

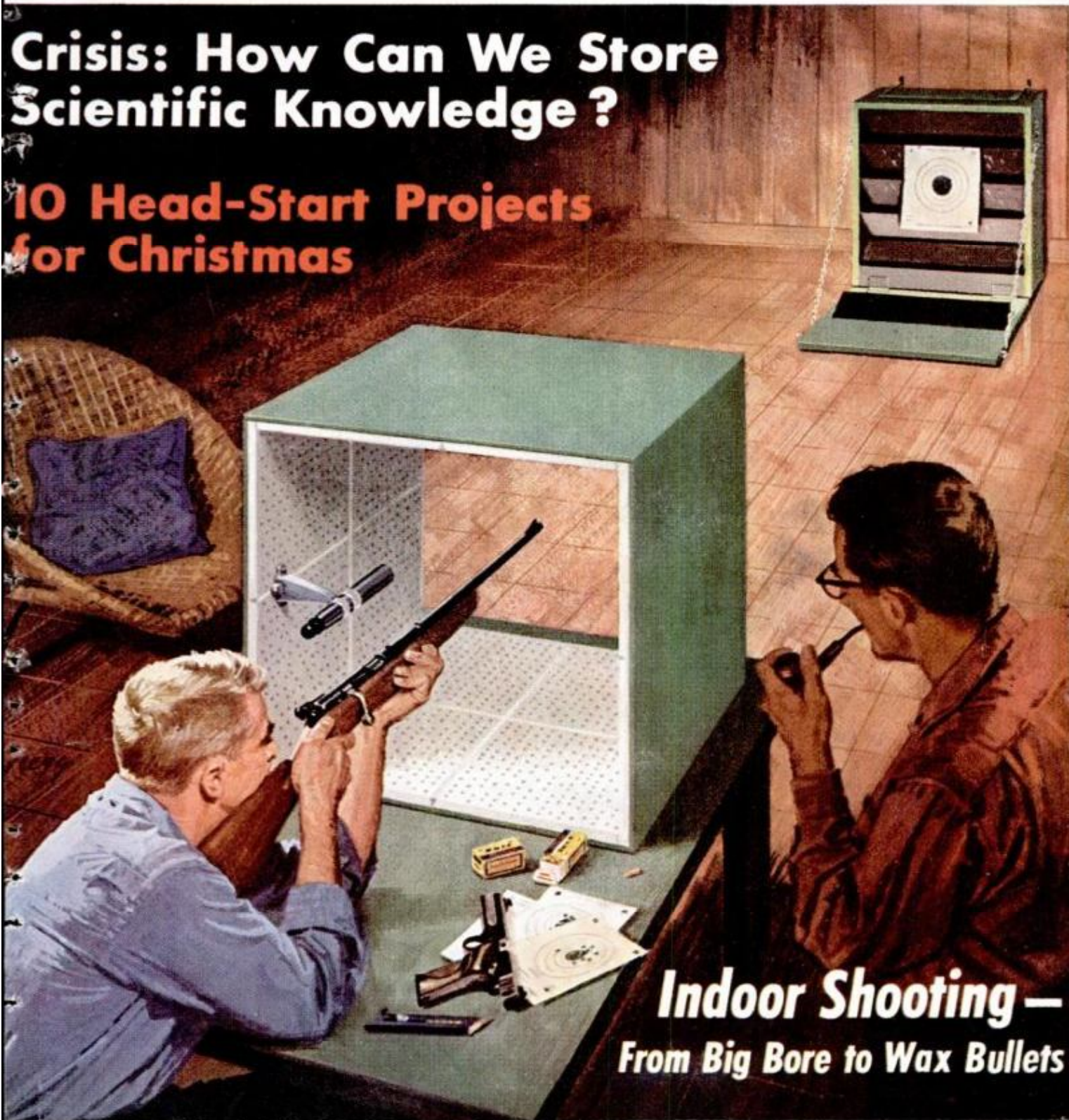
Add-On Entertainment Center: Complete Plans

POPULAR MECHANICS

NOV. 1962
35 CENTS

Crisis: How Can We Store Scientific Knowledge?

10 Head-Start Projects for Christmas



**Indoor Shooting —
From Big Bore to Wax Bullets**

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only one
of its kind!*



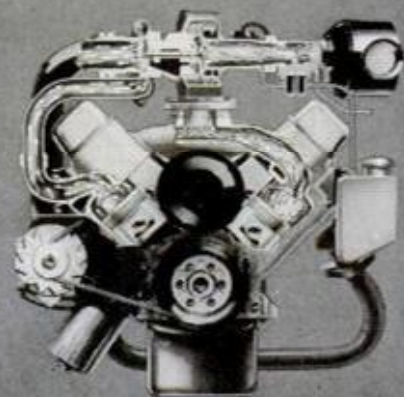
JETFIRE 

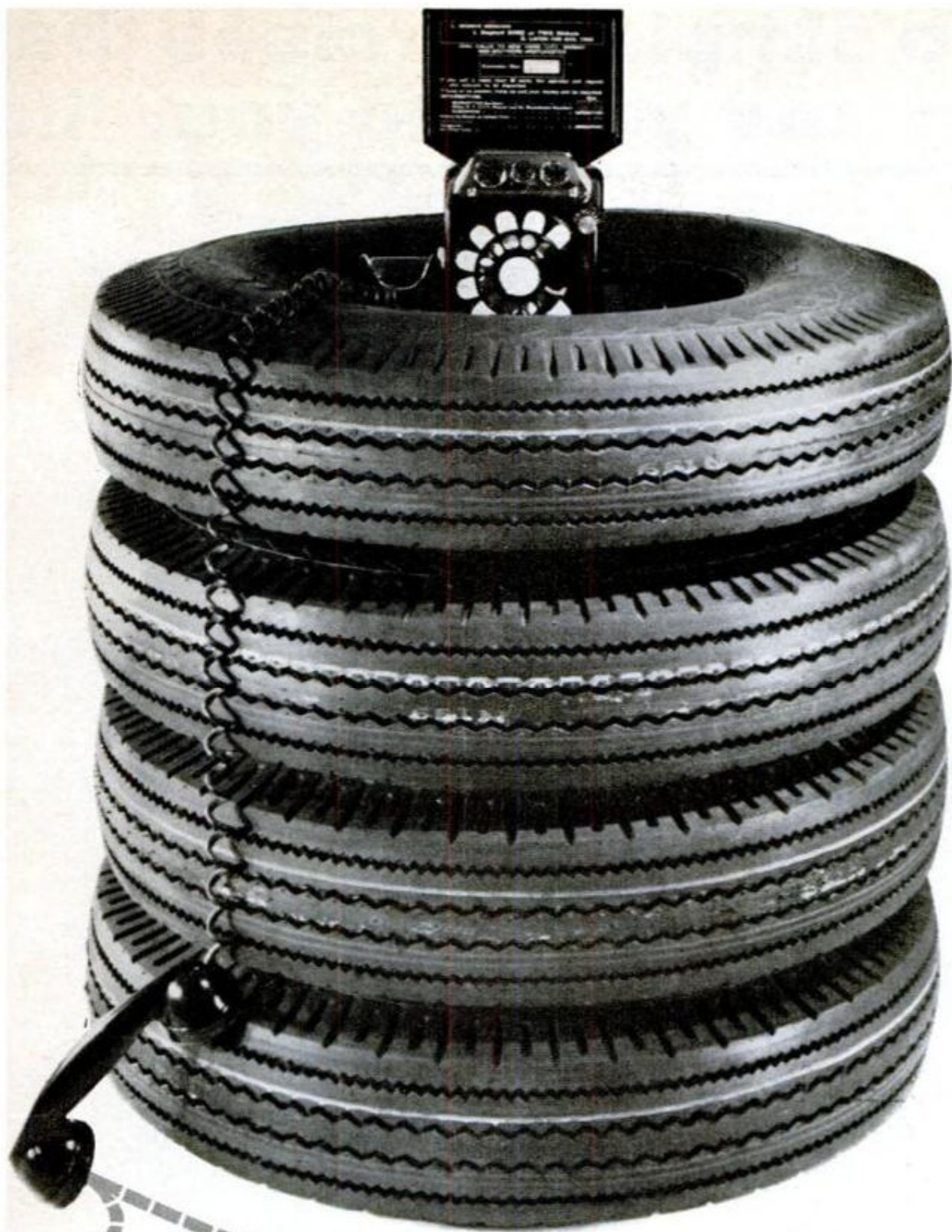
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This One

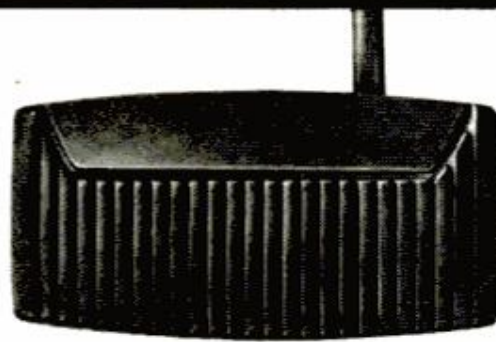


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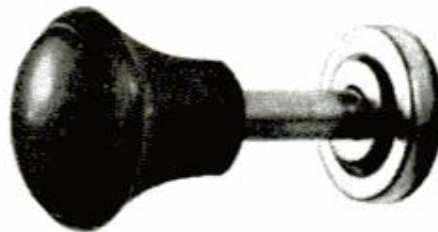
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Two simple exercises that can add years to your life



PUSH

This evening, while at home, get into your car and push the brake pedal. Have someone in your family make sure both your stop lights are working. If one is out, replace it tomorrow. You'll make it easier for the other driver—safer for yourself.



PULL

Then pull the light switch. Make sure all your headlamps (don't forget the upper beam) and your rear lights are working. And while you're at it, check your turn signals. These Push-Pull exercises will do you good—especially if you find a burnout. It's very possible you will—because one out of every six cars needs a new bulb.

When you find a burnout, replace it with a dependable General Electric lamp, the brand most people prefer.
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NOVEMBER 1962

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NO. 5

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Next Month . . .

CHRISTMAS COSTUMES for your house can be cut from panelboard in jigtime, using new Project-A-Plans for full scale tracing. December PM brings you a grab bag of Santa patterns, reindeer and Nativity scenes to choose from, plus a host of features including a road test report on Ford's Cardinal, which is far from dead; a hard look at UHF and what it will do to your TV picture; a rundown on the weird things they're doing with glass.

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Over the editor's desk

Lifetimers

I have read POPULAR MECHANICS since I was 12 years old. I am 68 and retired last August by company policy. The trouble with modern practice is that they judge a person's worth by his birth date.

Going through my third collection of PM I came across a December 1905 issue. On page 1246 was an item: *Life subscription to POPULAR MECHANICS may be purchased for \$10. Have you any living person with a life-long subscription?*

Downsview, Ontario, Canada

GEORGE W. POTTER

There are twelve such lifetime subscribers still living, George.

Plastic Hat for Pool Table

Have been buying PM for years with a great deal of enthusiasm. Something in it appeals to me and the first thing I know I am busy making it.

A few years ago, you had a boat on your pages called *Crusette*. I made it and it turned out to be a lovely craft I am quite proud of. Last January, you introduced a game table which I also made. It gives my wife and I, and our friends and family, no end of enjoyment. It is surprisingly accurate and I did not find it too expensive. I made a polyethylene top to put on the pool table when not in use. Thought this note would interest your many readers.

Sarnia, Ontario, Canada

LEN WILLS

It should, Len. So would pictures of the projects you built.

Slighted Platypus

Your July issue states that wild dogs are the only carnivorous mammals native to Australia. Not true. The platypus is a native of Australia, is a true mammal, and eats worms, bugs, etc.

Evansville, Ind.

R. B. ROBERTS

Also crustaceans. You're right and if we knew how to speak the platypus language, we'd apologize to them directly for the oversight.

Finding Telephone Poles

A hearty pat on the back for *Scuba Search* (July, PM). It proved to be a gold mine of information for our club, particu-

larly the info on search patterns and the construction of diving planes. We made a couple of the planes, and they were instrumental in helping us locate two telephone poles which had been lost in some 70 feet of water.

57th Air Rescue Squadron

WILLIAM J. HISSON

1st Lt. USAF

Glad to be of help, Bill, but what is your club planning to do with those poles? They might have made fine toothpicks for the passing whales.

Inventive Archeologists

The August PM article, *Life Again in Mummy Cave*, ably presents some of the work of archeologists in our Service. Stabilizing these prehistoric ruins of the Southwest is a highly specialized job and frequently the archeologists have to invent their own solutions to unique problems with whatever materials are on hand. Congratulations to author Richard Dunlop on a job well done.

National Park Service U. S. Dept. of Interior

JOHN M. CORBETT

Chief Archeologist

Carbon Tet Versus Ammonia

On page 200 of the September PM you mention using carbon tet to clean an oil-stone. Most households do not have carbon tet on hand. Most do have household ammonia which, when used with a rag to scrub the stone, will make it come clean like new.

Minden, La.

MAXWELL B. JESTER

Good idea, Max, though you may find when the stone is pretty well glazed that steel wool will work better than a cloth.

Tire Cutups

One of your readers asked (Sept. PM) how to turn tires inside out and make scalloped planters of them. Here is the way my father does it: Cut bead from one side of tire; cut V-shaped scallops along edge where bead has been removed; turn tire wrong side out with the aid of a strong helper.

Hoosick Falls, N. Y.

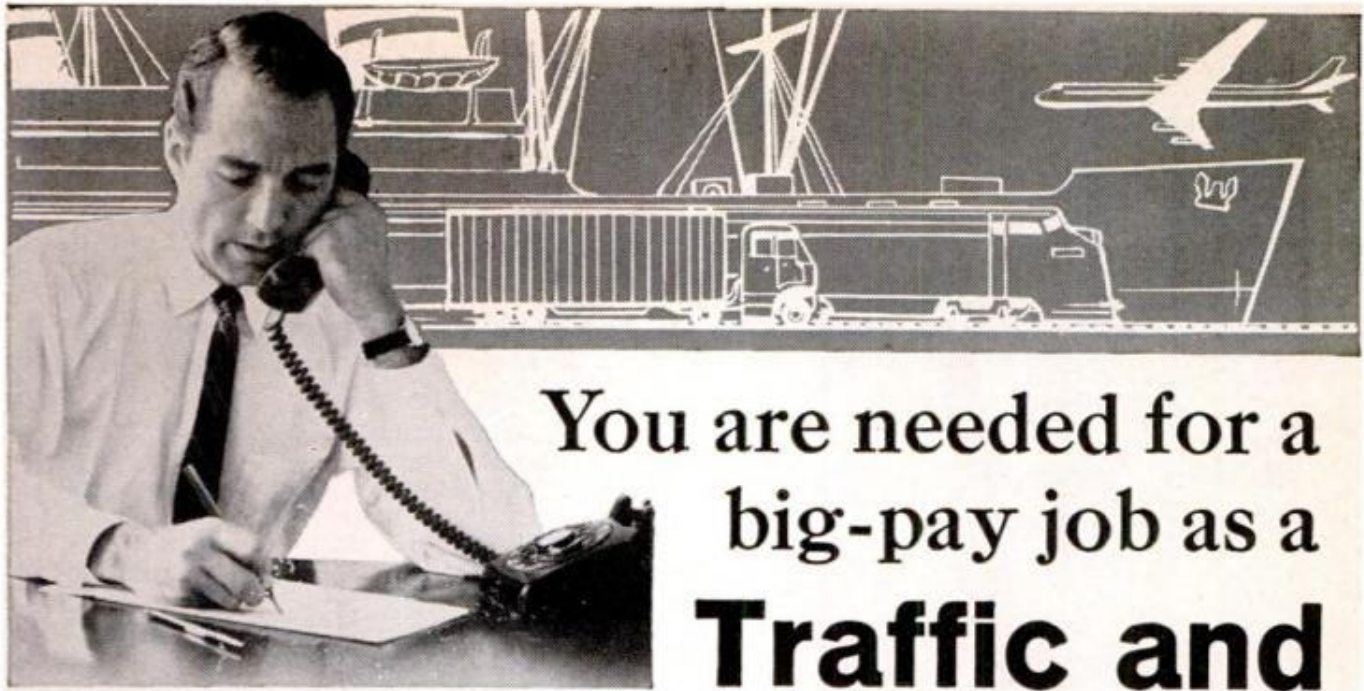
SANDRA PINE

It is easier (to turn inside out) and works as well with both beads cut out.

Crestview, Cal.

R. H. HATHCOCK

Use 4-ply tires. Trim bead and scallops with a sharp linoleum knife. Mr. Davison made a base for turning tires which consists of two tire rims welded on each end of a 4-in. pipe 27 inches long. Stand this on end and place tire on top. Mr. Davison turns a



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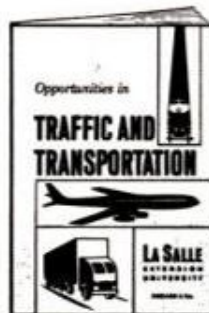
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I'M SICK AND TIRED OF WAITING!



1. **EVERYTHING** COMES TO HIM WHO WAITS? THAT'S A LAUGH. I WAITED FOR THE BREAK. WAITED 'TIL I WAS SICK OF IT. HOW LONG CAN A GUY WITH A WIFE AND 3 KIDS GO ON DREAMING?

THIS IS THE TRUE LIFE STORY OF JOHN W. HARVIN, JR. DAYTONA, FLORIDA. FROM OUR I.C.S. SUCCESS FILES

HONEY, THERE'S NO OTHER WAY, I'VE JUST GOT TO GET MORE TRAINING. OTHERWISE, I'M STUCK

BUT JOHN, YOU CAN'T AFFORD TO STOP WORK AND GO TO COLLEGE NOW. THERE JUST HAS TO BE ANOTHER WAY



2. MY WIFE AND I THOUGHT ABOUT IT, TALKED ABOUT IT, WORRIED ABOUT IT. WE WERE STUMPED. WE THOUGHT WE HIT A DEAD END

3. LOOK AT THIS: I.C.S. HAS A COURSE IN SURVEYING AND MAPPING. DO YOU SUPPOSE IT'S ANY GOOD?

WELL, JANE'S HUSBAND TOOK AN I.C.S. COURSE IN ACCOUNTING—AND SHE SAYS IT WAS THE SMARTEST THING HE EVER DID!



ONE DAY—MY LUCKY DAY—I TOOK A CLOSE LOOK AT THAT FAMOUS I.C.S. COUPON. I'D SEEN IT BEFORE A THOUSAND TIMES. BUT THIS TIME I REALLY LOOKED

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I'M GOING TO SEND THAT COUPON. THIS MIGHT BE JUST WHAT WE'RE LOOKING FOR!



4. THAT SETTLED IT! I DECIDED TO FIND OUT WHAT I.C.S. WAS ALL ABOUT. AFTER ALL, WHAT DID I HAVE TO LOSE?

5. WHEN I SAW THE THREE FREE BOOKS, I KNEW I'D FOUND THE ANSWER. I ENROLLED —AND I WAS ON MY WAY!

THIS STUDYING AT HOME SURE IS SAVING ME TIME. LOOK HOW FAR I'VE GOTTEN ALREADY

FROM THE WAY THEY HELP WITH YOUR INSTRUCTIONS, YOU'D THINK YOU WERE I.C.S.'S ONLY STUDENT



6. JOHN HARVIN'S SUCCESS STORY CAN COME TRUE FOR YOU, TOO. HERE'S THE FAMOUS I.C.S. COUPON. LOOK IT OVER. CLIP IT. MAIL IT NOW!

THAT RAISE WAS JUST THE BEGINNING, IT'S SO GOOD TO LOOK AHEAD WITHOUT WORRYING. WE'RE ALL SO PROUD OF YOU, JOHN!

HONEY. THE BOSS TOLD ME I'VE GOT A REAL FUTURE NOW!



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Take your pick. You can coat the inside of the bowl with honey or black molasses (wiping off excess). Or fill the bowl with good dark rum and let soak overnight. Or simply scrape it and moisten with water. Then smoke up a good caking.

A cake thickness of 1/16 to 1/8 inch is the usual recommendation—but who's measuring? Depends on how you like it.

An old-timer we know suggests: "If your little finger won't fit in the bowl, it's time to ream—but go easy. You can have your cake and smoke it too."

*The man who smokes thinks like a sage
and acts like a samaritan.*

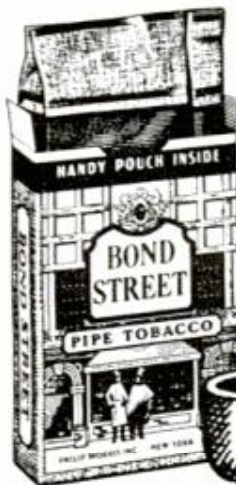
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is better than
a quiet wife.**



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little at a time while I hang on to it to keep it from turning back.

San Jose, Cal.

MRS. ARTHUR DAVISON

Place scalloped tire on a 20-gallon garbage can (cut side up). Peel down over can, turning tire inside out.

Westwood, N. J.

M. R. MYLES

And there you have it—right from an enthusiastic group of old "pros" in the inside-out tire planter business.

The Grease Is Flying

You must have been high when you wrote that grease monkey article (September *Detroit Listening Post*). I've operated a service station for 22 years. Never has inadequate servicing been performed here. Instead of condemning all grease monkeys, why not recommend that your readers take their cars to a long-time neighborhood dealer? Come on, now, start thinking before writing or we'll have to call you a "grease columnist"!

New York, N. Y.

AL FISHMAN

Your September *Listening Post* on greasing interested me. In almost 50 years I found only one service station that did a thorough lubrication job. One time I paid \$7.50 extra on a lube job to have the universal joints packed. Drove to the West Coast and on the way back a U-joint went bone dry. The service people later admitted they "must have missed it." Usually some untrained kid pokes around putting grease on any nipple with no reference to a check chart. Now I have a car which, according to the factory, will require lubrication after 32,000 miles. I should drive so far!

Kansas City, Mo.

BILL DAVIDSON

With the long term lube periods manufacturers now recommend, instead of watching over every service station lube jockey, all we need do now is to watch the man who does it at the factory!

PM Pays Its Way

Your magazine has become a must in my house. The money I have saved on things I have picked up in your magazine has more than saved the price of the magazine—one of the best I have ever subscribed to.

Milton, Del.

ROBERT E. FURROUGHS

Yours is not the first letter to point out the saving grace of reading PM. Have any other readers kept records of the savings they have achieved by using the information and instructions they find in our pages?

The Editors

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CTI's exclusive home study course is expertly written, clearly illustrated, easy to understand. It offers up-to-date knowledge and includes kits of tools and parts that you assemble into a working unit. It provides job experience projects which help you put knowledge to practical use. It's prepared especially for men who've had no previous experience. You'll enjoy CTI lessons.

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Opportunities to go in business are available because air conditioning is one of America's two fastest-growing industries. Start in a small way working from your home, and gradually expand. In time, you may want to add a sales division. Manufacturers offer attractive franchises and aids to ambitious and qualified men. Many CTI graduates report they are starting repair shops.



Make Money as You Train

Many CTI students earn money in spare time. Some handle servicing for food stores, restaurants, taverns, etc., on a monthly fee basis. Others work part time with local dealers. Many make service calls to homes on their own.



Graduates Praise Training

"I started my own business. Earn from \$800 to \$900 a month."—Dale Landsberger, Okla. "Have gone into trucking refrigeration. My wages have tripled."—James Wiest, Minn. "I quit my \$75 a week job and am now making \$120 a week in a refrigeration shop."—Roy Goldsworth, Wyo. "Am a repair man and earn \$200 a month over what I used to."—Albert Baum, Ill.

Over 50,000 Graduates

CTI is one of the nation's largest home study institutes and has graduated over 50,000 men. CTI is the only school in this field that sends parts-kits to build real equipment.



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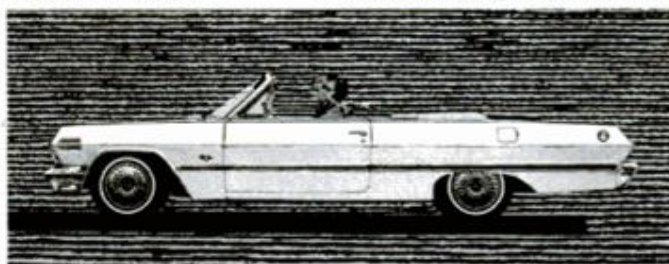
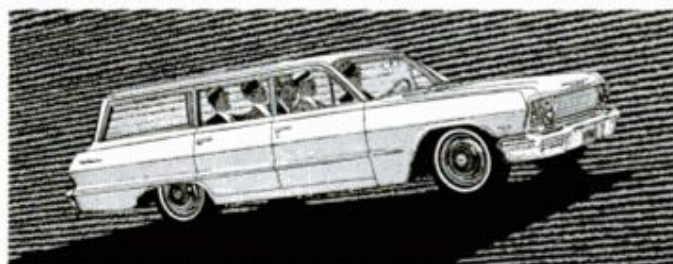
IT'S EXCITING!

GO JET-SMOOTH CHEVROLET for '63

▼'63 Chevrolet Bel Air Station Wagon

▲'63 Chevrolet Impala Sport Sedan

▼'63 Chevrolet Impala Convertible



GO CHEVROLET FOR THE GREATEST GOING EVER—Cover this car's price tag and you might think it cost a thousand dollars more. It offers luxurious styling, extremely comfortable, spacious and silent interiors . . . plus ways to keep it looking and running like a new car when a lot of others have started to sag and sigh: new air-washed rocker panels under the doors of its Body by Fisher to guard against rust and help protect its beauty . . . self-adjusting brakes to save you time and expense . . . Delcotron generator for longer battery life. There's a lot *more* to find out about the Jet-smooth '63 Chevrolet. Best way is to *drive* one.

It's Chevy Showtime '63! Come to the



'63 Chevy II Nova 400 Sport Coupe

Hard to believe, but this year's Chevy II is better than last year's. It shares the new easy-care features of the big Chevrolet and adds its own attributes of parkable size, four- or six-cylinder economy, and interiors that'll match cars with twice the price and half the charm. If you want maximum car for minimum dollars, Chevy II is your car. . . . Chevrolet Division of General Motors, Detroit 2, Mich.



'63 Corvair Monza Convertible

Change it? Calm yourself, nobody's going to mess with a winner like this one! We did add self-adjusting brakes and a more fully aluminized muffler; interiors are refined a bit, and you'll notice some trim changes, but the rest is pure untampered-with Corvair with all the over-the-road goodness that implies. Oh yes, we changed the rings around the tail-lights so all those people you pass will know you're driving a '63.

Go Show at Your Chevrolet Showroom



Science overseas

By William Kreh

The sun will soon become the object of a worldwide scientific study. Countries all over the globe are busily preparing for the IQSY—the International Quiet Sun Year. It may turn out to be the most extensive world cooperative scientific program yet attempted. It'll take place in 1964-65 when there's to be a minimum of sunspots. A lull in sunspot activity occurs every 11 years.

World data centers are being established and a series of special days will be designated when identical observations of the sun will be made from all over the earth.

Countries lined up so far are Argentina, Belgium, Canada, Czechoslovakia, Denmark, Finland, France, West Germany, Hungary, India, Ireland, Japan, Korea, Malagasy Republic, the Netherlands, Poland, South Africa, Spain, Switzerland, Taiwan, United Kingdom, the United States and Russia. Others may join later.

IQSY will be devoted to studying the sun's activity and its effects on the earth, including weather, communications and the composition of the stratosphere.

Speaking of sunspots, a Greek scientist at the University of Athens has uncovered evidence that solar flares definitely affect the growth of trees. He recently studied pieces of cypress used in the construction of the Parthenon. The wood had about 200 annual rings visible and microscopic measurement of them showed regular fluctuations, the most prominent being every 11 years—the sunspot cycle. This same period has been seen in modern trees, but never has wood so ancient been examined.

A Dutch company has developed a plastic tube that fits on a faucet to filter out radioactivity. Filled with removable resin charges that take out contamination, it can produce five and a quarter gallons of cleansed water an hour.

How much noise does a car make? Researchers in Great Britain's automobile industry now can tell exactly by using a new portable, transistorized noise meter developed by an instrument maker in London and designed especially to measure the noise made by a vehicle.

Russian scientists have found they can open ice-locked harbors by spreading coal dust. The dark dust absorbs the sun's heat, which melts the ice.

A table fork has solved an underseas mystery in Italy. The identity of a submarine hulk dredged up from the Adriatic Sea was in doubt until a fork with a name engraved on it was found inside the craft. The name proved to be that of a young sailor assigned to the Austrian submarine U-20 which disappeared in 1918.

Quit worrying and save your teeth. So say Australian dental researchers who have completed statistical evidence that worry causes tooth decay. They questioned 660 patients over three and a half years and found that 96 percent of those with acute caries reported having suffered a period of severe mental stress just before their tooth troubles started.

Even without a Liz Taylor picture playing, Danish air-conditioning experts have found that during an average-length film, a movie theater filled with about 1500 people gives off enough heat to warm 10 single-family homes.

Cartographers from 43 countries are pooling their knowledge to make a new, detailed map of the world, first project of its kind since 1913. When finished, the new map will have 2000 sheets that will cover an area of 700 square yards or make a globe with a 42-foot diameter.

Kids are learning to read twice as fast in England with a new experimental alphabet which eliminates Qs and Xs and adds 19 new letters. A test worked so well on 1000 students in 24 British schools that education officials are now teaching the "Augmented Roman" alphabet to 1500 more five-year-olds. It's expected to help children read in half the normal time and eliminate all failures.

The new alphabet is designed to avoid the confusion of usual letters which are combined in more than 2000 ways to form the 40 or so basic sounds of the English language. For example, one new symbol stands for the O sound found in such words as owe, hoe, though, no, sew, coal and yolk. In the same way, different symbols represent the different sounds of the O as it's used in done, gone, bone, one.

Children learn to read with the new alphabet and then change to conventional books when they are ready, usually about age seven.

GET READY FOR THE SPACE and SCIENCE ERA! SEE SATELLITES, MOON ROCKETS



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Experience endless fascination in converting sunlight into electricity to power small motors, amplifiers, etc. (See July '61 Popular Science article—"The Boat That Runs on Sunlight" for latest techniques). Plastic case 1 1/8" x 1 1/8" x 3/16". Produces .3 to .45 volts—10-16 millamps. 24-page Handbook gives full data on 12 pat experiments.

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Wonderful for experiments, miniature waterfalls, fountains. Christmas gardens. HO gauge railroad backdrops, hobbyists, labs, schools. Pumps continuous flow of water etc. Tiny (2 5/8" x 1 3/4") electric motor and pump ideal for hobbyists, labs, schools. Pumps continuous flow of water at rate of one pint per minute at a 12" head. With 2 D Batteries in series will pump to 24" high. Works in either direction. Stock No. 50,345-H \$2.25 Postpaid

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Go Treasure Hunting On The Bottom

Great Idea! Fascinating fun and sometimes tremendously profitable! Tie a line to our 5-lb. Magnet—drop it overboard in bay, river, lake or ocean. Trawl it along the bottom—your "treasure" haul can be out board motors, anchors, fishing tackle, all kinds of metal valuables. 5-lb. Magnet is war surplus—Alnico V Type—Gov't. Cost—\$50. Lifts over 125 lbs. on land—much greater weights under water. Order now and try this new sport. Stock No. 70,571-H 5 lb. Magnet \$12.50 Postpaid



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Projects illustrations up to 3" by 3 1/2" and enlarges them to 35" x 30" if screen is 6 1/2 ft. from projector; larger pictures if screen is further away. No film or negatives needed. Projects charts, diagrams, pictures, photos, lettering in full color or black-and-white. Operates on 115 volt, A.C. current. 6-ft. extension cord and plug included. Operates on 60 watt bulb, not included.

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Extra-powerful magnets, polarizing filters, compass, one-way-mirror film, prism, diffraction grating, and lots of other items for hundreds of thrilling experiments, plus a Ten-Lens Kit for making telescopes, microscopes, etc. Full instructions included.

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ASTRO-COMPASS AND TRANSIT

War surplus! Astro Compass alone cost Govt. \$75. We have added a Sighting Level to improve versatility. Hundreds of uses in carpentry, brick laying, foundation work, grading, irrigation or drainage. Much below cost of ordinary surveying instruments. Ideal for do-it-yourselfers. 10 1/4" high, 6" long, 4" wide. Adjustable leveling platform—2 spirit levels for aligning—also spirit level in sighting attachment, tremendous bargain.

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LARGE SIZE OPAQUE PROJECTOR

Ideal for photographers, this low-cost unit projects 3 1/2 ft. sq. image at 6 ft.—7 1/2" ft. sq. image at 12 ft. Projects photos, drawings, sketches, clippings, any opaque copy up to 6" x 6"—larger pieces in sections. Lenses are 2 plano-convex, 3 1/2" dia. mounted in 5 1/4" barrel. Projector is 11 1/2" high, 13 1/4" wide, 9" front to back, pressed steel in black wrinkle finish, bakelite handle. Uses two 200 watt bulbs—not included. Complete with side platform to hold illustrations, 6 ft. elec. cord, heat resist. plate glass mirror.



Stock No. 80,066-H \$42.00 Postpaid

WAR SURPLUS AMERICAN-MADE 7x50 BINOCULARS

Big savings! Brand new! Crystal clear viewing—7 power. Every optical element is coated. An excellent night glass—the size recommended for satellite viewing. Individual eye focus. Exit pupil 7mm. Approx. field at 1,000 yds. is 376 ft. Carrying case included. American 7 x 50's normally cost \$24.50. Our war surplus price saves you real money.

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6 x 30 Binoculars—similar to above and a terrific bargain.
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Multiplies, divides, figures fractions, percentages, squares, cubes, roots, proportions, circumferences, areas, prices, fuel consumption. Faster, easier to learn and use. Directions included.

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12 Different puzzles that will stimulate your ability to think and reason. Here is a fascinating assortment of wood puzzles that will provide hours of pleasure. Twelve different puzzles, animals and geometric forms to take apart and reassemble, give a chance for all the family, young or old, to test skill, patience, and, best of all to stimulate ability to think and reason while having lots of fun. Order yours now.



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Tune in on the inventors

by J. L. Pugni

Shoppers who can't resist testing products in aerosol cans will be disappointed when patent 3,049,263 is marketed. To prevent tampering with goods before purchase, a disposable lock especially for aerosol can tops has been developed by Sigmund E. Edelstone, Chicago, and Manley K. Hardison, Glenview, Ill.

For a light-footed feeling, try an inflatable attachment for sole and heel that gives a comfortable cushioning effect. It inflates by means of a self-sealing valve, and is held magnetically in place when attached to any shoe or boot. Patent 3,044,190.

Air pollution resulting from evaporating gasoline fumes can be reduced by fitting the float bowl of an ordinary carburetor with a fuel drain that returns the fuel to the gasoline tank as soon as the automobile engine is turned off. The invention won pat-

ent 3,048,157 for James B. Gregory, Charles C. Moore and Howard D. Emerson of Fullerton, Calif.

Continuous weighing of smoked products so the process can be stopped when the desired weight loss is reached is a food-processing method that earned patent 3,050,144 for Owen Rice, Allegheny County, Pa., and Donald M. Stough of Pittsburgh.

To lessen frost damage to plants and fruit trees, a chemical spray using a polymer of N-vinyl-2-pyrrolidone is applied with ordinary spraying equipment. The chemical reportedly gives protection for extended periods of time and is effective for all sizes of plant life. Inventor Thomas H. Coulter, Jackson, Miss., was assigned patent 3,045,394.

Drowsy drivers might avoid automobile accidents by using an automatic brake that stops the car when the motorist falls asleep and releases a hand lever. For his invention, Anthony Giannetti, Paterson, N. J., won patent 3,049,188.

Copies of the original patents may be ordered for 25 cents each from the Commissioner of Patents, Dept. of Commerce, Washington 25, D. C.

LOOKING FOR LONG WEAR IN SERVICE SHOES?

TRY Thom McAn SHOES WITH NEOPRENE SOLES!



Ask for
Style No. 01675
Mahogany



BETTER THINGS FOR BETTER LIVING... THROUGH CHEMISTRY

Thom McAn "Dynawork" service shoes are made for men who want day-long comfort and extra ruggedness on the job. Soft, flexible uppers... one-piece, molded heel and sole, eliminating heel separation... fully cushioned insoles are yours when you invest in hard-working "Dynawork" service shoes.

Long-wearing soles and heels of Du Pont Neoprene give the extra service life that means more wear for the money. Neoprene resists oil, grease, chemicals and cold-weather cracking... helps ease you through your working day because of lasting resilience. Write Du Pont, Dept. PM-11-NS, Wilmington 98, Delaware.

Try Thom McAn "Dynawork" shoes with Neoprene soles the next time you buy.

POPULAR MECHANICS

"OWN a Business" Coupon

DURACLEAN CO. 2-16N Duraclean Bldg., Deerfield, Ill., U.S.A.

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.

Name _____
Address _____
City _____ State _____

Start Now
while
employed



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

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.

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.

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... 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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a Growing
BUSINESS



FREE
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AMAZING **Amco** 8" TILT ARBOR

Save
80%

POWER SAW KIT

RUGGED . . . PROFESSIONAL QUALITY
HEAVY DUTY . . . LIFETIME ENGINEERED

UNCONDITIONAL
10 YEAR
GUARANTEE



\$9.95

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

f.o.b. Factory wt. 12 lbs.

YOU GET:

Complete blade carrying mechanism with depth of cut control • Ground spindle with saw flanges • Pre-oiled bearings • Tilt control • Etched metal tilt indicator • Mitre gauge • Motor mount assembly • Brackets, screws, nuts and bolts • ABC assembly plans, plans for sturdy base, massive 20" x 24" table • Full operating instructions.

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... NEW DESIGN

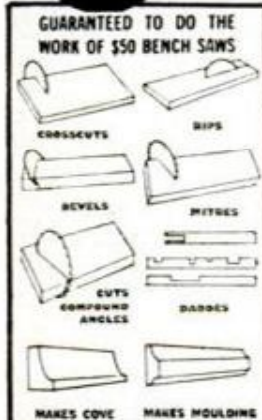
Top quality full scale power tool with speed and accuracy of \$100 machines! Even if you've never cut a piece of wood in your life, you can put this saw together in jig time. All you need are common household tools, about 1/2 sheet 3/4" plywood for table and base . . . about 2 hours of spare time. Metal saving economy design. We save expensive assembly labor costs. Special patents add to efficiency, accuracy, savings. Metal parts made, sub-assembled, tested in our own factories. Buy direct from maker . . . enjoy a truly fantastic saving.

TABLE STAYS LEVEL, BLADE TILTS

Patented motor mount takes any standard 1/4 h.p. or large motor . . . keeps belt tight, assures perfect alignment at any angle, transmits full power. Table stays level—blade tilts, locks securely at any angle to 50°, raises, lowers 0"-2 1/4". Patented tilt mechanism. Takes standard blade, saw insert removes easily for insertion of any STANDARD dadoe heads, cutters, etc. Accessories, when wanted, at factory prices.

PERFORMANCE PROVED
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BUILD ALL THESE
• INDOOR FURNITURE
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• ALL HOME IMPROVEMENTS
AND SAVE AS YOU SAW

NO RISK TO YOU 10 DAY MONEY BACK GUARANTEE

You must be completely satisfied or return 8" power saw kit for full refund. Fair enough?

SEND FOR YOURS TODAY!

CLIP AND MAIL THIS MONEY SAVING COUPON TODAY! FREE CATALOG!

American Machine & Tool Co., Dept. PM-112, Royersford, Pa.

- Send 8" Tilt Arbor Power Saw Kit at \$9.95
- Incl. Rip Fence at \$3.50 (both for 13.45)
- Payment in full enclosed \$..... or
- \$3 dep. enclosed, balance C.O.D. I MUST BE FULLY SATISFIED OR WILL RETURN WITHIN 10 DAYS FOR FULL REFUND, no questions asked.
- Please send free catalog of America's greatest power tool values.

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(Please print)

Items from all outdoors

The outdoorsman is regarded not only as big business these days, he has official recognition in Washington. The new Bureau of Outdoor Recreation is initiating a plan to turn 18 million acres of farm land into game preserves, camping and fishing areas and general sports centers. A pamphlet, Forest Recreation for Profit, is available from the Dept. of the Interior and it shows a farmer how to turn "resting" farm land into a profitable recreation business.

An interesting wildlife connection with the recent furor over the evils of insecticides, is a report from National Geographic Society naturalists that the bald eagle is being poisoned by eating small birds and mammals that feed on contaminated grain, leaves and insects.

K. D. Gilbert of Fort Benning, Ga., ran a consecutive 450 birds to win the All-Gauge Championship in the National Skeet Shoot last August. This brings to mind a bit of history about trap shooting. It started in England in 1750, and in the early 1800's the most popular group was named the "High Hats." The members all wore "toppers." A live pigeon was placed under the high hat, and at a given signal the shooter raised his hat to release the bird. He replaced his hat and then took his shot at the bird.

We lunched with the people from Johnson Outboard Motors not too long ago, and they announced that there will be no horsepower changes in their motors for 1963. But they did say that there are more than 100 under-the-hood improvements. We have word from Bundy Outboard Motors to the effect that their distribution of the 30 and 20 hp. motors has been expanded to cover the East from Minnesota to Texas. Outboard Marine Corp. has discontinued making private label outboards.

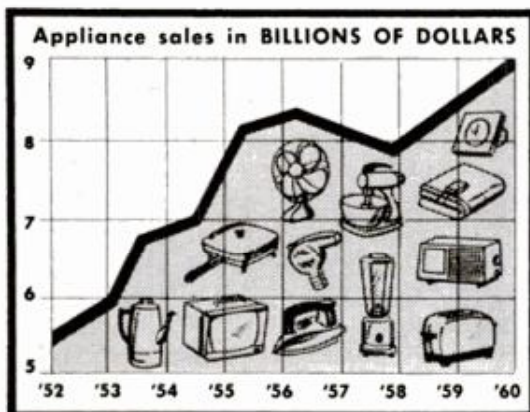
Fishermen and hunters always have yarns, and we like this one. A hunter in Manitoba, Canada was asked if he had seen any ptarmigan, and he answered: "See one? I can't even spell one."

Stuart James

POPULAR MECHANICS

Record-Shattering Boom in Electrical Appliances Opens Up Exciting Profit Chances for Men Who Can Repair Them

OVER FOUR HUNDRED MILLION electrical appliances are in use right now in American homes—and are increasing at the rate of 76 MILLION a year! No wonder that men who know how to service them properly are making \$3 to \$5 an hour—in spare time or full time. FREE BOOK tells how you can quickly and easily get into this profitable field.



(Above) Based on chart in *Electrical Merchandising Week Magazine*.

Just look at how dependent American homes have become on electric appliances!

Here are some of today's common appliances, and the number of U.S. homes containing each.

Air Conditioners (Room).....	6,500,000
Bed Coverings.....	10,800,000
Clocks.....	40,268,000
Coffee Makers (automatic).....	27,000,000
Freezers.....	11,200,000
Frypan Skillets.....	20,600,000
Heaters, Portable (Elec.).....	14,415,000
Heating Pads.....	19,925,000
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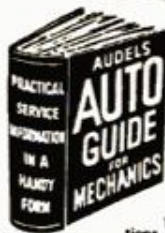
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Science bulletins

Should the lady wear a derby? A London pathologist says such plug hats would provide the same protection as a crash helmet in street accidents—for both men and women. He notes that many pedestrian fatalities result from head wounds suffered as the victims hit the pavement—not from initial impact injuries.

A blank spot in the heavens will soon be plugged, astronomers say. A new 20-inch telescope, which will be installed by 1963 on top of an Andes Mountain peak in Argentina, will give U.S. astronomers a window on southern hemispheric skies, according to Columbia University's Dr. Jan Schilt. Most observatories are located in the northern latitudes, he said, leaving about a third of the total sky area inadequately covered.

All that surplus grain in midwestern storage bins may not add up to a vast boondoggle, as many people think. The State of Utah, for instance, recently drew uncon-

taminated dairy feed from storage to feed cattle whose milk was showing alarmingly high levels of radioactive Iodine 131 fallout from atmospheric nuclear tests. In an atomic war, our surplus grain might become invaluable life insurance.

Even if Roger Maris could hit a line drive into space, he'd still be tagged out by a powerful Air Force pencil-beam radar that's to be completed at White Sands Missile Range next year. The 24 million-watt beam will trace and analyze missile test targets during re-entry—and can track baseball-sized objects for 1000 miles.

Someday it may be old-fashioned to get milk from a cow. Using weeds, cabbage leaves and pea pods, British scientists have fabricated milk that one titled lady says is "much nicer than ordinary milk."

It's made by extracting proteins from green leaves, then adding vitamins, minerals, carbohydrates and vegetable fats. The only remaining puzzle is to eliminate a slight vegetable flavor.

John P. McNeal

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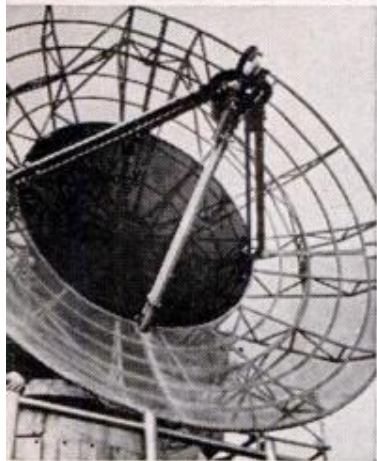
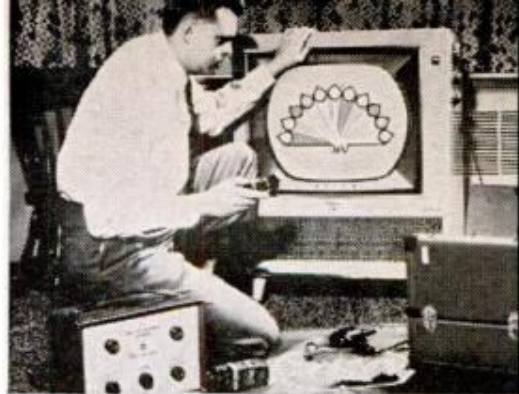
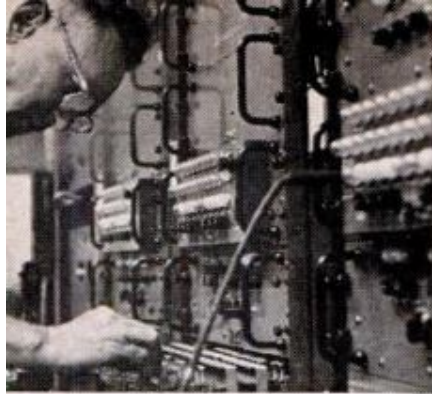
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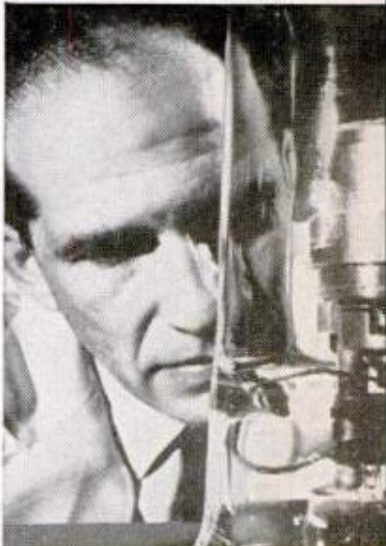
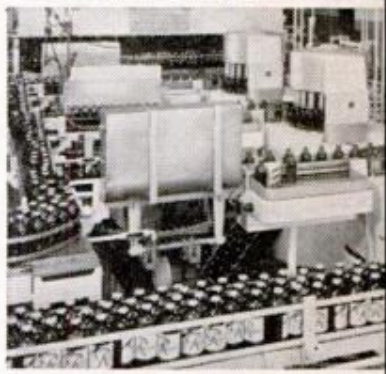
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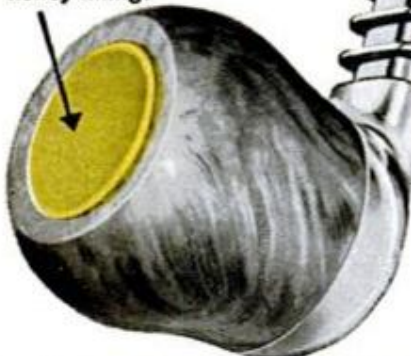
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No Fast Talk in Space

Calls to the folks back home are going to involve some long pauses in the Space Age.

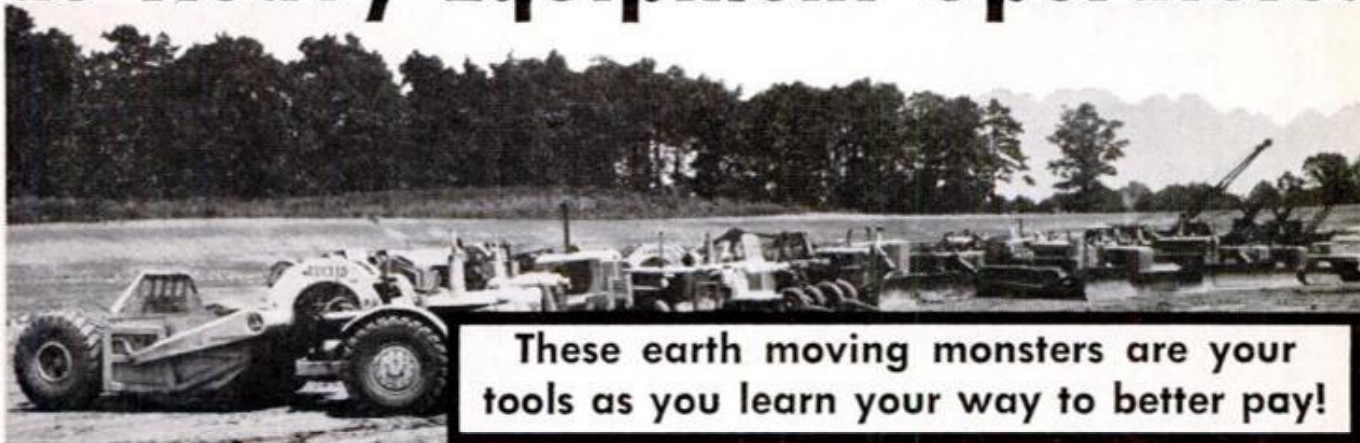
Light travels at 186,000 miles per second, and the known communications media are limited to that speed. A radio message from the moon, roughly 250,000 miles from Earth, would take 1 1/4 seconds to arrive.

According to Dr. M. L. Stehsel, Aerojet General Corporation, Advanced Research Division, the time lapse increases as man moves farther and farther to the other planets. By the time a Pluto pioneer radioed back to home, he would have to wait 10 hours to get an answer!

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Sidelights on aviation

Following up September's column on why so many model numbers are pinned on the same basic aircraft—the use the airliner will be put to determines the modifications—here is some information on how the original model takes the size and shape it does.

One of the aircraft manufacturers is planning a compact jet for short-haul routes. First, it analyzed the traveling patterns in the United States. They showed that 70 percent of the passengers and 50 percent of the revenues were involved in flights of 600 miles or less. These short routes had few modern aircraft. So the market was open for a short-haul jet.

Traffic density on these routes indicated that the most efficient vehicle would provide about 50 first-class seats and 75 in the tourist section, influencing the size.

Because of the short hops the plane would make, there was no necessity for designing it to fly at high speeds at high altitudes. The difference in start-to-stop time amounted to about two minutes on an average flight. So the compact jet was designed for a cruising mach of .75, or about 550 m.p.h. at 25,000 feet, somewhat less and lower than the big jets.

Another major factor was the availability of runways to handle the jetliner. Most short-haul routes involve small or medium-size cities with small or medium-size airports, many of them with runways 5000 to 5500-feet long. So the design was based on takeoff runways of 5000 feet or better. The big jets need 8000 to 10,000 feet.

With range, size, speed and takeoff requirements settled, the designers could now concentrate on operating costs. Simplicity was decided upon, because the short trips would not require the luxury features needed on big jets for long flights.

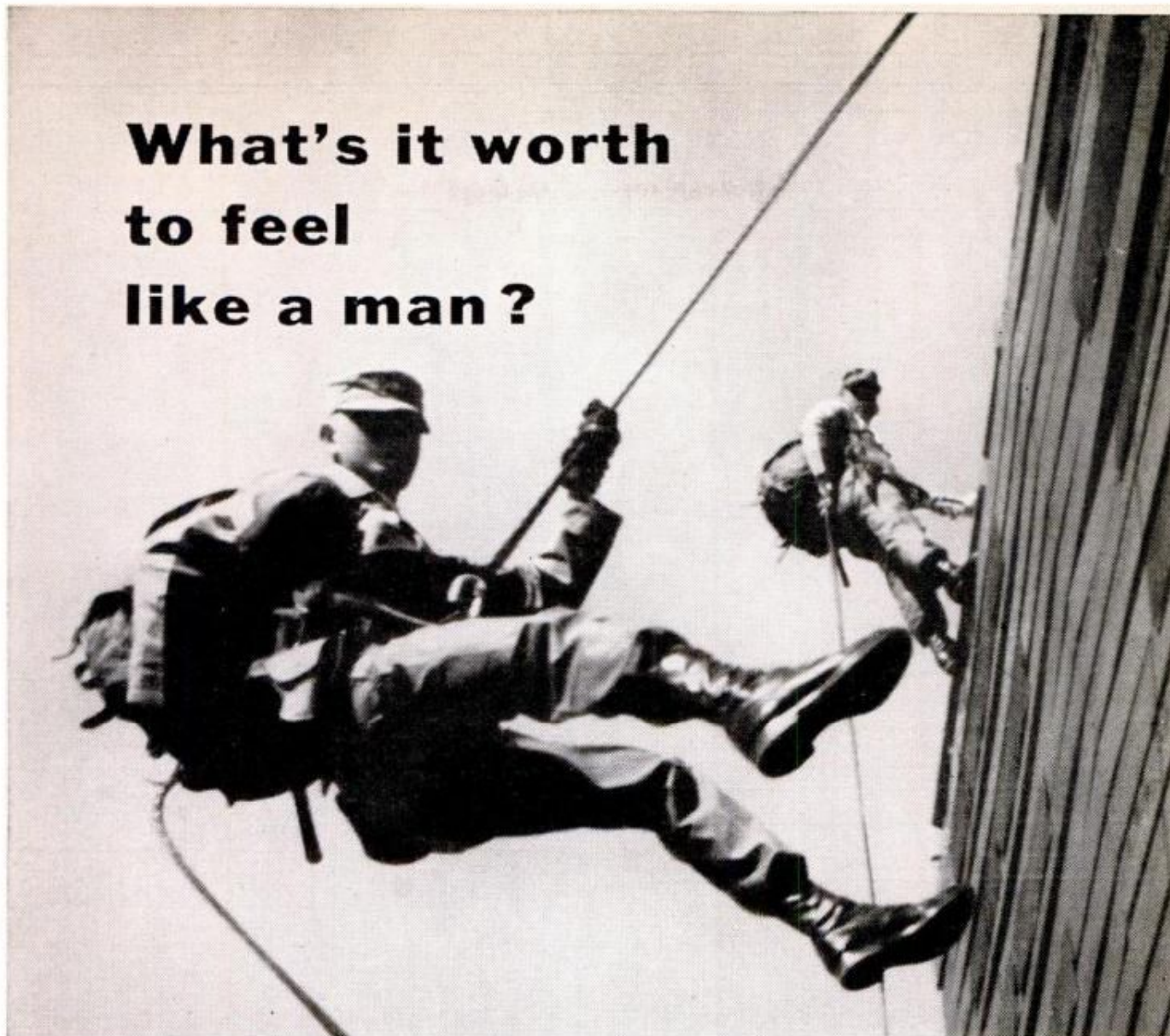
While engineering ideals are not ignored, aircraft design is much more a matter of necessity than art.

Safety statistics pop up annually along the air lanes, usually in the wake of some spectacular aircraft accident. No one listens, but aviation experts still maintain it's safer to fly—five times safer—than to go by automobile. In 10 years, 2.56 persons have died every year in autos, compared to .50 in airplanes, per 100 million passenger miles.

Kevin V. Brown

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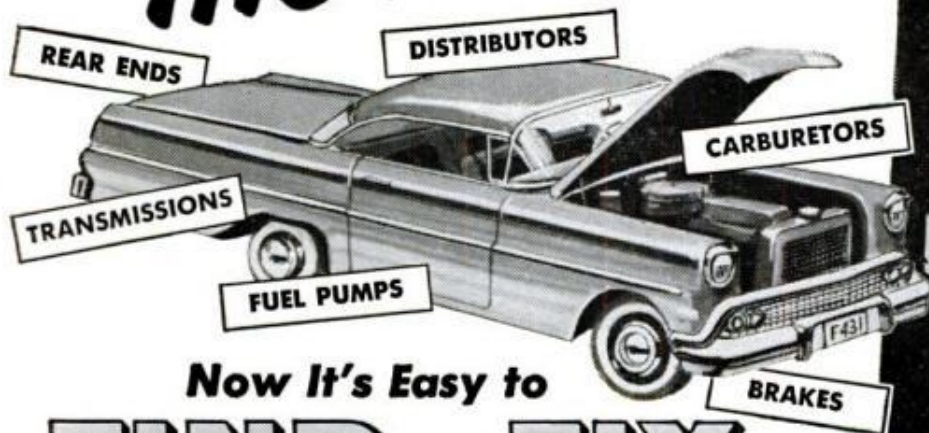
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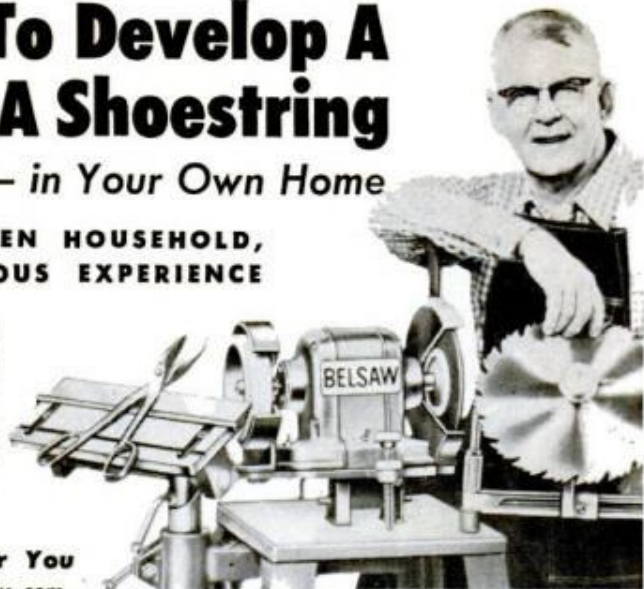
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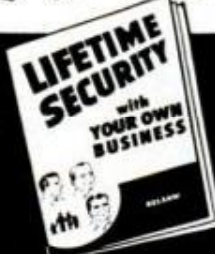
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Homemade Photosynthesis?

HOW PLANTS capture solar energy and transform it into the stuff that sustains all life on earth is close to being solved. Two biochemists at the University of California at Berkeley, Dr. Kunio Tagawa and Dr. Daniel Arnon, recently completed a series of experiments that tie up most of the loose ends concerning the process known as photosynthesis.

Much of the photosynthetic procedure had been explained in earlier experiments, specifically the chemical reactions by which carbon dioxide is changed into sugar, or plant substance. But a mystery remained. How did the process begin, and what role did sunlight play in it?

In solving this scientific whodunit, the scientists at California played a trick on nature. The researchers suspected that light energy triggered the whole process, and figured that if they could reproduce, or "kick off" the chain reactions of photosynthesis in the dark—by chemical means—they'd solve the riddle.

The two scientists started with a theory of their own that the whole process is set off when light energy is transformed into chemical energy by a flow of electrons among several compounds.

In earlier experiments Dr. Arnon's group had discovered that two key compounds, adenosine triphosphate (ATP), and reduced pyridine nucleotide (PNH₂) are formed in plants at the expense of light energy. These two compounds then carried out the chemical reactions of photosynthesis.

But what chemical transported the electrons released by light energy? The researchers found their answer in the recent discovery of an iron-rich compound called ferredoxin, which had been isolated from soil bacteria. They identified ferredoxin in the chlorophyll of spinach plants and found that it had tremendous electron-carrying capacity.

They then used ferredoxin to reverse the usual photosynthetic result—they succeeded in producing hydrogen gas instead of the usual oxygen that is normally "exhaled" by plants. The next step was to use hydrogen instead of light energy to trigger the photosynthetic process. The result was the production of ATP and PHN₂, the two chemicals necessary in the production of plant substance.

According to Dr. Arnon, the findings show a basic unity between photosynthesis and the chemical reactions found in certain bacteria that grow in the soil.

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310 Age

Pentagon sidelights

By William R. Kreh

They de-greased a duck the other day at the Naval Ordnance Laboratory, along with the footbones of an elephant and the upper skull of a gopher. The strange job for Navy technicians came about at the request of the Smithsonian Institution. The museum had some specimens it acquired which had not been prepared properly and were being ruined by fats still in the skin and bones. If the grease could be removed, the plumage and structures of the specimens could be saved. The Navy ordnance experts did it with the lab's trichlorethylene vapor degreaser, a machine normally used to clean the surfaces of metal which are to be electroplated.

Feet cold? Then keep your head warm. The Army, working to develop an ultra-warm uniform for soldiers in the Arctic, says that a hat will do as much to keep your feet warm as an extra pair of socks. The medics say that if your head's cold, Mother Nature automatically sends more warming blood to protect the brain. What's left goes to the other extremities, and this often isn't enough to do much warming.

Rolling salutes. The Navy had a problem out at its San Francisco shipyard. The saluting batteries, which by military tradition must sound off whenever an admiral, general or other VIP makes an official visit, were located too far from where the welcoming ceremonies were often held. Some of the shipyard technicians got their heads together and came up with a novel solution. They mounted the two three-inch guns on a truck so now they can travel anywhere on the yard's 1000 acres to bestow the proper honors.

Lamb bones were used by Army scientists to help develop a new boot designed to protect soldiers from land mines exploding underfoot. The bones were used to simulate a human foot and X-ray cameras recorded the effects of various types of explosions on the bones. Result of the experiments is a new wedge-shaped deflector that's embedded in the rubber lower part of an other-

wise conventional military boot. The footwear now deflects blasts from the heel, arch and lower parts of the leg.

Governmentese added a new word to its rolls recently when an Air Force study group concluded that a proposed scientific project was "feaseless."

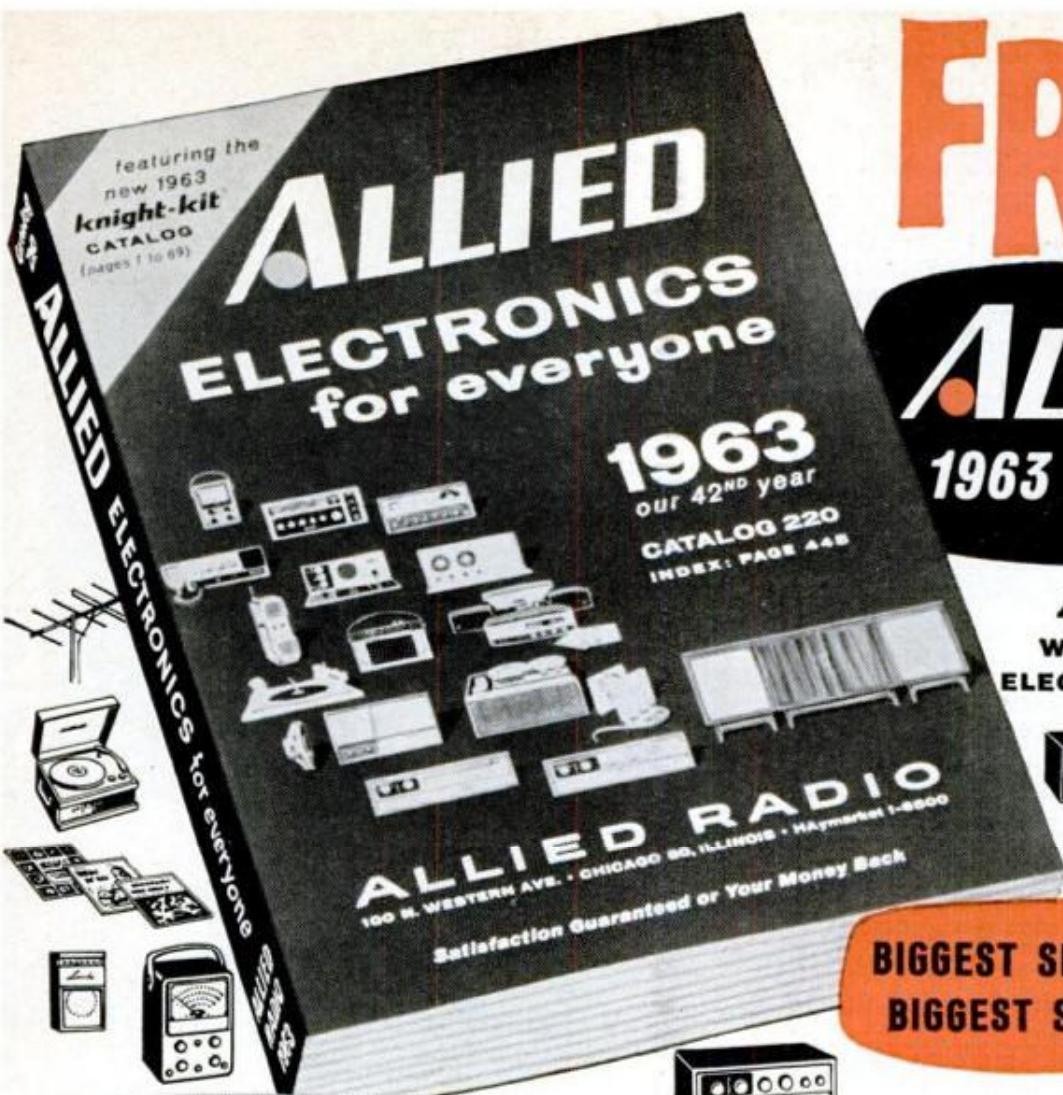
A raincoat sleeping bag is being tested by the Army. The garment is a water-resistant poncho with a liner. The liner can be removed and used as a ground cover, or when used with the poncho, can be made into a sleeping bag. It's lighter to carry and easier to roll and pack than the standard poncho and wool blankets now in use.

Fire-fighting foam will keep intense direct sunlight from melting ice runways in the Arctic if spread on in two-inch layers, the Air Force has found.

A steel ball slightly larger than a marble reached the highest re-entry speed ever attained by a man-made object when it was shot back down into the earth's atmosphere recently from 200 miles up. The ball became an artificial meteor, creating a bright trail visible in two states before it burned up. Air Force Cambridge Research Laboratory scientists used a six-stage rocket for the experiment at Wallops Island, using two stages to get the pellet into the air and four stages to fire it back down at a speed of nearly 12 miles a second. Special instruments measured its brightness and electrical charge as the marble descended.

Billy goat bleats may replace the groans of some sea buoys. The Coast Guard is experimenting with an electric horn designed to be used on the buoy that's farthest out in a river channel. Usually, this buoy is made to groan by the rocking action of the waves, but sometimes, especially in fog, the water is calm and the buoy remains silent. The new electric buoy with the bleat, however, needs no waves.

Two electronic tube patients visited an Army dentist recently. They were referred to him, believe it or not, by the Air Force. When a radar squadron found two of its special transmitter tubes out of order because they had become pitted on the outside, they took them to a nearby Army dental clinic where an ingenious dentist spent two hours drilling the cavities into a proper shape and then filling them with plastic. Dental bills are usually costly, but this one saved the Air Force about \$7000.



