BEGIN BY TYING the waist of the figure with a piece of string. If the leaves don't compress easily, put them back in the water for additional soaking

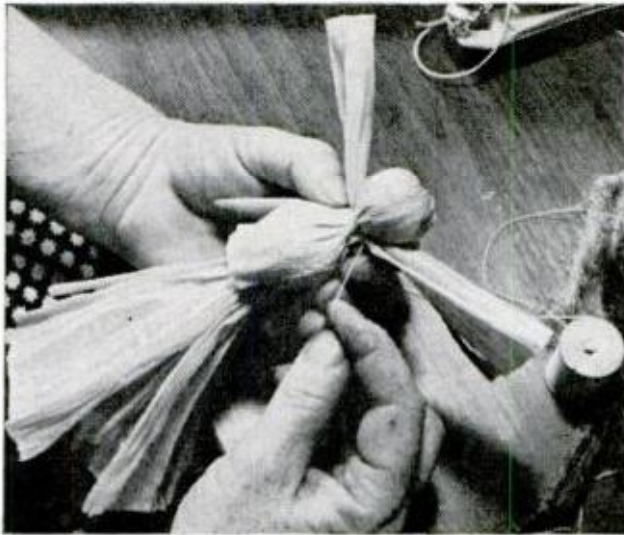




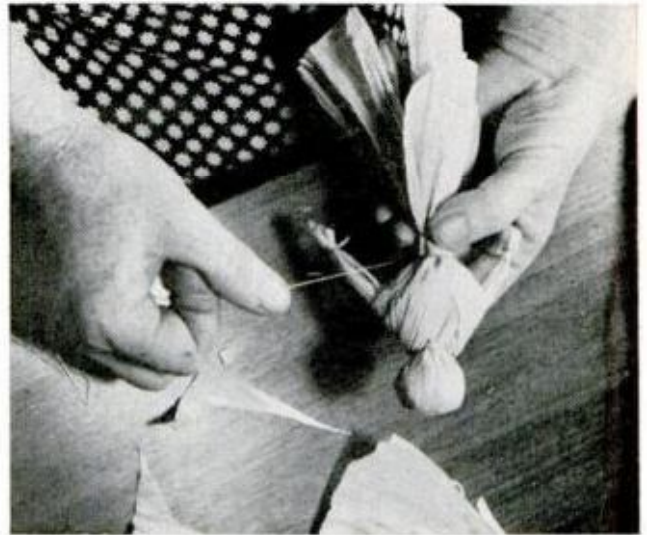
3. SPREAD HUSKS forming the upper part of the figure and insert a ball of husk to fill out chest. Lower trimmed edges become the long, old-fashioned skirt



4. TIE OFF BODY husks at the neck, then crumple remaining part into a ball to form the doll's head and cover it with a husk cut to the proper size



5. ARMS FOR FIGURE are made from two rolled strips of husk. Tie these to the neck, at the same time securing the husk which covers the head and chest



6. SHAWL AND APRON are made by wrapping a piece of husk around the shoulders and tying it at the waist. Cover string with a narrow belt cut from husk

7. USE TASSEL SILK for the hair. It can be curled, braided or even dyed, and looks surprisingly real. Tie braids with hair ribbons made from bits of husk



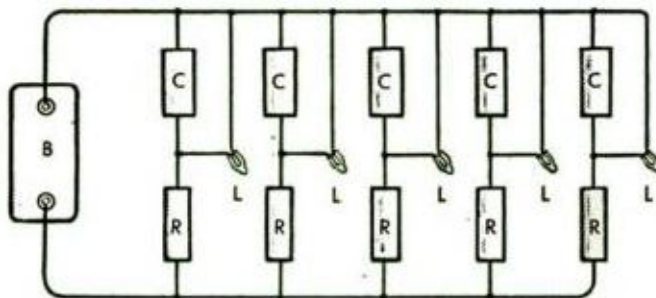
8. TO COMPLETE "Mollie," add a husk sunbonnet with scalloped edges and draw in the face with a pen. Her daughters are small dolls made from same pattern



DRIFTWOOD WALL PLAQUE



REALISTIC OUTDOOR SCENE is created by cementing artificial ivy and plastic squirrel on surface of the driftwood plaque. Picture hanger or screw eye at back permits hanging on wall



- WALL PLAQUE WIRING DIAGRAM**
- B—90-VOLT RADIO BATTERY
 - C—0.1 MICROFARAD, 100-VOLT CAPACITOR
 - R—RESISTOR: 500K, 1 MEGOHM, OR 2 MEGOHM
 - L—NE-2 NEON LAMP

FEATURING five flickering lights which give a "firefly" effect, this driftwood wall plaque brings the atmosphere of the outdoors into your home. Artificial ivy and a plastic squirrel from a model kit heighten the illusion.

To make the plaque, find a piece of driftwood about 2 ft. long with an interesting irregular shape such as that shown in the photo. Use a chisel to hollow out sufficient space in the back for installing the radio battery, capacitors and resistors necessary for the flickering-light hookup. Drill holes from the outer face of the driftwood to the battery recess for the neon-lamp leads.

Clean and prepare the surface of the driftwood by brushing with a stiff wire brush. Interesting effects may be obtained by wire-brushing and finishing with several spray coats of clear, quick-drying enamel or by rubbing the wood with ordinary brown shoe polish. The number of coats of enamel or shoe polish will depend on the type of wood and the finish desired.

The flickering-light circuit requires a 90-volt radio battery; five NE-2 neon lamps; five 1-megohm resistors; five .1-microfarad 100-volt capacitors and sufficient wire to complete the circuit. Connect the lamps, resistors and capacitors to the battery as shown in the circuit diagram. The battery will last from six months to one year, depending on usage. A reasonably steady rate of flicker is provided by using 1-megohm resistors. If a slower rate is desired, 2-megohm resistors may be used. A faster rate will be obtained by using 500K-(500,000-ohm) resistors. Lamps in the same circuit can be made to flicker at different rates by using different value resistors.

To complete the plaque, attach a picture hanger or screw eye to the back for hanging it on the wall. Then cement artificial ivy and squirrel in place.

—Frank Stephany



1. WORLD'S FIRST automatic-threading, 16 mm. sound projector, the Specialist Autoload Filmosound has a "follow-the-numbers" control system on an illuminated panel. Film is threaded and ready for projection in 6 sec., or it can be threaded or removed manually, even in the middle of a reel. Price \$755. Bell & Howell, 7100 McCormick Rd., Chicago 45, Ill.

2. IKOMAT 35-MM. SLIDE PROJECTOR enables the operator to completely control focusing, timing and slide selection through a series of buttons at the end of a 12-ft. control cord. The slides may be synchronized with recorded comments or music by means of a special tape recorder synchronizer. Price \$179. Carl Zeiss, Inc., 444 Fifth Ave., New York 18, N. Y.

3. HELIOTRON MM FLASH UNIT features a 3½-oz. rechargeable nickel-cadmium battery pack that provides about 60 flashes of 1/1000 sec. on one charge. Also operates from a wall outlet through an a.c. charger plug. Its retractable, built-in holder slides into a camera's accessory shoe. Priced at \$69.95. Kling Photo Corp., 257 Park Ave., S., New York 10, N. Y.

4. SEALED-BEAM MOVIE FLOODLIGHT provides as much light for picture taking as four standard 300-watt-type R30 floodlamps and has an 8-hour life compared to 4 hours for the R30. Rated at 650 watts, it is 4½ in. in diameter and resembles an auto headlamp. The unit, including bulb, holder and cord is \$19.95. Westinghouse Electric Corp., Bloomfield, N. J.

5. DURAFLEX PROCESSING TRAYS are made of high-impact plastic that is permanently inert against chemical corrosion. Attractively styled in yellow, the trays are available in 5 x 7 through 20 x 24-in. sizes and in 5 and 6-in. depths to hold many processed prints for fixing and washing baths. Packed in individual cartons. Eastman Kodak Co., Rochester 4, N. Y.

NEW FOR SHUTTERBUGS NEW



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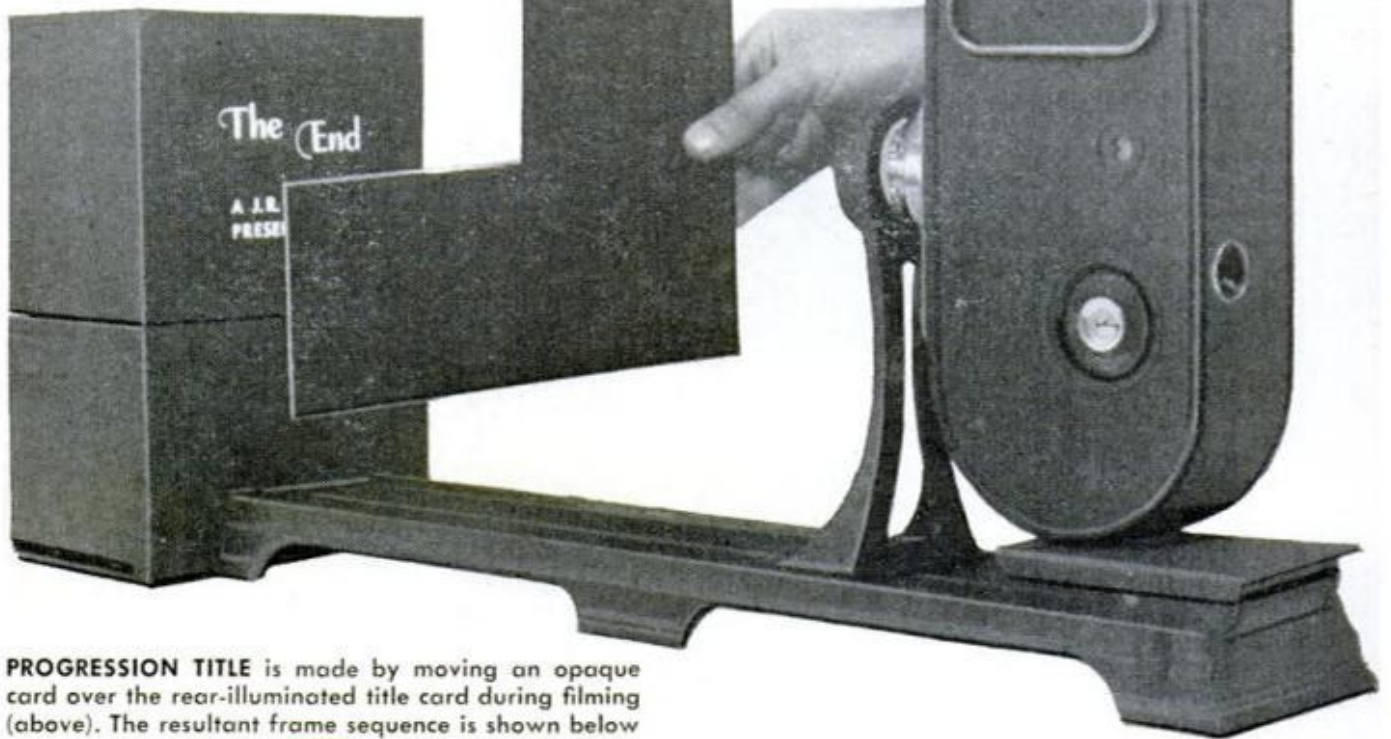
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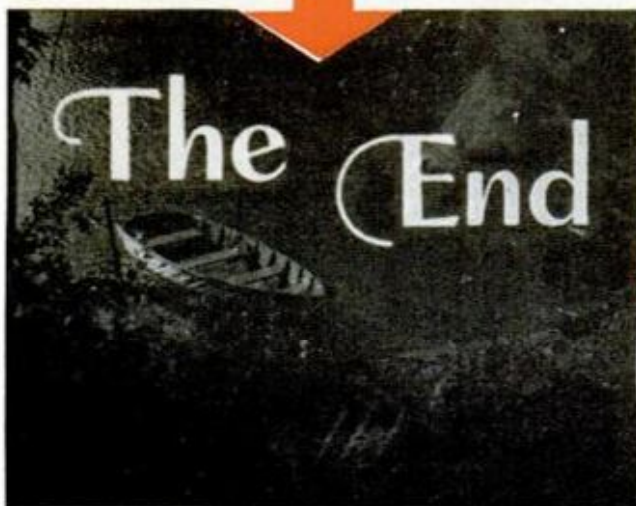
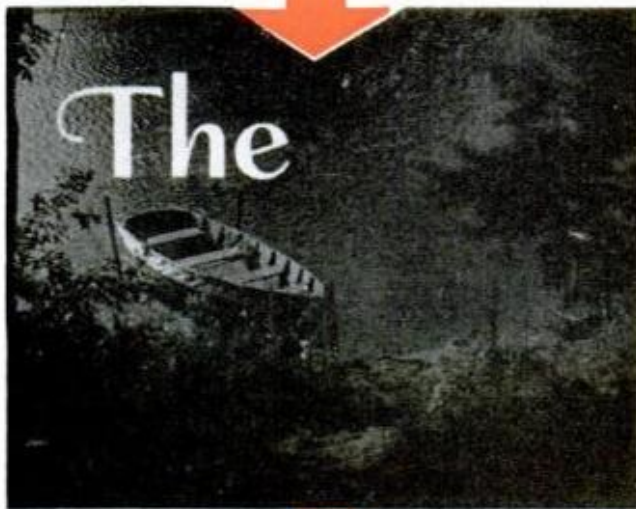


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BACKLIGHT YOUR MOVIE TITLES



PROGRESSION TITLE is made by moving an opaque card over the rear-illuminated title card during filming (above). The resultant frame sequence is shown below



OF THE MANY clever title effects to come from Hollywood, one of the most popular is superimposition, wherein the title copy is "wiped" over an action background. While titles of this type require that two separate exposures be made—one for the background scene and one for the title copy itself—I have found that if the title is backlit while it is shot, a sharper, better-defined image results on the movie film. The common practice of shooting the title copy against a dull black surface and lighted from the front, results in stray light reflections which tend to produce a halo effect around each letter.

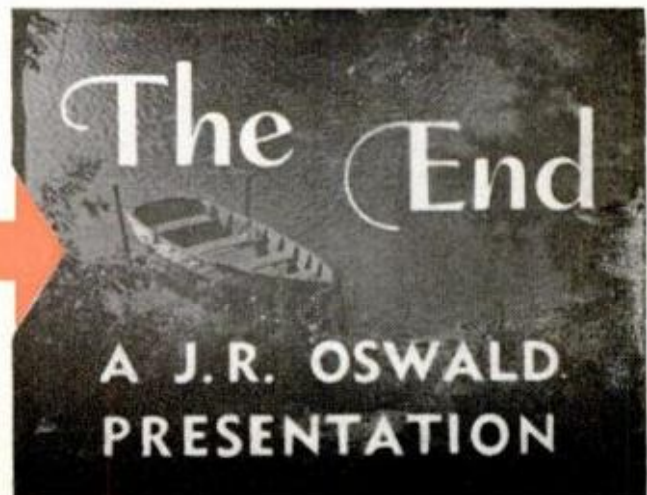
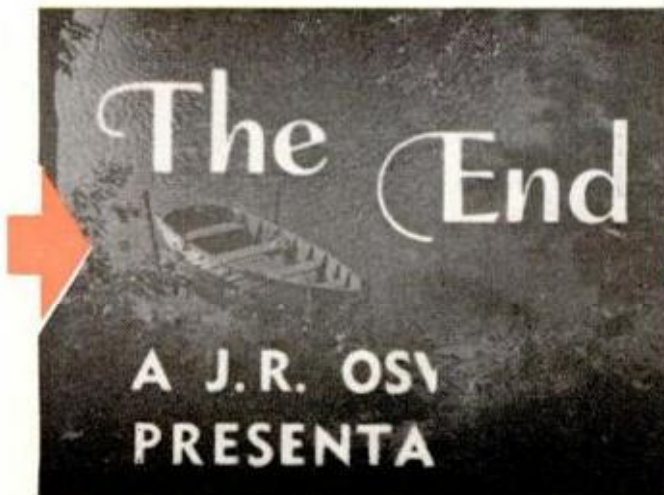
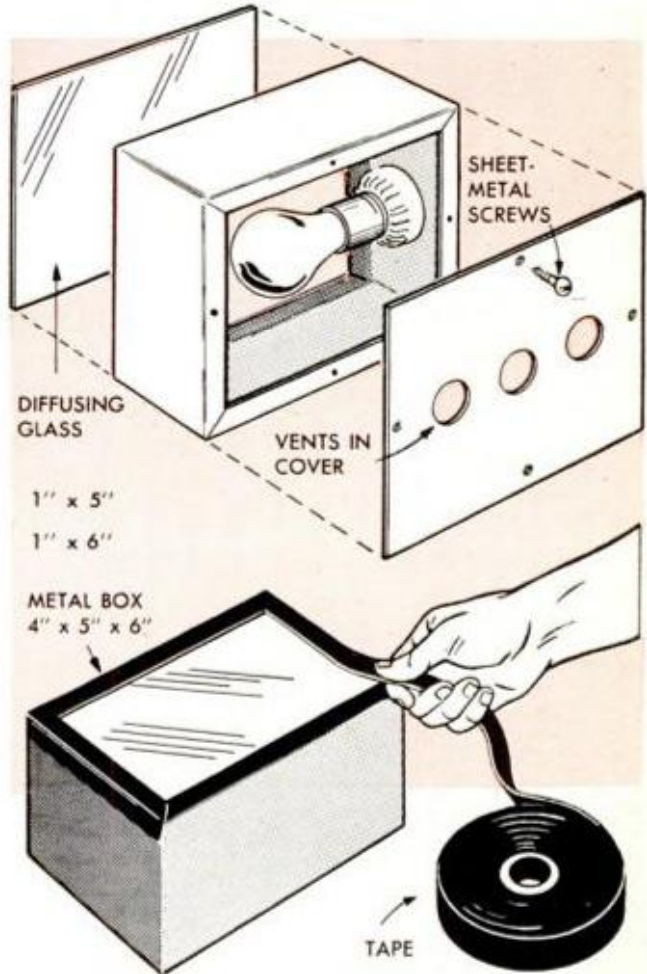


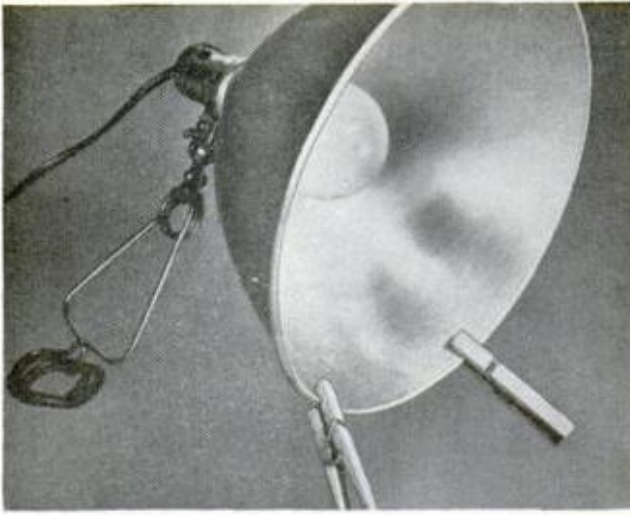
In the backlighting process, the title card becomes a "stencil" so to speak, which permits the light to pass and sharply define the lettering. Of course to produce a title card, the copy is prepared in the normal manner by mounting black lettering on a white surface and making a copy negative of it by photographing it with a 4 x 5 press-type camera. The resulting negative is your transparent title card.

To backlight the title card you need to make a light box as detailed at the right. This is nothing more than a readymade utility box measuring 4 x 5 x 6 in. which can be purchased at radio and electronic supply houses. The front cover of the box is replaced with a piece of opaque diffusing glass held in place with masking tape. The back cover is drilled to provide ventilation for a 10-30-watt lamp mounted inside. Actual tests will indicate the size lamp that is best, as well as the correct exposure. The copy negative is taped to the front of the diffusing glass. Use tabs of black masking tape to hold it in place.

Shooting and Wiping

In use, the light box is propped up so it is centered with the lens of the movie camera. Shooting is done in a darkened room to kill any stray light reflection off the glass. Wiping of the title is done during the actual filming by holding a card over the full title and slowly moving it from left to right. In the example shown in the frame sequence across the bottom of these pages, an L-card is used so that the upper part of the title is disclosed first, then the lower half. Where an action background scene is not desired, only one exposure need be made with no need to rewind the film. The title footage is merely processed and stripped into the edited film. Either way, with or without a background scene, your titling will be much sharper and crisper on the screen when backlit during the filming process.—James R. Oswald

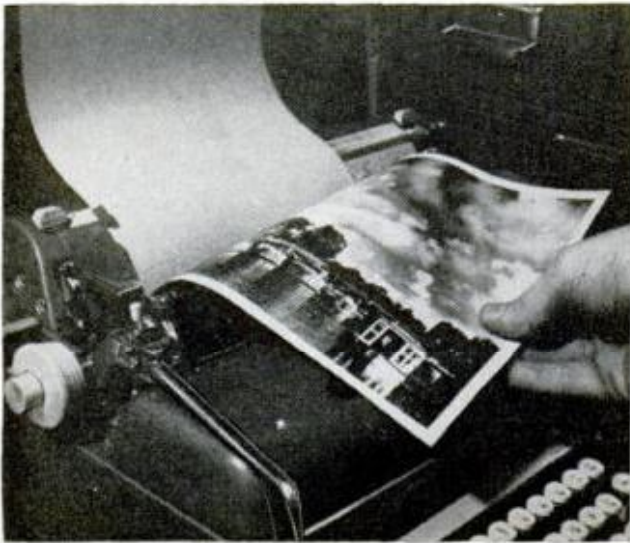




FOR CAMERA BUGS

Reflector Legs

Photoflood reflectors can get hot enough during use to scorch flammable material on which they may be placed. This hazard is easily prevented by simply clipping a couple of spring-type wooden clothespins to the bead of the reflector as shown. The clothespin legs will not only raise the reflector high enough to avoid possible scorching, but will also serve to keep it from rolling.—*Bil Toman*



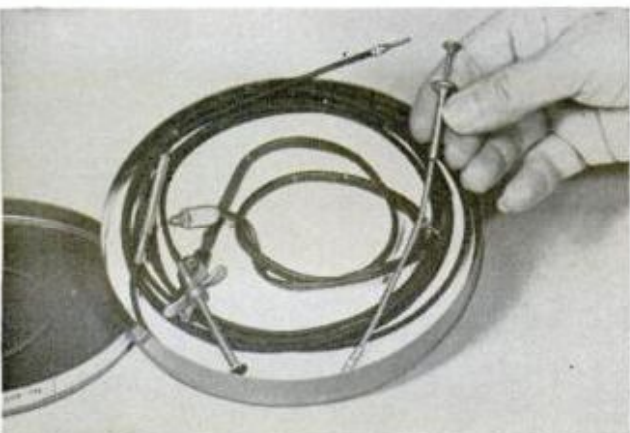
Flattening Glossies

Glossy prints tend to curl immediately after drying, especially in the winter when the humidity is low. You can flatten the prints effectively if it is done before they have cooled completely from the heat of the dryer. A simple but good way to do this is to run the prints through a typewriter, inserting the print backwards so that it will be curled in the opposite direction to the natural curl. Place a piece of typing paper against the face of the print to protect it from being marred in the process. Finally weight the prints with several heavy books for a few hours.—*Wayne Floyd*



Like New Again

An easy way to improve worn black-enamel finishes on cameras, optical equipment and other items is to apply a padding lacquer or French polish to which dry lamp black has been added. Use a piece of cloth folded into a pad for applying and rub to a sheen. French polish can be made by adding a little linseed oil to ordinary shellac. Place a few drops on a piece of glass or sheet metal and mix in a little lamp black. If the application doesn't suit you, wash it off with shellac solvent and start over.

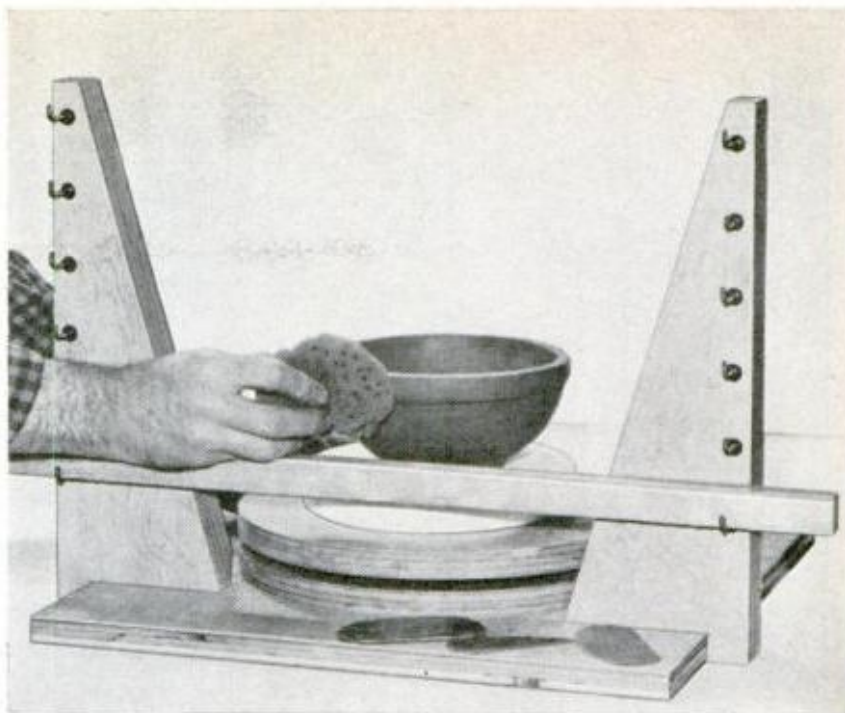


Cable and Cord Storage

For keeping long cable releases and flash gun cords in good condition, as well as having them handy when needed, you'll find that a metal film container is just the thing. The size used for storing 16-mm. movie film is ideal. Denting the rim of the container cover slightly before closing the can helps keep the cover on even if the can should be dropped accidentally. Place a sticker on the cover so you can keep track of the contents.—*H. Leeper*

POTTER'S WHEEL FOR THE CERAMICS FAN

By Manly Banister

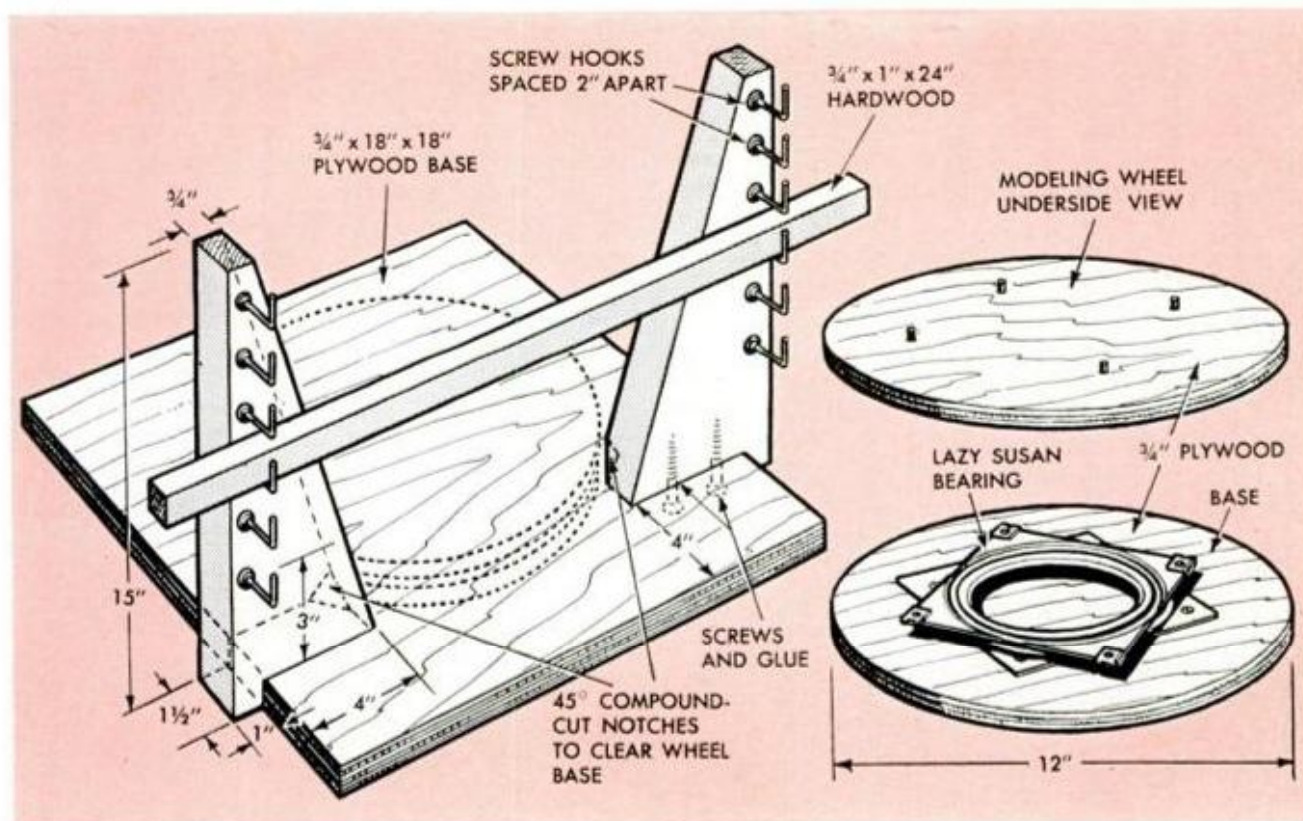


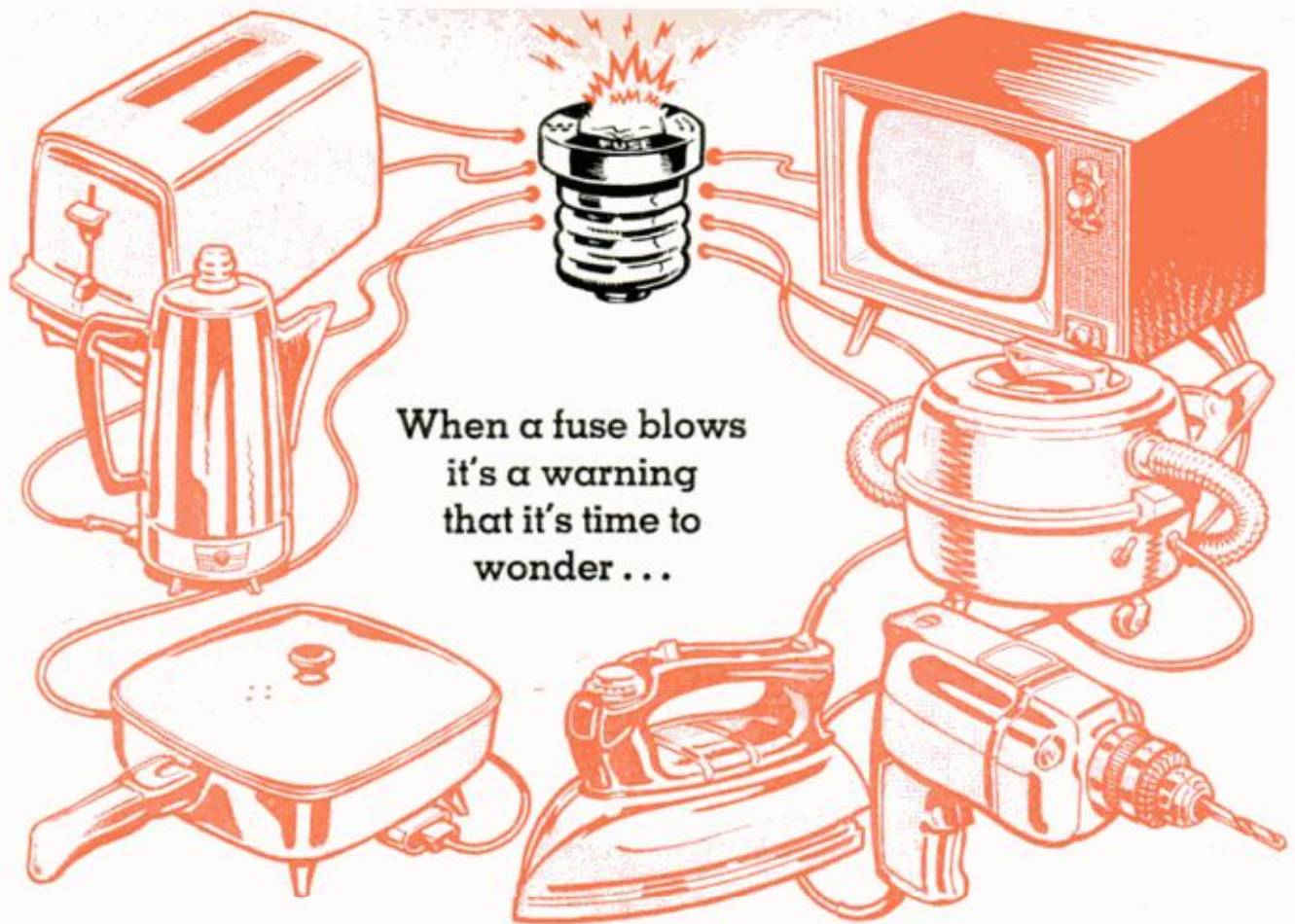
AN IDEAL COMBINATION for your ceramics craft work in both the pottery and sculpture fields, this modeling wheel and hand rest frame will help you turn out projects of professional quality and artistic appearance. The turntable can be used alone for such modeling as does not require use of a hand rest.

The base consists of an 18-in. square of $\frac{3}{4}$ -in. plywood. The two uprights are sawed to their triangular shape and size, $1\frac{1}{2} \times 5 \times 15$ in., from two pieces of $\frac{3}{4}$ -in. plywood glued together. Attach them to the base with glue and screws, not forgetting to first cut the 45-deg. compound

notches, as indicated, to permit the turntable to rotate unhindered. To allow raising or lowering of the $\frac{3}{4} \times 1 \times 24$ -in. hardwood hand rest, 90-deg. screw hooks are spaced every 2 in. up the uprights.