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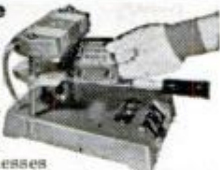
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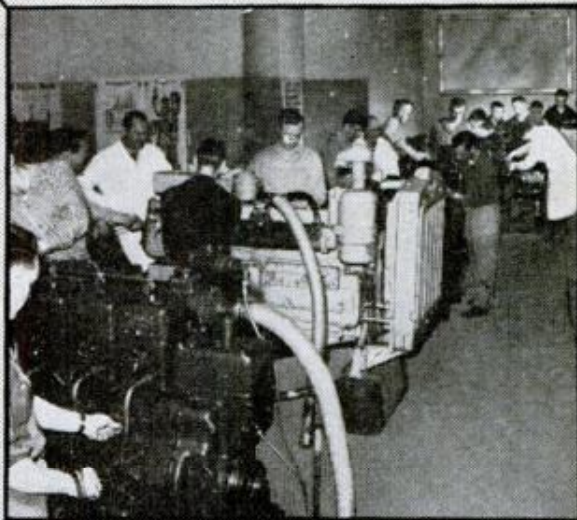
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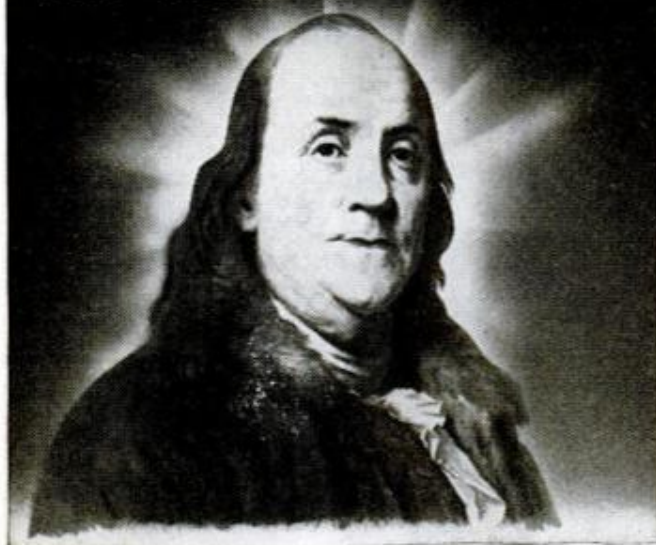
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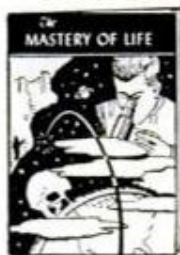
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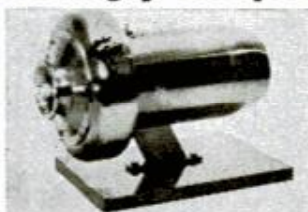
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Eyes to Steer Spaceship

Electrical current in a man's eyes may be used to steer a spaceship during takeoff. Scientists at the Naval Electronics Laboratory in San Diego, Calif., have found that there is a change in electrical charge when a person's eyeball moves from side to side.

When electrodes are taped on a person's skin above, below and at each side of his eyes, the voltages from four sides of the eyeball can be compared. These voltages are in the millivolt range, but can be amplified to actuate a pointer or produce a record of eye movements on an oscilloscope, an electronic measuring device.

A tracking system has been devised by which a beam of light can be pointed by the rotation of an eyeball following a target.

An eye-control system might be used during rocket takeoff when a man's limbs are pinned because of rapid acceleration forces.

Dig Salt From Frozen Mine

A gigantic salt dome is being mined in the bayou country of Louisiana by freezing the ground above and around the huge hump. Formed aeons ago by a saline upthrust through fissures in the earth's basement rock, the dome was covered with 200 feet of porous soil, saturated with subsurface water. Present-day excavation crews using ordinary mining methods were threatened with constant flooding and cave-ins.

Before the 16-foot-diameter shaft was sunk, an area of ground about 34 feet in diameter was literally frozen solid. This was done by circulating calcium chloride brine at minus 33 degrees F. through a network of steel tubing and casing set in 30 holes centered about the mine shaft and drilled 250 feet deep through the overburden. A two-stage 80-ton ammonia refrigeration system was installed at the job site to produce the subzero brine. After the brine reaches the bottom of each freeze hole, it is returned to the surface through the casing for recirculation.

In a joint venture, three American companies are mining the dome which is believed to have saline deposits sufficient to sustain mining operations for centuries, with about 35 million tons at first mining level alone. Its depth is theorized by geologists to reach about 30,000 feet beneath the earth's surface.

The salt will be distributed to warehouse points in north central, southern and southeastern states. It will be sold as a de-icing agent for highways, and to the chemical, meat-packing and water-softening industries.

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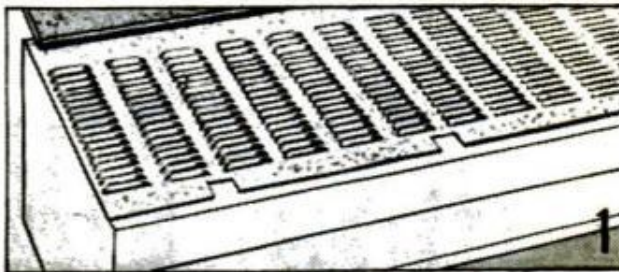
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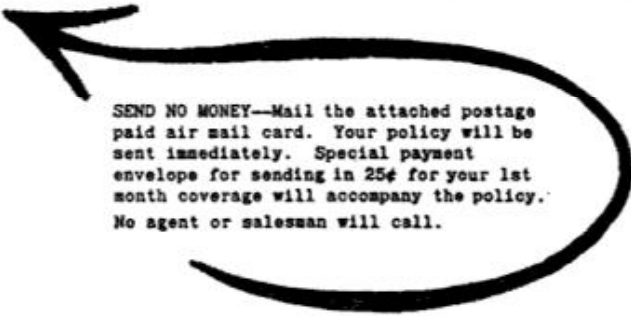
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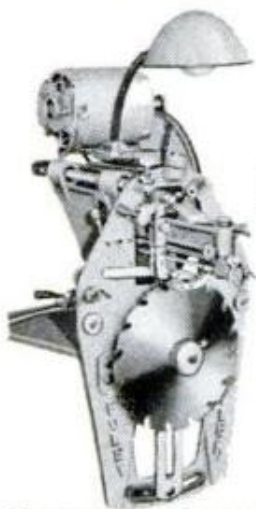
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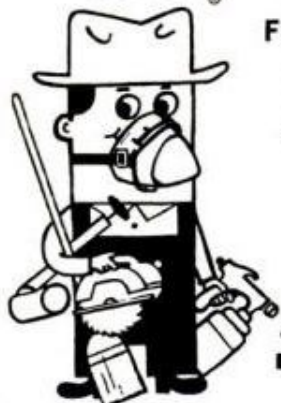
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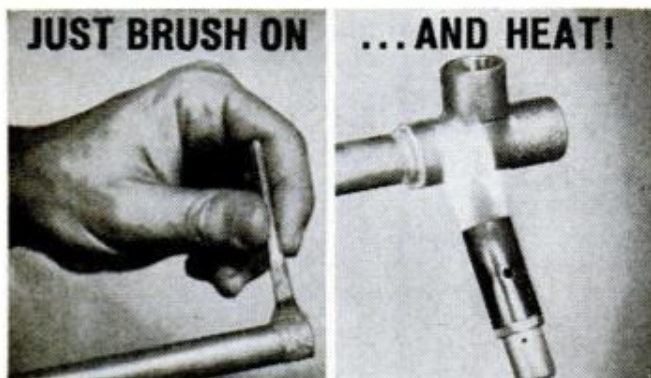
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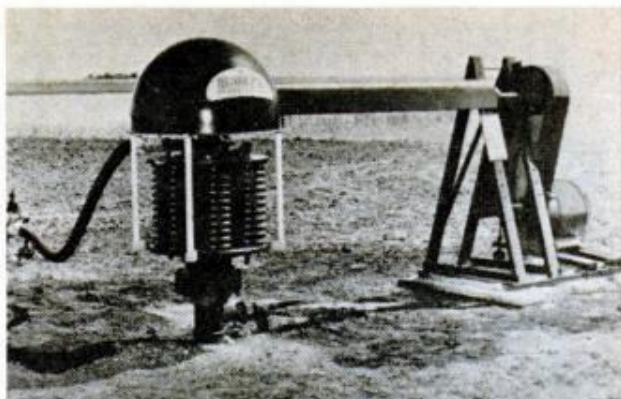
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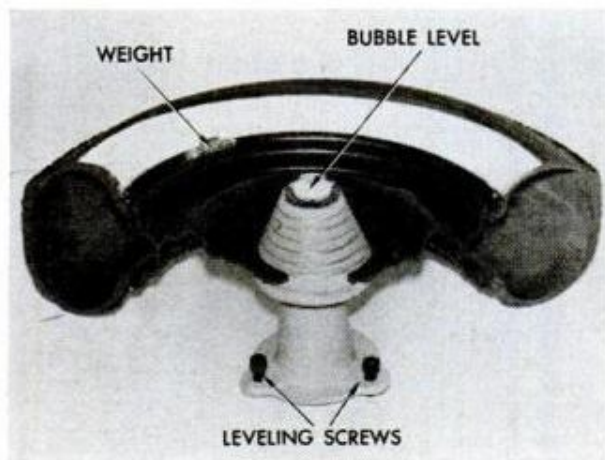
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The pump is being marketed for wells with tubing lengths of 400 to 4000 feet.

The tubing, vibrated by an oscillator, allows fluid from below to pass through on the down stroke; on the up stroke, the valves close and through accelerated action of tubing, fluid is impelled upward at a high rate.

The pump is normally operated between 600 to 1200 strokes (pumping cycles) per minute. It is made by Johnson Testers, Inc., Houston, Tex.



Low-Cost Wheel Balancer

Compact, precision-made and inexpensive, the Jacobsen Wheel Balancer is a mighty handy instrument for do-it-yourself car repairers, owners of small garages and service stations, and fleet operators. The cast aluminum balancer weighs only two pounds and stands but eight inches high. Its five-inch diameter base has two leveling screws and no special skill is required to use it. The unit statically balances most auto wheels and comes with an optional adapter for VW rims. Sold in auto supply stores, or direct from the maker (Jacobsen Mfg., 15029 Pacific Highway South, Seattle 88, Wash.) for \$14.95.

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Artificial corneas developed by Dr. William Stone, Massachusetts Eye and Ear Infirmary, have been successfully transplanted into the eyes of rabbits where they were tolerated for five years. A similar operation, performed on rhesus monkeys, resulted in the corneas being tolerated for two years. "There is no overgrowth of tissues," says the report, and sight has been restored to the animals. This new method of implanting artificial organs will be next attempted on blind human volunteers.

Another new type of skin graft is being developed at the University of Padua, Italy, by Prof. G. Dogo. Skin is removed from the body and sustained in a material whose temperature is lower than that of the body. These skin grafts lasted for three months, whereas the normal skin grafts persisted for only 25 days.

An Old Favorite With a New Twist

In grandpa's day the prop on a windmill weather vane was nothing more than a whittled stick. Today the whirring prop is an eight-bladed affair which spins like crazy. It's made by inserting eight vanes cut from a metal Venetian-blind slat in a hardwood hub. The metal vanes are forced into saw cuts made in the hub at a 60-degree angle and cemented in place. Saw cuts are spaced equally by means of a paper pattern folded as indicated in the detail. The natural curvature of the metal blind give the blades an air scoop which makes the prop spin in the slightest breeze. The tail part of the weather vane is cut from a 3/4-in. board as detailed.—P. Casperson

Fish Prefer Prefabs

Fish prefer to live in prefabricated concrete shelters rather than sunken junk such as wrecked streetcars, boats and rock piles, say sea scientists. In an attempt to create better fishing in barren waters, marine biologists are making use of fish's preference for expensive housing.

Artificial reefs have been strung along the coasts of New Jersey, Delaware, North Carolina, Florida, Texas and California to lure fish into these waters. These reefs look like large inverted concrete boxes with circular windows for the fish to pass through.



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By Jim Whipple



Chrysler's Five-Year 50,000-Mile Warranty — How Will It Work?

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Already nicknamed "5-50," the new warranty plan provides that if any part in engine, transmission, driveshaft or rear axle (yes, even a sticky valve lifter or growling rear end gear), shall malfunction (that's Chrysler's word for fail), it will be replaced at no cost for either the part or labor.

Some of the parts included under the 5-50 warranty are oil pumps, valves, camshafts, waterpumps. Not included are ignition parts, carburetors, fuel pumps, distributors, generators, voltage regulators and radiators. The 5-50 warranty will be added to the 12-month, 12,000-mile warranty now in effect. The 5-50 applies in Canada too.

For guaranteeing you freedom from major breakdown expense for five years, Chrysler Corporation asks relatively little in return—no more, in fact, than the periodic maintenance that almost all of us intend to give our cars. The only difference is that before Chrysler Corporation will replace your Plymouth's engine or transmission for nothing, they will simply require you to guarantee that you've faithfully completed some simple service operations.

Here's how it will work: each '63 Chrysler product will have a warranty book of Car Care Certificates imprinted with the car's serial number. In addition to the certificates, there are blanks for the owner to fill out recording the periodic 4000-mile or two-month oil change intervals. These blanks are basically for owner convenience.

The life of the warranty is based on the Car Care Certificates which are to be filled out by the authorized Chrysler-Plymouth or Dodge dealer (service manager), countersigned by owner and sent to Detroit.

This certifies to Chrysler Corporation that the car has been inspected and properly serviced at initial 1000 and 4000 mile intervals, and at the sixth month of owner-

ship and every six months thereafter. These checkups, paid for by the owner, are just good maintenance practice and include oil change, oil and air filter changes, plus checkup and filling of automatic transmission, rear axle, etc.

Cost of the six-month checkup should average about \$12 throughout the U.S. according to Chrysler executives. The certificate mailed to Detroit will include not only checkoff of the required service but date and mileage at the time of inspection.

If an owner should neglect to get his certificate of inspection and maintenance, signed and mailed in, his 5-50 warranty will be voided. How will they know he missed? The certification will be recorded on a punch card coded to the serial number of his car.

This means that for about \$25 a year—money that would probably be spent on maintenance anyway—Chrysler will give you 5 years or 50,000 miles of driving free of major repair expenses.

It sounded so good that we felt there must be a catch or gimmick. So we questioned Chrysler's VP in charge of quality control, Harry E. Chesebrough, and learned that the warranty's key phrase limiting coverage to cars "properly used and maintained," simply means that a car that has suffered a part failure through obvious physical abuse (you drove it through a guard rail, for instance) will be voided according to the best judgment of the dealer.

We learned also that the 5-50 warranty is transferable even though the car is resold by a non-Chrysler Corporation dealer as long as the original warranty book is with the car and has been kept up to date. The second or third owner need only have the book re-registered with a Chrysler Corporation dealer and he's covered until the specified time and miles run out.

Chrysler Corporation is betting heavily on their own product because they have tried it out under the rules laid down by the warranty.

Starting right now, as the first '63 Plymouths, Valiants, Dodges and Chryslers take to the road, the jury is out. Within a year or so, we should begin to hear the verdict.

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\$21⁹⁵

\$5 per month

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83 Y 980DJ. For Pos. Ground Systems. Each . . . \$21⁹⁵
83 Y 909. 9-V Battery & Accessories. \$1.50

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C-100 WALKIE-TALKIE KIT **LOWEST KIT PRICE EVER**

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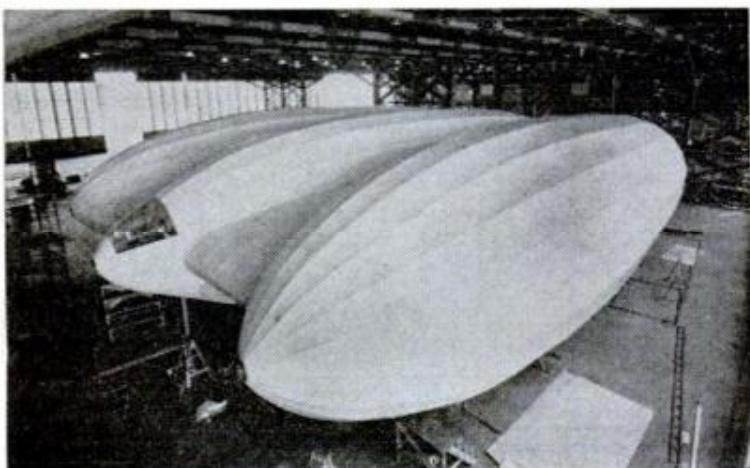
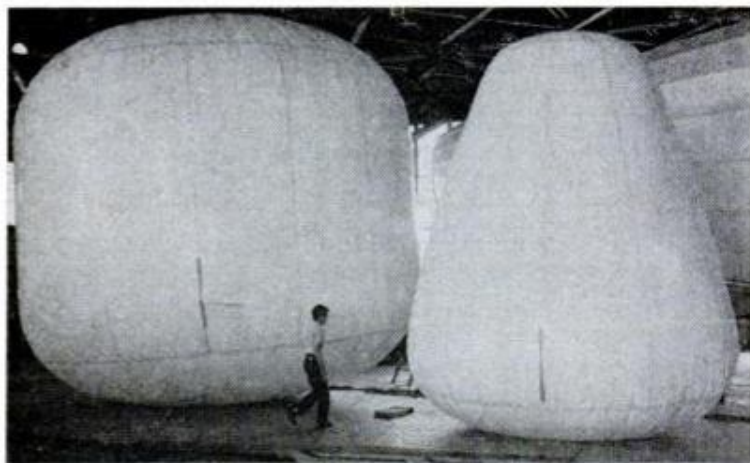
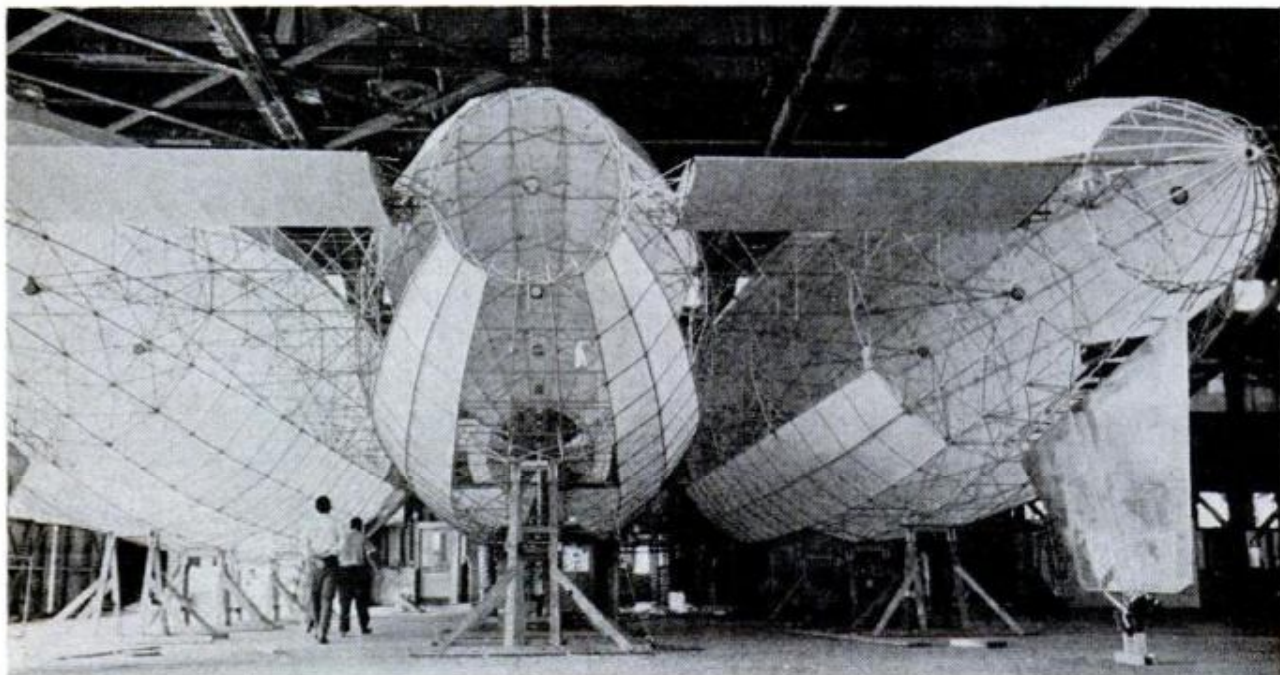
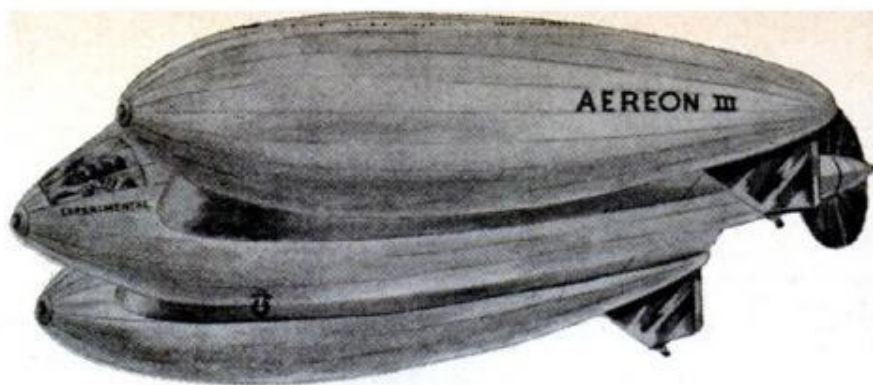
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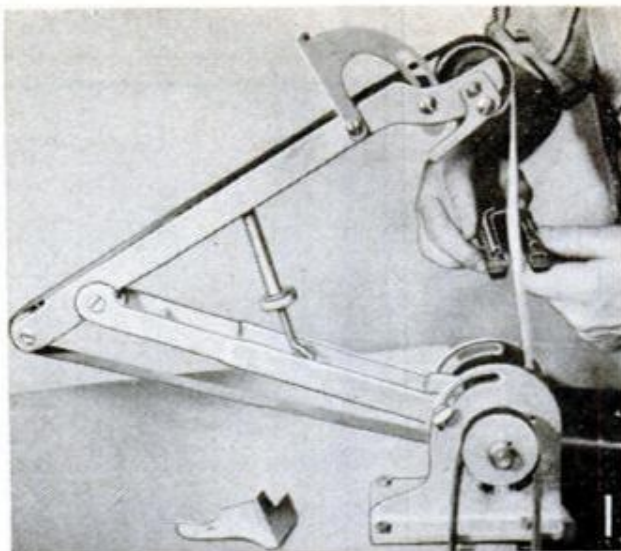
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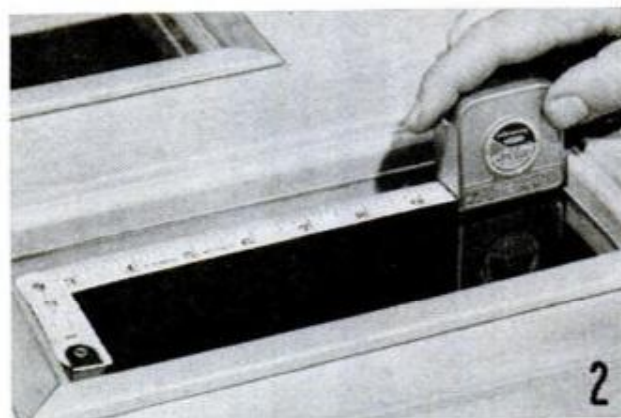
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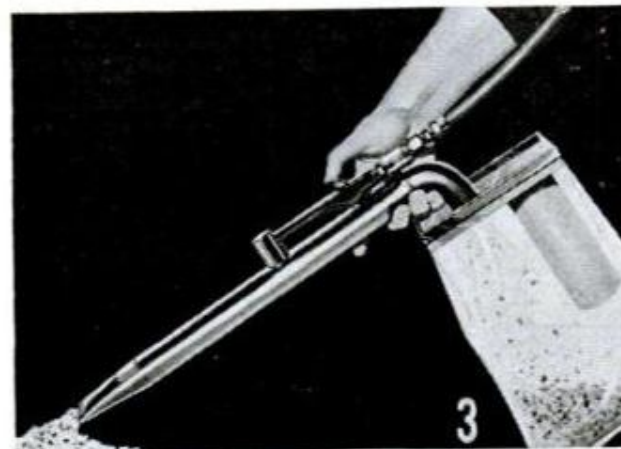
Shopping for tools



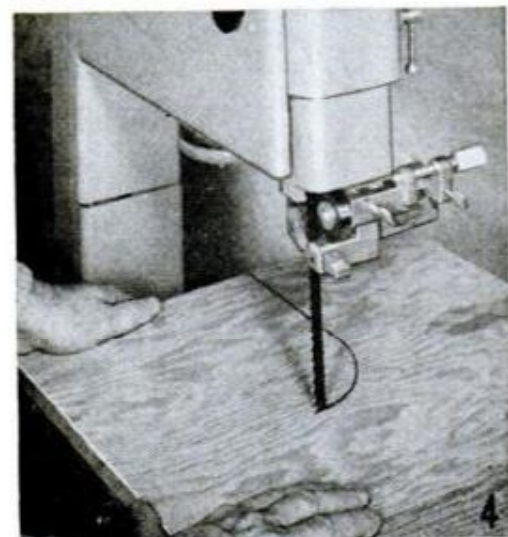
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2. STEEL-TAPE RULE has 2-in. section at end that folds right or left, to compensate exactly for case width when measuring inside of openings. Eliminates error by enabling user to read exact opening size at point where rule leaves case without adding case width to measurement. Comes in 10, 12, 16-ft. lengths. H. K. Porter Co., Inc., Disston Div., Pittsburgh 19, Pa.



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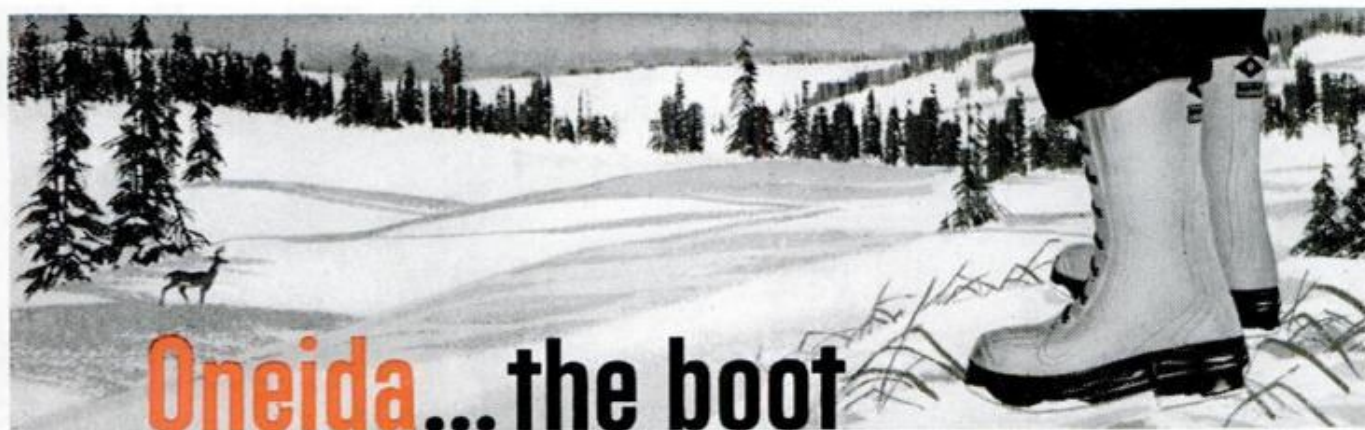


4. BANDSAW BLADE has skip tooth, each tooth having a positive rake, or hook. Compare tooth shapes A and B, the latter detail showing the new hooked tooth with 10-degree rake angle. Faster cutting, reduced feed pressures result, requiring less power and better dissipation of heat. Cuts metal or wood. Boice-Crane Co., 943 W. Central Ave., Toledo 6, Ohio



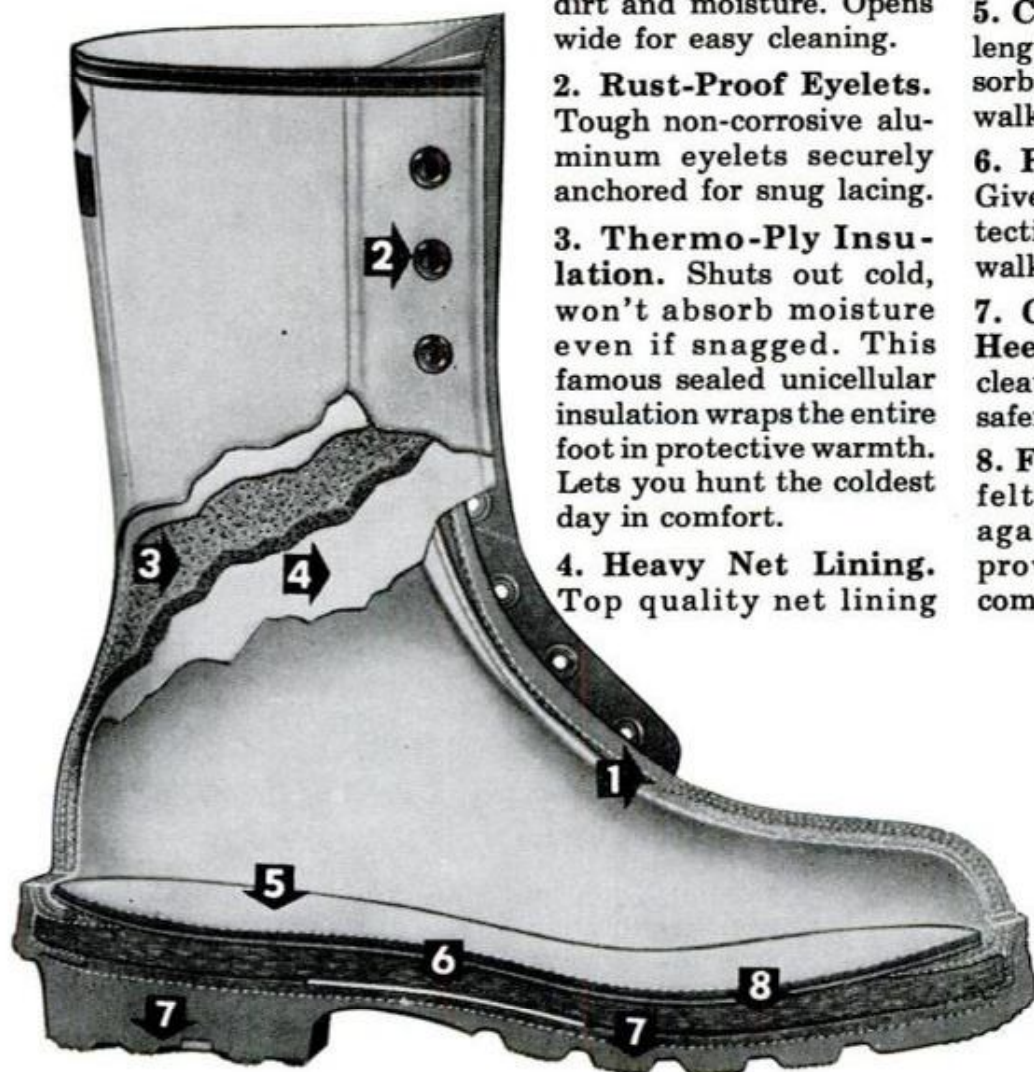
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NOW— FOR '63 PICKUPS UN



Only Ford offers so many *different kinds* of pickups . . . so many body styles, capacities and power choices to custom-fit *your* pickup needs!



NEW FORD FALCON PICKUPS

For doing a job in style, Ford's Ranchero is in a class by itself! In styling, comfort, handling ease and economy, it's a '63 Falcon car. For work, a sturdy 6-ft. pickup with 800 lbs. capacity. Great for business, perfect for personal transportation.



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Solid comfort in the cab, solid truck underneath. Built like big trucks for greater durability . . . Ford conventional pickups use the same type of axles, frame, springs you'll find in big trucks. 6½, 8, 9-ft. bodies; GVW's up to 7,800 lbs. Flareside bodies, too.

LIMITED FROM FORD!



NEW FORD ECONOLINE PICKUPS

No other pickup offers you such a combination of capacity and economy! Ford's Econoline takes payloads over $\frac{3}{4}$ ton in its big, easy-to-load 7-ft. box. And, thanks primarily to its thrifty Falcon engine, it can cut operating costs \$100 in a 16,000-mile year.



NEW IDEA! A "COVERED PICKUP"

Ford's new Econoline Van gives you 204 cu. ft. of loadspace under lock and cover. Big 4-ft. door openings at side and rear (both sides if you like) make loading practically as easy as in a pickup. All at a price below some open pickup prices!

FORD TRUCKS

For Outstanding Reliability & Durability

PRODUCTS OF  MOTOR COMPANY



**Pall Mall's
natural mildness
is so good
to your taste!**



*You can light
either end!*

**So smooth, so satisfying,
so downright smokeable!**

*For flavor and enjoyment you just can't beat
Pall Mall's natural mildness. It's so good
to your taste. Never too strong. Never too
weak. Always just right! Enjoy satisfying
flavor... so friendly to your taste.*

Outstanding... and they are Mild!

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COMPARE ALL THREE!

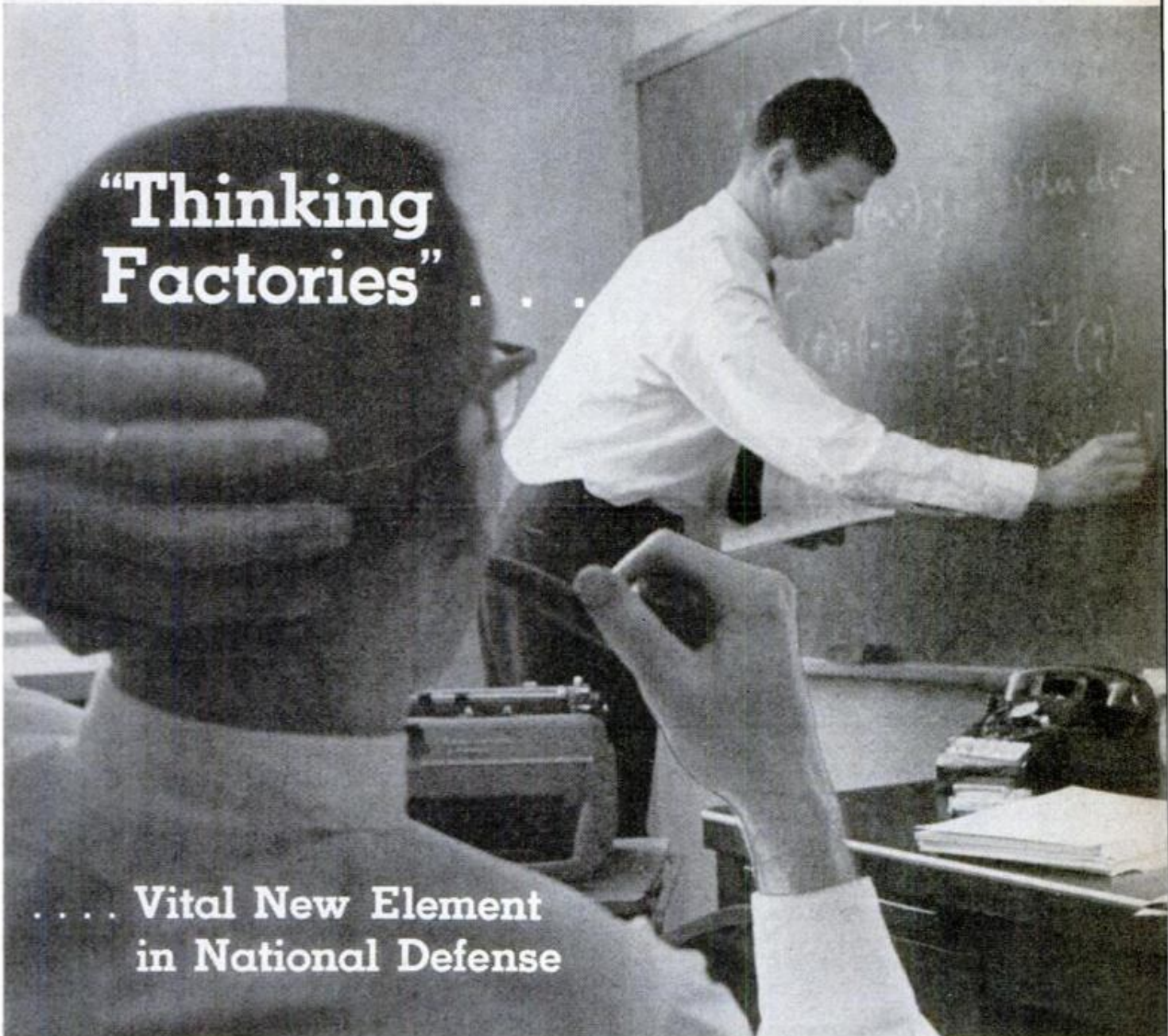
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**“Thinking
Factories”**

**. . . . Vital New Element
in National Defense**

CIVILIAN ‘OPSEARCHERS’ use slide rules, blackboards and brains to find solutions to military problems

The opsearchers’ tools are slide rules, mathematical equations and “queuing theories”; their product is sharp advice

**By
S. David
Pursglove**

WHEREVER A U.S. NAVY fleet cruises, standing on the flagship bridge beside the admiral is an American civilian scientist. If the fleet makes a diplomatic port call, “our scientist aboard” suffers through the reception line. If the fleet engages an enemy, he braves the same dangers faced by the crew.

When U.S. Army troops land on foreign shores, many of their moves

Day in Life of Navy Opsearcher. . . .



DR. LEON POCINKI (right), analyst for Navy force, studies aircraft fueling operation, one of many he must understand

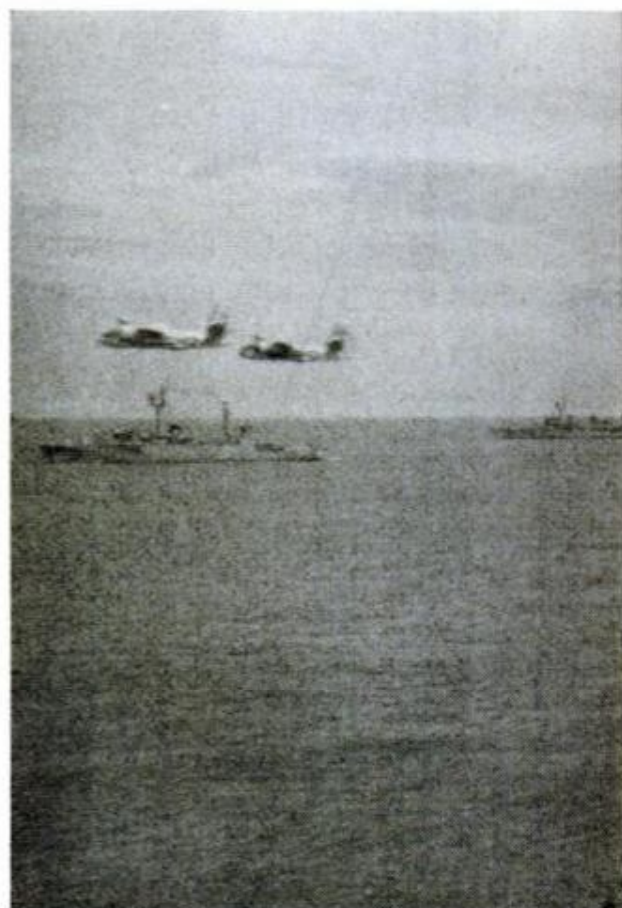


RADAR SCANNING is next. How close will subs get before operator sounds the alert?

are planned by unsung civilian scientists. If bullets are to be ducked, these scientists must duck their share. Whenever GIs maneuver in field exercises, these same civilians are right beside them, slogging through mud and eating at field kitchens.

These are a new breed of men, called operations analysts. They work for operations research firms—often dubbed “thinking factories” or “advice mills.” They advise Pentagon planners and military commanders on long-range strategy and short-range tactics. They help plan the defense of the United States against missile attack. They show commanders how to decide when a damaged or worn Jeep should be repaired and when it should be junked, and how to make chow lines move faster. They try to determine scientifically what world conditions will be like in 1975 so we can begin our long-range weapons research now. They study the problems that confront Special Forces advisers on guerrilla fighting in Southeast Asia and turn up ways of doing better jobs with limited manpower.

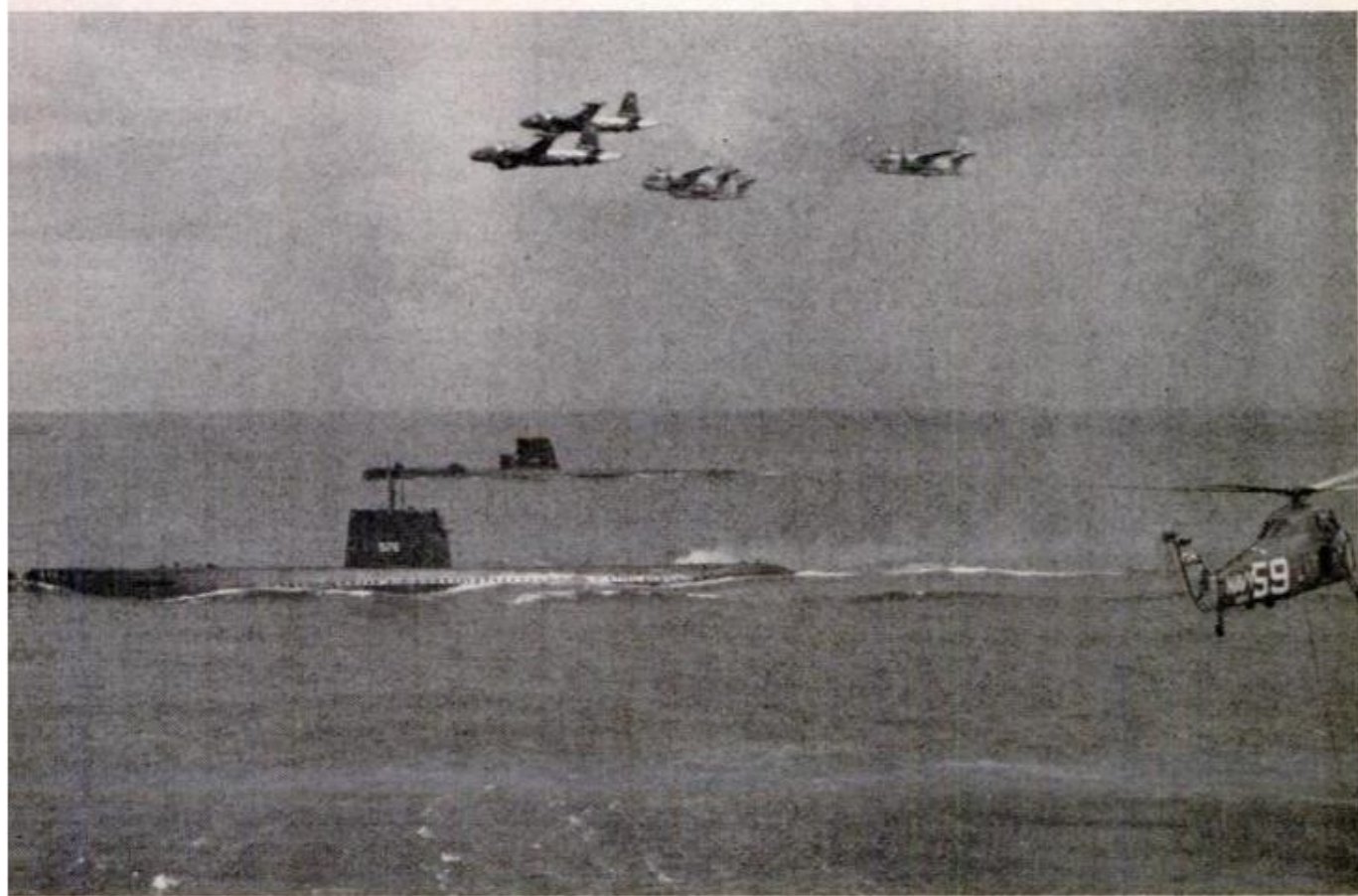
Today, when the Pentagon has problems that need thought, thinking factories tackle them. Critics charge that the mathematicians, physicists, sociologists, economists and other scientists in the ranks of operations research are trying to replace military commanders and substitute equations for

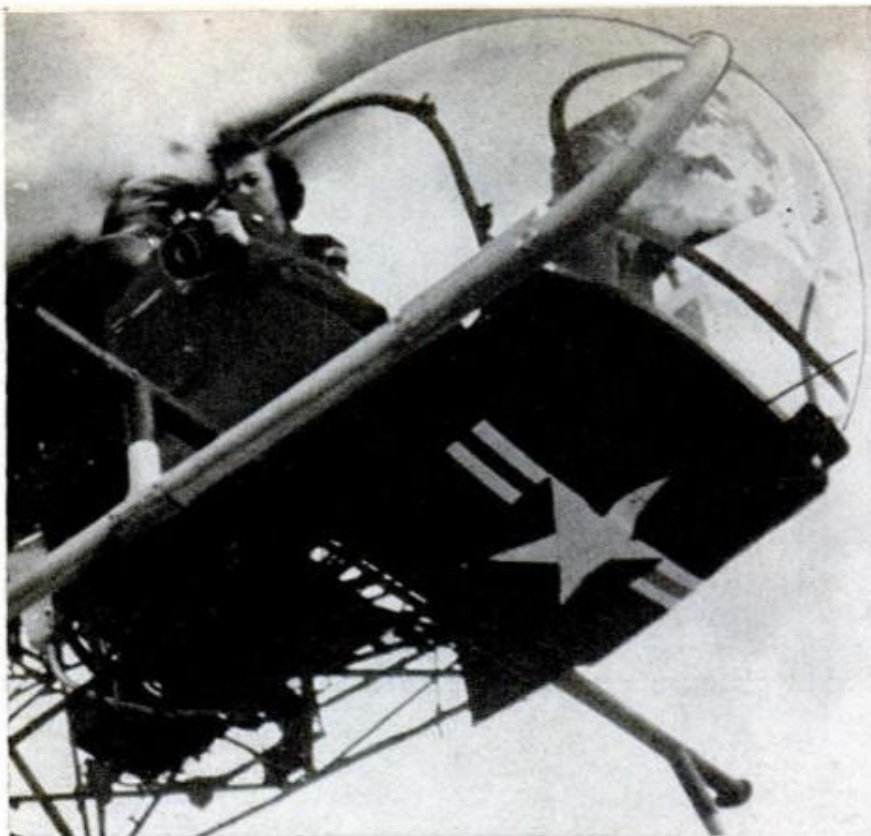


Studies Each Operation, Forms Plan



WAR GAMES begin. Analyst (above) checks maneuvering planes, subs, destroyers (below); computes results of exercise; produces data from which a rough plan is formulated for task force commander (top right)





WOMEN, TOO! They travel same route, take same chances as men. Here, female opsearcher leans from helicopter to take aerial photos. Army needs to know at what altitudes pictures will show tanks, people

NORTH KOREAN surrenders, waving safe-conduct pass designed by opsearchers. Early in Korean Conflict, Army was advised that Red soldiers would defect if offered food, safety, rather than promise of vote

human judgment. The fastest rebuttal comes from the military men themselves. They point out simply that the thinking factories are saving lives and money by bringing fresh and analytical points of view to bear on military problems.

Field Marshal Sir William J. Slim, post-war chief of the British General Staff and World War II leader of the offensive in Burma, told a military planning meeting in London that, when he had asked commanders after certain operations what they had achieved, the answers were that "We have not achieved very much, but we have gained a lot of experience." The field marshal's reaction: "It struck me that the application of a little scientific method to finding out the answers is a much more efficient and quicker way than going off and risking several thousand men."

The thinking factories are applying that scientific method—not to make decisions themselves, but to produce factual data that helps their military bosses make better decisions.

Their principal tool is *operations research*, the term they have selected to cover the use of laboratory research methods in studying operations. The traditional five laboratory steps are used:

Observation of the operation and determination of the questions to be answered, preferably questions rephrased to ask "How much?"

Model formulation—or formulation of an

equation that represents on paper the exact way the operation has been observed.

Derivation of a theory that applies to the operation under all conditions—even conditions not yet encountered but which may someday face a commander.

Verification of the theory sometimes by testing it against conditions programmed into a computer, but preferably actually in the field.

Making conclusions and communicating recommendations—the most important step since the whole effort is wasted if recommendations do not reach people who can act upon them, or if the conclusions cannot be expressed in terms that the non-scientist officer can understand.

Almost every problem can be boiled down to a choice between alternatives. When World War II convoy commanders asked, "What is the best way for me to protect my convoy?" what they really meant was "Should I place my escort ships in a nice tight ring around the convoy, or should I move them farther away from the convoy so they can intercept enemy submarines earlier?"

When operations researchers actually tackled this problem, they observed that too many precious escort ships were being wasted. They were guarding the rears of convoys that often moved faster than submarines; U-boats usually could not attack from the rear. Moving those escorts to the forward two-thirds of the protective ring in effect gave convoy commanders 30 per-



cent more escort ships plus efficiency.

Escorts deployed *near* the convoy, analysts pointed out, could be closer together and keep submarines from sneaking between them. However, the scientists added, tight deployment would allow U-boats to approach close enough to launch torpedoes. When the escorts were deployed far enough away to intercept submarines outside of torpedo range, then the gaps between escorts would be so large that U-boats could sneak through.

Equations vs Wolf Pack

Navy men then planned to deploy their escorts at a "happy medium" arrived at by intuition. Operations researchers, though, gathered data on convoy speeds, submarine speeds, detection distances and response time to detection. They converted what naval intelligence knew about German U-boat tactics to mathematical values. They rode convoys to examine first-hand the chances for mechanical failures and human errors and assigned mathematical values to these chances. The results showed convoy commanders the best deployment of escort ships under almost all possible circumstances. Hitler's U-boat massacre of Allied convoys ended abruptly.

Most convoy commanders followed the analysts' advice closely, but Navy headquarters did not require them to. The chair-borne Navy in Washington was leery of letting civilians advise officers. It would not allow the antisubmarine warfare man-

ual based on the studies to be issued until it had been rewritten several times and all the "musts" had been removed.

Captain (later vice-admiral) Wilder D. Baker who organized the antisubmarine operations researchers was not allowed to give the "mere civilians" the classified data that they needed for their studies (but they did manage to get the data). He could not bring them into the main navy building, but had to hide them three blocks away in a dangerously creaking World War I temporary building. Getting them into the submarine room required subterfuges that might have placed Capt. Baker—and his civilians—before a firing squad had they been discovered in those days.

Today, nobody is really certain what all the fuss was about. "It was a security consciousness that surely must have failed if spies ever tested it," recalls one grinning operations analyst. "I left my office headed for a meeting one day with a brief case jammed full of the most highly classified data. Despite my vigorous protests that absolutely nobody was to see the contents, a Marine guard demanded that I open the case. He rifled quickly through the documents and waved me through the gate, remarking to his armed partner, 'It's okay, there aren't any blueprints in there.'"

By 1945, when the war ended, Fleet Admiral Ernest J. King and Navy Secretary James Forrestal were deeply impressed with the results that could be produced by rank-free scientists working at all com-



FRONT-LINE OPSEARCHERS (with binoculars) help machine-gun team in Korea find the best method of fire

mand levels. They persuaded the Massachusetts Institute of Technology to organize the group as its own. The Navy then contracted for its services and arranged quarters in the Pentagon. It became the first of the private operations research groups to do some of the Pentagon's thinking.

The Navy had reasons for wanting civilians rather than science-trained naval officers. The "opsearcher" must be free to seek information at all levels; talk with recruits and argue with admirals. They must be outside of the chain of command to escape pressures on their thinking and to avoid interfering administrative duties. They must be inquiring and skeptical rather than doctrine-oriented. Navy officers themselves admit that they are essentially links in a command chain and they cannot spend a substantial part of their time doing the *doubting* that is necessary to objective study.

Now called Operations Evaluation Group (OEG), the close-knit team numbers somewhat less than 200 persons, mostly scientists. OEG believes that its small size helps the all-important informality. Instead of growing larger to handle newer types of problems that the Navy faces, OEG this

year transferred its contract from MIT to a new Center of Naval Analysis organized by the Franklin Institute of Philadelphia. Under the Center's direction, OEG continues Navy contract work on the problems that it knows best, while the larger group takes on new types.

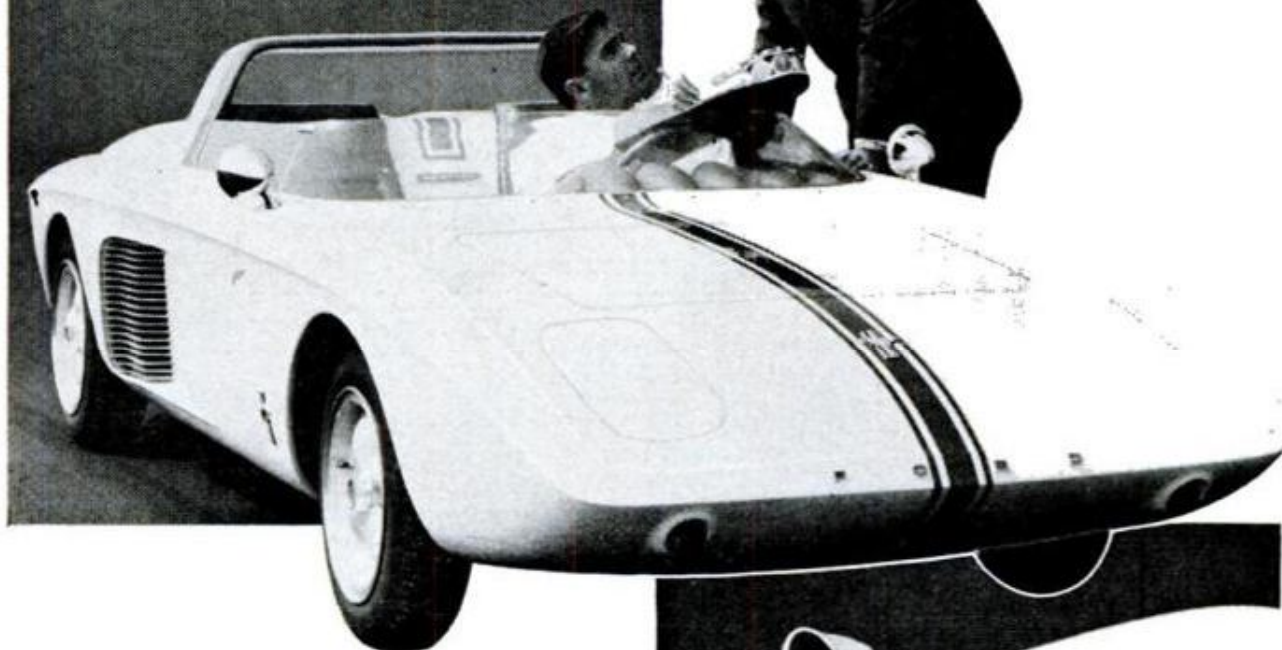
OEG keeps about 30 percent of its scientists in the field. Two are with each fleet—usually one at fleet headquarters or on the flagship, and one with an operating force. Others are with special units. They help local commanders solve immediate problems and they gather data on long-range problems under study in Washington. However, their biggest job in the field is to familiarize themselves with every aspect of Navy operations. How does a crew fuel a carrier jet fighter? Where in the operation can accidents happen and how often? Analysts need this information—converted to mathematical values—to make their equations realistic.

If a Navy aviator crashes at sea, a troubled fleet commander will turn to his OEG analyst and ask anxiously, "What are the chances of rescuing him?" What he really means is, "At this moment, what is the best of the many alternative ways of trying to

(Continued on page 204)

Ford Builds A Bomb THE MUSTANG

Ford engineers borrow
Cardinal's V4 engine and
driveline to make a
1500 cc sports car
with potentially
winning ways



WITH ITS EXPERIMENTAL Mustang Ford Motor Company makes a tentative bid to fill the vacuum between the Go-Karts and the Corvette, up to now the sole examples of true competition sports cars in mass production in the U. S.

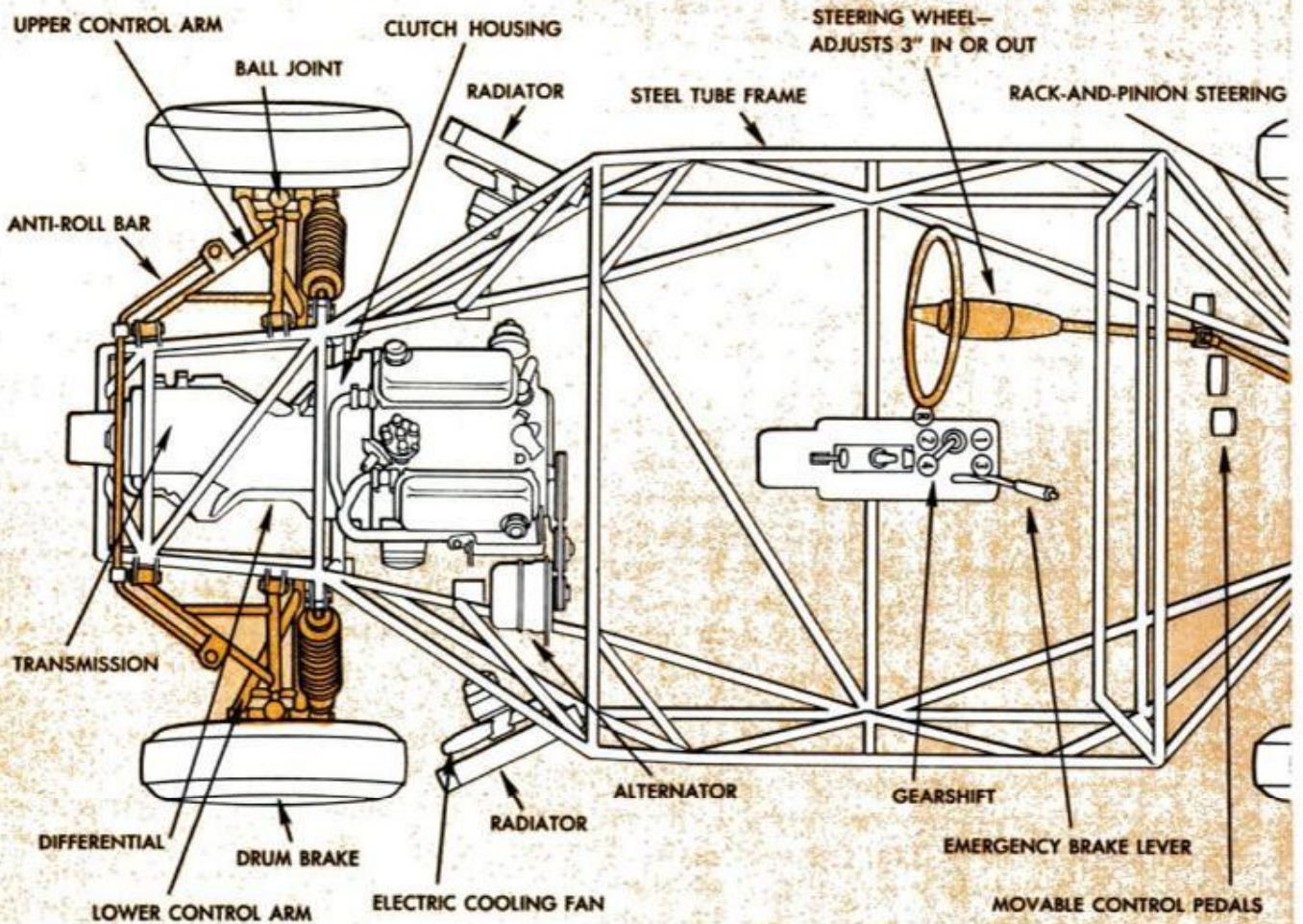
The Mustang is not in production at present and it exists only in prototype form, hand-built of .060-inch aluminum sheet on a steel tube framework. What makes it possible to visualize mass production of this "trial horse" at a competitive price is the fact that it utilizes both the 60° V4 engine and the transaxle unit of what would have been Ford's front-drive Cardinal which is now being manufactured by Ford of Germany as its new Taunus M-12.

As installed in the Cardinal (or Taunus), Ford's little overhead-valve V4 has a bore of 3.15 inches and an unusually short stroke of 2.3 inches. Total displacement is 73 cubic inches (1183 cubic centimeters) and with a conservative 7.8-to-1 compression ratio, horsepower developed is 50 at 5000 r.p.m., while torque is 57.7 ft. lbs.

By enlarging the bore from 3.15 to 3.54 on the Mustang version, Ford engineers have



MUSTANG'S COCKPIT is compact and complete with real bucket seats. Controls in center console to rear of shift lever are: horn button, turn signal and choke



STEEL TUBES for the skeletal space frame of Mustang, in plan view above, to which aluminum body panels are fastened. Component parts of steering and suspension system are outlined in solid color. Cross-section from rear of chassis, top right, shows U-jointed swing axles which make possible the independent suspension. Chart at right compares Mustang with two other sports cars with which it will compete

raised displacement to 91 cubic inches or 1462 cc. This jumps compression to a hot 11-to-1 and output is raised to 106 horsepower at 6500 r.p.m. with torque up to 96 ft. lbs. These figures are with a racing-type two-barrel Weber carburetor.

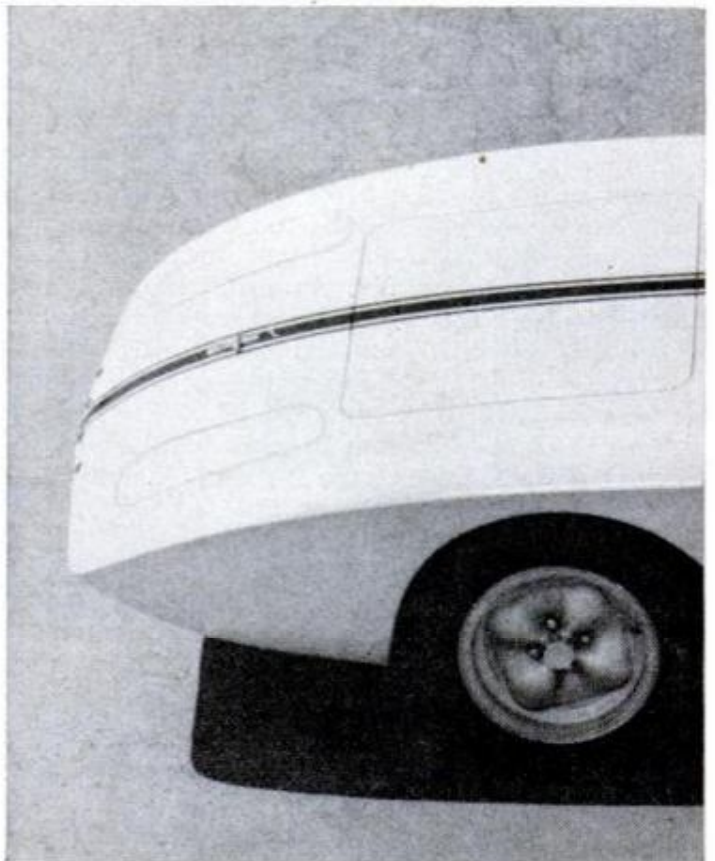
For road use, Mustang will be equipped with a single-barrel carburetor which drops output to 90 horsepower and 89.5 ft. lbs. of torque.

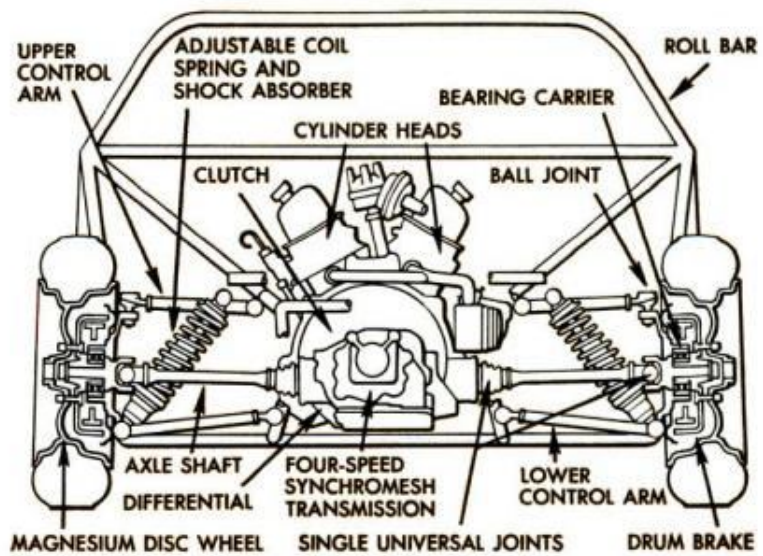
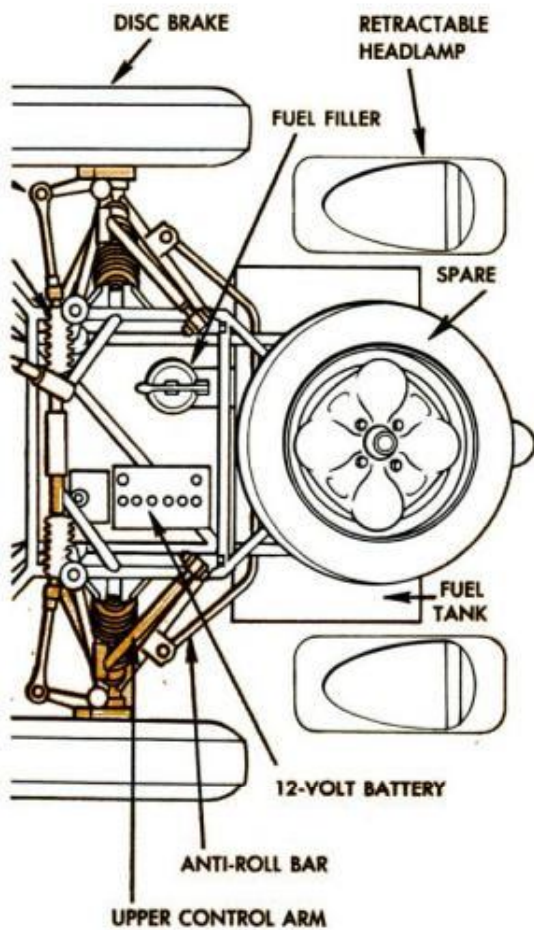
With its 1500 (1.5 litre) displacement, Ford's sleek sports car is designed to compete in FIA category 9 (SCCA Class G).

With curb weight estimated at 1450 lbs., the Mustang will be more than competitive in performance with the popular imports in its class (see chart) as its power-to-weight ratio works out to around 10 or 12 pounds per horsepower. If it lives up to its blueprints it should be hot as a two-dollar pistol.

Mustang's chassis is patterned on the most advanced race car designs. Its engine is mounted ahead of the rear axle and drives through a transaxle and swing half shafts to independently suspended rear

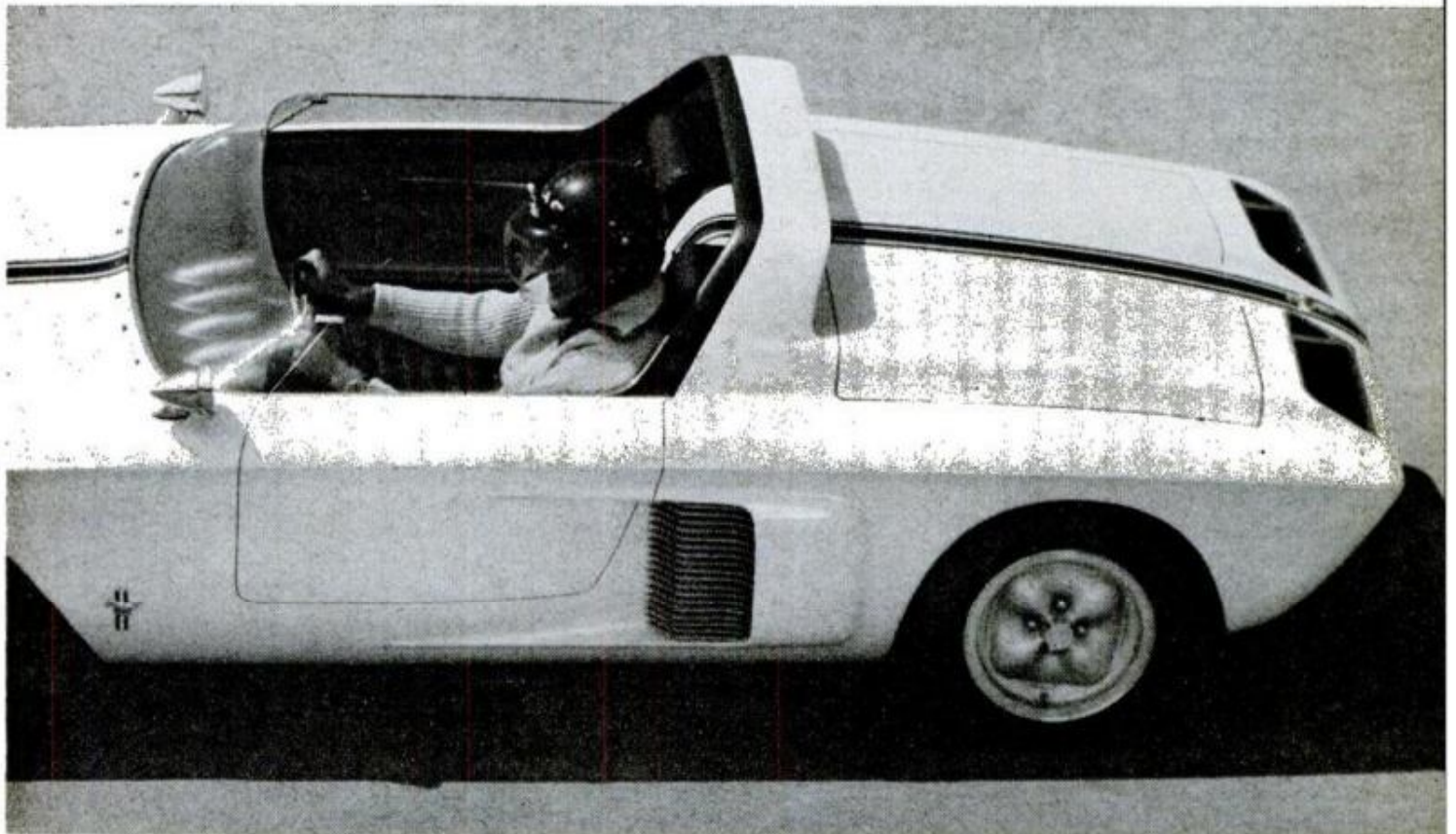
[\(Continued on page 228\)](#)





COMPARISON VEHICLE SPECIFICATIONS			
Make Model	MG 1600 Mark II	Sunbeam Alpine Mark II	Ford Mustang
Wheelbase	94.0	86.0	90.0
Tread, Front	47.5	51.2	48.0
Tread, Rear	48.8	48.7	49.0
Length	156.0	155.2	154.2
Width	58.0	60.5	61.0
Height	50.0	51.7	39.2 (a)
Displacement	1622 cc	1592 cc	1500 cc
Gross HP/RPM	93/5600	85/5000	106.5/6500
Torque/RPM	97/4000	94/3800	96/5200
Tire Size	5.60-15	5.90-13	5.00-13
Seating Capacity	2	2	2
Curb Weight	2050	2150	1450 (b)
P.O.E. Price	2444	2595	NA
Top Speed	105	100	108
Standing ¼ Mile	18.7 sec.	19.3 sec.	NA

(a) Over roll bar (b) Estimated





WILL



SHE

PM's

TOYS

OF THE

YEAR



SURVIVE?

When you drop a doll containing a remote control radio speaker from table top height (and how many times has your youngster knocked something off of the table?) you might wonder whether she could survive. Westinghouse's Saranade Doll not only survived the ordeal—she kept on singing! So did the record player which supplies her "voice"—when it was drop tested.



SHOCK CHECKING phonograph chassis (upper left) and heat testing toy vegetable (upper right) with temperature-indicating paints—two of the tests which supplemented an expert judging of the PM toys' play value

Here is our cream-of-the-crop selection, based on rugged testing and judging by experts and a very energetic Children's Panel

PITY THE BELEAGUERED PARENTS who each year select from groaning store counters the particular toys they are sure will gladden little Johnny's or Suzie's heart.

Comes the birthday, Christmas or some other special holiday, and too often the parents find that the toy which caught Dad's hopefully boyish attention—or Mom's sense of practical fun—was not what their independent youngster had in mind.

Or perhaps it *was* greeted with shouts of joy the day the gift was opened—only to end up in the nonfunctioning pile of discards shortly thereafter. It takes a rugged toy to withstand the impulsive workouts given it by eager youngsters. Toy manufacturers have become increasingly aware of this, and their products have been improving in wearability in recent years.

But which toys are the best ones—from both a youngster's and an expert adult viewpoint? Which are the most original, which have the greatest entertainment or educational value, the best design and engineering?

And are these choicest-of-the-choice toys durable enough to stand up to normal child abuse, safe enough for the age group that will use them, and also a good value for the money?

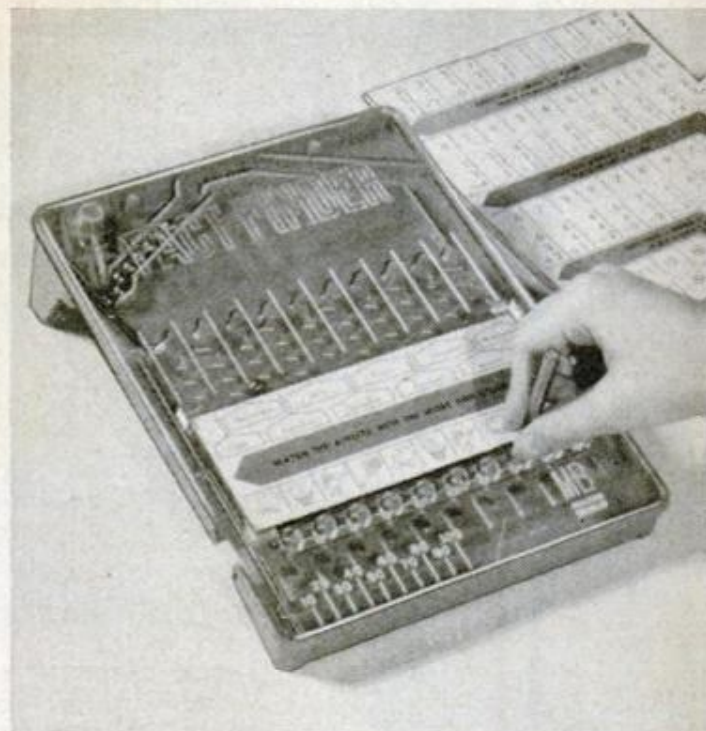
To find the answers to these questions, PM invited the nation's toy manufacturers to enter their best products in a Toy of the Year award program for playthings introduced to the market in 1962. Eighty-one companies responded by entering 145 new toys, hobby items, laboratory sets and amusement devices—each of which had some mechanical or scientific aspect.

A panel of 20 children ranging from three to 16 years in age

THE BIG BLAST Futura (\$10) showed good reaching power for a transistorized toy megaphone. It also survived hard, all-day-ON usage with batteries still working. For ages 4 and up, from Bell Products Co. The sturdy housing is made of high impact plastic



FACT FINDER, a pin-ball "teacher" for ages 6 to 14, makes math, sports facts, geography and other subjects exciting. As ball slowly zigzags down question slot it selects, player must quickly choose hole with corresponding answer to score. \$5, Milton Bradley



MIX YOUR OWN PERFUME

—and the girls on PM's Children's Panel found the process fascinating with this kit from Lisbeth Whiting Co. It includes: five bouquets, a perfume base, miniature labels, dropper, funnel, tiny bottles (which survived drop testing), gift boxes, ribbons and instructions. All for \$4. Good for ages 7 and up

MYSTERY SPACE SHIP is the name for this powerful, hand-wound toy gyroscope, which can be used in countless balancing and spinning experiments (see photos at right). "Missiles" can also be fired from the ship. For 4 to 9 year olds. Priced at about \$4.98 from Louis Marx & Co.

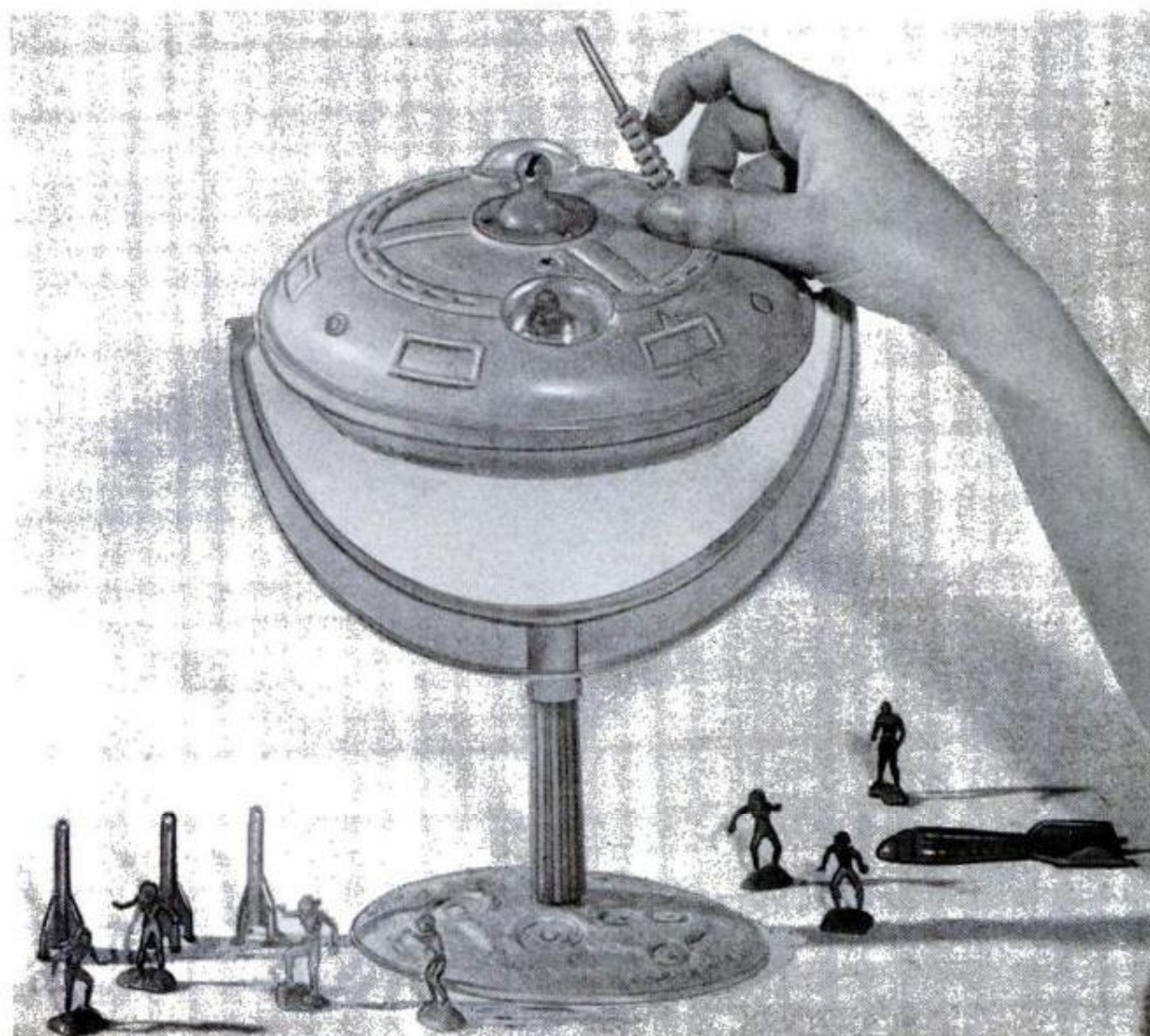
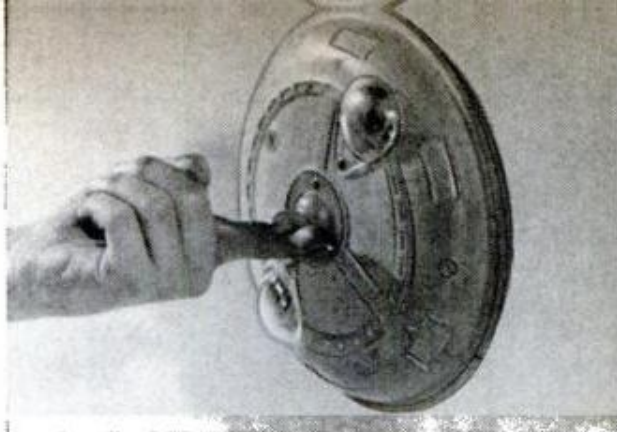
All of the toys for the very young entered in PM's award program were certified by the companies supplying them to be made of non-injurious materials and finishes

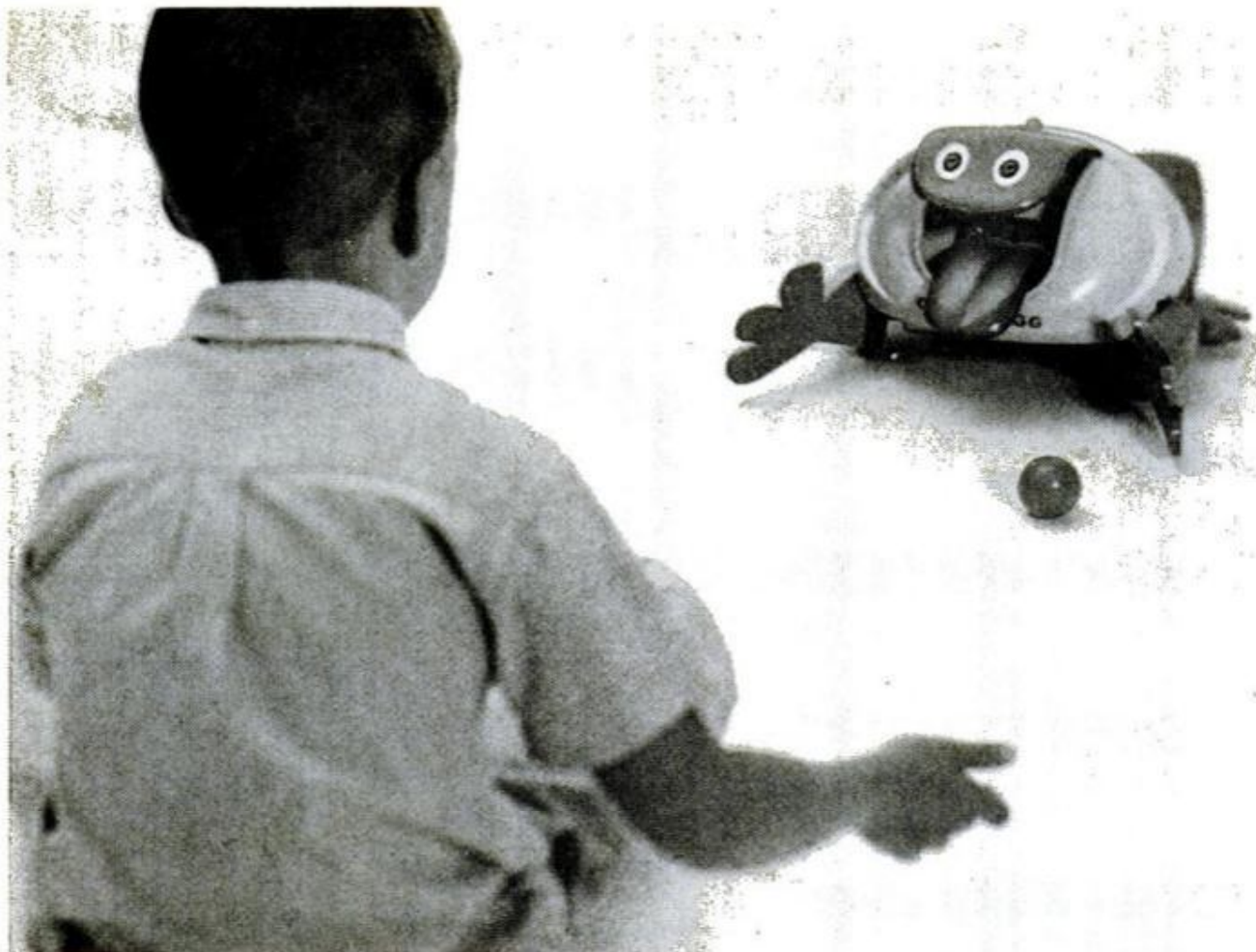
play-tested the toys for two days, while expert judges noted which toys drew the most spontaneous interest from the children, which were most successful in continuing to entertain, and which best survived the play ordeal.

Entries were drop-tested from table top height, and subjected to such heat as they would have to resist if left, for example, on the rear deck of a car in a hot sun. Electrical toys were tested for shock hazard and battery drain. Every entry was tested for efficiency in action, and its freedom from sharp edges or finger-trapping tendencies.

The official judges for the contest were Dr. Viola Theman, Professor, School of Education, Northwestern University, Evanston, Ill., and also Director of the Northwestern University Children's School; Phillip Dykstra, Chairman, Home Safety Committee, National Safety Council, and James Montague, Assistant Professor of Design, Illinois Institute of Technology, Chicago, Ill.

You'll find the top ten winners in the accompanying illustrations. A group of ten honorable mentions is listed on page 101.



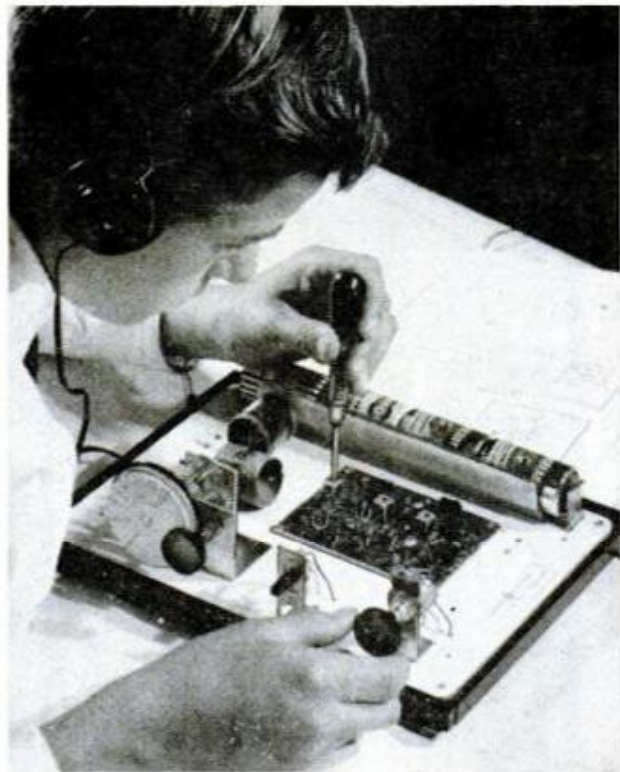


ODD OGG rolls croakingly forward when ball hits center bar beneath his mouth, but opens his mouth and sticks out tongue with razzing sound when ball misses. For 3 to 10 year olds. About \$13 from Ideal Toy Corp.

TINKER ZOO is an imaginative toy whose colored dowels and geometrically shaped sections of perforated polyethylene go together to make animals, cars, men from Mars or what have you. For 3 to 10 year olds. This Toy Tinkers toy retails in \$1 and \$2 sizes



SHORT-WAVE RADIO by General Electric is a 5-transistor set for experimenters 14 years and older. It has a clean interior layout and a superhet quality which separates stations well. Model EF 150 shown sells for about \$29.95 retail, has a plastic cover



Honorable Mentions

Buddy L Horse Van, Buddy L Corp., \$6.98.

Spacephone Kit Model S-2100 Walkie Talkie, Electrosolids Corp., \$21.97 each unassembled.

Eldon Bowl-A-Matic Bowling Game, Eldon Industries, \$16.98.

Fisher-Price Musical Tick-Tock Clock #997, Fisher-Price Toys, \$5.00.

Scottie Bagpipe, Kenner Products, Co., \$2.98.

Dino, Battery operated replica of Hanna Barbera character, Louis Marx & Co., \$14.98.

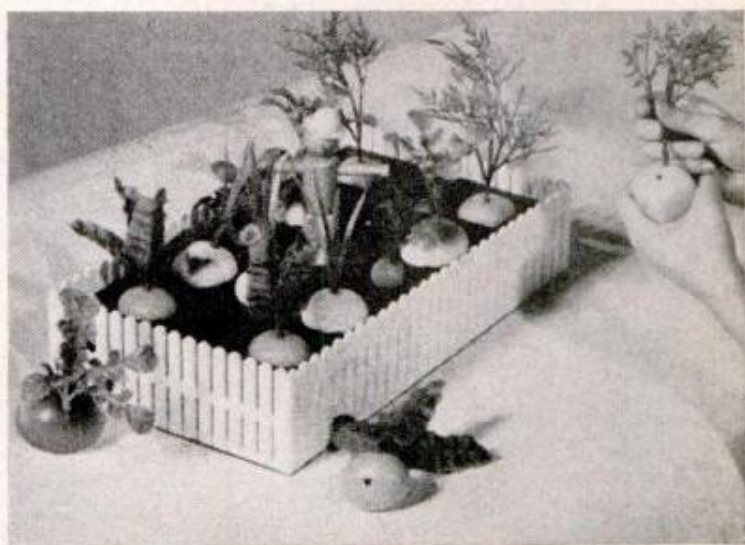
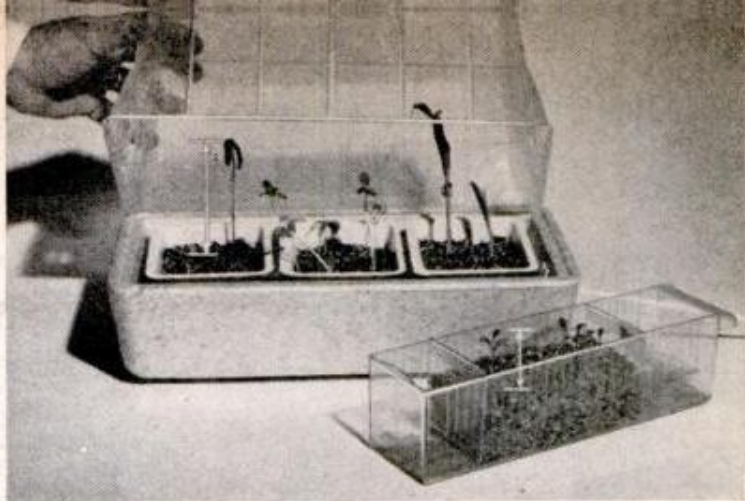
Big T, detailed custom Ford car kit, Monogram Models, \$10.98.

Doodle Dash Board #3003, Multiple Products Corp., \$4.95.

Play Doh Force Press 3-D Toy-molder, Rainbow Crafts, \$4 and \$6.

The Science Book Lab of Chemistry, Science Materials Center, \$3.95.

NOTE DIFFERENCE in seedling growth inside and outside of Westinghouse's \$13 Little Garden electric greenhouse after one week (upper right). Lakeside Toys' \$6.95 "Vegetables That Grow in the Ground" toy (right) proved immensely popular and durable. Stems of its colorful plastic plants are shaped to fit correct vegetable. Saranade Doll (\$40) comes with phono which broadcasts remotely through doll speaker



Imperial



COOLER FOR '63

ELIMINATION of last year's gun-sight tail lamps and the extension of the LeBaron's sharp roof line to the rest of the Imperial line are the major Chrysler Imperial styling changes for 1963.

They move the corporation's luxury car farther away from the heavily finned models of the late 1950s.

Use of the four-door's roof panel for both two- and four-door models permitted designers to move the back seat of two-door models well toward the rear, increase the seat's height slightly and still add a fraction of an inch to rear seat head-room. The change emphasizes the Imperial's length.

The parking brake, instead of acting on the transmission output shaft, now operates the rear service brakes. The change improved braking and allowed a reduction in transmission tunnel height. With the car in gear and the engine running, manifold vacuum automatically releases the parking brake. A manual override is provided for use in an emergency.

Total brake lining area is up almost 15 percent to 287.3 square inches from last

year's 251. Additional cast iron around the edge of the flared brake drums this year helps to cool the brakes faster, Chrysler says, to reduce brake fade.

The manufacturer expects most Imperial owners to be cool: The factory plans to install air conditioning in about 60 percent of the '63 Imperials built—about 90 percent of the LeBarons.

Other standard equipment for '63 Imperials includes power windows, a remote-controlled outside rear-view mirror, and small storage compartments hidden in the front arm rests.

Chrysler tests show a 4-percent improvement in engine breathing from a redesigned air cleaner, one of the few mechanical changes. The container is shallower, but outside diameter is up from 15 to 17 inches and the paper element (5/16 inch thinner) is 1/4 inch deeper.

The 413-cubic-inch, 340-hp. Imperial engine, a 90° V-8, and other mechanical details are basically unchanged. Wheelbase remains 129 inches. Over-all length is 227.8, up a fraction of an inch from 1962. ★★



LOOK ALIKES are '62 and '63 Cadillac (right) but new car has many changes including double U-joints, see inset

Cadillac Gets Lighter Engine, Double Universals

Cadillac stylists have an annual problem. Next year's Cadillac must look a lot like last year's, yet at the same time look brand new.

A glance at the '62 and '63 Cadillacs side by side should convince most people that the stylists have solved their problem for '63. The new car looks cleaner and crisper due principally to the removal of the "fin" that ran along the lower body of the '61 and '62, and to the switch to a straight windshield pillar.

What Cadillac calls a "modernized" engine for '63 has a new cast steel crankshaft with cored-out main bearings. The new engine is 1¼ inches shorter, but more important, 52 pounds lighter. The weight reduction is due to a new die cast aluminum

front cover on which water pump, oil pump, fuel pump, distributor oil filter and steering gear pump are mounted. Bore and stroke remain 4 x 3.875 inches leaving displacement at 390 cubic inches, and horsepower at 325 is unchanged from '62.

To eliminate high speed vibration and quieten the prop shaft, Cadillac for '63 has gone to a two-piece drive shaft with double constant-velocity universal joints at the rear axle and between the two shafts, and a U-joint at the transmission. Delcotron alternators and extended life lubrication are on all models.

Cadillacs are little changed in size for 1963. Wheelbase remains at 129.5 inches on all but the series 75 limousines, while overall length generally is up an inch to 223.

LONG LIVE THE FIN, at least the upper one which Cadillacs have worn since 1948. The 1963 car is at left





SCREENED IMAGE, left, of a Popular Mechanics cover illustrates a new method of storing and retrieving scientific data. Developed by the National Cash Register Co., the photochromic micro-image process can reduce images by a 40,000-to-1 ratio

MAGAZINE COVER, right, was reconstituted to full size from a speck on a glass slide. Scientists predict that whole libraries some day will be recorded by PCMI—with reading screens set up in every home

CRISIS! HOW CAN WE STORE HUMAN KNOWLEDGE?

By Joseph N. Bell

A steel executive insists it's less expensive to repeat a \$100,000 experiment than to pay for a search to determine whether the same work has already been done. Where can new information be stored and promptly recalled?



DURING WORLD WAR II, one of the most effective means discovered by the Germans to pass coded messages was the use of periods in otherwise innocuous documents. The message would be reduced by microphotography to the size of a single period; it could then be brought up through a microscope to decipherable proportions by the German agents on the receiving end.

The Germans accomplished this feat by blowing up the message, photographing it, then reducing it to the size of a period on a typewritten sheet of paper. It was a time-consuming and expensive—although highly effective—process, made possible only by the spend-whatever-we-must-to-get-the-job-done desperation of a nation at war.

Out of this wartime espionage technique has come an idea that may solve one of the growing problems of our technological society—that of the storage of scientific knowledge in such a way that it will be easy to find and instantly available. The accumulation of scientific data has gone forward at such a rapid pace since World War II that researchers are sometimes overwhelmed by sheer abundance. Libraries, especially, need a method of winnow-

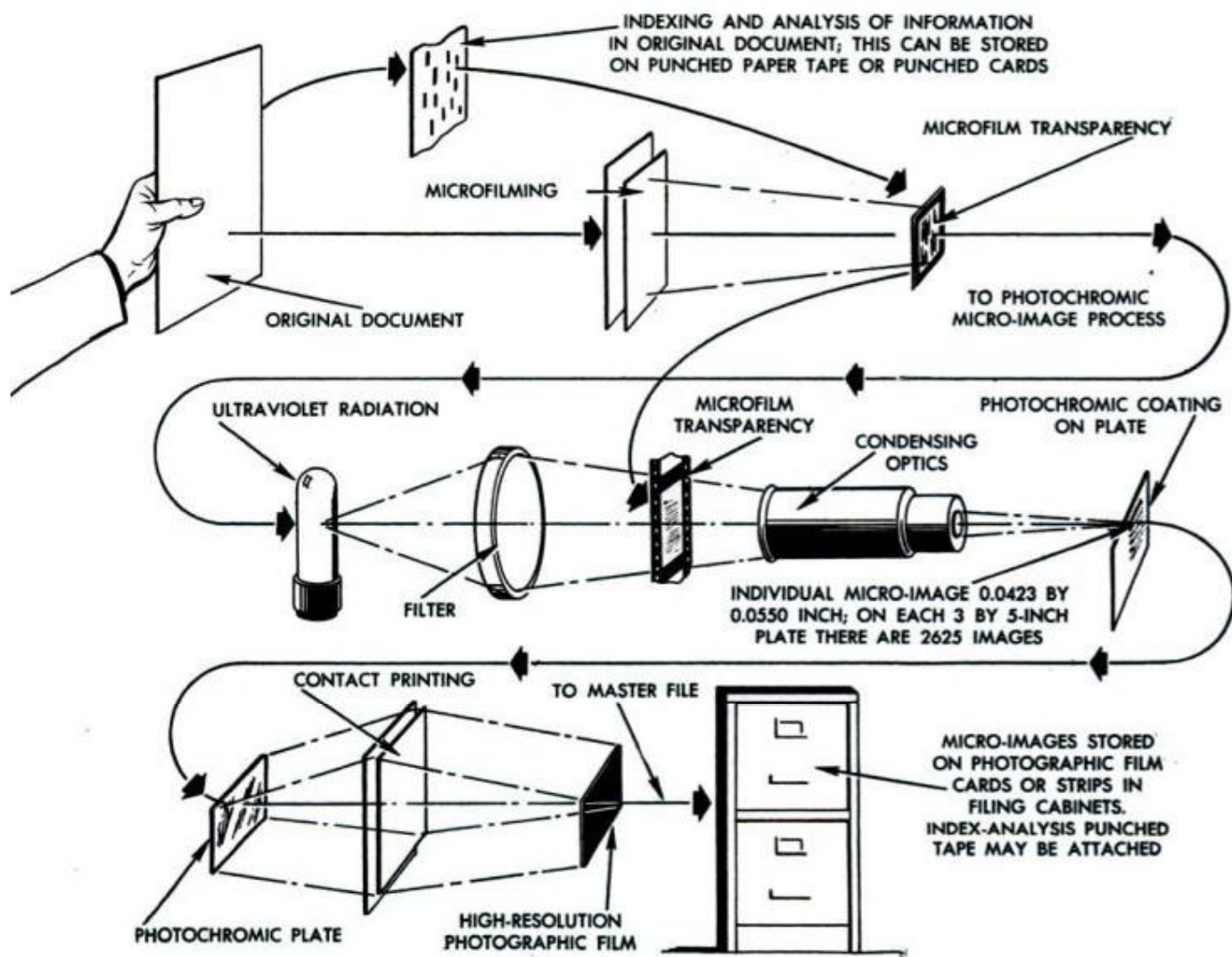
ing out desired data from the mountain of material on hand. Scientists, as usual, have a cumbersome name for this cumbersome problem; they call it information storage and retrieval.

David H. Clift, executive director of the American Library Association, said recently, "The scientist and research worker can no longer keep up with, much less read, the published materials in his field."

How serious is this problem?

During the time it will take you to read this article, some 40,000 pages of books, newspapers or reports will have been published somewhere in the world. There are almost 100,000 technical journals being published in more than 60 languages—and new journals keep appearing at the rate of two a day. This year's journals will carry well over one million scientific and technical articles. Much of this material will relate to vital areas of human knowledge that are growing so fast that even the people most closely involved can't begin to keep pace.

Fortune magazine estimates that 10 percent of the nation's public and private \$13,000,000,000 research and development

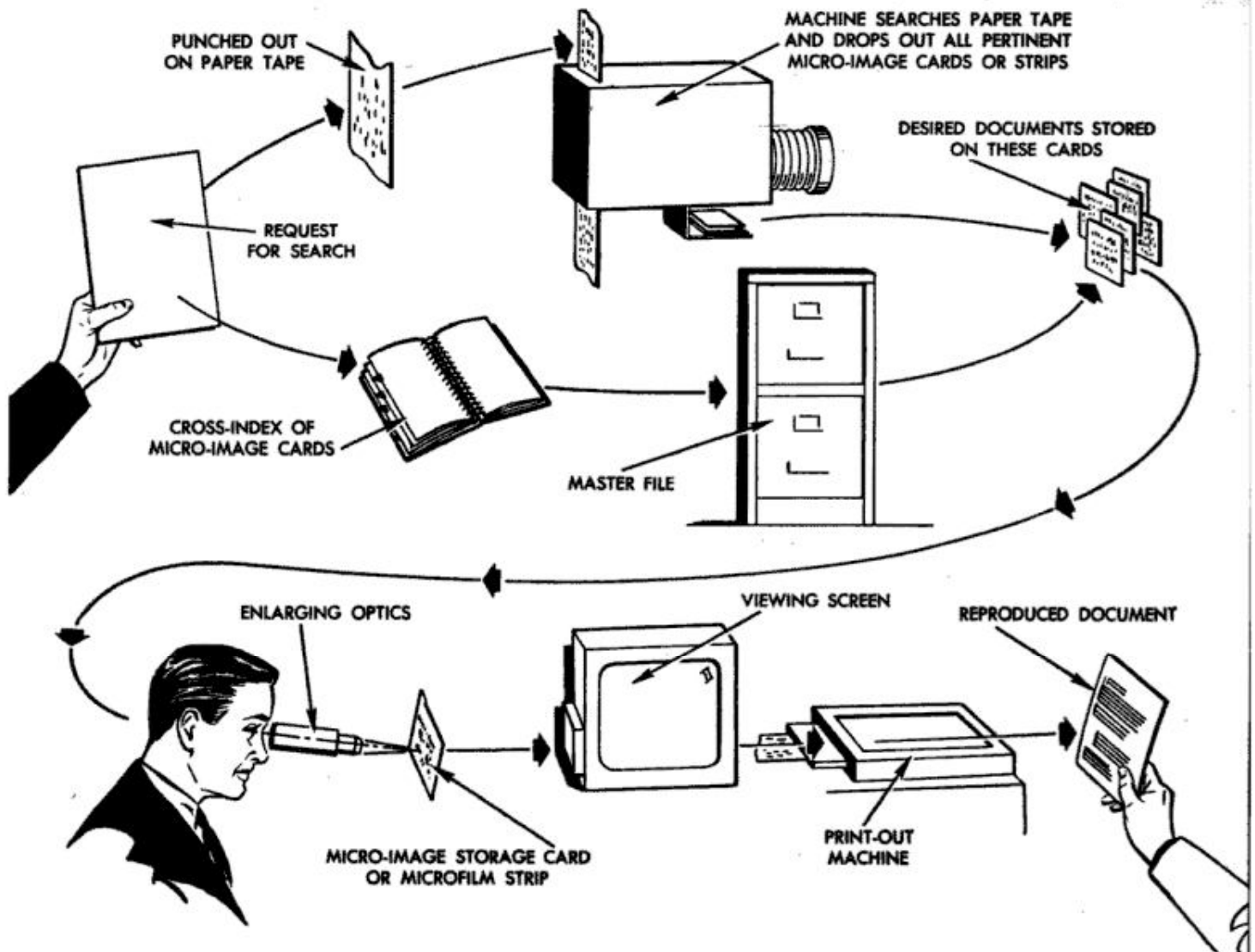


budget goes for pointless duplication of effort. Probably half of these funds would be spent differently, the magazine says, if the researchers had in hand all the facts that might be turned up from a thorough search of published material. Scientists and engineers live constantly with the fear that they are working on a problem that has already been solved and the solution published.

The ridiculous aspect of the problem is illustrated by a steel company executive who insists that it is cheaper to repeat an experiment costing less than \$100,000 than to pay for a search of existing information to determine whether it has been done before. Another company recently paid \$8,000,000 for two patented inventions only

ALREADY doing yeoman service in filming scientific and commercial data, the micro-film process was a forerunner of PCMI. Many firms, such as Thomas Publishing Co., provide subscription services for research personnel and engineers. The jumble of catalogues behind the secretary was reduced to the tidy stack of cards at right for quick viewing

..... and Retrieval



to find they were valueless; buried in the files of the U. S. Patent Office were old patents showing that both ideas had been registered by earlier inventors.

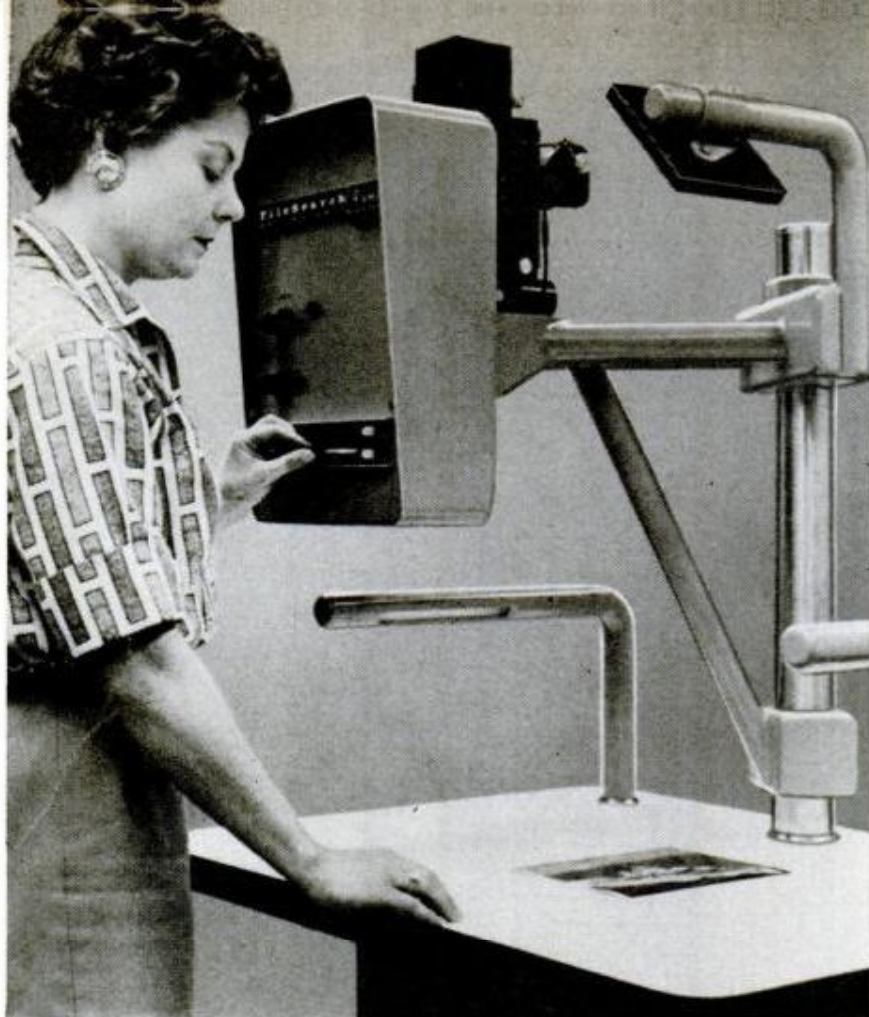
The problem has finally become so acute—and expensive—that electronic experts are searching for more efficient methods of storing, cataloguing and making use of accumulated information. Many of these efforts have been directed toward more efficient miniaturization.

One of the most promising developments in this field is the new photochromic micro-image process discovered by research scientists of The National Cash Register Co. The process permits a much greater reduction in scale of printed material and photographs than is possible with the familiar microfilm technique—in multiple quantities, at small cost, and with unrivaled clarity. PCMI promises to revolutionize the storage and retrieval of information (known as IR), and may even render our libraries obsolete.

An area reduction of about 900 to 1 is

the best that can be expected of microfilm because anything finer runs into costly mechanical problems. Photochromic micro-images, by contrast, can be reduced by 40,000 to 1 in a few seconds and at a low cost. Using a 40,000-to-1 PCMI process, it is possible to reduce 300 separate images the size of a page of *Popular Mechanics*, to one square inch of area—including 45 percent of white space around the images. This means, for example, that one three by five-inch file card could contain the equivalent of a full year of *Popular Mechanics*. A mechanical viewer would be able to pick out one of these minuscule dots and project it, a page at a time, for the reader.

Photochromic materials are *reversible*, light-sensitive dyes—meaning the information stored can be optically erased and rewritten repeatedly. Photochromic coatings resemble photographic emulsions in appearance; they can be made to retain two-dimensional images which are optically transferred to their surface. In addition, both positive-to-negative and direct-posi-



PCMI is touted by its discoverers as being the library of the future. Other electronic systems will supplement it for fast reference.

ANOTHER information retrieval (IR) unit, the FileSearch, is made by FMA, Inc. It can record a million and a half documents on film that fits easily into a single filing cabinet

tive transfers are possible. Photochromic materials are in no sense intended to replace either microfilm or photographic film. Rather, PCMI will extend the applications of these processes.

The properties of photochromics can best be understood by contrasting them with those of microfilm, which makes use of normal photographic emulsion. Here are the major points at which the two processes differ:

- Photographic film is grainy—in widely varying degrees—and thus is subject to much greater limitation in feasible reduction and enlargement. Photochromics are not dependent on clusters of molecules and thereby offer a much greater clarity of reproduction, making possible extreme reduction without loss of quality.

- Photographic film, if overexposed or out-of-focus, cannot be corrected. Photochromics can be, on the spot. The technician is able to see an immediate image, and if it is not completely satisfactory, it can be erased and replaced with a new image as many times as is necessary to get a satisfactory reproduction.

- Photographic film has to be developed before it can be read or examined. Photochromics do not; they provide an immediate image, either positive or negative, as the operator chooses. It should be noted, however, that photochromics

are brought out under ultraviolet light. They are not sensitive to natural light and therefore couldn't be used in ordinary cameras.

- While a photochromic image is being recorded, the technician is able to control the contrast and adjust it by direct reference to the image, itself. Thus, a technically near-perfect reproduction will consistently result.

- The life of the photochromic micro-image is dependent on the surface temperature of the coating. At room temperature, it will last only a few hours; as the temperature is lowered, image life extends rapidly to months and even years. However, this decay limits the use of photochromic images in their original form. To overcome this problem, NCR scientists have developed a means for transferring the micro-images to a high-resolution photographic film. Result: permanent micro-images that can be stored in minimum space.

This "master" can then be used to reproduce any number of duplicate three-by-five micro-image cards by contact printing on photographic film. When I asked, "Why not go direct to photographic film instead of using the PCMI process?" an NCR scientist pointed out:

"Technologists have tried to do that for years but have never been able to make more than a few micro-images at a time



IN RECORDING, the FileSearch codes documents for rapid selection and scanning when needed. It presents desired information within seconds, either on a viewing screen or in a hard copy. Other, and less complicated IR systems, include the familiar IBM and Remington Rand punched cards and sorters



ALL 32,000 pages contained in the above books can be recorded, at the rate of 15 books per minute, on a single 1000-foot reel of 35-mm. film by the FileSearch. IR systems vary enormously in cost. This unit sells for about \$125,000; the Minicard system, made by Eastman Kodak Co., costs up to \$3,000,000

without errors—resulting, for example, from a piece of dirt in the system or improper focus. The odds of producing a perfect three-by-five micro-image matrix containing more than 2600 separate images without error are almost astronomical. The PCMI process permits inspection and correction at every step.”

The PCMI process grew out of a broad research program conducted by NCR for many years in the fields of special papers, inks, dye chemistry, porous rubber stamps and micro-encapsulation—a process in which tiny capsules can be made by dispersing a liquid into fine droplets and surrounding them with a layer of encapsulating material. After drying, these micro-capsules form a fine powder, dry to the touch, although it may consist of up to 95 percent liquid. Inside the tiny capsule, the liquid is protected from its environment, being released only when the shell is crushed or dissolved.

The first practical application of this research was the commercially successful NCR (No Carbon Required) paper. This special paper provides multiple copies without the use of carbon paper. Basic researchers then extended their dye chemistry research to include light-sensitive dyes, seeking other unique applications.

What can PCMI accomplish? Let's look at some possible examples:

In 1961, taxpayers of Los Angeles spent

\$13,700,000 to erect a building for the sole purpose of storing old volumes of vital statistics and documents—accumulated for more than 200 years. The 13 floors of the new Los Angeles County Hall of Records will hold 81,500 books of records—and will probably be too small in another decade. Figuring an average of 500 pages per book and using the photochromic micro-image process, *all* of these records could be reproduced on approximately 16,000 three by five cards, filling a few filing cabinets instead of a 13-story building.

Probably the most aggravated example in the nation can be found at the U. S. Patent Office in Washington, D. C. The Patent Office has over three million patents, dependent heavily on bulky drawings to convey essential features—and the load is growing daily. The backlog of pending patents presently stands at about three years. The three million patents on file, averaging six pages per patent, represent about 18 million pages. A four-inch high stack of three-by-five micro-image cards would hold a million images. Thus, if all documents were reduced by the PCMI process, the entire contents of the U. S. Patent Office could be contained in a 72-inch-high stack of file cards.

Micro-images could also be used to revolutionize libraries as we know them today. With micro-images, an entire library could be reduced to a single filing cabinet of



COMPUTER FIRMS set up exhibits at the Seattle World's Fair to demonstrate how the library of the future might operate. Remington Rand's Univac was primed to answer visitors' questions based on "Great Books of the Western World"

three-by-five cards. These cards are expected to be so inexpensive to reproduce that the reader could afford to keep them. In order to read the books miniaturized on the card, he would, of course, have to have access to a micro-image viewer. Eventually it is expected that low-cost viewers will become available in all sizes and shapes. The one I examined at NCR's Electronics Division laboratory projects a picture about the size of a 17-inch TV screen. NCR engineers believe it will be possible in the future to develop a home viewer at a price within the reach of the average family reader.

PCMI could help in establishing libraries in the underdeveloped countries where one of the urgent needs is for educational materials and library resources. The cost of setting up a series of libraries in these countries using the PCMI process would eventually be very small. The same is true of parts of our own country where library facilities are either inadequate or nonexistent.

NCR engineers are not suggesting that books as we know them today would no longer exist. Obviously, some things will probably always appear in conventional book form. But the great mass of educational and technical data would lend itself well to micro-images.

However, the ability to produce and store micro-images economically and reliably represents but one step in the complex IR problem. Other vital steps include:

- Indexing the information to be stored;
- The mechanics of searching the stored file;
- The retrieval of the information after it has been found.

IR systems vary enormously in complexity and cost. Perhaps the most familiar systems are the IBM and Remington Rand punched cards and sorters. More complicated systems include:

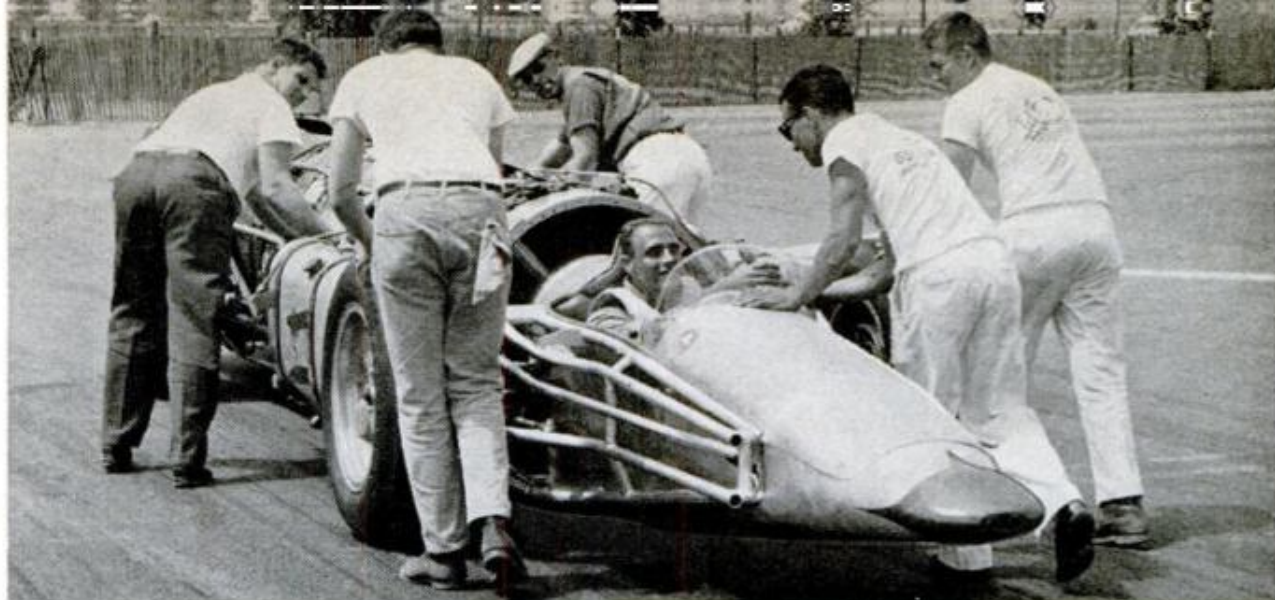
FileSearch, made by FMA, Inc., uses an indexing code imprinted beside a microfilm frame of the original document. A reel of this indexed microfilm can then be searched serially until the proper frame is found. A hard copy print of the frame is available on demand. This system sells for about \$125,000.

Minicard, manufactured by Eastman Kodak, uses individual strips of special photographic film chips, 0.6 by 1-3 inch in size, each with its identifying index code. Information is stored on the film chip at an area reduction of 3600 to 1. This system costs from \$2,500,000 to \$3,000,000.

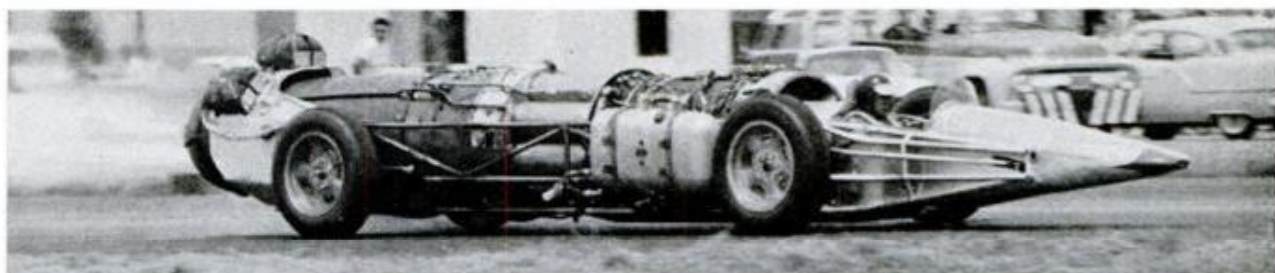
A number of companies, such as IBM, Remington Rand, Burroughs, Minneapolis-Honeywell, General Electric and RCA, offer IR systems in combination with their digital computer equipment. Many of these companies participated in the American Library Association's exhibit at Seattle's Century 21 World's Fair. The ALA exhibit projected features of the library of the future, many of them made possible by current research and development in information storage and retrieval. Most of these computer-type IR systems are both complex and costly.

The National Cash Register Co., recognizing that maximum use of PCMI will depend upon the parallel development of indexing, searching and retrieval techniques, is working with a slightly different

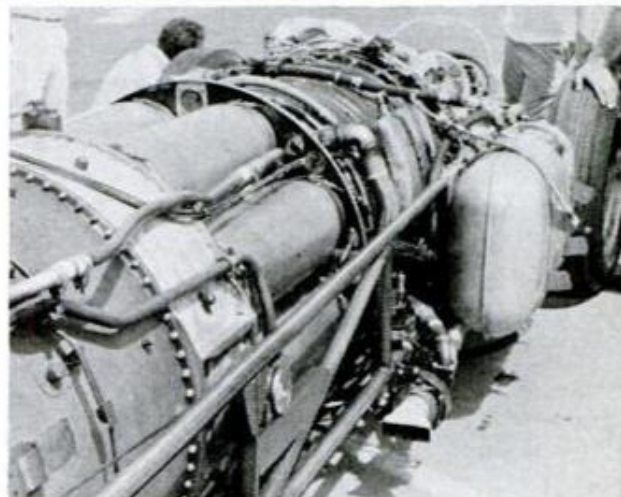
(Continued on page 224)



UNTOUCHABLE'S DRIVER, ex-fighter pilot Glenn Leasher, has set West coast dragstrips afire with the pet-engined creation, turning the standing-start quarter-mile in 7.4 seconds, with a top speed of 225 m.p.h.



STEERING combines wheel and "dead man" control that shuts off everything if pilot relaxes grip



DRIVER SITS AHEAD of front wheels and the 5000-h.p. Sabre Jet engine which develops 5200 lbs. of thrust

Untouchable—At 225 m.p.h.!

The *Untouchable* is a dragster with an F-86 Sabre Jet engine with which Romeo Palamides of Oakland, Calif., plans to make an attempt on the world land speed record.

The 5000-hp. engine is an integral part of the vehicle's tubular frame. Suspension and brakes are modified truck parts, and the entire craft weighs 5000 pounds. A nose section for the driver is the only piece of bodywork. The car is held on the starting line by its brakes until enough power has been built up for a "takeoff." Palamides and co-mechanics Ken Kamb and Vic Elischer believe their creation can attain 500 m.p.h.

SPECIALLY DESIGNED, side-mounted parachutes are used for stopping, with third ready for emergency





Fluorescent Tube Changer

Even at ceiling height single-pin fluorescent tubes can be replaced by one man without a ladder. A grip holder lined with sponge rubber minimizes breakage, pivots to change tubes from any angle. With 12-foot handle, \$31.50. St. John Tube Changer, 2134 S.E. Harney St., Portland, Ore.



Hard Hat Protects Head

Strong enough to withstand a two-ton weight, a bowler hat doubles as an anti-thief helmet designed to protect the wearer from a robber's assault. It's lined with resin-bonded glass fiber and plastic foam.

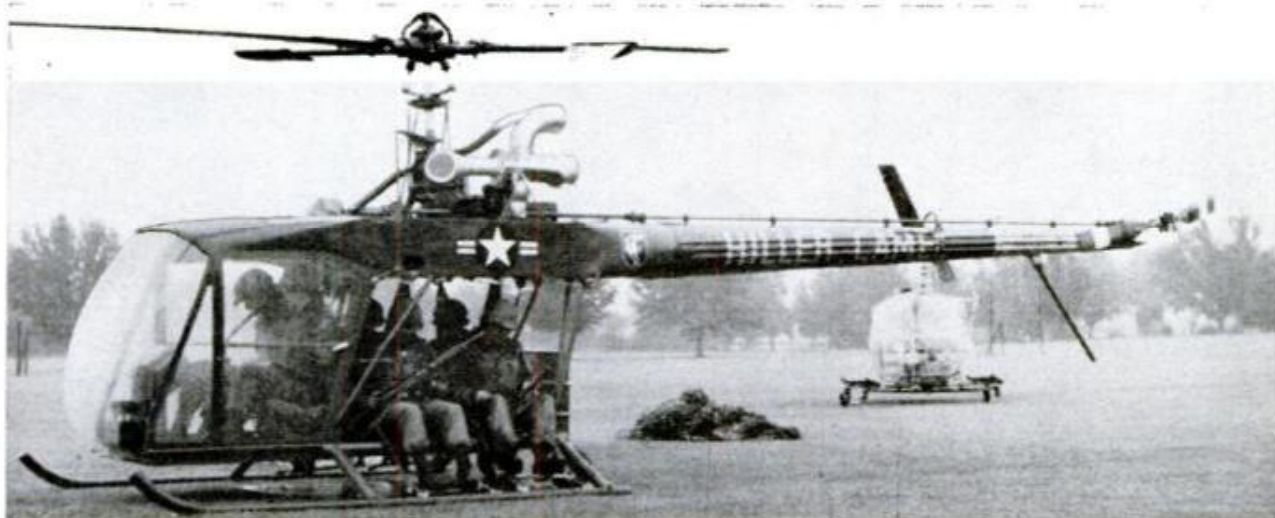
The manufacturer is C. S. Transit Ltd., Farnham, Surrey, England.



Compact Carry-All

A strong, reuseable, heavy-gauge all-purpose container (which its maker claims won't deteriorate from any known chemical or petroleum product) can be used to carry gasoline, oil or acids.

The 10 by 18-inch bag holds 1 1/3 gallons and is designed not to spill when carried full. It has a nondrip pouring spout, yet seals itself so that fumes cannot escape. Empty, it can be rolled or folded for storage in a small space; it can also be used for permanent storage of dried foodstuffs, or filled with water and frozen to use in a cooler. The Emergen-See sells for 35 cents; Fairbanks Co., P.O. Box 74, Sugarhouse Station, Salt Lake City, 6, Utah.



Instant Helicopter Can Be Carried Into Battle

Assembled from a small package that can be carried or air-dropped to the front lines, a collapsible helicopter can be put together without special tools and flown.

Called the *Camel* (collapsible airborne military-equipment lifter) by its maker, Hiller Aircraft Corp., it can also be camou-

flaged and cached by guerrilla forces. Sixteen of them can be carried in a C-130.

In flight, it can carry five troops or equivalent equipment, plus pilot. Not yet in production, the 3000-pound aircraft could be powered by any one of several light turbine engines now available.

Light on His Feet

Shoes with a bulb in the toe allow the wearer to walk in a dark room without a night light. The shoes can also be used by dancers to create special effects. The power source is a battery in the heel.

The shoes were designed by M. L. Dickens and S. W. Bilton, Orangeburg, S.C., but are not yet in production.



● Although the sun loses four million tons of mass per second, it is so enormous that its fuel should last for several billion more years.

Brought back to life by jet-age

PIONEER PLANES



By Chris Edwards

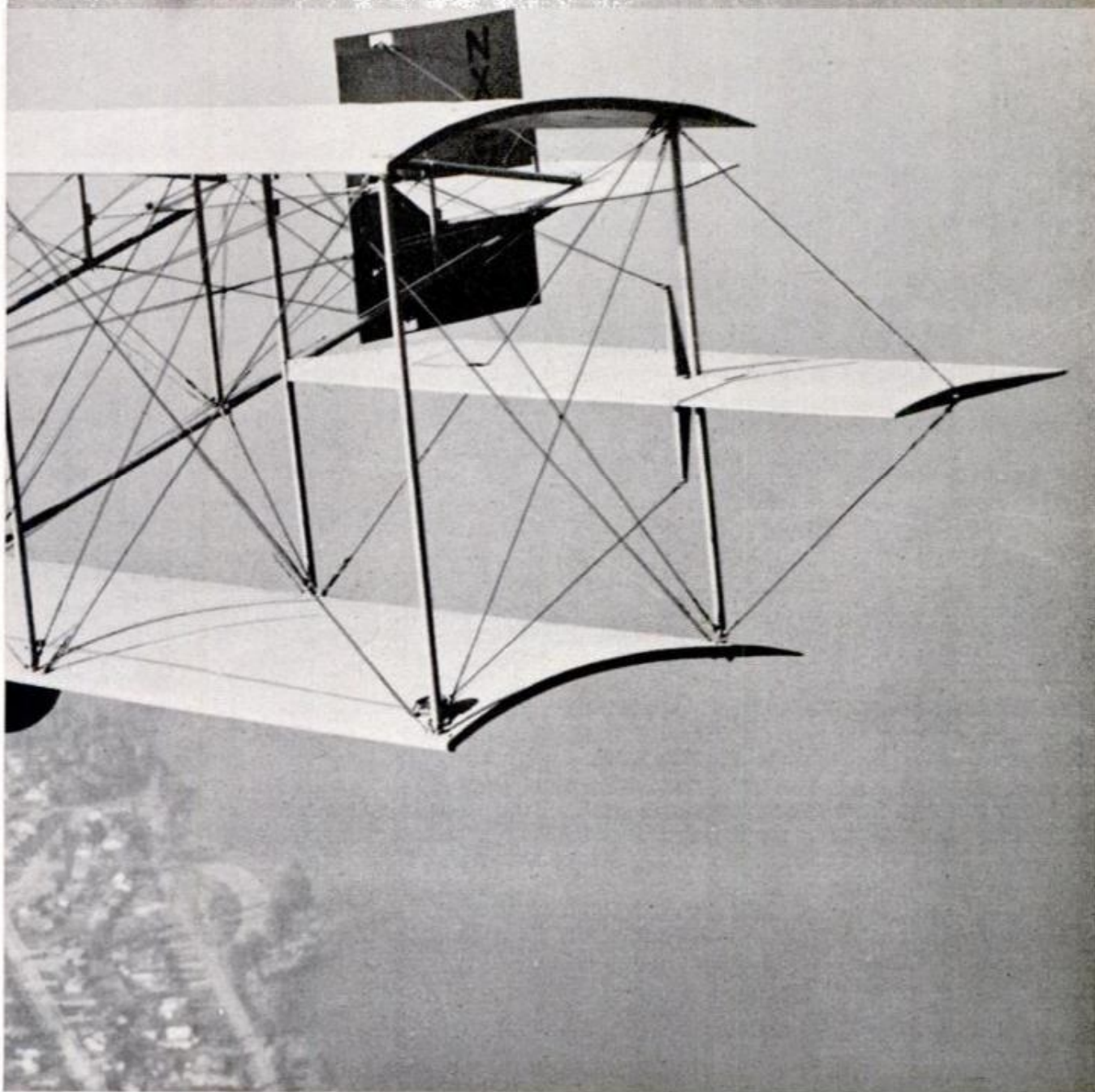
SEATTLE STROLLERS, gazing at the skies over Puget Sound, are likely to do a double take when the airplane that caught their attention turns out to be something right out of a *Tom Swift* novel. Clouds in the area frequently serve as a backdrop for an assortment of swooping monoplanes, biplanes and triplanes, held together with struts and wires, and powered by ancient pop-pop engines. These hangovers from turn-of-the-century avia-

tion are far from an illusion; nor are they "props" for some Hollywood World War I production. They are part of a flying menagerie of antique aircraft, duplicated or restored, and flown by a group of jet-age engineers. Some of the sputtering flying machines have a top speed less than one-third the take-off speed of a modern jet transport!

"We're a sort of throwback," explains Pete Bowers, founder of the group. "The

engineers ...

HEAD FOR THE BLUE



CURTISS 'PUSHER', Pete Bowers at controls, flies over Seattle. It's one of earliest replicas in air

faster we build and fly the jet transports—and they're crowding Mach 1—the more fun it is to restore and fly an antique with a cruising speed of 40 to 60 knots." Pete is a Boeing engineer who once piloted a replica of Glenn Curtiss' 1912 biplane pusher all over the United States. He took it off from an aircraft carrier in Puget Sound and wound up circling the Statue of Liberty.

Not all the old-style airplanes are true antiques. Most of the really old types now

flying, like the 1912 Curtiss and most of the World War I Spads, Nieuports and Fokkers, for example, are "replicas." That is, they are built to look like the old airplanes but otherwise are completely new. When possible, authentic drawings are used to build the replicas, but that doesn't mean that each airplane is like the original part-for-part. A Fokker triplane built by Pete looks identical to the original that scoured the skies of France in 1918 but has struc-



FLYING JENNY, a true antique, was found in old barn, its engine gone, its fuselage deteriorating. It's typical of antiques, prompting pioneer-plane enthusiasts to build new replicas rather than restore originals

tural improvements to increase performance and reliability. Like the original, however, it will use a now rare Le Rhone rotary engine actually built during World War I. The old power plant develops a husky 110 h.p. and will drive the three-winger at about 110 m.p.h.

When faded or cracked blueprints or drawings from yellowed magazine pages fail to turn up all the needed detail, the builders turn to Pete's file of antique airplane photos. By piecing together known dimensions from history books, and searching photos for proportional sizes of parts, an authentic replica can be developed. Pete's photo file which now includes more than 25,000 negatives probably is among the five largest private collections of old plane photos in the world. The pictures also aid in producing authentic markings of the period for the old timers. The camouflage on the World War I Spad was copied from one in the Smithsonian Institute.

Old Planes In Rafters

Some of the old craft restored by Pete's group are genuine "antiques". The Antique Airplane Association classifies airplanes as antiques if they are 25 or more years old, though most buffs now regard any airplane built before World War II as qualifying. Real antiques of World War I and earlier are rare, and most are in museums. Surprisingly enough, such originals usually are found in the rafters of old barns or attics.

"Old-timers, are too expensive to store around airports," Pete explains. "The place to find one is in an out of the way spot where the space does not cost anything."

Enthusiasts often build replicas simply because there are not enough bona-fide antiques available. Engines used to power the antiques are an even bigger problem. After World War I, boat owners took to stripping the engines off the planes for their boats, just as today's hydroplane builders are us-

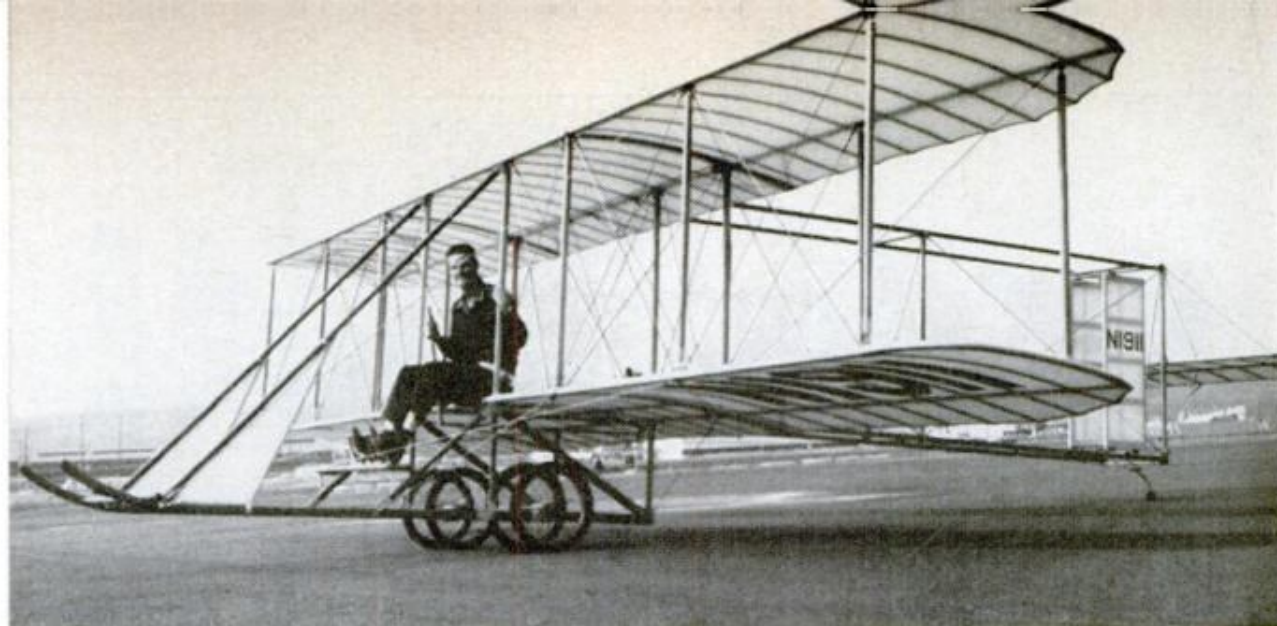
ing World War II Allison and Rolls-Royce aircraft engines.

The old engines are almost always well worn, sometimes are rusty, and usually haven't run for years. Restoring these old power plants means hand production of many parts, a time consuming and costly job.

Building and repairing rickety old airplanes is fast becoming a lost art. "For example, how many of today's airplanes use the intricate wire-braced structure that was so common on early aircraft?" Pete asks. "A good wire rigger is hard to find. And another thing, self-starters have become so common that it is sometimes difficult to remember that the antiques are 100 percent hand-fired. The job of swinging the prop on a high-horsepower engine is another lost art except for the few antique airplane flyers."