The two 12-in.-dia. disks for the turntable are cut from $\frac{3}{4}$ -in. plywood with either a bandsaw or jigsaw, or by hand with a coping saw. The Lazy Susan bearing, available at hardware stores, is first centered and attached to the underside of the top disk with screws, after which the bottom disk is attached to the bearing with $\frac{3}{16}$ -in. F.H. stove bolts. Finish the assembly with lacquer or varnish.





When a fuse blows
it's a warning
that it's time to
wonder...

IS YOUR WIRING OVERLOADED?

By Donald W. Segraves

A BLOWN FUSE in your home is like a fever in your body. It's a signal that something has gone wrong—not just a nuisance to be ignored.

The most popular way to ignore this signal is to eliminate the warning by putting in a bigger fuse—usually 30-amp. This *does* succeed in stopping electrical blackouts, but it may also run up your electric bill, cause your motors and appliances to give poor service—even set your house afire.

What you're doing, in effect, is tying down the safety valve so you can pull 30 amperes of current through wires designed to carry only 15 or 20. It can't be done efficiently, so each appliance on the overloaded circuit operates at less than full power. Electric motors run slower, struggling to carry their loads. Toasters take longer to brown bread, bulbs give less light. Since you pay for electricity by the kilowatt hour, you run up your electric bill when appliances are slow, or when you must use a 150-watt bulb to get the same light normally shed by a 100-watter.

Worst of all, overloading the wiring causes it to heat up. Gradually, the insulation bakes off, leaving the hot wires ex-

posed to start fires by direct contact with dust, wood or paint—or by shorting out in a shower of sparks. That's why overloaded circuits are the top cause of home fires.

Fortunately, there are safer and more efficient ways to solve blackout problems than using oversize fuses. The first step is to find out what's causing those fuses to blow. You can usually tell whether the cause is an overload or a short just by looking at the blown fuse—as the chart on the opposite page demonstrates. If the mica window is blackened with smoke, it means that somewhere on the circuit served by that fuse there's a bare wire touching either another wire or some other metal. This sent a surge of current coursing through the wires, producing a flash of heat that vaporized the filament.

If the window of the blown fuse remains clear, your trouble was overload. The heat buildup, here, was gradual; the fuse filament simply melted at its weakest point.

Either way, it's time for a check. The following method can also be used to check for shorts and overloads in circuits protected by circuit breakers or cartridge-type fuses, neither of which provides any visible

clue to the cause of failure.

To check for a short, unplug everything served by the circuit that blew the fuse—that is, all lights and appliances that don't work. Also turn off ceiling lights—and appliances wired into that circuit, such as dishwashers, sump pumps, garbage disposers and furnace blowers. These devices should have separate fuses and on-off switches located somewhere near the motors. Either turn off these switches or remove the fuses.

When the circuit is completely clear replace the blown fuse with a good one, or push the circuit breaker button back on. If the new fuse blows or the breaker button snaps off again, there's a short in the circuit wiring itself. You'd better call an electrician; this is no job for an amateur.

Most likely, though, you'll find the bare wire in a frayed lamp cord, extension cord, or appliance wiring. Check each lamp, switch and appliance one at a time by turning it on. When you reach the faulty one, the new fuse will blow.

If your original inspection of the blown fuse led you to suspect an overload, the same check for a short will provide confirmation: say the new fuse blows only when you plug in the last item on the cir-

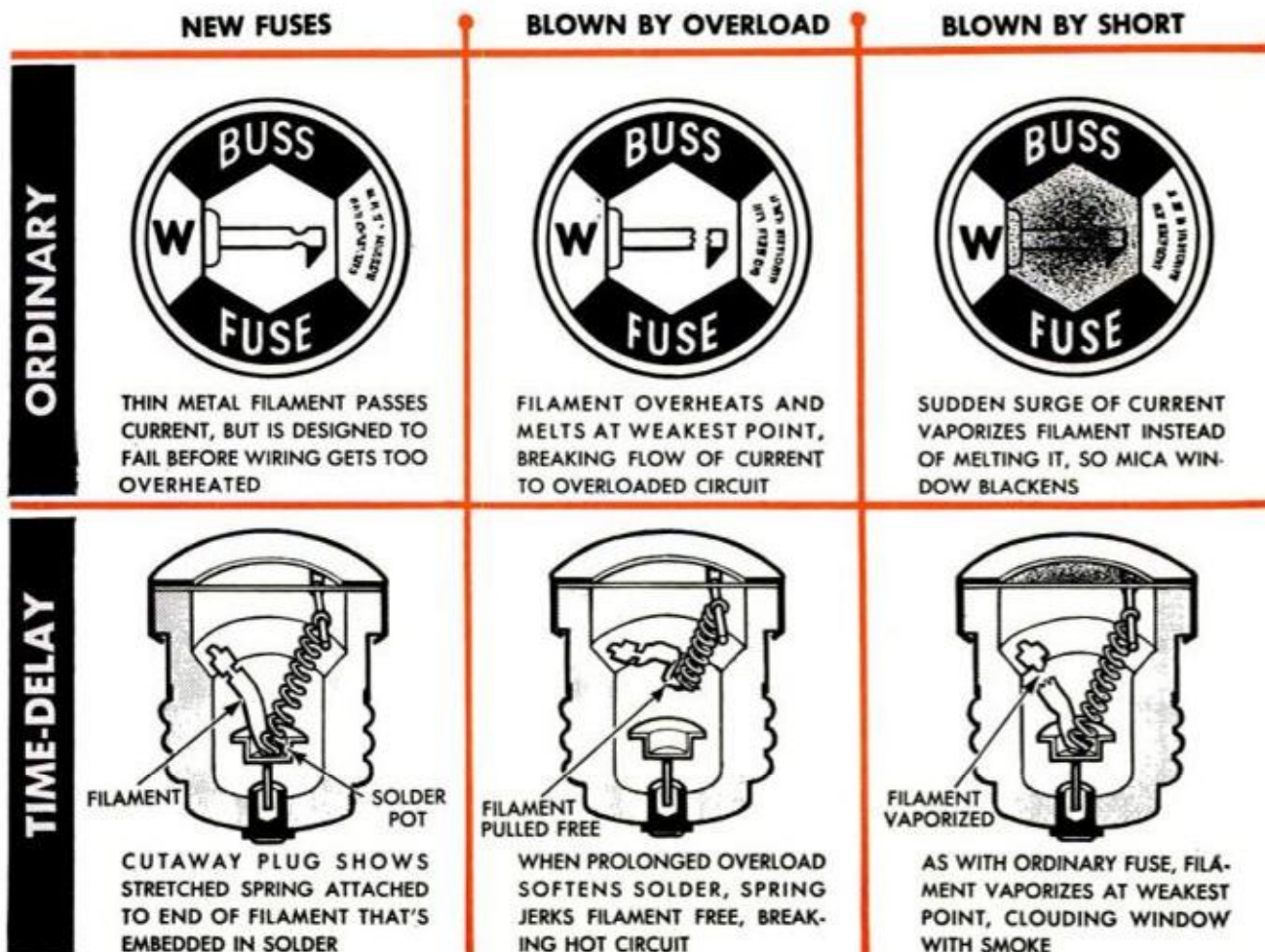


TAMPER-FREE FUSE (held in right hand) has smaller-diameter base that requires special adapter to fit standard socket for Edison-base fuse (foreground). Spur on adapter locks it permanently into socket

cuit. Unless it happens to be defective, your problem is an overload. Further checking will tell you if you can cure it.

If that final, fatal appliance is driven by an electric motor, the issue is still in doubt. What you want to know is whether the overload is constant, or whether the

HOW TWO TYPES OF PLUG FUSES WORK



| LOCATION | CEILING LIGHTS | FUSE NUMBERS | | | #1 FUSE | WATTAGES | | | |
|--------------|----------------|--------------|-------|-----------------|---------|---|------------|---------|-------------------|
| | | WALL | | OUTLETS | | #2 FUSE | #3 FUSE | #4 FUSE | #5 FUSE |
| | | NORTH | SOUTH | EAST | | | | | |
| Living Room | | #2 | #2 | #2 | | 300 TV. 600 Vacuum 150 Lamp 150 Lamp | | | |
| Kitchen | #1 | | #1 | #1 | | 1000 Toaster 600 Peric. 150 Radio 40 Light 30 Clock 100 Fan 1100 Skillet 1000 Iron 300 Refrig | | | |
| Utility Room | #2 | #2 | #2 | #2-#3 and #4 | | 75 Light 100 Furnace 20 Light 20 Shaver 150 Radio 4 Clock 200 Blanket 185 Drill | 700 Washer | | 4500 Elec. Dryer. |
| Bath | #2 | #2 | | #2 | | | | | |
| Bedroom A | #2 | | | #2 | | | | | |
| Workshop | #2 | | | #2 | | | | | |

INVENTORY your wiring system to check for overloads. In example above, circuit No. 1 is in bad shape, since several combinations of kitchen appliances would pull more than allowable 1800 watts. It should be split in two. Circuit No. 2 is probably safe—overload combinations aren't likely unless heavy workshop load is added. Fuse No. 4 is a 220-amp. circuit

fuse blows only when a motor kicks on. An electric motor usually pulls three to five times its normal current to start.

You can cure this type of temporary overload by buying time-delay (dual-element) fuses. A 15-amp time-delay fuse will handle motor-starting currents every bit as well as an ordinary 30-amp type—and the smaller fuse gives you far better protection against prolonged overloads and short circuits. That's why the National Electric Code now specifies time-delay fuses for all home-wiring circuits. The most widely-sold brands are Fusetron and Fustat. They're identical except that Fustats also have a tamper-free feature, as shown in the photo on page 173. The reduced-size base requires an adapter, if you're using these fuses in an old-type socket. The bases on 15-amp., 20-amp. and 30-amp. fuses differ as to length and thread, so once the adapter to fit the right size for a given circuit is in place, you can't substitute a different size. And the old penny-in-the-socket stunt won't work, since Fustats

have a clip that presses against the rim of the adapter to complete contact when they're screwed tight. Jagged teeth around the adapter's rim tear apart foil or wire used in any ill-advised attempts at bridging.

But how do you tell whether your overload is temporary or constant? One way is to replace the blown fuse with a time-delay type of the correct size (either 15 or 20 amp) and see if it blows with everything turned on. If not, your problem's solved. But if it does, you'll either have to split the overloaded wiring into two circuits, shift some appliances to other outlets, or be extra careful how many major appliances you operate off any one circuit at one time.

You can avoid trial and error by making an inventory of your wiring system so you know how big a load is being placed on each circuit. Here's how:

1. Go to the main entrance switch and number each fuse or circuit breaker, using small gummed labels, or the diagram often pasted inside the fuse-box door. Make a worksheet like that shown above,

tailoring it to fit your home. Under "wattages," provide a separate column for each fuse or circuit breaker in actual use.

2. Turn on every light in the house and check to see that all bulbs are burning. Then, unscrew fuse No. 1 and go through the entire house, marking a #1 on the work sheet for each light that's out. Do the same for all receptacles, using a small hand lamp to see if they're dead. As you go, note the wattages of all lights and appliances served by this circuit, listing them in the column marked #1 Fuse.

Most appliances have their wattage rating marked on a nameplate attached to the device itself, or to the motor that operates it. Motor-driven appliances may give only a horsepower figure; to convert to wattage, multiply this figure by 746, since 746 watts equal 1 Hp. If no rating is given, use the averages for common appliances listed on the color panel at right. These should be close enough to permit a proper evaluation of circuit load.

3. Replace Fuse No. 1 and repeat Step 2 for each remaining fuse (or circuit breaker). Don't forget to check closets, hallways and appliances that aren't plugged in permanently, such as workshop tools and kitchen gadgets. Others easily overlooked include sump pumps, attic fans, vacuum cleaners, vaporizers and furnace motors. (When you're through, check to make sure pilot lights are still on.)

4. Add up wattages of all lights and appliances served by each circuit. Consider the maximum load likely to be placed on each. If kitchen circuit has two double-socket wall outlets, for example, list the four highest-rated appliances that might be plugged in simultaneously (for example: toaster, percolator, skillet and waffle iron—a whopping 3,800 watts).

Maximum safe load for circuits wired with 14-gauge wire is 1800 watts. These circuits should carry 15-amp fuses only. Circuits wired with 12-gauge wire can carry up to 2400 watts, using 20-amp fuses (30-amp fuses are *not* recommended for any home lighting or general-use circuit). If you don't know what size wire you have, pick up short pieces of each size at your hardware store and compare them with the exposed wires visible when you take the cover off your fuse box. No. 14 wire is about the size of the lead in an ordinary wooden pencil; No. 12 is slightly larger.

After all this checking, you should be able to decide intelligently whether that blown fuse is only an easily-remedied annoyance, or the sign of a serious malady that calls for professional cure. At least you'll know which appliances you can safely use till Doctor Watt arrives. ★ ★ ★

AVERAGE WATTAGES

110-120-VOLT APPLIANCES

| BASEMENT | |
|----------------------|---------|
| DEHUMIDIFIER | 160 w* |
| DRYER, CLOTHES, GAS | 350 w* |
| FREEZER, HOME | 350 w* |
| FURNACE, COAL STOKER | 400 w* |
| FURNACE, GAS | 100 w* |
| FURNACE, OIL | 800 w* |
| INCINERATOR | 600 w |
| IRONER-MANGLE | 1650 w* |
| MOWER, LAWN | 300 w* |
| PUMPS (WELL OR SUMP) | 300 w* |
| WASHER, AUTO CLOTHES | 700 w* |

| WORKSHOP | |
|-------------------------------------|---------------------|
| DRILL, 1/4 IN., 3/8 IN., OR 1/2 IN. | 100, 185, OR 375 w* |
| GRINDER, LIGHT OR HEAVY DUTY | 185 OR 375 w* |
| IRON, SOLDERING | 150 w |
| LATHE, WOOD OR METAL, 1/3 HP | 250 w* |
| SANDER, PORTABLE, 1 HP | 746 w* |
| SAW, BAND, 12 IN., 1/3 HP | 250 w* |
| SAW, BENCH, 8 OR 10 IN. | 375 OR 560 w* |
| SAW, CIRCULAR, PORTABLE | 1120-1500 w* |
| SAW, JIG, 18 IN., 1/3 HP | 250 w* |
| SAW, RADIAL ARM, 9 OR 10 IN. | 1300 OR 1500 w* |
| SAW, SABRE, 1/8 OR 1/3 HP | 100 OR 250 w* |

| LIVING ROOM | |
|---------------------------------|----------------|
| AIR CONDITIONER, 1/3 OR 3/4 TON | 750 OR 1400 w* |
| PHONOGRAPH | 75 w* |
| RADIO, CONSOLE TYPE | 150 w |
| TV SET | 300 w |
| VACUUM CLEANER | 600 w* |

| KITCHEN | |
|---------------------------|---------|
| BAKER, PORTABLE | 900 w |
| BLENDER, FOOD | 250 w* |
| CASSEROLE, 6 QUART | 330 w |
| CORN POPPER | 500 w |
| DISHWASHER (HEATED) | 1250 w* |
| DISHWASHER (UNHEATED) | 400 w* |
| DISPOSAL, WASTE FOOD | 500 w* |
| EGG COOKER | 500 w |
| FRYER, DEEP-FAT | 1350 w |
| HOT PLATE (PER UNIT) | 700 w |
| IRON, HAND (DRY OR STEAM) | 1000 w |
| MIXER, FOOD | 150 w* |
| PAN, SAUCE | 1000 w |
| POLISHER, FLOOR | 350 w* |
| PERCOLATOR, 6-CUP | 600 w |
| REFRIGERATOR (12 CU. FT.) | 300 w* |
| ROASTER-ROTISSERIE | 1400 w* |
| SKILLET, FRYING | 1100 w |
| TOASTER | 1000 w |
| WAFFLE IRON | 1100 w |

| BEDROOM & BATH | |
|---------------------------|--------|
| BLANKET | 200 w |
| BOTTLE WARMER | 400 w |
| DRYER, HAIR | 275 w* |
| FAN, WINDOW (LARGE) | 500 w* |
| HEATER, PORTABLE, REFLEC. | 1200 w |
| HEATER, WALL (BUILT-IN) | 1250 w |
| LAMP, HEAT, INFRA-RED | 250 w |
| LAMP, SUN, ULTRA-VIOLET | 400 w |
| PAD, HEATING | 60 w |
| SHAVER | 20 w* |

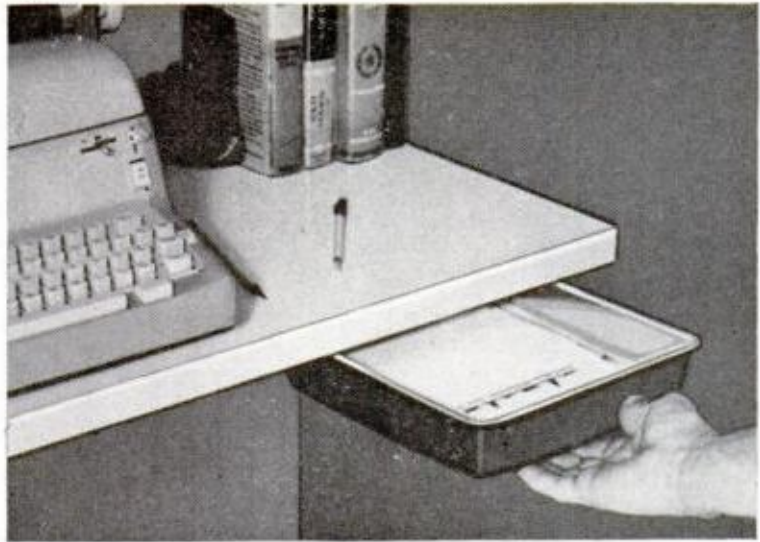
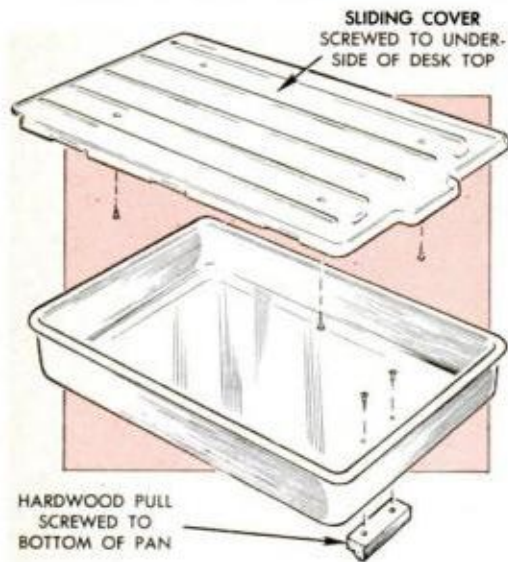
220-VOLT APPLIANCES

(NEED SEPARATE CIRCUITS AND FUSING)

| | |
|------------------------|--------------|
| AIR CONDITIONER, 1-TON | 1600 w* |
| DRYER, CLOTHES | 4500 w* |
| PUMP, WATER, DEEP WELL | 1250 w* |
| RANGE, COOKING | 8000-16000 w |
| WATER HEATER, 50-GAL. | 2000 w |

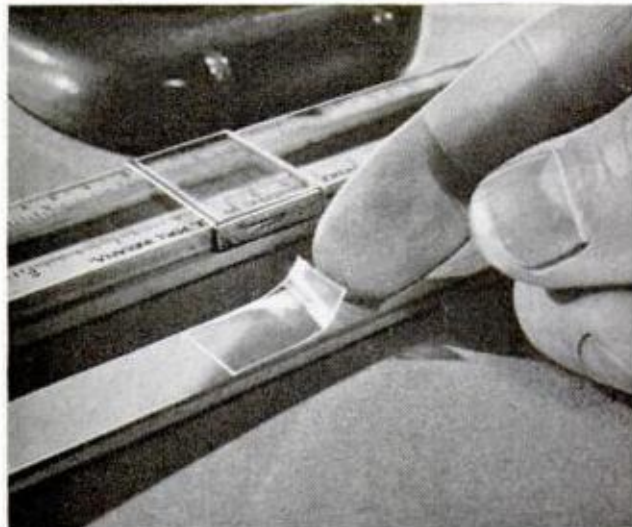
*MOTOR-DRIVEN APPLIANCE

Cake Pan Makes Ready-Made Drawer for Desk



This "drawer" is ready-made for installation under a desk top of the kind often supplied with corner or wall units of the modern modular type. It's a cake pan, costs about \$1.50, depending on size, and comes with a metal or plastic cover that slides on and off easily. You utilize this feature by screwing the pan top to the underside of

the desk top in a convenient location, slide the pan in place and there's your drawer for typewriter-size paper and other everyday odds and ends. Attach a pull, if needed, by means of screws passing through holes drilled through the bottom of the pan. Spray-finish the pan with a coat or two of colored enamel.—*Gordon P. Manning*



Tape Tightens Loose Slip Stick

The slide in an inexpensive slide rule will often become progressively looser with use until it must be held in place with the thumb when moving the cursor or taking a reading. If there is too much slip in your slip stick, you can regain that original tight fit by removing the slide and adding one or two pieces of cellophane tape to the back. The extra thickness serves as a brake, yet allows the slide to move smoothly. Should the edges of the tape begin to lift, it can be easily removed and replaced in a few minutes with a minimum of bother at any time.—*Ken Murray*



Save That Shoe Brush!

Before you throw away that old suede shoe brush with the fine brass bristles think of these uses: It's just the thing, for example, for cleaning a soldering-iron tip as pictured, especially a small tip which is difficult to clean properly. A few light strokes with the brush and the iron is ready for use again. Or, use a suede shoe brush for the pre-polishing steps when cleaning old brass work; the fine bristles will get into places you can't possibly reach in any other way. It's also ideal for cleaning Swiss-pattern files and other small files which have fine teeth.—*Donald Spichuk*

Rows in Line

Although plants are said to grow just as well in a crooked row, such a planting can have little eye appeal for the serious gardener even though his plants may thrive ever so luxuriantly. Straight, uniformly-spaced rows are easy to achieve at planting time if you use a cord and stake that will hold the cord taut. Pointed wooden stakes will do, of course, but it takes only a little more time to make better, longer-lasting stakes by bending 30-in. lengths of 5/16-in. steel rod to the shape indicated. The loop formed at the center of the rod is made large enough to take the toe of your shoe, enabling you to drive the stake into the ground just as you would a spade. A handle, bent at the upper end of the stake, allows you to stretch the cord taut simply by inclining the stake slightly as it is driven.—*Robert S. Tupper*



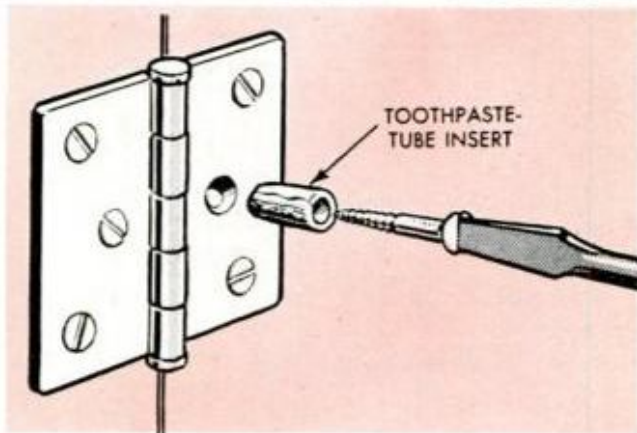
The Eyes Have It

Small screweyes, which come in a wide assortment of sizes, make excellent hangers for hand tools, better even than dowels or nails. For most tools you will need only one screweye, but for such tools as tinsnips and pliers you will need to use two, spaced according to the requirement.—*Bil Toman*



Wood-Screw Anchor

Here's a quick, effective repair for enlarged screw holes. Turn out, or pull out, the screw that no longer holds. Then unroll a used toothpaste tube and from it cut a strip about as wide as the hole is deep. Roll this into a cylindrical shape, insert in the enlarged hole and then drive the screw back in place. It will hold almost as securely as it did originally. The toothpaste-tube sleeve also will anchor a screw in masonry.—*Daniel Bousha*

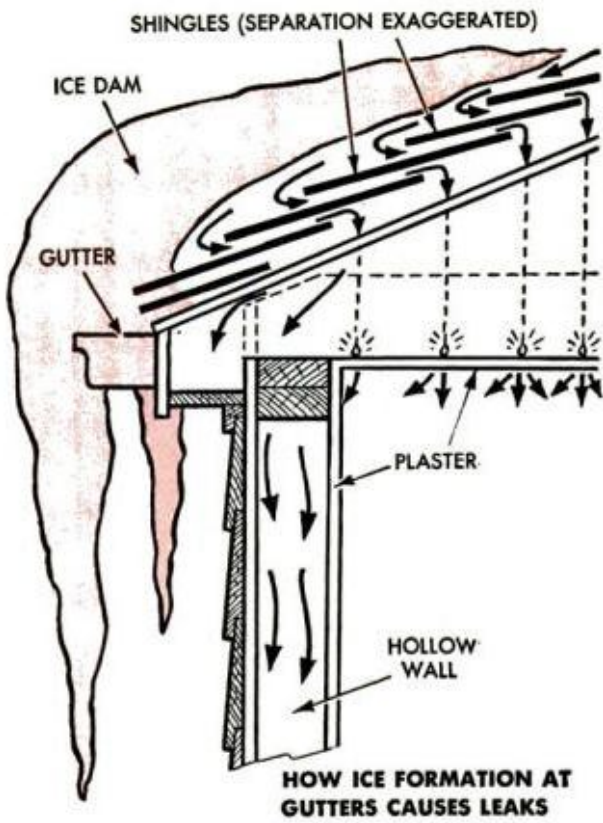


Oil On Tap

There are times when fuel oil is needed in small quantities for supplying space heaters in outbuildings. It's then that the bypass line at the main supply tank can save a lot of time and, in some instances, the cost of an auxiliary tank. A Tee is installed in the main supply line from tank to burner. A valve, four nipples and two elbows are assembled as pictured to form the bypass tap.—*John Krill*



● **Lubricating oil, fuel oil or light grease** can be removed from concrete floors without leaving a discoloration if you wash the area immediately with carbon tet.

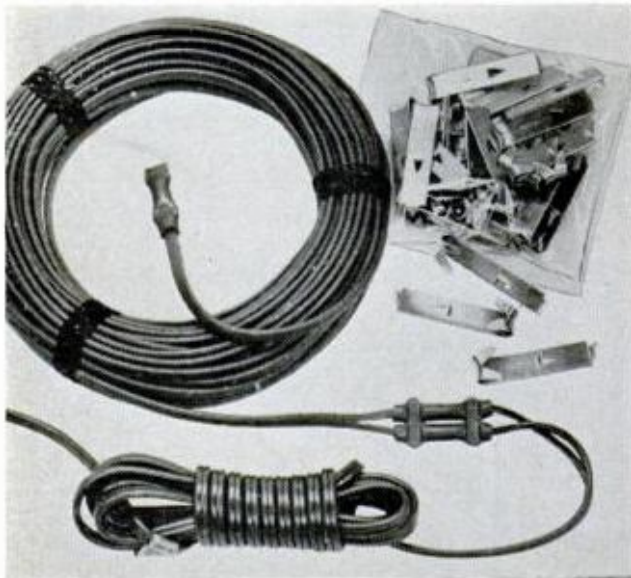


THIS WINTER HAVE ICE-FREE GUTTERS

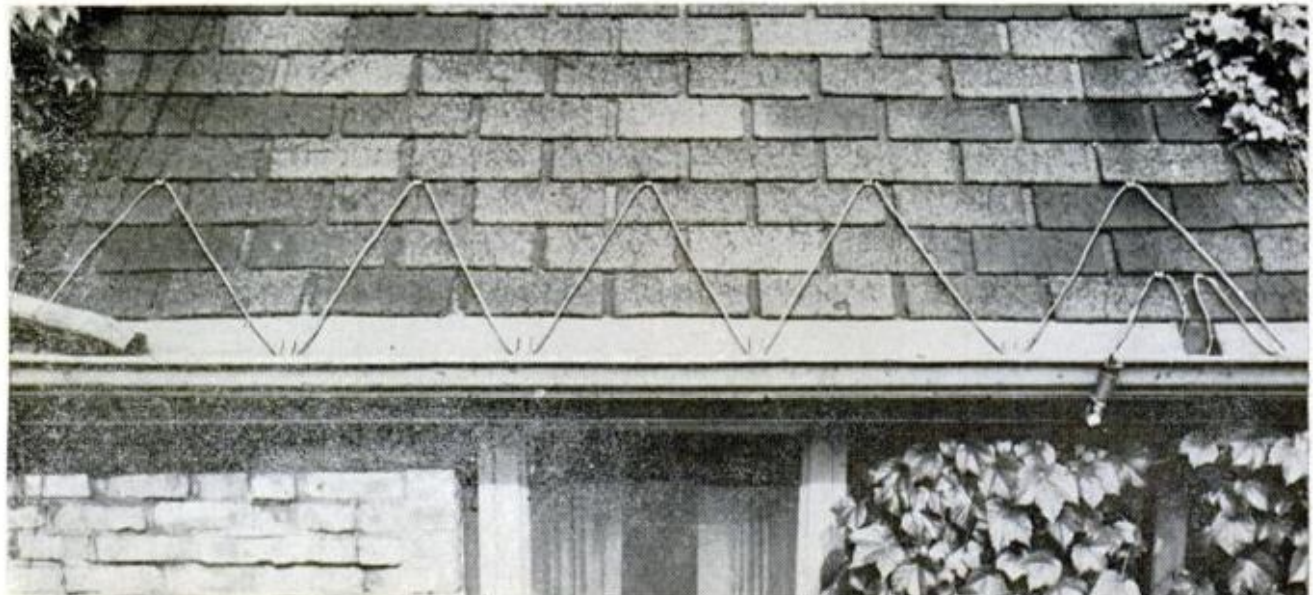
NO MATTER HOW WELL you cleaned out those gutters and downspouts last fall, Old Man Winter can still dam them up with ice in short order.

What causes an ice dam? Even in below-freezing weather, an accumulation of snow on the roof is subject to thawing due to heat from the sun, and more important, heat loss from inside the house through the roof. This water trickles down the roof until it reaches that portion directly above the overhang. Here, there is very little heat loss through the roof, so the surface is much colder, and this is one of the basic causes of an ice dam.