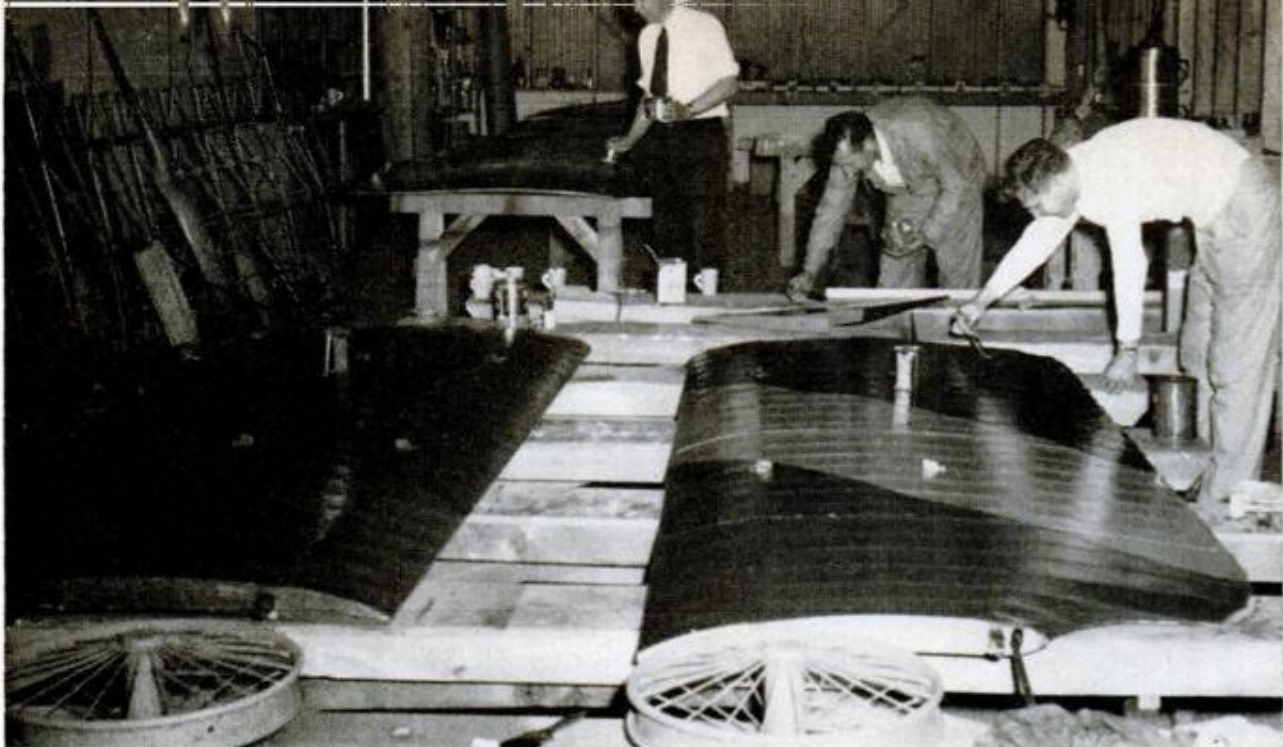
Pete's Tiny Antique Airplane Association membership is part of the much larger Experimental Aircraft Association. The members trade information at monthly meetings in Pete's shop, only four miles from Boeing's main plant in Seattle. Some members are expert aerodynamicists, for example, and will work with other members to iron out problems of wing and tail design. Another member may be an expert on weight and balance—a science that often solves flutter or stability problems. Other specialists may overhaul engines for the pure fun of getting grease under their fingernails—it's a change from daytime jobs involving jet engine and missile problems.

In addition to swapping skills among their own group, outside specialists often are asked for advice. At one meeting, a modern paint chemist and engineer demonstrated the newest techniques for doping fabrics. Other experts recently updated the buffs on methods for reinforcing structural elements with glass-fiber cloth and plastic.



WRIGHT REPLICA was built new by Bowers. Original was first plane to cross United States. Below Bowers flight tests it, without engine, by tow rope hitched to car. Glider flights prove craft's airworthiness





ANTIQUE AIRPLANES are recreated even to correct camouflage paint, this one for a World War I Spad

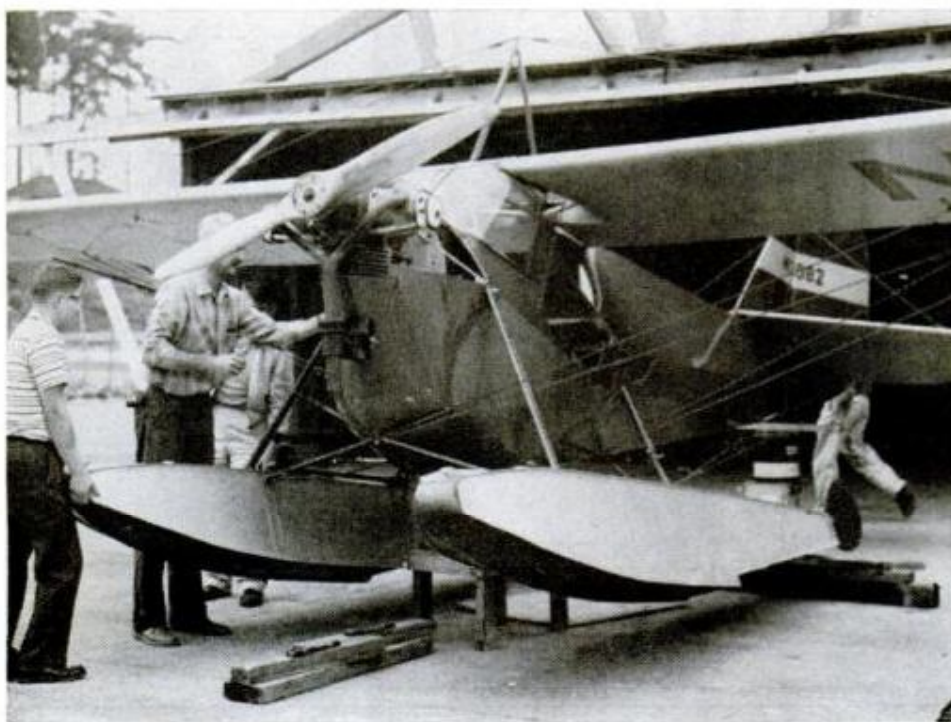
Oddly enough, restoring old-time planes is easier today than it was 30 years ago, Pete points out. Reason: better materials. "Back when wing ribs were hand assembled from small sticks, gussets and bent wood capstrips nail-glued together, the glues were not strong and didn't last long," he explains. "Once you stick ribs together with modern adhesives, they're stuck for good."

Some liberties are taken with original designs so the old-timers can fly with an acceptable degree of safety. One inimitable question asked by observers who have watched Pete "put put" over head in his

pictureseque collection of Curtiss-type sticks, wire and fabric, with pusher prop: "you do have a modern engine, don't you?"

"Yes," Pete replies. "It caused us the most trouble. When the original 'pusher' was designed and built, engines were heavy and slow. The airframe was designed to balance a heavy bulk where the engine was mounted. Our modern air-cooled engine is lighter, it turns over at twice the r.p.m. and is designed for a small diameter prop. Mounting it far enough aft for the propeller to clear the wing made the 'pusher' tail-heavy. To balance the airplane by moving the engine forward would have

ELDERLY AERONCA C-3, introduced in 1931, is genuine antique equipped with floats from another plane





PINT-SIZE REPLICA of German Fokker Triplane was scaled down to $\frac{3}{4}$ -size, fitted with new 65-hp. engine

meant building a long extension shaft with attendant vibration and bearing problems. Instead, we put nearly 100 pounds of lead up forward by the rudder pedals."

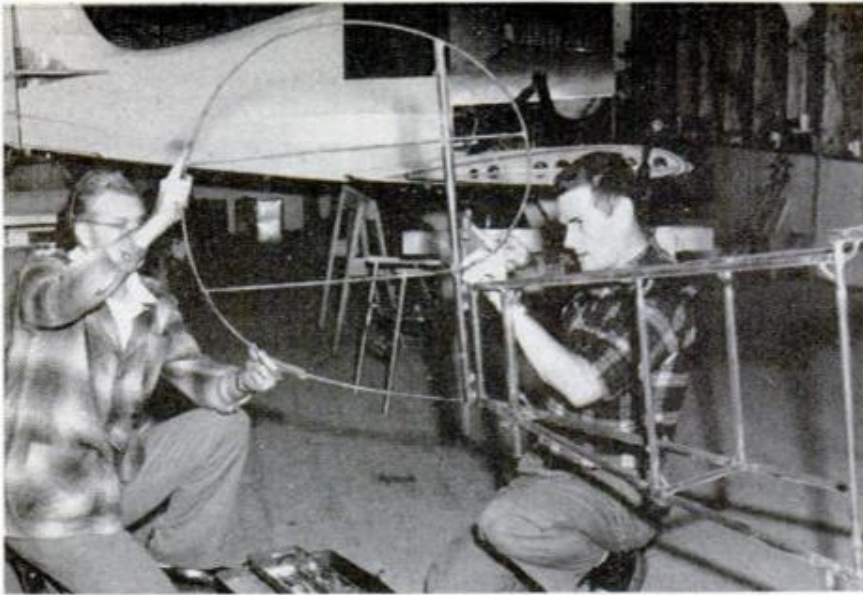
Actually, the rudder pedals are new on this replica. Originally, there were none. The ailerons were operated by a shoulder harness worn by the pilot. To make a left turn, the pilot leaned to the left while turning the wheel to the left at the same time. Such a primitive technique was considered too drastic for pilots who learned on conventional controls. So rudder pedals were installed and ailerons were linked to the wheel.

"While complete authenticity is not always in the replicas, performance characteristics are usually faithful because of the basic design features," Pete reports.

Pete's most recent project is a full-scale replica of a twin-prop biplane designed and built in 1911 by the Wright brothers (page 117). The Model EX Wright was the first airplane to fly across the United States. The airframe is now complete and Pete has tested it as a glider. About 1200 man-hours of design and construction time went into the construction with the engine and propeller installation yet to go. Even the twin propellers were built by hand because nothing

WITHOUT FLOATS, Aeronca "Razorback" flies near Washington mountains. It originally sold for \$1000





FULL-SIZE FOKKER is now under construction by antique group. Like original, its frame is made of welded steel tubing. Another experimental design is visible in background of Bowers' shop

similar is available today. Pete plans to use a Ford Model B auto engine because it is the nearest operating engine available to that which powered the original. The single engine will drive two 8½-ft. propellers.

Building the antiques could be expensive if all new parts and equipment were used. Actually, many materials are salvaged from airport junk piles and from salvage yards. Steel tubing for welding engine mounts, fuselage frames and control surfaces can be picked up with relatively little trouble. Instruments and wheels are a little harder to come by. Practically all of the old-timers were built from wood, and the straight-grain spruce spars that carry the main wing loads are bought new, along with new fabric for covering wings, body and control surfaces.

Old instruments are particularly hard to find. Few were used in early planes. A lavishly equipped craft might have an engine tachometer, water-temperature and

oil-pressure indicators, and that's about it.

Flying these antiques also presents problems. "Pilots in the old days flew by listening to the tune of the wire rigging strummed by the wind," Pete explains. "When a pilot who is trained to fly today's planes climbs into an antique or a replica, he invariably takes off and lands hot."

By 'hot' Pete refers to holding an airplane on the runway until well above lift-off speed, or bringing in an airplane for a landing well over its stall speed.

Why do the jet-age engineers and specialists spend their time building and flying rickety-looking airplanes that were outmoded years ago? Most admit their desire to recapture the "wind in the face" thrill of flying—something missing in today's efficient craft. As Pete says, "It's like sailing as opposed to power boating; flying an old-timer may not be the best way of getting from one place to another but, for some people, it's more fun!" ★ ★ ★

ANTIQUE GLIDER is also one of projects of group. This is restored Detroit Gull primary glider of 1930



Motorized Centipede

Crawling over the countryside near North Plains, Ore., is a queer assemblage of cars and a truck. It is the Centipede, a wagon-train conglomeration for traveling cross-country.

A pair of inventive brothers, Almer and Ervin Wagner, put it together. It consists of four rear halves of car bodies, and the front of a truck.

Each rear-half unit receives power from the front unit through a hinged, continuous drive shaft.



The Foamy Deep

For use in mines, a urethane foam has been developed to strengthen roofs and walls. Two commercially available chemical liquids are mixed together; they expand to 30 times their original volume within seconds.

Developed by the Bureau of Mines, the foam is being tested for binding structurally weakened roofs and ribs, sealing stoppings, inhibiting deterioration of mine surfaces due to moisture and for insulating against heat transfer.

The foam is not flammable. It bonds strongly to surfaces such as damp or dry coal, rocks, timber, cloth and concrete.

Vermin and mildew do not affect it and indications are that it will not deteriorate with age.

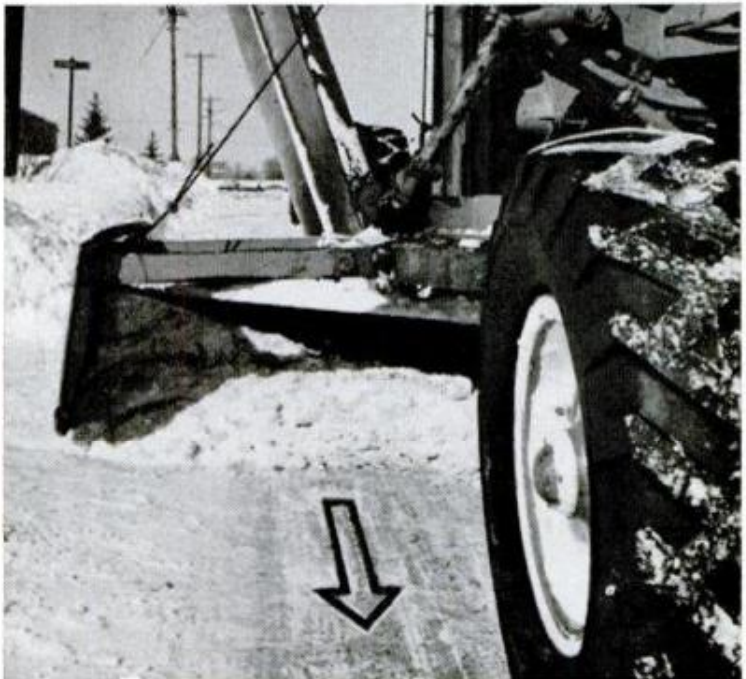


Gate Keeps Drive Clear

Moans from homeowners who find snowdrifts deposited by snowplows in newly shoveled drives can be silenced, residents of Edina, Minn., have found. They've done it by adding hydraulically operated gates to the community's snowplow blades.

In a raised position, the gate allows snow to spill out at the side. However, when the grader passes a driveway, the gate is lowered alongside the end of the blade, as shown, keeping the snow from forming a drift. Once past the drive, the operator raises the gate, and the snow is again deposited at the side of the road.

The gates were developed by Adam Batko, Edina's superintendent of public works.



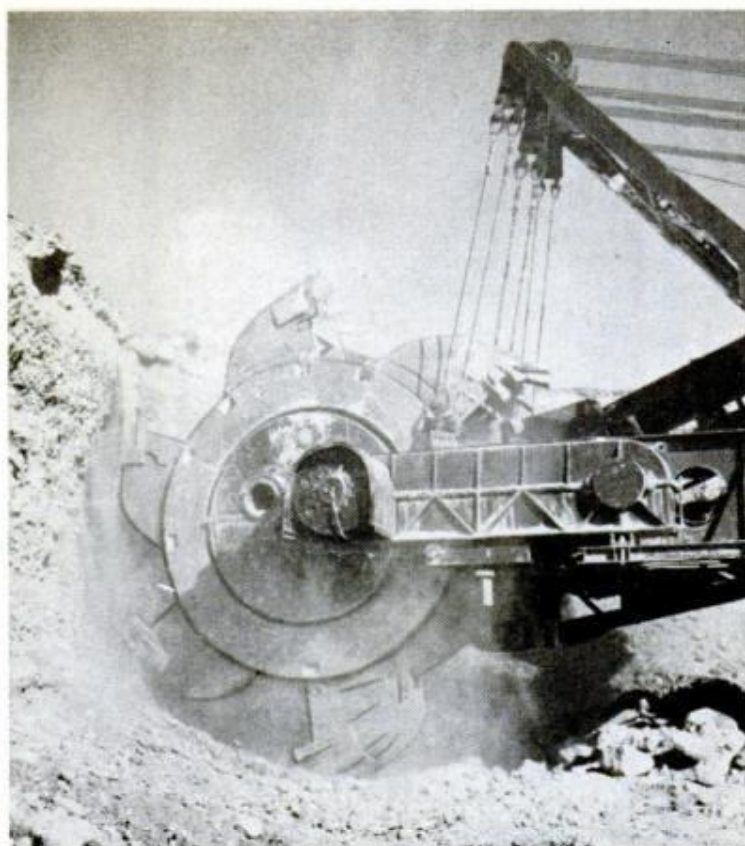
Giant Earth Chewer

Twenty feet in diameter, a giant wheel excavates 3600 cubic feet of earth per hour. It makes eight revolutions a minute, filling each of its six buckets with $1\frac{1}{4}$ cubic yards of dirt.

Shown at work along the historic Escalante Trail near the Chama River in New Mexico, the earth-devouring gargantua is the brainchild of F. K. Mittry, Jr., president of Mechanical Excavators, Inc., Los Angeles, Calif.

Its wheel swings back and forth in an arc of 180 degrees, and moves up and down via a boom. The revolving buckets are automatically emptied into a conveyor belt that continuously discharges the material through two spouts into waiting dump trucks.

The wheel operates nearly 24 hours a day, producing no peak loads and minimizing maintenance. It is diesel powered.



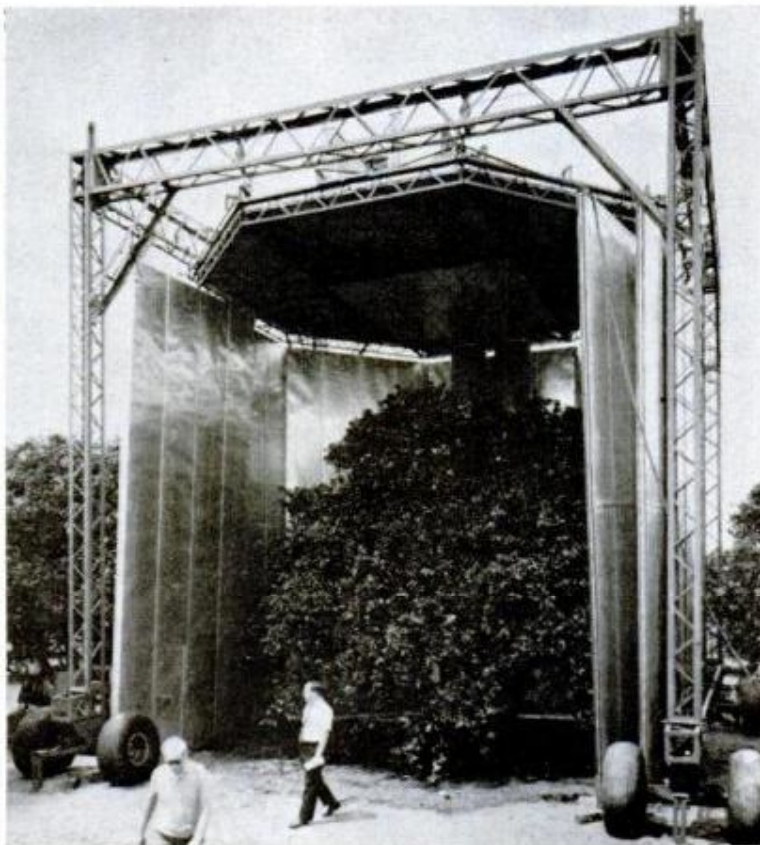
Portable Tree Freezer Tests Effects of Cold on Citrus Fruit

Down in Florida where an unexpected cold spell could ruin a season's citrus crop, they take their temperatures seriously.

A portable freezing machine, which can engulf an entire tree and produce subfreezing temperatures outside are in

the 90s, is being used in studies of the effects of cold on fruit.

The temperature chamber was designed for the Florida Citrus Commission, which is conducting the tests. Scientist, left, examines icicles produced by the machine.





Flexible-Bladed Cutter Trims Underfoot or Overhead

With its blade bowed, a double-edged cutting tool serves as a grass and weed cutter; with its blade straight out, it's a trimmer for overhead brush and small tree limbs.

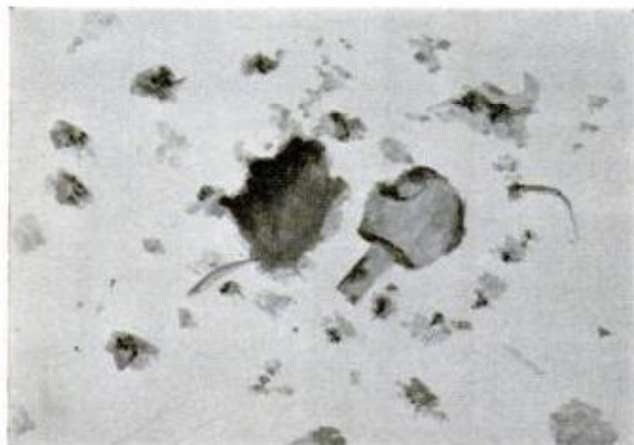
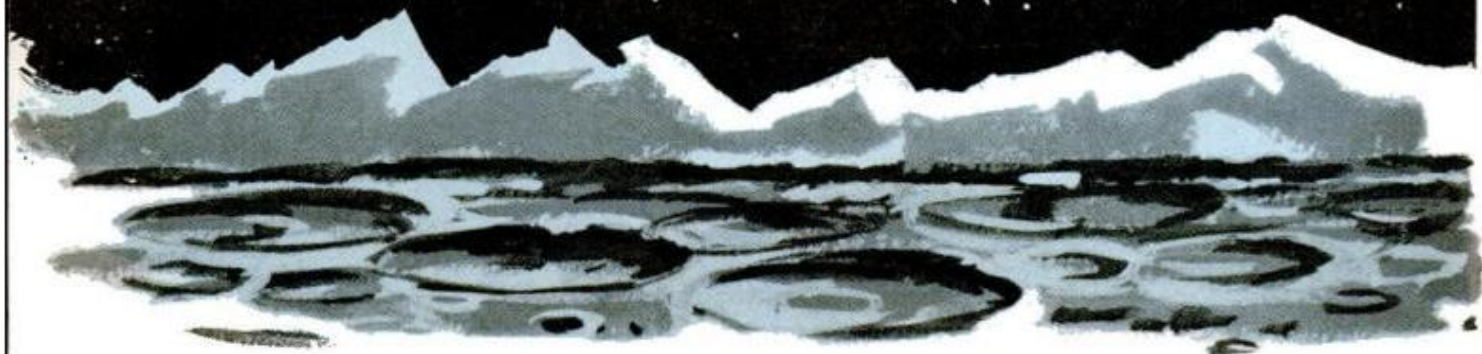
The tool, the Bow-Knifer, is designed

around a double-edged flexing blade of steel. The blade is attached to a light-weight hickory handle. The entire unit weighs about two pounds.

Made by the Jimsin Company, Franklin, La., the tool sells for \$4.95.



UNKNOWN MENACE: Germs from Outer Space



METEORITE FOSSILS (left) show striking resemblance to germs found on earth (above, right). Are they space germs? If so, spaceships will have to be equipped with germlocks to decontaminate spacemen (right)

By Theodore Berland

JETS WHINING, the shiny airliner settled smoothly on the runway at Washington National Airport near the nation's capital. It swung onto a taxi strip and stopped. A battery of trucks swarmed out to meet it.

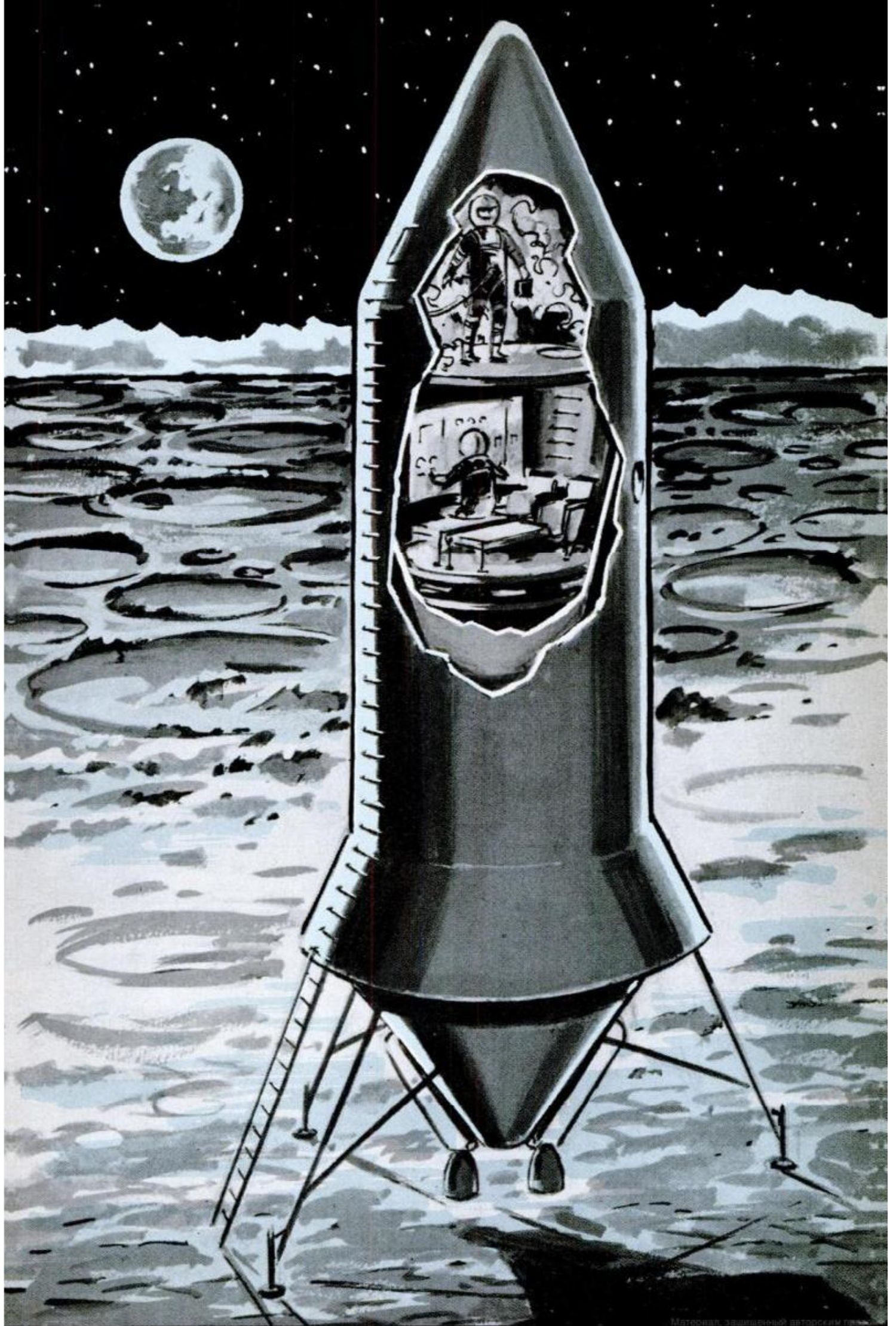
Inside the cockpit, the sweating pilots worried about their deadly stowaway. Pink fluid alive with poliovirus had leaked from a two-quart jug being shipped from a Detroit vaccine maker to researchers at Johns Hopkins University at Baltimore.

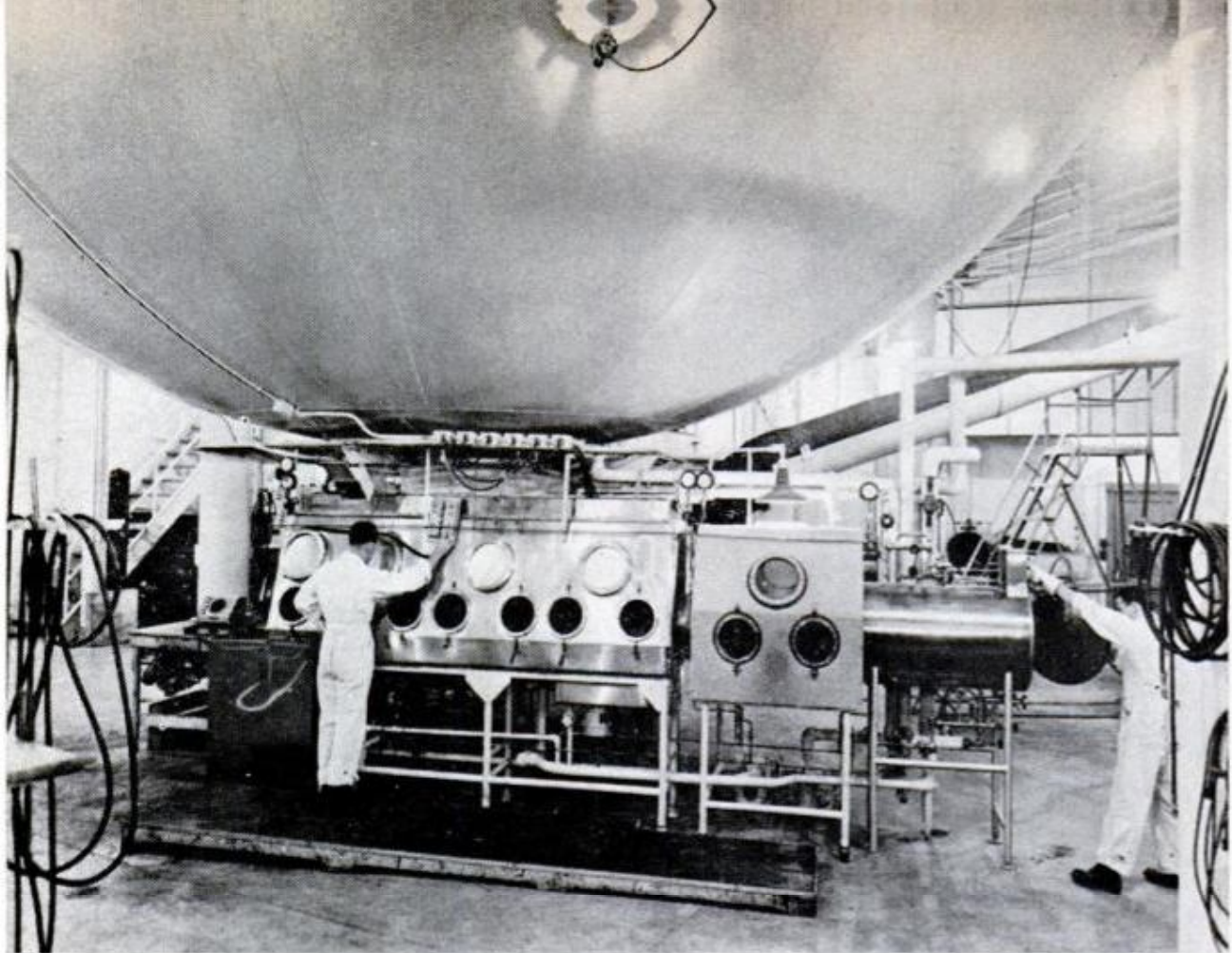
The crew and passengers fled from the plane's emergency exits. (All were later given Salk shots and had their baggage scrubbed with alcohol.) Then a team of strangely-dressed Army chemists and technicians stepped into the plane and pumped a sweet-smelling but deadly gas called ethylene oxide into the cabin.

Within hours, all of the fugitive germs were dead. The next day, the DC-4 was back in service. A major epidemic in the nation's capital and on the airlines had been averted.

This incident—which actually happened—had a happy ending. So did the invasion of germ-carrying Martians in Orson Welles' infamous radio rendition of H. G. Wells' "The War of The Worlds," which panicked several million 1938 listeners who thought it was a factual news report. Wells' work was fiction, fortunately.

Both of these seemingly unrelated incidents may, however, have an ominous—and very real—space-age sequel. What will happen when expeditions from earth go to the moon or Mars and come back with as yet unknown germs from other planets? Such germs could cling to the spacecraft or





space men and be brought back accidentally. Other samples will surely be collected deliberately by scientists for laboratory analysis under rigidly controlled conditions.

In either case the danger is there. Dr. Joshua Lederberg, Stanford University's Nobel Prize geneticist warns, "The return of such samples to earth exposes us to a hazard of contamination by foreign organisms. The most dramatic hazard would be the introduction of a new disease which would imperil human life."

Around the world, other scientists, too, are becoming concerned about what might happen if a returning space ship brought back vicious space germs, to which there was no earthly immunity.

Scientists at Lockheed Missiles and Space Co., Sunnyvale, Calif., state flatly that "human life could be wiped out."

The Lockheed men point to measles which became a rampaging killer when introduced among innocent South Sea islanders during the 1700's; and less than 100 years ago, Hawaiians were almost wiped out by smallpox carried in by foreign sailors.

At least one other industrial lab is concerned about bringing back other-world germs. Physician Charles F. Gell, chief of Chance Vought's life-sciences division at Dallas, says that an astronaut returning from a visit to another planet could bring back strange diseases for which we have no names, no defense, no cures. He added:

"The possibility of dangerous expansion of these life forms depredating and destroying earthly life cannot be disregarded."

That extraterrestrial life exists has been guessed for more than a century. But in the last two years scientific evidence has pointed to that guess as being right. Fordham University researchers found what appear to be fossils of once-living microscopic life in meteorites (see picture on page 124), and a Washington scientist found that germs from meteorites will grow.

There's a good chance that life on other worlds will be similar to life on earth. One reason is that, according to theory, the entire solar system was formed from the same cosmic dust cloud.

However, astronomer Carl Sagan of the University of California says, "While the basic chemistry may be similar, the forms of living organisms on other planets must be intriguingly diverse. On each world a multitude of different environmental problems must be solved. From our standpoint, extraterrestrial life forms should be generally unfamiliar, exotic and bizarre."

Further, says Dr. Sagan, while conditions on the surface of the moon would probably kill any living thing, there could well be living organisms in deep, sheltered crevices. Famed Dr. Harold C. Urey of San Diego—who proposed the dust-cloud theory—concludes that life-bearing meteorites may well come from the moon.

FT. DETRICK CHAMBER (left) houses deadly germs for bacteria-warfare experiments, may be prototype for equipment to test unknown space germs. Animals are put into chamber through door at right and infected

GERM-FREE TECHNICIAN (right) works with built-in rubber gloves and peers through plastic window while working with solutions in germproof chamber. Anything that enters or leaves chamber is decontaminated first



Even further out is the University of Chicago's Dr. Edward Anders, who says that we may well have had Martian germs on earth for a millenia—and vice versa. When huge meteorites, such as those that formed the mile-wide Arizona Crater, collide with

the earth, they explode with the force of an H-bomb. Bits of earth are shot out at speeds exceeding that of escape velocity. So Mars may have some of our germs.

We're even more likely to get Martian germs, he says, because Mars has less grav-

FIRST, THERE WILL BE PRELIMINARY INVESTIGATIONS

Before sending the germ-collecting expedition into space, we will have a better idea of just what kind of microscopic life there is on the moon, Mars and Venus. Even sooner, we'll know whether there is any life at all in outer space.

According to Dr. Freeman H. Quimby, chief of exobiology in the Office of Space Sciences of the National Aeronautics and Space Administration, rocket probes to the planets have started this year.

- Under a NASA contract, General Mills is sending balloons from Minneapolis to the edge of space. There, giant turbines suck the thin air through filters designed to trap the smallest microbes. If germs live at these altitudes, they can live in outer space.

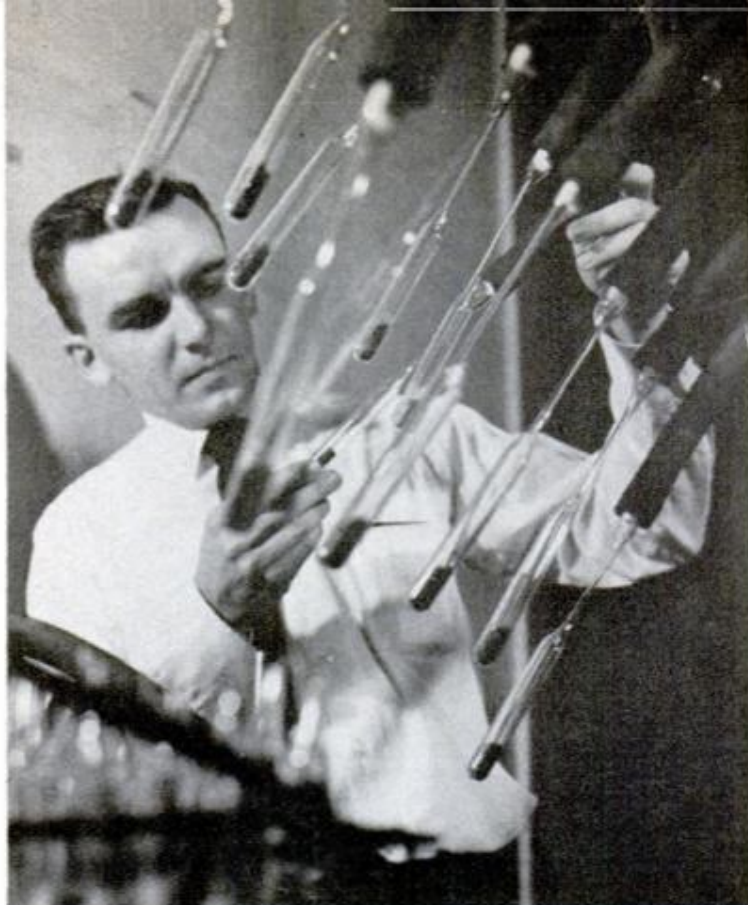
- A Mariner-R rocket probe to Venus will measure the planet's temperature—a key to whether or not life can exist there.

- Early in 1964, the first *Surveyor* instrument payload should make a soft landing on the moon. Chemical analyzers will send information back to earth. In its telemeter report may be informa-

tion about life chemicals on the moon.

- Also in 1964, we'll try a soft instrument landing, cushioned by parachute, on Mars. For this trip, Dr. Joshua Lederberg of Stanford University is designing a "multivator." It will have a sticky transparent tape to pick up germs from "any drop of water, pinch of soil or gust of wind." The germ-laden tape will automatically be run under the lens of a microscope and its image will be relayed by television to earth.

- American Machine and Foundry Co. has made a germ sample called *Gulliver* which it hopes to send to Mars, too. On landing, *Gulliver* shoots out two 100-ft. long pieces of sticky string, at 90 degrees to each other. A miniature electric motor reels the string back. As it recoils, the string dips into a special germ-growing broth. In this is radioactive carbon-14. As the germs grow, they take the C-14 from the broth and exhale it as radioactive carbon dioxide. This radioactive gas finds its way through a baffle system to the top of the device, where a detector "sees" its radiations and signals earth.



"CANALS" ON MARS, as well as occasional "green" areas lead many astronomers to think there may be some form of plant or other life on the red planet (above)

MARTIAN ENVIRONMENT is created in sealed test tubes at Illinois Institute of Technology to prove germs can grow there

MARTIAN GERMS may be captured with germ sampler, Gulliver (see box, page 127). Sticky string is shot out and reeled back

ity and is closer to the asteroid belt from which meteorites "fall."

What's more, at Illinois Institute of Technology, researcher Ervin J. Hawrylewicz has shown that moss-like lichens and some germs (those that cause food poisoning and a cousin of the one that causes anthrax) thrive under simulated Martian environments in test tubes.

Of all the planets, Mars and Venus are considered the best bets for having life. Reputable astronomers—such as Dr. Gerard P. Kuiper of the University of Arizona—are certain they have seen evidence of lowly plant forms on Mars. Venus, covered constantly by thick clouds, is still a puzzle.

Life on some planets may be completely different from life on earth. A National Academy of Sciences report says it is possible to have life based on silicon rather than on carbon, the basic chemistry of life on earth. A British astronomer, V. Axel Firsoff, says there could be life forms on Saturn and Jupiter that "breathe nitrogen and drink liquid ammonia."

Dr. Alvar P. Wilska of the University of Helsinki, Finland, says that other-world microscopic life may not come in neat cell packages as earth forms do. Such unusual germs, he says, "may not be sensitive at all to our usual sterilization procedures" and could, if brought back to earth, "profoundly alter the entire biosphere within a short time." The biosphere is that layer around the earth which holds life.

And, as California Institute of Technology's Normon Horowitz says, "We know

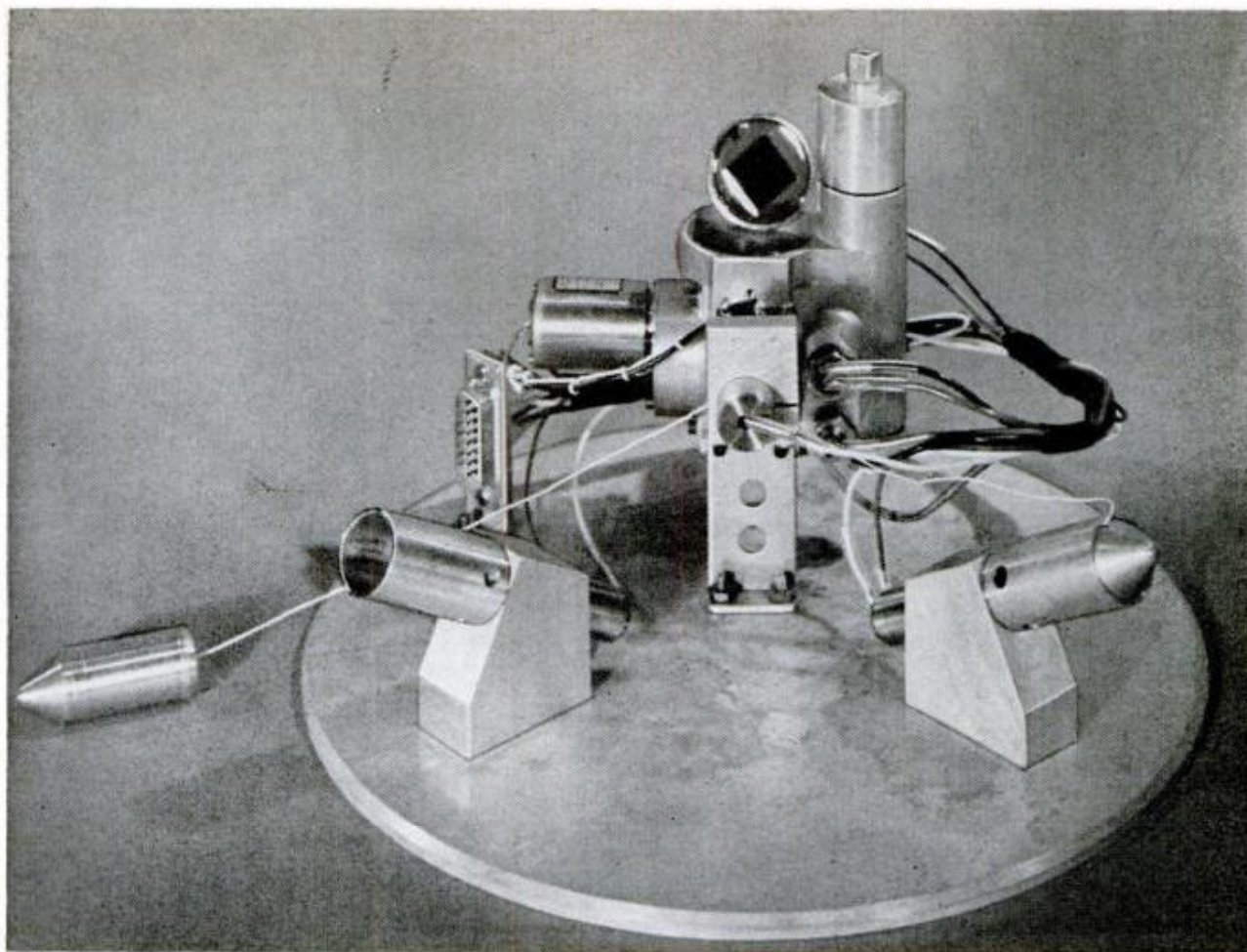
that if we import strange organisms from other places on the earth, into a new environment, they often find the new environment so satisfactory that they take it over and destroy the indigenous life."

The world's leading advocate of prevention of "back-contamination" (as he calls it) is a tall, husky daffodil-breeding bachelor who works for the Army Chemical Corps at its high-security biological laboratories at Ft. Detrick, near Frederick, Md. He is Dr. Charles R. Phillips, a chemist.

The reason for the secrecy at Ft. Detrick is that the Army conducts most of its biological warfare (BW) research there. Dr. Phillips, who heads up the physical-defense division, merely extends the principles of BW defense—kill it or contain it—to defense against germs from outer space.

To kill any germs an enemy might throw against us, Dr. Phillips's lab has turned to gases. Chief among these is ethylene oxide, which some of his technicians used to sterilize that polio-infested airplane that landed at Washington. This gas kills every known form of life, yet is harmless to the materials it sterilizes. "We at Detrick have used this method to sterilize all types of laboratory equipment," Dr. Phillips says. "We have even demonstrated that an Army 6-by-6 truck can be so sterilized, just in case you need a sterile truck."

Dr. Phillips believes, too, that ethylene oxide could probably kill other-world germs. And it penetrates besides, a good attribute of a gas used to sterilize things like the inside of a space ship. It can even



kill an unborn chick through its egg shell! But if ethylene oxide doesn't do the job, stronger—even corrosive—gases could be used.

To contain the dangerous germs of BW, his labs use chambers similar to those used to handle hot radioactive materials. They are similar, but opposite, to those at the germ-free labs of the University of Notre Dame. The chambers at Notre Dame keep bacteria out so that germless animals can be raised and tested. The chambers at Detrick—designed by Safety Director Arnold G. Wedum, a physician—keep germs in.

Detrick's pride is a several-stories-high hollow steel ball into which deadly bacteria are sprayed. Animals—guinea pigs, usually—are put inside to test the germs' potency. Around the sides and at the bottom of this sphere are plastic windows and ports with built-in heavy rubber gloves that enable technicians on the outside to manipulate the infected animals on the inside.

Air in and out of the sphere is passed through an ultrafine filter. And there are germs locks—similar to air locks—so that the guinea pigs, in their steel cages, can be put in and out.

There are also, at Detrick, laboratories filled with benchtop germ-proof chambers. Inside these chambers, the animals can be examined or autopsied; bacteria can be

taken from their bodies, grown in cultures, centrifuged and studied under the microscope through plastic windows.

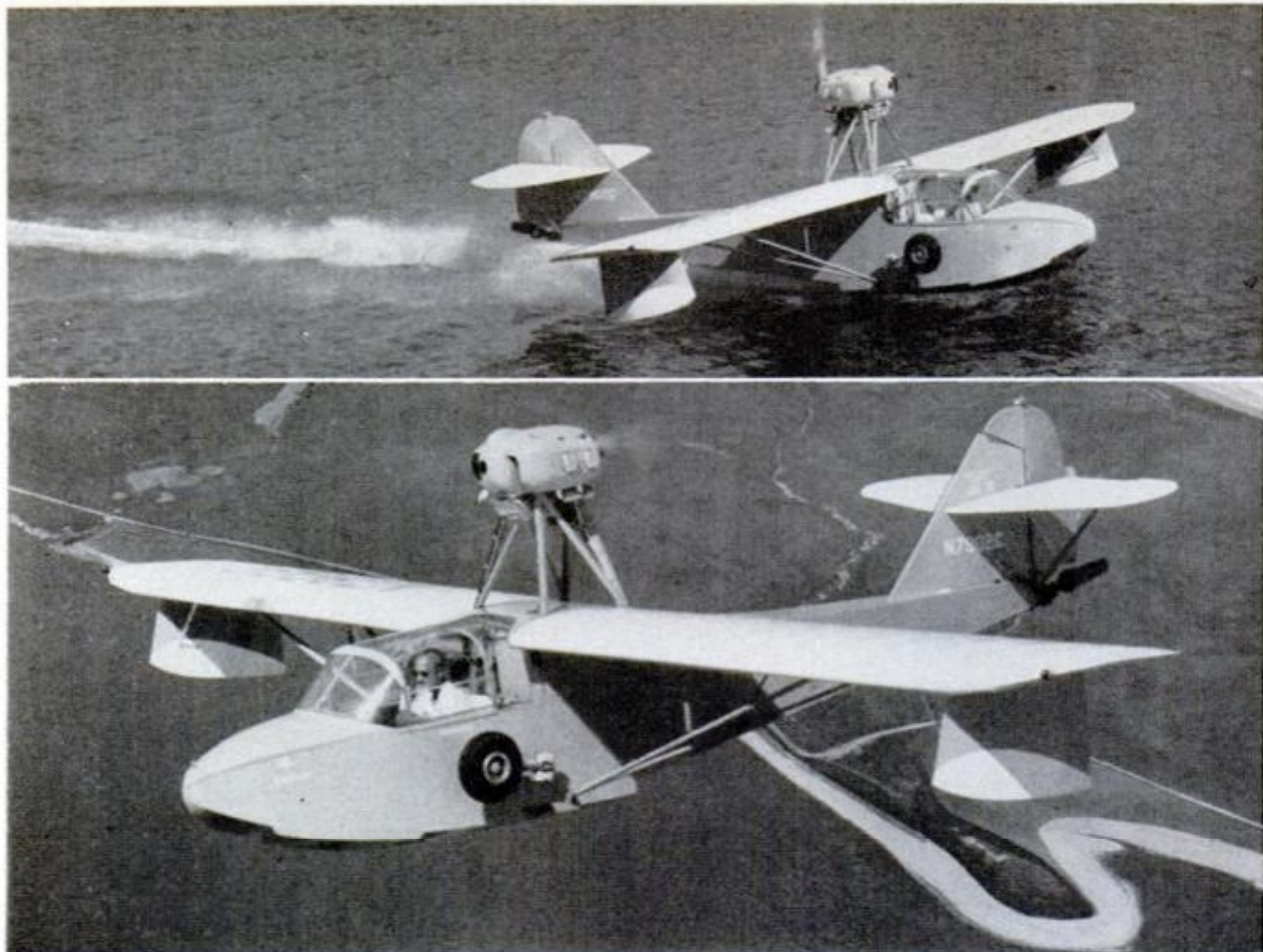
And while the animals are soaking in vicious germs, the technicians handle them safely from the outside.

Detrick's containment procedures are highly perfected. So much so that, despite the fact that they are working every day with some of the most deadly disease germs known, its workers have a lost-time accident rate as good or better than most industries.

Some people believe that germs from other planets would be no danger because they would arrive dead—they couldn't withstand the rigors of space travel. Yet it was proven long ago that when bacteria find themselves in hostile conditions, they revert to small crusty spores. And, when conditions get better, they unfold and become cells again.

Dr. Phillips cites study after study which show that spores can stay in high vacuums or be frozen to almost absolute zero (-459.6°F.) and still come back fighting. He also points out that radioactivity in outer space is too mild to kill spores. As for ultraviolet light, it would kill only the outermost layer of germs; any in the shadow would be unaffected.

[\(Continued on page 218\)](#)



Designs and Builds Amphibian for Do-It-Yourselfers

Designed and built by a Californian who claims any do-it-yourself hobbyist could duplicate it in 1500 hours of spare time, a sports amphibian has a range of 320 miles and a cruising speed of 80 miles an hour. Its wing and tail structure are from used

Aeroncas, its hull is glass-fiber-covered plywood and its engine is an 85-horsepower Continental. If you think you would like to build one of these for yourself, plans are available from Volmer Jensen, 104 E. Providencia, Burbank, Calif.



Pedals for Pencil Pushers

Middle-age spread, the occupational hazard of sedentary office workers, can be pedaled away with a piece of British gymnastic equipment designed for office use.

The unit, which fits comfortably and unobtrusively under a desk, has a pair of bicycle pedals with crankshafts fitted to a disk. Office workers can secretly pedal away inches, nervous energy and ill temper while eating lunch, typing or balancing accounts. The pedal speed can be regulated to suit individual taste or typing rate.

● The term, "dog days," used to designate the warmest period of deep summer, originated in the time when ancients studied the stars. The Greeks and Romans observed that Sirius, known as the Dog Star, rose with the sun just before midsummer. Therefore, they associated it with the hottest, driest time of the year.



Instant Space Huts Will Be Lunar Living Quarters

Coated with a plastic-foam material which foams and hardens when exposed to solar radiation, space huts and even furniture can be carried to the moon in hip-pocket packages or small canisters.

The plastic material is applied while the structure is deflated. Tests in vacuum

chambers demonstrate that when the structure is inflated and exposed to infrared lamps, the material foams into a rigid structure. In space, the lunar explorers will only have to inflate their canned homes and let the sun do the rest. The foam material was developed by Hughes Aircraft.

Soviet Building Blocks

Huge prefabricated building blocks, equipped with doors, windows and plumbing facilities, are being used to solve the housing shortage in Krasnodar, U.S.S.R.

The concrete cubes can be lifted quickly and easily into place with a crane. Russian construction workers are able to erect prefabricated apartment buildings four stories high. Access corridors and stairwells are separate units. Water-shedding roof is added last.



● *Death Valley in California holds the record for the highest temperature ever officially reported in the U.S. On July 10, 1913, the mercury climbed to 134 degrees F.*



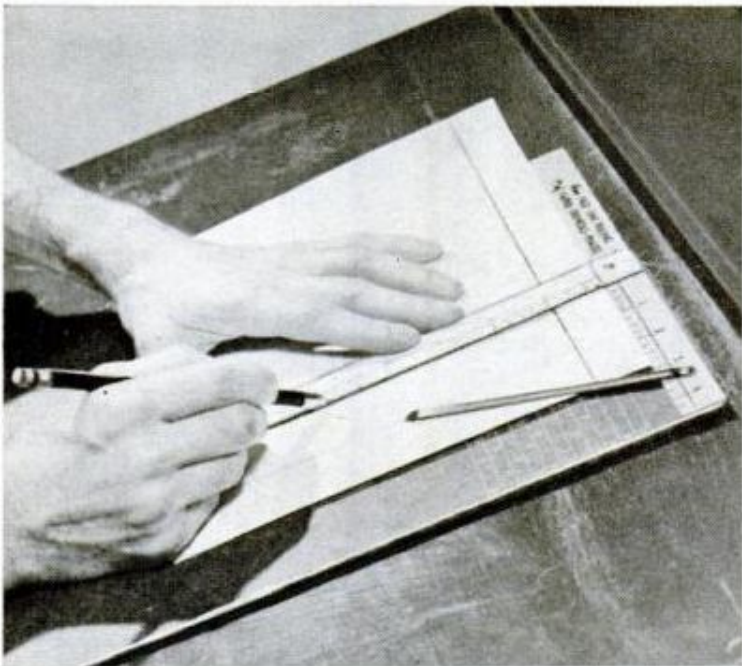
Modern Gun Slinger

To reduce arm strain during prolonged gun handling, a sling strapped around the neck or shoulders can hold up most shot-guns and rifles.

It fits all guns except double barrels and guns with full-barrel type stock. Called the Guntote, it is appropriate for upland birds, big game, skeet and trap.

A plastic-covered clip snaps down over the barrel at a point immediately in front of the fore-piece. The clip can be released for shooting merely by forcing the barrel down or out.

The sling can be adjusted to various lengths. It is listed at \$3.45 by the manufacturer, Dandale Sports Products Co., Box 403, Lincoln, Neb.



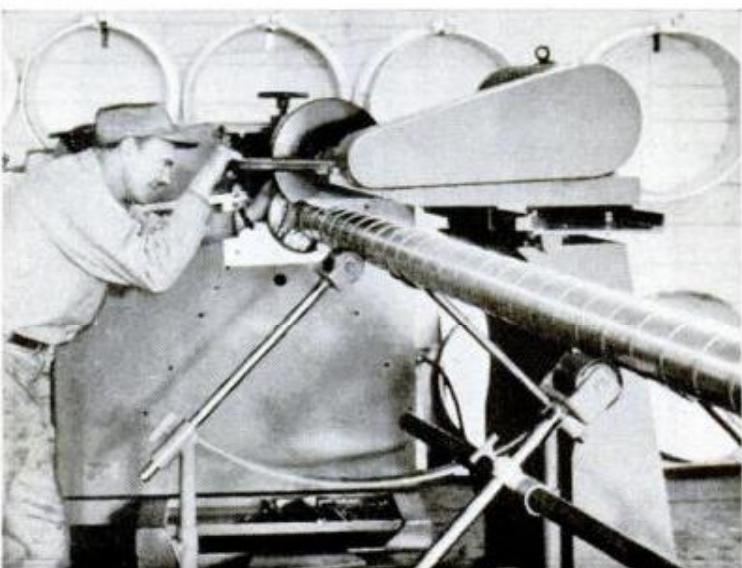
Flexible Rule Maker

Vertical lines, horizontal lines and squares, either equal or random, can be drawn with a special T-square board.

A special scale that accommodates all sizes of paper from 7½ to 17 inches long marks the spot to place the paper for the first line. A special pointer then marks the spot to place the paper for each succeeding line.

Stencils and plates may also be used with the board, or the T-square can be used for impromptu random lining.

The Speed-Ruler is listed at \$4.50 by Irwin Products, 403 N. Ridgeland Ave., Oak Park, Ill.



Pipe From Strip

Lightweight pipe, four to six inches in diameter, is being made from inexpensive metal strip by a machine that forms the strip into a spiral and creases the edges to form air- and watertight seams.

One operator produces up to 1700 feet of 12-inch pipe per day. The machine is transported to a job to make required lengths and diameters on the site.

This spiral pipe is used in heating and air-conditioning applications and in ventilation and dust collection systems. The manufacturer is Beall Pipe and Tank Corp., Portland, Ore.

PM Shopping Guide

Insulated Clothing



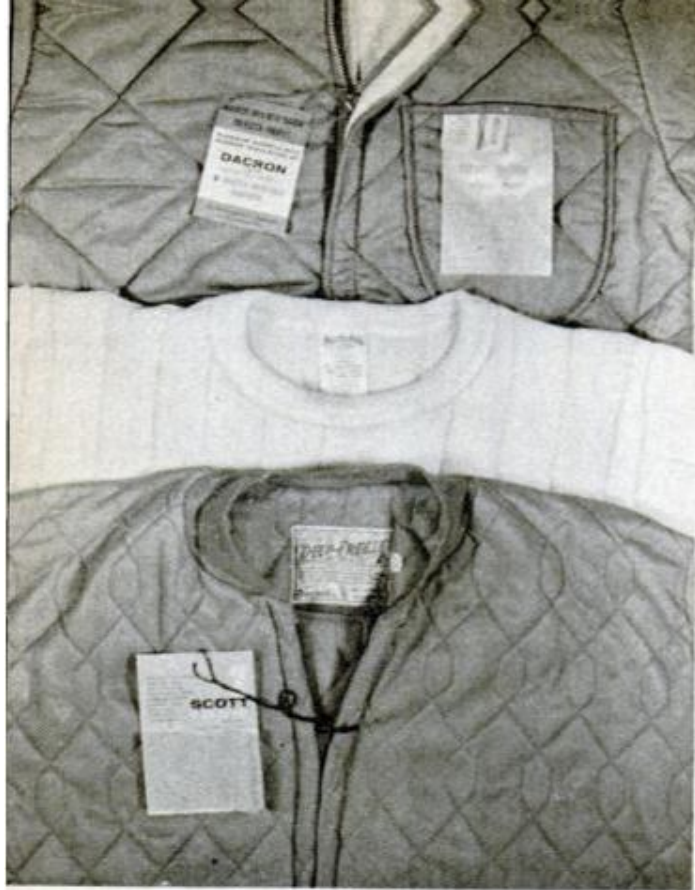
FEW PRODUCTS have changed American dress habits as much as the insulated garments that have appeared on the market. Though insulated gear had been known and sold for years, the development of inexpensive synthetic fiber fillers boomed the business until, last year, over a million and a half insulated garments were sold in this country. Sportsmen, outdoor workers, kids—everyone who spends any time outdoors in cold weather likes the idea of maximum warmth with a minimum of bulk and weight, and that's what insulated clothing does for you.

Key to this entire field of clothing manufacture is air—ordinary air. The simple rule of insulating efficiency in clothing is that the more dead air the garment traps between your body and the cold, the warmer you'll be inside. It's that simple, but there are a lot of ways to trap air, and the prices

per degree of comfort vary, too. Here's how to rate insulated clothing:

Most important factor in an insulated garment is the insulating filler that does the air-trapping. After that, the shell, or outer layer of fabric, ranks a poor second, with the lining material coming in third. Strangely, all the chemists in the business still haven't been able to produce an insulating filler as good—pound for pound—as goose down. The oldest of insulating fillers, it's still the best. Unfortunately, it's also the most expensive and hardest to buy, though experienced outdoorsmen, especially in very cold areas, insist that down is worth it.

Best synthetic fillers so far are the polyester fiber fills, downy materials that are 50 to 75 percent as efficient for their weight as down, and only about a third as expensive. In addition, the synthetics (all of them) are

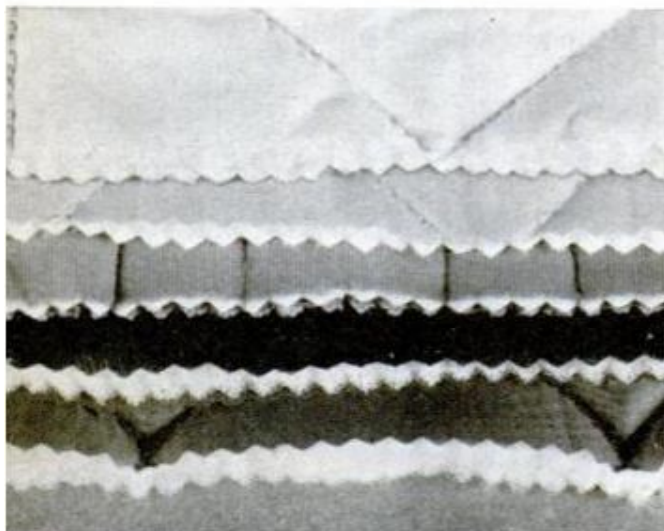


LABELS AND TAGS, required by law, list the filler, lining and shell materials. Read them

more durable, more washable, and are nonallergenic. They are often bonded in place with a light resin coating.

Polyester fillers usually come in two weights—3.3-ounce and 5-ounce (weight of the fiber batt used per 45-inch yard). Generally, the 3.3 is good enough for mild winter weather or on an active sportsman or worker; the 5-ounce is for very cold weather or more sedentary outdoorsmen. While some 6-ounce polyester fiber fill is used, the gain from increasing the

FIVE popular synthetic fillers, top down; acetate; 3.3-ounce fiber fill; polyurethane foam; foam-fiber combination; 5-ounce fiber



thickness above five ounces seems to be debatable.

Pushing polyester fillers in thermal efficiency—and probably their equal—are the new polyurethane foam insulators. A thin layer of light foam— $\frac{1}{8}$ to $\frac{3}{32}$ -inch thick—is approximately equal to the 3.3 and 5-ounce polyester fillers, respectively though no concrete research figures are available. The foams apparently match the polyesters in other desirable qualities, but so far are only available in higher-quality, higher-priced garments.

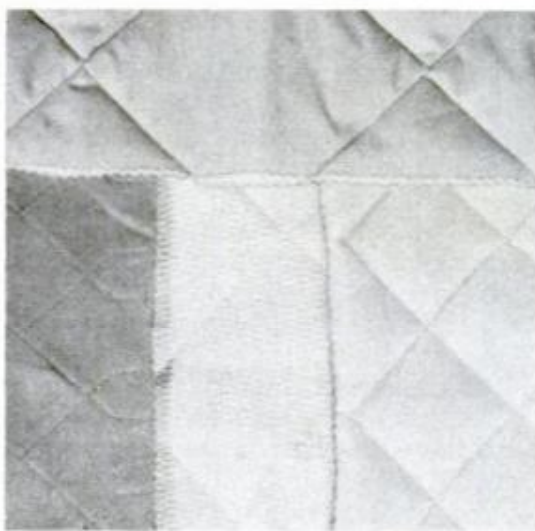
Another new idea, just out this year, is a combination of a thin layer of foam with a light layer of polyester fiber fill. The two-ply result has great insulating efficiency for its weight, less bulk than the fiber fillers, and less of foam's slight-but-sometimes-undesirable stiffness.

A very popular less expensive filler is acetate fiber, which rates as a good insulator for moderate climates—down to zero to 20 degrees. Five-ounce acetate is about equal to 3.3-ounce polyester in thermal value.

The poorest of synthetic fiber fillers is still almost twice as efficient as wool as an insulator. All the synthetics are good—but some are better than others.

Outside the insulating filler, a good garment will have a tightly-woven, water-repellent (even in underwear) shell fabric to help hold in heat, hold out wind, and protect the filler. Most experts agree that it is best to buy your insulation in the form of “under-

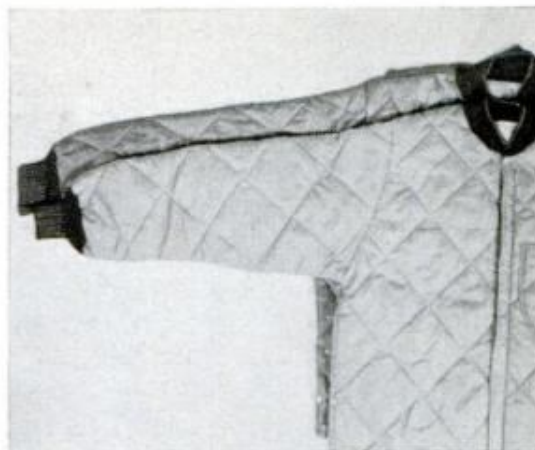
FOUR lining materials — top, conventional nylon-cotton mix; left, two-ply cotton-wool; center, raschel-knit cotton; right, nylon fleece



TIP-OFFS TO QUALITY



FREEDOM of motion is important. Look for a bellows back, diamond-shaped crotch insert, elastic shell fabric, or elastic insert panels



BETTER garments are cut fuller than cheap competitors; two jackets above are both medium. To be sure, try on both pants and shirt



WIND FLAP inside zipper is important. Also look for tubular knit cuffs (no seam), smooth zippers and snaps of self-lubricating materials



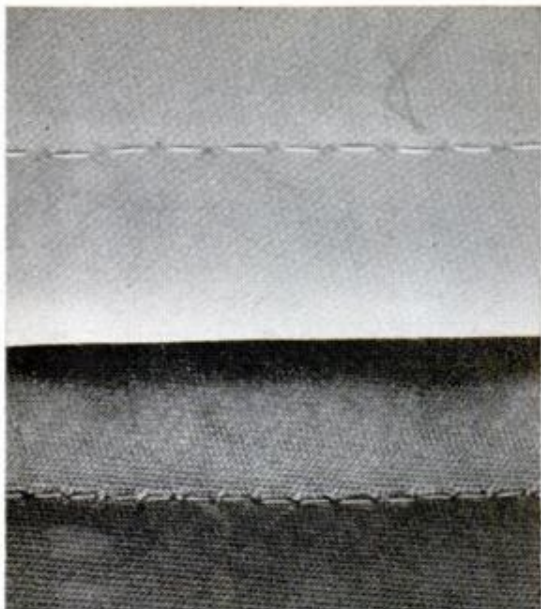
SNAPS connect pants and shirt to keep tail down while sitting. Even better is a long "kidney flap" shirt tail, or one-piece coverall

wear," to give maximum flexibility in choice of outer clothing, maximum life to the relatively expensive insulation, and to avoid the need to have the insulated garment cleaned any more than necessary. There are, however, many fine insulated outer garments, usually with a hard cotton, nylon or poplin outer fabric. Since they obey the same rules as the underwear, which is by far the most popular type of insulated clothing, we will concern ourselves with the latter.

Best shell fabric for underwear, almost all manufacturers agree, is "a high-denier filament synthetic"—a nylon or dacron material with around 70 threads per square inch in the weave. Less expensive underwear uses 50-denier shell fabrics; still lower-priced suits use rayon.

One fairly new—and promising—shell fabric is nylon tricot, an elastic weave that is much more flexible than the usual taffetalike fabrics, and which feels better to the touch—and therefore to the skin—of the wearer.

Good insulated underwear requires only a water-repellent windbreaker over it in ordinary winter weather. In extreme cold, a heavier wool shell is better (and quieter on a hunter, too). For all weather, especially heavy rain and extreme cold, it's hard to beat a good neoprene-coated nylon rain suit for complete wind and water protection. Only trouble is that they tend to be too hot, and to permit perspiration moisture to remain inside—a real danger in arctic cold. Many smart outdoorsmen wear a light nylon jacket and pants and carry



STITCHING is important. Look for nylon thread, 9 to 11 stitches per inch (top sample is $7\frac{1}{2}$; bottom 12), safety reinforcement

a rain suit along for wind, wet weather and sudden cold.

Inside the insulator, a lining helps hold it in place and protects it from wear and wearer. Almost all experts agree that a light set of ordinary cotton underwear is best beneath the insulated underwear, both for comfort and to avoid the cleaning problem that insulated gear is heir to. The lining material itself is usually nylon or a blend of nylon and cotton, though some less expensive suits are lined with rayon and some of the higher-quality suits are being lined with insulating liners for added warmth. Three good ones are soft nylon fleece, "raschel knit" cotton—a fish-netlike textured knit, and a two-ply cotton-and-wool sandwich that is a good insulated underwear fabric in itself. All three are good; all three add warmth (up to 10-15 percent more) and all three are marks of good insulated underwear.

It is generally agreed that some cotton is a good idea in the lining fabric, since pure nylon is not absorbent and is cold to the touch. A layer of wool outside the cotton-nylon lining helps the absorbency greatly, and adds its own insulating quality. Some nylon, however, is desirable for its fast-drying and long-wear qualities.

Though most insulated clothing comes in two-part suits, there are also some very good coveralls and

one-piece suits on the market. While the one-piece outfits won't let you wear the jacket alone in just-chilly weather, you won't have the tail sliding up and exposing your back with it, either. Choice of styles is pretty much up to the buyer.

Insulated accessory clothing includes hoods, socks, and mittens or semi-gloves. All work just as well as the body insulation, though the socks seldom fit well enough for long-distance walking and the mittens and gloves are bulky enough to restrict freedom of movement. Those with the elastic nylon-tricot shell fabric seem least restrictive.

Best way to tell good insulated clothing is by the labels and hang tags required by law. Though they seldom give the amount of batt weight of the materials listed and don't rate the garment for temperatures (users vary too much for that), they do identify all the materials used and show if satisfaction in the garment is guaranteed—a sure sign of good stuff.

The easiest tip-off to quality is color. Nylon is least expensive in buff and gray. A darker shell fabric costs more to make, won't show soil as easily as the lighter ones, and usually marks good underwear. The stitches can tell a lot, too.

Cost? Surprisingly low, considering what you get. You can buy a suit of insulated underwear for as little as five dollars. Not the best—but warm. A good suit of nylon-shelled, polyester-fiber-filled underwear will cost just over \$10 for 3.3-ounce filler and around \$15 for the 5-ounce weight. The best synthetic-insulated suit of underwear will cost around \$25—that gets 5 or 6-ounce polyester fiber fill or $\frac{3}{32}$ -inch polyurethane foam, with all the quality features. (Generally, suits under \$11, unless advertised as a special for a couple of dollars less by a large store or chain, are not likely to be suitable for long wear or low temperatures.)

A good suit of down underwear, in contrast, will cost around \$40—but it'll be the best, and nobody makes poor down-insulated gear. The cost of the down makes it foolish to put it in second-rate gear, and it takes good clothing to hold the down in, too.

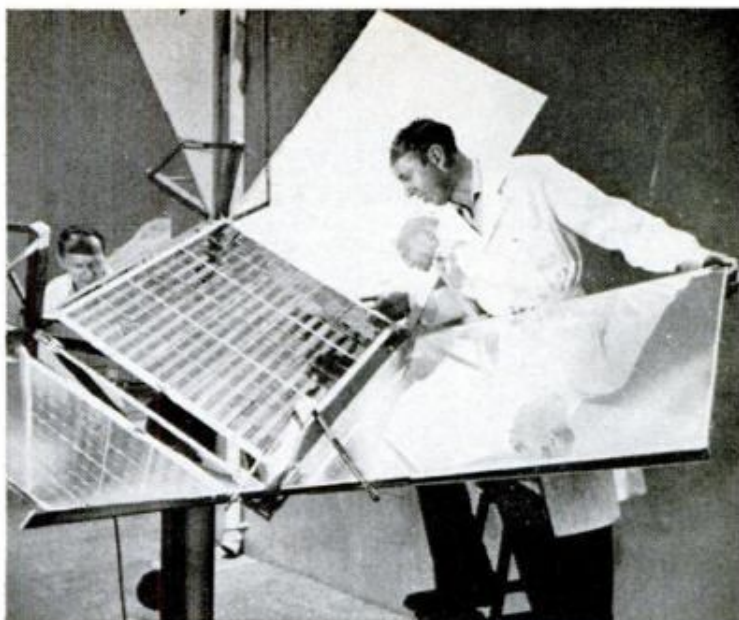
Happily, all of it is good—though some is better. Decide what you need, and pay what you must to get it. ☆☆☆

Mirrors for Solar Power

Lightweight mirrors increase power in a solar panel by as much as 170 percent.

Developed by Electro-Optical Systems, Inc., the flat mirrors are designed to fold down over each solar panel during launch of a spacecraft and open up in space.

The 50 watts delivered by the combination of the mirror and panel is more than twice the power output of the panel itself. This lowers the weight of the unit compared to what it would weigh if solar cells alone were used. The mirrors, made of electroformed metal foil, reflect nearly 100 percent of incident light.



Two-Man Sub

Seating two persons comfortably, an 18-foot submarine can reach depths of 230 feet for observation of sea life.

The streamlined vehicle, called the *Cubmarine* by its maker, the Perry Submarine Builders, Inc., of West Palm Beach, Fla., has 12 plastic portholes.

Intended uses include exploration of underwater life and ocean floors, research, salvage operations, military reconnaissance and sport diving.

The *Cubmarine* can stay submerged for up to eight hours.



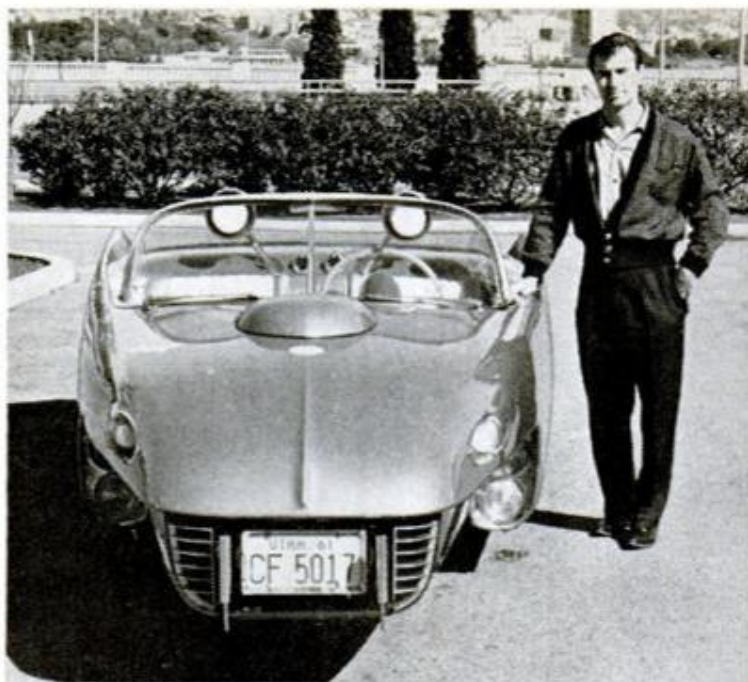
Lunar Pinball Machine

Space scientists can play pinball games with a circular table that includes a simulated Earth and a simulated moon and launches satellites (steel balls) from one to the other.

The Earth, complete with outlines of continents, revolves at a scale speed representing its daily rotation. The moon, complete with craters, is rotated around the earth by the moving table surface. Both earth and moon are set in depressions in the rubberized surface roughly equivalent to their gravitational fields. The steel ball is then launched from the earth to the moon by push-button action from a control panel.

Its flight is similar to that of an actual spacecraft flight.





FRONT OF CAR sports three pairs of running lights in all. Futuristic headrests house radio speakers, protect against whiplash



Delta-Shaped Car Is Three-Wheeler

Delta-shaped, with a single wheel in front and two in the rear, the *Vortex-2000* is a sleek departure from conventional automobile building.

The windshield frame is also a roll bar, the taillights are the full width of the car, there are six forward driving lights, and electric locks on the passenger-side door are controlled by the driver.

The car was built by Jerry Woodward of Provo, Utah, who spent six years in the process. He has test driven the vehicle over 150 m.p.h., and he says that its unique construction "allows right-angle turns at 60 miles an hour with complete safety."

The *Vortex-2000* is 17½ feet long on a 133-inch wheelbase. Rear tread is 72 inches. The engine a modified V8 that produces 450 horsepower, is located in the rear.

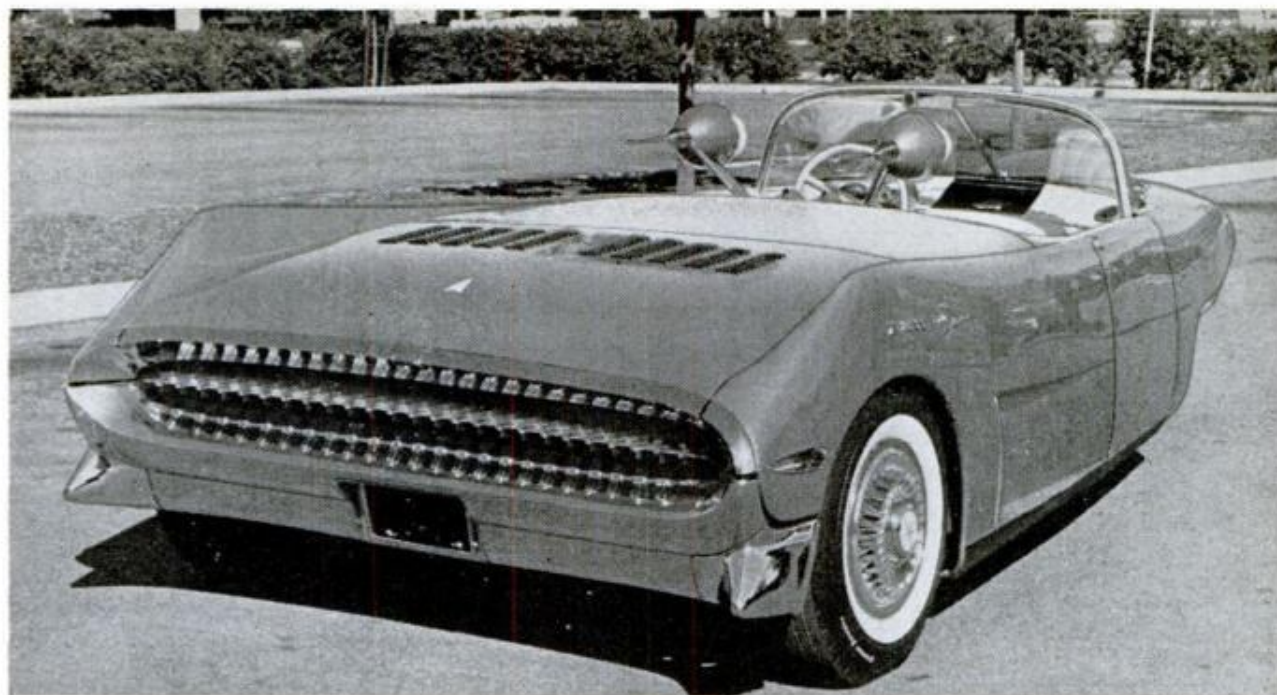
Woodward says that there are no heating problems due to hill climbing and pulling as engine temperatures are thermostatically controlled by electric fans linked to the car radiator. He feels that the shape and innovations of his car make it ideal for high speed travel along the superhighways of the future.

Orchard Snorkel

Borrowing a good idea from the big-city fire fighters, who use snorkels to get access to awkward places on burning buildings, a Wisconsin apple grower uses a smaller version to prune the 2000 trees in his Oconomowoc orchard.

Called a *Travel Tower*, the unusual vehicle consists of a three-wheel power unit, an arm and the platform. All the controls—for raising and lowering the arm and for moving the entire machine forward—are operated from the platform.

The operator can raise the platform as high as 13 feet to use his air-powered pruning shears. The miniature version of an industrial monkey has other handy uses—as a mobile scaffold, for instance.



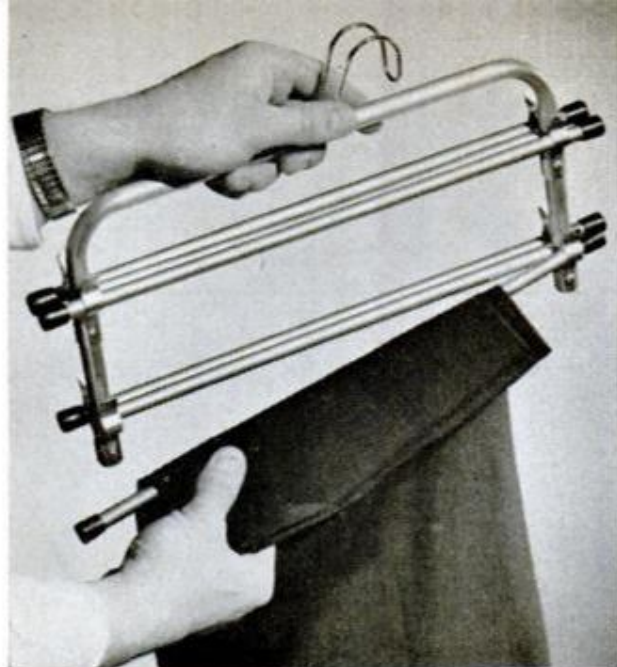
TRIANGULAR SHAPE of the Vortex emphasizes builder's use of full-width taillights which are encircled by the rear bumper. Door locks are electrically-operated by the driver. Windshield frame incorporates a roll bar



Piggyback Camper Is Contoured to Family Car

Tailored to fit the auto that carries it, a new camping unit clamps to the car without blocking the car doors. Turnbuckles on the rear bumper of the auto and a clamp-type luggage rack hold it firmly in place.

Able to sleep six and seat four at the breakfast table, the *Tourotel* has a butane stove, ice box, sink and its own water supply and electrical system. Maker is Sloat Mfg. Co., 111 W. Lowden, Fort Worth, Tex.



HANGER HOLDS TROUSERS, SLACKS and shorts without wrinkling. Swing-action of the hook keeps hanger on rod. It fits all lockers. Price: \$4 from Mar-Co Enterprises, PO Box 235, Toledo 1, Ohio



MAIL SLITTER opens envelopes. Tapping the automatic bar activates rotary blade. Costs \$18; Gifts by Terri, Larkin St., Springdale, Conn.



BATTERY-OPERATED PEPPERMILL grinds when a button is pressed. It's sold by Roberto Associates, Dept. 52, 2814 Gillham Rd., Kansas City 8, Mo., and costs \$6

OPENER WITH VISELIKE GRIP fastens to underside of shelf or cupboard. It gives a steady grip to work against and lifts lid even if container is glued shut. It opens several sizes while keeping one hand free and the container right side up. The opener is available from Uncapper, Box 1113, Palo Alto, Calif., and costs \$3





CONVERTIBLE BABY BED can be used as a conventional bed in the home or (with one set of legs extended) in a car. It is equipped with a sag-proof and wet-proof mattress. For storage, it can be folded flat. Carrying handles are part of the frame. Zipped apart, the bed converts into a safety seat that hooks over the back of front seat of car. Made by International Mfg. Co., 2512 Washington St., Roxbury 19, Mass., it sells for \$12.95

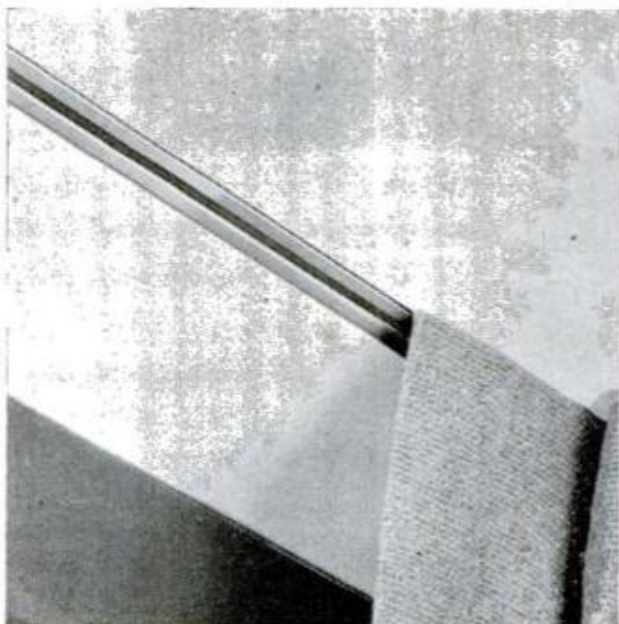


WALL-MOUNTED HOLDER keeps glasses when not in use; it attaches with glue or screws. Price: 59 cents; Roskam's Mfg. Co., 1148 SE Powell, Portland, Ore.



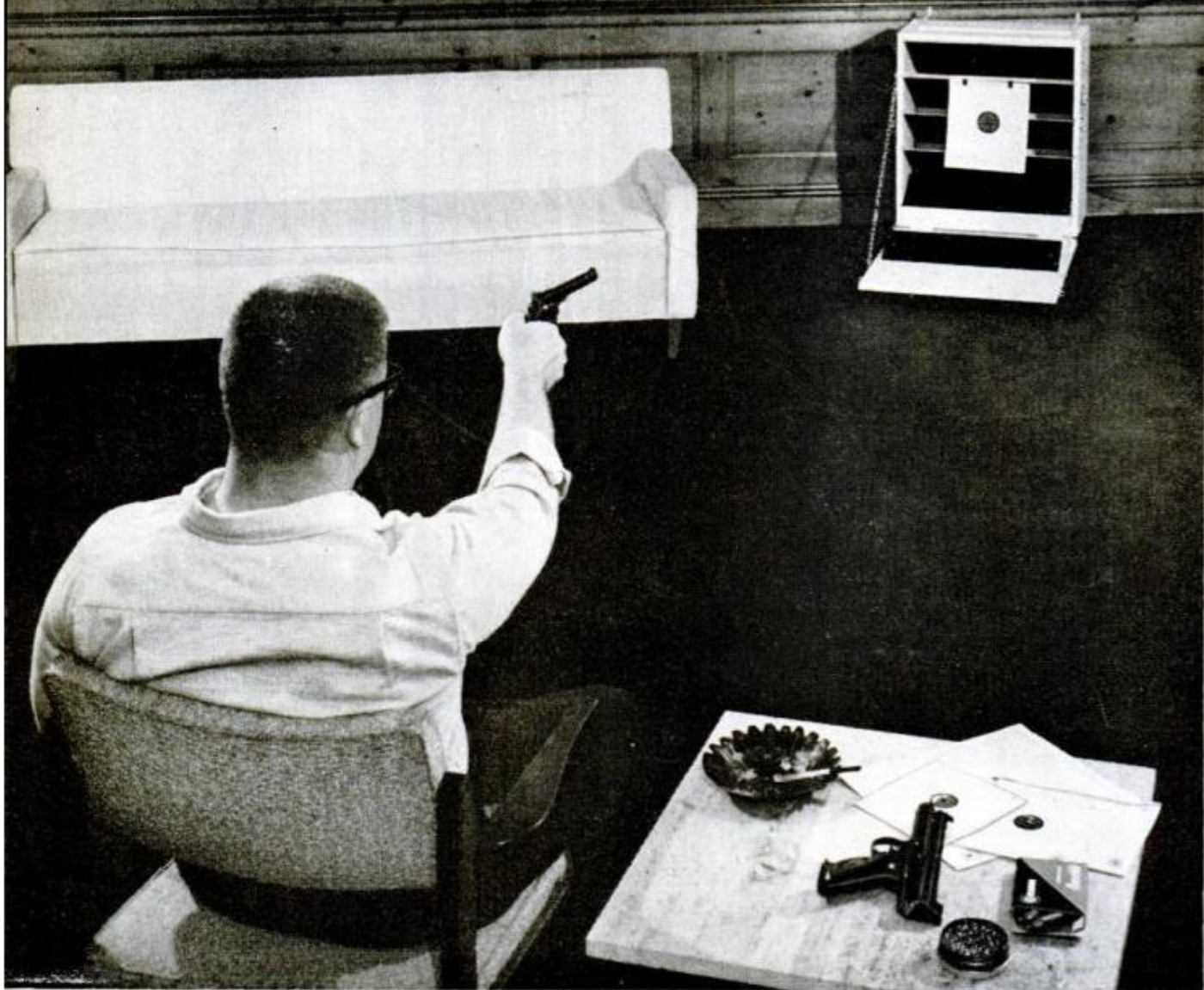
SAFETY SECURITY BOX can be installed in new or existing homes. Costs under \$30; Safe-T Products Co., Dept. SB-29, 3921 Xerxes Ave. S., Minneapolis, Minn.

RECESSED DRAPERY TRACK carries hand-drawn drapes; another similar track hides cords of cord-drawn drapes. Maker: Silent Gliss, Inc. Freeport, Ill.



FLEXIBLE-SHAFT KITCHEN AID has eight attachments to mix foods; polish shoes, silver furniture. Costs \$29.95; Taylor Sales, 226 W. Wayne Ave., Wayne, Pa.

SHOP AND CRAFTS



YOU CAN SHOOT ALL WINTER—indoors—if you have the right hardware and a proper trap. Below, some of the right hardware. Top to bottom, CO₂ target rifle; spring-powered BB gun; .22 rifle; .38 revolver



ARMCHAIR TARGET SHOOTING

By Dick Kirkpatrick

WHAT, FIRE THAT REVOLVER in the den? Sure, why not? He's shooting .22 shorts into a perfectly safe bullet trap that soaks 'em up with no danger of back spatter. It's cold outside, and he couldn't shoot safely in his suburban neighborhood anyway; it's comfortable indoors, and the thick paneled walls and acoustically tiled ceiling keep the noise down. And if his wife does complain about noise, he can always switch to the quieter CO₂ pistol on the table. They'll hardly hear that upstairs . . .

Indoor shooting, whether in an armchair or a regulation basement range, is becoming more and more popular. And more and more good equipment is becoming available for it. You can shoot anything from spring-powered BBs to big-bore handguns and rifles in your living room—if you can get away with it—in complete safety. With 15 feet of space, you can set up a range for BB guns, and the new spring-powered weapons are a far cry from the equipment you got in trouble with when you were a kid. With 25 feet, plus a little leg room, you can set up an official-scale NRA course for .22 target work. And 35 to 50 feet (plus an indulging family) is enough for your own indoor trapshooting setup if you like, using the efficient and inexpensive little .22 shotguns with eggshell birds and launching equipment to match. About the only thing you can't scale down to the living room or basement is full-sized shotgun shooting.

Living Room Rifle Range

Big-bore rifles—guns over .22 rimfire size—are no big problem, though. Too powerful to stop with a simple bullet trap, too noisy to fire indoors without acoustical help, and pretty expensive to shoot for fun. However, you can throw away the book and shoot them with wax, plastic, or small-bore insert bullets; then the big gun becomes very practical and quite inexpensive for indoor plinking. The power for all three systems is just the pistol primer—no regular powder charge at all. It provides power—and accuracy—enough for close-range indoor shooting, and still feels like the real thing. So you can shoot your .30-06 in the living room, too.

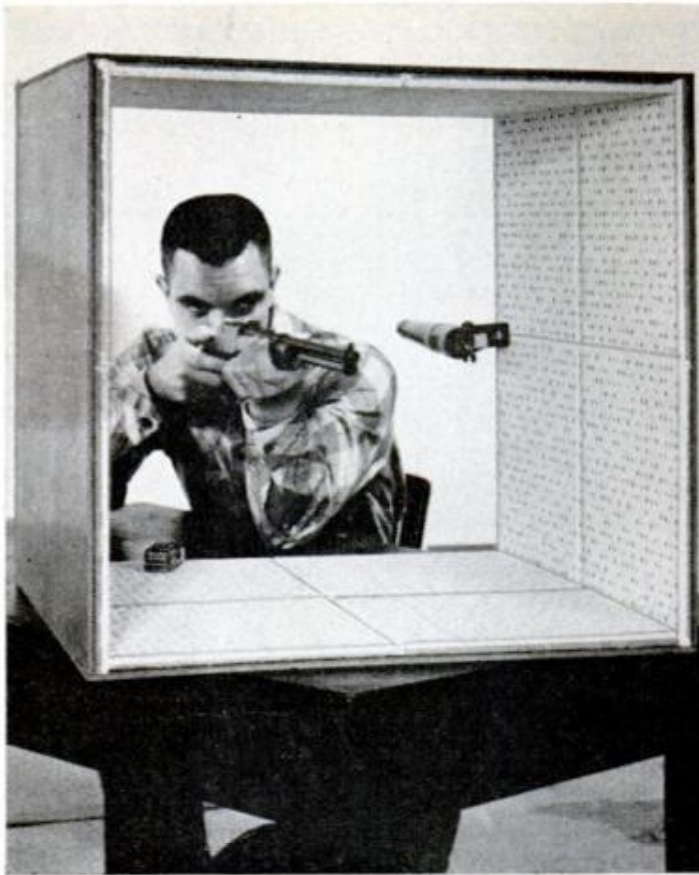
Wax bullets are probably the easiest, and certainly the least expensive. Starting with an empty cartridge, you fit in the proper-sized primer (large pistol or shotgun prim-

ers work best) for the power. You melt a pan of paraffin (or, better still, specially-made bullet wax you can buy at a sporting-goods store) and pour it into a shallow pan until it's about 5/16-inch deep, though the depth isn't critical. Shove the empty case down through the cooled wax like a cookie cutter, then lift it back out with a slight twist, and it's loaded and ready to fire. For serious wax-bullet shooting, you'll want to drill a few cases to take the big shotgun primers for maximum power, or buy pre-drilled cases designed for that kind of loads. There's a wax-loading kit on the market that contains all the equipment plus some simple tools to simplify reloading plus a supply of special wax that doesn't foul gun barrels as much as paraffin. In either case, you'll want to clean out the barrel frequently to remove wax deposits. For best results, the flash hole inside the primer pocket needs to be opened to about 1/10 inch, too. For the wax-bullet man, there are precast wax bullets that fit right into the cases, but they aren't reusable.

That factor brings up the second way to shoot big-bores indoors. You can buy molded nylon cases and bullets that work like the wax outfits, using the same primers for power. The nylon slugs, though, are tough enough that they're reusable indefinitely as long as you shoot into a fairly soft backstop. While neither wax nor plastic bullets will reproduce real-bullet accuracy, you can get three-inch groups at 25 feet with any of them and probably a little better with the nylon bullets.

One big advantage of wax bullets for western-style shooters: The fast-draw boys use low-primer loads and soft wax bullets and draw down against themselves in a heavy plate-glass mirror. The wax won't break the heavy glass, and it sticks where it hits for scoring. But don't try it out on the antique pier glass. Wax bullets do deliver a pretty good punch. They'll break ordinary glass, and can deliver a pretty good bruise—maybe even put out an eye. Whatever "soft" load you use, handle the gun as if it had real bullets in it.

Another way to shoot big-bore handguns indoors is to use the cylinder insert bullets that use a primer to fire a BB through a short barrel built into the case. They carry out through the barrel without touching it, hit hard enough to penetrate 3/4-inch plywood at 25 feet and deliver fair accuracy.



The cost of primer-powered shooting is very low. The primers themselves cost less than a penny apiece; a pound of good bullet wax costs about 60 cents and is reusable. Brand-new, specially drilled .38 cases for wax-bullet loading cost less than eight cents apiece, and the full reloading kit is under \$5.00. The nylon bullets cost from \$1.50 to \$2.00 for six (plus primers, which can't be mailed to you) and are reusable until you hit a hard surface with them. The set of six inserts to fire BBs through any size handgun costs under \$9.00, plus primers and BBs. None of the systems is very expensive compared to the real thing.

For pure fun-shooting, it's as hard to beat the old spring-powered BB gun now as it was 20 years ago. The new ones are a lot easier to use and harder-hitting than they were then, too, but the cost is still only the price of the BBs—and they're reusable if you shoot into a soft backstop like the one shown on page 144. The best BB gun you can buy costs around \$12.00, delivers good, consistent accuracy at BB-gun range (15 feet) and hits 350 feet per second for impressive punch at that range. With good, copper-coated steel BBs selling around 50 cents a pound and the power coming from your good right arm, it's a lot of shooting for as little as a dollar.

Next best for economy, but accurate enough to be used in National Rifle Association 25-foot competition, are the hand-pumped pneumatic guns. They use arm

power (and more of it) but shoot BBs, .177 caliber or .22 "skirted" lead bullets through a rifled barrel. You can pump them from 2 or 3 up to 10 or 12 strokes, and get low power for soft backstops and indoor shooting, or very good punch for long-range shooting or varmint hunting. The gun is more expensive than the spring-powered models (at \$25.00 to \$35.00 for a good pistol or rifle) but if you buy the .177-caliber models, you can still shoot BBs for plinking at a fraction of a cent per shot.

Plus Pellets For Plinking

Skirted pellets, or pellets, aren't expensive, either, at just under \$1.00 for 250 in .177; just over \$1.00 for that many .22s. They provide the best accuracy for the money of any of the indoor guns if you don't mind pumping them. The pumping isn't tough for most people, though some women and smaller kids find it difficult.

The liquid CO₂ bottle made the big breakthrough in pneumatic weapons right after the war, when pellet-gun manufacturers learned to use that inexpensive bottled power for their guns. Now you can get CO₂ powered rifles and pistols—even a simulated revolver—that'll fire from 20 to 40 rounds or more on a one or two-cartridge charge of CO₂, delivering effortless, consistent shots at up to 650 feet per second. The cost, of course, goes up, but not too much. A cartridge costs less than 20 cents.

You can buy CO₂-powered pistols for as

◀ **SHOOTING BOX**, lined with acoustical ceiling tile, gives a break on noise with .22s. The bigger the box, the better it works; 2 by 4-foot sides cut noise 15 percent NRA recommends 4 by 4 or larger. Shooting mat, pad, also helps

◀ **STOP FOR BBs, CO₂** and air-gun pellets and wax or plastic bullets is easy. This one's only a cardboard box with 4 in. of old telephone books at rear. Good for hundreds of rounds, it costs nothing at all. Let new targets cover old to close front

▶ **NEW CORK-FIRING** "trapshooting" outfit gives a new kind of indoor shooting. Foot on bulb releases a breakaway "bird", shooter fires to try to "break" it



little as \$15.00 or as much as \$49.00 and rifles from \$16.00 to \$75.00. The \$75.00 model has everything the big-time match .22 rifles have, including pinpoint accuracy. Both pistols and rifles are available in single shot, manual repeating and semi-automatic models just like powder weapons. They're tops for indoor shooting, with plenty of accuracy, big-gun sights and features, but a minimum of noise and no need for a bullet trap. The simple box stop shown at the bottom of page 144 will do nicely if you shoot carefully.

This winter most of the high-level indoor shooting is being done with the regular .22 rifle on 25 and 50-foot indoor ranges, as it has for years. The .22 is hard to beat for inexpensive precision shooting on regular ranges, and makes a perfectly practical indoor weapon—if you have an adequate bullet stop—or trap. You can buy a .22 handgun for \$20.00—or \$300.00; a rifle for \$16.00—or \$365.00. That's stock. You can pay more if you like custom goodies. Almost any of them will provide satisfying accuracy at indoor distances; at 25 feet the sights mean more than the gun as a rule.

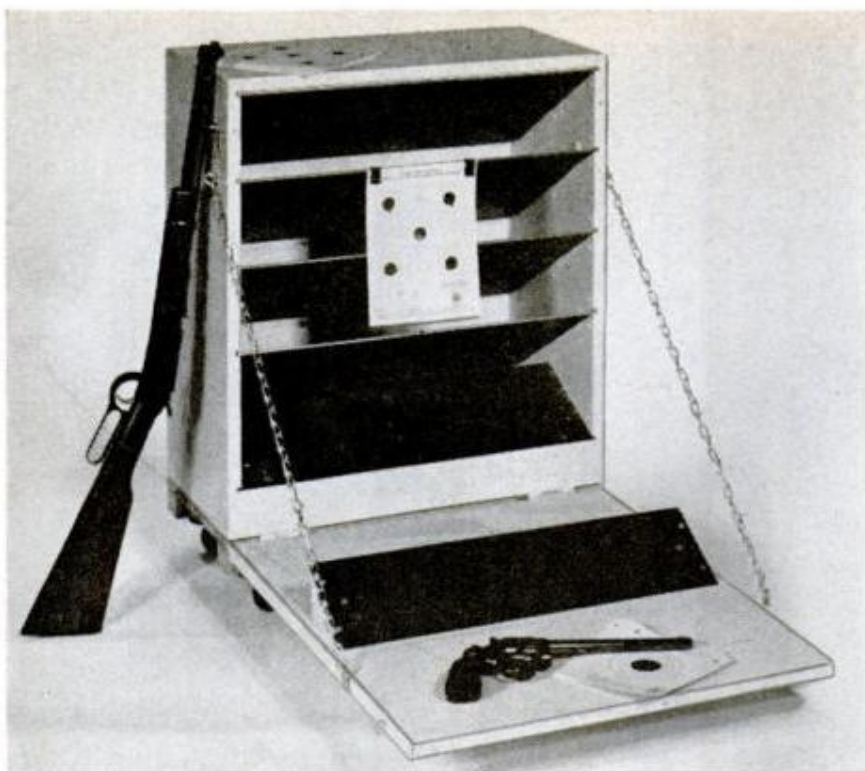
The bullet trap isn't too big a problem. You can buy a commercial .22 trap for as little as \$10.00 and a heavy-duty model for any size handgun load for just over \$25.00. You can build the excellent PM "venetian-blind" trap on pages 146 and 147 for little more than the price of the steel plates. It'll stop .22s for years, and take an occasional

bigger load once in a while.

Maybe the biggest problem in shooting the .22 indoors is the noise. Especially in a concrete-floored basement, it does ring the ears a bit. An acoustical ceiling and acoustically tiled walls make a big difference. The acoustical shooting box shown on page 144 will be some help. Surprisingly, the normally quiet .22 shorts seem to make almost as much noise as the long-rifle loads when shooting indoors, though they have a definite price advantage—65 cents for 50 shorts, compared to 80 cents for the same number of long rifles. At 25 feet they're both more accurate than you will be for anything but formal target work.

Best place to go for information on shooting indoors—or anywhere else, for that matter—is the National Rifle Association, 1600 Rhode Island Avenue NW, Washington 6, D. C. For 35 cents you can have their excellent booklet on the 25-foot shooting program; better still, you can become an individual member for \$5.00. Still better, check out and join your local NRA-affiliated club. It's always more fun to shoot with friends, indoors, or outdoors.

PM's bullet trap is an inexpensive, easy-to-build home-range version of the excellent "venetian-blind" bullet traps designed for commercial and police range use by Joseph Nikoden of the Detroit Bullet Trap Company of Chicago. It's less likely to produce "splashback" than the traditional single-plate traps. It doesn't throw as much



PM'S "VENETIAN-BLIND" bullet trap is designed to stop any rimfire .22, and will contain the lower-powered handguns up to .38 short for occasional shooting. This 24 x 26-in. size is big for beginners on the 25-foot range, and is perfectly safe and easy to build as shown at right

sand around the basement, nor does it take up so much floor space when not in use. This design can be scaled up or down to almost any size, and is flexible enough that it can be changed to fit the steel plates available to you. We show this one in detail, but mostly to give you the principles of venetian-blind trap design.

Key to the trap are the angled, overlapping plates that actually do the work of deflecting the incoming bullets. Key to *that* feature is that bullets don't bounce like billiard balls, but smear out and slide along a hard, smooth surface. The soft .22 slug smears down along the slanted plate, off onto the steel back plate, and down into the sand or wet sawdust in the base of the trap. The angle of the primary plates isn't very critical—30 to 45 degrees will do, though the shallower the angle, the less backspatter you'll get. However, the 45-degree angle soaks up more of the force of impact, reducing wear at other points. You'll get a slight, harmless (at five feet) powder spatter at any angle, however. When the bullet upsets against the plate, some of the metal is squeezed back in the direction of its flight. In any indoor shooting, where a bullet might strike something other than the backstop or trap, it's a good idea to wear glasses as a safety extra.

For frequent, heavy shooting, the side, top and bottom lining plates are a good idea, since spattering metal will wear the wood walls in time. Lining "plates" can be very light sheet metal of any kind. The 20-gauge steel used in the pilot model would last a lifetime. Heavy plate pays off on the louvered deflectors and the pro-

tective plate over the built-in lights.

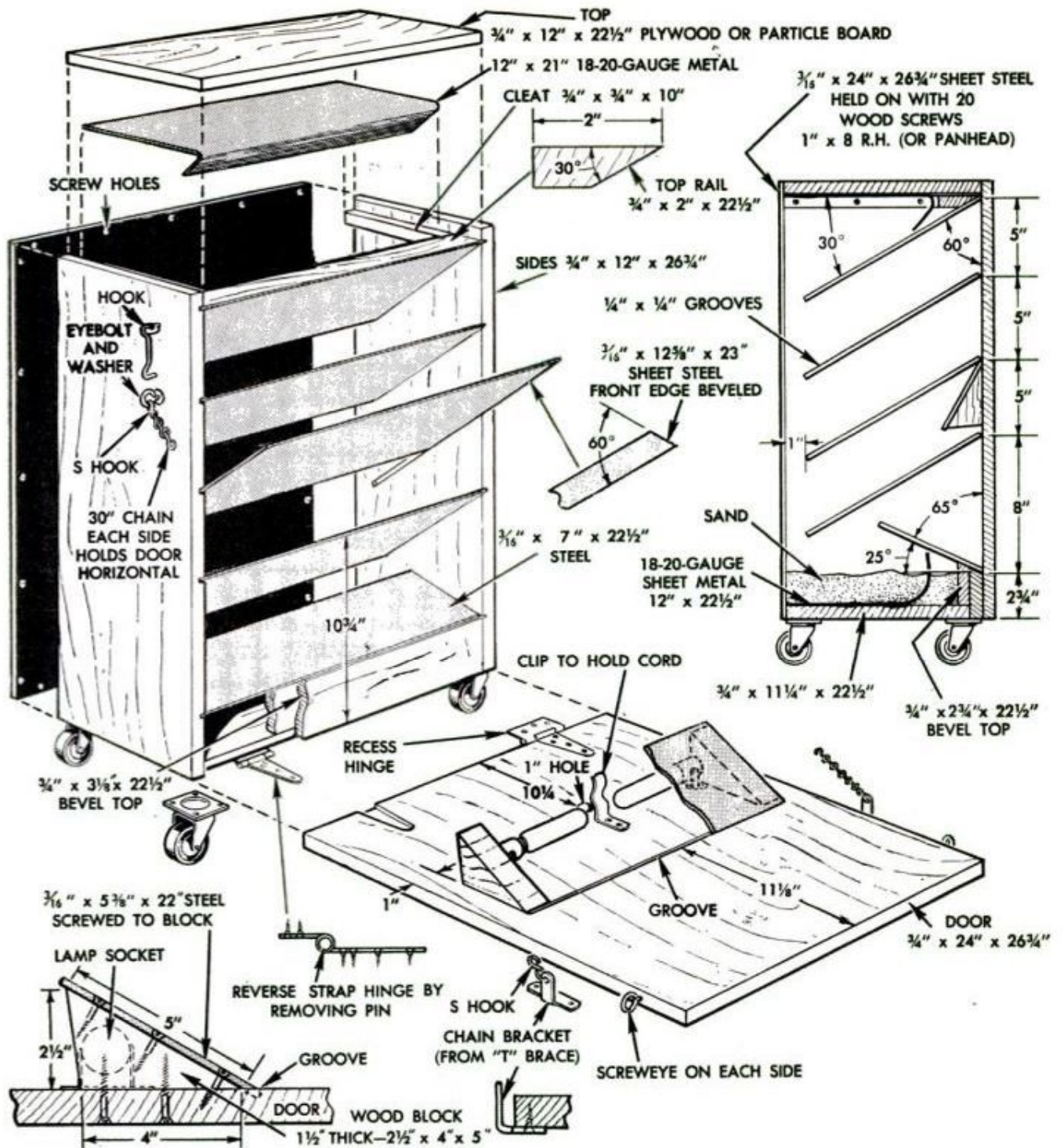
It's important to make sure that each primary plate overlaps those above and below it enough that, no matter from what position you're firing, you can't see the backplate. (It's best to paint the backplate light grey to be sure you can see it if you work into a dangerous position.)

Mr. Nikoden's basic design holds, no matter how big—or small—you build a venetian-blind bullet trap. It could be six inches square or six feet square. About the only limiting factor would be its weight—it must be heavy enough to stay put under bullet impacts and light enough to be somewhat portable, though the latter isn't important if you have space to spare.

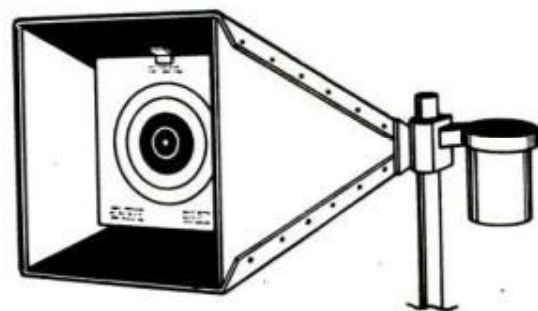
The paper target (another inexpensive item at less than a penny each) is easily attached by bending it over the leading edge of one of the primary plates, using masking tape to anchor it to the reverse side. Or a wire can be run across the face of the trap, passing through the coiled springs of two clamp-type clothespins, which in turn hold the target. Either way, there's nothing to deflect a bullet.

With the PM trap 30 inches tall (depending on your choice of targets), there is no reason to elevate it for shooting in the standing position. With smaller traps this may be necessary; it's an easy matter to set it on a box or table, or to hang the whole trap from the ceiling beams on chains.

One word of caution: The trap won't do for BBs. They don't slide—they bounce. They not only leave the trap, but flatten themselves out of reusability. Better to use a soft backstop. ★★★



EXPLODED PLAN, above, shows details of construction of this particular trap, but sizes can vary to fit the available materials. Below, simple (but less efficient) one-plate trap; commercial spiral-drum trap at the right



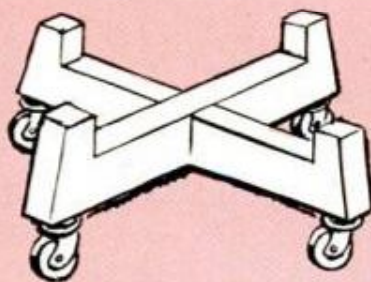
Solving HOME PROBLEMS



SPOT REMOVAL will be a breeze if you use a carpet-backed caster cup as an applicator for the cleaning fluid. The raised pile of the carpet insert is ideal for brushing the cleaning fluid into the soiled fabric

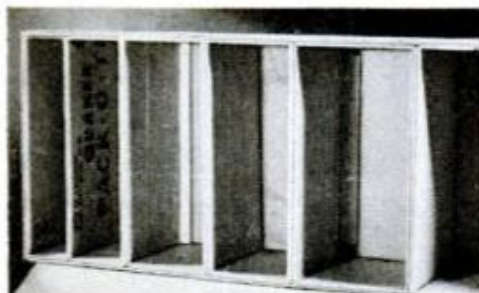


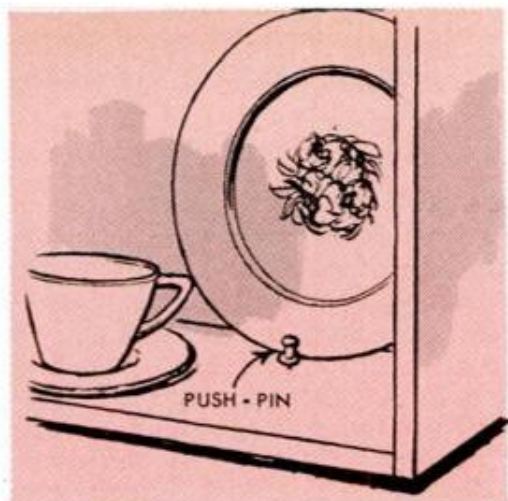
HEAVY FLOOR PLANTS can be moved from room to room or outdoors effortlessly with this simple plant dolly. Make it from 2 x 4 stock, using a half-lap joint at the center, and notch pieces to fit plant's tub



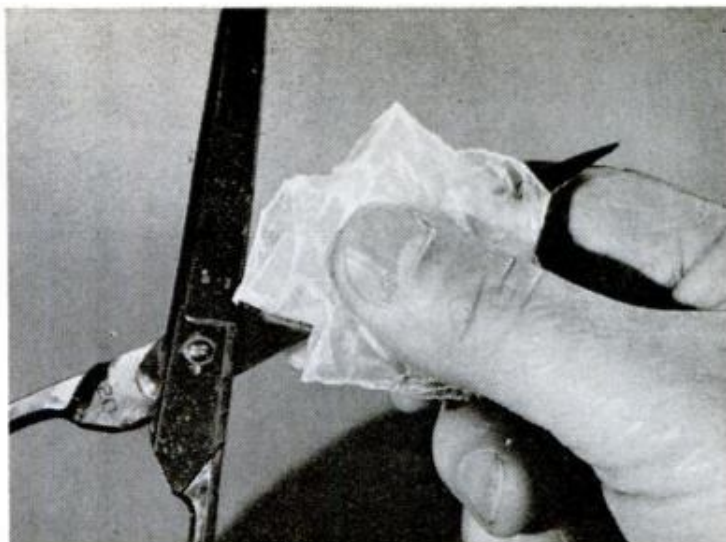
CARDBOARD STRIPS bent U-shaped to fit snugly into a rectangular cardboard box form shelves in this cabinet. Wings of U serve as supports for each succeeding shelf as in left-hand photos. Glue wings in place or hold with tape. Cover the cabinet with wallpaper

KITCHEN TOWEL HOLDER mounts in a minute and holds towel securely. Make it by driving a screw through a hole in handle of a plastic spoon so that bowl of the spoon is tight against the surface. Slip towel under spoon and tension will hold it in place





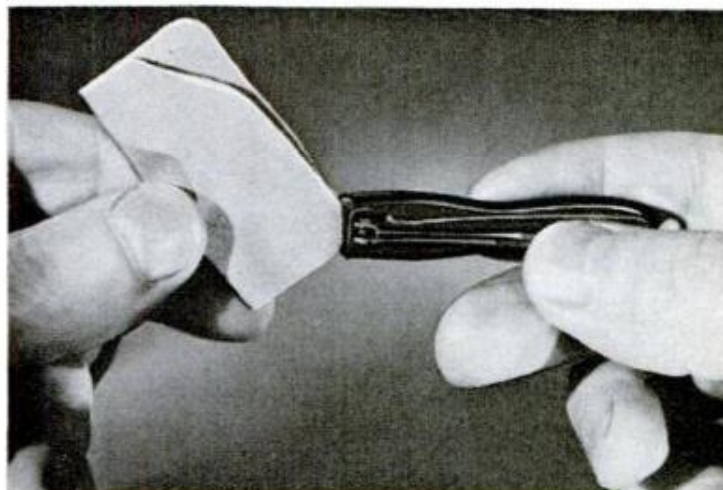
PUSH PINS can substitute for grooves to hold china plates standing edgewise on shelves. Press pins into wood so that only heads project. For large plates or platters use two pins, so that the piece cannot roll



TO RUSTPROOF SHEARS, rub the unplated inner surface of each blade with a wad of ordinary wax paper. If you plan to store them for any length of time, you can protect the cutting edges by folding a piece of wax paper and cutting it with the shears



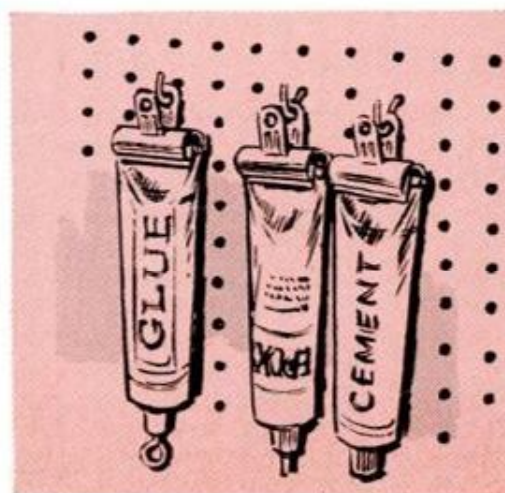
EMERGENCY ICE CREEPERS can be made from strips of fly screen. Wrap a strip around each shoe and tie with a cord looped around your ankle. They'll get you from house to garage, across street, safely



PRESS-ON MENDING TAPE holds better and won't lift if the corners of each patch are rounded. A quick, neat way to do this is to fold the patch over twice so that all corners are aligned and then snip them off with a fingernail clipper

HAVING TROUBLE keeping track of all those tubes of repair compounds in your workshop? You can tell at a glance how much is in each tube if you clip each one in a spring-type paper clip and hang

PULL-OUT SPOUTS on boxes of kitchen products often open so wide that you accidentally pour out too much material. To slow the pouring rate, run a strip of tape around the edge of the box so that it keeps the metal spout from opening completely

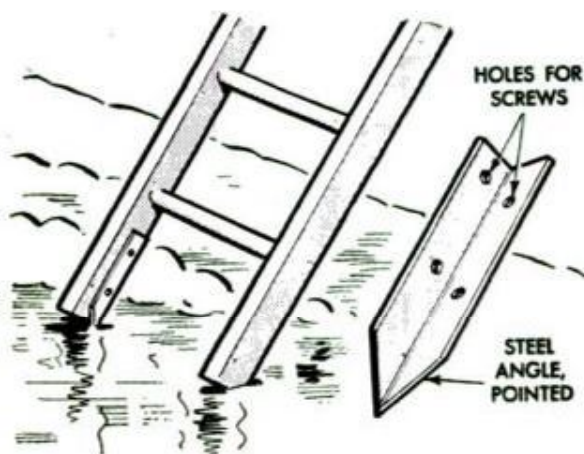




WORTH REMEMBERING

Chain Locker

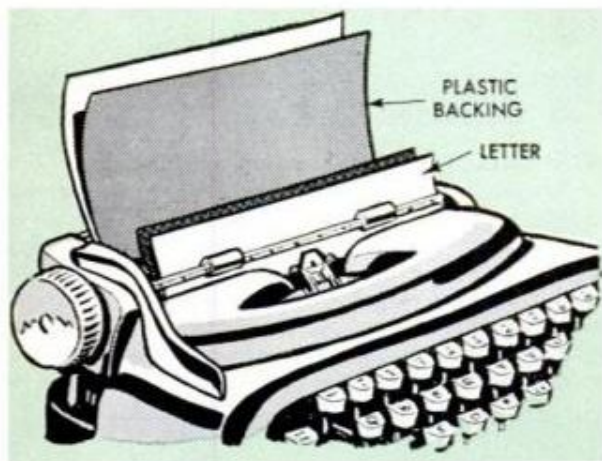
There's just no suitable place for tire chains in a pickup truck, except perhaps somewhere in the cab, where they're usually underfoot. One pickup truck owner built a chain locker just back of the cab, the side members of the 2 x 2 frame extending so that they fit into the stake pockets. The hinged drop door is a frame of 1 x 2s covered with 1/8-in. hardboard, which also forms the back panel of the locker frame.—*R. B. Crook*



Ladder Creepers

To prevent a ladder from slipping when you must use it on ice in an emergency, cut two short lengths of steel angle, 1/8 x 1 x 1 in. or larger, and file the webs at one end of each piece to a sharp point. Then drill two holes in each web for screws with which the creepers are fastened to the lower ends of the ladder legs, or stringers, with the sharpened ends projecting.

—*William Longcor*



Tip for Stenos

When the platen on your typewriter ages and becomes indented with rows of type impressions, you can compensate temporarily for the loss of resilience by inserting extra sheets of typing paper in addition to the carbon and second sheets. But a better way is to cut a piece of plastic material of the type having an adhesive backing to the size of a sheet of typing paper and insert it along with the letter paper and the carbon. The comparative stiffness of this backing gives a clear imprint.

—*Frank Shore*



A Drop in Time

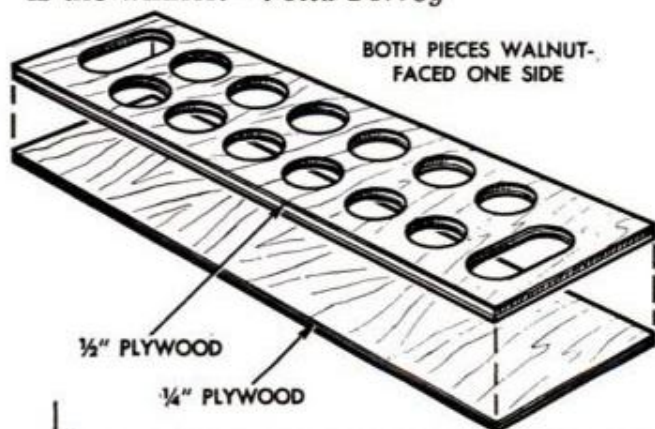
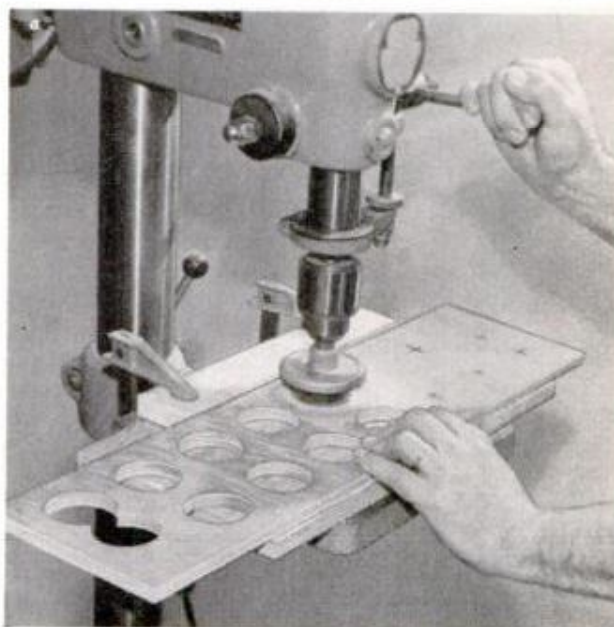
Solder the tip from a discarded mechanical pencil to the spout of a pressure, or squirt-type oil can and you've got a one-drop oiler for those hard-to-reach oil holes, oil cups, and small bearings that require just one drop, no more. For a longer reach and a larger drop, use the point, or tip, from a pencil of the type taking a large-diameter lead like that pictured in the right hand at the left. Of course, the same idea can be applied to any spout-type oil can for controlled one-drop oiling. It doesn't have to be a squirt type.

—*Robert Micals*

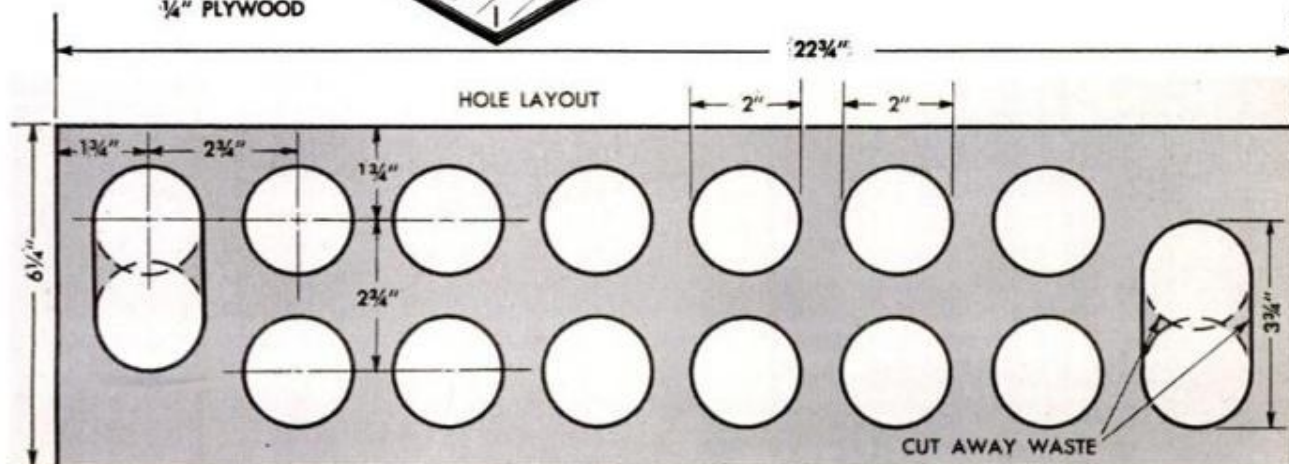
Mancala

THE NATIONAL GAME of Africa has suddenly caught on among Americans, and you can join in the fun by making a Mancala board in your home workshop, following the details below. One of the world's oldest games, Mancala is played by two people, and the object is to capture the most counters. Each player places the same number of counters (coins, marbles, etc.) in every one of the six holes on his side of the board. You can start with six and use more as you gain proficiency.

To begin, the first player picks up all the counters from any one of his six holes and distributes them to his right, placing one in each hole. If the last one lands in his scoring bin, he gets another turn, but otherwise the turn passes to his opponent. If he has enough counters to go beyond his scoring bin, after dropping one there, he proceeds from right to left along his opponent's side of the board. When he can go around the other end (skipping the other player's scoring bin) and drop the last counter in an empty hole on his own side of the board, he captures all the counters in the hole opposite. The game ends when all holes on either side of the board are empty, and the player with the most counters in his scoring bin is the winner.—*Volta Torrey*

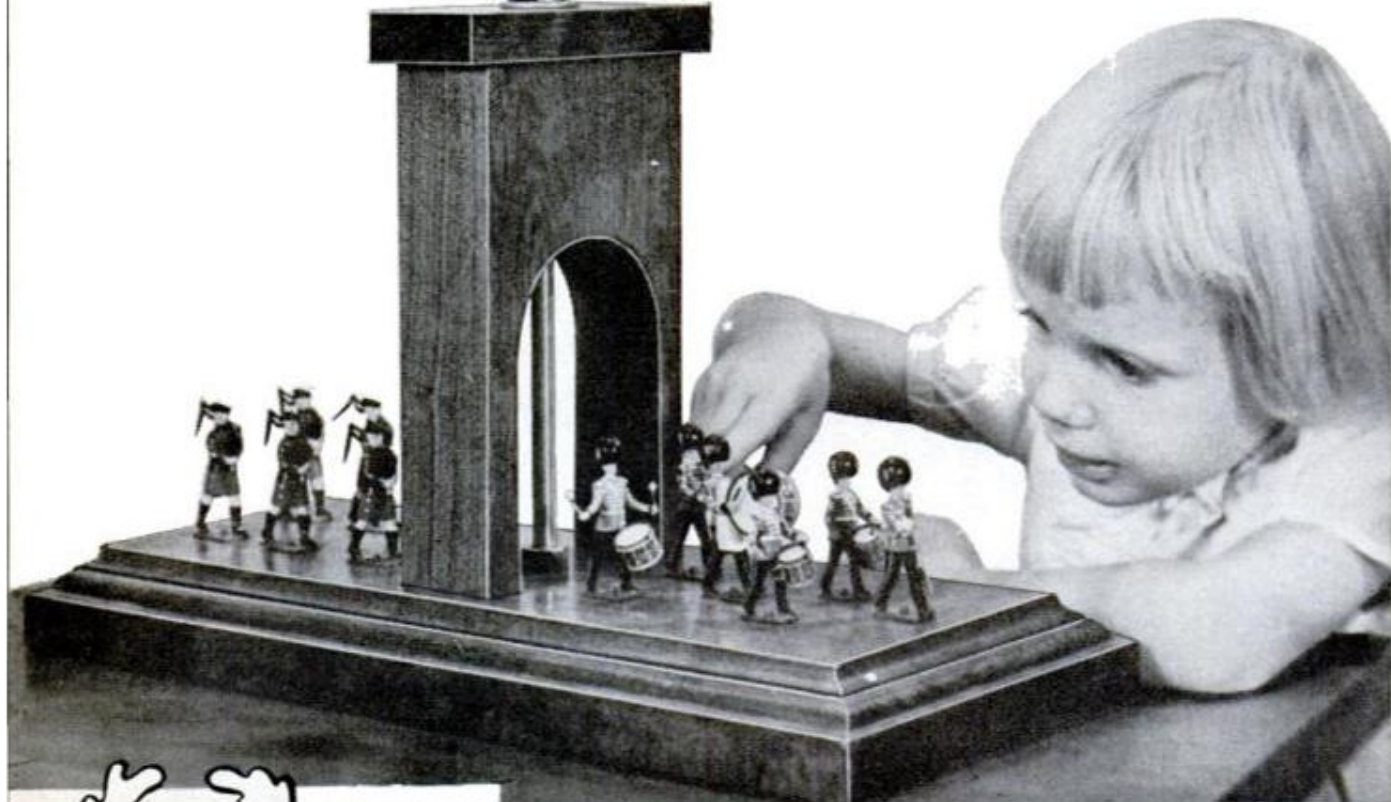


HOLE SAW is perfect tool for making the cutouts in the upper half of your Mancala board. If you don't have one, use a jigsaw for this job. To cut out scoring bins with hole saw, make two overlapping hole cuts and trim the waste to leave a smooth side



10 GIFTS YOU CAN

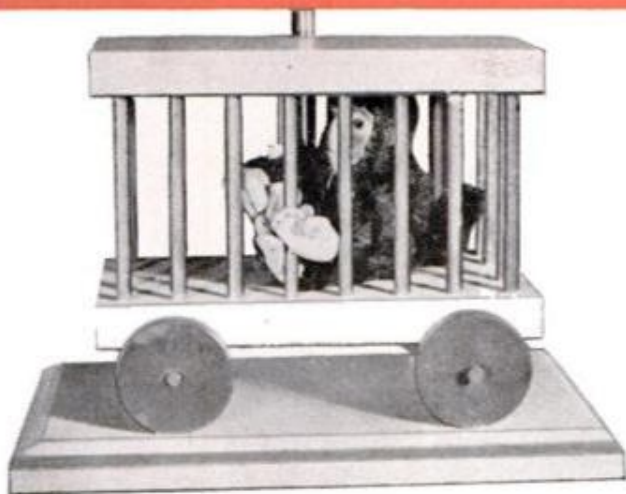
Novel Lamp Bases



THE BOSS-MAN SAYS WE'RE
GONNA NEED HELP TO MEET OUR
DEC. 25 DELIVERIES. HERE ARE
14 PAGES OF OUR HOTTEST ITEMS.
ANY VOLUNTEERS?

YOU'LL BE THE LIGHT of your youngster's life if you tuck one of these intriguing lamps under the Christmas tree. Any of the five designs shown here will bring a touch of magic to a child's room. And though they all bristle with colorful detail, none of them should take more than an evening to assemble. The secret lies in dressing up simple materials with ready-made elements. In several cases, you may be able to make use of toy figures your child has already collected. By cementing or

MAKE FOR CHRISTMAS

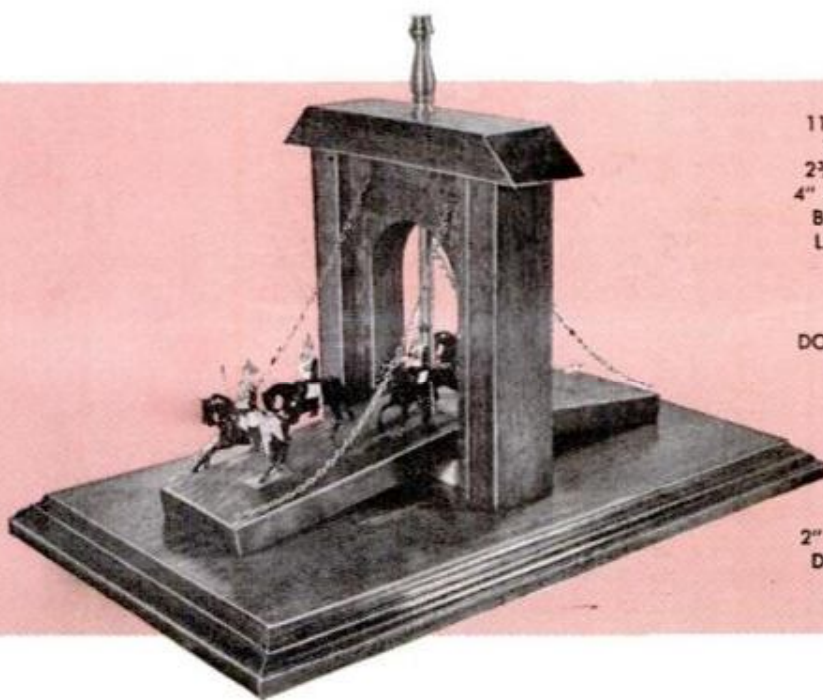
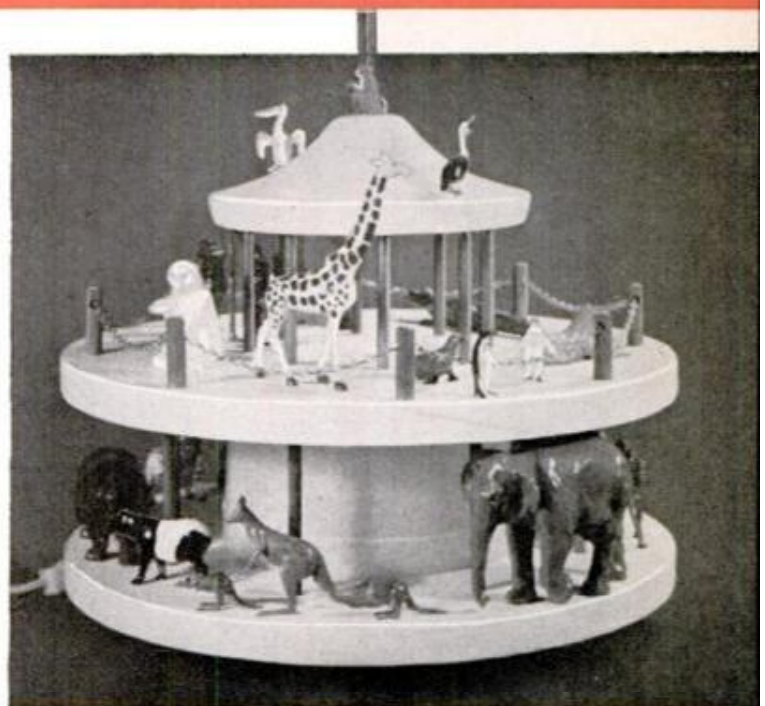


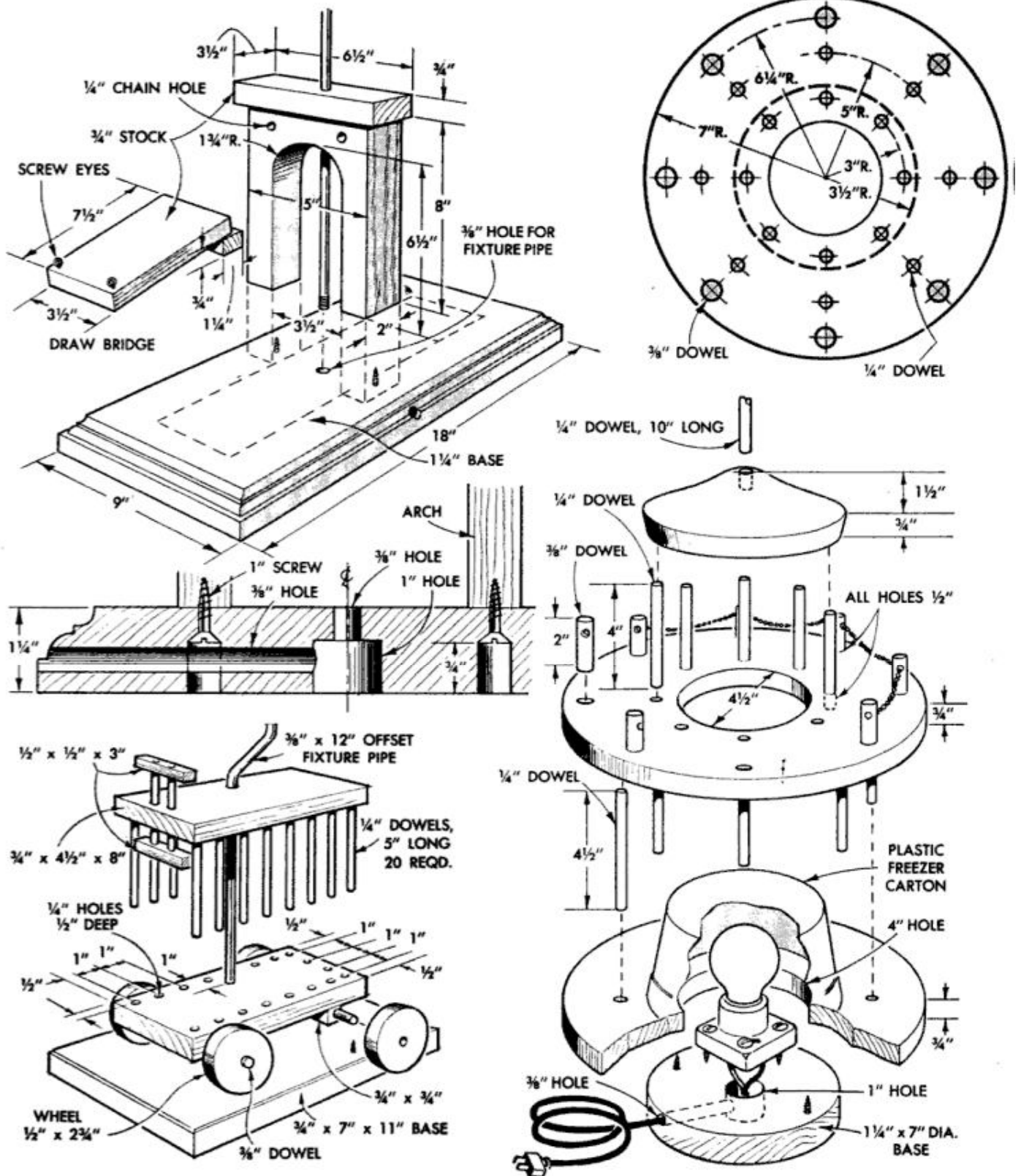
bradding them to a lamp base, you'll put them on permanent display. Otherwise, a little rummaging in a toy shop will turn up exactly what you need.