If weather conditions are right, water passing over this cold edge of the roof will freeze again, and the thin layer of ice formed here becomes the dam's foundation. Once started, a dam builds up rapidly, and soon the trouble begins. Water running down the roof under the upper edge of the dam is stopped by the ice, so it creeps up under the shingles and leaks into the house. Sometimes, water flows out over the jammed gutter to form huge icicles or

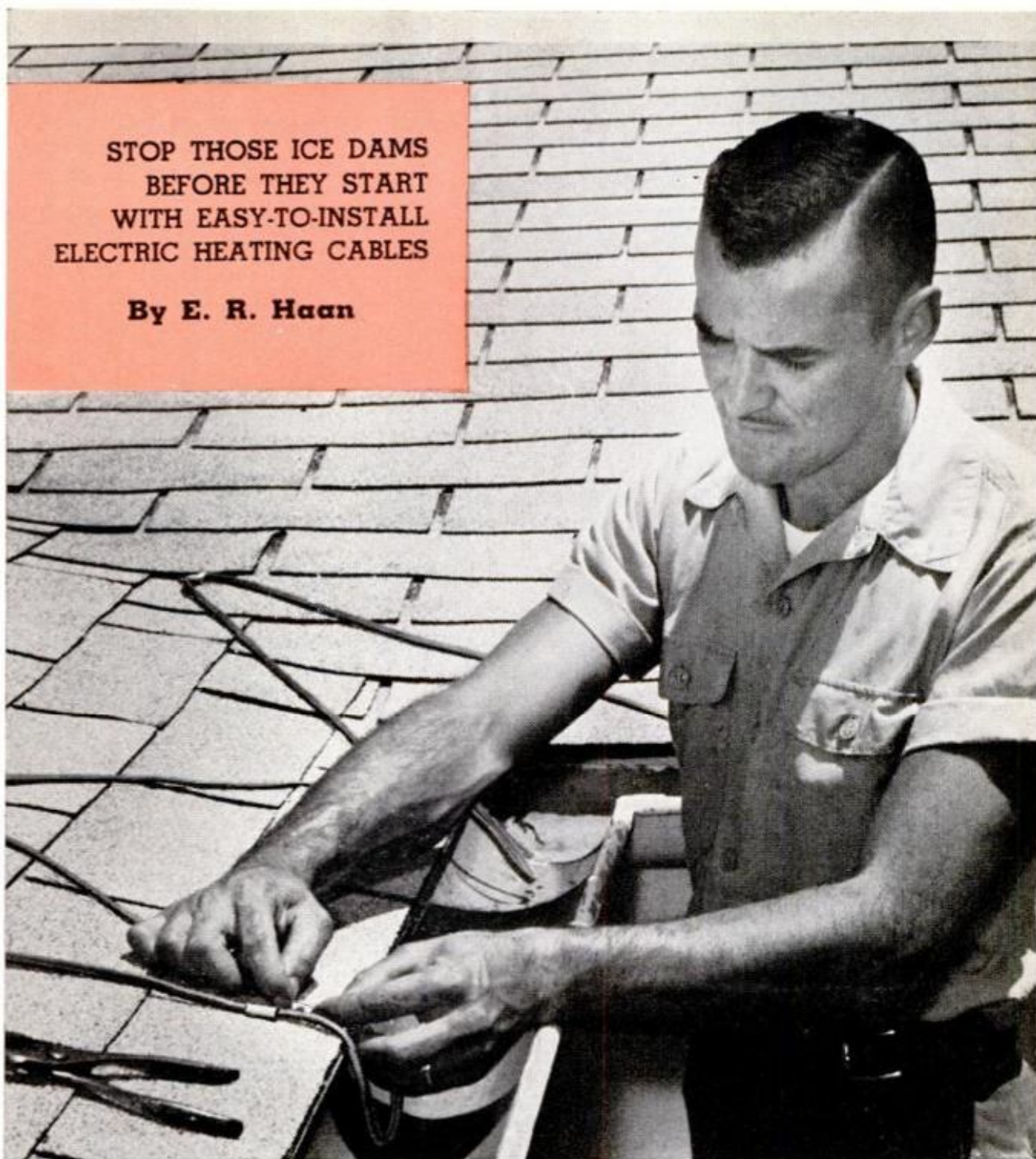


ICE DAM, upper left, causes water to creep up between shingles and leak into house. Electric heating cables, left and below, provide just enough heat to prevent ice from forming. Turned off when not in use



**STOP THOSE ICE DAMS
BEFORE THEY START
WITH EASY-TO-INSTALL
ELECTRIC HEATING CABLES**

By E. R. Haan



HEATING CABLES are mounted zigzag fashion along the edge of roof, using clips which slip under shingles

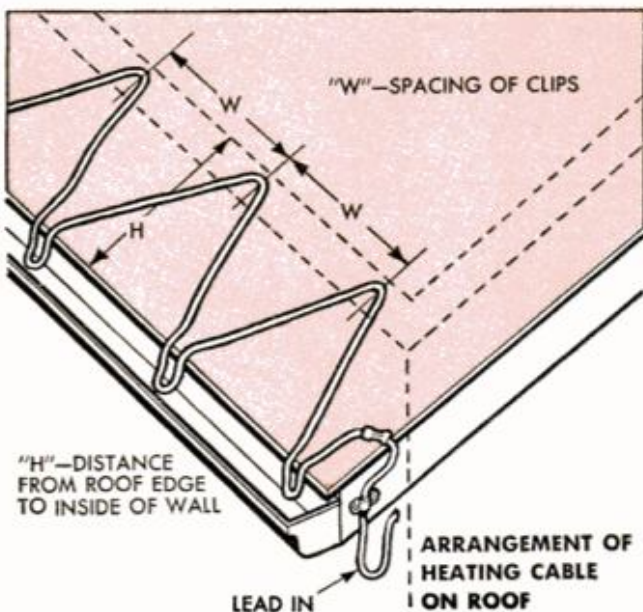
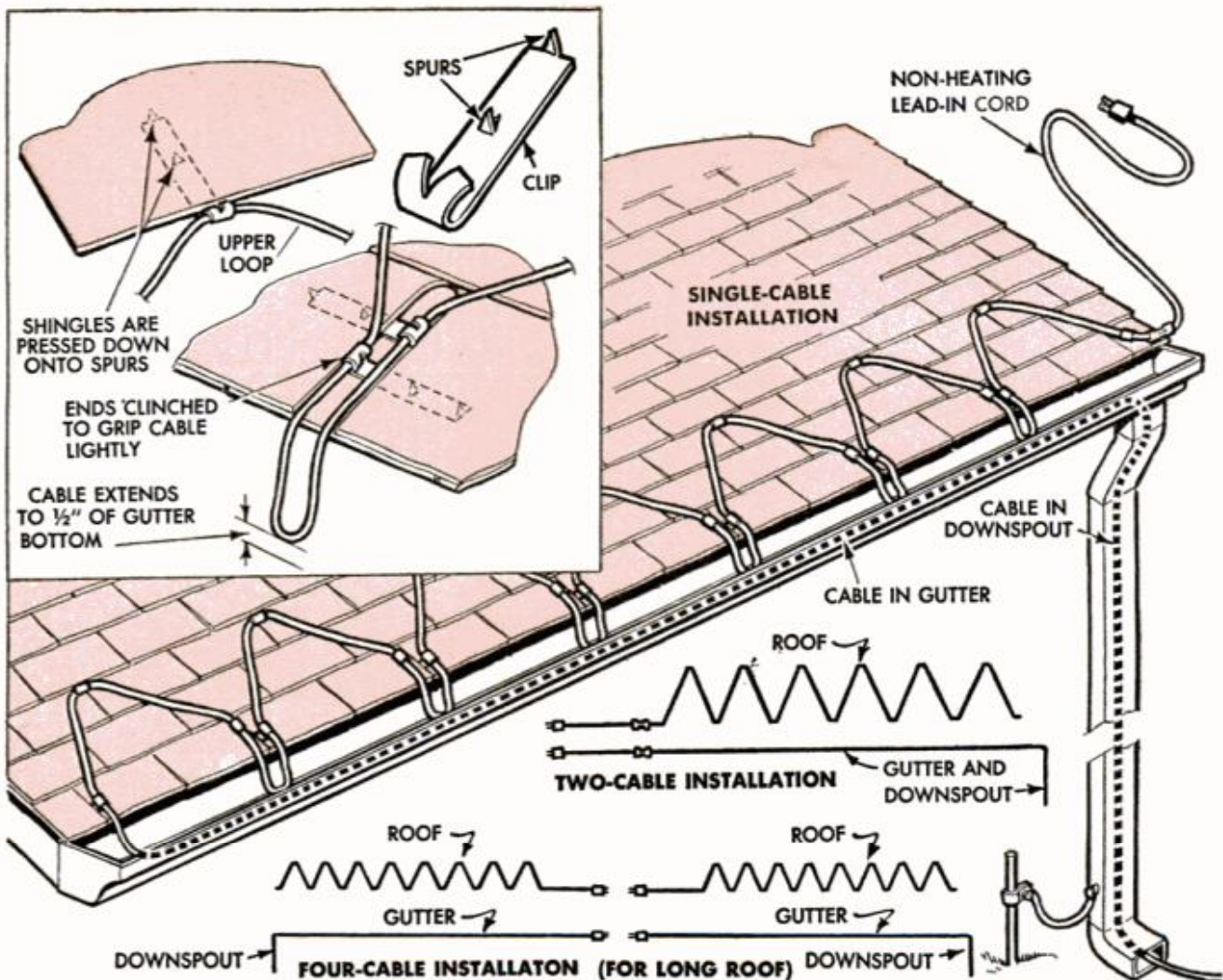
cover the wall with a glistening sheet of ice.

The simplest and most effective solution to this problem is installing electric heating cables along the cold edge of the roof and in the gutters. These will produce just enough heat to prevent ice from forming, and can be turned off when not needed. Neutral-gray in color, the cables are available in lengths from 20 to 200 ft. for either 120-v. or 240-v. circuits. You have your choice of either a 1-ft. or 10-ft. lead-in cord. Electrical consumption is very low—from 160w. to 1650w. depending on the size cable used. At the end of the winter, take the cables down and store them until next fall.

Heating cables are mounted zigzag fash-

ion along the lower edge of the roof with special clips. These clips must be pushed up under the shingles and then pressed down so that the tiny spurs on the hidden end will hold them in place (see upper detail, p. 180). The exposed end of each clip is hook-shaped to hold the cable. For slate or metal roofs, the clips can be attached with epoxy-resin cement or roofing compound.

The cable should project down past the edge of the roof, forming loops that dip into the gutter to within $\frac{1}{2}$ in. of the bottom. Don't cross or overlap the cable at any point, nor space it closer than $\frac{1}{2}$ in. Note that two clips are used to assure this separation where it loops into the gutter.



To determine how much cable would be required for your roof, refer to the lower detail drawing. Cable spacing, distance W , varies with the amount of snowfall in the locality. The table below gives the required length of heating cable per lineal foot of roof under different snow conditions:

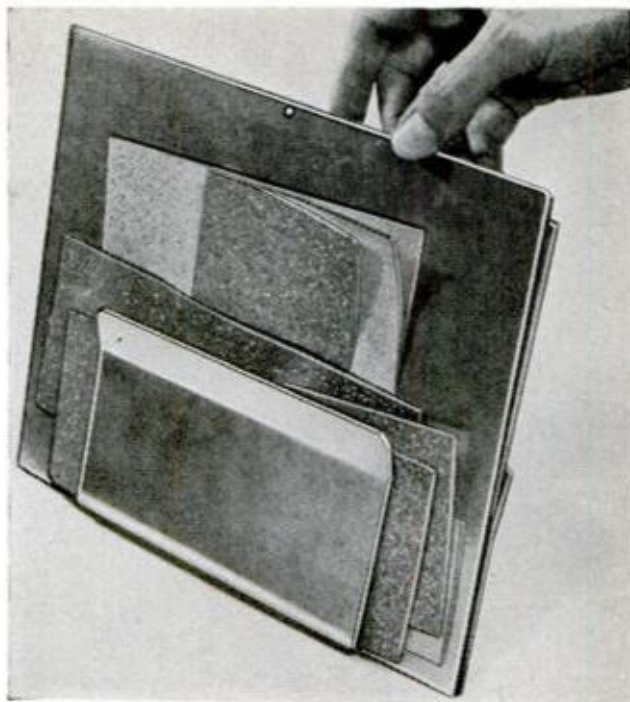
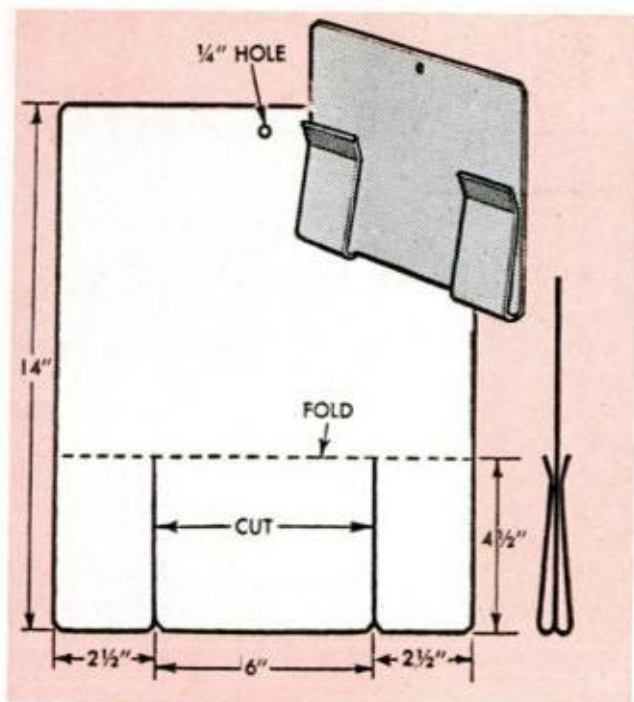
| Snowfall | H. (in.) | Cable Length (ft.) |
|------------------------|----------|--------------------|
| Light $W = 24$ in. | 12 | 2.8 |
| | 24 | 3.6 |
| | 36 | 4.5 |
| Medium $W = 12$ in. | 12 | 3.8 |
| | 24 | 5.6 |
| | 36 | 7.0 |
| Heavy $W = 6$ in. | 12 | 6.0 |
| | 24 | 10.0 |
| | 36 | 14.0 |

Once the cable is mounted, the lead-in can be brought to an outdoor or indoor receptacle on a properly fused circuit that will not be overloaded by the cable's electrical requirements. Where several cables are connected to an outdoor junction box, they should be wired to the entrance box as a separate circuit, and this is a job for your electrician. Be sure that the gutter and downspout are well bonded together, and ground them to a pipe or metal rod.

Once you have figured the length of cable required for the roof, add the amount needed for gutters and downspouts. Don't try to shorten the cable by cutting the heating portion as this will ruin it.

When installing a cable during freezing weather, first unroll it and lay it out flat so that it doesn't overlap at any point. Then plug the cable into an outlet and allow it time to warm up. This will make it more pliable and easier to mount. ★ ★ ★

Hanging Caddy Stores Sandpaper in Perfect Order



In the small shop, in the home or elsewhere, storage space for tools usually is the first thought, but where do you keep the sandpaper? Toss it in a drawer, and you'll take out sheets with curled edges and creases. Not only that, the abrasives

prevent safe tool storage in that same drawer. This hanging caddy solves the problem for good. It's made of fairly heavy sheet metal, cut and bent as indicated, the bends being made over a narrow strip of 1/4-in. stock.—*R. Hanscom*

How to Take the Wobble Out of That Chair

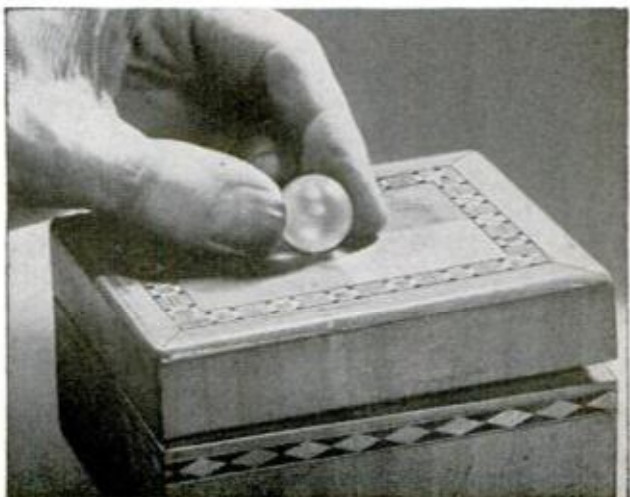
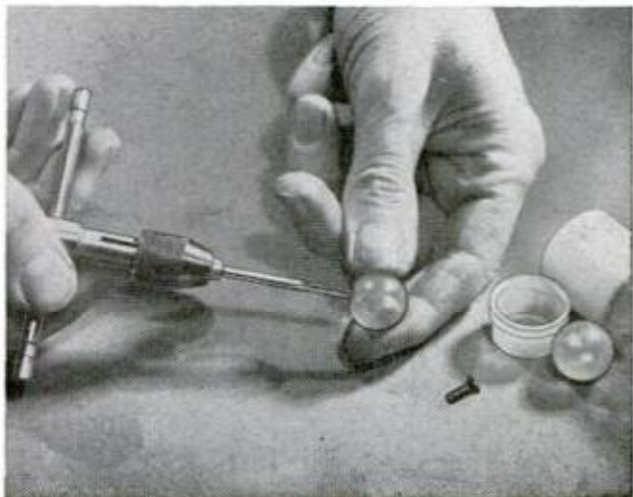
No good householder will put up for long with a wobbly chair. Correcting the wobble is easy if you use this trick: Measure three of the legs, down from the seat, and cut to length. Then place the chair on a

table with the uncut leg overhanging. Lay a yardstick on the table with its edge against this leg. Pencil-mark the leg and cut off. With care in measuring you'll end up with all legs even.—*B. Wollenzien*

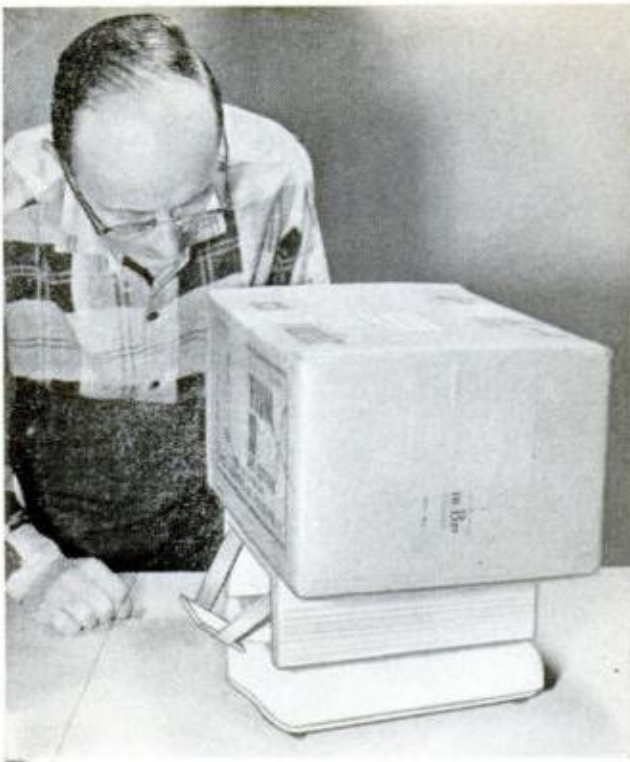
Plastic Ball Makes Fancy Knob for Jewelry Box

You may have wondered what further use might be made of the translucent plastic ball you see in the "roll-on" type of dispenser cap provided with some cosmetic bottles. Here's one use for it: Remove the

ball, being careful not to score it, and file a flat on the surface. In the center of this drill and tap for a 6-32 screw. Then attach the ball to the lid of a trinket box as in the right-hand photo.—*Walter E. Burton*

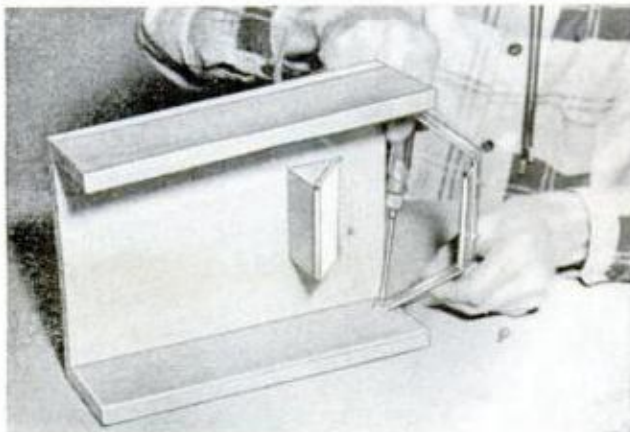


BATHROOM SCALE DOUBLES AS PLATFORM SCALE



WEIGHT READING on the scale's dial is reflected from the mirror on the underside of the platform base to the face of the tilted bracket-mounted mirror.

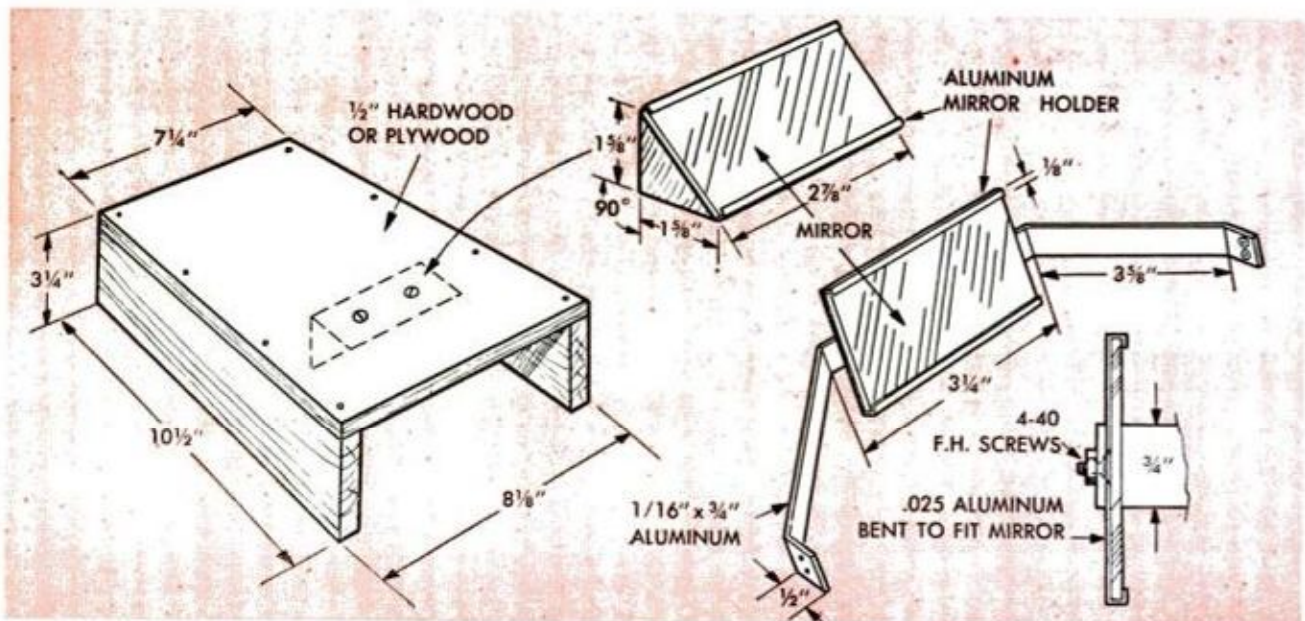
WEIGHING OF CARTONS or other bulky items to determine shipping charges can be done on your bathroom scale with this piggyback platform. Consisting of a base and two side pieces made of hardwood or plywood, the platform supports the package on the scale and permits the weight to be read through the use of two mirrors. One mirror is mounted at a 45-deg. angle on a triangular shaped block attached to the underside of the platform at a point directly over the scale's dial. The other mirror is mounted on an extended aluminum bracket, bent and attached to the platform as shown. The image of the dial reading appearing in the underside mirror can be seen in the face of the bracket-mounted mirror.—H. P. Strand



UNDERSIDE MIRROR BLOCK is attached with flat-head screws. Extended bracket mounting for the second mirror is screwed to the side pieces for easy reading.

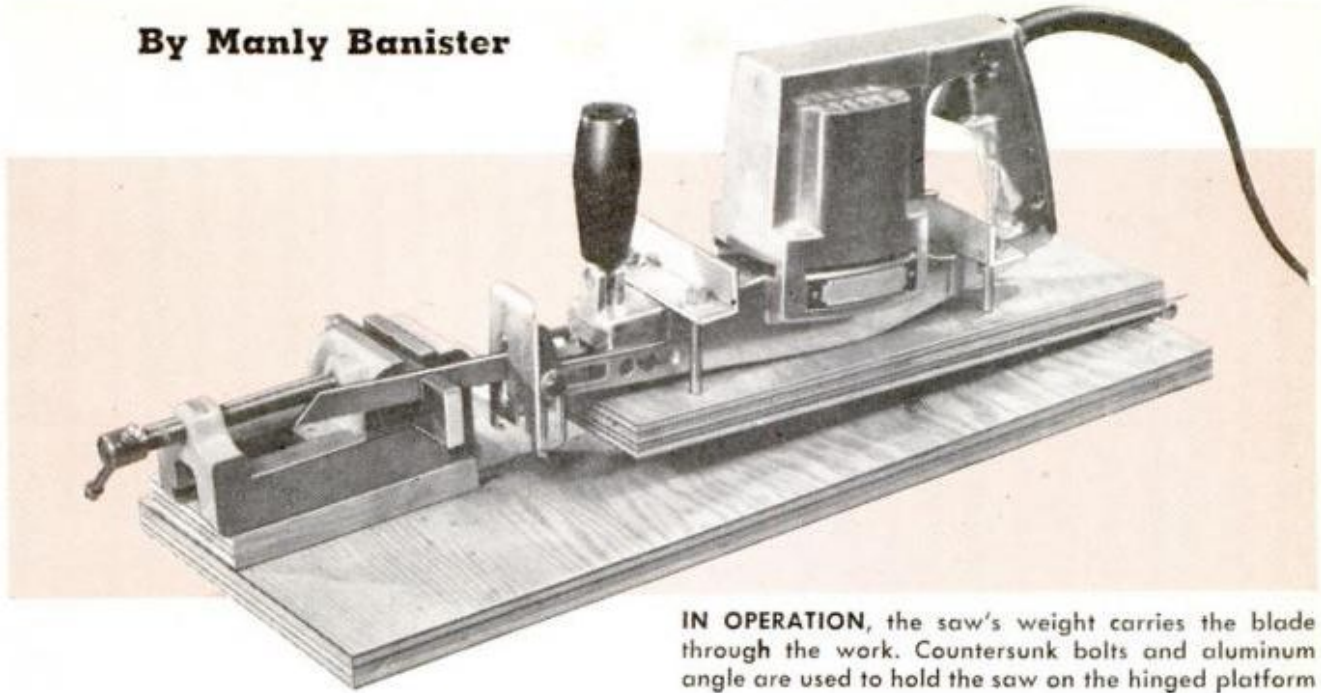


RAISING OR LOWERING the bracket will bring the scale's dial in full view on the mirror. Drawing details can be modified to apply to any bathroom scale.



HINGED STAND AUTOMATES PORTABLE HACKSAW

By Manly Banister

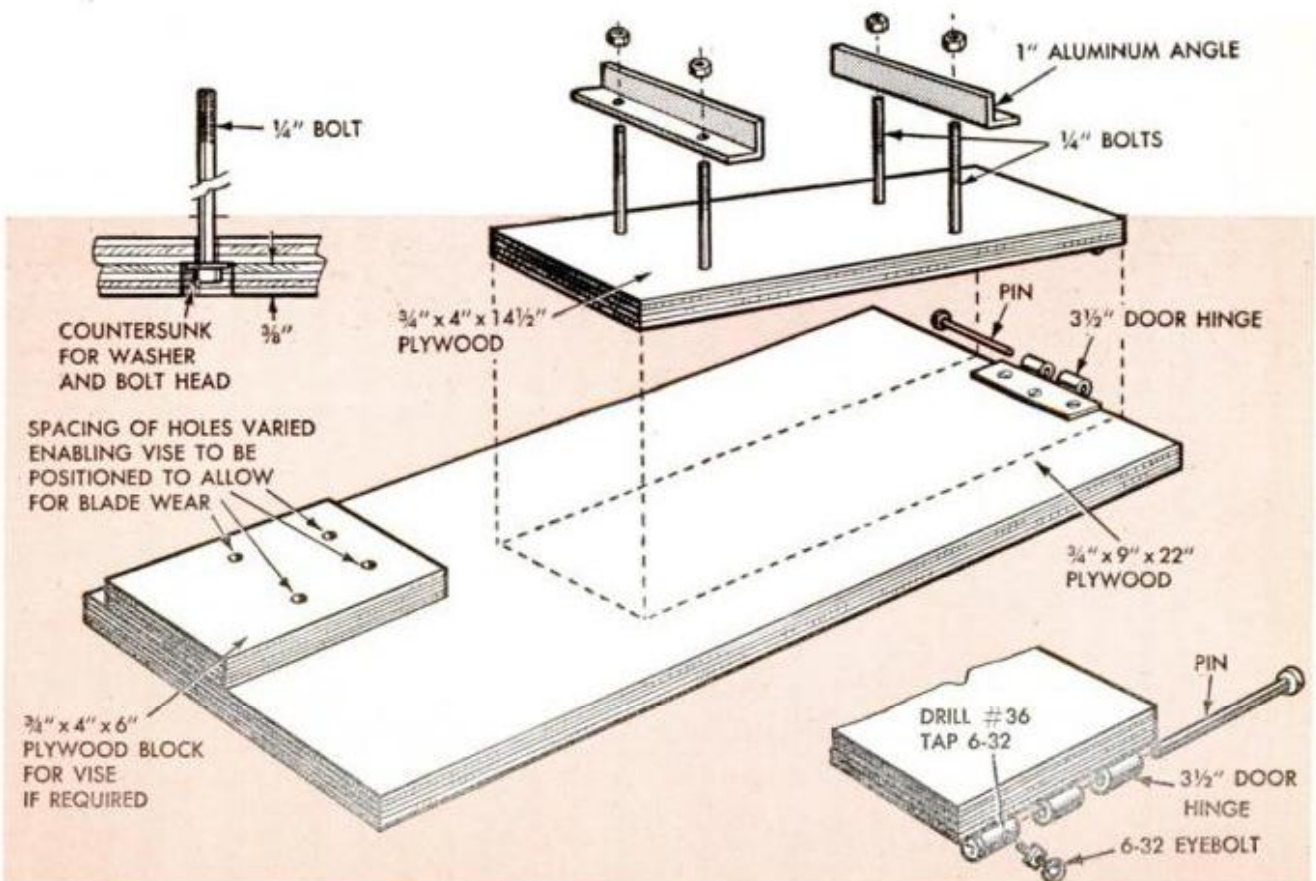


IN OPERATION, the saw's weight carries the blade through the work. Countersunk bolts and aluminum angle are used to hold the saw on the hinged platform

FITTED WITH A SIMPLE three-piece hinged base, your portable reciprocating saw will cut metals unattended, just like a regular power hacksaw. The weight of the unit alone will feed the blade into the work with just the right amount of pressure. And, you get an accurate cut, something you may not achieve when saw is held.

A look at the detail tells you everything you need to know to make the three-piece

base. By using a loose-pin hinge as shown, you can easily detach the saw for freehand work without removing the platform to which it is clamped. Although all reciprocating saws are similar in design and size, you should check the thickness of the base piece on which the vise is mounted. You may need to use either thicker or thinner stock than indicated to make sure the vise is at the correct height. ★ ★ ★



SHOP SHORT CUTS

Tool Sockets from Tubing

The handiest way to mount tools with slim handles or shanks is in individual sockets made from metal tubing. Choose tubing of a diameter appropriate to the tool, and trim it to a length that will provide good support. Flatten one end by crimping in a vise and drill holes for two mounting screws. Angle the tubing so the tools lean forward. They're much easier to grasp than when mounted flat, and you can get many more holders on the same tool-board space. Thin-wall conduit is ideal and bends easily.—*Theo. A. Johnson*

Saw blade gummed up from cutting resinous lumber? Just apply paint and varnish remover, let it set a few minutes, and wipe it off. This method even cleans the teeth when the resin has become glazed.