Standard 8 or 9-in. brass harps, rods, finials and base nuts are used for all but the circus tent and lighthouse lamps. The tent contains its own bulb, shaded by a quart-size freezer or ice-cream carton. Inverted, the translucent plastic makes an ideal night light. For brighter illumination, you can cut out the bottom.

Lay out and cut the two platform disks before cutting the center holes. The top canopy is turned on the lathe. Paint all parts before final assembly. White or light yellow platforms give the best illumination. Lightweight brass chain, run through dowel posts around the edge of the upper platform, lends a finishing touch.

The wood parts of the lighthouse are all





lathe-turned. The striping is easy if you paint the column white, then spiral wide masking tape around it before spraying or brushing on red paint. For a night light, use a 7½-watt bulb inside the lens. Or, make a conventional lamp by enlarging the base and running a lamp rod up through the top for a socket and harp.

Two of the lamp bases feature a lofty arch cut from a hardwood block. In one case, a drum and pipe band of the Irish Guards parades through it. As a variation, add an incline at each side, "hung" on

brass chain, and you've got a drawbridge that's an ideal setting for mounted knights.

To simplify construction of the cage lamp, you can omit the moving gate by inserting a stuffed animal at the time of assembly. Paint all the parts first.

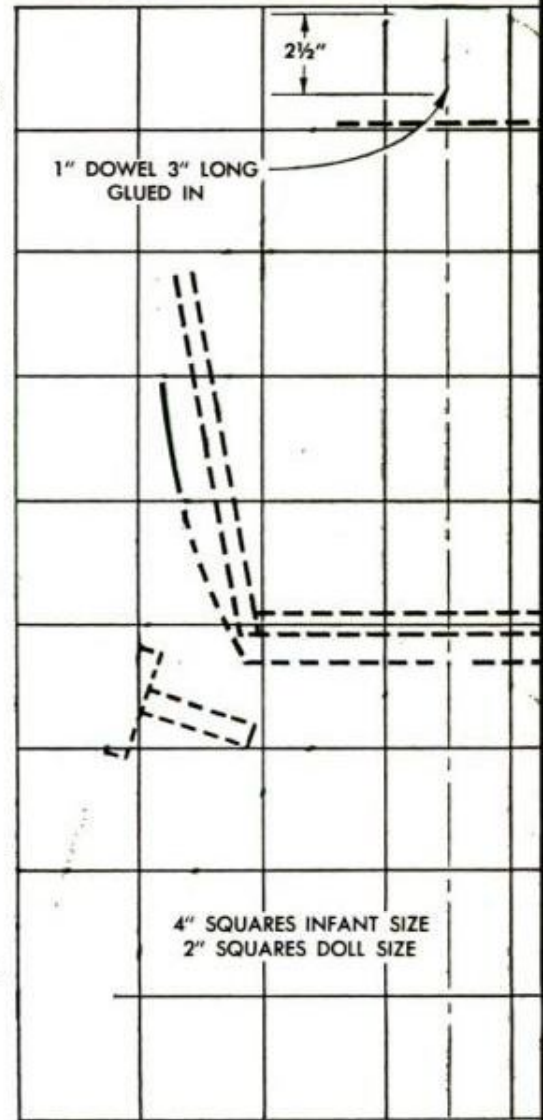
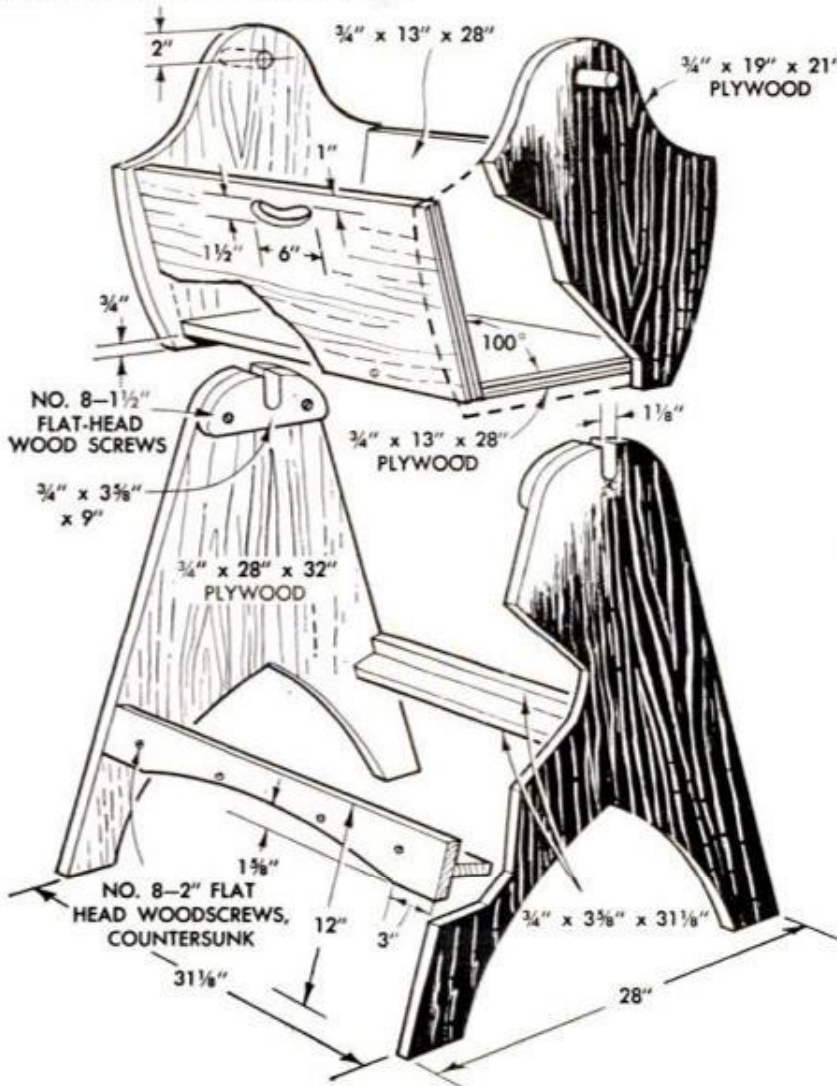
Four of the lamps are wired by feeding the cord through a hole drilled in the edge of the base and into a well deep enough to recess the nut on the end of the fixture pipe. For the cage lamp, simply run the wire between the base and the bottom of the wagon.—Patrick K. Snook.

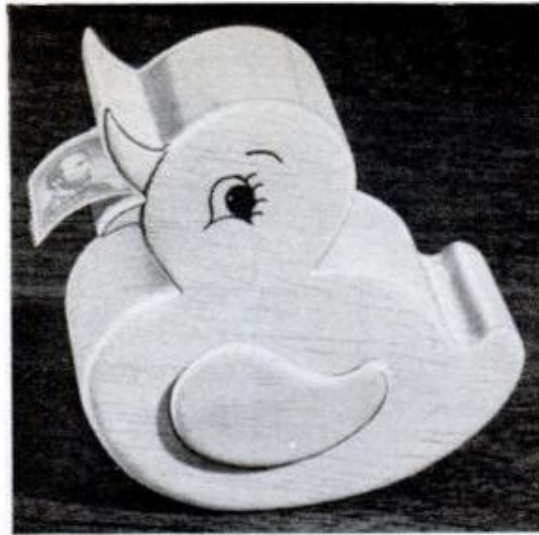
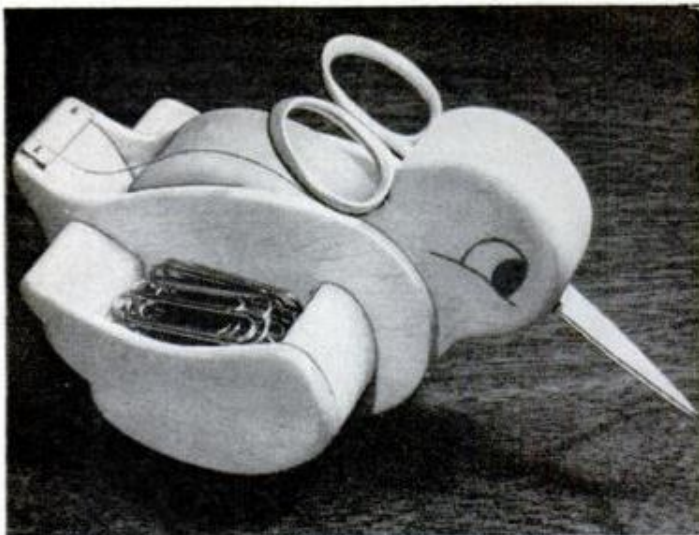


Portable Cradle

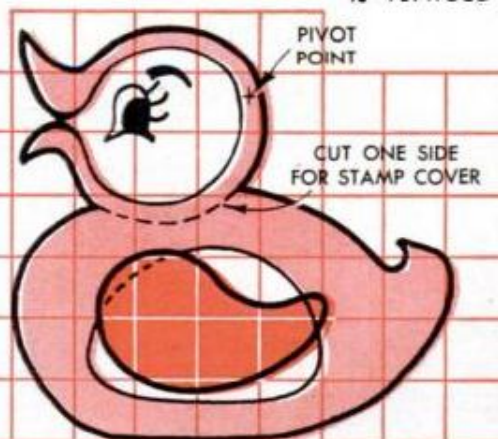
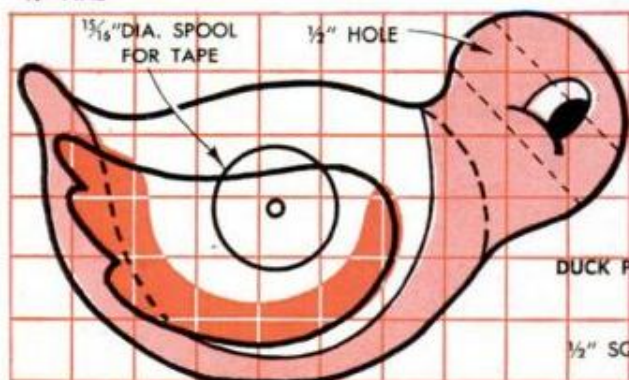
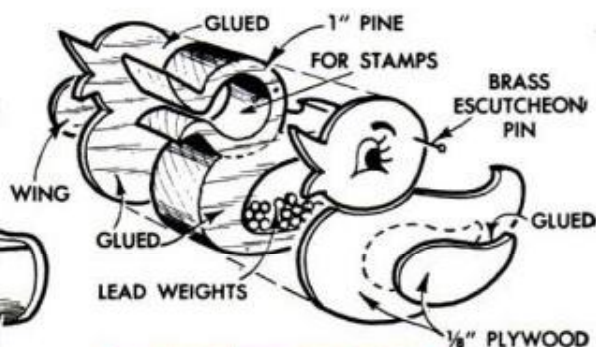
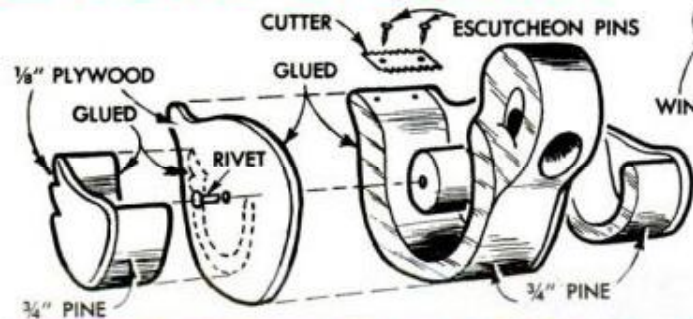
THE PERFECT GIFT for a new baby's first Christmas, this modern cradle is sized to use a standard 13 x 28-in. bassinet pad and styled for double utility. Lift the cradle out of its stand and you have a portable bassinet or car bed. Or if you have a little girl on your gift list, think how delighted she would be to discover a small-size version of this cradle under the tree on Christmas morning.

Use glue and countersunk screws to assemble the pieces, and fill the screw holes with wood putty or wood plugs. Either leave the wood natural or give it a light stain, then finish with several coats of shellac. For an interesting effect, enamel the edge grain of the plywood to fit the color scheme used in the nursery.





Desk Ducks

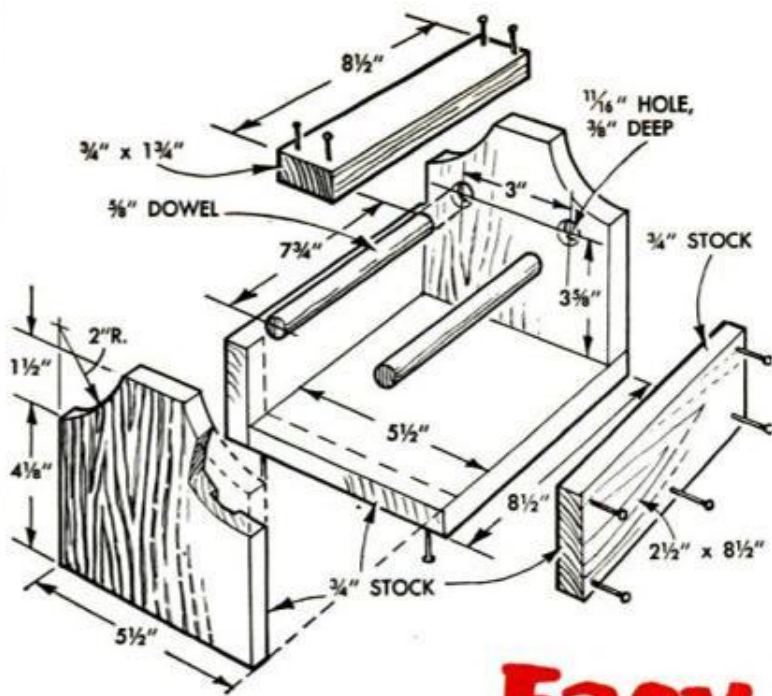


THESE TWO BRIGHT little birds will do a great job of keeping your kitchen desk neat and orderly. Scissors-Bill holds two wingfuls of paper clips, and cellophane tape rolls off his back like water. His cheerful friend, Stamp-Bill, has nothing on his mind but postage stamps. However, a heavy meal of lead sinkers turns him into decorative paperweight.

To make the scissors-holder duck, mark the cutting outlines of the various pieces on $\frac{3}{4}$ -in. pine and $\frac{1}{8}$ -in. plywood. Drill the scissors hole in the head at a 45-deg. angle to the base, and add press-fit holes in the sides for the rivets on which the tape spool turns. Cut out and assemble all pieces using a quick-setting white glue, then round all edges with sandpaper, ink in details and attach the cutter (which is salvaged from

an old dispenser). Finish with several coats of white shellac or colored enamel.

The second duck is designed to dispense postage stamps from a roll through a narrow slot in his bill. One side of the head pivots upward on an escutcheon pin to allow for refilling when empty. Since the width of a roll of stamps is slightly over $\frac{3}{4}$ in., use a clear piece of pine 1 in. thick for the center section. Trace the outlines of the different pieces and cut them out with a jigsaw or bandsaw. Before gluing the sections together, place lead sinkers or chunks of bar solder in the body cavity and pack the remaining space with crumpled aluminum foil to prevent them from shifting. After assembling, round off edges, ink in eyes, and finish with white shellac or enamel as you did the first duck.—Pat Sinapi



Easy Shoe Shine

THIS NOVEL LITTLE shoe-shine kit will give you twice the shine with half the work since the more you pull on the polishing cloth, the more friction you put on the shoe and the greater the shine. In itself it's a simple box fitted with two free turning

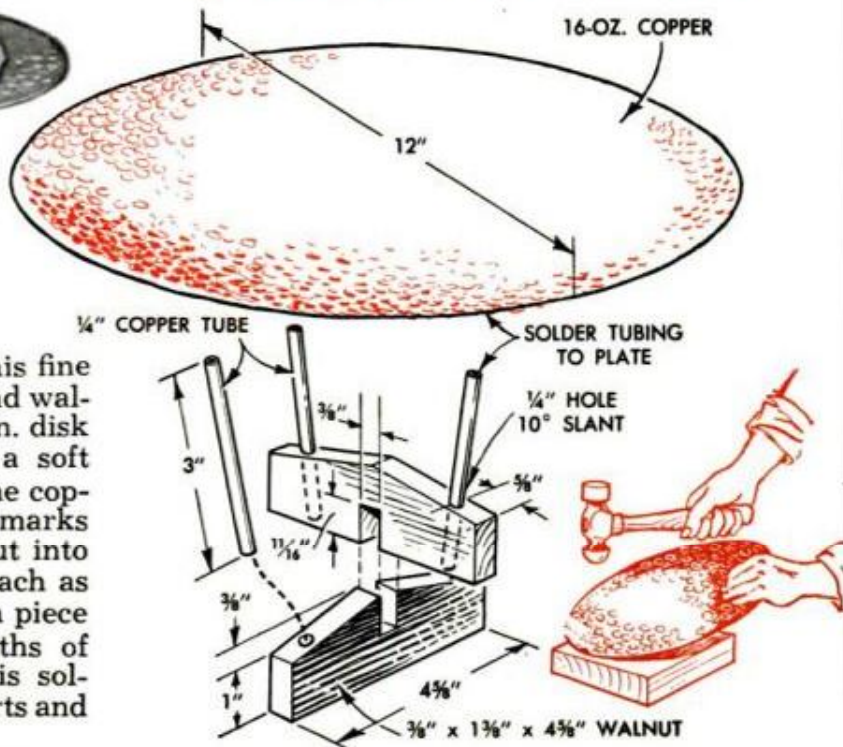
dowels which serve as rollers for the polishing cloth. Whole thing can be made in an evening with wood from your scrap box. Usual space is provided for cans of polish, daubers and brushes. Footrest can be covered with rubber.—Loring Burk



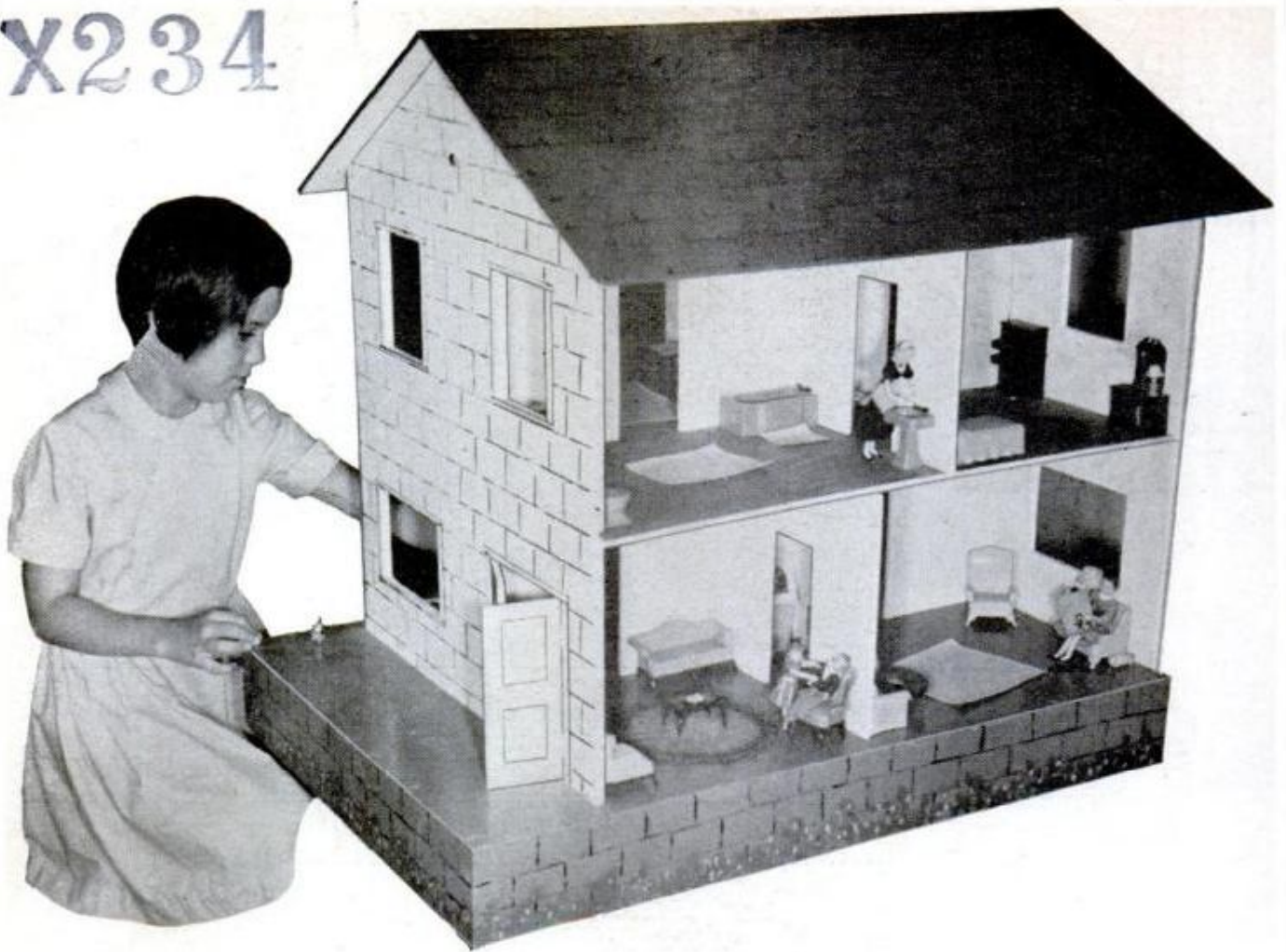
Copper-Walnut Fruit Bowl

DECORATIVE AND USEFUL is this fine bowl fashioned from 16-ga. copper and walnut. Cut the sheet copper into a 12-in. disk and file the edges smooth. Using a soft board and ball-peen hammer, dish the copper 1 in. deep. Leave the hammer marks for an antique effect. Cut the walnut into two pieces, notching and tapering each as shown. Drill two 1/4-in. holes in each piece at a 10-degree angle to hold lengths of copper tubing to which the bowl is soldered. Wax and polish the walnut parts and lacquer the bowl and tubes.

—Robert Micals



X234

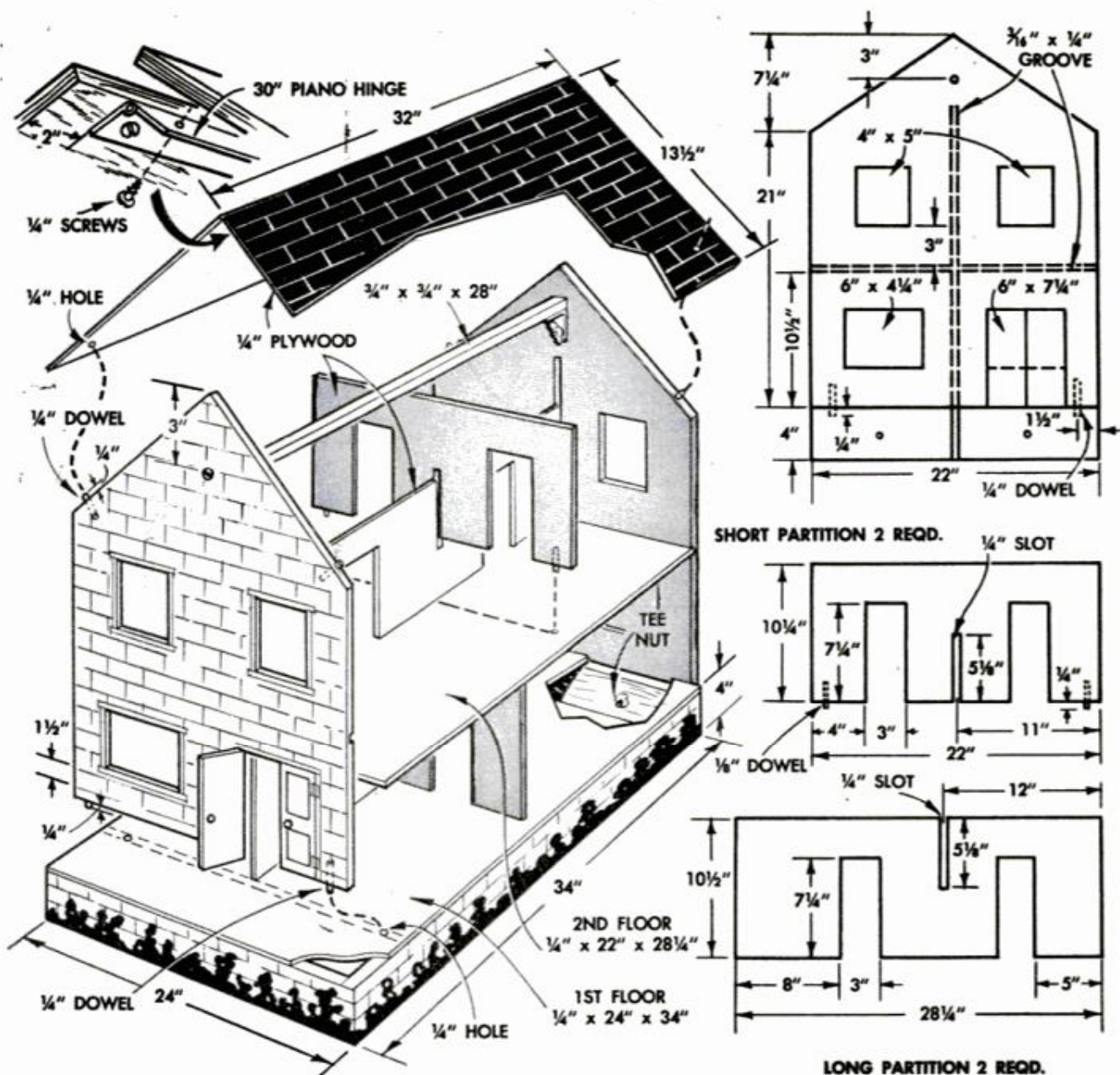


A DOLL HOUSE should be large enough to let the young home-maker indulge that feminine whim to shift furniture around. But this usually means a bulky unit that's awkward to store. This house solves the problem. It's big and sturdy enough for several youngsters to play with simultaneously—and is open on two sides so they won't get in each other's way. Yet it swiftly collapses to store inside its own inverted foundation, as shown below. If you wish, you can even hinge

a cover to this tray so the knocked-down house can be stood on edge, or carried to Grandma's like a suitcase. Re-assembling the house is child's play, almost as simple as setting up building blocks.

Floors, partitions and roof can all be cut from one panel of $\frac{1}{4}$ -in. plywood. A half-panel of $\frac{3}{8}$ -in. ply is plenty for the two end walls. The rear wall is 4 in. longer than the one at the front, so it will lap the base and can be secured by turning $\frac{1}{4} \times 1\frac{1}{2}$ -in. bolts into Teenuts driven inside the frame.



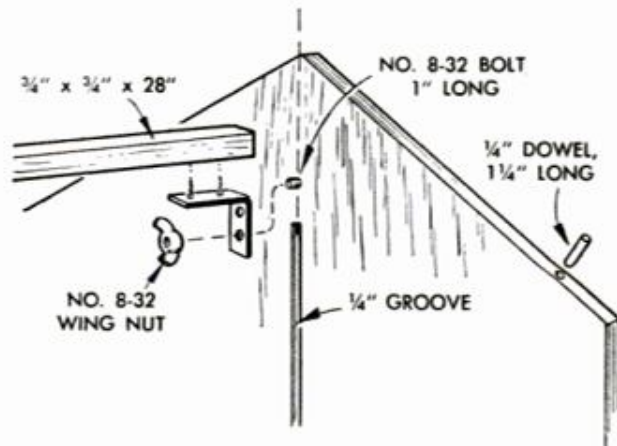


The opposite wall butts against the base platform, leaving a narrow porch across the front of the house. Two dowels project from its bottom edge to pin it in place.

Cut the 7¼-in.-high door opening in this wall only. Save the piece cut out, slice it in two, and mount the resulting door panels in the opening with ¾-in. hinges.

Both end walls have dowels in their gable edges that mate with holes through the folding roof panels. And the walls are further braced with a ridge beam fastened between their peaks with small angle brackets, as shown at right.

With the finished end walls assembled on the base, measure between the bottoms of facing grooves to determine exact length for the long partitions and second floor. Each partition is slotted half its height for "egg-crate" assembly. To keep the short partition from pivoting, dowels project ¼ in. from the bottom edge and pass through holes in the floor.—H. A. Fluchere



MAIN FLOOR	2ND FLOOR	ROOF
	LONG PARTITION	ROOF
BOX COVER	LONG PARTITION	SHORT PARTITION
	LONG PARTITION	SHORT PARTITION

PANEL LAYOUT FOR ¼" PLYWOOD, 4 x 8 SHEET



X342G

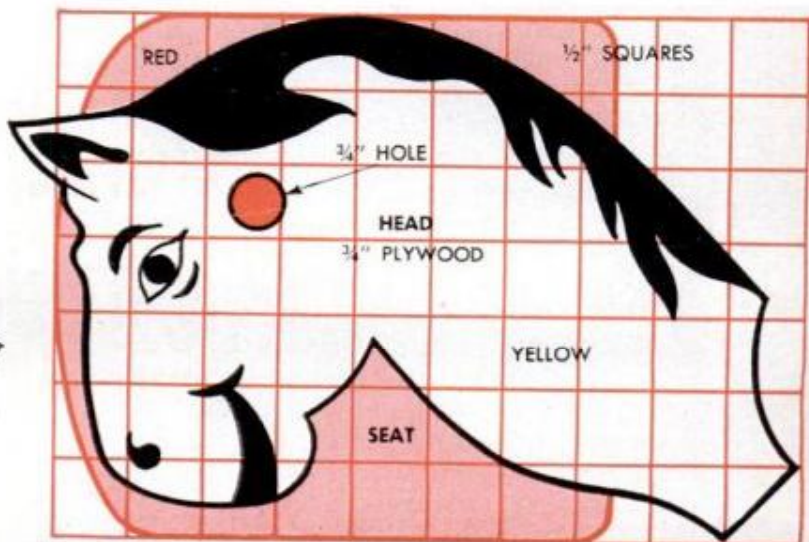
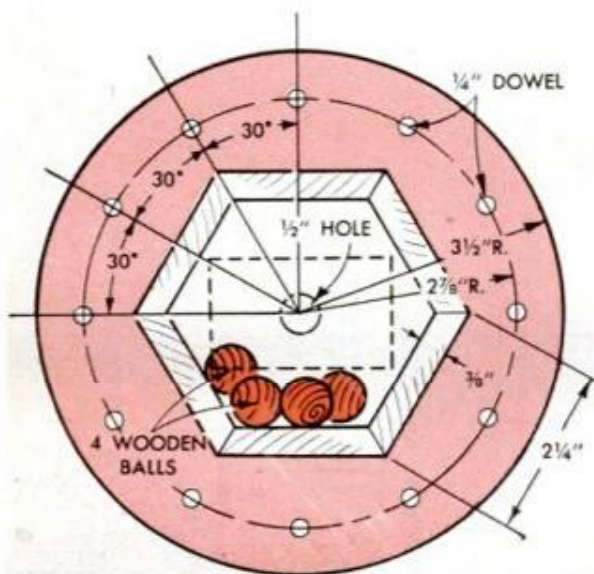
Galloping Horse

YOUNG COWBOYS will spend many happy hours riding the range on this trusty pinto, the sound of horses' hooves adding realism to their imaginative cow punching. Wooden balls tumbling around in a hexagonal box sandwiched between two circular pieces of $\frac{1}{4}$ -in. hardboard account for the "pounding hooves" when Junior pedals away.

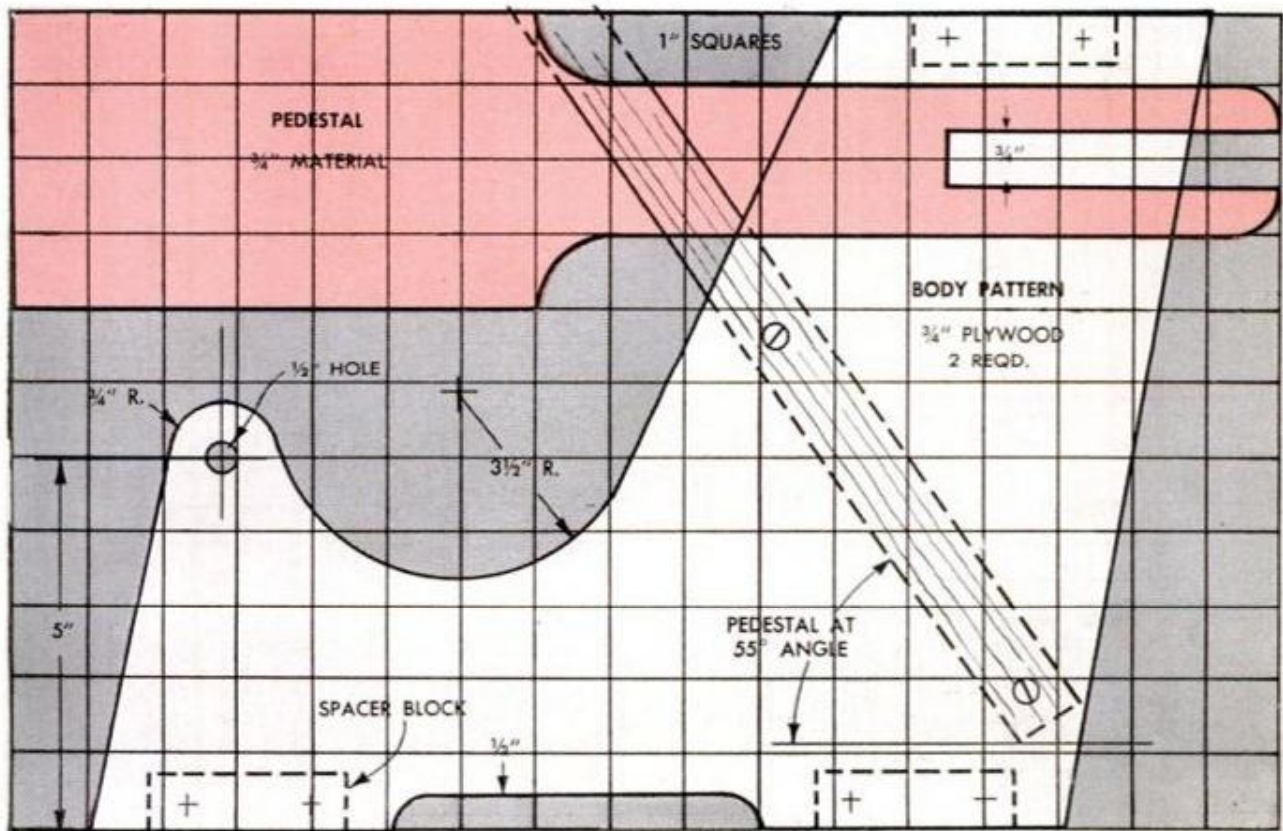
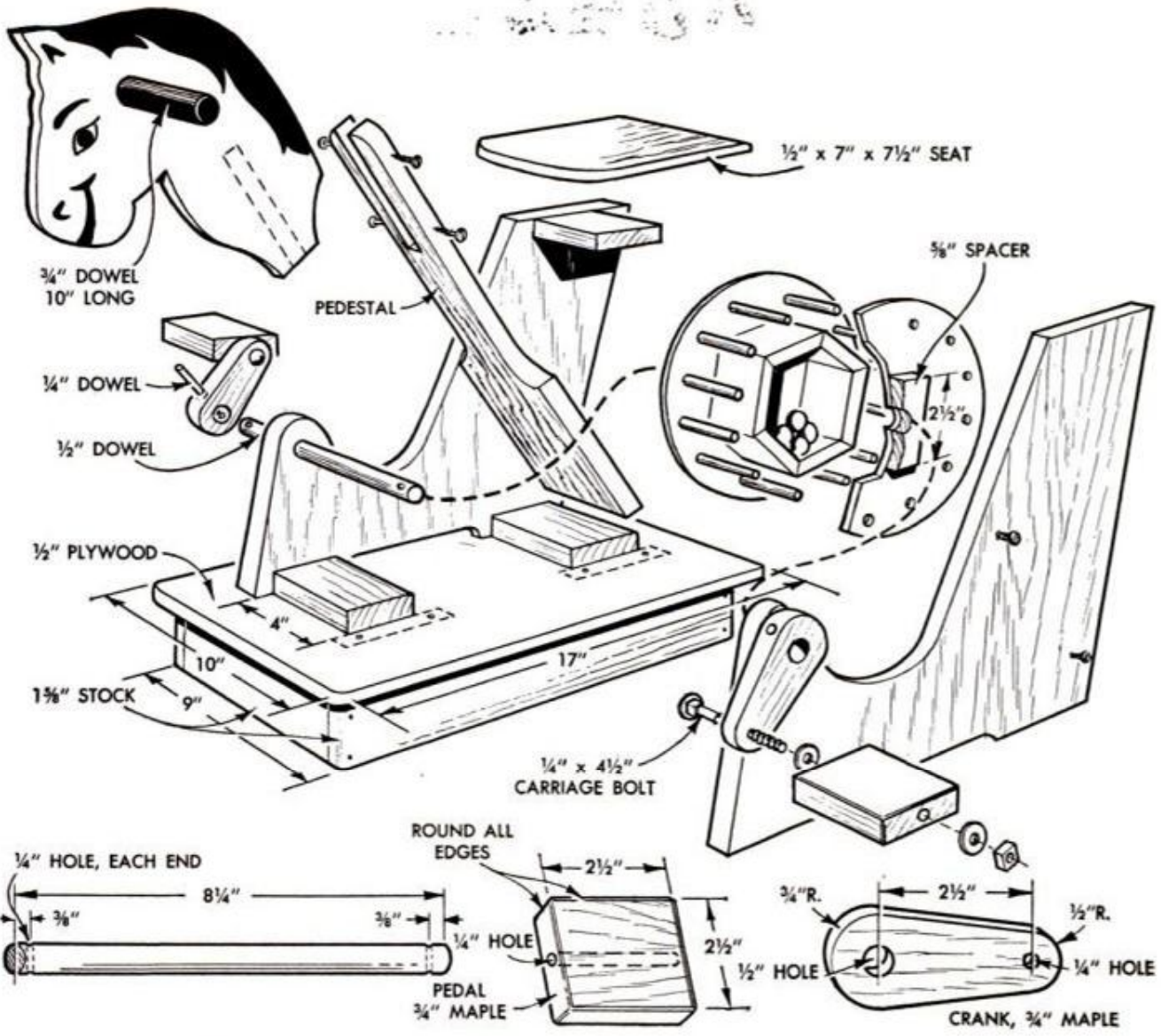
The base consists of a piece of plywood supported by a rectangular frame of $\frac{3}{4}$ x $1\frac{5}{8}$ -in. solid stock. Assemble with glue and finishing nails. The hexagonal box, shown in section below, is assembled from $\frac{3}{8}$ x 2 x $2\frac{1}{4}$ -in. solid stock, each piece being beveled at an angle of 15 degrees on both edges. The box, which contains the wooden balls, is assembled between two disks cut from $\frac{1}{8}$ -in. hardboard, each disk having twelve spaced holes for dowels. The whole thing is then assembled on the pedal shaft as you see in the pulled-apart detail on the opposite page. The cranks are pinned to the shaft carrying the box and the pedals are pivoted on carriage bolts. The rest of the assembly is easily seen from the detail and you take patterns and sizes from the cross-hatched details below and on the opposite page. Round all exposed edges slightly and sand all parts smooth. Finish with two coats of lead-free enamel.—G. L. Widdicombe

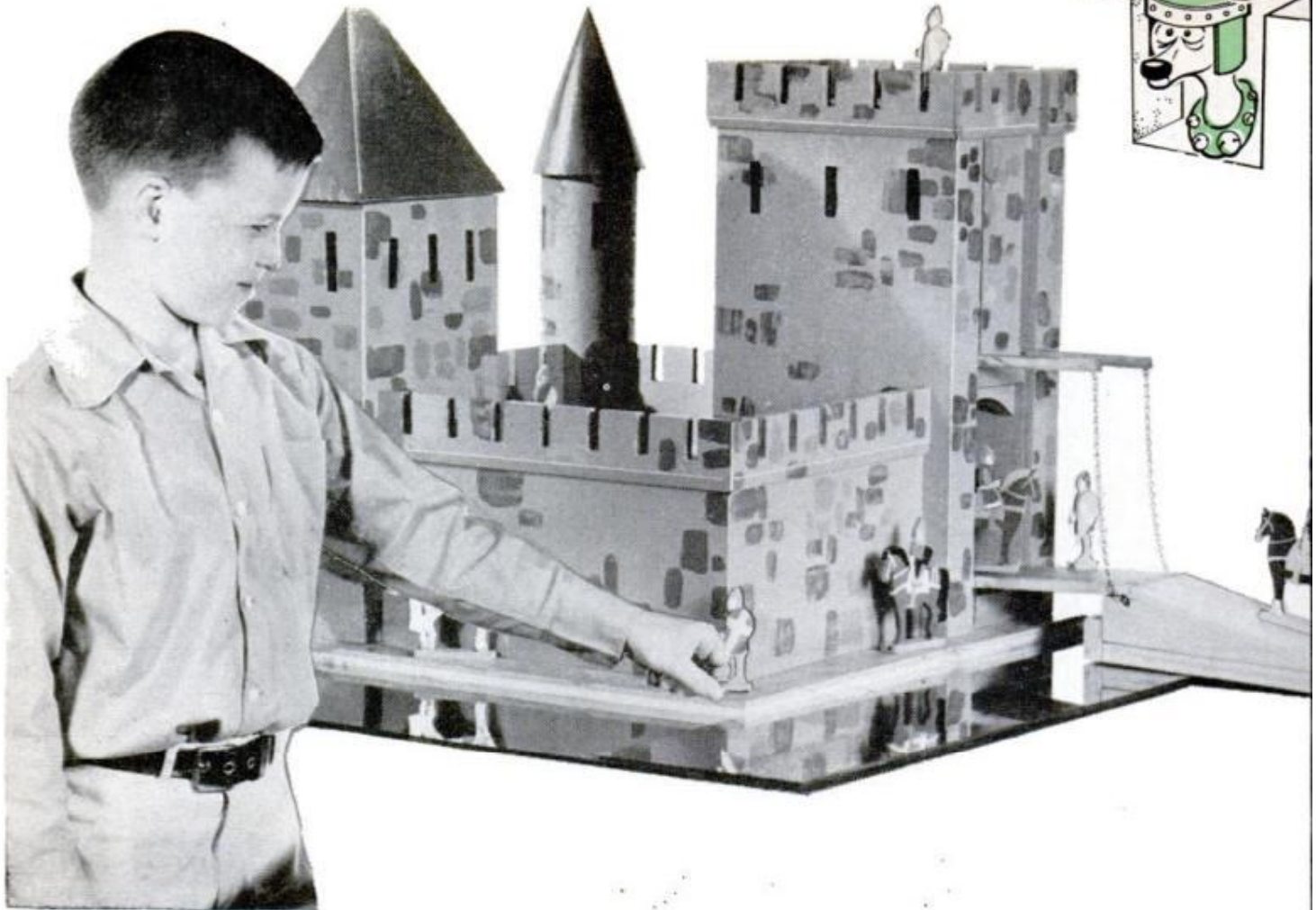


RIDING THE RANGE on this stationary pinto toy horse will thrill any youngster. Simple construction drawings show only a few nails and screws are used in the otherwise all-wood assembly. Paint as desired



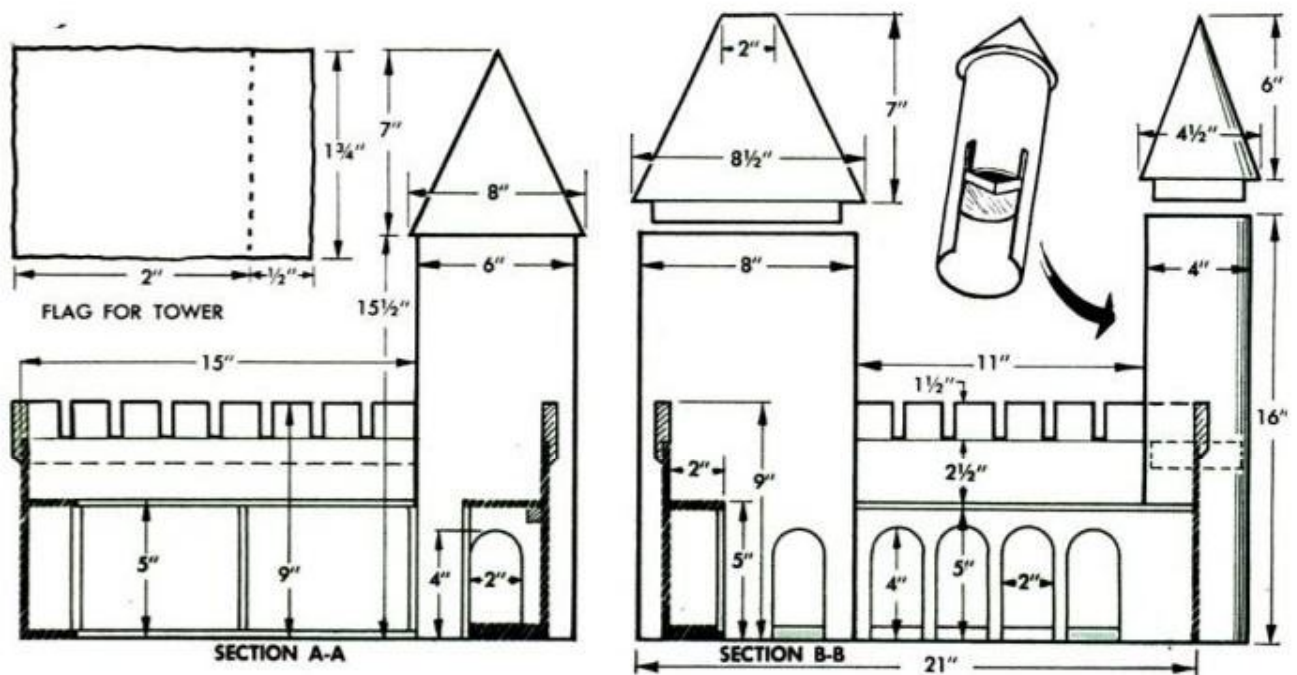
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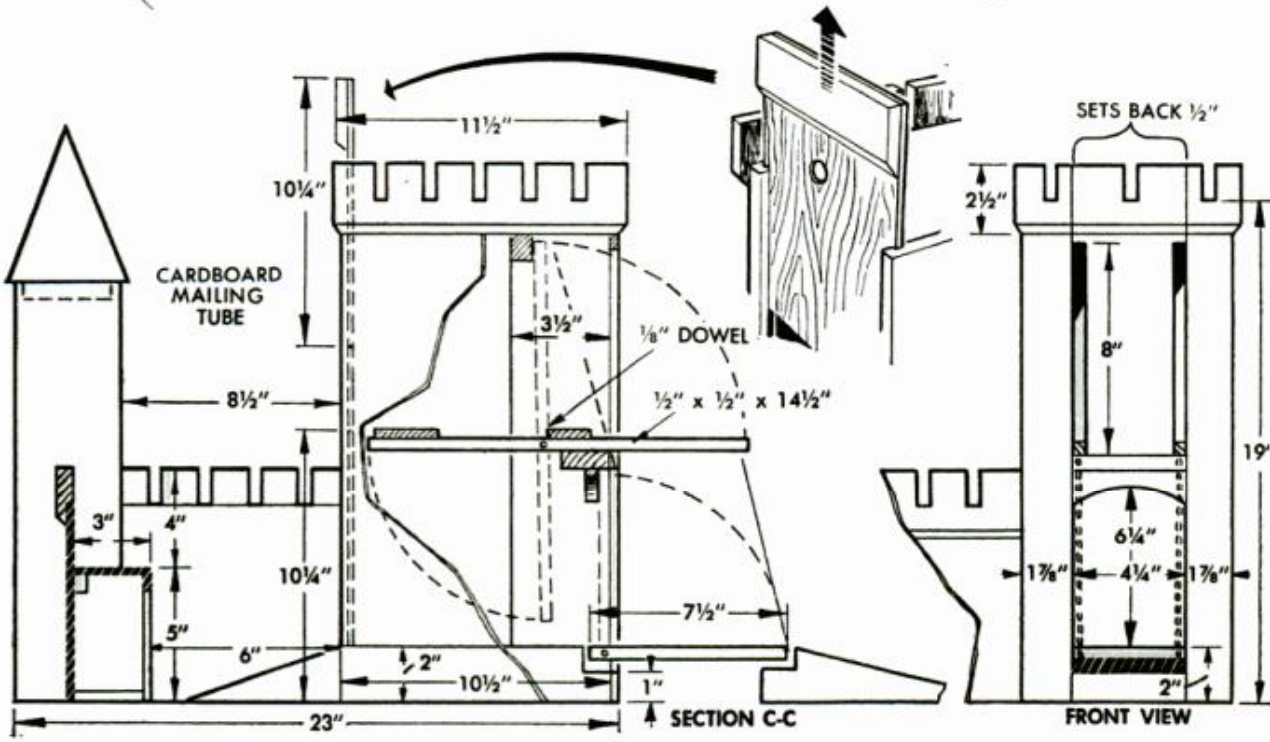
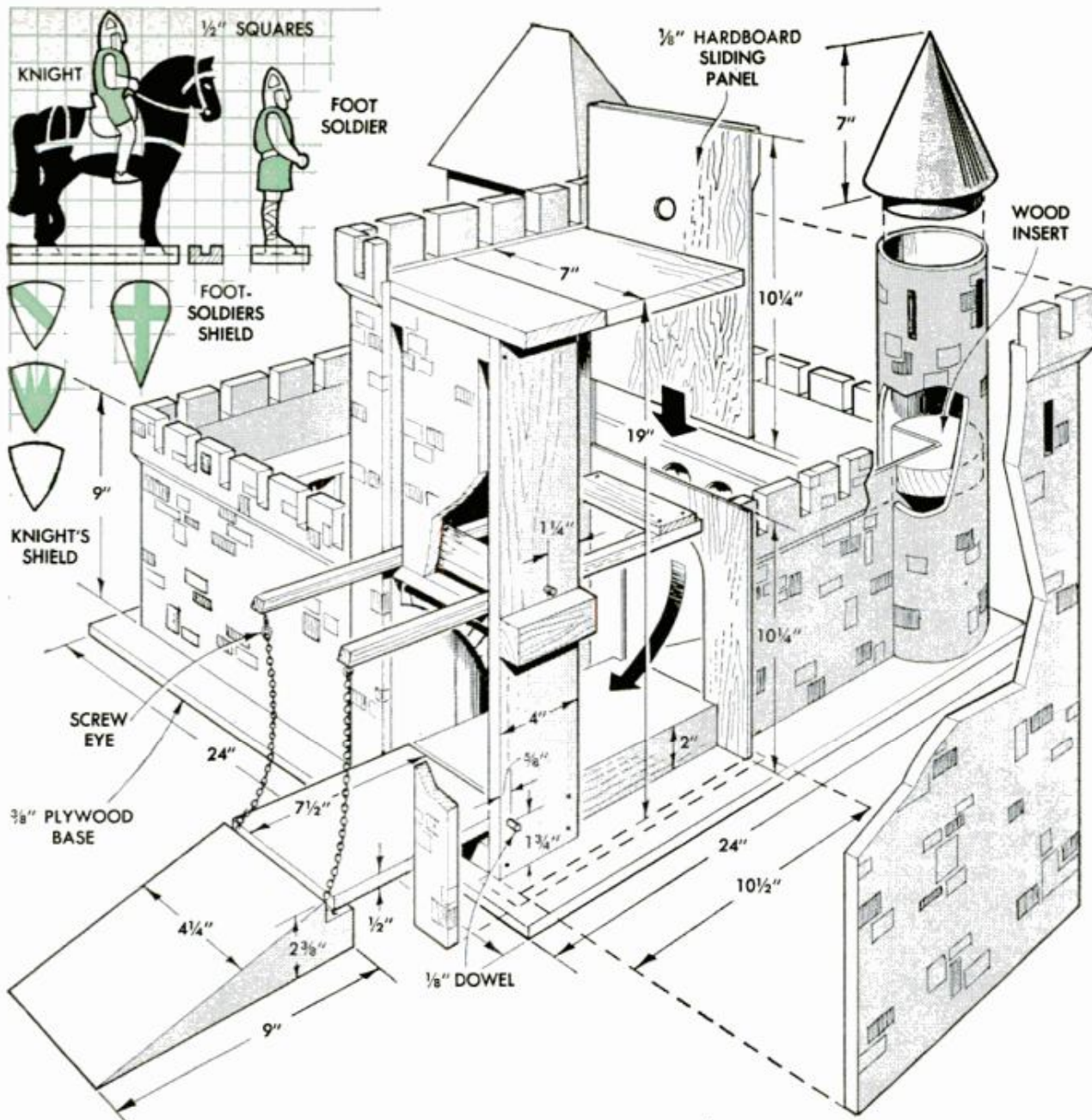


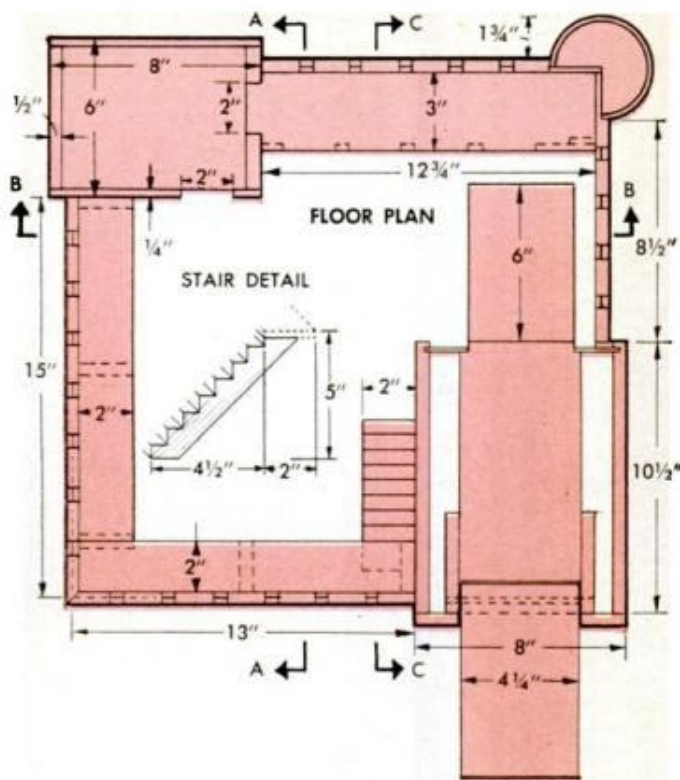


THIS HANDSOME MODEL, built largely of plywood, is at its best when centered on a heavy mirror bigger than its base. This has the novel effect of forming a water moat on all sides, to point up the purpose of the drawbridge in the entrance tower.

Since this tower is largest and most complex of the three, it's a good place to start construction. The front and two sides are $\frac{1}{2}$ -in. pine. The latter are grooved near their rear edge to take the two-section hardwood panel that forms the fourth side of the







tower. The bottom half of this panel is glued in the slots, and has an archway cut in it. The top half lifts up to permit access to the drawbridge beams.

These beams pivot on dowel pins that pierce flanking frame members. The rear ends of the beams are joined by a brace that serves as a balance weight and keeps the beams parallel. When the beams are vertical, retracted into their slots, chains attached to the front ends lift the bridge so that it closes flat against the entrance.

The round tower is a 4-in.-dia. mailing

tube, cut away and slotted so it will fit over the plywood wall before the battlement strips are attached. The roof is a wooden cone turned on the lathe, with a shoulder to slip inside the tube. The roof of the other square tower is a beveled pine block, attached the same way.

Battlements are cut from 1/2-in. pine with crenels (slots) 1 1/2 in. apart. A 1/4 x 1-in. rabbet at the back fits over the top edge of the castle wall. The lower front edge of these strips is beveled.

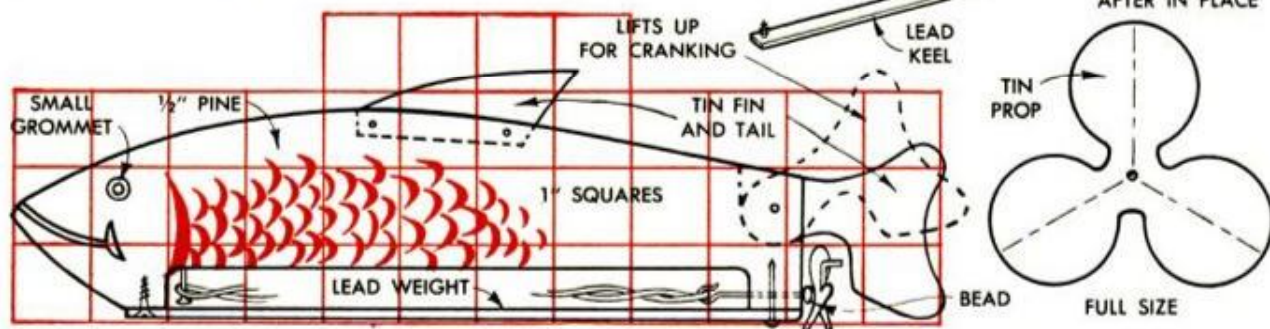
Three walls have a narrow platform 5 in. above the castle courtyard, on which the defenders can stand during a siege. This level is reached by means of stairs, cut from 2-in. pine and glued to the left wall of the entrance tower. The platform connecting the two smaller towers is supported by a series of arches cut from 1/4-in. plywood. Doorways of the same size are cut in the 6 x 8-in. tower at courtyard level. The inner door of the entrance tower has a ramp down into the courtyard.

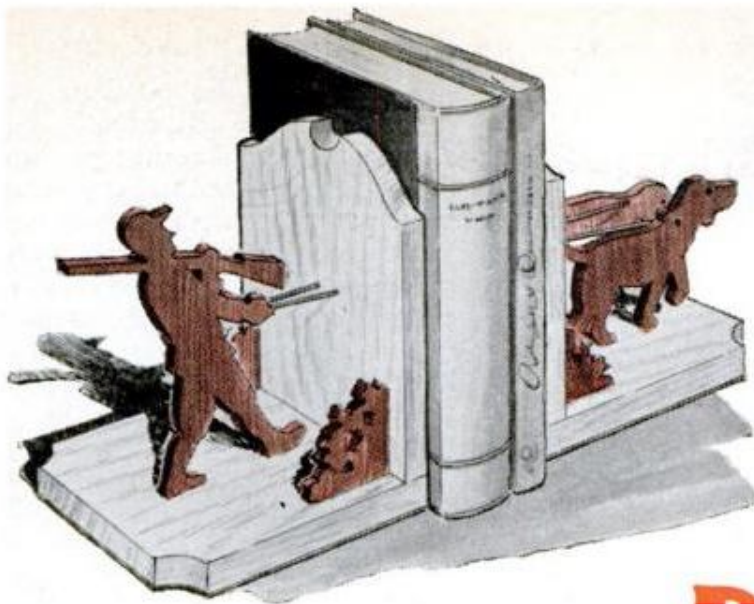
After assembling and sanding, brush on two coats of medium gray enamel. A few daubs of lighter and darker gray will suggest stones. Use black to paint on the narrow windows. The tower roofs can be red (for tiles) or gray-green (for slate).

Enlarge the patterns for the knight and foot soldier and paste them to stacks of 1/8-in. hardboard blanks, so you can jigsaw several at once. Glue these into slots cut into 1/2-in. pine bases. Snip shields from stiff cardboard and glue to the sides of the figures. Paint the designs in different colors to distinguish Sir Launcelot from Sir Gawain.—Philip L. Martin

Baraboo Bass

OLD LEADBELLY, here, stays frisky by never opening his mouth. But you'd better hook him on a line if you expect to retrieve him from a pond. The weight sinks his buoyant body enough to keep the rubber-band-powered prop in play. You just crank him up and launch him. A bend of the tail sends him circling right or left.—Hi Sibley



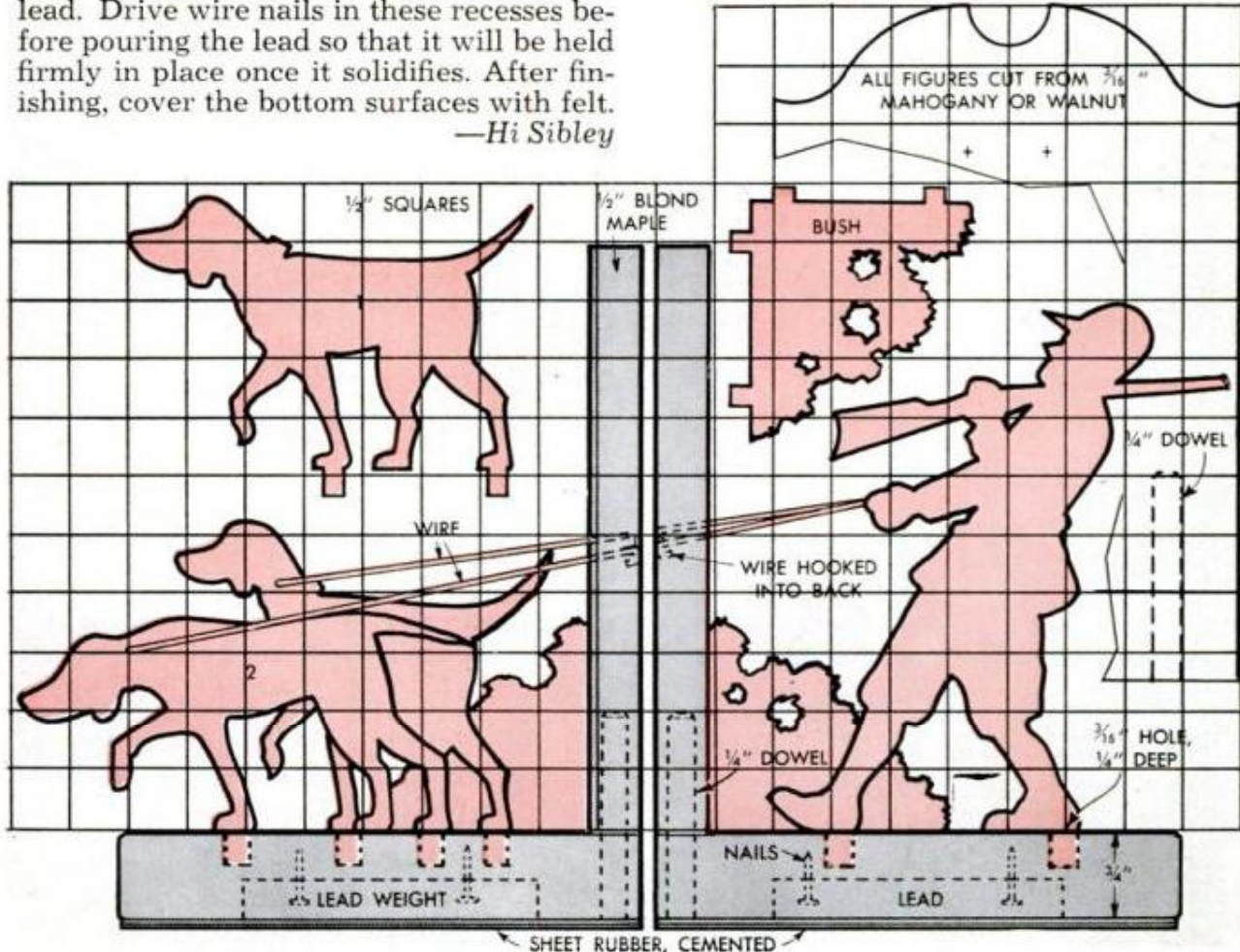
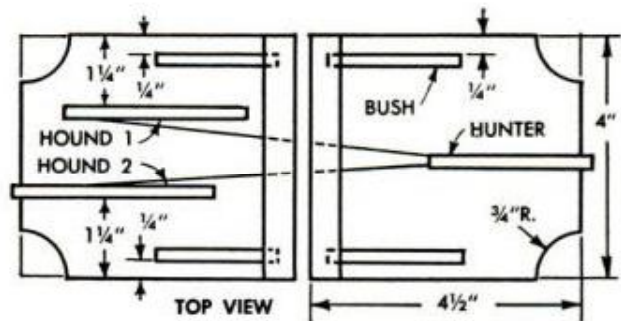


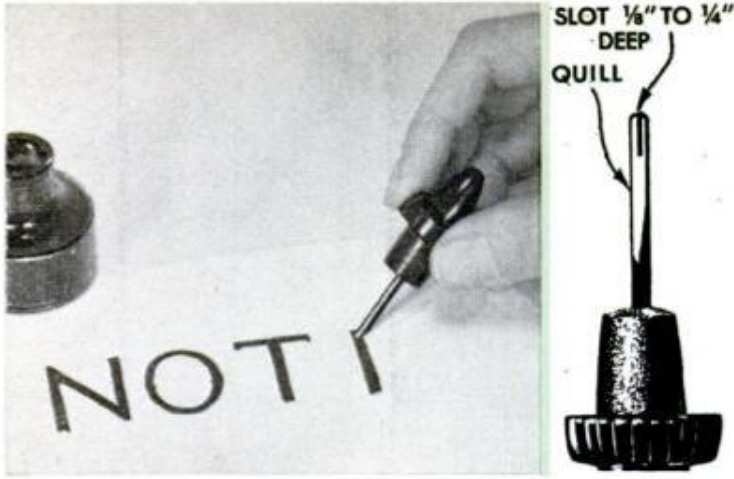
Hunter's Book Ends

HUNTERS, like bears, usually have dens, and these novel book ends will be a welcome addition to any such sportsman's lair. With the hounds straining at the leash on one side and the hunter digging in his heels on the other, the wire leashes appear to pass right through the books.

Made of walnut and blond maple, these book ends should be finished with shellac or some other clear finish to show the attractive grains of these woods. To add the necessary weight, cut a large recess in the underside of each base and fill with molten lead. Drive wire nails in these recesses before pouring the lead so that it will be held firmly in place once it solidifies. After finishing, cover the bottom surfaces with felt.