Easy Micrometer Reading

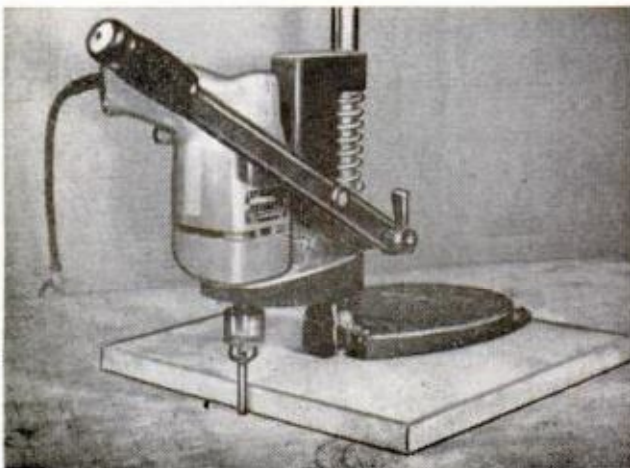
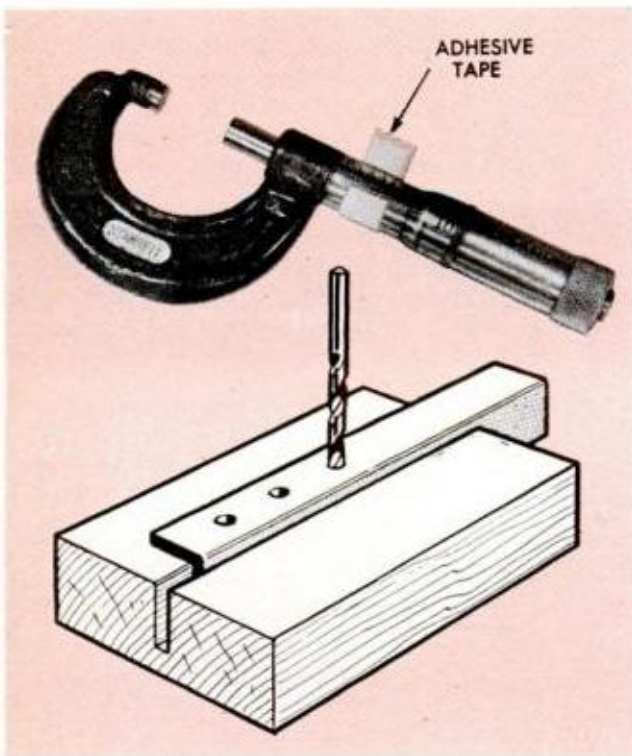
Wrap a strip of tape around the barrel of a micrometer at the marking just under the required dimension. The tape retains the main setting of the thimble on the spindle while subsequent settings are made. This eliminates checking and resetting the thimble to the barrel settings and prevents the turning lathe work undersize due to an incorrect setting.—*R. Hanscom*

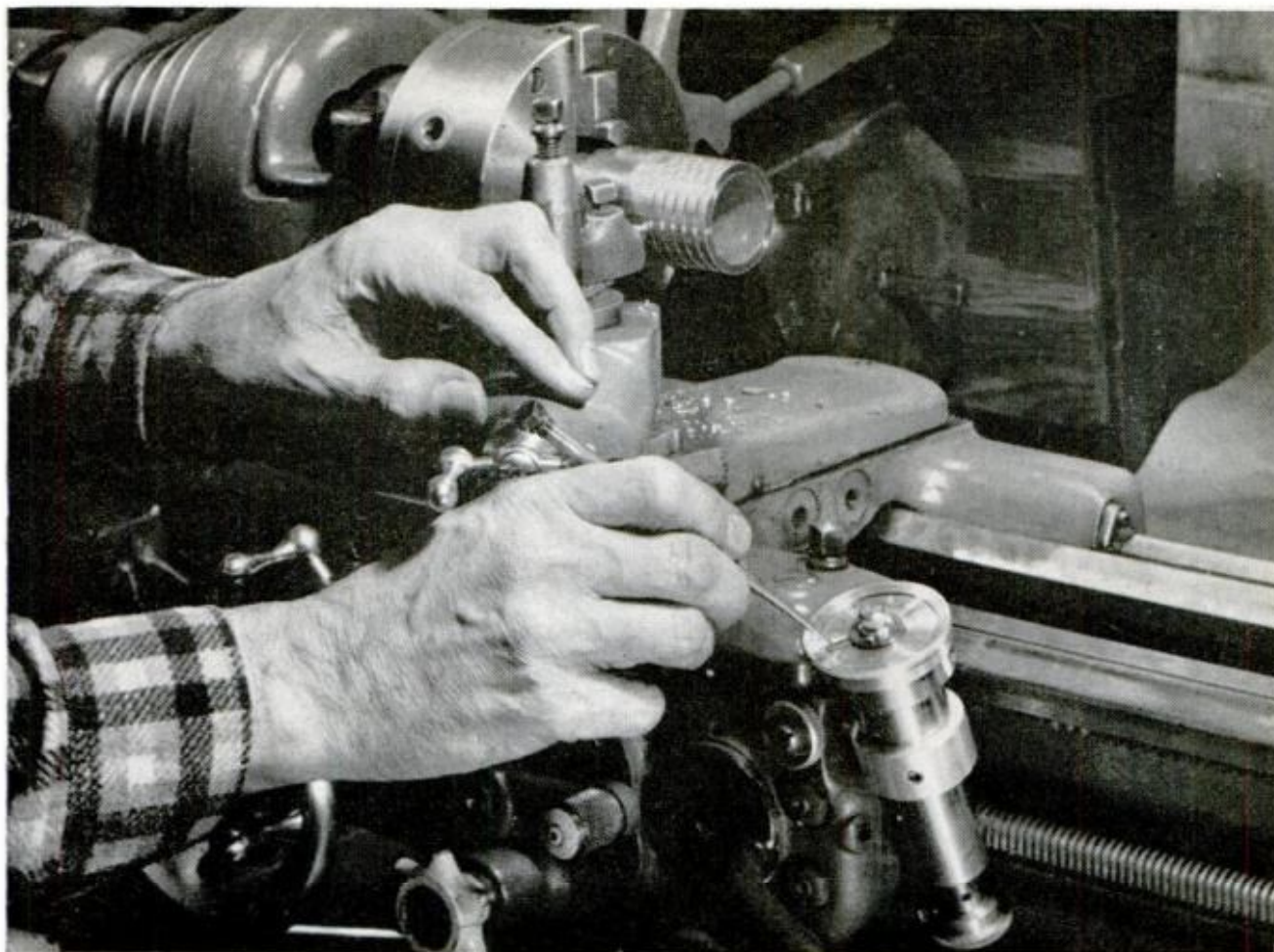
Holding Steel Angle

No need to risk holding a short length of steel angle while you drill it. The simple "clamp" shown at the left gives greater accuracy as well as safety. Across a softwood block, cut a saw kerf that's slightly deeper than one leg of the angle and just wide enough to provide a firm press fit. The opposite leg rests flat on the surface of the block, providing solid support under the drill bit.—*C. W. Woodson*

From Drill to Router

What do you do when you don't have a portable router, but do have an electric drill and stand? I was faced with this problem until I hit upon the idea of simply mounting the drill-press stand on a flat board and swinging the drill around to overhang the edge. With a router bit in the chuck and the drill locked for depth, I found I had an efficient makeshift substitute for a regular router which I could slide over the surface of the work like the real thing.—*Dr. H. A. Hattstrom*





LIMIT DISKS can be set with point of scribe—here, to machine equally-spaced grooves on brass tube

LATHE MEASURING GAUGE

By Walter E. Burton

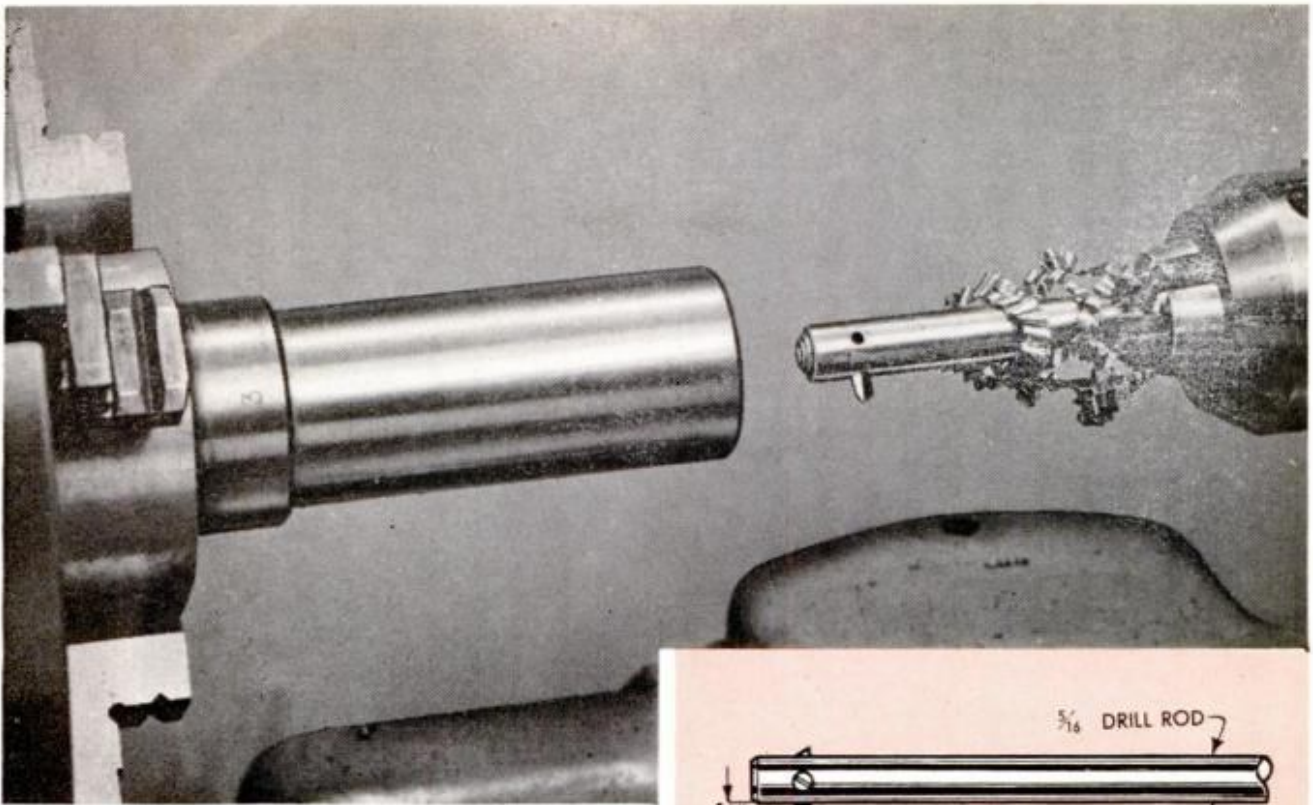
FEW ATTACHMENTS can improve the metal-working lathe as much as a gauge that measures, in small fractions of an inch, the carriage travel along the ways. Such a gauge will help you to:

- Cut accurately-spaced grooves or slots on the inner or outer face of a cylinder—controlling both spacing and width of cut.
- Control depth of boring-tool cuts.
- Control amount of material removed in facing cuts.
- Machine grooves and recesses in the face of work to predetermined depth.
- Cut series of rings, disks or pins to uniform length or thickness from a chucked tube or bar.
- Position the steps in work being machined to several diameters.

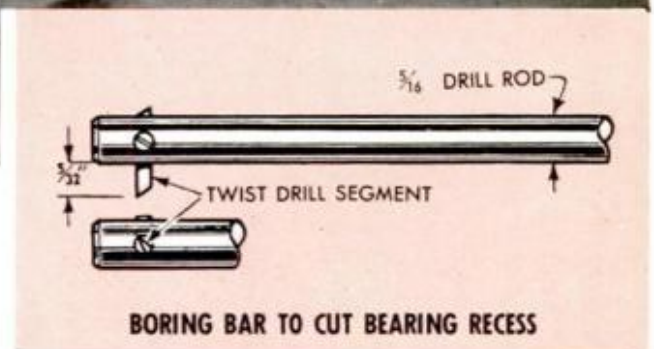
Using the gauge shown above, I've performed all these operations—without stopping the lathe or resorting to hand-measuring tools. I even find I don't have to watch the work or the tool. I've also used the gauge as a conventional thread dial to indicate where to engage the split nut in making repeat cuts.

The working part of the gauge is a shaft (made from $\frac{5}{16}$ -in. drill rod) with a gear at one end that engages the lathe lead screw. At the shaft's other end is a calibrated dial encircled by an adjustable ring bearing an index mark and vernier scale. This serves as a carriage-movement gauge when the lead screw isn't turning, and a thread dial when the screw is revolving in thread-cutting. Either way, the gauge is a time-saver—and a guard against spoiled work.

The gauge in the photograph above (and detailed on the following pages) was designed for use with a 9-in. Model A South Bend lathe that has a lead screw with 8 threads per inch. One revolution of the dial indicates two inches of carriage travel. To adapt the attachment to other lathes, you may have to alter lengths, mounting arrangement, and gear dimensions. So that you can calculate the latter, the formula is given in full on the next page. I hold a U.S. patent on certain features of the gauge, so these instructions are offered to the reader who makes the unit for his own use, not for sale.



1. BORING TOOL—custom-built for this job—cuts bearing recess in each end of body, prior to final shaping. Break a high-speed twist drill, grind shank to cutting edge, fasten in rod with setscrew. A 5/16-in. hole through body axis guides of boring tool



use a spacing collar or washers between gear and bearing, and fasten the knurled knob directly to the shaft with a setscrew that won't interfere with the brake shoe.

If you make the gear, cut the teeth on an angle so you can mount the gauge vertically. First, machine a brass blank, then cut the teeth with the blank mounted on a 5/16-in. mandrel in the collet of an indexing attachment, using a 24-pitch gear cutter in a milling machine. The indexer could also be mounted in a lathe for this job. (The unit shown in Fig. 3 was made from plans in PM's October 1954 issue, page 223.) To the lower hub, solder a knurled knob with a flat, smaller-diameter "brake surface" (Figs. 5 and 6). The knob is useful when setting the dial before engaging the gear and lead screw, and for moving the gear into close contact with the screw thread to improve accuracy—especially when the direction of carriage travel is reversed.

Brake

This friction drag (Fig. 5) is just a curved metal shoe riveted to a fairly stiff, flat spring strip and lined with 1/8-in.-thick leather. Cement the leather in place and lubricate it with neatsfoot or similiar oil.

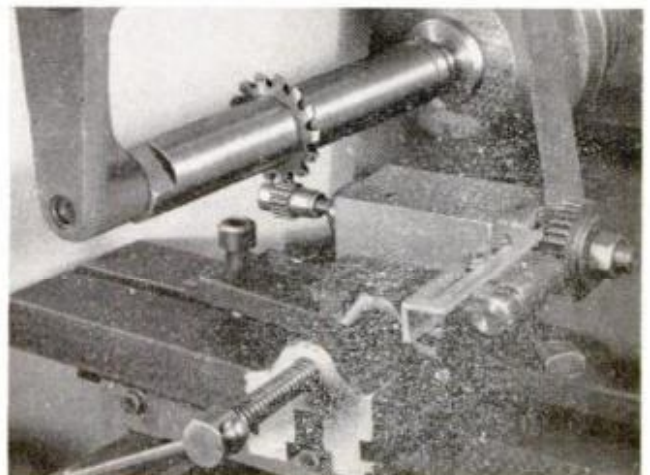
Gauge Dial

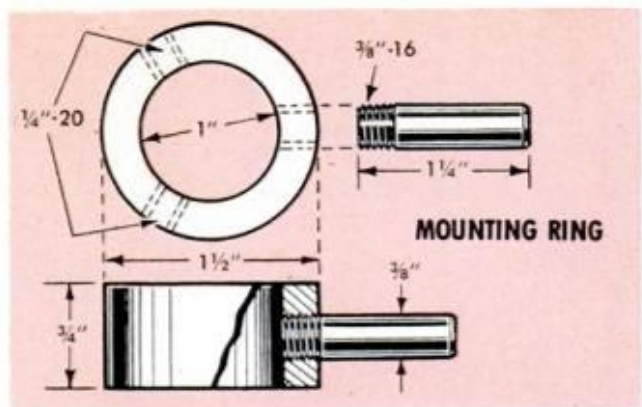
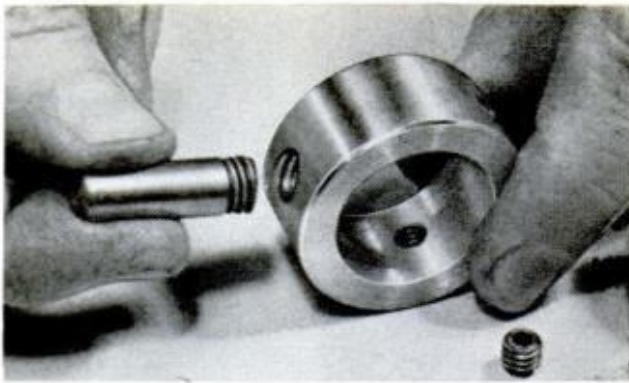
Stainless steel is the best material, but brass or ordinary steel can be substituted.



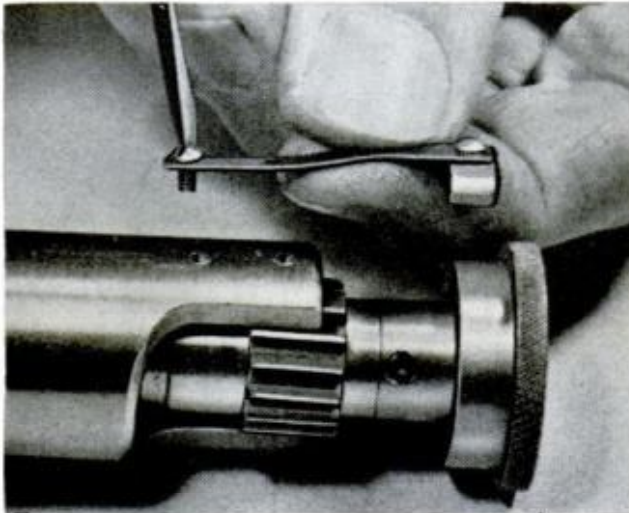
2. SPLIT BRONZE BEARINGS are held in recesses by setscrews, which also adjust clearance. Gear shaft (lying alongside body) is inserted through them

3. GEAR TEETH are cut by clamping indexing unit to table of milling machine (or lathe) at slight angle

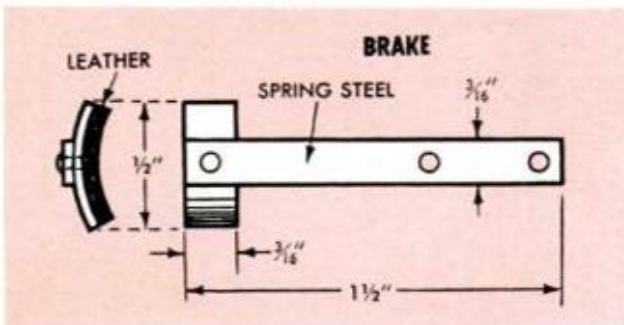




4. ALUMINUM RING has inside diameter that slips over gauge body, permits vertical adjustment with two setscrews. Mounting stud (held above left) was made from steel bolt to fit existing hole in the lathe

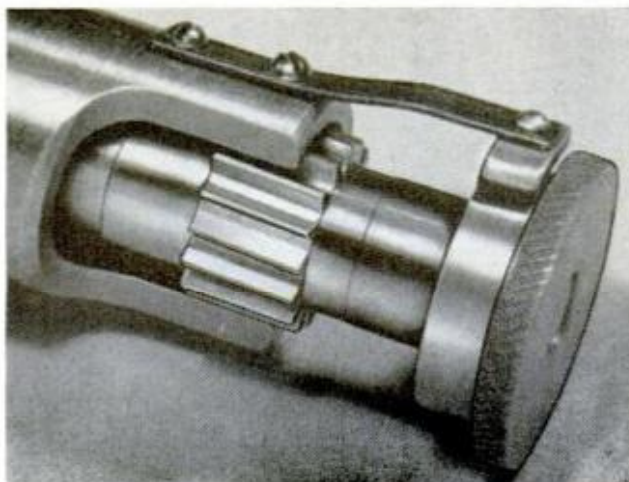


Machine the blank to approximate dimensions given in sketch with Fig. 8, and fasten it to a $\frac{5}{16}$ -in. drill-rod arbor with a 6-32 setscrew, for finish machining. Use fine abrasive cloth to polish the face. Transfer the unit to the indexing attachment (Fig. 9) for engraving the scale. You can calibrate the dial in either decimal or fractional units of an inch. The decimal scale may be handier, since lathe feed-screw scales are usually in thousandths.



5. TWO 2-56 SCREWS hold brake spring to gauge body. This drag produces light pressure between gear teeth and thread of lead screw for accuracy

6. LOWER END of completed gauge shows knurled knob for turning dial by hand or adjusting to eliminate play. Note body is cut away to clear lead screw. To clarify assembly, body of this model is a bit shorter than correct dimension shown in plans on page 186



Index Ring

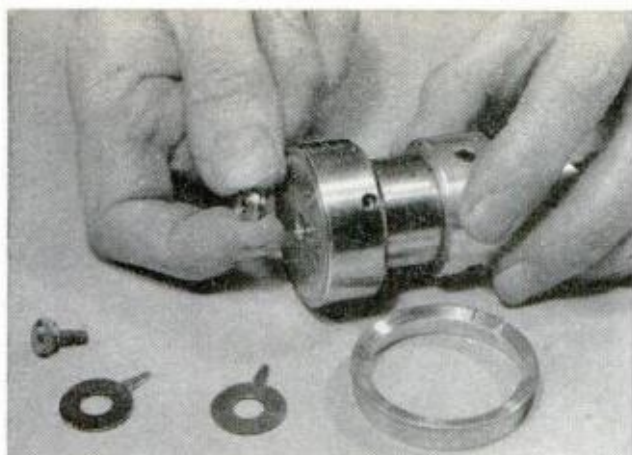
This knurled ring fits the gauge body snugly enough to hold any position to which it is rotated. It has an index mark flanked by vernier divisions (a diametrically-opposite index mark is handy for threading operations). For a decimal scale consisting of 100 dial divisions, each representing .020 in. of carriage movement, a vernier having four divisions covering five scale divisions will enable you to read to .005 in. For a fractional scale of 64 dial divisions, each representing $\frac{1}{32}$ in., a vernier scale of four divisions covering three on the dial will give readings to $\frac{1}{128}$ in. Method of calibration is shown in Fig. 10.

Limit Indicators

Two metal disks, with fingers slotted for accurate setting to various dial lines, let you mark starting and stopping points in repeat operations. The disks are clamped by a screw-and-collar arrangement (Fig. 7). A punch mark in each disk finger lets you set positions with a scribe or pencil point. When gauging grooves, don't neglect to make allowance for tool-point width.

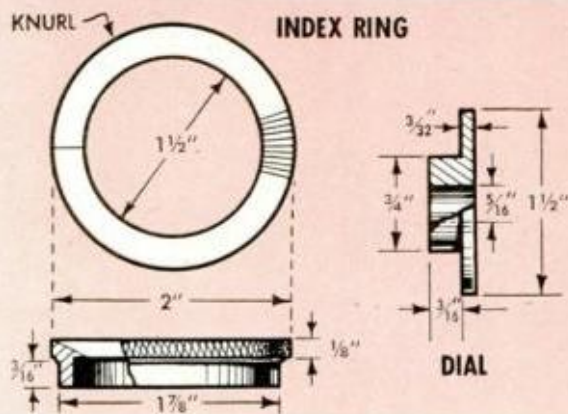
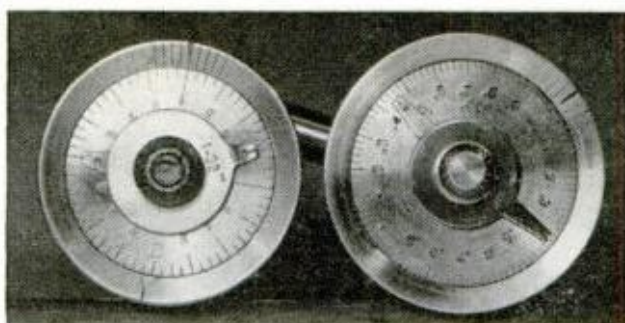
Mounting Bracket

The size and shape may depend on the provisions in the carriage design of your lathe for mounting a thread dial. The carriage of mine had a $\frac{3}{8}$ -in. hole with a wrench-type locking screw (which I re-



7. DISK CLAMP COLLAR (held in fingers, left) has small hole to take pin projecting from shaft end. Pin, made from a brad, keeps collar from disturbing setting of limit disk when clamping screw is tightened

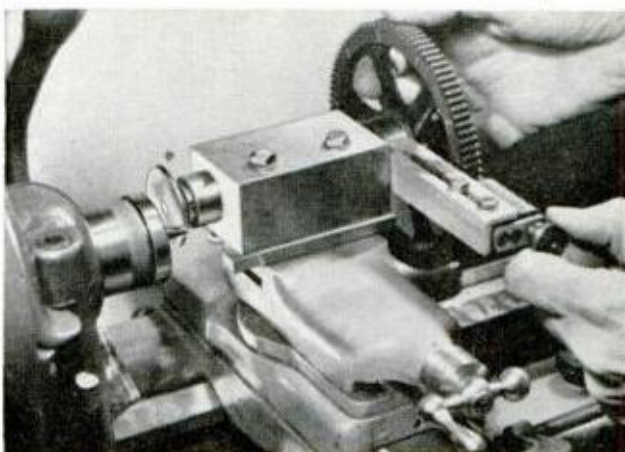
8. TWO TYPES OF DIALS are shown in photo at upper right. Left one is calibrated to read directly in $1/32$ -in. steps, and $1/128$ in. with vernier on index ring. Right one is dial being calibrated below; it reads directly in $.020$ -in. steps, to $.005$ in. with vernier



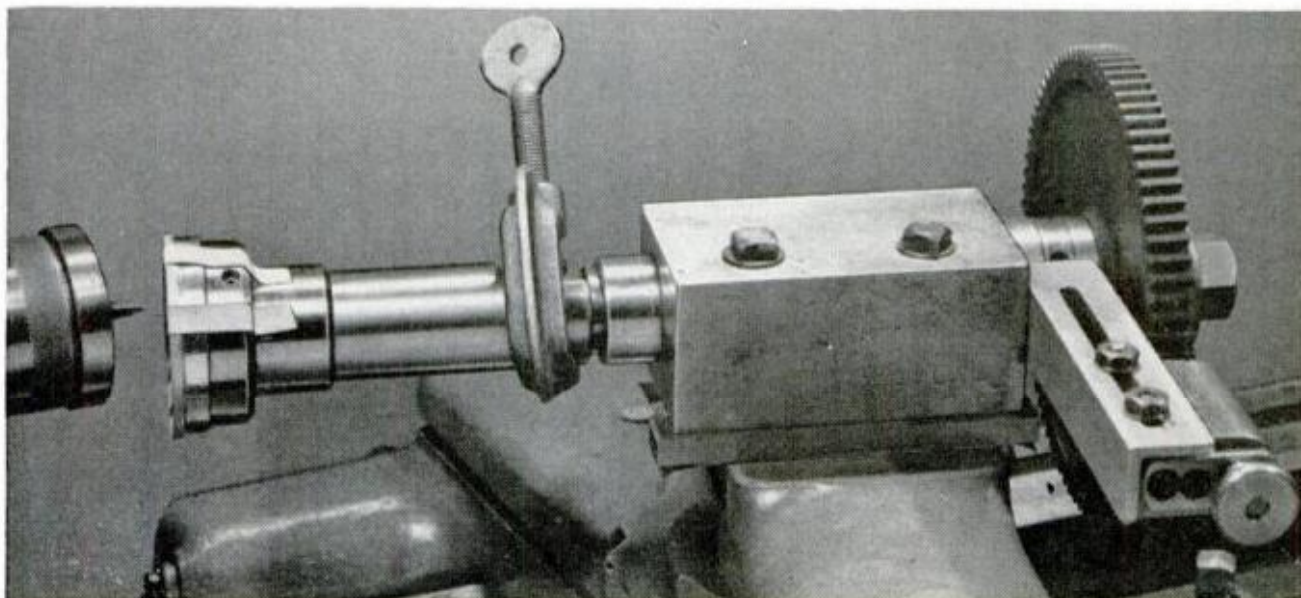
9. CALIBRATE DIAL into $.020$ -in. divisions by bolting indexer with 100-tooth gear to toolpost slot. Shim it to lathe centerline so scribe in headstock collet cuts radial lines on surface as crossfeed screw is operated

placed with a knurled-head thumb screw). In attaching the gauge, adjust it so the gear teeth make good contact with the lead screw. Great pressure isn't necessary; moderate play will cause no trouble. Keep the gear teeth lubricated. In time, they'll show wear—partly from adapting to the contour of the lead-screw thread—but the drag feature helps offset this. In several years of use, my gauge has show a consistently high degree of accuracy, and has caused no detectable wear on my lathe's lead screw.

From my experience, once you become accustomed to using this gauge, you're likely to feel at a loss when, for one reason or another, you must do a precision job without it. ★★★



10. ENGRAVE VERNIER MARKS on index ring by using 80-tooth gear with indexer angled to match bevel. Vernier permits reading of $.005$ in. Ring is taped to body which, in turn, is clamped on rod in indexer collet

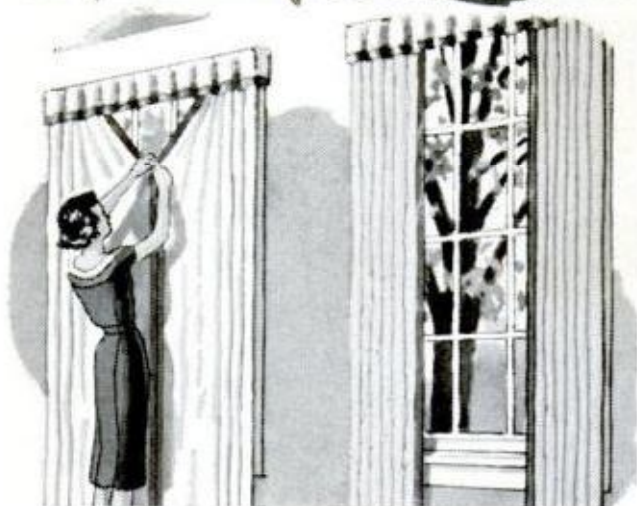




Kite Stabilizer

Often, a kite will dodge and dive whether it has a tail or not, but you can stop these antics by attaching narrow strips of paper to the kite at the corners. The paper streamers should be 2 ft. or more in length and about 1 to 2 in. wide, depending on the size of the kite. If colored paper is used, it will add to the beauty of a flying kite. Try experimenting with streamers of varying length and widths to find the combinations that produce satisfactory results in variable winds.—*G. E. Hendrickson*

Screw sections from discarded earrings make ideal clamps for holding mended jewelry or other miniature items together while glue sets. They are particularly useful in holding freshly glued parts of model airplanes in position, but don't apply too much pressure on the screw. If you do, the earrings will spread open.



Draw-Drape Hitch

An ordinary hook-and-eye fastener can be used to convert stationary window draperies into effective draw curtains to keep out drafts or bright sunlight. No pull strings or traverse rods are required; simply attach the hook and eye along the back edges of the draperies near the top. To close them, just snap the hook and eye together and the panels will be held in a drawn position. The small size of the fasteners makes them practically invisible whether the draperies are in open position or drawn.—*Robert L. Sargisson*

COMING UP NEXT . . .

"LITTLE DIGGER." Small-fry construction engineers who are always busy making excavations in the backyard will be delighted with this toy power shovel. Big enough to ride on, it's fully equipped with a control lever to operate the boom, another for the shovel and a push rod for opening the bucket. There's even a winch for pulling "stumps." A perfect springtime toy to make now.

ICE FLIES FOR JIGGING. If you're one of those hearty millions who prefer an ice shanty to a warm fireside, then you'll be interested in this timely report on a new wrinkle in ice fishing. Instead of setting tip-ups baited with minnows for pike and walleyes, try jigging ice flies for panfish. Complete, from step-by-step photos on tying the flies to an insider's tips on jigging with flies.

STUCK WITH A GLUING PROBLEM? Then you'll be interested in next month's wrap-up on adhesives. Tells the right type glue to pick for every job, the advantages and disadvantages of each type, plus plenty of how-to tips on application, clamping, etc. If you don't know the difference between an acrylic resin and an aliphatic resin, be sure to read the February PM.

COMPOUND SLIDE REST FOR YOUR WOOD LATHE. Any wood lathe becomes doubly useful when equipped with a cross-feed slide for then it can be used for light metal turning on a face plate and between centers. A special shop feature in February shows how you can make such an accessory from stock steel shapes, threaded rod, nuts and bolts which merely clamps to the bed of the lathe.

Nature's toughest craft material is usually considered a luxury. It needn't be, if you know how to mend, trim and polish it yourself. Here are the secrets of

WORKING WITH MARBLE

By George Daniels



WITH A FEW inexpensive additions to your shop tools, you can work marble almost as easily as wood. A \$3 masonry cut-off wheel on your table or portable saw will slice through a foot-wide slab of inch-thick marble in about 20 seconds. An ordinary \$1.50 carbide-tipped masonry bit in your power drill will penetrate marble almost as fast as cement block. And standard abrasives on your electric sander disk will polish the scarred, surface of a second-hand slab to a mirror finish at about 15 minutes per square foot.

You can buy marble new in more than 200 types and color combinations from dealers throughout the country—or used, from any building wrecker's yard. Prices vary, but a typical square-foot price for new 7/8-in. polished marble, cut to size, is \$7 or \$8. For equivalent used marble, sold "as is," price ranges from \$2 down to as little as 60c, where the surface may be stained or

pitted—conditions you can easily repair.

If the marble you buy has to be cut, use a firm guide for the saw. Any veering will shatter the brittle abrasive wheel. Wear goggles, use the saw guard, don't rev the wheel over the peak speed printed on it, and don't stand in line with the cut.

To minimize chipping, don't try to cut the slab in a single pass. Set the blade to bite no deeper than 3/8 in. at a time—and never force the saw. For curved cuts, make a series of straight cuts tangent to the curve, and grind off the peaks with coarse (No. 3 1/2) floor machine paper on the flexible disk of your 1/4 in. drill or a rigid disk in your table saw.

Portable drills with an r.p.m. between 600 and 1250 will bore holes up to 1/4 in. diameter in marble. A drill-press stand for the drill assures a perpendicular hole, avoids chipping, and helps get the 25 to 75 lbs. pressure the carbide-tip bit needs.



RESTORATION of worn slab starts with block of 80-grit abrasive. This is a back-and-forth hand operation, since power sanding with so coarse an abrasive can cause scooping. Waiting in background are progressively finer grit sizes: 120-220, and 320—all available at hardware stores. After first two stages, you can switch to power sanding, if preferred. Ball-joint rigid-disk sander (shown on previous page) does best job, throwing loose abrasive particles away from the disk to avoid scratching. Keep in steady motion under moderate pressure.



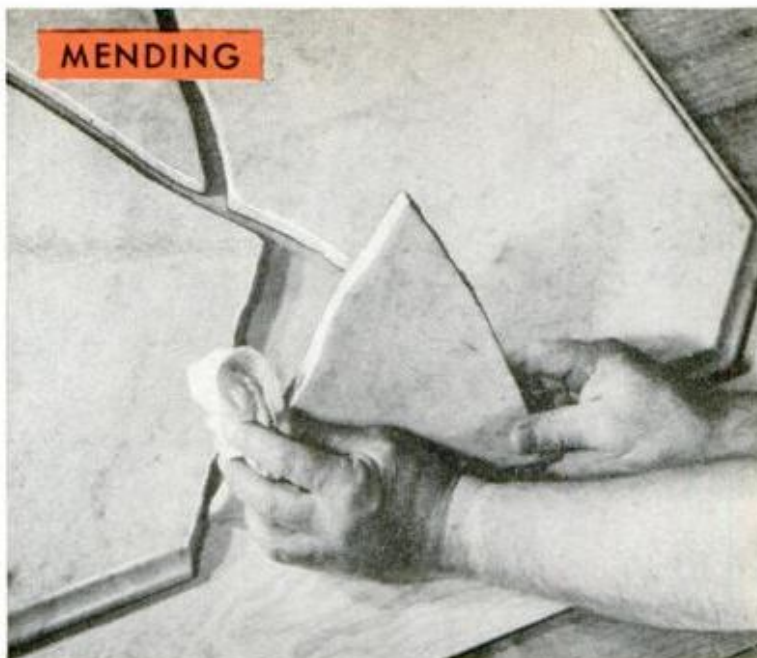
SPONGE SURFACE frequently to avoid clogging and to check progress of abrasive stages. Wetting gives preview of final appearance, picking up pattern and depth of color much as polishing will do. Change to finer grit when abrasive marks are even—no deep individual scratches. Don't skimp on coarse stages or you'll have to overwork final ones. If there are chips or holes to fill, save marble dust to mix with resin. After first four steps go to 600 grit. It's stocked by most auto supply stores. If yours can't supply it, more common 500 will do.



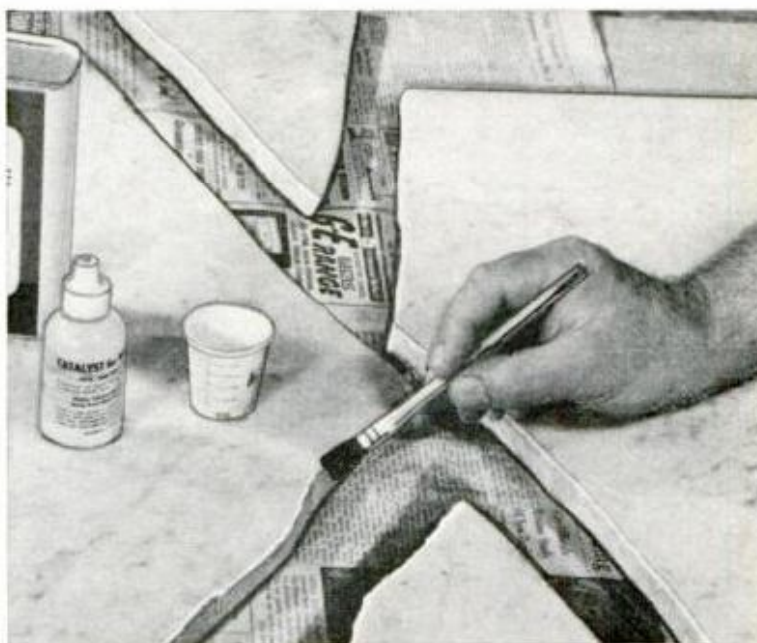
FINAL ABRASIVE is tin oxide powder, available from marble dealers and chemical houses. Wet it to form a creamy paste and apply with a saturated cloth. Cover the pad of a power sander with thin felt or flannel. Orbital or reciprocal types are best as they hold paste under pad, don't sling it away. Keep paste moist with light sprinkling while working; add more as it wears away. Minute scratches will disappear with final washing. To check polish, stand a pack of cigarettes on surface. When label's printing is readable in reflection, job's done.

MENDING

ASSEMBLE FRAGMENTS on flat surface to make certain no large parts are missing. Edges must be wiped thoroughly clean. Use rag moistened with acetone. Buy a polyester-resin adhesive designed for marble repair, and mix a quarter-ounce test sample to be sure resin-catalyst proportions recommended on label allow ample working time. If sample sets too fast, use less catalyst. Average proportions: 15 drops catalyst to 2 tablespoonsful resin. This is enough for a major tabletop repair, with 20 minutes working time before it sets up.

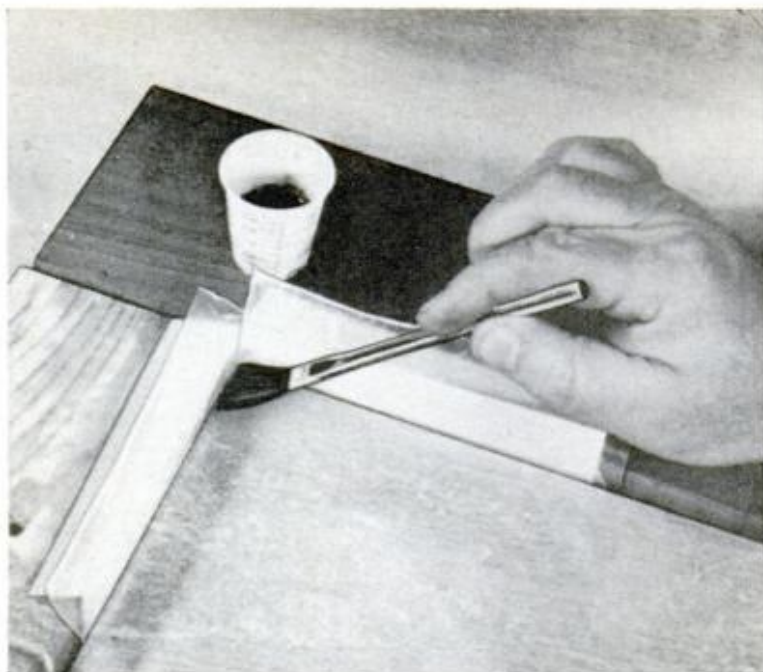


BRUSH ADHESIVE on both joining edges of each break, and slide fragments together firmly. Their own weight provides clamping effect. Scrape off any squeeze-out with clean putty knife; what remains will fill small chips along joint. Other minor chips, gouges and holes should be over-filled, so resin won't "dish" to a hollow as it sets. Half-ounce of resin did job shown here. This catalyst (for Marfix resin) comes in dropper bottle; for other types, use medicine dropper for accurate mix. Note layers of newspaper to protect the work surface.



FORTY MINUTES LATER, adhesive is fully hardened so excess can be gritted off with 120-grit abrasive block. If you're in a hurry, infra-red bulb cuts setting time to 15 minutes. Use successively finer grades to polish and blend out repaired area. Resin is translucent and blends with marble figuration so repair will be virtually undetectable. Where this is critical, resin can even be pre-tinted to match marble. Your unmixed leftovers won't go to waste: this adhesive also bonds marble to wood, or wood to wood, is an effective workshop cement.





CHIPPED CORNERS or edges can be patched with resin mixed with marble dust. Make dam of scrap wood blocks, line with waxed paper. Flow resin into depression with small brush to slight overfill. Tackle such repairs after first coarse-grit stage so you can polish the patch along with rest of surface. Use same paste to fill big holes. For large patch, add lightening pigment, as resin tends to darken natural color of dust.

If the original surface is only slightly pitted, you can skip the first two abrasive stages described in the polishing captions. If it's merely dull, skip the first three. If it retains considerable polish, with only small areas dulled, you can often restore it with tin oxide alone. Not all marble surfaces require a mirror finish. For hard-use counter tops, stop with the satin polish produced by the 600-grit abrasive. This conceals the effects of wear that a high polish would emphasize.

Marble stains that persist after the first two stages of a polishing job should be removed chemically before further polishing.

FACTS ABOUT MARBLE

Marble is limestone that's close-textured enough to be polished. It's a unique material, in that impurities increase its value. Pure marble is white; impurities produce the various shades of green, as well as red, black, gray, blue—and attractive mottled effects.

Marble weighs 170 lbs. per cubic foot—about a third as much as cast iron. In average forms, it can withstand up to about 1200 deg. F. without injury, and has a crushing strength of 5 tons per sq. in. Unlike polished metal, marble gets its glass-like luster from the fact that light penetrates the polished surface and is reflected from deeper-lying crystals. It's one of the toughest of decorative materials—but keep acids away from it. Remember that acid is poured over marble chips to produce carbon dioxide in laboratories.

Organic stains (as from plant leaves or tobacco) can be removed with hydrogen peroxide of hair-bleach strength. To slow evaporation and prolong its effect, mix it to a paste with whiting or talcum and spread it over the stained area. Add a few drops of household ammonia to start the action, and wash off the mix when the bubbling stops.

Oil and grease stains come off quickly with acetone or mineral spirits. If a color blemish remains, bleach with peroxide, as just described. Iodine stains—likely on bathroom counters—yield to a poultice of denatured alcohol and whiting or talc.

Paint spatters should be removed with a razor blade as soon as discovered. Follow with liquid or paste paint remover to take off absorbed paint, and bleach out any remaining pigment with peroxide. If an oil blemish remains, finish with acetone.

If you catch rust stains quickly enough, you can usually erase them with energetic hard-cloth rubbing. For deep stains, shake sodium hydrosulfite crystals onto the stained area, moisten with water, and let stand not more than half an hour. Rinse and apply sodium citrate solution. If some stain remains, repeat the process. Slight surface etching may call for repolishing.

For ink stains, rinse with water and follow with alternate wettings of ammonia and alcohol, applied by saturating blotting paper and holding it against the surface for a few minutes. Metallic ink may leave a stain which can be removed by the method described for rust.

The sooner a stain is removed, the easier the job. To keep stain removers from spreading the stain, wet the surrounding area before applying them. If you're timid about mixing chemicals, buy ready-to-use removers from marble dealers. ★ ★ ★

BULLET LAMP AMPLIFIER

IF YOU ARE ANY KIND of musician, you are probably aware that electronics is bringing a brand new richness of sound and manipulating ease to many musical instruments. Amplifying a guitar, for example, relieves you of having to pluck the strings as hard. As a result, it isn't necessary to press so hard on the frets, and more rapid fingering is possible.

Musical instrument amplifiers are usually as expensive as the instrument itself. So Popular Mechanics decided to design a simplified one. It will serve for the musician who wants to practice, or just to play for his own amusement.

We used a pin-up bullet lamp as the housing for the unit. Remove the front bezel which is friction-fitted on most such lamps. Cut a piece of $\frac{1}{4}$ -inch plywood to fit loosely inside the bezel, and then cut the speaker hole in that. We used a five inch PM speaker. Mount the speaker to the plywood and cover it with a suitable grille cloth. The cloth can be stapled to the back of the board. With grille fabric in place, the board should fit tightly into the bezel. Remove the lamp socket and switch, but use the lamp wires for the speaker leads. Now replace the bezel in the lamp.

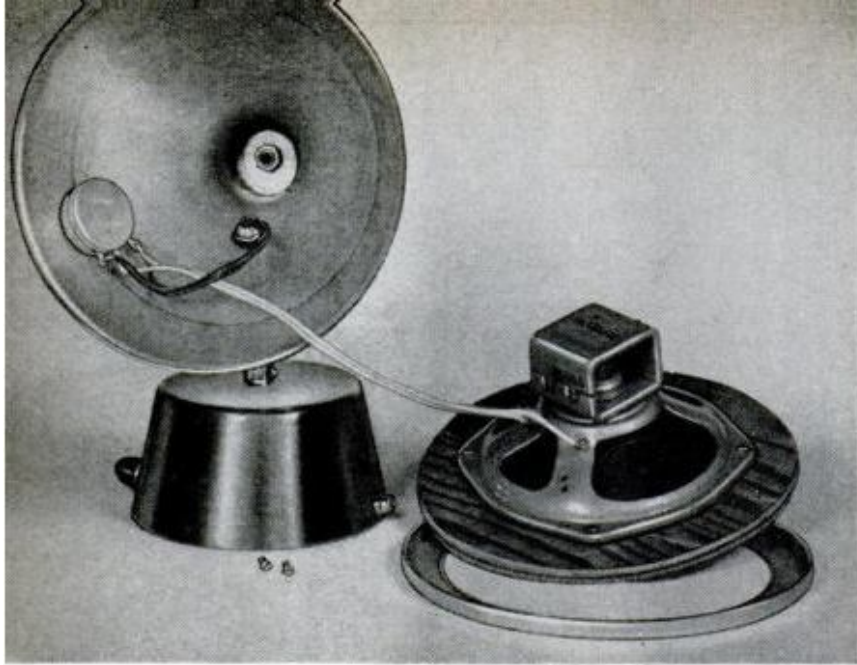
Any good pre-wired transistor amplifier module can be used effectively. Wire the output leads to the speaker terminals and

for your

- GUITAR
- ACCORDION
- HARMONICA
- P.A. SYSTEM



ELECTRONICALLY amplified music gives a rich tone, controllable volume and, with portable amplifier, travels with you



LOOKING INTO THE SPEAKER end of the amplifier. Note the method of utilizing the power cord as a speaker lead



VIEW FROM BENEATH amplifier shows location of parts in the lamp base housing

connect a phono jack to the input leads. The board is mounted by bolting a pair of solder lugs to two corner holes and then soldering these directly to the lower housing of the lamp. No wire is used to plug this into a wall outlet, so the wire can be removed. The hole is just the right size for the phono jack. Another hole is made on the other side of the housing for the volume control and switch.

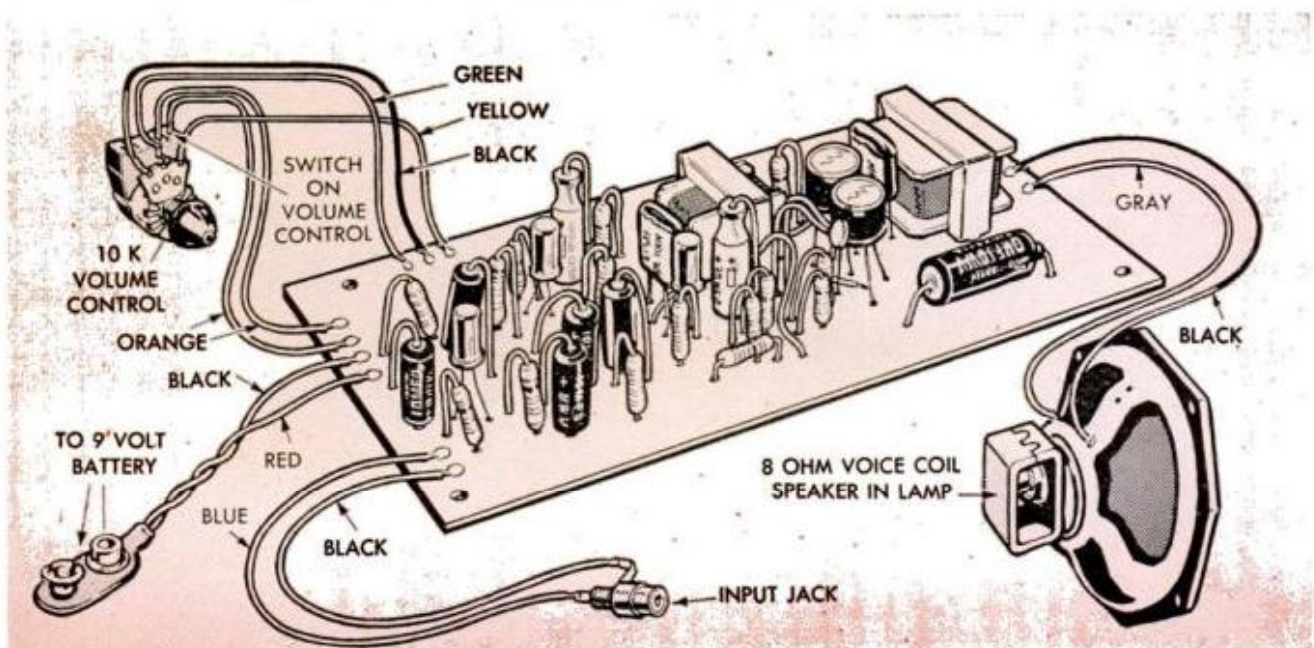
Connect the battery terminals to a nine volt battery, and plug a musical instrument microphone into the phono jack. With the volume control on the instrument at maximum, rotate the amplifier volume control clockwise until a click is heard. Strike a note on the instrument and continue the rotation. The note should come through the loudspeaker, richer in tone and with far more volume. If squealing (feedback) is

heard, simply change the position of the microphone, instrument or the amplifier until the noise disappears.

If you have more than one instrument, use a "Y" connector to parallel these. You can use the volume controls on the two instruments for blending.

Use an ordinary magnetic phonograph pickup. This makes it possible to play records through the amplifier if you wish. By the same token, plug a magnetic microphone into the phono jack and you can use the unit as a portable public address system.

If you need a pickup for your guitar, just install a magnetic phono cartridge with the stylus touching the guitar body. Connect the cartridge output to the phono plug on the amplifier. Move the cartridge until the best tone is achieved and hold it in place with tape.



Electronically New . . .

Slim-Trim TV Kit

Utilizing printed circuit techniques and easy-to-follow instructions, the Custom Seventy television kit goes together very easily. The kit has a nineteen-inch bonded picture tube, a prewired tuner, and all critical stages are pre-aligned.

The unit is constructed on a vertical chassis with components toward the front and tubes toward the rear, for easy replacement. The result is an easy to service set.

The kit was assembled at PM and required over 48 hours of constructing time by someone with kit-building experience. It would take somewhat longer for a novice. The kit is complete without tools.

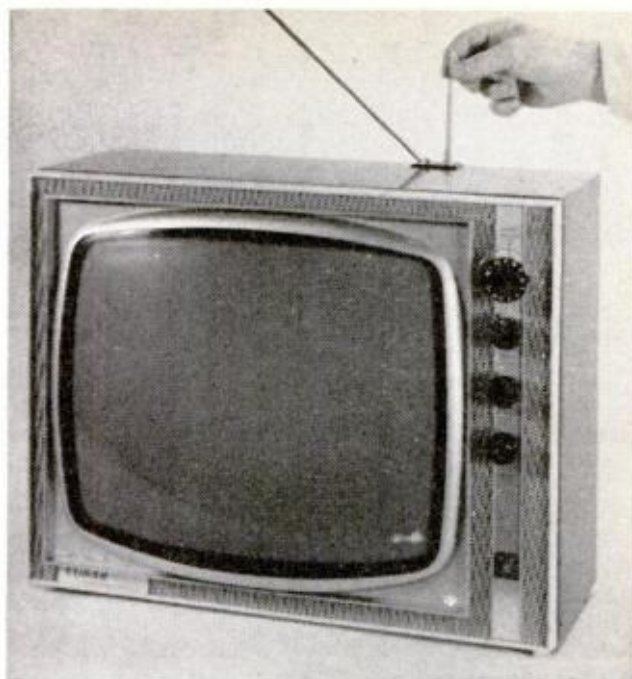
The finished kit is housed in a metal and plastic cabinet, complete with built-in rabbit ear antennas. The weight of the finished kit is 55 pounds.

The kit could use, however, two more access holes on the back cover. You must remove the back (and defeat the interlock) to adjust sync stability and ringing.

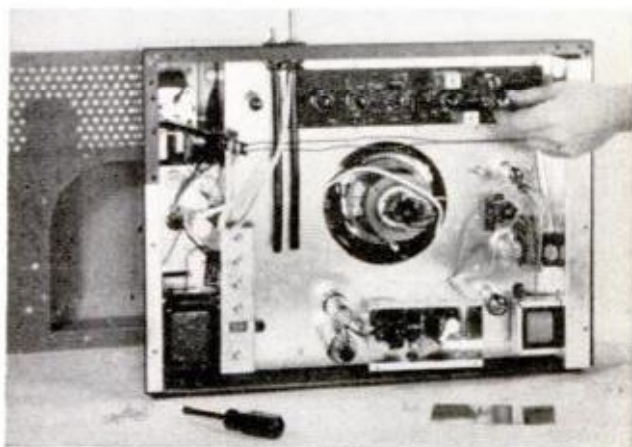
The sheet metal screws that hold the back in place also secure the chassis to the cabinet. The hole alignment problems thus created are easily eliminated by enlarging two of the back mounting holes to clear the chassis screws. The set costs \$135 from Connar Instruments, 3939 Wisconsin Avenue, Washington, 16, D.C.

Ham Desk Kit

Helping to organize the ham shack is a DesKit from World Radio Labs, Council Bluffs, Iowa. The tilt-top makes the equipment easy to see. Knocked-down for \$29.95.



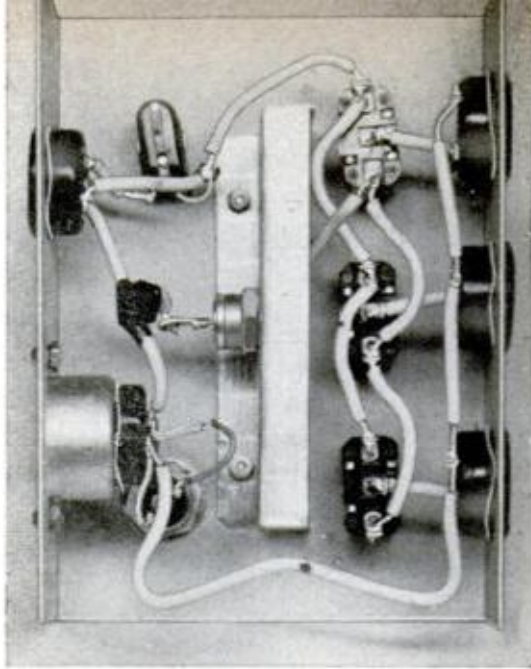
TELESCOPING ANTENNA folds into top of set when not in use. Vertical chassis (below) permits easy access to tubes, allows for simple checking or change



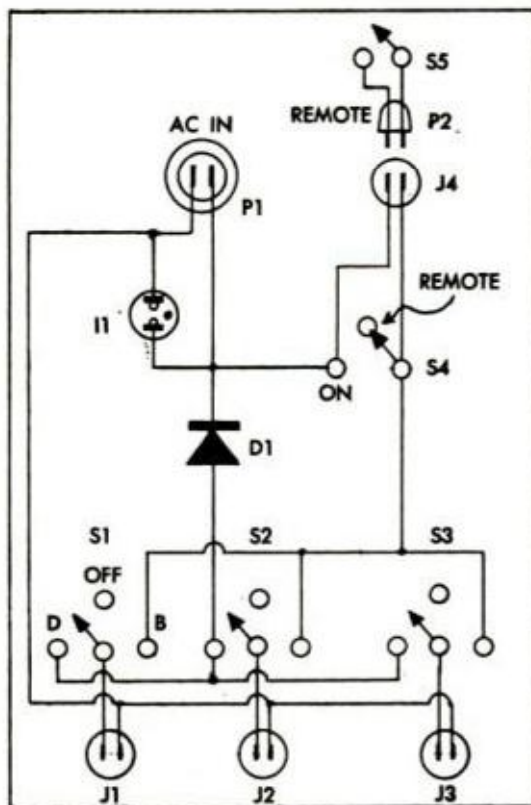
Contact Cleaner

Cleaning TV tuners is easy with the Contacare II kit. You get cleaner, lubricant and a soft, lint-free cloth for only \$1.25. Standard Kollsman Ind., Melrose Park, Ill.





Photoflood Control Box



PARTS LIST

- D1 diode 1N3210 (Motorola)
- I1 neon indicator assembly
- S1, S2, S3, switches, single pole, double throw
- S4 switch, single pole, single throw
- S5 switch, pendant, single pole, single throw, spring return
- J1, J2, J3, J4, chassis-mounting AC receptacles
- P1, chassis mounting AC plug, recessed
- P2, cord mounting AC plug
- Also required:
- chassis box, 7"x5"x3"
- heat sink made from scrap metal
- insulating washers for diode

YOU TURN ON the floods, open the shutter and busy yourself with proper light placement. Meantime your subject sits there sweltering, and the bulbs burn up. The light must be on so the photographer can decide where to place it. But the practice often can run to needless discomfort as well as additional expense.

The simple control box shown here, however, will go a long way toward curing these headaches. The lamps last longer, since they burn at full power for picture taking only. The subject basks in a comfortable half-light while you set the lamps where you want them.

Assemble the sockets on a chassis base, and then mount the diode bracket. The switches are mounted next. Wire the unit according to the schematic diagram at the left and the layout photo above it. Take care to use insulating washers on the diode-mounting stud, as it carries enough voltage to give you a jolt.

With the unit connected to a source of alternating current, and switches S1, S2 and S3 in the off position, plug three photofloods into sockets J1, J2 and J3. Switch the three switches to the B (for bright) position and with S4 on, the three lamps should light to full brightness. You can put all three switches in the D (for dim) position and the lamps should reduce to a cool, half-brightness for posing and focusing.

You can use switch S5, a plug-in type, for remotely controlling the unit in an on-off function. If you connect it to short-circuit the diode, it will serve to operate the lights from half- to full-brightness permitting you to expose the picture.

When the testing has been completed, bolt the box cover in place and apply labels so that you will know the function and position of the various controls. A light spray of plastic from a pressure-can will seal the decal labels in place. Allow this to dry and unit is ready for use.—J. A. Fred



Quick-change artist:

A WORK-AND-PLAY CHEVROLET PICKUP WITH WORK-SAVING POWER STEERING

A Chevrolet pickup with power steering wears several hats. As a conventional pickup it works its head off. Hitched to a camper body it's a work vehicle and can double as a vacation vehicle too. And with power steering, it handles and steers almost as easily as the family car. Parking? You're in fast and e-a-s-y. Rough terrain? You're up, over and away with near-perfect control. Traffic? Maneuverability without peer. For an eye-opening demonstration when you're ready to buy . . . ask your Chevrolet Dealer for a close-up of the '63 Chevrolet pickups with power steering! *Power steering—a product of Saginaw Steering Gear Division, General Motors Corporation, Saginaw, Michigan.*

The "new reliables..." '63 Chevrolet Trucks

CLINIC FOR HOMEOWNERS

Concrete Patch

Q—The concrete walk from my house to the garage has a number of breaks, or defects, in which the surface has flaked, leaving depressions a square foot or so in area and about ½ to 1 in. deep. How does one go about repairing such defects permanently?—O.W., Fla.

A—There are a number of concrete patchers available containing special ingredients permitting them to be troweled or brushed to a feather edge. Use one of these products to repair the walk and be sure to follow the instructions on the container in every detail to assure success. Usually you will be directed how to prepare the mix, how to clean and otherwise prepare the surface and how to apply the material. You do not say where the breaks are located, in from the edges of the walk, or at the edge. In the latter case, you may have to prepare a simple form to hold the patcher in place until it sets. Usually this can be done by placing a short length of 1 x 4 and holding it in place with a couple of stakes. Just make sure that the stakes are driven in solidly enough to hold the form board in place.

Removing Glass Stopper

Q—I have a very old cruet which is a family heirloom. The glass stopper is stuck fast and so far has defied all efforts to remove it. I'm afraid to put much pressure on it as it may break. I did upend the cruet and held the stopper in hot water for a time but no luck. Are there any other possibilities?—G.H., Ohio

A—Holding the stopper alone in warm water would tend to expand it and lock it even tighter in its socket. You were fortunate that the whole thing didn't shatter. If this item is highly valued as an heirloom, then we would suggest right away that you let well enough alone, as the risk of breakage is very great, especially if the cruet is, as you say, very old. However, it is just possible that lacquer thinner poured into the recess around the stopper would, in time, work its way down into the socket and loosen the stopper sufficiently to enable you to turn it out with light pressure. You will have to keep renewing the small amount of lacquer thinner in the recess as it is a volatile solvent and evaporates rapidly. We have no other suggestion—this is the only safe way.

Finishing Block Wall

Q—My basement walls are of cinder blocks and I'm wondering how best to finish them. The house is new and I merely wish to brighten up the basement without going to too much expense. I've been told that I must plaster the walls before applying any finishing material. Is this necessary? Isn't there some cheaper way that will serve my purpose?—C.R., Pa.

A—No, it is not necessary to plaster the walls but, of course, as you probably are aware, applying a masonry paint directly to the blocks will not alter the rough texture appreciably. We are assuming that you have no water-seepage through the walls. If this is so, you can apply any of the masonry paints directly to the blocks without any preparation. You can do this with a brush, but a better way is to apply as a spray. In this way the material will be driven into all the voids in the blocks, resulting in a much neater and more satisfactory job than you can do with a brush. Much faster, too, and there's an appreciable saving in paint. You should be able to rent a suitable sprayer from your local paint dealer for a nominal rental. If you use a sprayer, have all the windows open for adequate ventilation and wear a mask to prevent inhalation of paint particles.

Polishing Aluminum

Q—I have two aluminum windows in my home which I installed myself about a year ago. Now the sash frames are coated with a whitish substance that is difficult to remove. After removal it reappears. What is this, and is there any way to prevent it and keep the metal bright?—T.H., N. Carolina

A—The coating you describe is an oxide which forms on aluminum on exposure to the air. It is, of course, difficult to remove, but does no harm. It only grows somewhat more unsightly with the passage of time. It can be prevented, to some extent at least, by going over the metal with a prepared polish and then immediately applying a clear lacquer. This will protect the surface as long as the lacquer film remains unbroken.

As a service to Popular Mechanics readers in solving the hundreds of problems pertaining to a home—inside or out—you are invited to present your problems to The Clinic Editor for his helpful advice. Address your questions to The Clinic Editor, Popular Mechanics Magazine, 575 Lexington Ave., New York 22, N.Y.

Nationwide study of 10,000 cars reveals major cause of winter starting trouble

On a cold or damp morning, does your car grind away helplessly—while your neighbor's car starts right away? To find the reason, the ignition systems of some 10,000 cars were analyzed. Whether you live up near Duluth or down in Dixie, the following facts from the study can make your morning motoring easier . . .

On the first day of each of the year's four seasons, in some 300 cities spotted all over the nation, ignition systems of cars pulling in for refueling were carefully analyzed. Distributors, spark plugs, cables, coils and condensers all received attention. In all, more than 10,000 cars were studied.

1 in 4 report hard starting

As part of the study, on the first day of spring motorists were queried about starting trouble during the just-ended winter, while facts were still fresh in their minds. Slightly more than one in every four (26.7% of them) reported hard starting.

Surprisingly enough, winter starting trouble was almost as great a problem in the south as in the north. In Arizona and California, for example, the incidence of hard starting was *right on the national average!*

What about batteries?

The study showed that battery age did not seem to be nearly as important as you might think. While you may have called your service man to tell him, "My battery's dead and my car won't start," it's more than likely your battery went dead trying to coax an engine-igniting spark out of worn and weary plugs.

Worn spark plugs key factor

The study showed that hard starting might be due to any of several factors—but it clearly showed the major cause is worn spark plugs! (Plugs with over 10,000 miles on them.)

The figures showed that only 12 out of every 100 cars that started the winter with good plugs experienced hard starting. But of those that started with worn plugs—41 out of every 100 had starting trouble!

The study also showed that as plugs piled up mileage and became more worn, starting trouble occurred more and more often. Surprisingly enough, it was found that plugs are generally in their worst condition at the beginning of winter, when good plugs are needed most.

Why more trouble in winter?

Why does your car have a harder time getting going on a cold or miserably damp morning? Because it takes more battery energy to spin the hard-to-turn engine. And it also takes more voltage to flash a spark across chilled spark plug electrodes. This is why worn plugs cause trouble. As wear makes the sparking gap bigger, more voltage is needed for sparking. And the need increases sharply as the gap widens.

That's why your neighbor's car may start when yours won't. His spark plugs are probably in good condition. The extra voltage needed for firing your worn plugs is, in effect, the straw that breaks your battery's back. The result: Hard starting at first. Later, probably *no starting!*

What's the remedy?

If you didn't start the winter with new spark plugs in your engine, have them installed now. And ask for silvery-plated Champion spark plugs. New Champions make any car start easier and run better. That's why they're first choice with engine experts everywhere. Don't settle for less in your car. Always specify Champions.





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Sealed Power Stainless Steel
oil rings stop oil pumping

Balloons: Long Arm of Science

(Continued from page 121)

Once the superpressurized balloon is at its maximum shape, it stays there, never getting any larger or smaller. It's sort of like blowing a bubble of molten glass and then letting it harden.

What does all this mean? First of all, it means that ballast is no longer necessary, vastly increasing the pay load.

It means that a balloon can now be sent aloft for indefinite periods, limited only by the deterioration of the material itself brought about by the wind and weather at high altitudes. It could even mean around-the-world balloon flights.

Test Beds for Space Ships

Superpressurized balloons could also be used as relatively inexpensive test beds for space instruments and vehicles by keeping them in the near-space conditions of around 100,000 feet for long periods of time.

And then, too, they may some day be used to provide a network of weather observation stations, gathering and transmitting weather data from various constant altitudes, improving forecasting techniques and analysis and adding to the data gathered by weather satellites.

One of the biggest challenges put to balloon scientists has been in the field of astronomy. Looking at space through an earth-bound telescope is like trying to see out of fogged-over eyeglasses. The atmosphere is filled with tiny particles of dust and debris that cause distortions.

Two European astronomers tried to lick the problem in 1956 by taking a telescope up in a balloon. Reaching about 40,000 feet, the flight didn't get above enough of the atmosphere to eliminate star twinkling and to see infrared radiations.

Then a Princeton astronomer, Dr. Martin Schwarzschild, outlined a balloon project that could lift a telescope to an altitude of 80,000 feet—above 96 percent of the earth's atmosphere. At that height, the view would be virtually distortion-free.

The Navy showed immediate interest. It had developed a high-altitude balloon system to explore the upper atmosphere. That system could possibly be used. And it was interested in supporting the project because it knew future advances in navigation and communications depend on more detailed knowledge of the stars and planets. The Navy called the project Stratoscope I.

The big problem was in building an unmanned balloon-borne telescope system. This had never been tried before. In 1957,

(Continued on page 204)

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Balloons: Long Arm of Science

(Continued from page 202)

the Perkin-Elmer Co. came up with a system. It included a 12-inch telescope designed to study the sun. The telescope was hoisted into the stratosphere, guided by a remote control mechanism, by a Navy Skyhook balloon from Huron, S. D., and took nearly 48,000 pictures of the sun.

Now the same firm is about to complete a massive two-ton, 36-inch spaceborne telescope system which will be lofted to heights of around 80,000 feet during the Navy's forthcoming Stratoscope II program, beginning early in 1963.

Mars to Be Special Target

The program will concentrate on telescopic and spectroscopic studies of Mars, Venus, nearby stars and nebular systems. Mars will be a special target of the first ascent, a study that could well prove that life is possible on that planet. Astronomers expect to get clues on the amount of water vapor and other gases in the Martian atmosphere, and may possibly detect organic molecules on the planet's surface.

This telescope-camera is so refined that it can distinguish two golf balls only 15 inches apart at a range of 1500 miles. It is maneuvered on polished ball bearings floating in mercury and will be locked onto its stellar target by an intricate automatic stabilization system. The 36-inch optical mirror for the telescope is made of fused silica—the first time a fused silica blank of this size has been successfully formed. Fused silica is used because it is unaffected by the sharp changes in temperature that Stratoscope II will experience.

A new dual-balloon system was designed by Vitro Laboratories specially for Stratoscope II. The main lifting balloon is enclosed in a plastic sheath during the launching period to protect it against low-level winds. The entire apparatus is lifted by a small top balloon to a height of about 4000 feet. Expanding helium then begins to flow down into the main balloon and splits away the protective sheath. The system is stabilized by remote control at about 80,000 feet to train the telescope on the desired target.

The telescope is focused and monitored by means of a remote-control television system and a 70-station command channel.

When its mission is finished, the balloon is gradually valved down to a soft landing so the telescope and balloon system may be re-used. Two cargo parachutes can be brought into play during the descent in case of an emergency.

The Air Force has a project called Star

Gazer coming up that will use a giant balloon to put a 12½-inch telescope into the air 16½ miles over the earth. While the telescope isn't as big and heavy as the Navy's Stratoscope system, the Air Force project will be just as ambitious because two men will ride in a 3600-pound aluminum gondola to make observations.

Capt. Joseph W. Kittinger Jr., who made headlines in 1960 when he made a parachute jump from a balloon 102,800 feet in the air, will be the balloon pilot. William C. White, a Navy (cq) civilian scientist, will be the balloon-borne astronomer.

The Star Gazer balloon will stay in the air until about midnight and then start its descent. An 83-foot-diameter parachute is included in the system in case of emergency, and the men will wear special pressure suits that will automatically inflate should the pressure fail within the gondola.

The Air Force also has two other balloon projects in the works involving astronomy—Sky Top and Ballast. These are both unmanned probes of the stratosphere. Sky Top will be used to obtain temperature measurements of the moon at night that are accurate within five degrees, while Ballast will test refinements in automatic star trackers for future telescope flights.

Why put telescopes up in balloons when they could be put into satellites?

Dr. J. Allen Hynek of Northwestern University, scientific director of Project Star Gazer, says that satellite observatories most certainly are necessary because it is only at satellite heights of 100 miles or more that the important ultraviolet region of light from space can be observed.