—Hi Sibley





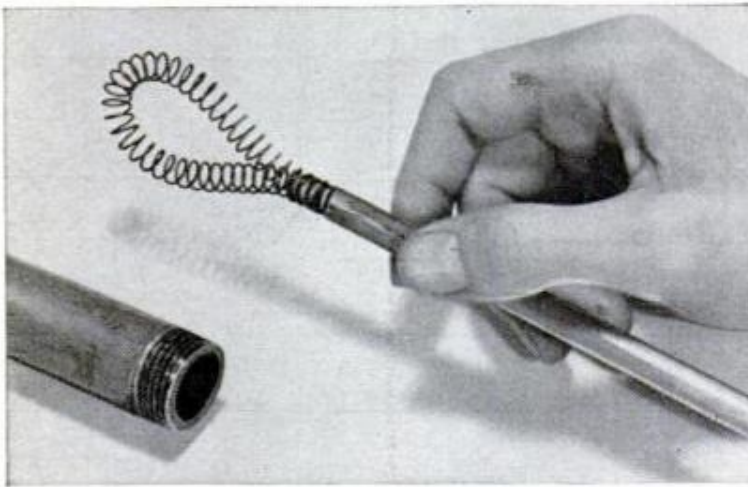
Make Your Mark

By altering the quill on the stopper of an India-ink bottle you can use it as a lettering pen in a pinch. Simply pare the end of the quill with a sharp penknife to a point and then slit it as shown in the detail. You can use it to make quite heavy lines as pictured, or you can draw fine lines with a little care.—*Richard Hanscom*



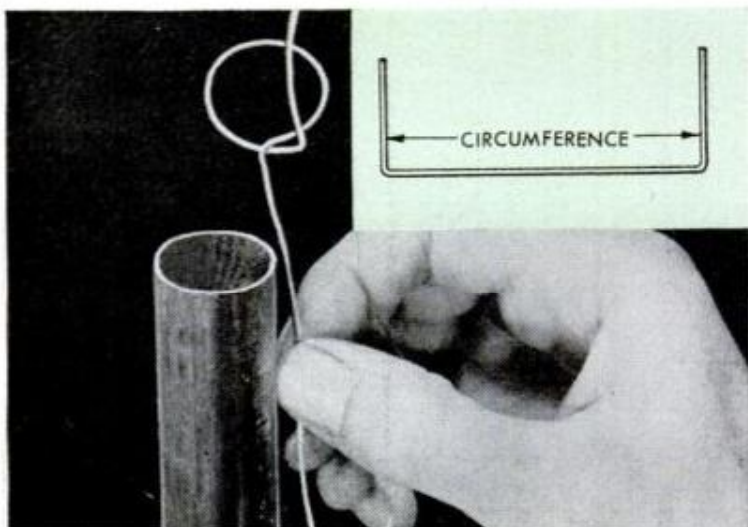
Longer Reach

There can come a time when you will need an extension for your socket wrench to get into an otherwise inaccessible place. With no extension at hand remember this one: Square the threaded end of a hex-head machine bolt as pictured and you've got the extension you need for the emergency job.



Pipe Cleaner

Ever try to clean rust and dirt out of a length of pipe? A cloth swab on a stick simply won't do it, but a length of coil spring attached to the end of the rod will even loosen scale as well as the dirt and rust. Just turn one end of the spring over the rod and turn the other end into the loops of the attached end as pictured.



Long Way Around

It's possible to measure the circumference of a pipe, rod or tube with a cord or masking tape but a better, more accurate way is to wrap a length of light wire around the pipe, pull tight and twist the ends one half turn where they cross. Then remove from the pipe and carefully straighten to a U-shape as in the detail. Measure the distance between the legs of the U and you've got it.

FOR SHUTTERBUGS

1. 35-MM. CAMERA has electric eye built around lens to transmit exposure information to view-finder on manual setting. On automatic setting it is impossible to take incorrectly exposed picture. Under \$113.00. Bell & Howell, 7100 McCormick Rd., Chicago



2. UNIQUE MINIATURE FLASH GUN about the size of a 1½-in. cube adjusts from direct flash to 90-deg. full bounce. Accommodates AG-1 bulbs, exposure guide, ejector, 15-v. battery, shutter cord, lenses. Price \$6.95. Scopus Inc., 404 Park Ave., S., New York, N. Y.



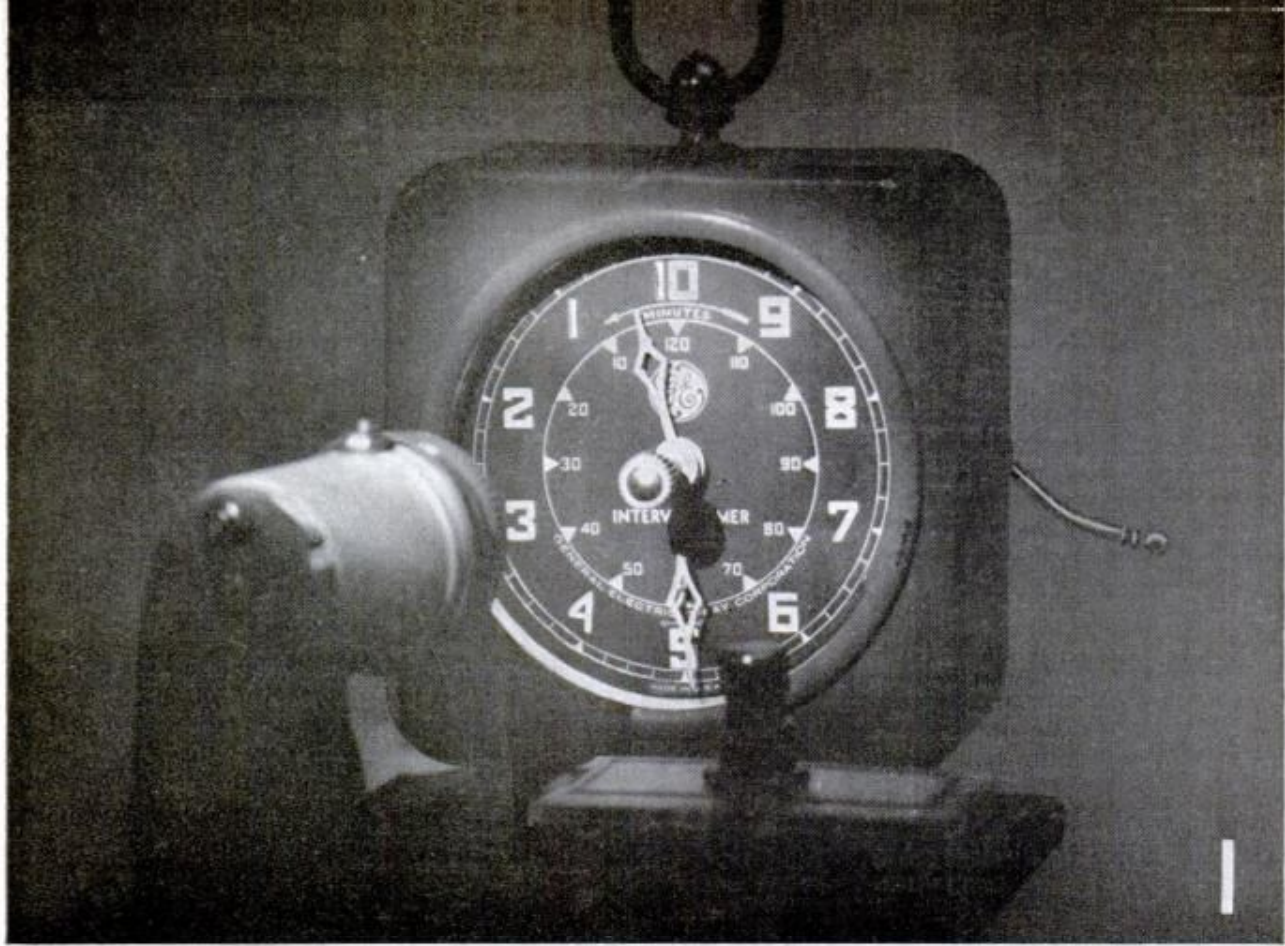
3. NEW WHITE, NONCORROSIVE photo trays are of solid lightweight material that will stand much abuse and cost less than metal trays. Dimensions are generously oversized to suit prints. American Hard Rubber Co., Div. of Amerace Corp., Ace Rd., Butler, N. J.



4. INTERCHANGEABLE BACKS for some Zeiss Ikon 35-mm. cameras will make it just as easy to change films as you now do filters and lenses. No need to carry more than one camera. Price \$49.00 and \$55.00. Carl Zeiss Inc., 485 Fifth Ave., New York 17, N. Y.

5. EASY-TO-USE low-priced camera takes sharp color slides, color snapshots and black-and-white pictures of subjects five feet and beyond. No adjustments required—just aim and shoot, indoors or out. Less than \$6.00. Eastman Kodak Co., Rochester 4,

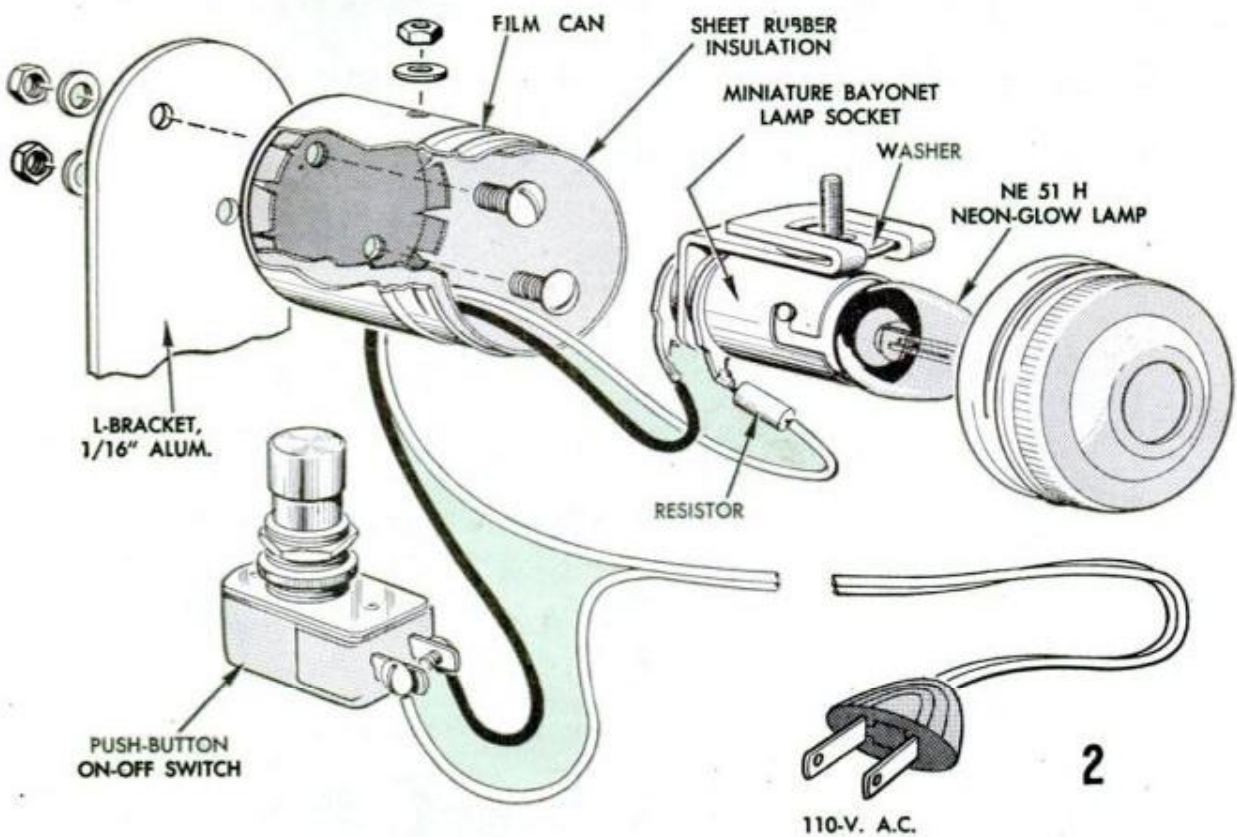




HERE'S HOW the light spotlights the dial of a darkroom timer. There's no guessing about the time

DARKROOM TIMER LIGHT

X 2 11



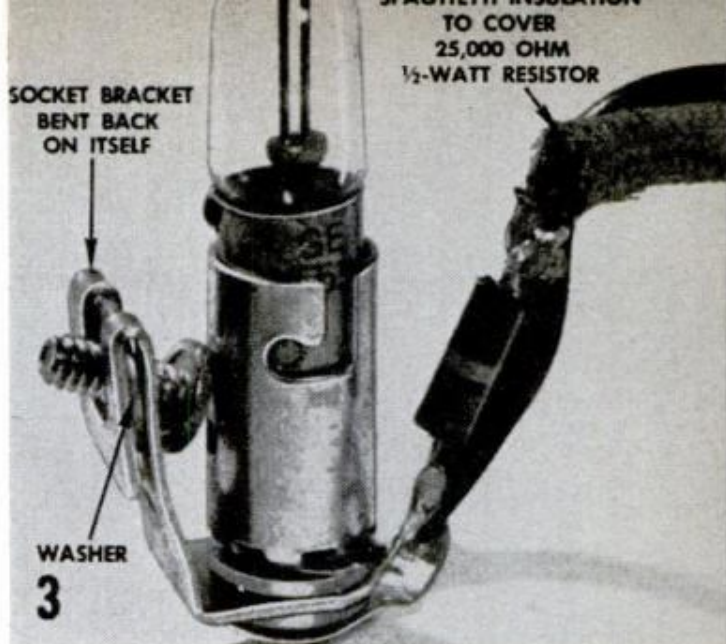
MANY QUESTIONS plague the photographer when developing films in total darkness. Like—where is that timer? How much more time have I got? Is the timer running? Did I or didn't I agitate properly? In many cases the proper agitation is 5 seconds every 30 seconds and although one may concentrate and count the seconds, more often than not the mind will wander to other subjects and agitation is either overdone or insufficient. Improper, erratic agitation may result in a poor negative—usable, but not perfect, according to the manufacturer's recommendation. Also, some negatives may need more developing time and the clock must be changed. This requires that the developing tank be covered, those bright room lights turned on and the timer reset. As a result, you are momentarily blinded. Here's where this timer light has proved to be the answer.

A 35-mm. film can is used for the lamp housing. Holes are drilled in the bottom for fastening it to an angle bracket; and in the side for the lamp cord and switch. A push-button switch is mounted on the cover of a plastic parts container found in radio and hardware stores. Use a 1/8-in. drill and press gently when drilling holes for the switch to avoid cracking the plastic. The holes are enlarged with a penknife or a reamer to the proper size. Then the box is permanently mounted on a base of hardboard with cement.

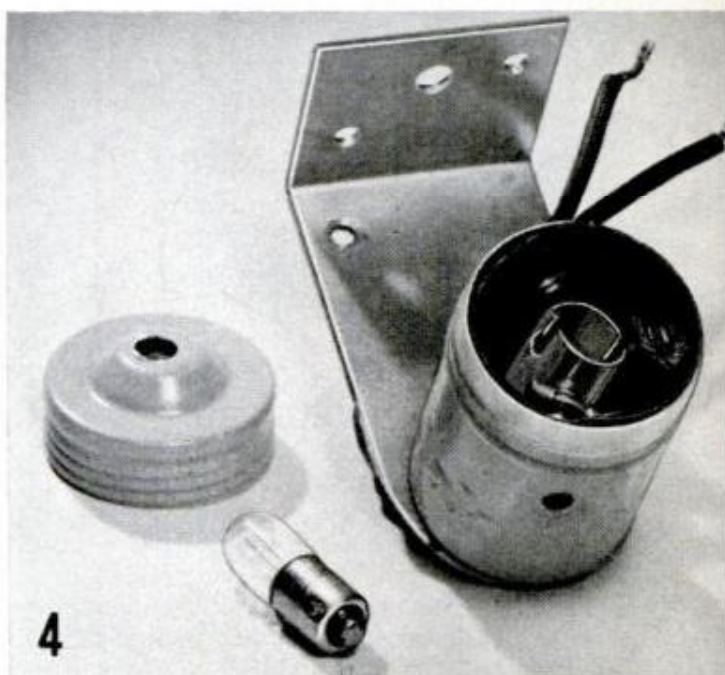
The lamp-socket bracket is bent to permit the socket and lamp to fit properly in the can. A washer of the proper screw size is inserted between and the bracket ends bent to prevent the washer and screw from dropping out before or during assembly. Before assembly of the lamp socket in the can, the inside and bottom of the can must be insulated to prevent the lamp socket from making contact with the can.

After assembly of the complete unit, a 3/8-in. hole is drilled in the cover and the hole flared by reaming with long-nose pliers. Flare the hole a bit at a time, testing in the dark, until the light output just covers the clock dial. The timer light is not to be used as a safe light. All safe lights will fog negatives during prolonged exposure to the light, and although the timer light output is weak and concentrated on the face of the timer, it too will fog high-speed films if exposure to the light is prolonged.

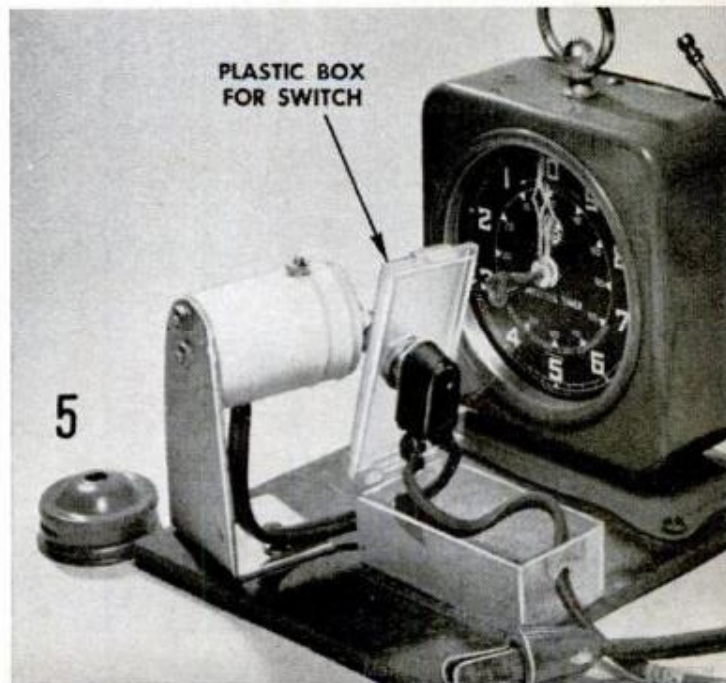
If the light output is too bright, insert a neutral density filter of tracing cloth inside the cap. Do not use green—it will kill the light entirely. Also, remove the clock face cover (glass or plastic) to avoid reflections and paint the clock body and all metal parts with dull black paint.—*Frank Fritz*



THIS ASSEMBLY, detailed on the opposite page, is fitted inside the film can. Note bend in bracket

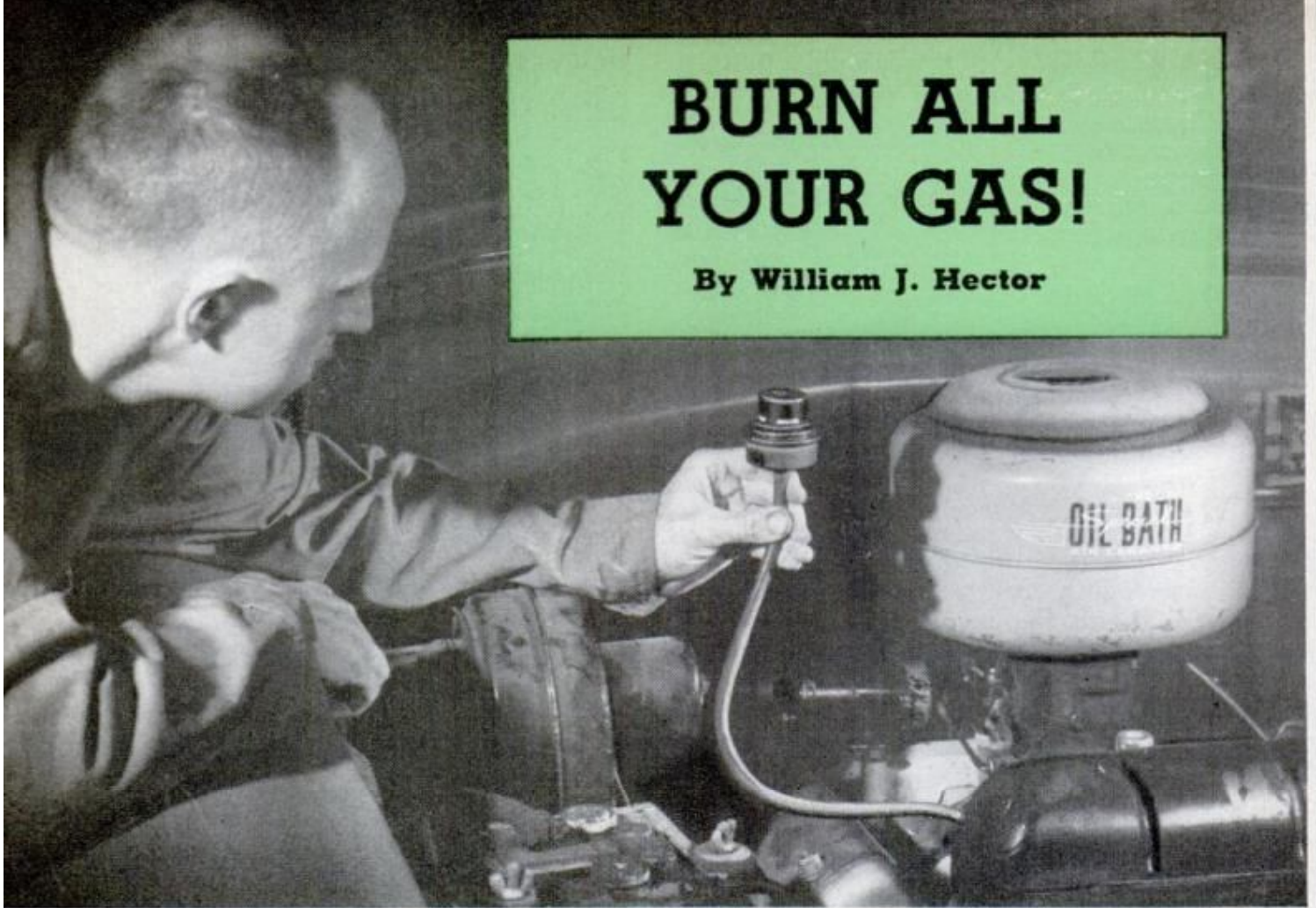


ABOVE IS COMPLETE UNIT mounted on its bracket and ready for installation on the base. Below, push-type switch is mounted in plastic box as pictured



BURN ALL YOUR GAS!

By William J. Hector



1. AFTER INSTALLING, system is checked out with this special vacuum tester. Proper vacuum is essential

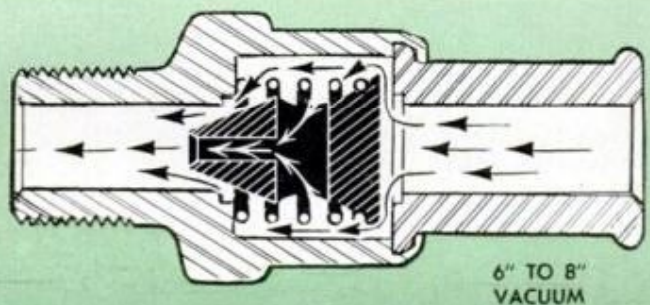
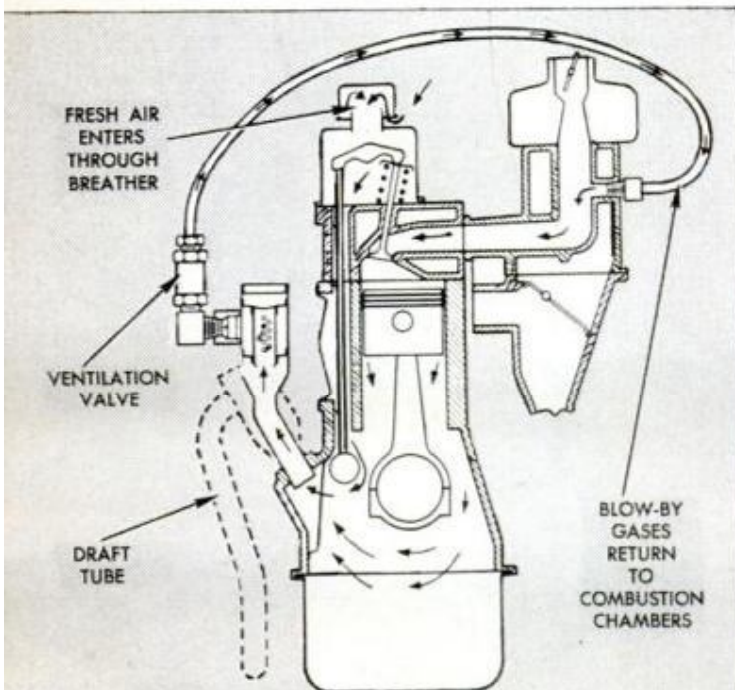
UTILIZING UNBURNED hydrocarbons that originate in the engines of cars and trucks is a major concern of health researchers. Not all burnable elements in motor fuels are consumed in the engine cylinders at the instant of ignition. A portion of the unburned gases pass the pistons, enter the crankcase and are vented through the road-draft tube of the crankcase ventilating system. That portion that does not

enter the crankcase passes out through the exhaust system. These vented elements combine with nitrogen oxides in the air to produce what has come to be known as smog, a growing health problem in nearly all major cities.

Of the three methods of burning all the fuel—recirculating blow-by gases, fuel shutoff during deceleration and eliminating unused exhaust gases by means of an

2. FORCED VENTING SYSTEM shown diagrammatically. Note how fresh air is admitted through breather and how unburned fuel elements (blow-by) are recirculated back to intake manifold and to cylinders

3. VENTING VALVE of new system fully open. This valve compensates for vacuum variations, maintains adequate, continuous recirculation of unburned gases



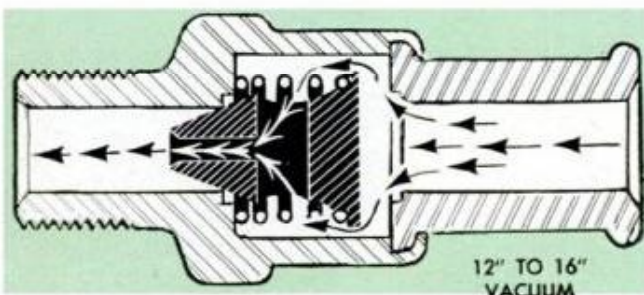
SATURDAY MECHANIC

afterburner—the first appears to be the most efficient under average conditions. A kit of parts for the installation, Figs. 1, 2, 3, 6, 7, 9 and 10, costs only a few dollars and the resulting protection is threefold. Here's the reason why: The regular crankcase ventilating system with which late-model cars are equipped removes blow-by gases—which consist mainly of unburned fuel remnants, oil and water vapor, and acids—from the crankcase at road speeds of 20 miles per hour or more. At lower speeds these contaminants remain in the crankcase and in time form sludge. Thus, forced crankcase venting by means of a recirculator system does three things—recirculates unburned fuel elements continuously back into the intake manifold; prevents contamination of the lubricating oil under all driving conditions and prevents the greater portion of the unburned hydrocarbons from entering the atmosphere via the exhaust system.

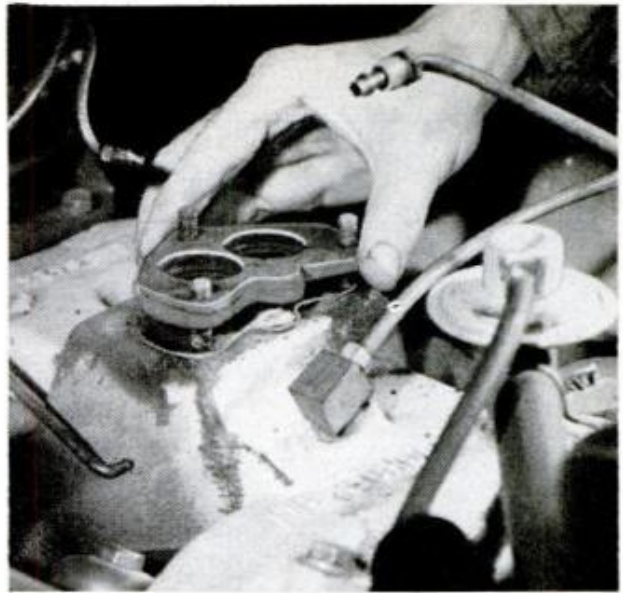
The recirculating installation utilizes manifold vacuum to withdraw gases from the crankcase and recirculate these back into the cylinders. Since the vacuum in the intake manifold varies with the motor speed, some compensation is necessary in the system to maintain adequate circulation. In other words, as the speed of the car increases the vacuum in the intake manifold decreases so a regulating valve is installed in the positive venting system to open completely, compensating for varying vacuum. As the motor slows down the vacuum increases and the valve closes with just a bleeder hole open, allowing the gases to circulate at a rate comparable with the production of blow-by. See Figs. 3, 6 and 7.

In making a typical installation there are several steps to be followed closely and in sequence. Basically these will hold for all cars. In general you clean the oil breather cap in a solvent by soaking for 10 or 15

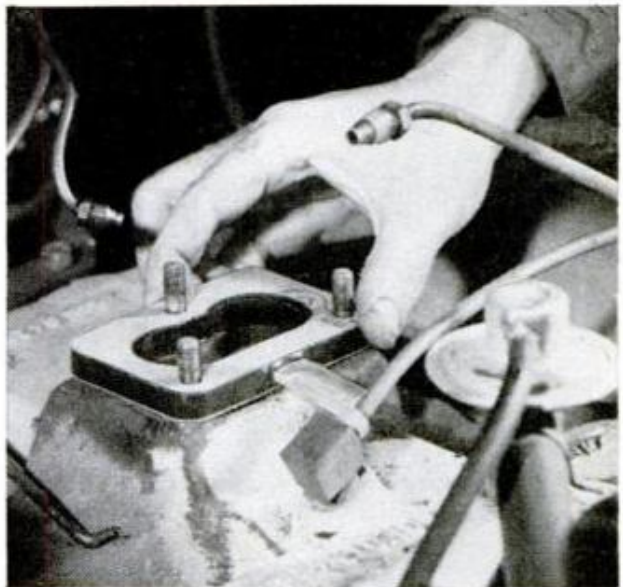
6. AS MOTOR SLOWS vacuum increases and valve closes with only a bleeder hole open, permitting gases to circulate at rate comparable with the blow-by



NOVEMBER 1962

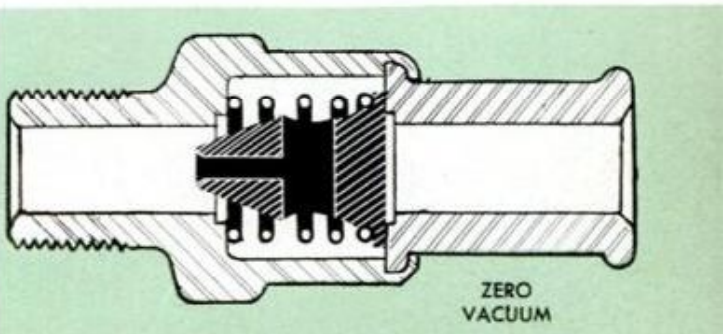


4. ON MANY CARS there is a special spacer, or riser, about $\frac{3}{8}$ in. thick under the carb. This must be removed and discarded. Also the old studs are removed and replaced by longer ones that come in kit. Take it easy with wrench and screwdriver. One slip, one too-hard twist, and you may buy a new part



5. NEW CARB SPACER being installed. This spacer provides opening into intake manifold for passage of unburned gases from crankcase. Note also the new studs which are somewhat longer than the originals

7. WHEN ENGINE stops, valve closes completely, allowing no gases to pass. Condition is that of zero vacuum. Valve also is pictured in Figs. 9 and 10



171

minutes, then agitate actively in the solvent and brush out any sediment, Fig. 8. Be sure to drain the cap dry and re-oil with engine oil. Remember the filter element won't perform properly without re-oiling since fresh air enters at this point and will carry dust with it unless this is done. Next, remove the air cleaner. Then, loosen the carb hex nuts, and remove the carb from the intake manifold. Remove the old gaskets, Figs. 4 and 5, and clean the gasket surfaces of both the carb and the intake manifold. Be sure you do not allow any dirt or grime to fall into the manifold when cleaning. On some cars there is a gasket block, or spacer, about $\frac{3}{8}$ in. thick. This must be removed permanently.

Remove the old carb studs. An application of penetrating oil can make the job easier. The studs that come with the kit have a longer thread than the original. Care should be used not to damage the threads when installing the new studs. Install in this order on the intake manifold the new carb gasket, carb spacer with tube pointing front and down, carb gasket, and finally the carburetor. Hook up the fuel lines and linkage. Do this before tightening down the carb on the manifold. It's best to use a torque wrench to assure tightening the carb nuts to correct specs.

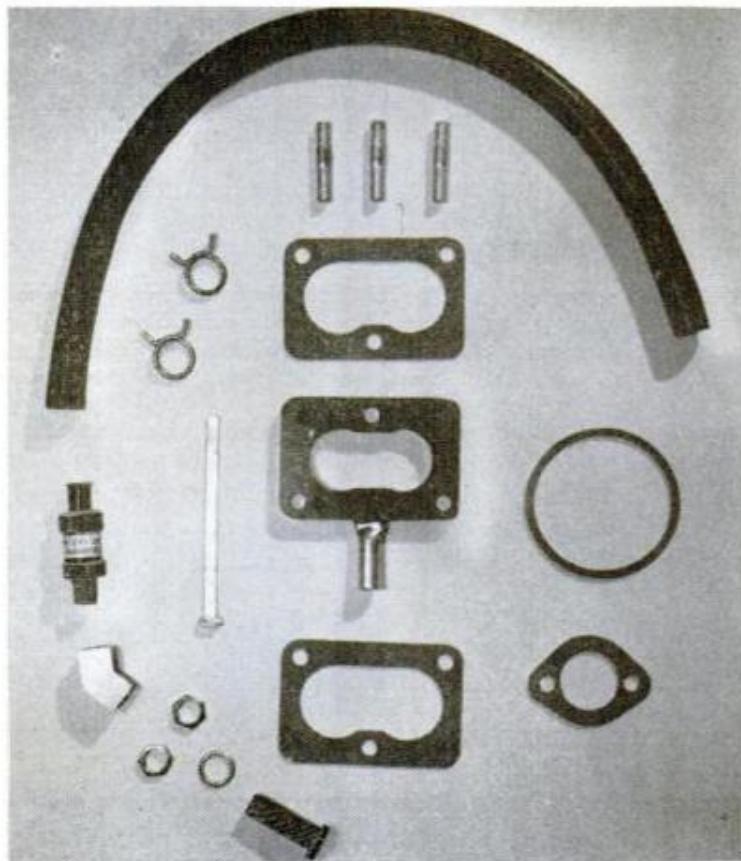
Next remove the road-draft tube and crankcase filter base assembly by removing



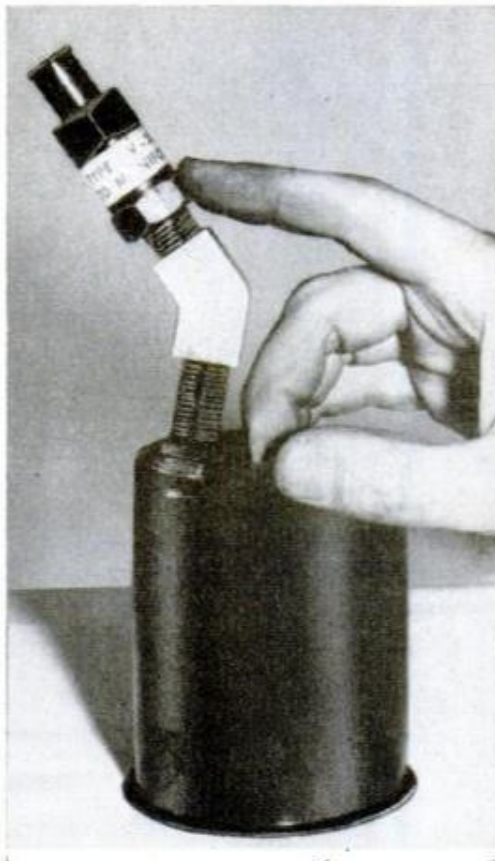
8. AS FIRST STEP in making installation remove the breather cap, clean in solvent thoroughly and re-coil

the screw on the element shell and the two screws retaining the assembly on the motor block. The two latter screws often have Phillips heads. Discard the filter element and clean the base assembly in solvent. Flatten the lower end of the road draft tube several times in a vise in 1-in. folds, Fig. 13. Since this must be an airtight seal, place gasket sealing compound in the opening before you crimp the tube. Clean the gasket surfaces on the motor block and the filter-base assembly. As the opening on the motor block could be the

9. HERE'S COMPLETE KIT for do-it-yourself installation on all common makes of cars. Kit is inexpensive and simple to install



10. FINGER POINTS to valve which is the heart of the forced ventilating system



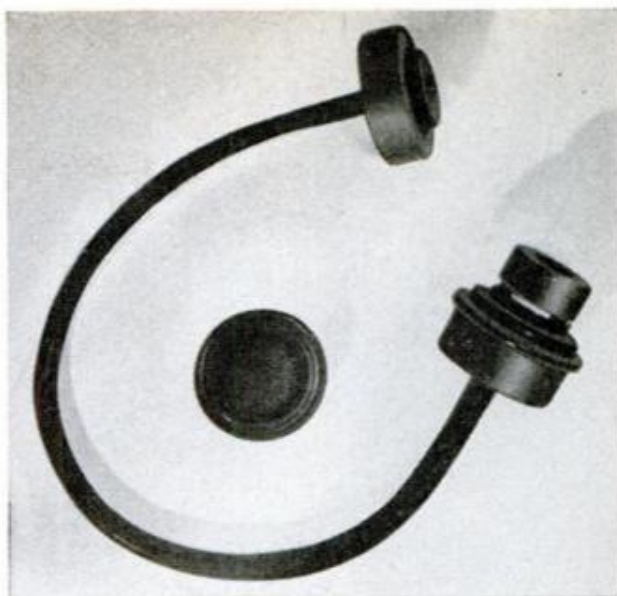
cause of a serious oil leak it's best to use a gasket sealer on these surfaces. Install on the motor block and tighten the screws carefully. Coat the filter-cover gasket with wheel-bearing grease and place in position.

Now drill a 17/32-in. hole in the element cover, Fig. 12. Slide the threaded sleeve (hollow screw) through the inside of the cover, through the hole, and slip the 14-mm. spark-plug gasket over the sleeve. Tighten one nut securely over the gasket, then tighten the second nut over the first to act as a lock nut. Coat the hex end of the screw inside the cover with gasket cement as a seal against possible leaks. Place the filter cover over the base assembly with the sleeve towards the front of the car. Tighten down with screw and washer. Thread the brass elbow onto the sleeve, tightening so it inclines up and toward the center of the car, Fig. 10. This will prevent any acute angles in the rubber hose, Fig. 9, as well as keep hose away from the hot motor. Since the fuel reclaiming valve, Fig. 10, will be removed for periodic servicing it will help if a slight bit of graphite grease is added to the valve threads before assembling and tightening on the elbow.

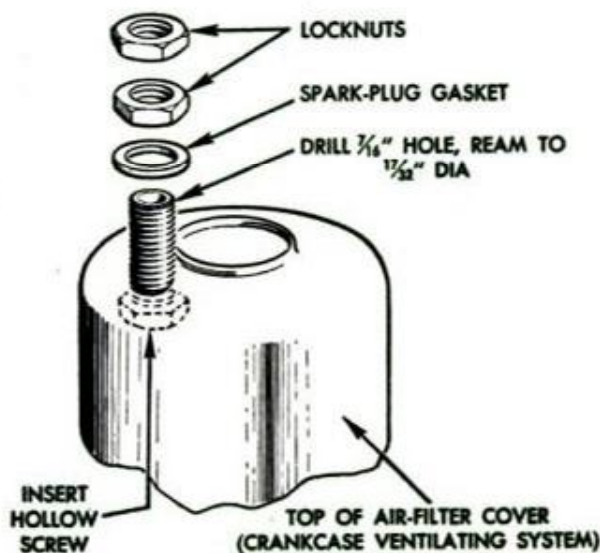
With the slightest bit of silicone grease on the tip of your little finger lubricate the inside of each end of the hose. Slip a clamp over each end and slide over the carb spacer and valve, then move the clamp in place over each input. Take the metal strap and place over fuel line and rubber hose, positioning the elbow for good clearance.

Replace the air cleaner, start the engine and run until warm. Then adjust the carb for smooth idle. On a simple carb there are two adjustments, idle speed and mixture. Turn out the mixture adjustment first a turn or so, then turn in until the engine starts to roll. At this point back off the screw until the engine idles smoothly. Because of the extra quantity of air entering the intake manifold through the new ventilating system it may be difficult to achieve the proper fuel mixture. If signs of lean mixture are apparent, and you can't get a correct adjustment, consult your auto parts dealer and a service manual regarding installation of richer main metering jets and proper adjustment.

Since the correct operation of this system depends on the proper vacuum existing in the intake manifold, check with the gauge made for the purpose, Figs. 1 and 11. Then check the entire vacuum system. This includes windshield wipers, washers, fuel pump, and check for possible leaks around the gasket of the intake manifold and carb. Make any corrections or replacements necessary as loss of vacuum will reduce circulation of gases in the new system. ★★★

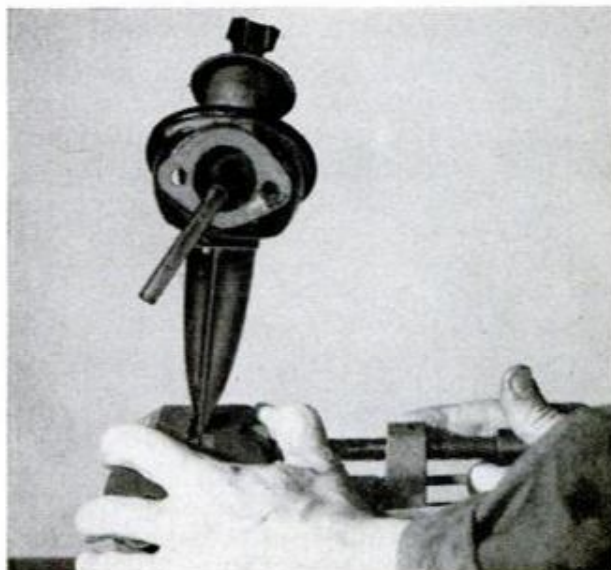


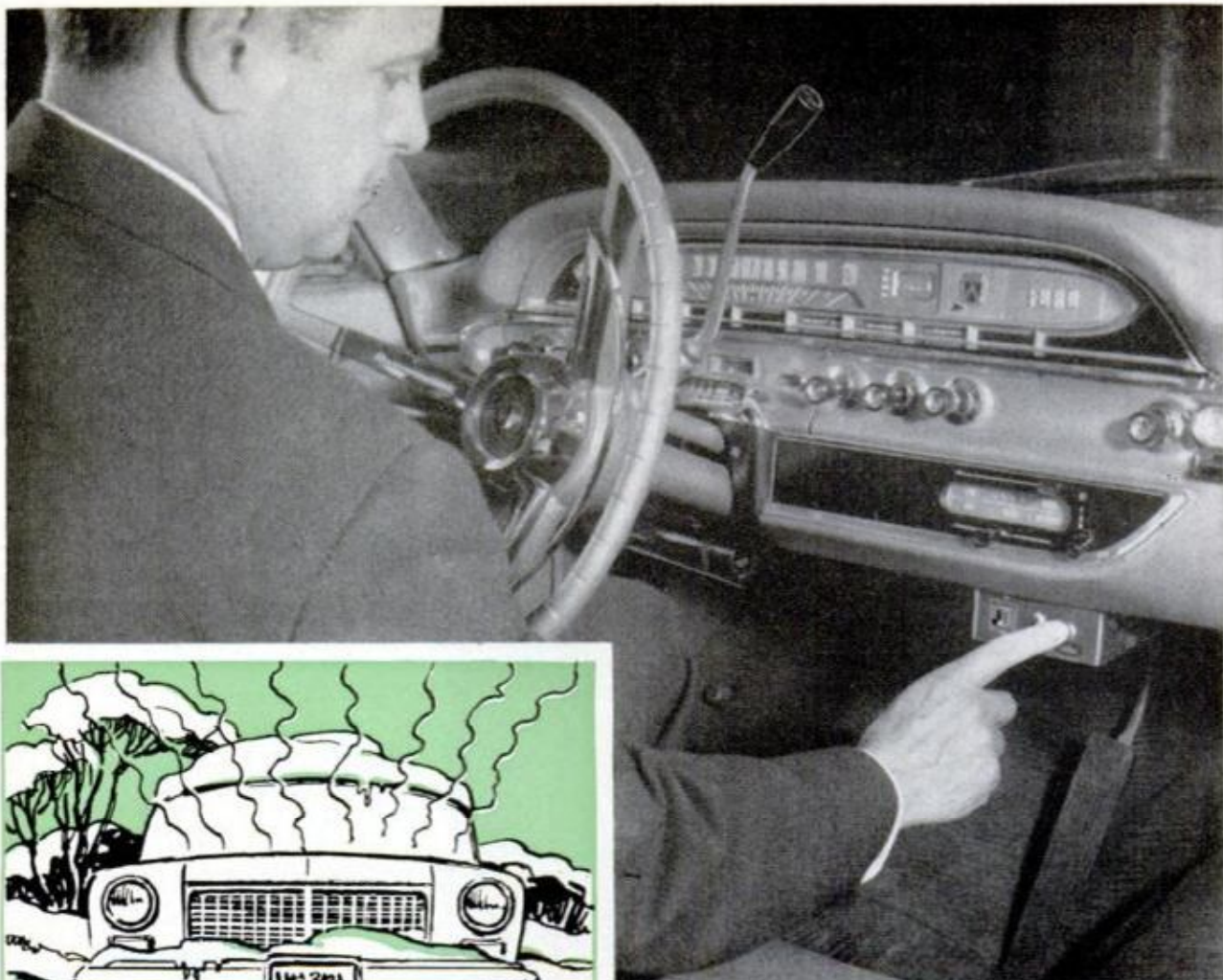
11. VACUUM TESTER, or gauge, gives accurate check on the vacuum in a new system. See Fig. 1



12. HOLLOW SCREW, or sleeve, is inserted through hole drilled in air-filter cover. Takes vacuum valve

13. ROAD-DRAFT TUBE is closed by flattening end, folding in three 1-in. folds and crimping in vise





DRIVER PUSHES BUTTON at dash-panel unit to put robot in control of car's motor to run it intermittently and so keep motor and car warm. Indicator light near button shows car is under automatic control

Robot Keeps Parked Car Warm

Runs motor intermittently, eliminates cost of heated garage and makes carports "up north" more practical

HARD STARTING in frigid weather, discomfort of getting into a cold car and the frosting up of the windshield are troubles of the past. Now a car-control robot, designed for 12-volt electrical systems, starts and stops the motor, heater and defrosters automatically for easy starting and comfortable riding.

A parked car can be kept warm as long as the gas supply holds out. When leaving the car, you turn off the ignition, remove the key, push a red button on the dash-control unit that puts the robot in control, then lock the doors as usual. Nobody can drive the car away without the ignition key because shifting the transmission lever automatically disengages the unit and stops a

running motor. When you return you simply start up and drive off. You are not leaving your car running unattended in the sense meant by anti-theft ordinances, and therefore you are not violating them.

Persons with kind intentions to stop a running motor of an unoccupied car are informed by a sticker on the windshield that the car starts and stops by itself during cold weather and cannot be driven without a key. If, when the motor is placed under automatic control, it does not start within approximately 20 seconds after the starter has been switched on by the control unit, the device ceases to function, so the battery won't run down. When parking the car in a garage, you don't switch over to automatic

control. In this way, the unit cannot operate by itself. This eliminates danger of carbon-monoxide gas in a closed garage.

Called AutoStart, it consists of a dash-panel unit, a control assembly, a motor-block thermostat, a motor-speed solenoid, and either a safety switch or a vacuum switch. The dash-panel unit contains a pushbutton switch which puts the unit in control, an indicator light that shows when the unit is in control, a thermostat that turns on at 35 to 45 deg. F., and off at 70 deg. F., and a selector switch which allows you to select either the interior thermostat or the motor-block thermostat to function.

The control assembly contains all switching and time-limit relays. It is mounted under the hood where it is convenient to connect to the car's electrical system. The block thermostat is attached with heat-conducting cement to the motor block or a metallic part of the water line; turns on at about 80 deg. F. and off at 125 deg. F. It functions when the selector switch on the dash-panel unit is set to "block" position. The motor-speed solenoid connects to the accelerator linkage, steps up motor speed to 850-1000 r.p.m. This speed prevents battery discharge and also the rapid formation of carbon due to idling.

All cars except those having push-button transmissions require a safety switch connected to the "Park" or "Neutral" positions of the control lever. This disconnects the automatic control when the lever is shifted. Cars having alternator ignition systems, regardless of the type of transmission, require a vacuum switch which senses when

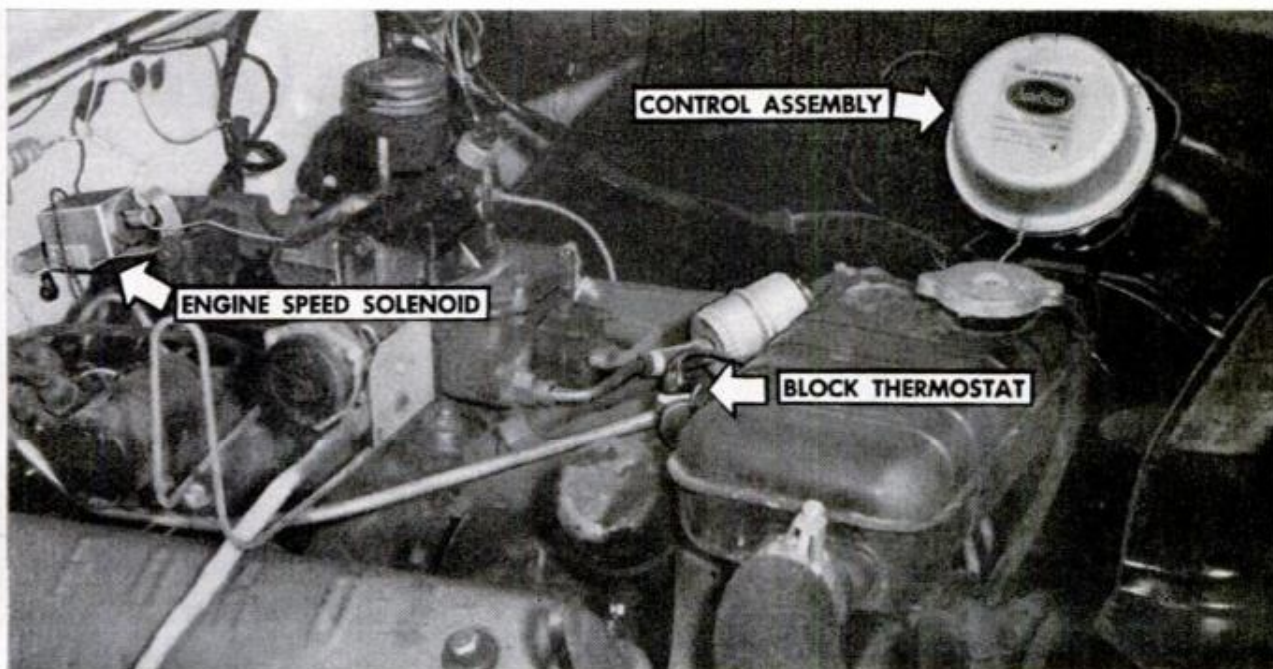


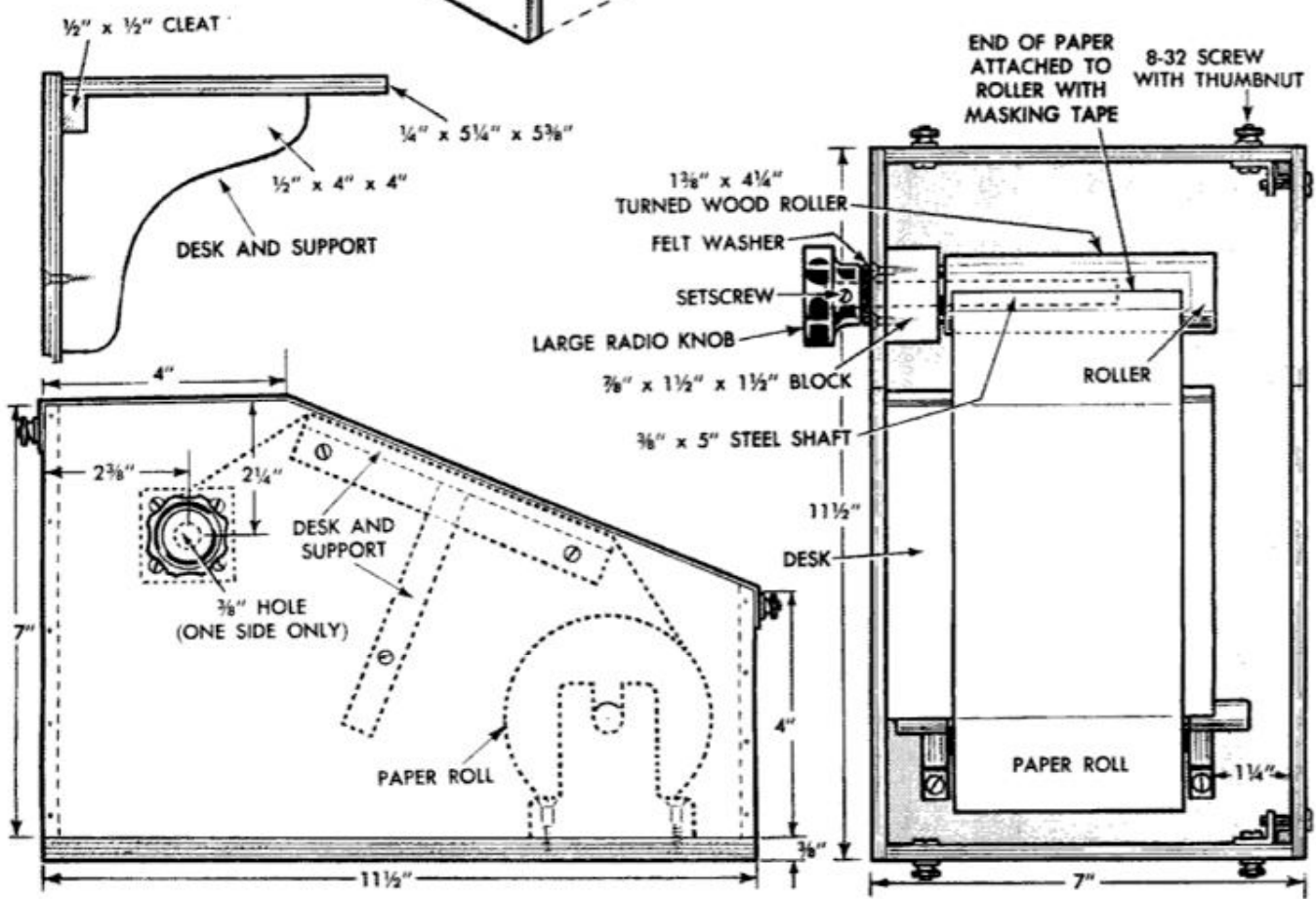
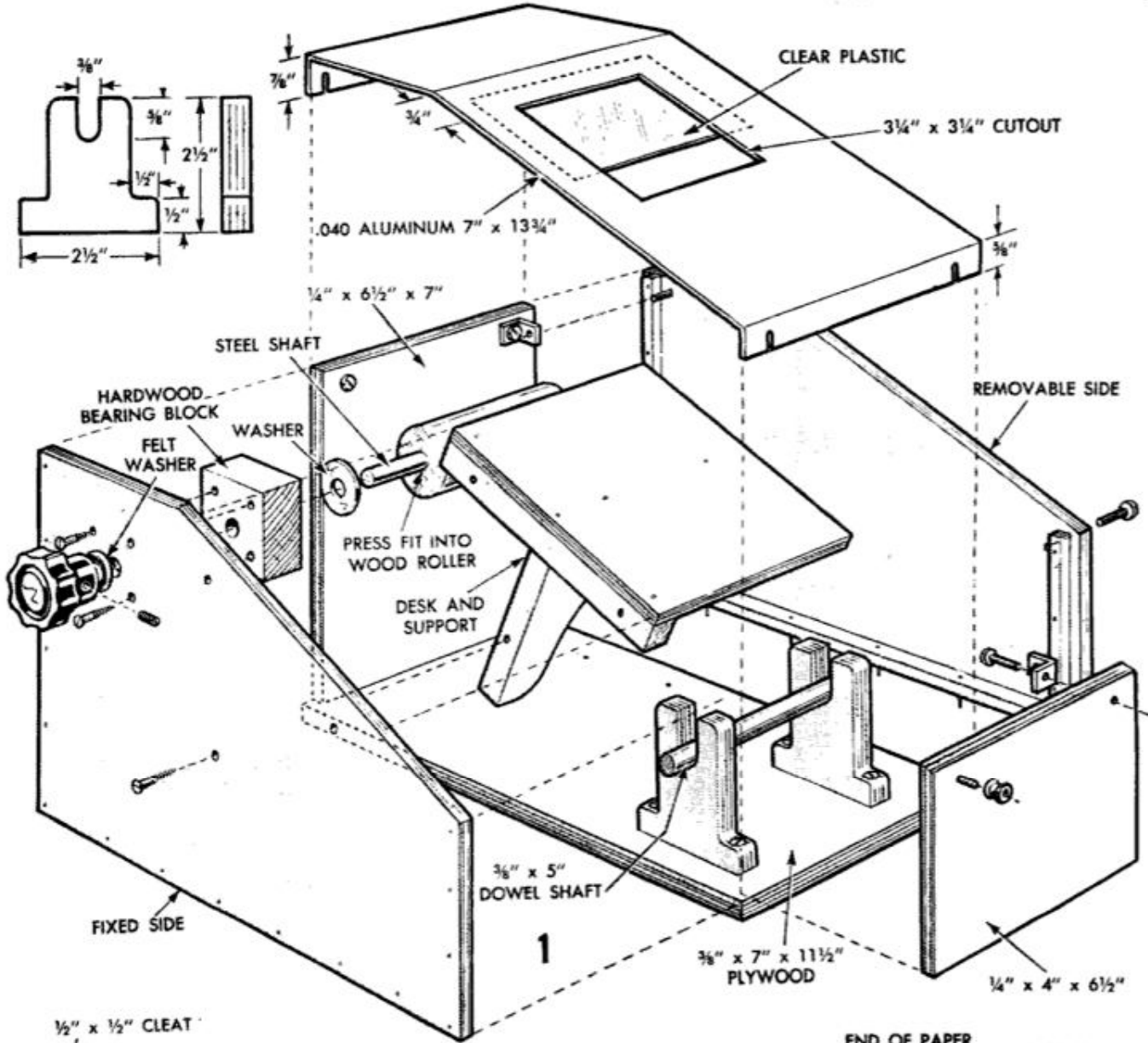
INTERIOR THERMOSTAT is held behind the dash-panel unit in free air out of airstream of the car heater

the car is self-running and shuts off the relay to the car-starting circuit.

Installation should be attempted only by those who have a good working knowledge of the car's electrical system. Available through your local new-car dealer, the unit is made by Systematics, Inc., 1821 University Ave., St. Paul 4, Minn., and costs from \$74 to \$85 approximately, varying with the items furnished, as dependent on the make and year of the car, the type of gearshift, whether it is alternator equipped and also if it is air-conditioned. ★ ★ ★

UNDER THE HOOD is the control assembly which connects to the car's electrical system, the block thermostat cemented to the motor block, and also the motor-speed solenoid which connects to the accelerator linkage





TEACHER'S HELPER

By Harold P. Strand



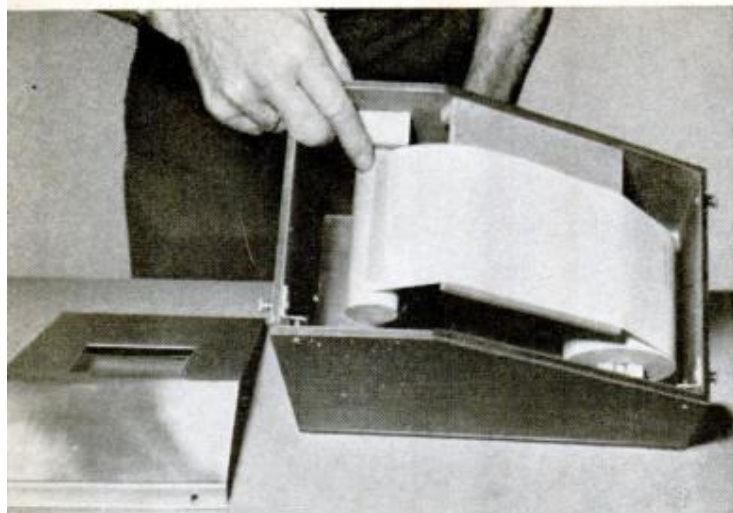
TEACHING MACHINES, now being used experimentally in schools all over the country, may well bring about a revolution in mass education (See "Will Robots Teach Your Children?", Oct., 1961). The many commercial models now available range from simple, inexpensive types to sophisticated versions costing several hundred dollars, some of which even involve the use of a computer. However, the basic idea behind all of these machines is the same: to give the student information in simple steps which include frequent test questions to determine his understanding of the material. After the student has recorded his answers to each question, the machine reveals the correct answer.

The most important feature of programmed learning is that the student finds out the correct answer to the question immediately. This elimination of the normal time lag between testing and grading has been shown to increase understanding and produce greater memory retention of the subject. In the case of problems, he can check his calculations against the solution included with the correct answer, and thus pinpoint any errors.

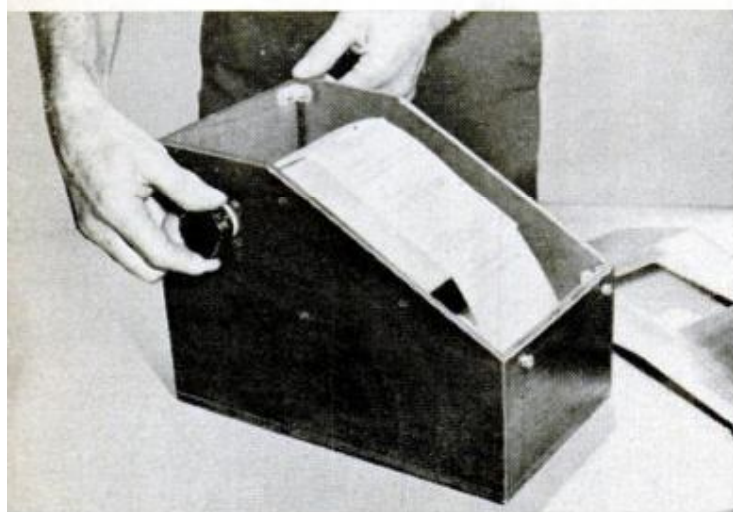
Naturally, most smaller school systems are reluctant to invest any large amount of money in experimenting with the use of teaching machines. The simple teaching machine detailed in Fig. 1 here can be built in the school shop for about \$5 and is well

2. PAPER TAPE being prepared by using typewriter without removing the paper roll from the unit



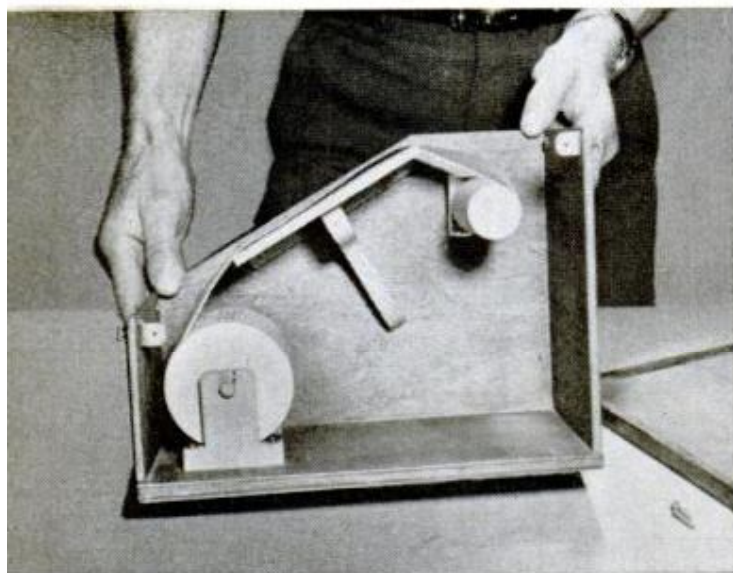


3. **END OF PAPER** is fastened to the winding roller with a strip of removable tape. It must be cut and attached squarely for good tracking. A 10-in. blank space is needed between end of roll and typing



4. **TURNKNOB** on the left side of the housing is attached to shaft of winding roller with a setscrew. Here the roller is given one turn to test for proper tracking of the tape before the machine is put to use

5. **FULL ACCESS** to interior of the housing by easy removal of right side permits the quick insertion of the paper roll in the slotted supports from which tape is pulled across the "desk" and viewing window



suitable to such experimental use. If encouraging results are obtained from a thorough test of the method using these economical machines, the school may wish to give some thought to the purchase of commercial machines for regular use.

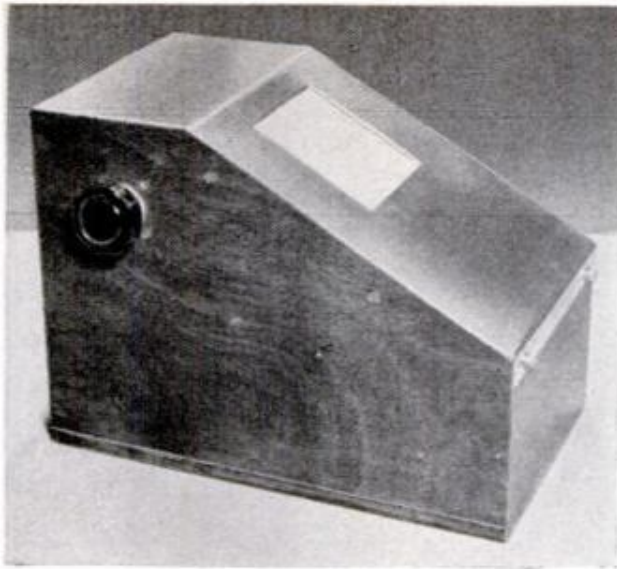
The unit shown here holds a roll of paper tape containing the test questions. This tape is drawn across a "desk" under a viewing window, the top two thirds of which are covered by a piece of clear sheet plastic, and answers to the questions are written directly on the tape, using the opening just below the plastic sheet. The roll of paper tape is slipped over a dowel which is supported by two slotted blocks mounted on the bottom. Then the loose end is brought up over the desk surface and attached to the wooden take-up roller at the opposite end with masking tape. A knob on the outside turns the roller, thus winding the tape on it, Fig. 6.

Type Directly on Tape

Some copying machines can accommodate special roll stock, and while this will increase the cost of testing programmed teaching, the purchase of such stock should definitely be considered if a large number of machines are involved in the test. However, if only two or three machines are to be used, then lessons or tests can be typed directly on the tape, Fig. 2. The end of the tape is left blank for about 10 in. to reach the winding roller before the typed material appears at the window position, Fig. 3. The heading consists of space for the student's name, the subject of the test or lesson and the date space, Fig. 8. The first numbered question comes next, followed by spaces for the student's answer, and then the correct answer. These three items are grouped together so that they can all be seen at the same time through the window, as indicated by the dotted lines in Fig. 8.

Operation of Unit

The student turns the knob until the space for answering comes below the open portion of the window. An asterisk can be typed on the tape to line up with a dot or arrow on the plastic to indicate the stopping point. After writing his answer, the student turns the knob to bring the correct answer in view. In so doing, his written answer slides up under the plastic so that it cannot be altered but still permitting him to compare his answer with the correct one to know whether he is right or wrong. The correct answer should include some explanation of how the problem was solved. By turning the knob to the next question the process is repeated.