Better Than Satellites

But he's quick to point out that "for the visual and infrared regions of the energy spectrum, balloons are singularly well adapted, and they are in every way equal to or better than satellites."

"In fact," he adds, "balloon flights are far less expensive; manned balloon flights are immediately practicable, and scientific results are easily recoverable."

Because of the great promise of balloon research, Dr. Hynek hopes to see national balloon observatories set up, just as national radio observatories have been established recently to study radio emissions reaching the earth from outer space.

A possible first step in that direction has been taken by the National Science Foundation which is now setting up a year-around facility devoted exclusively to scientific balloon flights.

Located at Palestine, Tex., the flight

(Continued on page 206)

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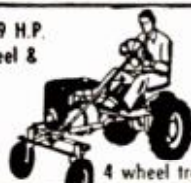
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Balloons: Long Arm of Science

(Continued from page 204)

station will be an integral part of the national balloon program of the National Center for Atmospheric Research at Boulder, Colo. This balloon program is designed to spur improvement in balloon technology for use in scientific experiments and to make balloons more readily accessible to scientists who need their unique ability to float a large platform for heavy instruments at high altitudes over a long period of time.

When finished, the station will:

- Provide fixed equipment for launching, tracking and communications.
- Permit savings in the costs of balloon flights by helping to avoid duplication.
- Reduce delays in flight programs.
- Provide assurance of safety by being remotely located from major air lanes.

As balloons get larger, the harder they are to launch and the Navy's busy developing a new method for launching large, high-altitude balloons. Called "Project Wetfoot," the system consists of trailing a balloon on the water behind a ship at sea.

Ships Launch Balloons

Launching balloons from ships has many advantages. Bad weather areas can be avoided; the launch position can be chosen with respect to favorable recovery areas, and balloons can be launched in regions which are important from the point of view of the experiment itself. A ship also provides readily available living space, shop facilities and instrument shelters.

Until now, the problem with launching balloons from ships is that there has to be enough deck area to properly lay out the balloon material before inflation, as well as to place the payload, launching rig and helium supplies in the most favorable positions. With balloons of million-cubic-foot sizes and larger, only carriers and some seaplane tenders have decks large enough.

But the big ships aren't always available for balloon flights, so the Office of Naval Research started Project Wetfoot to work out a system of using the more readily available small ships.

With the Wetfoot method, the balloon is dropped over the fantail into the water with the ship steaming downwind. When the helium bubble at the end of the balloon becomes large enough to rise from the water's surface and to pick up the balloon train, the drag forces decrease and the ship speeds up until she is going the same speed as the wind. This, in effect, creates a "no wind" condition and the balloon rises clear

(Continued on page 208)

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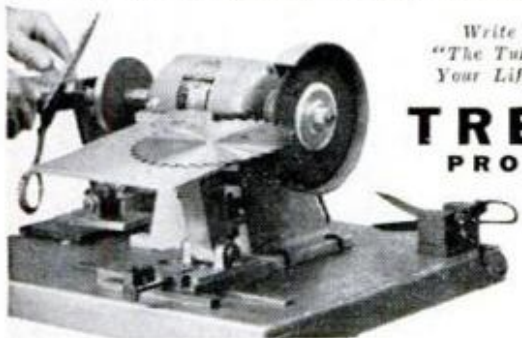
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Balloons: Long Arm of Science

(Continued from page 206)

of the water and stands erect. The water runs off the balloon in a matter of minutes and it's ready for the stratosphere.

Successful launches using this method have been made on Lake Michigan from the *USS Lamar*, a small patrol craft, and from the destroyer *USS Kraus* in heavy seas off the east coast, with winds of up to 15 knots.

The National Center for Atmospheric Research is also exploring the use of deep canyon sites for balloon launchings. The agency reasoned that for launchings that require near-calm wind conditions, deep canyons should be ideal. Two test sites have been established in Glen Canyon, Ariz., at a dam built by the Bureau of Reclamation. Test launchings have shown the feasibility of the plan, with no turbulence or downdraft encountered during ascents.

Skirt-Wearing Balloon

The Army's latest contribution to balloon technology is the development of a skirt-wearing weather balloon that speeds aloft nearly twice as fast as conventional types. Made of neoprene, the balloon uses an eight-foot-long skirt with a narrow bottom to sharply reduce the drag induced by the balloon as it speeds upward.

The skirted balloon rises at the rate of about 1700 feet a minute, as compared to the 1000-feet-a-minute ascent of a regular weather balloon. Seven feet in diameter when launched, it grows to about 24 feet by the time it reaches its top height of 75,000 feet, where it bursts.

Electronic sensing devices suspended beneath it transmit data to a ground tracker on temperature, pressure and humidity, while the tracker gathers data for computing wind speed and direction by following the course of the balloon with a radio direction finder.

A fast-rising balloon was needed by the Army to get information more rapidly so the trajectory of ballistic missiles and artillery shells could be forecast, and also for predicting atomic fallout.

The new balloon's fast ascent gives it several advantages over slower types. Because of its speedy climb, information is obtained more rapidly. And since it drifts less, especially during high winds, the information is gathered more directly over the operational site.

According to *Scientific Ballooning*, a publication put out by the NCAR, Ameri-

(Continued on page 210)



Powerful
Carlson says:
P&C makes tools that
make work easy.

more grip...
less gripe!

P & C PLIERS

P&C pliers work for you . . . without fighting you. They have that solid construction and the "feel of quality"—whether regular, slip-joint, needle-nose or midget. Handles are comfortable, gripping teeth properly shaped and each provides correct leverage. You'll find the P&C pliers you want on the colorful self-service merchandiser at your hardware store.

P & C TOOL COMPANY

Portland 22, Oregon

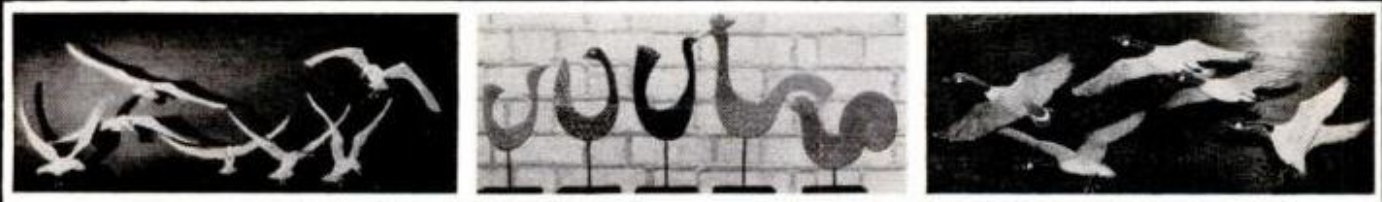
Subsidiary of





"That's got it! Hold it . . . right there!"

HARRY
MAGE



WILD LIFE FORMS AND STORY BOOK CHARACTERS
That You Can Make Yourself With Castoglas

The seagulls and flying geese are not paintings but dramatically handsome wood cut-outs which you color and glaze with Castoglas. Requires no heat. The translucent porcelain-like finish gives the forms the quality of fine art objects. The authentic bird cut-outs and the chicken, hen and rooster set are only a few of the more than 100 designs now available, complete with patterns and coloring charts. Write for "How to Make Wild Life Forms" and "How to Make Story Book Characters." Mail 25¢ to Dept. A-1. **THE CASTOLITE COMPANY** Woodstock, Illinois

MAKE YOUR OWN TILES WITH LIQUID CASTOGLAS
Pours Like Honey—Sets Like Glass

Here are NEW tiles that are REALLY NEW and as simple to make as they are beautiful. The Japanese tray and tile with fish design were made with napkins on wood. Paper becomes invisible, design "floats" in Castoglas. Leaves embedded 20 years ago are as colorful as the day they were picked. Also laminate translucent glass panels and make coasters, trays and table tops with embeddings of coins, fish flies, butterflies, seeds, photographs and others. For "Tiles and Laminating" remit 25¢ to Dept. A-2. **THE CASTOLITE COMPANY** Woodstock, Illinois



Balloons: Long Arm of Science

(Continued from page 208)

can scientists consider helium the best and safest lifting gas for balloons. But hydrogen, the magazine says, has some distinct advantages. It has greater lifting power for one thing, and is not necessarily dangerous; in its pure form (96 percent) hydrogen is not explosive. Also, it can be manufactured on site, rather than having to be shipped in heavy storage tanks. Ammonia has other advantages, the NCAR says. It can be carried in liquid form in much lighter containers than are required for helium, and is most used in remote areas, such as the polar regions, where weight of equipment is crucial.

The art of ballooning has come a long way since 1783 when a French nobleman, Francois Pilatre de Rozier, climbed aboard a balloon made by two brothers, Jacques and Joseph Montgolfier, and made man's first flight into the atmosphere. (The French, incidentally, haven't lost their knack for ballooning. A 20th Century Frenchman, Audouin Dollfus, uses a multiballoon system to hoist aloft his astronomical equipment. With more than 100 balloons linked together on a cable, Dollfus is able to stay up for as long as three hours observing the heavens. When he wants to descend, he merely blasts loose a few balloons and floats down gradually.)

And, you can be sure there'll be plenty more new developments in the art from now on. There's talk of using large balloons to carry mammoth space flight boosters from factory to launch site, since they're too big for conventional transports, too unwieldy for overland hauling and too much in demand to permit a long ocean voyage.

If the idea comes into use, it'll mean that the first leg of future space ship's mission to the moon—the trip from builder to launch pad—will, ironically, be by way of the most ancient form of air travel. ★ ★ ★

Rockets May Spoil Atmosphere

Missile exhaust could release large quantities of chemicals in the atmosphere, perhaps damaging or destroying some of its protective functions.

A meteorological research scientist for the U.S. Weather Bureau said that chlorine in the exhaust chemicals could dissipate the ozone layer that protects the earth from sterilizing ultraviolet radiation. Other chemicals in the high-powered rockets might do other unforeseen damage in the upper atmosphere where the air is much thinner than at sea level. The harmful effects might force changes in missile fuels.



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NEVER
EQUALLED

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When you buy a Channellock, you get two exclusive patented features you can't get in any other adjustable plier:

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- 2 Reinforcing rib for added strength when you put the muscle to a job.

Only Channellock—the original tongue and groove plier—has these features. Be sure you're getting the genuine Channellock . . . look for the trademark on the handle. Your choice of five jaw capacities: $\frac{1}{2}$, $\frac{7}{8}$, $1\frac{1}{2}$, 2 and $2\frac{1}{4}$ inches. Write for catalog showing our complete line of pliers. Champion DeArment Tool Company, Meadville, Pennsylvania.



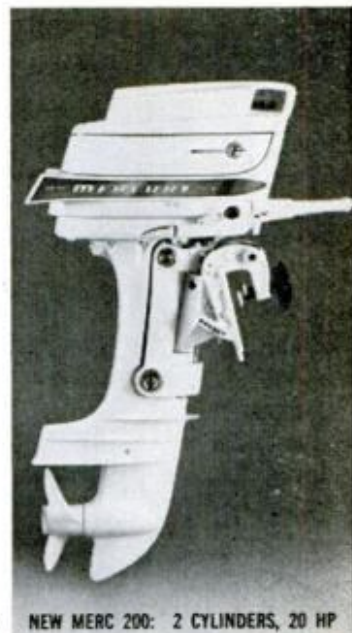
NEW MERC 850: 6 CYLINDERS, 85 HP



NEW MERC 650: 4 CYLINDERS, 65 HP



NEW MERC 350: 2 CYLINDERS, 35 HP



NEW MERC 200: 2 CYLINDERS, 20 HP



HERE'S HALF THE NEWS FOR '63

The only new outboards this year are branded "Mercury." Eight new models offer you a range of horsepower from 6 to 100. Here's just half the news:

NEW MERC 850... now a full 90 cubic inches for more lugging power with heavier loads. Here's an 85 hp outboard that will out-muscle anything on the water (except the Merc 1000). It features Power-Dome combustion chambers and Jet-Prop exhaust for minimum noise and maximum fuel efficiency. A wide range of props lets you match the power to your purpose.

NEW MERC 650... Mercury's most powerful 4-cylinder motor. Here's a 65 hp outboard that gives you all the advantages of an in-line, small-bore, short-stroke engine. Power-Dome combustion and a new balanced manifold system give you smoother idling and greater fuel economy. Hydraulic shock absorbers protect you and your boat. Jet-Prop exhaust silences the sound and buries the fumes.

NEW MERC 350... This lightweight, 35 hp Merc was the basic test engine from which the Merc 1000 and Merc 650 were developed. As a result, this twin has had more testing and refining than probably any other outboard. This year, we decided to

market it with the quality features of the Merc 1000... Power-Dome combustion chambers, reed valves, and extra-husky rods, bearings, pistons and crankshaft. A new high-output magneto starts it with a flip of the wrist, or with the optional electric starting. A single lever gives you one-hand control of gear selection and speed. A new high in dependability and value!

NEW MERC 200... This is a brand-new 20 hp engine from powerhead to Jet-Prop exhaust. The Glide-Angle design has been changed to accommodate the new full gear-shift which can now use Ride-Guide steering and standard Single-Lever control. It is available in long and short shaft. The crisp, sculptured styling of the forward slant lends beauty and function by letting it slip through weeds and over obstructions. For portable power this is a beauty. And remember, *it's all new!*



100, 85, 65, 50, 35, 20, 9.8, and 6 hp outboards
MerCruiser Stern Drive Power Packages
310, 225, 190, 140, and 110 hp gasoline/100 and 39 hp diesel

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Remodel with Marlite paneling for wash-and-wear walls

Soilproof finish of beautiful Marlite takes wear and tear that would harm most other finishes. Tough and dent-resistant, Marlite resists heat, moisture, stains . . . stays like new with an occasional damp cloth wiping.

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Please send full-color "Professional Guide to Home Planning." 25c enclosed.

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ANOTHER QUALITY PRODUCT OF MASONITE® RESEARCH

Perspective T-Square

(Continued from page 156)

proportions of the object are determined by placing the plan view at the top of the drawing in the usual manner and positioned at an angle which suits the amount of front and side of the object you wish to show. In the example in Fig. 4 you'll see that the plan drawing is placed at a 15-degree angle which gives more front than side view, while in Fig. 5 the plan is placed at a 45-degree angle which gives an equal view of front and side.

Use either $\frac{1}{16}$ or $\frac{1}{8}$ -in. clear plastic to make your perspective T-square — the lighter the better. Scribing the material for the curved heads is done as in Fig. 3. The sheet plastic is clamped to a flat surface and a stick with a nail in each end serves as a beam compass. The distance of the nails center to center should equal the desired radius. Carefully cut out the curved heads on the scribed lines and smooth the rough edges. Fig. 7 shows how a clip of sheet aluminum, affixed to each curved head, lets you quickly mount the head to the beam in switching from one to the other.

Urges Better Space Education

Many space scientists lack basic competence, reported Dr. James Van Allen of the State University of Iowa. He said there are no more than 25 "real pros" in space sciences.

As a remedy, he suggested that the government allot \$2000 and tuition fees as the bare minimum for fellowships and \$100,000,000 a year for university space research. At present, no appropriations for such purposes are available.

Dr. Van Allen also recommended that undergraduates who are potential space scientists have thorough training in mathematics, physics and classical mechanics.

Synthetic Sun for Research

Solar radiation beyond the Earth's atmosphere can be simulated in environmental space chambers bathed in both visible and invisible light from a bank of carbon arcs, according to the National Carbon Company. The visible light of the carbon arc is man's closest approximation of sunlight.

Using banks of carbon arcs with no filters or added energy, the simulated solar radiation will help space-equipment designers evaluate the operation of space vehicles as well as the solar cells used to convert the sun's energy into electrical power for the vehicle.

Ultrasonic Burner

Sound waves beyond the range of human hearing have been used by Esso engineers to develop a typewriter-sized oil burner that heats, they report, as well as home burners three times its size.

An engineer holds the "horn" which acts like a megaphone to magnify and direct the sound to the liquid fuel's surface. The sound atomizes the fuel, and the fine spray is mixed with air for efficient burning. Less fuel is required than for a conventional burner, they found.

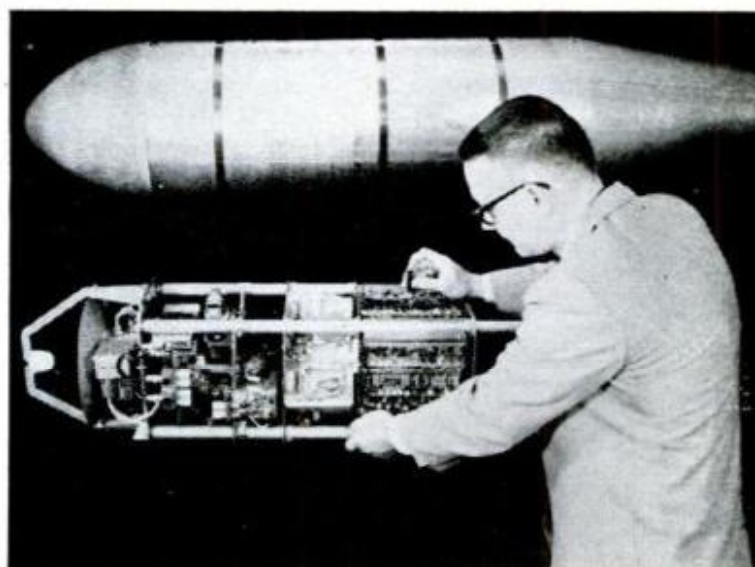


Low-Level Blind Flying

Instrument flying as low as 100 feet is possible with a new "terrain avoidance" radar that sends out an egg-shaped beam ahead of the aircraft, warning the pilot of obstacles.

Small enough to fit into a wing pod, the unit includes a computer to translate signals into a display for the pilot or to control the autopilot.

This type of radar enables a plane to fly high-speed, ground-hugging missions over unfamiliar territory in any weather.



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Goes where your work is! It's a handsome professional piece of equipment!

This complete rolling cabinet is ruggedly built of heavy formed and welded steel for permanent service on the job or in your home workshop. Three top drawers are cork-lined for precision tools—two heavy duty bottom drawers are extra deep for power tools. Complete with built-in lock.

MODEL 250

HUOT Rhymes With Do-It!

See your hardware dealer—or write:

HUOT MFG. CO., 555 N. Wheeler St., St. Paul 4, Minn.

Look What Those Knuckle-Heads Are Doing

(Continued from page 138)

error. Panic reigned. Agitated planners and spenders urgently called on all departments to report ways of cutting back expenditures, and the tax assessor recommended: *Don't spend \$150,000 allotted for additional computers for tax office.*

The benevolence of computers is well-remembered by one of the nation's largest magazines that had installed a robot book-keeping system that handled, among other things, the company payroll. Came Christmastime and the machine automatically sent out the usual Christmas bonus checks—plus a few that were unusual. A number of people who had not worked for the magazine for several years were delighted to find substantial checks in their mail boxes come Christmas season.

The magazine discovered the error, but asked that the money not be returned. It would have cost them more than the amount of the checks to revise their books.

The Bonus Was a Turkey

Computer doctors came in and cured the machines, and the following Christmas the machine did not send the former employees checks. It sent turkeys instead!

Nowadays, after one computer makes out your paycheck and mails it to you, another computer takes it away from you at the bank, automatically reacting to the code numbers printed in magnetic ink on both checks and deposit slips. The human versus mechanical battle of brains reached a high point in Chicago, when one enterprising fellow put the banking robots to work for himself. He took his stack of magnetically imprinted deposit slips to his bank and distributed them in the deposit slip pigeon holes in the writing counters. Other people wrote deposits that were sent magnetically to his account. The errors were not discovered until a routine check of the handwritten signatures, and by then he had skipped with his money.

The legal aspect of computer goofs has raised major questions of jurisprudence, and the courts are already filled with robot cases. What recourse do you have, for example, if a bank's computer mistakenly refuses to honor checks you have written in stores and returns them marked "insufficient funds?" What about compensation for a businessman who might be ruined by a loose wire that damages his credit rating? Who do you sue if you are injured in the crash of a computer-designed air-

(Continued on page 216)



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Deming, New Mexico is in the southwest corner of the state, away from the rigors of winter. A boom has begun here and Deming's present 8,500 population will be 17,000 in the next 10 years. And DEMING RANCHETTES is only 5 minutes from downtown. It is rich with fertile soil, pure water and gorgeous mountains. Yet a half-acre Ranchette is only \$199 complete, \$5 down, \$5 a month. Write for FREE color portfolio. No salesman will call.

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Please send your FREE portfolio in full color including maps and story.

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Most Dreams Are in Color

Full-color dreams occur more often than black and white dreams, according to tests made on 38 college students.

With the use of an encephalogram of brain waves, the eye movements of a sleeping student were observed as he followed the action of his dream. At this sign of dreaming, the student was aroused and asked to narrate his dream to a tape recorder.

Of the 38 students (10 women and 28 men) who were awakened 100 times, 87 dreams were recalled. Sixty-one were in color, 11 were slightly colored and 15 were colorless. Color was mentioned spontaneously in 22 dreams and elicited by questions from the experimenter in 39.

The study upsets the earlier theory that dreams are usually colorless, report Drs. Edwin Kahn and Joseph E. Barmack, psychologists, City College, New York, and Drs. William Dement and Charles Fisher, psychiatrists, Mt. Sinai Hospital, New York.

Life on Tahiti 2000 Years Ago

Those Tahitian beauties seen by the *Bounty* mutineers apparently had earlier ancestors than scientists had thought. Recent archaeological discoveries on Maupiti, an islet in the Society Islands, of which Tahiti is the largest, indicate that these remote specks of land were inhabited at least 2000 years ago.

An expedition from Bishop Museum in Honolulu early this year recovered stone adzes, pearl-shell fishhooks and ornaments from the grave of an adult male who died about the time of Christ, according to radio-carbon dating.

Previously, archaeologists had thought there were close ties between Hawaii and Tahiti from earliest times, but the new discoveries bear no relation to the most ancient artifacts found in Hawaii. They are, however, identical with tools and ornaments found in New Zealand burial sites which date back about 1000 years. The expedition's leader, Dr. Kenneth P. Emory, said that Hawaii apparently was first colonized by people from the Marquesas Islands, with later settlers coming from Tahiti.

Shocking Defender

Vicious animals or humans can be effectively subdued by farmers, stockmen, watchmen, mailmen or police with a transistor-powered aluminum cane. Pressing a button sends a tiny electric current through the transistorized circuit to produce a harmless 4000 volt shock.

The cane costs \$14.95 and is made by Freeman Electric Co., Freeman, Mo.

JANUARY 1963

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TO THE NEW
HI-VISIBILITY AMBER
WITH**

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YOURSELF
IN MINUTES!*



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—NO BULBS TO REPLACE**

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"SIGNAL-COTE" kit includes everything you need to professionally color the lens on your turn or parking lights to brilliant amber.

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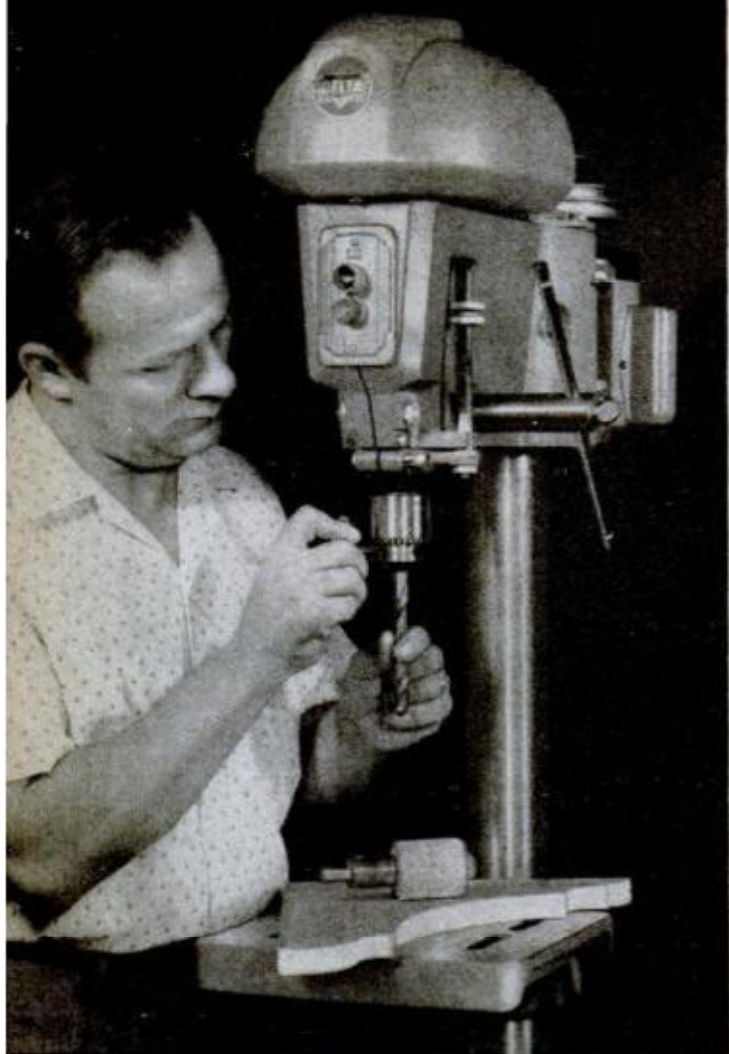
Please rush my SIGNAL-COTE kit. Enclosed is \$2.00.

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DAY OR NITE, YOU'RE SAFER WITH AMBER



What's so great about Delta's new 15" drill press besides the price—\$124⁰⁰*?

Just this. Delta quality features and standard Delta industrial construction. For you, it adds up to accuracy and versatility you can't match at this low price. Check these advantages:

- Husky 2" quill with 4 7/16" stroke**
- Lubricated-for-life ball bearings**
- Dynamically balanced spindle pulley**

Machine converts in seconds with any of six interchangeable spindle adapters to do dozens of jobs in wood, metal or plastic.

See this big value soon. Your Delta dealer is listed under MACHINERY in the Yellow Pages. For FREE BROCHURE with full details, write: Rockwell Manufacturing Company, Delta Power Tool Division, 502A N. Lexington Ave., Pittsburgh 8, Pennsylvania.

*Bench model less electricals

Rockwell
MANUFACTURING COMPANY



Look What Those Knuckle-Heads Are Doing

(Continued from page 214)

plane that had an obvious design fault?

Take the case of Chester Wroble, a Chicago telephone company employee. He received a machine-written court summons charging him with parking his car, license NA 2488, overtime at the Windy City's O'Hare airport. Wroble was puzzled; he had never parked at O'Hare airport. Then he remembered that his license number was NA 2489. He returned the ticket, explained the error and forgot about it.

But the machine did not. It sent Wroble an order to appear in court for not answering the first summons. Wroble returned the notice with another note of explanation. It was not his license number, he had never parked at O'Hare airport. The machine was stubborn. It sent Wroble another notice—a court date had been set. Wroble was furious. He called his lawyer and said that he wanted to sue for false arrest. "Impossible," said the lawyer. "You'll have to go to court; you can't sue a machine."

It's tough to take a brow-beating from a machine, so it warms the embattled human heart to see the machines run afoul of themselves. The new translation machines are enough to make the battered human heart swell with unbounded joy.

Limited Vocabularies

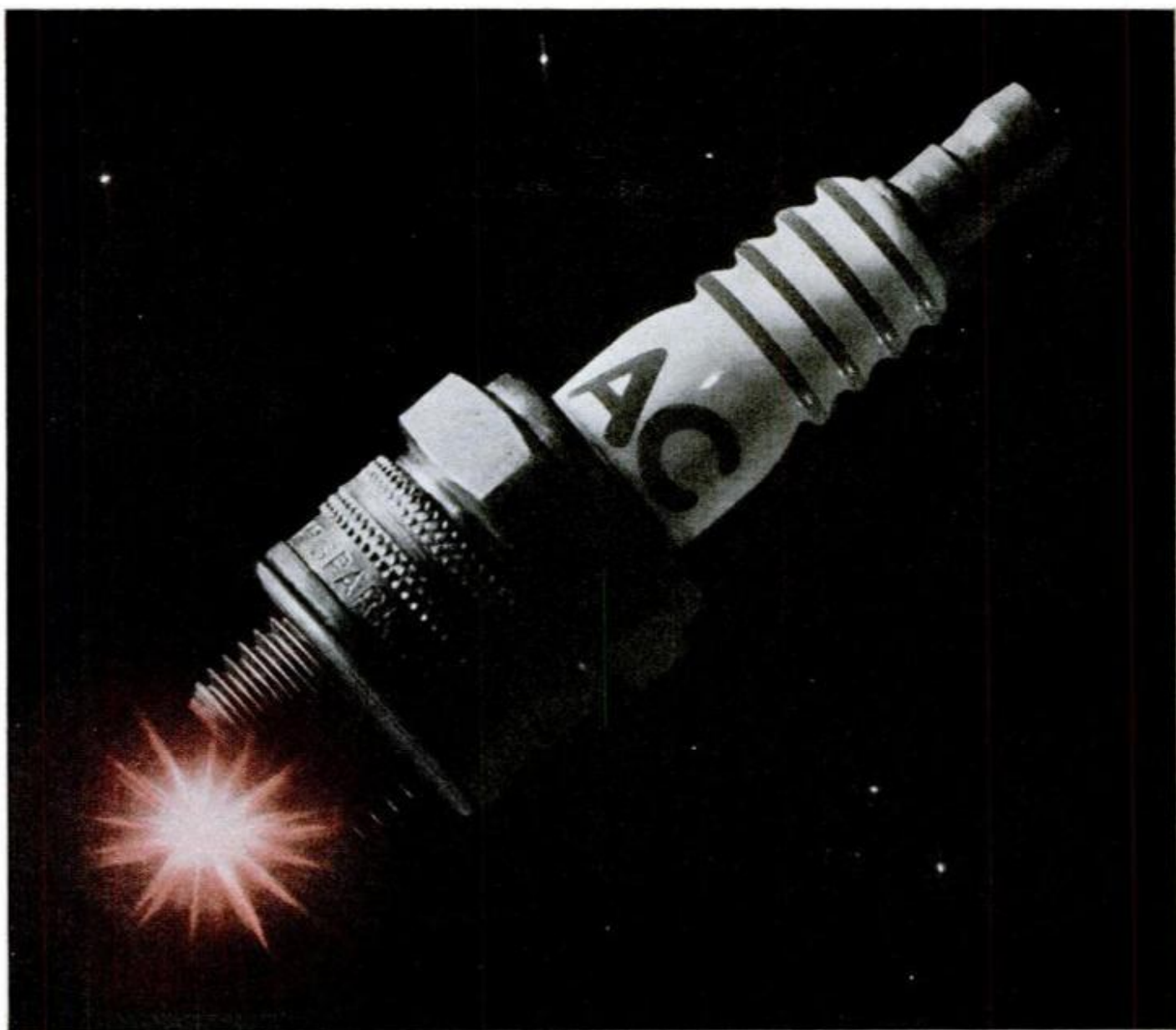
While remarkable technically, translation machines have limited vocabularies and one word must often do the work of several words.

The title of a Russian technical article, "New Uses For Hydraulic Rams," was translated: "New Uses For Water Goats." In the other direction the machine was asked to translate into Russian the expression, "The spirit is willing, but the flesh is weak." It whirred into action and came out with, "Vodka is strong, meat is weak."

Six years ago a marine motor manufacturer decided to switch to a fully automated assembly line. All manner of computers and robots and their kin were lined up to produce motors. But no matter how the robots were arranged, one job was not being done. The metal scrap from a die-casting machine was not being removed.

The company's chief engineer toured the U.S. seeking a robot scrap remover that would be practical. After many weeks of checking all kinds of robots and talking with other people who had run into the same problem, he reported his recommendation to the company's top management:

"Hire a man with a wheelbarrow."



AC Fire-Ring Spark Plugs are self-cleaning in all cars

AC Fire-Ring Spark Plugs give maximum self-cleaning action in all cars! Only ACs have the famous recessed Hot Tip that heats faster to burn away fouling carbons . . . cools faster to reduce pre-ignition. Because of the recess, more of the insulator tip and center electrode is exposed to the scrubbing action of the swirling hot combustion gases. Sounds technical, but it all boils down to the fact that ACs stay cleaner

JANUARY 1963

longer because they get hotter faster. Next time you change, ask for ACtion . . . ask for AC!

AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS



FIRE-RING SPARK PLUGS

217

An Engineer Evaluates the '63's

(Continued from page 102)

Chevy II has now replaced the 25-year-old Six in the big Chevrolet. And the new 221-260 cubic inch V8 designed for the Ford Fairlane and Meteor "senior compacts" has now replaced the 292-cubic inch standard V8 in the big Fords.

What gives here? Are these new compact engines strong enough to haul these heavier cars? Certainly, and here's how they're reengineered to do it.

The Chevy II engine is cast with larger bores to give 36 more cubic inches in the big cars. Chevrolet engineers allowed for this in the original design of the block. And, of course, the modern short-stroke, low-friction design, with freer-breathing ports and improved combustion chamber shape, is a much more efficient engine. It will give just as good performance as the old Six on a lot less fuel—and it should last longer. Same with the new Fairlane V8 in the big Ford. The smaller engine weighs 170 lbs. less than the earlier 292 engine, costs much less to produce and uses less gas. Power and torque of the small 260-cubic inch are a bit less, but this should be just about balanced by the lower car weight. Bread-and-butter acceleration on the road should be comparable.

Lincolns Will Barrel Better

It looks as if Lincoln engineers have finally solved their 4-barrel carburetion problems. They originally switched from a 4-barrel back to a 2-barrel carb to get better fuel-air mixture distribution between cylinders and better throttle response with the smaller throat area.

But this same reduced throat area that helped them at low speed also restricted the "breathing" at the top end, so the car lacked brisk passing acceleration. Now they've gone back to a big 4-barrel, but with an important change. By moving the whole carburetor back on the manifold, they have placed the two front primary throats—which work alone about 95 percent of the time—right in the center of the manifold. This gives equal distances to all the valve ports, so the front throats on the 4-barrel give all the benefits of a single two-throat carburetor. And there are still those two rear barrels that can be popped open anytime to give that extra punch for passing on the street.

Several interesting new high-performance engine options are available this year. Chevrolet, Ford and Dodge-Plymouth now offer new "police" engines using their biggest cylinder blocks (around 400 cubic inches or more)—but with rela-

tively "cool" camshafts and hydraulic valve lifters, single 4-barrel carbs and reduced compression ratios. They are rated at around 330 horsepower.

Thus you can get torrid torque and near drag strip acceleration times in a package that's flexible enough for smooth driving on the street.

Pontiac has switched its police option from 389 to the 421 cubic inch block. They can now offer you up to 370 horses with hydraulic valve lifters.

And it was probably inevitable that Studebaker would eventually offer the supercharged Avanti engine in all its cars. What with the latest moves to exhaust turbo-supercharging by Corvair and Oldsmobile (F-85), it begins to look as if pressure induction might be one of Detroit's new frontiers in the constant search for more horsepower.

Self Cleaning and Drying Rocker Panels

One of the big '63 trends is toward long-life and reduced maintenance on our family cars. In this connection Chevrolet has an interesting new feature on all '63s. (It was launched on Chevy II last year). Part of the air taken in through the cowl openings for the heater is routed around the sides and down through behind the rocker panels along the side of the body. Also, if any rain is scooped in through the openings, all this goes through the rocker panel ducts.

The reasoning is obvious: Most of the rusting in the rocker panel area is due to moisture that doesn't have enough ventilation to dry out quickly. In northern cities, salt used to melt snow on the streets will collect up behind the panels and prevent drying even when you do have adequate ventilation.

That's why Chevy engineers routed the blast of rain water down behind the rockers—to wash away this salt and dirt and mud. The forced flow of air and clean water run the full length of the rocker panels, with drain holes at the very rear.

Speaking of more corrosion protection, the new Rambler unit body uses 30 percent fewer separate stampings—which means that much less welding and a more rigid, longer-lasting structure. The entire side of the body, including the area surrounding the two doors, is a single piece. (This mates with a corresponding inner piece, and the two are then welded together like a clam shell into a rigid unit.) Obviously, we get better door and window fits with a deal like this—not to mention the cost and weight savings. All of which goes to prove that Detroit is never "finished" with a given design. ★ ★ ★



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Famous BENJAMIN Quality

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WITH **EXTRA MARGIN**
BENJAMIN'S Unique **DOUBLE SAFETIES**



KEEPS SHOOTING & SHOOTING & SHOOTING & SHOOTING AS FAST AS YOU CAN SQUEEZE THE TRIGGER!

FREE Write today! Complete Catalog Benjamin Rifles & Pistols—Single Shot & Repeaters—BB or 177 or 22. Also, Special Offer on Hunting Knives.

Use Benjamin H-C Pellets in Model 422 for Accurate, Jam-Free Shooting.
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New principle that contradicts every idea you've ever had about pipe smoking. I guarantee it to smoke cool and mild hour after hour, day after day, without rest without bite, bitterness or sludge. To prove it, I'll let you try a new Carey Pipe. Send name today for my FREE complete trial offer. Write to: **E. A. CAREY, 1920 Sunnyside Ave., Dept. 252-A, Chicago 40, Ill.**

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JANUARY 1963

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DULUTH MINNESOTA EST. 1908 TORONTO ONTARIO

Hillary

(Continued from page 91)

each auto—so I don't think we would have much trouble carrying a jet boat.

These big rivers penetrate through most of the populated areas of Nepal. If some of them proved navigable for the jet boat it would provide an emergency system of transport when the monsoon spreads its clammy hand over the land.

Antarctica's Mystery Mountains

Despite widespread expedition activity in the antarctic over recent years there still remain many problems to solve in the icy southern continent.

On the western coast of the Ross Sea lies Cape Hallett with some of the most spectacular scenery in the world—hundreds of square miles of fierce mountains and mammoth glaciers. Only a few tracks have scratched the surface of this vast, wild continent, made by a handful of parties on limited "summer" traverses.

Stories have been growing of great mountains sighted far inland, peaks of perhaps 20,000 ft. or more, which would make them the highest in Antarctica. Stories of this nature have a habit of being proved wrong, but it would be a fascinating task to find out the truth. And no matter what the result of the search for towering peaks, there's plenty of useful work on such an expedition for cartographers, glaciologists, and geologists—and there would still be formidable mountains to climb. Regardless of their exact height, they certainly are there.

While helicopters would make travel in this sort of country much easier, they are expensive items and require considerable care and maintenance. The task could be accomplished efficiently—and more economically—with several small single-engined ski-equipped aircraft in a "bush pilot" operation. Base camps could be established by these aircraft, and then two or three men could work their way into the more rugged regions on foot, ski or towing a sledge. Antarctic exploration need not be limited to the vast organization of men and machines; there is still a place for the small, compact expedition.

Bhutan Blue Bears

Lying far to the east of Nepal, but embraced by the southern border of Tibet, is the small Himalayan state of Bhutan. This is a closed country. It is rarely visited by Europeans, but by all accounts it is a country of great beauty and interest. In the rugged northern region lie

(Continued on page 222)

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Hillary

(Continued from page 220)

several peaks of 24,000 ft., and as far as I can discover, they have never been examined by an expedition. The dense forests of Bhutan have been subjected to little or no scientific scrutiny, and they would be a fascinating area for the botanist and zoologist. It is believed that the Tibetan Blue Bear—possibly the origin of much of the story of the Abominable Snowman—might be found deep in the Bhutanese forests.

The major problem here would be to gain the necessary permission to enter the country, but the rigorous travel restrictions are slowly softening under the pressure of Communist China to the north and the democratic world to the south.

Surrounding Mt. Everest

For many years I have wanted to make the first complete circuit of the passes and glaciers of Mt. Everest, and it is only the extreme difficulty of obtaining permission from the Chinese rulers of Tibet that has stopped me.

It is not a large project. A couple of fit climbers, half-a-dozen strong Sherpas, a minimum of equipment, and the ability to move far and fast under a heavy load are the prime requisites for the trip. The route I would choose involves the crossing of eight passes ranging from 19,000 to 22,000 ft. high, and the traverse of 11 great glaciers. It would give an unparalleled view of every face and ridge on Mt. Everest, together with fine mountaineering, and plenty of hard work. I do not suppose it would have much value as far as science or humanity is concerned, but for pure adventure this is the one trip I would like to make before I hang up my ice axe for the last time. While it is true that most expeditions today are primarily for scientific exploration, the true mountaineer does not need excuses.

So there is still plenty to do, and every mountaineer or explorer could offer an entirely different list of projects he has simmering in his mind. Adventuring is not merely a matter of muscle and skill and courage. It is far more a mental attitude—a constant restless seeking for new and exciting vistas, new challenges.

If a musty old pirate chart complete with skull and bones and cryptic directions to buried treasure does not stir your imagination—then you're lost! Money and technology are great factors in exploring, but it will always be the insatiable curiosity of man that will lead him to the unknown. ★ ★ ★



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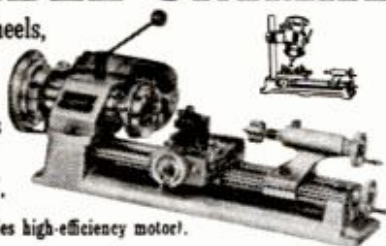
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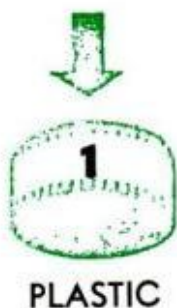
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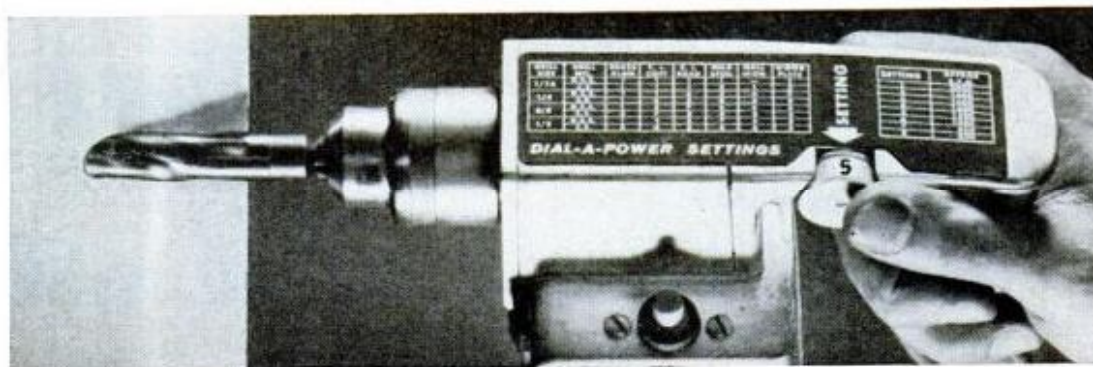
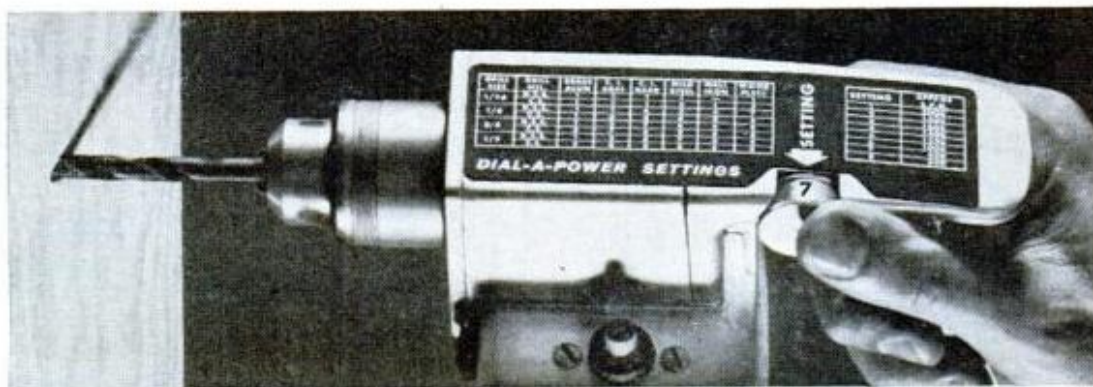
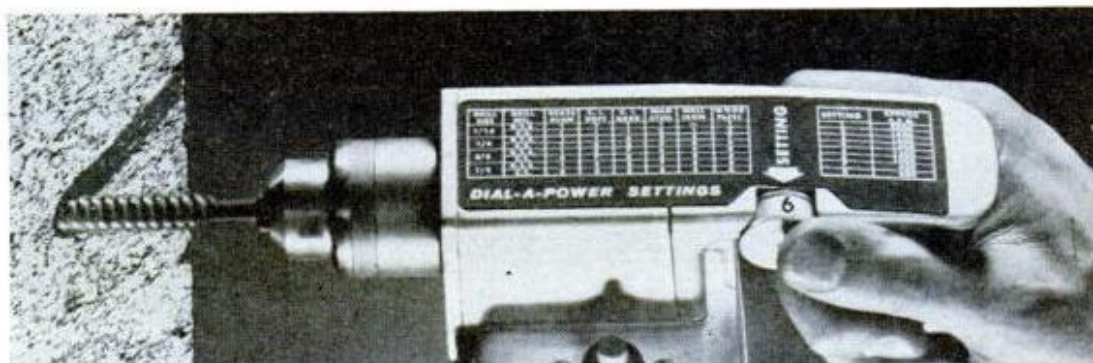
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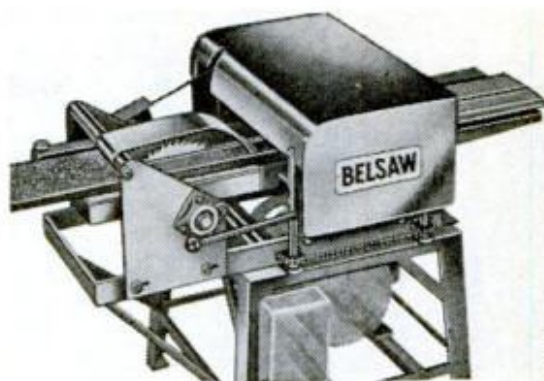
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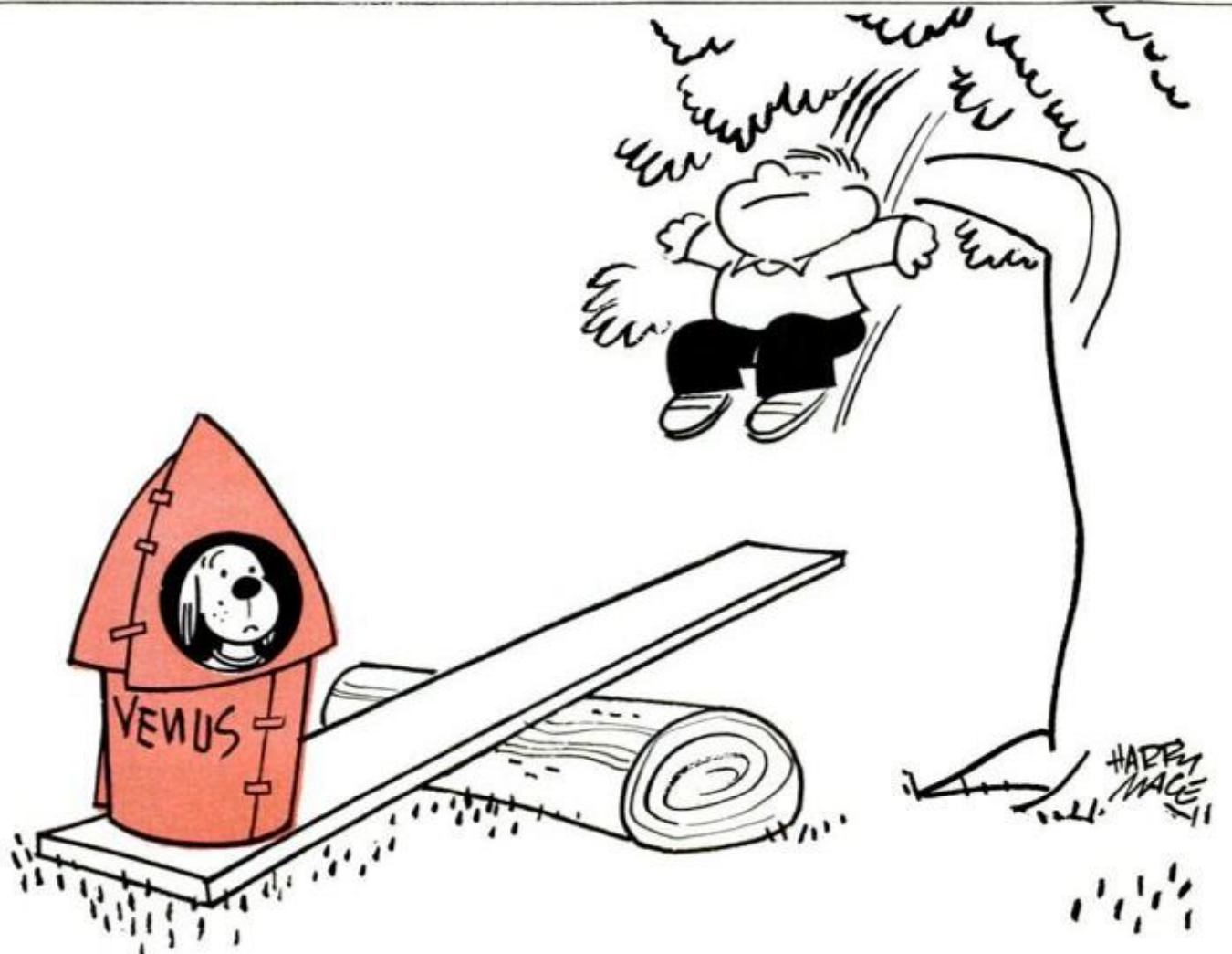
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Testing the Wilder Ones

(Continued from page 97)

is a pleasant surprise and our final impression is definitely an upbeat one.

In the Riviera I notice first of all a simplicity and quality of the interior . . . what the British might define as a "Gentleman's Carriage" fine motor car feel. Like the black, no-reflection areas of the whole instrument panel and center console . . . chrome is moderately used.

"Forward vision over this broad hood seems better . . . perhaps because of the absence of a dummy air-intake bump.

"Nice, smooth power flow through the automatic transmission . . . under full-throttle take-off it does not break traction, yet response is more powerful through the Buick's torque converter transmission than the T-Bird's. It seems both more positive and more efficient.

"Car has good control considering its nature. With this weight you couldn't use it without power steering in traffic. On winding, corduroy-type black-top roads, the Riviera has rear axle tramp or hop due to the heavy, unsprung weight of the axle. Ride is excellent, and, on most surfaces all anyone could want, and every bit as good as T-Bird. However, there is more juddering, more body shake over these rough secondary roads than T-Bird has. Possibly it's due to Buick's use of separate body and frame in contrast with the T-Bird's welded, one-piece hull structure which combines body and frame."

(PM's Auto Editor adds the thought that T-Bird's Hotkiss rear suspension, where long leaf springs are the only connection between axle and chassis or body, may be a reason for the lesser amount of body shake in contrast to the Riviera which has a system of rigid links connecting the axle with the frame.)

"There's better wiper coverage on the Riviera than on T-Bird, with more overlap of blades to minimize center blind spot.

"Instrument panel layout is good with the three-dial grouping directly in front and nicely cowled against night-time reflection up into the windshield . . . it's a pity that with such a nice start Buick didn't see fit to put instruments on their panel! All we've got to go by is a speedometer and a fuel gauge . . . and, of course, the usual collection of Christmas tree lights to warn one of something or other."

"There seems to be a bit more room in Riviera than in the T-Bird . . . there's definitely more room than in the Avanti.

"Brakes are good, powerful, however

(Continued on page 227)

Testing the Wilder Ones

(Continued from page 226)

the power assist is much too sensitive . . . it comes on with a bang before you really want it or expect it.

Corvette on the Road

"Normally this type of car is one of the most awkward to get in and out of or sit in but Corvette is as easy to get in and out of as any front seat of its type. Getting into an E-Jag, for example, is quite a contortion. Corvette's got wide doors and good height thanks to that cutout in the roof. . . . Without power brakes the brake action is very pleasant, easy to use and not a hard pedal. Relative location of brake and accelerator allows you to heel-and-toe it without any trouble.

"It's easy to drive . . . delightful . . . so responsive. It's comfortable . . . forward vision seems, surprisingly, fully as good as the other cars even though you're sitting about four inches lower.

"The windshield corner post is obviously pretty substantial (fiberglass reinforced with steel), but it doesn't obstruct vision badly at all.

"Seats are quite good, but could give more back support. I'd like a cage effect to hold upper torso, the rib cage, in place. Also, as on Mercedes, I would like to see perforated leather.

"Now we're on a very uncomfortable road, the same area where Riviera and T-Bird were constantly bottoming and wallowing. At 55 m.p.h. Corvette takes it well and smoothly. With a car of Corvette's power-to-weight ratio, you must take considerable care with the throttle—feather it on sharp turns, gravel, wet leaves, etc. or you'll break loose. . . . This is one reason Corvette race drivers, to be successful, must be very very good. This is especially true with the former model with its live axle. However even with the new suspension there's still enough power to break traction.

"In gearing there isn't enough difference between first and second ratios. First gear is too high for maximum acceleration (i.e. too low numerically in conjunction with low overall axle ratio). Other gears are quite reasonable.

"Driving Corvettes in 1960 at LeMans we could hold a number of Ferraris everywhere except down in first gear where they would walk away from us until we got into higher gears. On rough, corduroy-type blacktop the suspension is no harsher in feel than Avanti's and the car remains perfectly stable—does just what a good independent suspension ought to do.

(Continued on page 236)

JANUARY 1963

FIX LEAKS YOURSELF!

Why pay a
\$10 repair bill?
39¢ gets you

NEW HERCULES TAPE DOPE!

Stop leaks fast in shower heads, sink traps, radiators, valves, water lines, hose connections—any threaded joint—with cleaner, faster Hercules all-purpose Tape Dope, the modern pipe joint compound in easy to use tape form. Made of DuPont Teflon,® Hercules Tape Dope eliminates old-fashioned messy pastes, gloppy brushes, soiled hands; it never runs or drips. Tape Dope permits easy assembly and disassembly and does a permanent leakproof job on all household plumbing connections. Only 39¢ for the 30" roll (seals 20—½" joints) at your hardware store or wherever plumbing supplies are sold. For free literature write to:

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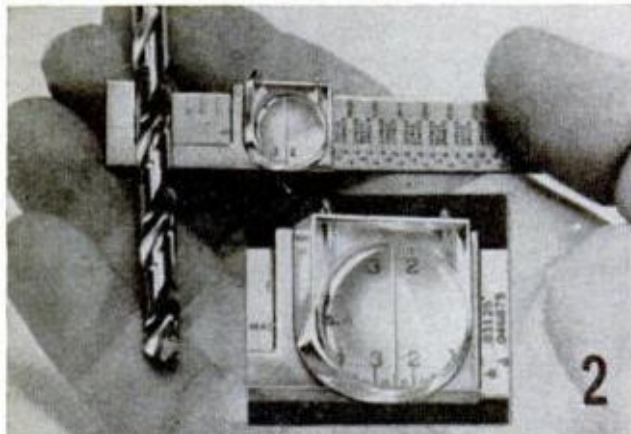
E. F. JOHNSON CO.

1401. 10 Av. SW, Waseca, Minn.

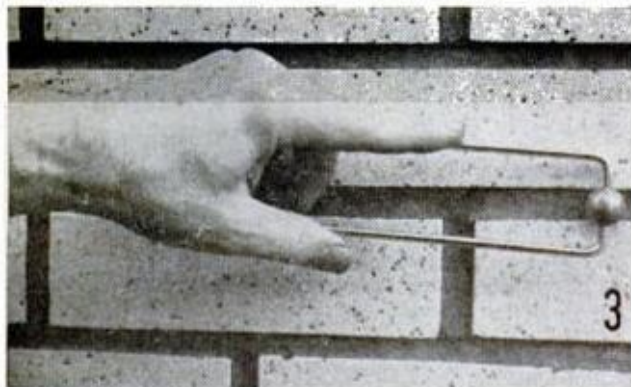
Shopping for tools



1. RECHARGEABLE BATTERY carried on the user's belt provides power for this $\frac{3}{8}$ -in. drill. A charger permits overnight recharging when connected to a 115-volt outlet. On one charge it will drill from 100 to 4000 holes, depending on material. Prices are: drill \$49.95, battery \$50, and charger \$14.95. Skil Corporation, 5033 Elston Ave., Chicago 38, Ill.



2. SLIDE MICROMETER provides accurate, easy-reading measurements up to 1 in. Requires no turning or adjusting, the object being inserted between the jaw and body of the slide and a reading, accurate to 1/100 in. and up to plus or minus 1/1000 in., is then visible on a magnifier window. Micro-Slide costs \$2.50. Amtronix, Inc., Box 44, Chula Vista, Calif.

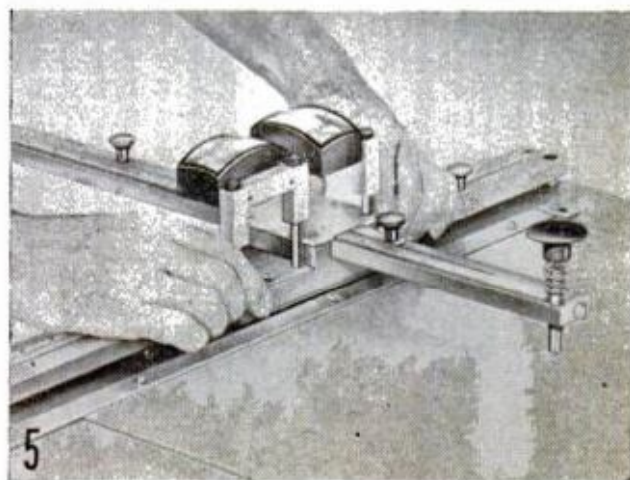


3. ROLL-A-JOINT mortar tool produces uniform, weathertight and attractive mortar joints in all types of masonry. The ball roller is effective on joints of varying width when pressed against the mortar before it dries, creating a firm, trim appearance. Guaranteed, it is available for \$1 postpaid. The Walters Co., 15-20 202nd St., Bayside 60, N. Y.



4. MIDGET POW-R-ARM features push-pull control arm that locks or releases a perforated work holder in any position. Only $1\frac{1}{4}$ in. high, with a $2\frac{1}{2}$ -in. diameter base, it was designed to hold tiny relays and switches but is stable enough to handle a 9-lb. work load. Made of cadmium-plated steel, it sells for \$5.60. Wilton Tool Mfg. Co., Schiller Park, Ill.

5. LOKATOR LAYOUT MACHINE eliminates the separate steps of using a square, scribe, scale, punch and hammer in sheet and template layout work. Scale bars are equipped with magnifying glass for accurate reading. Magnets hold the work securely on a table of rust-proof chrome. Machine is priced at \$445 FOB. Di-Acro Corporation, 779-8th Ave., Lake City, Minn.



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The American Shop Tool Guild
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industrial rated electric drill

for only **\$3.95**
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3 lbs. UL & CSA tested and
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1. CHAIN WRENCH—Replaces 3 sizes of pipe wrenches. Heavy duty, forged alloy with easy to grip handle. Adjusts to full 3" OD—holds any shape—automatic ratcheting, with positive gripping action..... **\$2.88**



2. TUBING TOOL KIT—For home and automotive use. Top quality cut-off tool, flaring die and yoke for 6 sizes: 3/16" to 3/8" and 3 tube benders: 1/4", 5/16" and 3/8" **\$4.40**



3. SABRE SAW ATTACHMENT—Turn any 1/4" electric drill into a sabre saw! Cuts any shape. Saws any material. Complete with mounting bracket, extra blades..... **\$4.65**



4. POWER SCREWDRIVER ATTACHMENT—Rugged, screwdriver attachment saves time and energy. Fits any 1/4" or 3/8" electric drill. Comparable to similar units priced at \$6.00 retail..... **\$2.88**

TOOL-OF-THE-MONTH CLUB brings you a new concept in buying fine, precision built, American-made hand tools at a great price reduction. Each month, as a charter member, you will be supplied with a selection of four different quality tools; this month's selections shown above: **1. CHAIN WRENCH—\$2.88, 2. TUBING TOOL KIT—\$4.40, 3. SABRE SAW ATTACHMENT—\$4.65, 4. POWER SCREWDRIVER ATTACHMENT—\$2.88.** During the coming year you will be offered over 50 selections from which to choose. Ideal for your workshop; each selection is fully guaranteed to be of excellent quality and priced

50% below the retail cost of comparable quality tools.

ALL TOOLS are carefully constructed from the finest materials, alloy steels where necessary—made by craftsmen... for craftsmen who take pride in their work and the tools with which they work. The American Shop Tool Guild provides you with the means to have the right tool for any job—and at savings of 50%!

FULLY GUARANTEED—If you are not completely satisfied, you may return any selection you order and either substitute another selection or have your money refunded.

HOW TO GET YOUR \$13.95 RETAIL, INDUSTRIAL RATED 1/4" ELECTRIC DRILL FOR ONLY \$3.95

Select your choice of any one of the four TOOL-OF-THE-MONTH CLUB selections shown above at the regular American Shop Tool Guild prices listed. Make your choice on the coupon at the right. Then, simply mail the coupon—without money—and you will promptly receive the TOOL-OF-THE-MONTH you desire, along with a bill for \$3.95 for your nationally advertised brand name 1/4" industrial rated electric drill plus the cost of your TOOL-OF-THE-MONTH selection, as priced above, and a small shipping charge. Upon receipt of payment, we will ship your 1/4" industrial rated electric drill.

AS A TOOL-OF-THE-MONTH CLUB MEMBER, you will receive a choice of four or more TOOL-OF-THE-MONTH selections each month; over 50 different high quality American-made hand tools during the coming year. You may choose any selection described—and the tools you want will be mailed and billed to you at the American Shop Tool Guild's special price of \$4.95 or less, depending on value of selection, plus small mailing and handling charge.

Your only membership obligation is to purchase five additional selections during the coming year... and you may discontinue membership anytime thereafter. If you decide to continue as a member after fulfilling your enrollment agreement, you need not purchase any specified number of tool selections—but, for every 3 selections you do accept, you will receive your choice of a selection from our Bonus Selection absolutely FREE!

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Please send me the TOOL-OF-THE-MONTH selection I have indicated below. With my selection I will receive a bill for \$3.95 for the 1/4" electric drill plus the cost of the selection indicated below and a small shipping charge. Upon payment of this bill, I will receive my electric drill.

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1. Chain Wrench 2. Tubing Tool Kit 3. Sabre Saw Attach. 4. Power Screwdriver Attach.

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

How Service Free Are the '63's?

(Continued from page 118)

filter or drained off with the used oil. Antioxidants soak up oxygen to prevent it from reacting with the oil itself.

These additives have made it possible to increase mileage between oil changes. But, eventually, the material is used up. An alkaline additive, for example, can neutralize only a certain amount of acid. A dispersant can hold only so much foreign matter in suspension. A detergent is consumed as it does its job, just as a bar of soap is washed away after repeated use.

Everybody agrees that oil should be changed before the additives are depleted but how can you pick an arbitrary mileage or time that will be satisfactory for all cars?

The Housewife and the Salesman

The suburban housewife who makes repeated short trips in cold weather never lets her car's engine get warm enough to vaporize water and fuel in the crankcase. In their liquid state they can't escape through the ventilation system, so they remain in the crankcase to contaminate the oil. Additives working overtime to neutralize these trouble-makers are used up quickly.

Contrast this suburban operation with that of a traveling salesman who may clock 40,000 miles a year on the open road. His engine operates at normal temperature most of the time, there is little fuel dilution, and most of the blowby vapor escapes through the crankcase ventilation system.

Specifying the same oil change interval for both of these owners is bound to penalize one of them. Either Mrs. Suburbia isn't getting the protection her car's engine needs or Mr. Traveling Salesman is throwing away perfectly good oil. This is the simple logic behind the time-or-mileage recommendation of most car manufacturers.

The 1963 Oil Change Jungle

For 1963, General Motors has joined Ford in advocating the 6000 mile oil change, but with an important proviso. GM says 6000 miles or 60 days, whichever occurs first. For the average car owner, this actually means an oil change every 2000 miles. Other auto companies have stuck with the 4000-mile change but also include a time limit which is usually 60 days.

It's interesting to note how this compares with the American Petroleum Institute's recommendation of a change every 30 days in winter, 60 days in summer, or a maximum of 2000 miles.

One oil company, though, has decided

that "if you can't beat 'em, join 'em." They recently announced an oil with a formidable array of additives. Using this lubricant, the company says, the car owner can safely follow the drain interval recommended by the car manufacturer. The price? One dollar per quart!

Let Docile Transmissions Lie!

Drain intervals for automatic transmissions have also been greatly extended. In fact, most car factories have eliminated periodic drains completely, legitimatizing a practice that has been going on for years. Few car owners heed the owner's manual instructions on when to drain transmission fluid. Many service stations hesitate to push fluid changes because the operation is a bit more complicated than changing engine oil. Some have experienced customer complaints about leakage after new fluid was installed. This happened occasionally when the replacement fluid had slightly different chemical characteristics from that used for factory fill. As a result seals sometimes shrank enough to let fluid seep out. Car owners and servicemen alike seemed to agree that as long as an automatic transmission was working well, it was best left alone.

Although transmission fluid doesn't have to put up with the combustion by-products that contaminate engine oil, it has its own problems. Abrasive material is created as metal clutch plates and fabric bands wear. A certain amount of dirt finds its way through the breather. Finally, oxidation occurs when air reaches the hot fluid. All transmissions breathe as temperature fluctuates and fluid flows from one area to another. But transmissions that change ratio by dumping and filling fluid couplings admit relatively large amounts of air, so all cars with automatics of this type still require periodic drains.

Chrysler has eliminated transmission fluid changes for 1963 but has added a replaceable filter to the unit. This is a pregnant idea in Chrysler's case, since the transmission is one of the components covered under the new 50,000-mile warranty.

Obviously, engineering and service departments of the various factories don't agree on the ability of lubricants and seals to hold up for prolonged periods. Chevrolet and Buick apparently figure that if the owner must bring his car in for an oil change every 6000 miles, he might as well have the chassis lubricated at the same time. Companies advocating lube intervals of 30,000 miles or more are shooting for maximum convenience and minimum ex-

(Continued on page 232)

Where-To-Find-It List

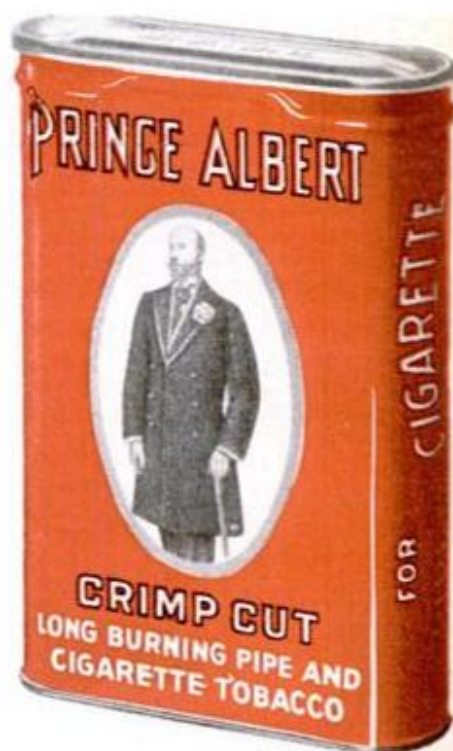
If you want to find out more about the articles in this issue, write for sources of supply or further information which are given in the free WHERE-TO-FIND-IT list. Send stamped, self-addressed envelope to SERVICE BUREAU, 575 Lexington Ave., New York 22, N. Y.



The proof is in the puffing!



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PRINCE ALBERT

JANUARY 1963

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SPECIAL FACTORY
OFFER!**



\$300
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USES POWDER CHARGE

This small bore gun shoots .12 cal lead bullets fired by small 44 mg. powder charge. Not a CO₂ gun! You'll like the handsome lines, grip, and balance. Western in style, but patented ball and cap action allows this low price. 9 3/4" steel barrel cased in knurled styrene stock, overall 13 1/2". Develop pistol form, accuracy at a fraction of cost of large caliber pistols. Comes with 50 lead bullets. Satisfaction guaranteed. Send \$3 to: HAIG MFG. CO., P.O. Box 4-Y, Alhambra, Calif.

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Tremendous demand from owners of trophy-cup-grabbing Michigan "cupped edge" outboard props last year has prompted expansion of the line to all stock engines listed below. The fabulous performance of this new 2-blade cupped wheel led us to stamp our "Trophy Cup" mark on the hub of all genuine Michigan cupped wheels. Cupping takes know-how... other cupped wheels may disappoint you... look for the cup mark. 3-blade wheels are also available.



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| 10 1/4 x 15 | 2 blade | Bronze | CUP-48 | \$29.00 | |
| JOHNSON-EVINRUDE-GALE 60-75 h.p. | | | | | |
| 10 1/4 x 14 | 2 blade | Bronze | CUP-108 | 34.00 | |
| SCOTT-ELGIN 40-43.7-45 h.p. | | | | | |
| 10 1/4 x 15 | 2 blade | Bronze | CUP-158 | 29.00 | |
| SCOTT-ELGIN 60-75 h.p. | | | | | |
| 11 1/4 x 16 | 2 blade | Bronze | CUP-208 | 34.00 | |
| WEST BEND 40-45 h.p. | | | | | |
| 10 1/4 x 16 | 2 blade | Bronze | CUP-258 | 29.00 | |
| WEST BEND 80 h.p. | | | | | |
| 11 1/4 x 16 | 2 blade | Bronze | CUP-308 | 35.00 | |
| MERCURY 350-450-500 (PROP EXHAUST) | | | | | |
| 10 1/4 x 13 | 2 blade | Bronze | CUP-354 | 30.00 | |
| MERCURY 50-55-35A-300-350, MARK 58-58A 400-500 | | | | | |
| 10 1/4 x 13 | 2 blade | Bronze | CUP-360 | 27.00 | |
| MERCURY 800A-850, 1000-650 (GEARSHIFT) | | | | | |
| 13 1/4 x 21 | 2 blade | Bronze | CUP-404 | 38.00 | |
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MICHIGAN

3-4

How Service Free Are the '63's?

(Continued from page 230)

pense for the first owner.

Some idea of the confusion prevailing comes from the fact that Oldsmobile, which last year recommended no lubrication of ball joints or steering linkage for the life of the car, now specifies repacking of ball joints every 30,000 miles and steering joints every 6000. Cadillac, on the other hand, has stuck with its permanent lubrication. Thunderbird originally announced lifetime lubrication for its 1963 models. Lifetime, as far as Thunderbird was concerned, meant 100,000 miles or seven years. Later, the recommendation was modified to 100,000 miles or three years.

Reaction to Long-Term Lube

Reaction to long-life chassis lubrication has been mixed. Most of the trouble that has occurred has shown up early in the life of the car, due to improper packing or a defective seal. In some cases, such premature failures have discouraged the owner to the extent that he has had grease fittings installed.

Yet one of the country's largest limousine services continues to use Cadillacs with sealed fittings in an operation where a squeak is as out of place as a Stillson wrench in a watchmaker's shop.

A number of the mechanical changes in this year's cars are designed to reduce the frequency of routine service. All makes now use self-adjusting brakes. Ford has adopted hydraulic valve lifters for its compact Sixes to eliminate the need for valve adjustment, and equally important, cut the noise level of these engines. All General Motors cars except Corvair, as well as Studebaker and some Ford and American Motors products, have switched from the d.c. generator to the alternator, which will cut the incidence of run-down batteries. The regulator used with an alternator is also much simpler than conventional types, so should be less likely to give trouble.

These new warranties show that automobile manufacturers mean business with their reduced service pitch. These service policies don't give the car owner a free ride for the life of the car but they do protect him from catastrophic repair bills. It's one thing for the advertising department to spout claims. It's quite another for the company to lay money on the line to back up its product. If somebody guessed wrong, warranty cost could easily put a car maker in the red.

The manufacturers' confidence bodes well for the new car buyer in 1963. ★ ★ ★



One-Man 'Copter Has Counterrotating Blades

Believed to be the first successful coaxial helicopter, using two counterrotating rotors and no tail rotor, the *Rotorcycle* is a one-man craft made by the Gyrodyne Company of Long Island with a 72-horsepower Porsche engine made in Germany.

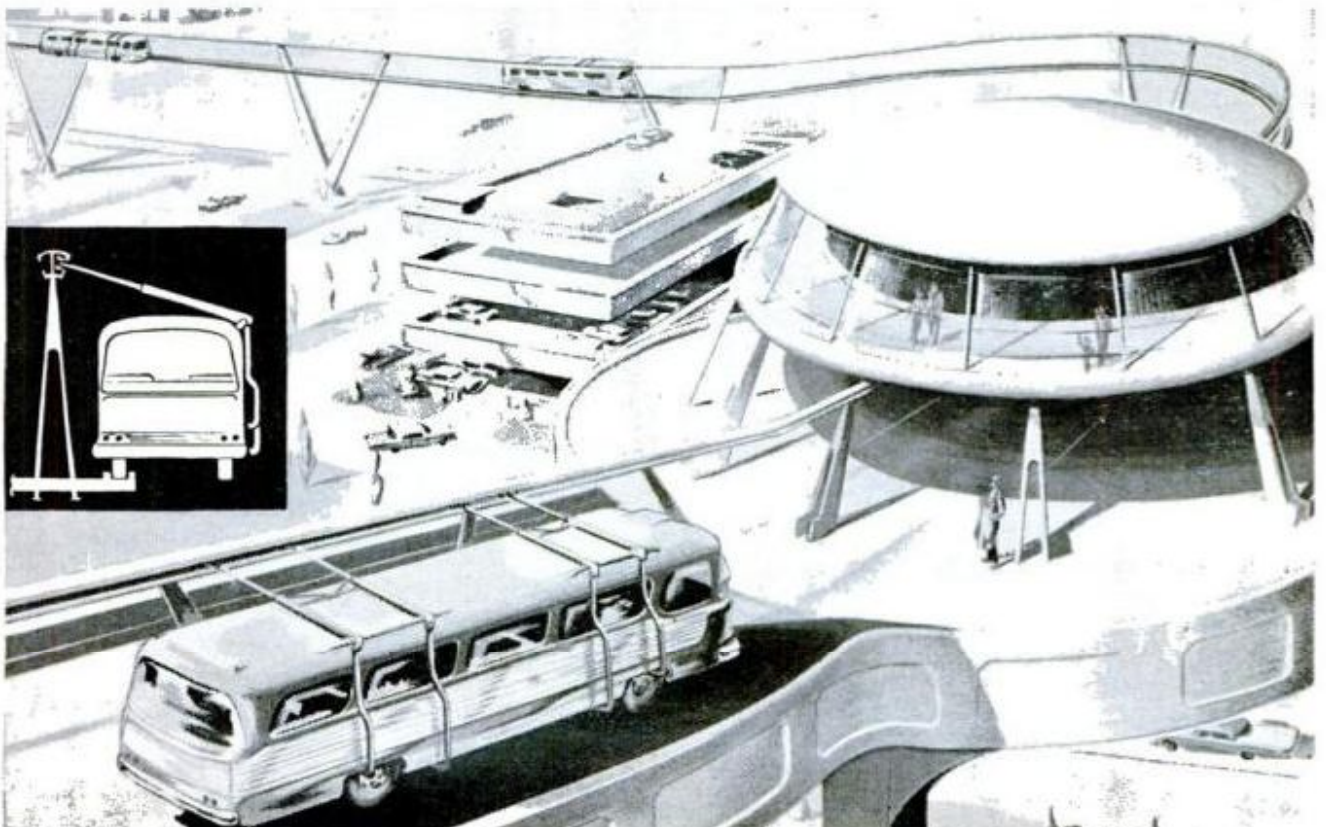
The inverted-V tail assembly is for stability only. All control is achieved through the overhead rotors. A unique feature is tip brakes mounted on the ends of the rotor blades which provide smooth directional control.

Overhead Bus System Proposed for Intercity Travel

Specially rigged buses that would descend to ground level to pick up and discharge passengers, then ride overhead rails on intercity trips, have been proposed by a Detroit designer.

The Monobus—a bus driver's answer to

the Monorail—would be slung from overhead rails by huge arms. One set of wheels would ride in a shallow trough (inset) to give the bus traction and stability. The buses, which are standard in other ways, would also be able to travel on streets.





Pint-Size Roadster Built "from Scratch"

Compactest of the compacts is this seven-foot midget auto designed and built by Alfred H. Uglum of Minneapolis, Minn.

Weighing 425 pounds and powered by a five-horsepower air-compressor motor, it

has a maximum speed of 35 m.p.h. The construction is completely original from chassis to the three-speed transmission. The body is fashioned of 24-gauge sheet metal. Uglum built the car for \$325.



Atlas 6" Back-geared
Screw-cutting **LATHE**
...for turning Metal - Plastics - Wood

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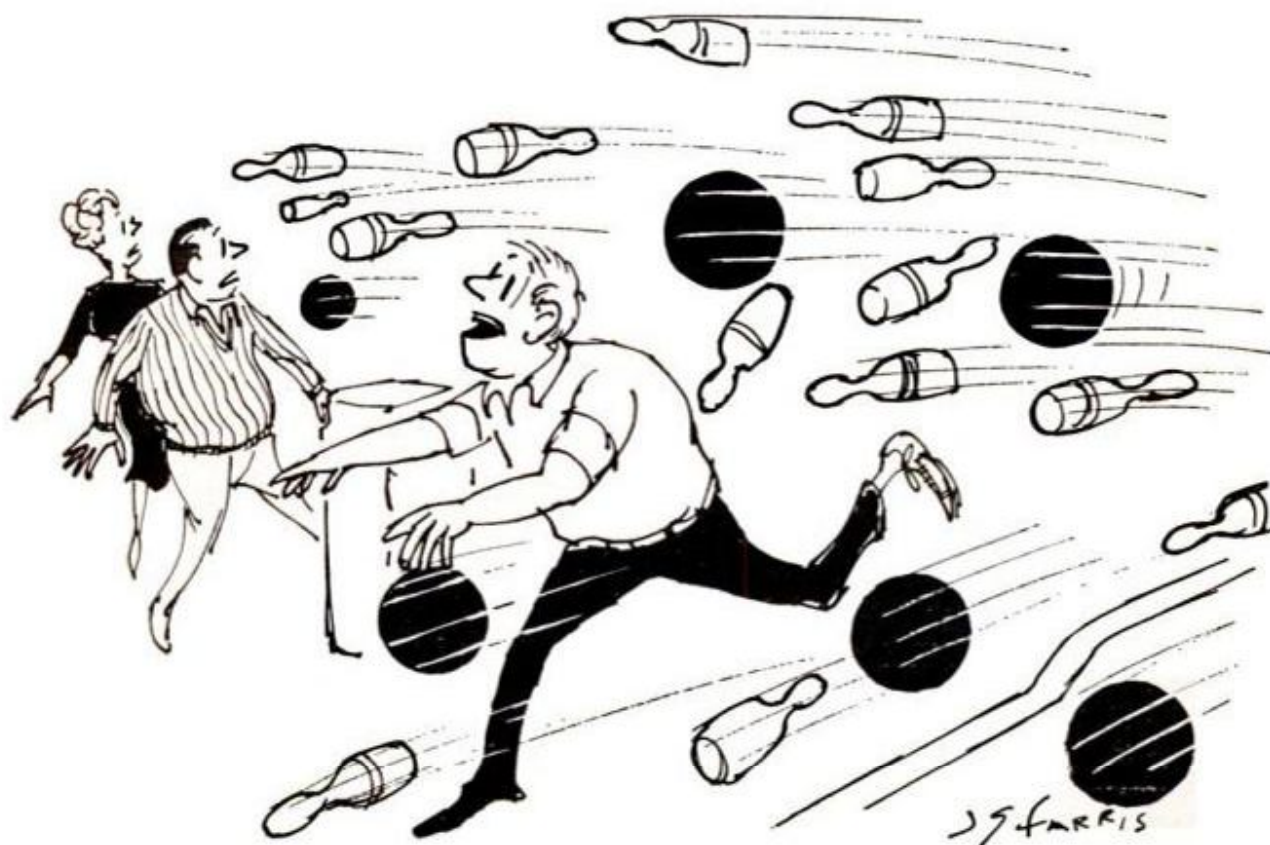
Heater That Cooks

Heating and cooking facilities are combined in a single kerosene heater. A removable trivet holds cooking utensils. A flame-control valve makes leveling unnecessary; the heating-and-cooking unit is available from Regis Distributing Corp., P.O. 204, Pompano Beach, Fla.



Walls Roll Up for Comfort

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send name and address to
ARIENS COMPANY
161 Calumet St., Brillion, Wis.



Testing the Wilder Ones

(Continued from page 227)

"Only time that we get wheel tramp is on a washboard section of road with a lot of power on; otherwise you just sort of hear the suspension working and nothing comes through in the form of cowl shake, loss of directional control or any other bad effects. You actually have to induce tramp in rear wheels by using too much power.

"Corvette's a highly satisfactory road car—comfortable, good road-holder and has good response . . . (PM's auto editor adds that, on bad roads, that it is actually truly as comfortable as some other cars where softer spring rates, body mounts, etc. insulate the passenger compartment more thoroughly . . . even though you get more jar or feeling of firmness in the passenger area, Corvette's better control over rough surfaces makes the passenger's total ride feeling just about as relaxed as in the other cars. John Fitch agrees).

Avanti on the Road

"There's noticeable rear end noise from ring and pinion; we pushed it hard on the track, possibly the rear end is over-worked. We find that Avanti doesn't break loose under hard acceleration on wet asphalt pavement, however.

"It's quite obviously a sporting suspension compared to the Riviera and T-Bird, not uncomfortable and not unpleasant, with a good solid feeling. However, understeering characteristics are evident even in highway driving; there's a delay in the response when you want to turn . . . it just doesn't seem to want to come around. The seat is obviously harder and more containing, it locates your body more than on the Riviera or T-Bird but it's basically comfortable and not objectionably hard.

"The floor falls away so you don't get much of a brace with your left foot . . . good amount of foot room. Already there's some discoloration around gearshift boot . . . gearshift linkage has some looseness that transmits vibration up into the cab and we hear it. This supports observation that this particular car, at least, is put together in a hurry and not up to the finish quality of the other three. Vision forward compares favorably to T-Bird and Riviera . . . vision to left is better. Driving position is quite satisfactory; wheel location is good . . . difficult to find a flat resting place for your left foot that's comfortable. Engine response to full throttle, as on the track, seems to come in two or three stages; there's no consistent and im-

(Continued on page 237)

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fix it quick with

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EXCLUSIVE DOUBLE-BEARING HEAVY DUTY PUMPS

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TYPE X—2 oil-less bronze bearings. **\$10.95**
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Selling the Midwest and Southwest
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Selling the East, Southeast and the West

Testing the Wilder Ones

(Continued from page 236)

mediate throttle response. On the Avanti we found a lack of the rear axle hop found on both Riviera and T-Bird . . . because ride is firmer and axle is controlled by firmer shock settings and torque reaction rods fastened to the frame.

"Avanti definitely bottomed on railroad tracks . . . and there's more harshness, general cowl shake and rattle of window frames, etc . . . the road holding ability for a heavy, live-axle car like this, with not much sprung weight to compensate for the unsprung rear axle, has reached the limit. We are not considering its action on corners at this point, but rather how well it retains contact with the road surface. It's not unpleasant in terms of ride and wheel hop, though. But the overloaded front end does produce harshness on wash-board road surfaces, vibration and a higher noise level than the other two (Riviera, T-Bird)."

Corvette as a Racer

After he had completed evaluation runs, we asked driver-designer Fitch to sum up his reactions to all four cars with some special emphasis on the racing competition potential of the new Corvette.

"The type of car these four cars seemingly represent points up Detroit's idea that "money is going out of style". This is not altogether a bad thing as it promotes innovation and variety. It's also a result of the impact of the imported cars with their varied types . . . now U.S. cars show considerable variety too . . .

"In its standard form, the new Corvette becomes a first rate sports car that looks and costs as if it will go 150 miles per hour, and it will. But nobody but a certified maniac would try to exploit its potential outside the limits of a race track.

As a racing sports car, though, it again reflects the knack of the Chevrolet sports car department to dramatically reveal warmed-over discards of European racing engineering as brilliant innovations.

"Corvette's chances in international racing remain as before—the possibility of picking up an occasional high placing when the fast cars are not present, due largely to the chronic overweight problem which stalks U.S. cars. By dint of some inspired driving by Dick Thompson and a few competent supporters, past Corvettes have, and the new Corvette will, pull off a few good wins in racing.

"I say this on the basis of personal experience. Ten years ago I was racing a

(Continued on page 239)



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the Boy Scientist



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Written by John Lewellen, noted writer of a dozen books on science and natural history, Preface by Dr. Wilbur Beachamp, Professor of Education, University of Chicago, who says "the Boy Scientist may well be the spark that starts some boy on the way to becoming a scientist and the Nation's need for scientists is very great."

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Fire Fighter Digs In and Throws Dirt To Smother Flame

Still in the experimental stage, a forest-fire fighting machine throws dirt on the fire from the fire lane it builds. The dirt can be hurled up to a distance of 100 feet.

Known as a sandcasting machine, it can throw three to five cubic yards of sand or

dirt a minute in suppressing forest fires. The experimental prototype, above, was engineered and built by the Michigan Forest Fire Experiment Station in cooperation with the U.S. Forest Service. It has been tested in forests in Georgia.

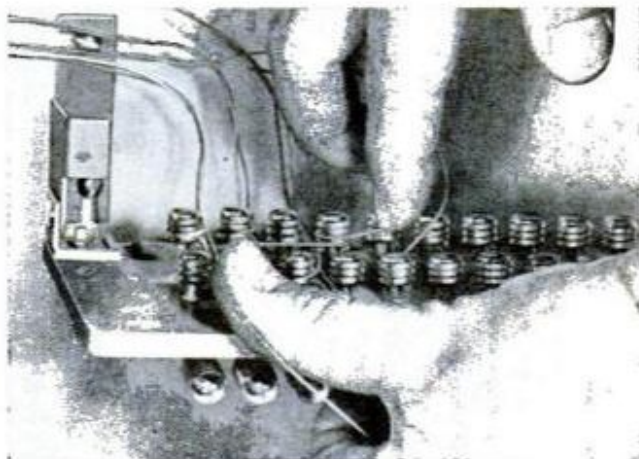
'Big Brother' Keeps an Eye on Entire Aircraft Carrier

Borrowing an idea from supermarkets, which use wide-angle mirrors to keep tabs on shoplifters throughout the store, the captain of the USS *Midway*, a Navy aircraft carrier, installed one on his flight deck.

Now, while watching the bow of the

ship, he can still keep a wide-angled eye aft without turning his head.

His whimsical crew promptly dubbed the mirror "Big Brother" and, with appropriate ceremonies, the mirror had this nickname printed along its top edge.



Fast Wire Connection

Utilizing a coil spring, an electrical connector makes positive contact without the use of solder or binding posts and nuts. When wire is forced into the coil, sharp edges cut through the insulation and make stable, vibration-proof contact. Developed by Bell Telephone, rows of coil spring connectors will be used in telephone terminal blocks.

Testing the Wilder Ones

(Continued from page 237)

3000-pound 5½ liter (340 cubic inch) sports car, the Cunningham, when such vehicles had their greatest opportunity of winning (the new Corvette is 3000 pounds and 327 cubic inches). In fact, the Cunningham was actually the fastest car at Le Mans in 1952 and only failed to win because of a fluke engine fault...sticky valves. But by 1955 it was clear that the big engine approach was hopeless when Briggs Cunningham was forced to withdraw his big, Chrysler-engined cars. Smaller-engined, lighter cars with better brakes, lighter gas loads and less tire wear had this big engine concept beaten.

"In the meantime, European competition has made even further improvements in lighter construction, better roadholding, higher engine output per litre, (now approaching 100 hp. per litre) and reduction of frontal areas. American efforts, such as they are, have trailed way behind... best U.S. results have been achieved by outright copying, or the adopting of complete units such as Dunlop or Girling disc brakes, Cooper and Colatti gear boxes, etc.

"These have been used on the modified Buick-engined Cooper Monacos etc. and, have done quite well. The new Corvette,

by virtue of its design, can't be anything great in international racing; however, it is a great value for money and will race well in American club circuits.

European Innovations?

"Touching on some of the innovations that these cars represent... disc brakes on the Avanti... the quite improved cast-aluminum finned drums that the Riviera uses with cast iron liners... things of this kind are pretty much old hat. Allards and Jaguars were using the aluminum drum in England 15 years ago. The Avanti's disc brakes are new (to production cars) in this country, but they are British Dunlops made by Bendix copies of brakes used by Jaguar to win at LeMans in 1953, and they also appeared on the production Citroen DS 19 back in the mid '50's. The use of the long radius rod and the unsplined axle shaft as a control arm in rear suspension, as on '63 Corvette, also harks back to Dr. Porsche's GP design for Cisitalia in 1948.

"No one objects to a little gentle larceny of engineering lifted from racing experience; indeed, it is the traditional pattern of automotive development for innovations to move from racing car to sports car to production car. But let's put the credit where it is due." ★★★

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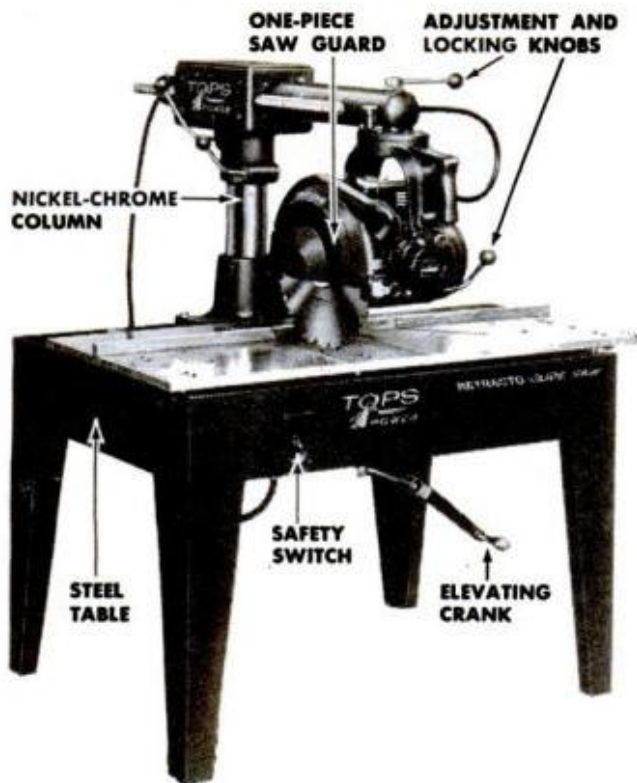
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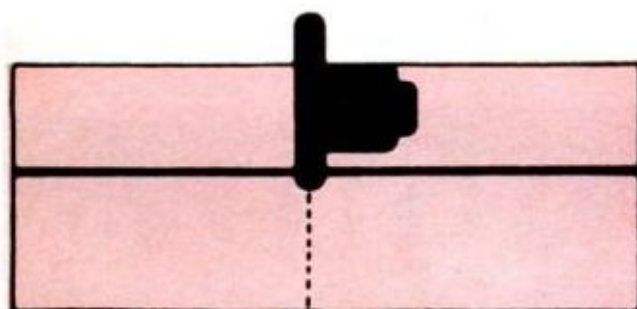
New Radial Saw Features Retracting Arm



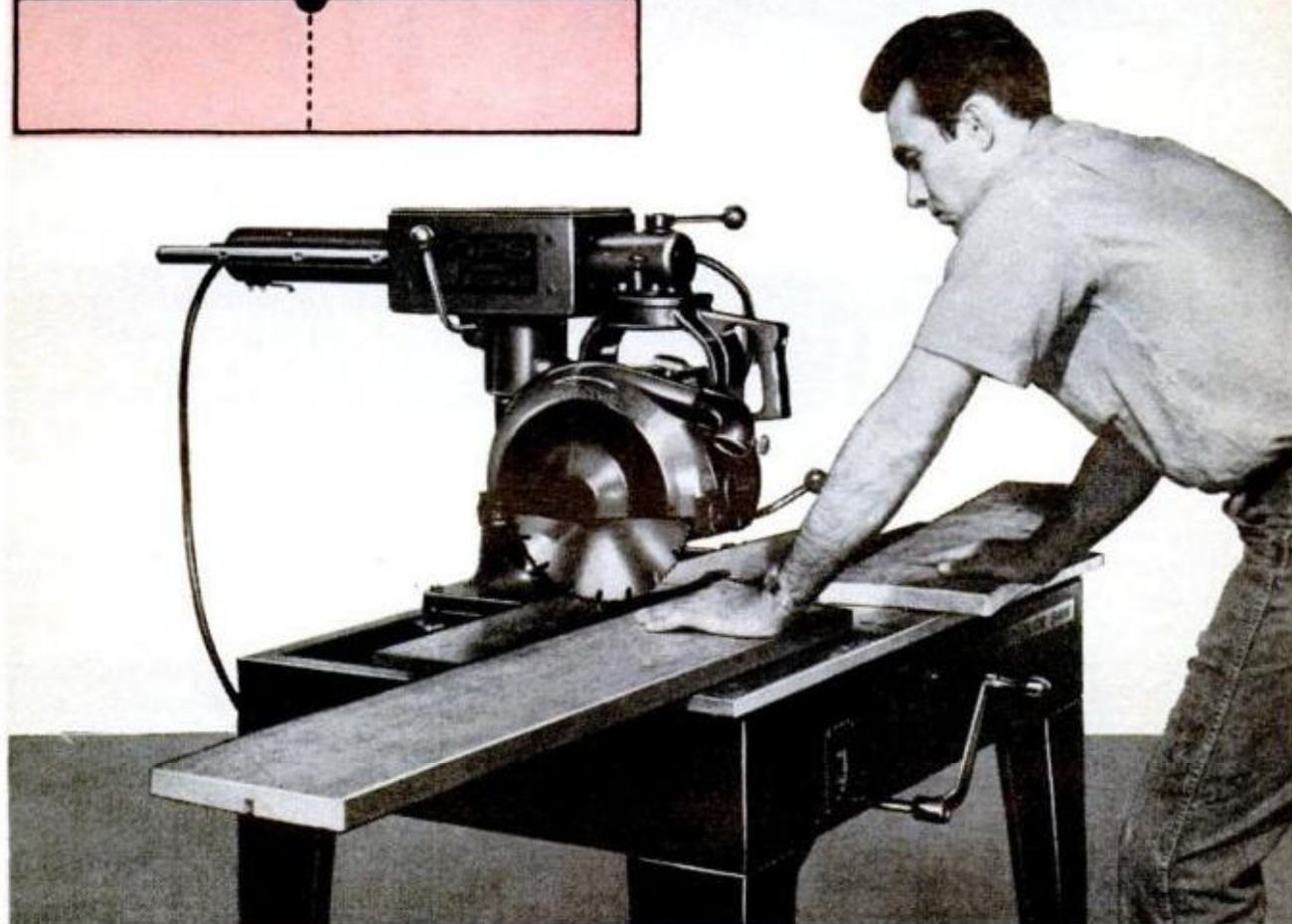
SOMETIMES IMPROVEMENTS in power-tool design make such good sense, you wonder why tools weren't always made the new way. This seems to apply to the radial-arm saw just introduced by Power Tools Inc., 315 S. Green St., Chicago 7. It's a heavy-duty model for small builders, cabinet shops and lumber dealers, but one of its features is bound to appeal to the home craftsman: The blade and motor housing don't roll along a stationary arm, as usual.

Instead, the arm retracts through the column head, so that when the blade is in its rear position, there's nothing suspended over the work surface. Getting rid of that projecting arm makes for easier layout, faster setup and greater safety. The arm glides on precision-ground rails and grease-sealed ball bearings.

The saw has a 14-in. blade with a $3\frac{1}{4}$ -in. depth of cut and a dado capacity of $1\frac{1}{2}$ in. With the standard-length arm, cut-off capacity is 16 in., rip is 30 in. The saw is called Tops Power 555 Special because it's priced at \$555. The manufacturer claims it is the lowest tag ever tied on a saw for heavy-duty continuous production.



ENTIRE TABLE SURFACE is free of projecting obstruction when saw housing is in rear, as shown in diagram, left, and photo below. Arm is fully retracted.



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Glitter Might Be Brass

(Continued from page 105)

resist the tarnishing action of air, moisture and airborne chemicals. It therefore must be protected with a transparent coating. Lacquer is the only coating that's proven clear enough to let the brass shine through. But, like pigmented lacquer (paint if you will) the clear lacquer is affected most by those friendliest of elements, fresh air and sunlight. The air oxidizes the lacquer while the ultra-violet rays promote a chemical breakdown. The problem then has been to beef up the protective lacquer and also increase its ability to cling tightly to the plated metal in the face of scratching and abrasion.

Researchers at the brass manufacturers have pooled their efforts and are almost at the point of announcing the solution to these three problems. They've come up with a better chemical bond between the lacquer and the brass. They've added ultra-violet absorbers and anti-oxidants to the lacquers in the form of silicones and acrylics.

As a result, they are already satisfied with the performance of coated brass for interior trim and feel sure that in a short time their protective lacquer will have passed accelerated wear tests and be on the way to hard-won approval. Thus, although you may never see a solid-gold Cadillac, before too many New Year's pass you might be driving a brass-trimmed one. ★ ★ ★

Storms May Be Hazard on Moon

Violent dust storms resulting from micrometeorites slamming into the moon's surface may be a serious hazard for man when he gets to the moon. The gravitation pull of the moon attracts more micrometeorites than an astronaut would encounter in space.

Surfaces representative of the moon have been impacted with fast moving pellets in a series of tests conducted at the National Aeronautics and Space Administration's Ames Research Center. "We have found that from one primary particle or pellet impacting salt rock . . . tens of thousands of secondary particles are thrown around," says James L. Summers, NASA senior scientist.

A lunar pioneer would be safe if he stayed in the space vehicle, but would be subjected to intense sandstorms and striking micrometeorites when he emerged from the craft to explore the moon's surface.

Lightweight shielding is adequate to protect the space craft. Impact studies are presently being carried out to devise a micrometeorite-proof suit for individuals.

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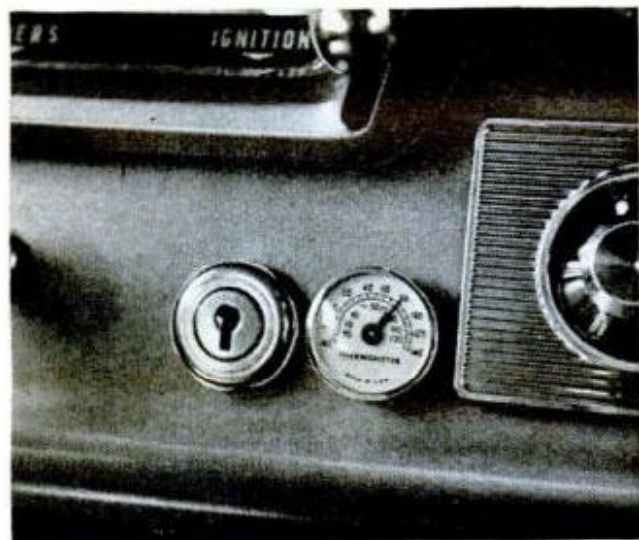
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For home or car, a coin-sized magnetic thermometer reports the temperature accurately wherever it goes. The circular dial-type gauge clings to any steel or iron surface. It can be used on a dashboard of a car, in a bathroom, refrigerator, on an air-conditioner. It can also be carried in pocket or purse.

The unit has a nonbreakable crystal, non-tarnish nickel finish and is calibrated from 40 degrees to 140 degrees F. Its dimensions are 1 1/8 inch diameter by 1/2 inch deep.

The thermometer is manufactured by Zinn Originals, 6 Murray St., New York 7, and costs \$1.95.

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JANUARY 1963

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"They Told Me I Didn't Have What It Takes!"



The words hurt. But deep down I knew what the boss was saying was true.

"Sure you're a good man, Frank. You work hard. What we need, though, are men with special training. Job specialists who can come up with the right answers. Nowadays experience isn't enough."

So there was the answer. Why other younger men were moving ahead, earning pay raises, getting the good jobs, while I was being left behind.

I just didn't have what it takes.

You feel desperate at times like that. Family to support. Job to hold down. No chance for the future. I needed help.

Then I heard about I.C.S. How I.C.S. had helped others like me get the job training they needed to get ahead. Some even found new careers.

I figured maybe I.C.S. could do the same for me. I clipped out the coupon from an I.C.S. ad and mailed it in. The free career kit I received a few days later convinced me to sign up for a course.

Things began to happen after that. The instruction was practical, down to earth. It seemed what I learned the night before I was able to apply on the job the next morning.

Word got around I was taking an I.C.S. Course. My boss learned of it and three months later I got a raise. Six more months and I got another. Now I'm looking forward to a promotion.

Once in a while I think back to the time the boss told me I didn't have what it takes. Makes me smile now. But still I thank my lucky stars for I.C.S.

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| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Science & Chem. Eng'g |
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