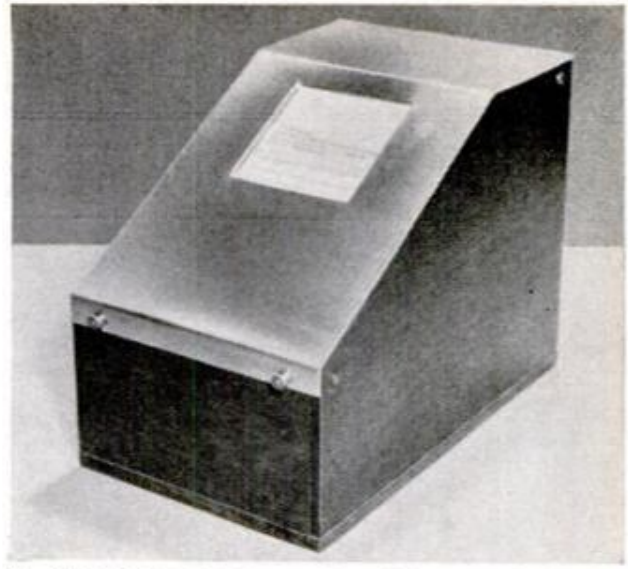


6. **READY FOR USE** after the top has been firmly secured with four thumbnuts which hold it in position

Details of construction and assembly are shown on the full page of drawings. The top is made of half-hard sheet aluminum .040 in. thick. It is fastened by means of four thumbnuts to permit quick removal. One side also is removable, being held in place with thumbscrews. This provides full access to the interior for installing the paper roll. Figs. 3 and 4 show the top removed, and Fig. 5 shows both top and side removed. If it is considered advisable to make the box tamperproof, other methods of fastening the removable parts can be improvised.

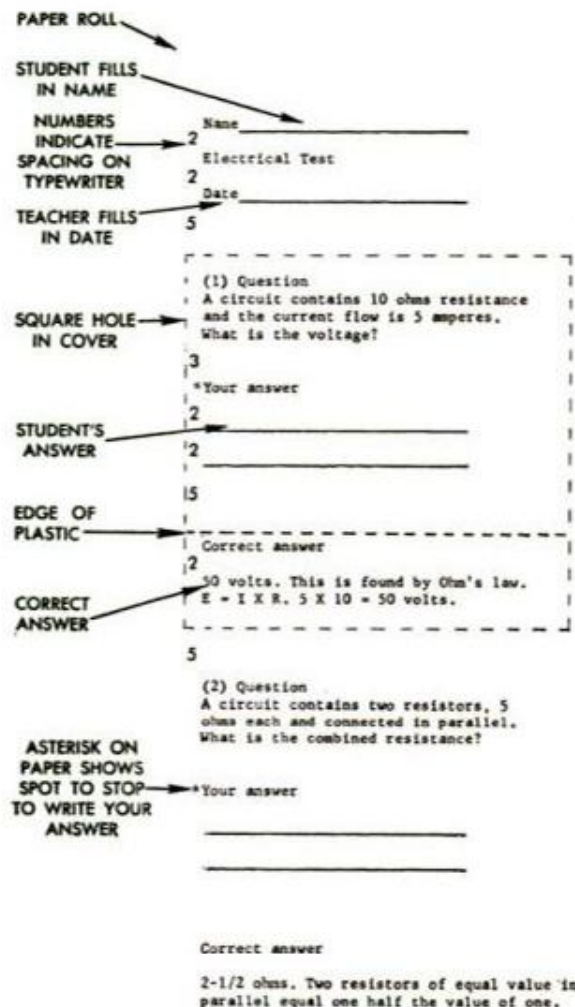
Permanent joints of the plywood are fastened with glue and brads. Angle brackets secured to the ends of the box, adjacent to the removable side, are tapped for the thumbscrews that hold it. The winding roller is a piece of wood drilled for a tight drive fit on a $\frac{3}{8}$ -in. steel shaft and then turned down in a lathe to $1\frac{3}{8}$ in. dia. A hardwood block serves as a bearing for the shaft and must be drilled true so that the shaft will be parallel to the paper roll. Otherwise the paper will run off one end of the winding roller. The end of the paper is attached to the roller with masking or drafting tape.

A piece of birch plywood, fastened to a cleat and bracket, forms the "desk" which holds the tape and also provides a smooth writing surface. The bracket and cleat are attached to the side of the housing with three screws driven in from the outside. A sheet of clear plastic about .040 in. thick is cemented to the underside of the top to cover the upper two-thirds of the window. When assembled, Fig. 7, the unit may be finished with a stain and at least two coats of shellac or simply given two coats of pastel enamel. ★ ★ ★



7. **ALUMINUM TOP** is smooth and sloping which adds to ease of writing answers in open part of window

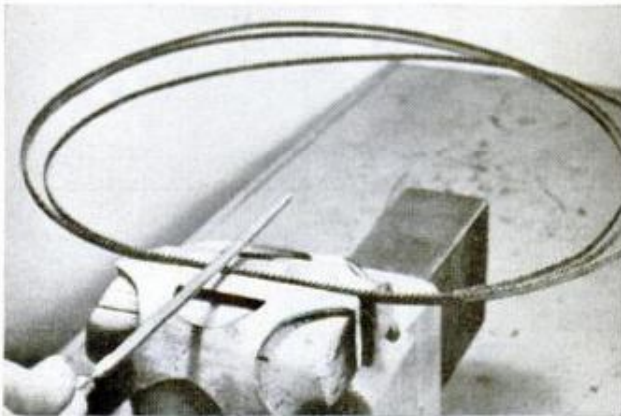
8. **ACCURATE GROUPING** of copy on tape is important for student's easy observation and comparison





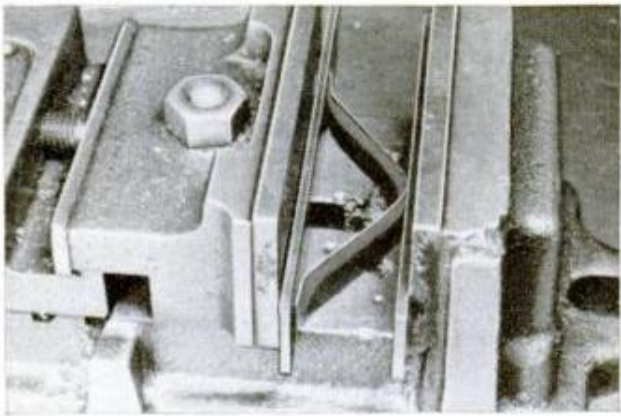
Ruled C-Clamp Aids Setting

White lines painted on the body of a large C-clamp at points spaced at $\frac{1}{2}$ -in. intervals from the stationary anvil, will simplify setting the jaws almost to the exact opening desired before putting the clamp on the work. This eliminates the inconvenience of holding the clamp and work pieces with one hand and turning the screw a considerable distance with the other—*R. Hanscom*



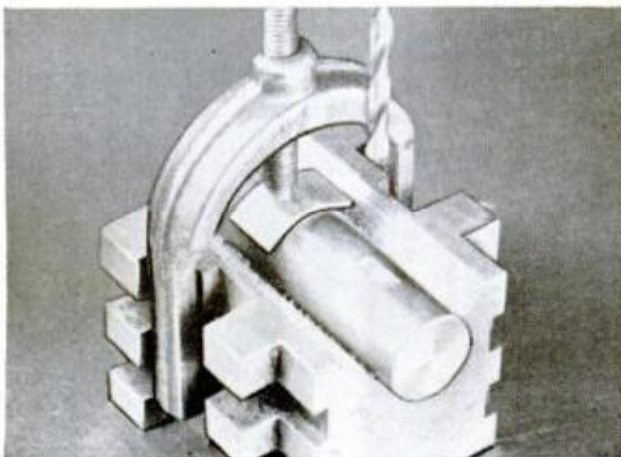
Gang-filing Bandsaw Teeth

By coiling a bandsaw blade to form three loops you can grip them side-by-side in a vise and file three teeth at once. Arrange the blade sections in perfect alignment in respect to width and tooth position. First grip them with two small C-clamps spaced slightly more than the length of the vise jaws and then mount them carefully in the vise so gullets come just above the jaws.



Spring Holds Parallels

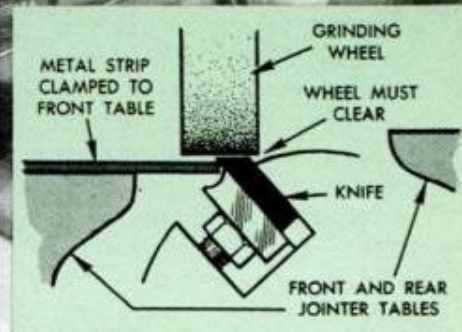
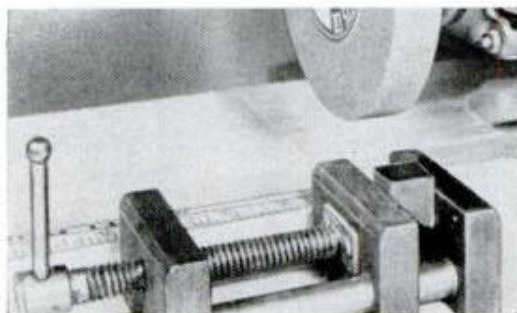
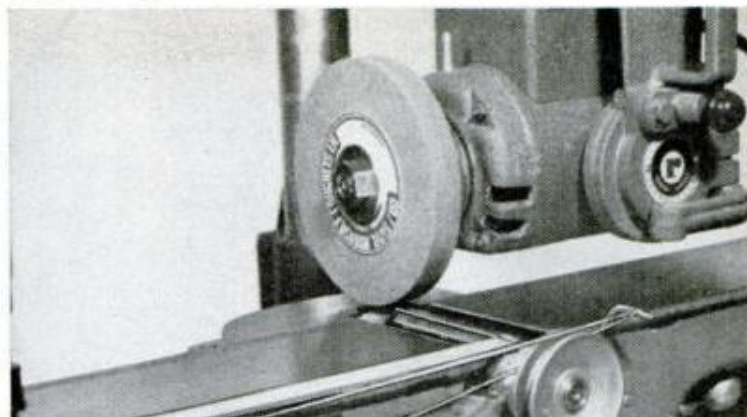
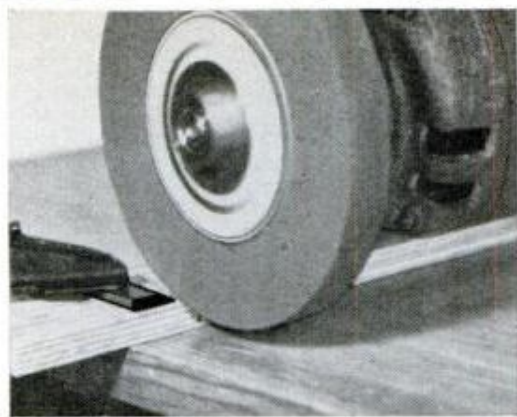
Bent to a hat shape, a length of flat spring steel or old bandsaw blade will hold thin parallels in a drill vise from falling over, slipping around and permitting chips to get under them. The shape of the holder can be altered to accommodate various gap openings. The spring flattens when the vise jaws close. It is also handy for milling-machine setups.—*H. J. Gerber*



Centerpunching Shafts

Locating the center of a shaft accurately to centerpunch it for drilling a crosshole is easily done as follows: First use a small two-flute end mill in a drillpress to make a narrow flat on the side of the shaft while it is clamped in a V-block. Then locate the center of the flat by eye and centerpunch it. The narrower the flat is the easier it will be to locate its center.

How to Surface-Grind on a Radial Saw



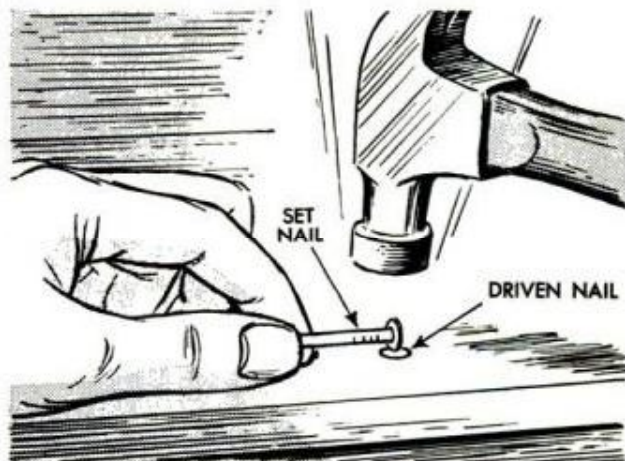
Surface grinding to a plane surface, also any grinding job where the work can be stationary and the wheel moved, can be done with your radial saw. Three examples are pictured above, the photo and detail at the right showing one way to grind jointer knives. Set the jointer on the saw table and then level it so that the travel of the wheel face is parallel with the bevel of one knife, as in detail. Then clamp a straightedge to the jointer front table in a position that will hold the cutter head with the knife bevel in position as in the detail. Loop a strong cord over a setscrew wrench which is inserted in the setscrew in the pulley and tie it around the slide projection at the front of the table as pictured. Then lower the overarm of the saw until the grinding wheel just touches the knife, make a pass or two and again lower the overarm slightly. Continue the

procedure until the knife edge tests sharp throughout the length. Repeat the setup for the remaining knives, turning the jointer head and locking as before.

To grind a bevel on a cutter, chisel or plane iron, clamp it to a piece of plywood which is in turn clamped to the saw table as in the upper left-hand photo. Once the work has been located, just back the rotating wheel slowly until it touches the bevel. An advantage of this method is that the curvature of the wheel will hollow-grind the bevel slightly. To grind a surface, clamp the work in a drill vise as in the lower left-hand photo and place the vise against the fence. Then lower the grinding wheel to a light contact and make as many passes as are necessary to finish-grind the entire surface. Ordinarily, it's best to use a fine-grit wheel.—Ben Quan

To Set a Nail

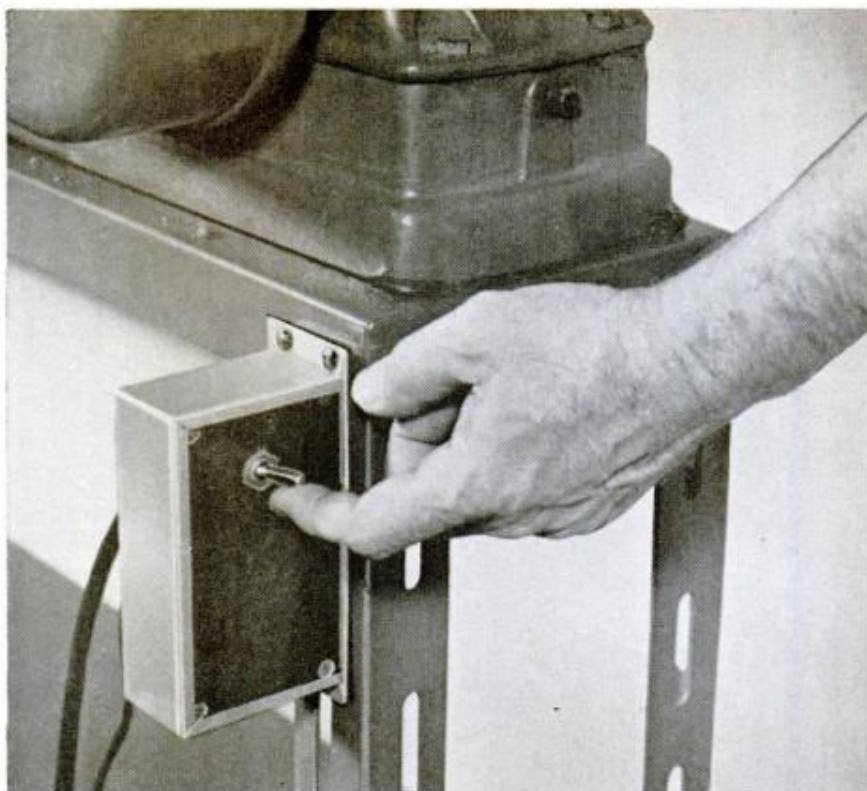
When you need to set the heads of common nails in soft wood for concealing with putty, don't use a nailset; use instead the head of a nail of the same size. Just place the head of the set nail on the head of the driven nail and strike with the hammer as illustrated. Usually one light hammer blow will sink the nail head sufficiently for concealing with putty. The one thing to make sure of in this method is that the head of the set nail is centered squarely on the head of the driven nail so it doesn't skid off when struck.—Robert Micals



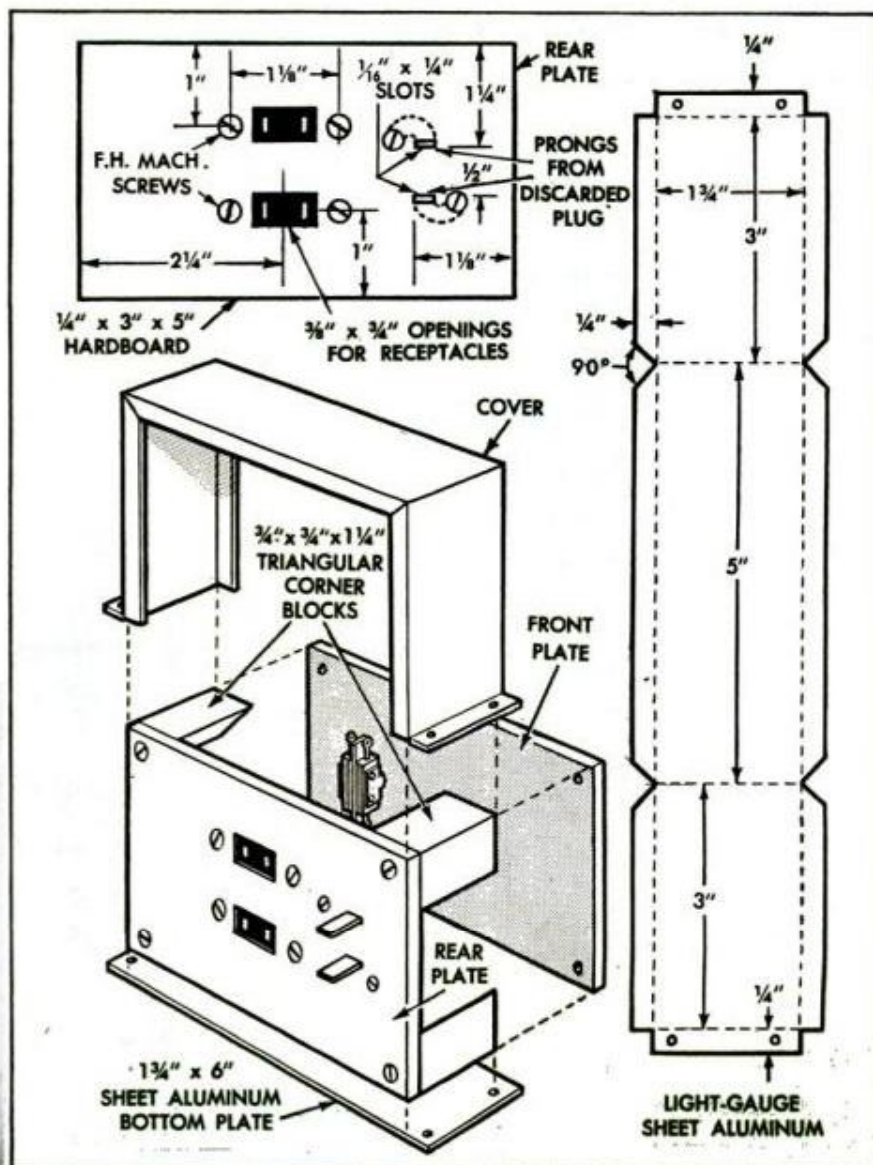
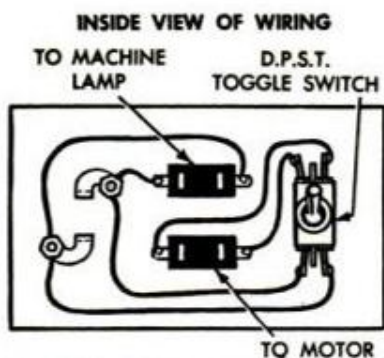
LIGHT— and POWER

Mount this unit on or near any power tool and you can control the motor and work light through one toggle switch. It's especially handy where one motor is used to service several small machines from a single mounting rail. With this switch on each tool, the motor can be interchanged easily and quickly and the light on each machine controlled with the one switch. Looking at the details you'll readily see how the unit is made and how it works. A cord from any nearby receptacle brings power to the box. Two taps enable you to plug in motor and work light. The one toggle switch, pictured at the right, controls both. Use $\frac{1}{4}$ -in. hardboard for the side panels of the box.

—F. L. Greenwald



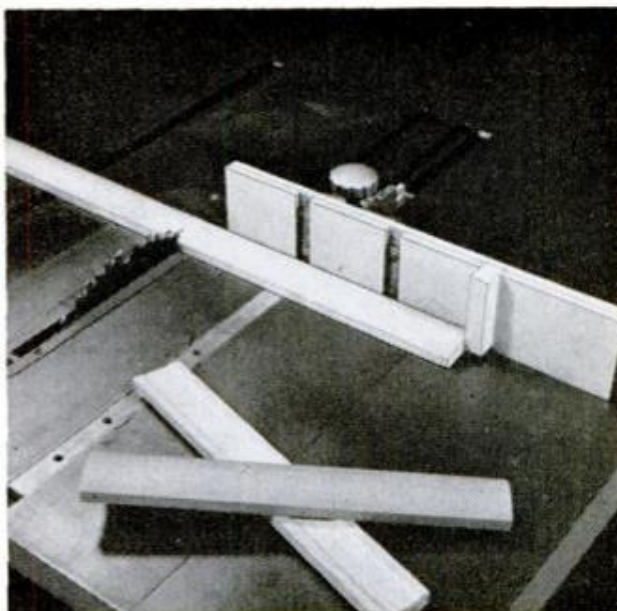
THIS TOGGLE SWITCH controls both motor and work light simultaneously



Multiple Cut-off Stop

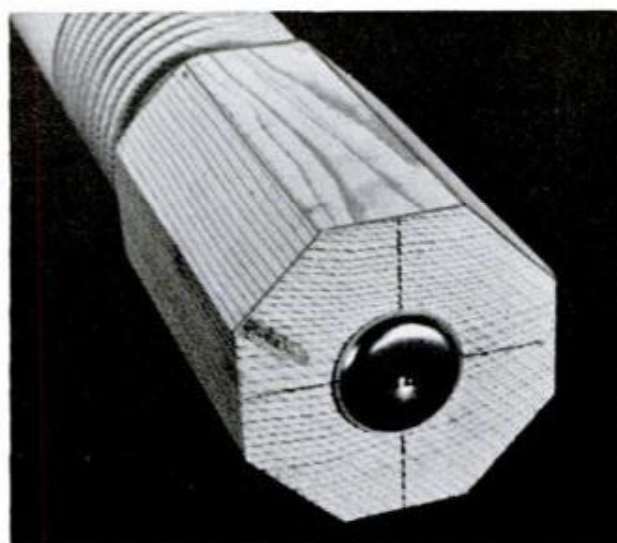
Cutting duplicate pieces to length can be speeded up to a high-production rate by screw-fastening an extension to the miter gauge on your table saw. The extension is a 1 x 4 strip of hardwood having one, two or three vertical grooves spaced along the length. The extension pictured has three grooves, which means that it can be used to cut three different duplicate lengths. The grooves take a stop, which should be a close fit in each groove. Before screwing the extension to the miter gauge make sure that you have the grooves properly spaced to give the required lengths.

—R. J. DeCristoforo



Non-Wear Turning Center

As you know, turning between centers in a lathe requires frequent advancement of the tail center to take up end play caused by the gradual enlargement of the hole in the end of the turning. This friction wear, of course, is all the greater in soft wood. Here a common metal furniture glide can be used to form a non-wear seat for the dead center. Simply drill a small hole through it after prick punching the center and countersink slightly to provide a bearing surface for the 60-deg. point of the dead center. In use, the glide is driven into the end of the turning blank and pried out after the turning is finished.



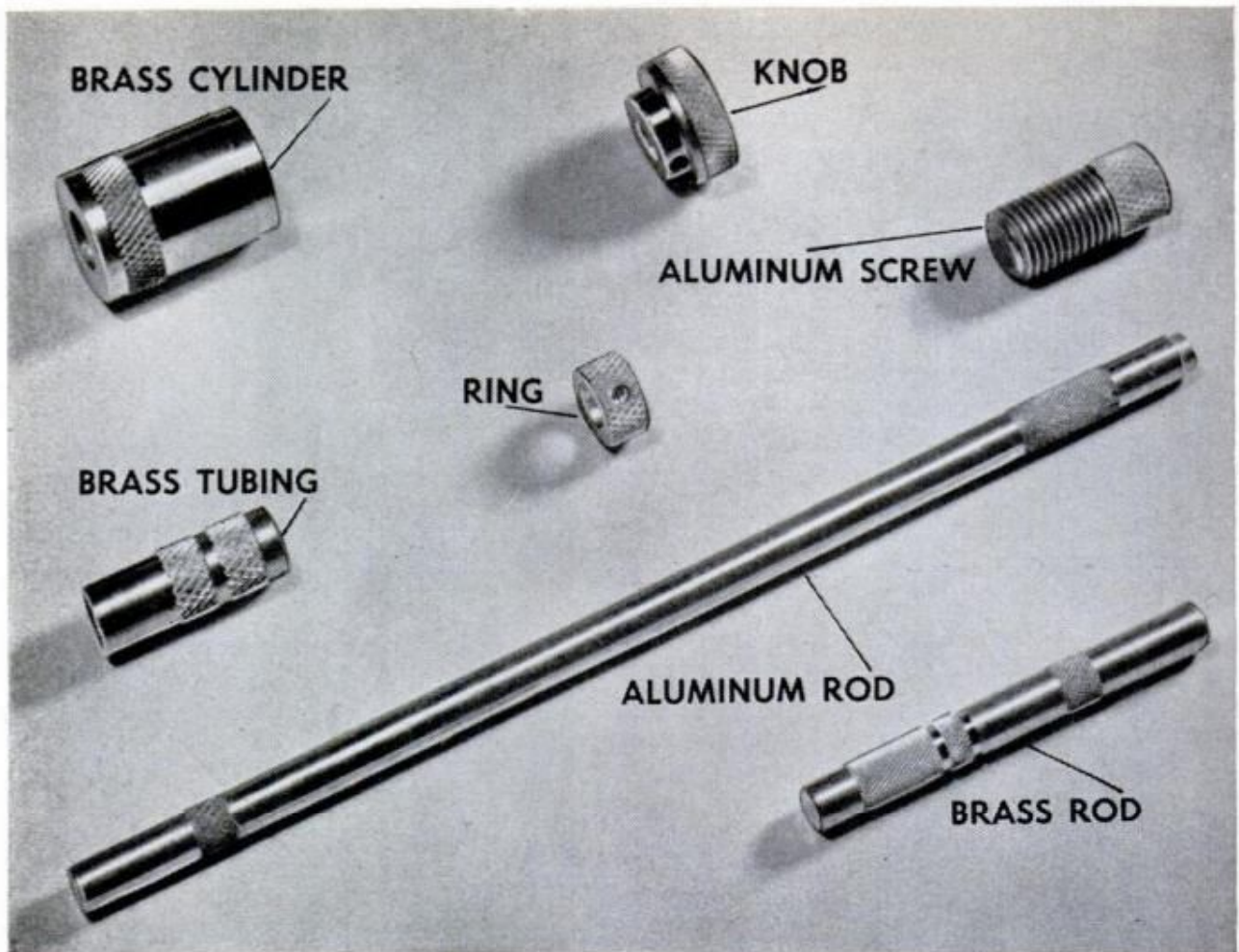
COMING UP NEXT...

CHRISTMAS DISPLAYS MADE EASY. What's the hardest part of making Christmas displays? Anyone will tell you it's enlarging the small magazine patterns to giant size. But what if you could do it with your 35 mm. projector? For the first time PM presents its readers with Clip-out Project-a-Plans which can be projected any size in any slide projector and merely traced. As for the patterns, you'll be eager to make one of these clever Christmas cutouts for decorating your home and yard. Watch for this PM "first."

BUILD YOUR OWN TOBOGGAN. Fun begins with a toboggan even when you're making one. Curling the ends of the slats, then joining with cleats and finally stringing with rope handles are fascinating steps which lead to fun galore for the entire family.

MAKING RUBBER STAMPS. Cooking a rubber stamp in the oven may sound a bit fantastic, but it can be done. And the rubber stamps made in this way can say anything you like, or sign your name with a flourish. Materials are inexpensive, the procedure very simple and the equipment, other than the rubber "dough" and the linotype slugs which carry the type and act as the matrix, can be almost anything at hand, including the oven.

PARTY MAGIC. There's lots of fun in fooling, being fooled and trying to outguess the magician. The mystifying bag of tricks we have up our sleeve for December includes such posers as pumping water from one's elbow, making an egg disappear, pouring "wine" into a hat. There's eight tricks in all—all designed for the beginner magician.



Mandrel for Tricky Knurling Jobs

Simplifies knurling of slender rods and tubes, formed knobs, rings, collars and screw heads

By Walter E. Burton

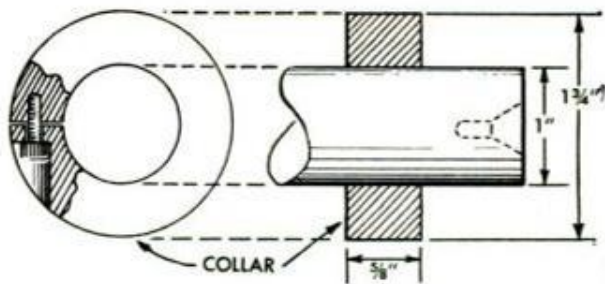
DIFFICULT KNURLING JOBS such as those shown above, which cannot be handled in the usual manner of mounting in a lathe chuck or between centers, are easy to do with a mandrel on which the work rolls. It is simply a shaft and two adjustable collars securely clamped to it. The collars prevent endwise movement of the work. Tape on the mandrel provides traction, and a two-wheel knurling tool holds the work in position.

Turn a steel shaft 1 to 1¼ in. in dia. and about 10 in. long. Center-drill the ends deeper than usual for more resistance to side pressure. Turn the collars to fit on the shaft snugly. They are about 1¾ in. outside dia., and about ⅝ in. thick. Drill and tap them for screws and saw a slit radially as shown in the drawing so the collars can be tightened on the shaft. This method is better than using set screws that bear against the shaft as was done in the original model,

because the screws then will mar the mandrel. Sides of the collars are polished smooth. For some special jobs you may later find it advantageous to have a mandrel and collars of other sizes.

Mount the mandrel between centers and drive it with a dog, or with one end in an accurate chuck and the other supported by the tailstock center. Adjust the collars so they will be separated about 1/32 in. more than the length of the work, or its thickness in case of a ring or disk. For lubrication of centers use a long-lasting lubricant such as light graphite grease, or an oil or grease containing a high-pressure additive.

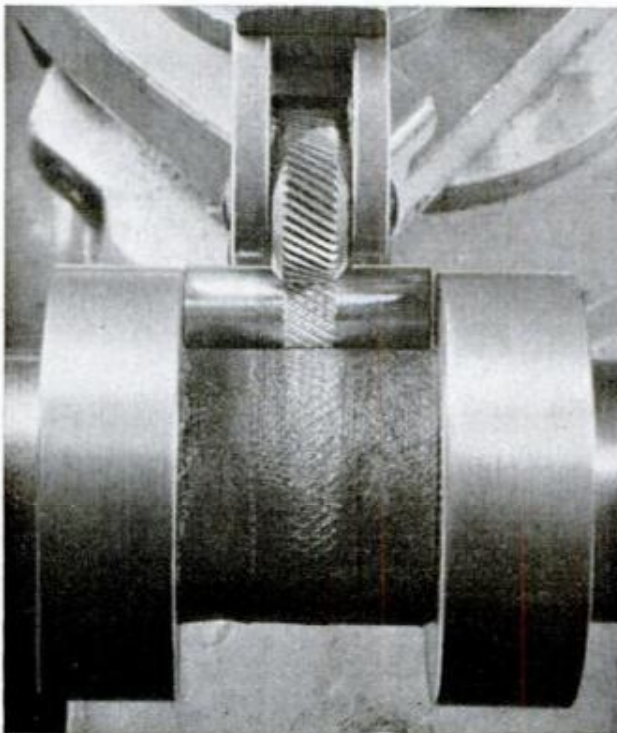
Wrap two turns of ordinary electrician's friction tape around the mandrel between the collars, trimming the end back to avoid an overlap that forms a bump. Besides providing the traction to rotate the work when the mandrel turns, the tape also acts



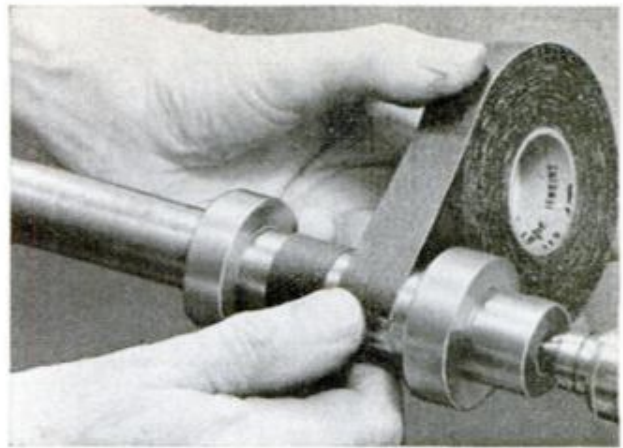
as a cushion to prevent flattening of the knurling from pressure against the mandrel.

After placing the work in position on the tape, a two-wheel knurling tool is adjusted carefully to hold the work firmly in its proper position. Adjust the tool so that its swinging head cannot move farther in the direction in which the work tends to force it. Position the tool squarely with the center axis between knurling wheels lined up with the center of the work and mandrel; also so that the knurls will be properly spaced. Faulty adjustment may cause the work to pop out. Because of this possibility it's wise to wear suitable goggles or a face shield. A film of oil on the inside surfaces of the collars minimizes friction. Do the knurling at the slowest back-gear speed of the lathe. When oiling bearings avoid getting oil on the work.

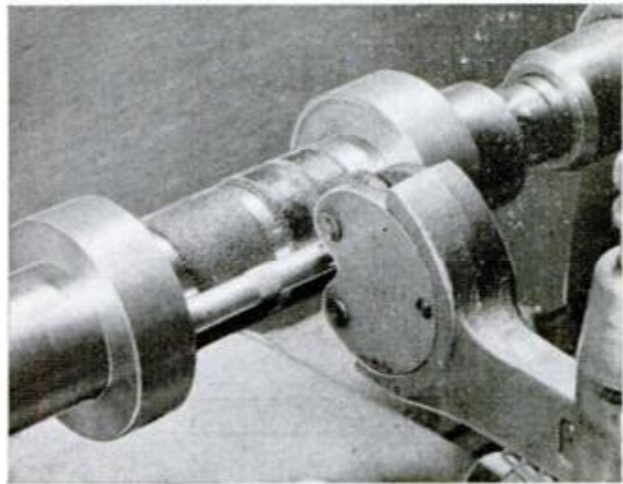
SQUARE ALIGNMENT of tool and work is very important as is clearance between work and collars



NOVEMBER 1962

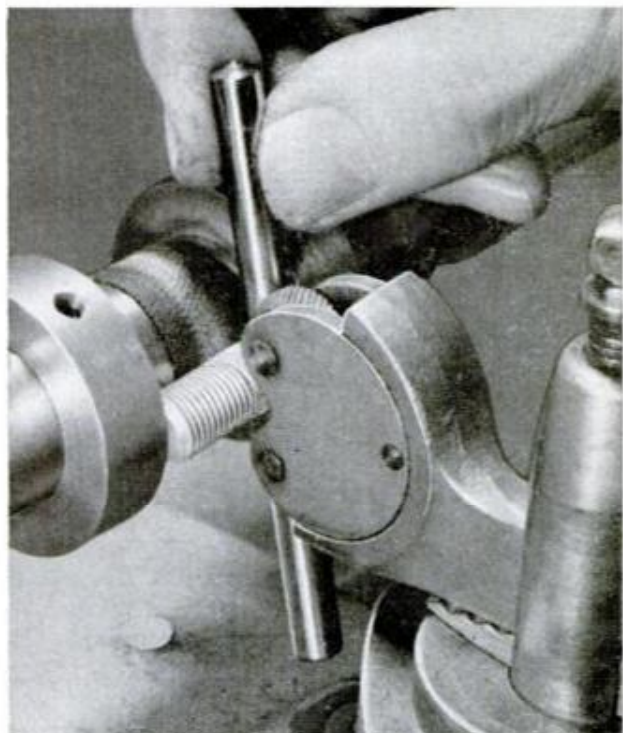


TAPE ON MANDREL to provide traction for work is wrapped so work will not tend to loosen end of tape



WORK HELD FIRMLY in position by a two-wheel knurling tool properly adjusted so it cannot pop out

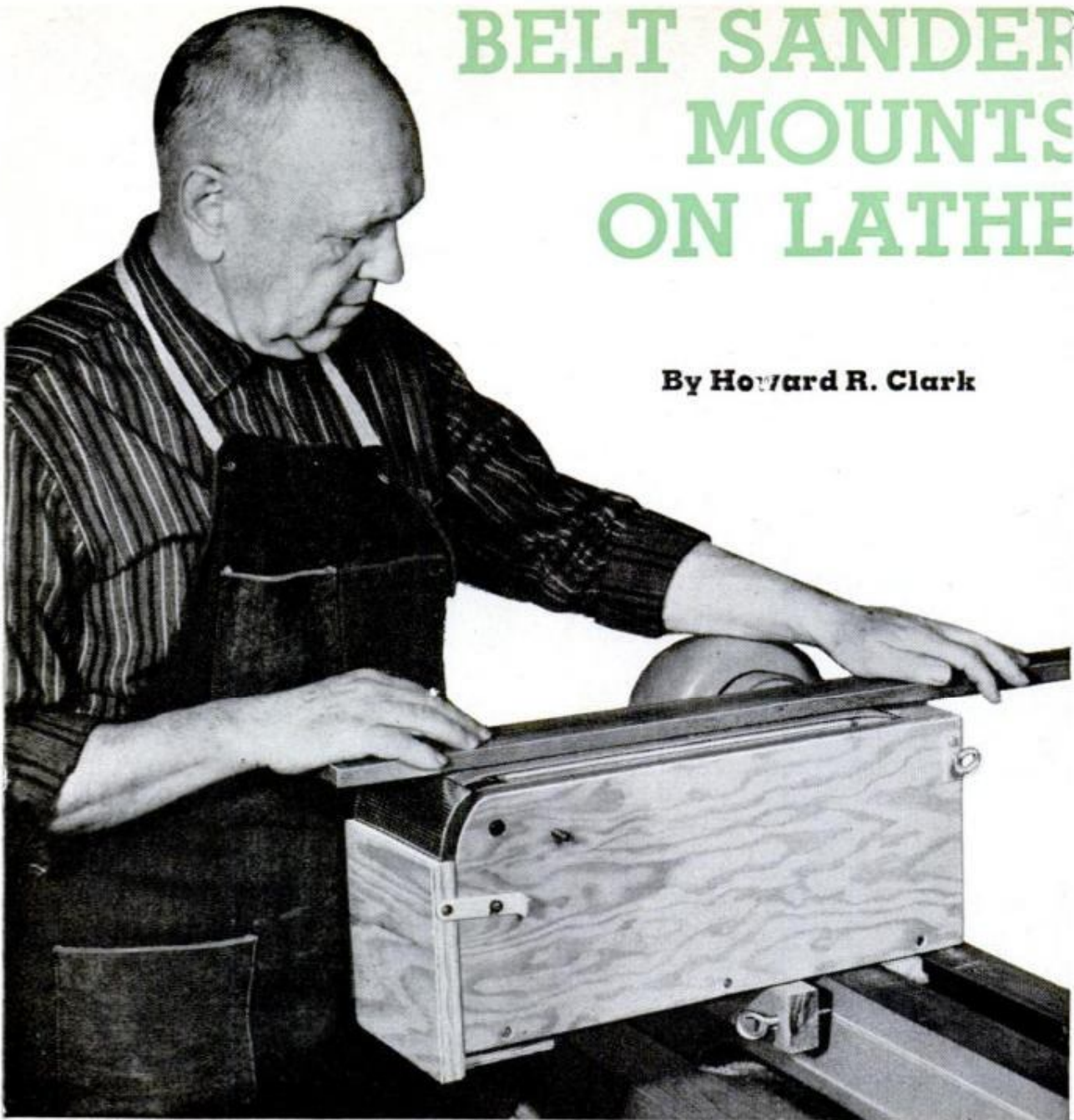
FOR END KNURLS shift collar to insert rod slightly less than work dia., and rest end on lathe slide



185

BELT SANDER MOUNTS ON LATHE

By **Howard R. Clark**



PRACTICALLY DUSTFREE, this little belt sander clamps on lathe bed; adjustable for belt tension and tracking

QUICKLY ATTACHED to a wood-turning lathe, this belt sander, measuring about 6 by 8 by 18 in. in size, is just the thing for occasional jobs in the home workshop. It costs only a few dollars, is sturdy in construction and accurate in tracking. An added feature is the provision for using a vacuum-cleaner hose so that you can enjoy belt sanding that is practically dustless.

The sander illustrated here was made to fit in a 12-in. Delta lathe, and uses 4 by 36-in. belts. Some of the dimensions may have to be altered to fit other makes. The driving drum is screwed onto a 3-in. faceplate which turns onto the lathe spindle. The faceplate should be an extra one so it can be left on the drum permanently. If you have to fasten the drum to a faceplate every

time that you want to use the sander, considerable time is lost in assembling even though you have marked both drum and faceplate, and have the same attachment screws conveniently at hand. The drum is held entirely by the lathe spindle and is not supported by a bearing on the sander.

The housing of the sander consists of a bottom, ends or access doors, two sides and a sanding table. All of these parts are made of $\frac{3}{4}$ -in. plywood except the left side, which is $\frac{1}{8}$ -in. hardboard as it serves only to enclose the housing and does not support other parts. A T-shaped clamping block slips under the lathe bed and holds the sander firmly in position. Two bolts passing through the clamping block fit slots in the bottom and are tightened by means of wing

nuts. The slots permit adjustment of the sander for belt tension and tracking. This adjustment is obtained by means of an aligning bar which is rigidly attached to the underside of the bottom. Two eyebolts that turn in nuts recessed in the aligning bar, bear against the side of the lathe bed to pull the belt tight. The bed should be spot drilled lightly to provide seats for the ends of the eyebolts.

Both ends or access doors are hinged at the bottom so that they can be swung open. The rear access door must be opened when the sander is being attached to the lathe. This door is held in the closed position securely with a spring latch, detail A. It is merely a pin made from an eyebolt and provided with a coil spring and a small plate screwed to the side of the housing. The pin enters a hole in the door edge thus locking it, but allows instant release by pulling the head. The front access door has a different locking arrangement as shown in detail C. It is a simple pivoted catch having a notch that slips over a screw projecting from the side. The end of the catch is bent at right angles to form a finger hold. Both doors are provided with deflectors or shields of No. 18-ga. sheet aluminum projecting inwards as shown, almost up to the surface of the belt where it passes over the sanding table.

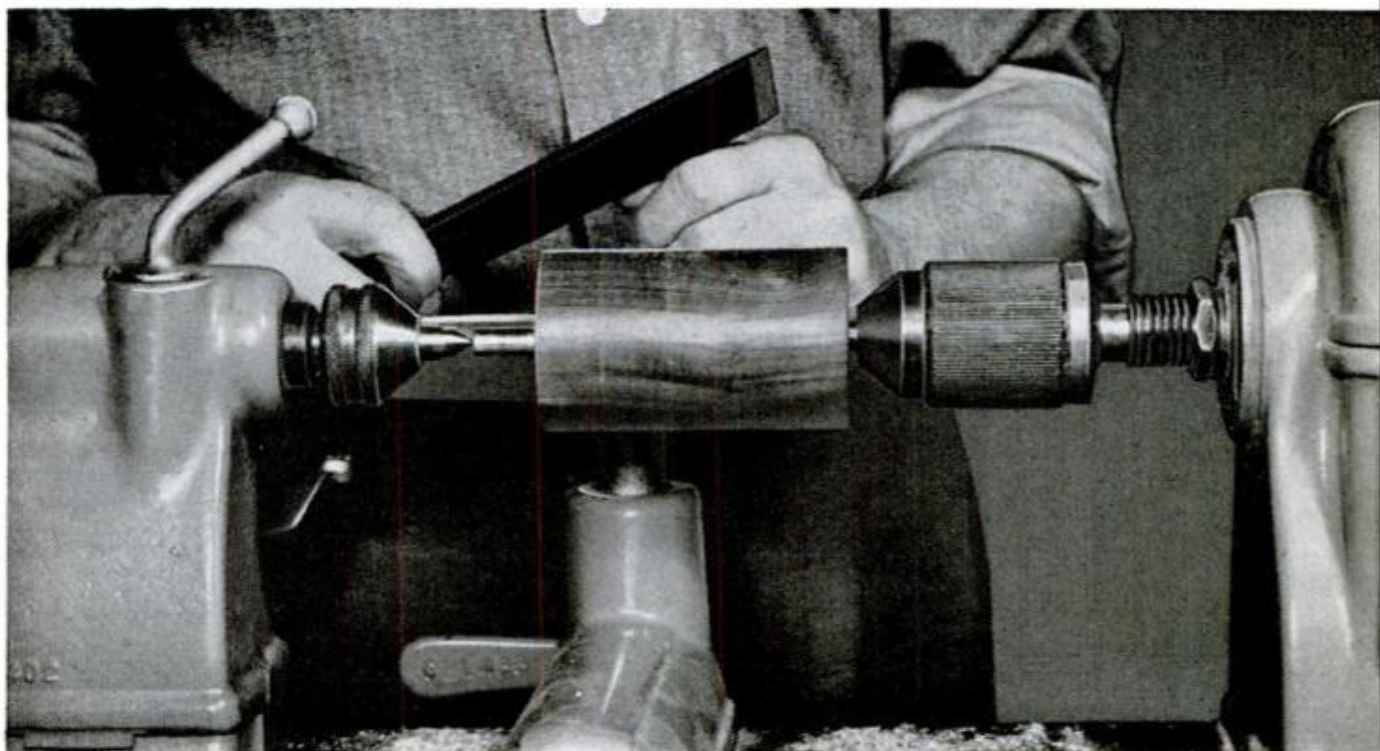
Both the drive and idler drums are turned from hardwood and should be slightly crowned to keep the belt tracking centrally over them. In turning the idler drum, a true-running job is assured if the stock is first mounted on a $\frac{3}{8}$ -in. shaft and then turned to finish size. The shaft projects

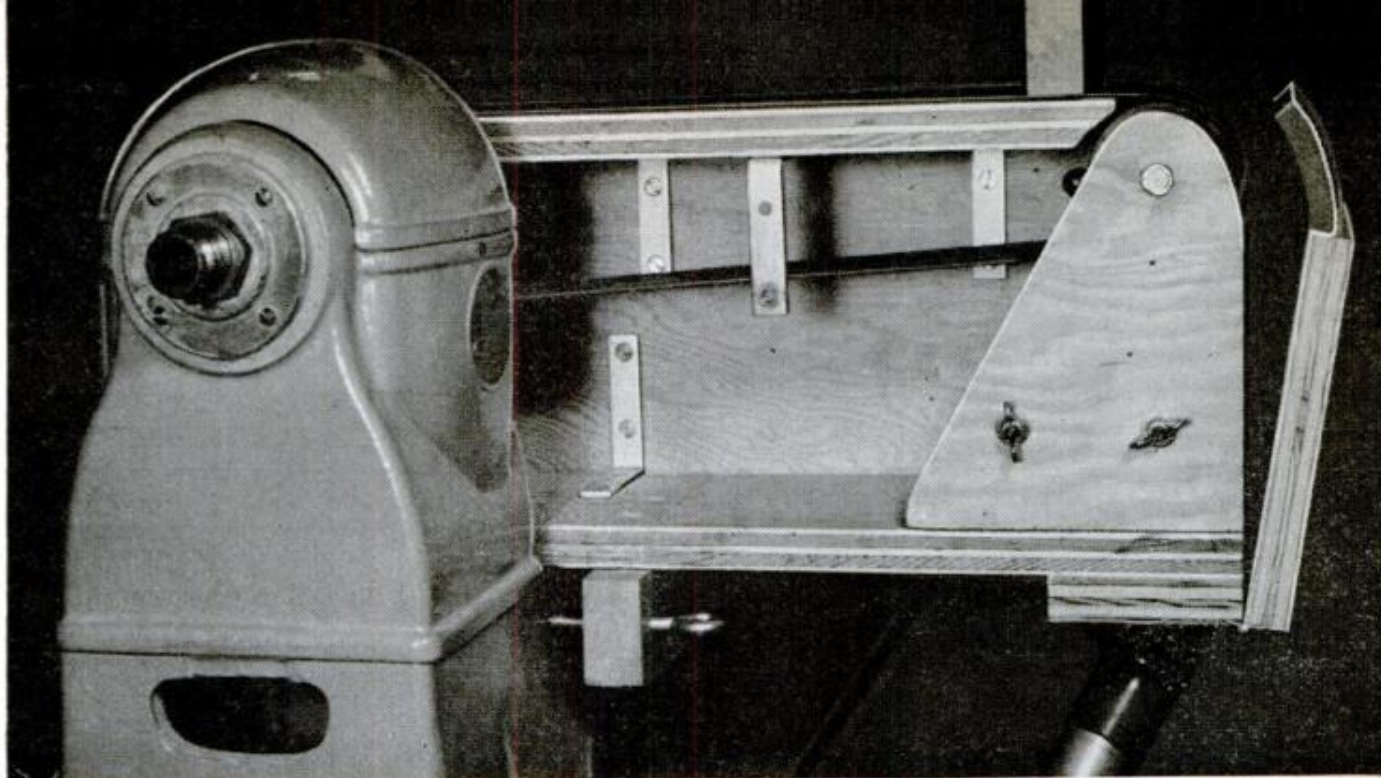


ACCURATE RIGHT-ANGLE SANDING is assured by using fence held firmly by tool-rest support on lathe bed, and holding work against stop at end of fence

through two brass or bronze bearing sleeves as shown in details B and C, or through ball-bearing races, which are held in the housing side and a bearing support block. To assure boring the bearing holes in these pieces so that they will be in perfect alignment, they are first carefully stacked to-

IDLER DRUM after being turned and crowned. It is first drilled and pressed on a steel shaft which is mounted in lathe as shown here so drum surface will be concentric and true-running, assuring smooth operation





INSIDE VIEW of sander with hardboard side removed to show belt, sanding table and front access door open

gether in alignment, clamped in this position and then bored. The bearings should be a press fit in the plywood, and are locked with setscrews if they tend to rotate with the shaft. The bearing-support block is removable to permit installing sanding belts, and is held with bolts and wing nuts to another block which is permanently attached to the bottom.

The ends of the sanding table are shaped to a radius of $\frac{1}{8}$ in. more than the radius of the drums. The table is held by angle brackets and has an angle bracket (with nut soldered on) for holding the $\frac{1}{8}$ -in. hardboard side. The top surface of the sanding table comes slightly above the top line of the drums. When the table is in place the location of the hole in the hardboard side is marked from the inside after dropping down one of the access doors. In the arrangement shown, the end of a vacuum-cleaner hose was slipped up through a hole in the bottom, just below the idler drum, and a tapered wooden cylinder was used to wedge the hose in place. However, the exact method of attachment varies with the type of hose used.

A hardwood work stop is also shown. This attaches to a bolt projecting through the side (detail C) and rests firmly on the edge of the side so there is clearance between the stop and belt. This is handy for sanding end grain, in which case the work is held vertically against a fence to assure accurate 90-deg. sanding. The fence is provided with a bracket, floor flange and pipe nipple that fits the tool rest support.

One each of 40, 60, and 100-grit aluminum-oxide sanding belts will provide a

good assortment. Belts are marked with a directional arrow and should be installed to run in this direction. ★★★

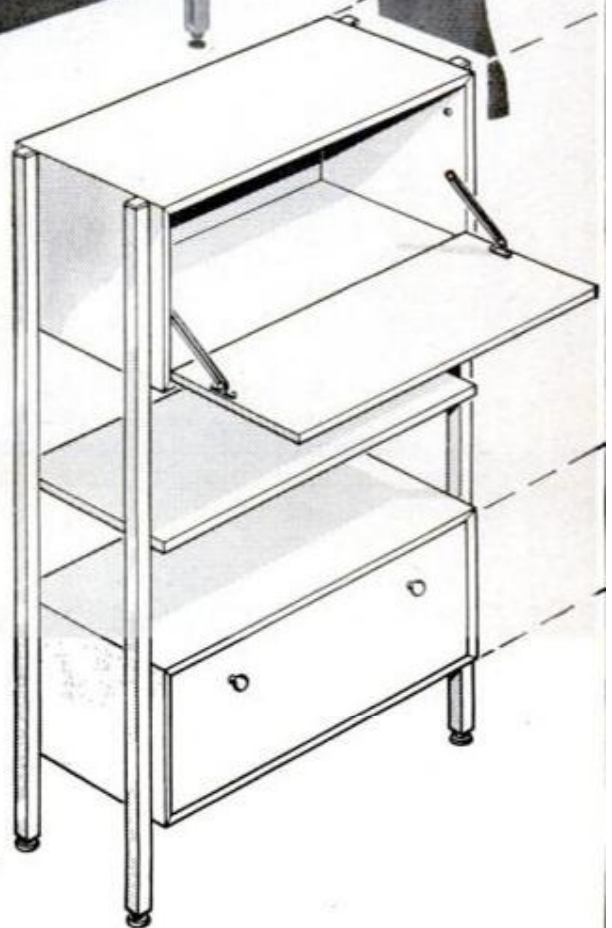
STURDY FENCE attached to pipe floor flange and nipple that fits in tool rest support. Stock over 4 in. wide is run at slight diagonal over the sanding belt





1. MODULAR TWO-UNIT family entertainment center set up as wall console. Note placement of four cabinets, or modular boxes, arranged for convenience without the usual unfinished look of components

YOU CAN BEGIN with one unit and as your interest expands and the budget permits, the system can be expanded to suit. What you have built is never lost and nothing has to be discarded or rebuilt



Add-On Entertainment Center

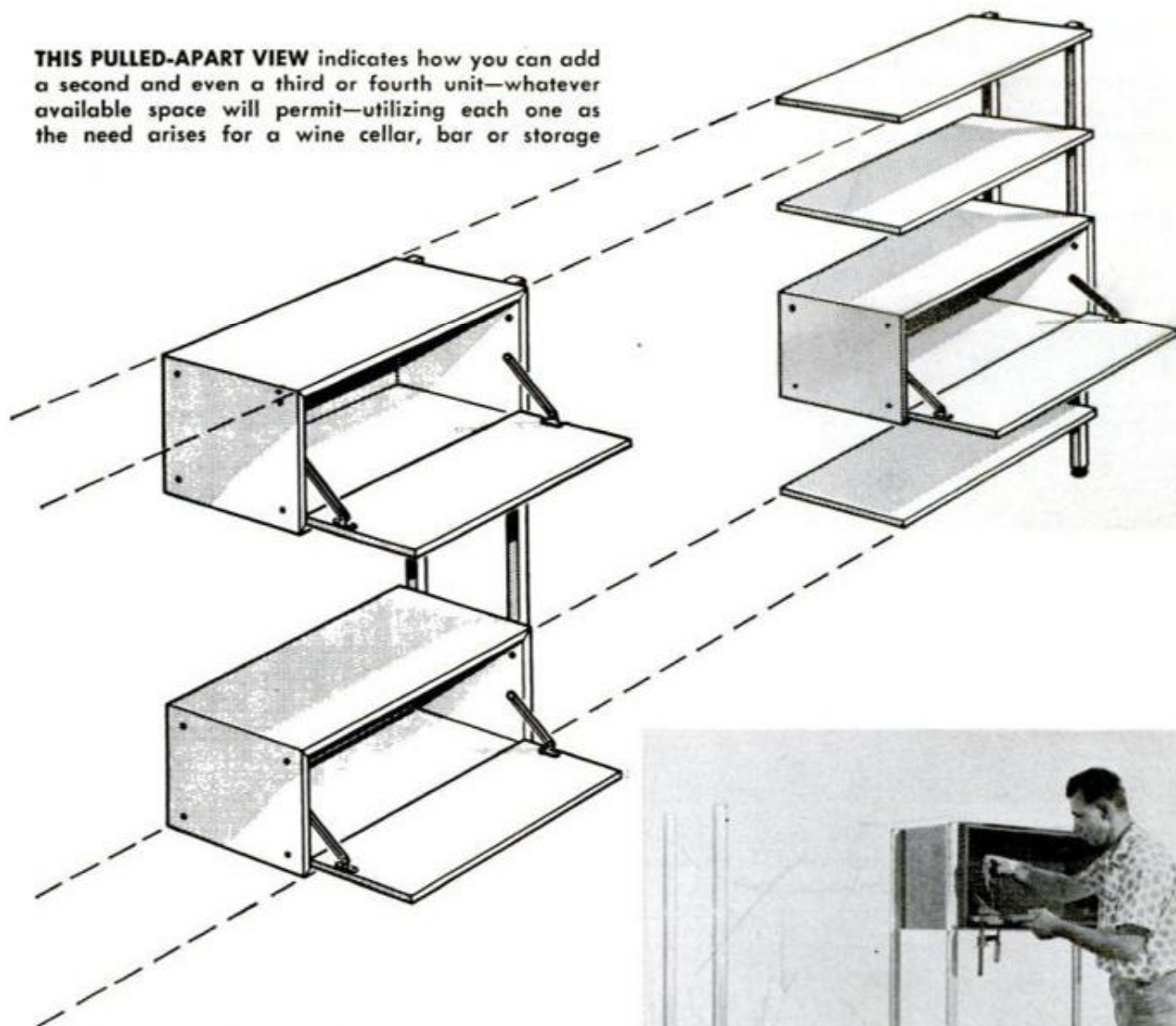
with a growth plan to spark the imagination of hi-fi fans and serious home recordists

By John Jefchek and Byron G. Wels

HERE IS NOT ONLY a tasteful addition to contemporary modern or traditional home furnishings, but an expandable system affording a complete home studio for all hi-fi activities. The single modular unit can be placed anywhere in a room as

a free-standing piece, or it can serve equally well as a wall unit, or console. The backs of the cabinets, or box models, have the same simple design feature on both sides, permitting use of the unit, or units, as a wall divider. You can begin with the mini-

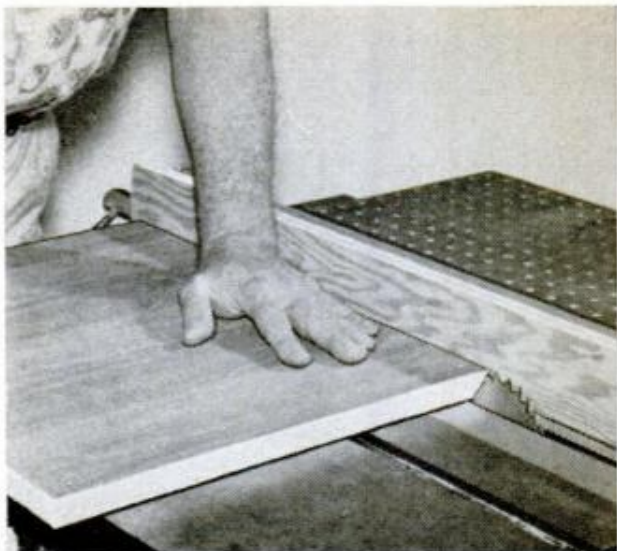
THIS PULLED-APART VIEW indicates how you can add a second and even a third or fourth unit—whatever available space will permit—utilizing each one as the need arises for a wine cellar, bar or storage



ADDING A SECOND UNIT gives you space for all the electronic components required for a home hi-fi studio, like that pictured in Fig. 1. Flexibility of the dual unit permits almost any arrangement of shelves, cabinets

2. DUAL-UNIT MODULAR in process of assembly shows three cabinets and two shelves in position, less the easel which is part of the phono shelf at the left in this view. Note the laminate-surfaced drop door



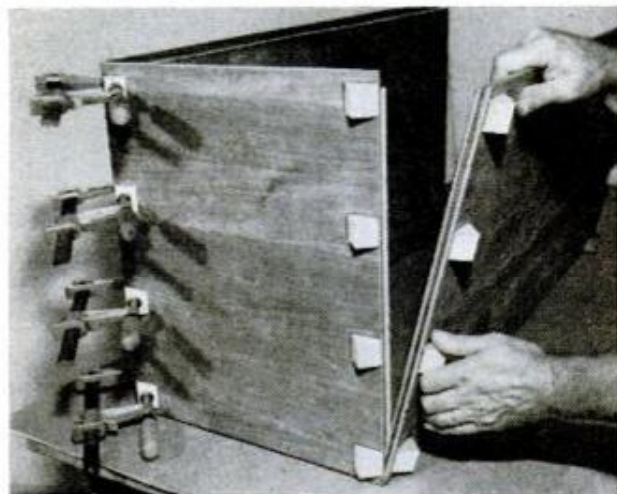


3. CUTTING MITER on a cabinet panel. All four corners of each cabinet are joined by 45-degree miters which are strengthened with hardwood splines. Note the facing strip screwed to the rip fence of table saw

4. AFTER CUTTING MITERS the spline grooves are cut with a similar setup on table saw. See also details A and B in Figs. 10 and 11. These show how setup is made and how a portion of miter is left uncut



5. ASSEMBLY OF CABINET with one miter joint clamped and a second being assembled. Note especially the spline in, unassembled miter and spacing of the four pairs of triangular clamping blocks



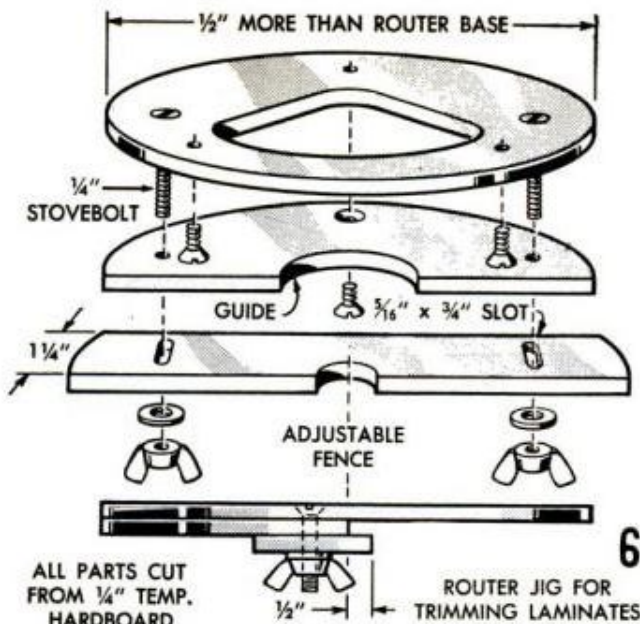
mum, a single modular unit, and as interest and budget expand you can add modules one by one to accommodate any electronic equipment you may acquire, or add units to serve as storage, a wine cellar or a bar.

With the modular system expanded to two units as pictured in Fig. 1 you have space for equipment to play stereophonic records, stereo FM and stereo tapes. You can play the shortwave receiver through the system and also the TV audio. You can tape any of these, or copy tapes for friends.

Assembly of the modular unit is detailed in Fig. 10 and the construction of the cabinets, or box modules, is shown in Fig. 11. The modular unit, Fig. 10, is supported on four columns, or legs, of extruded aluminum, one pair being U-shaped, the other I-shaped. The U-shapes form the end legs and the I-shapes the center legs of the two-module assembly, such as that pictured in Figs. 1 and 2. This same modular construction can be repeated to form a modular structure consisting of any number of units desired. If, on the other hand you wish to build only one unit, then you use four U-shapes for the legs. Both types of legs are available with end caps and the I-shapes with snap-in closures, Fig. 10, but in order to provide a leveling adjustment and more easy portability, all four legs of the basic modular unit are fitted with standard adjustable furniture glides in the manner shown in the lower left-hand detail, Fig. 10. In fitting the glides to the center legs, the web is cut away to take the spindle of the glide as in the right-hand detail, Fig. 10. The latter detail also shows how the cabinets and shelves are attached to the center legs by means of lugs, or spring nuts and brackets, which are ready-made parts available with the legs. Note also that a slot is provided in the web of the back center leg as a convenience in wiring. This can be located at any point, but in the original it was cut in the upper part of the leg, registering with slots cut in the ends of the two upper cabinets. The slot is shown in the upper cabinet in Fig. 10 and is located and dimensioned in Fig. 8.

Fig. 13 shows how to lay out and cut the stock for the four cabinets in the two-unit module in Fig. 1. When making the layout give special attention to arrangement of the grain of the wood, selecting the best, where possible, for the fronts, or drop doors, A, B, C, and D in Fig. 13. You may have to depart from the plan somewhat in order to take advantage of the best grain in your panels. All four corners of the four cabinets are joined with splined miters and the details in the lower panel, Figs. 10 and 11,

(Text continued on page 197)



ALL PARTS CUT FROM 1/4" TEMP. HARDBOARD

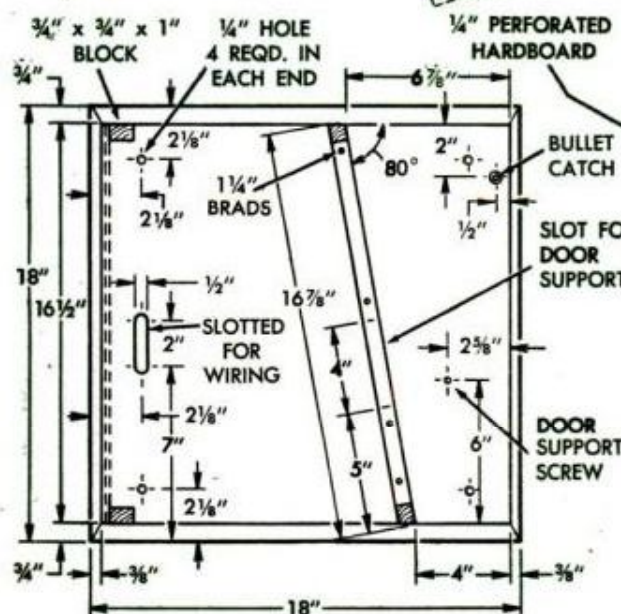
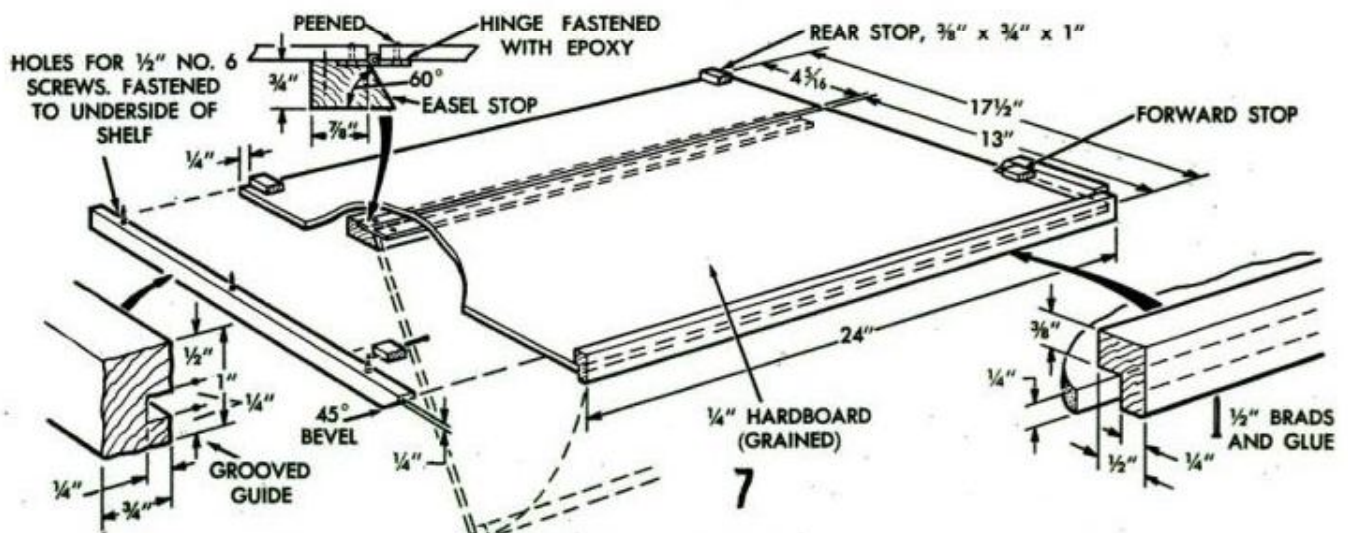
ROUTER JIG FOR TRIMMING LAMINATES

SHOP-MADE ROUTER JIG for truing laminate cemented to backs of drop doors. Slots provide adjustment

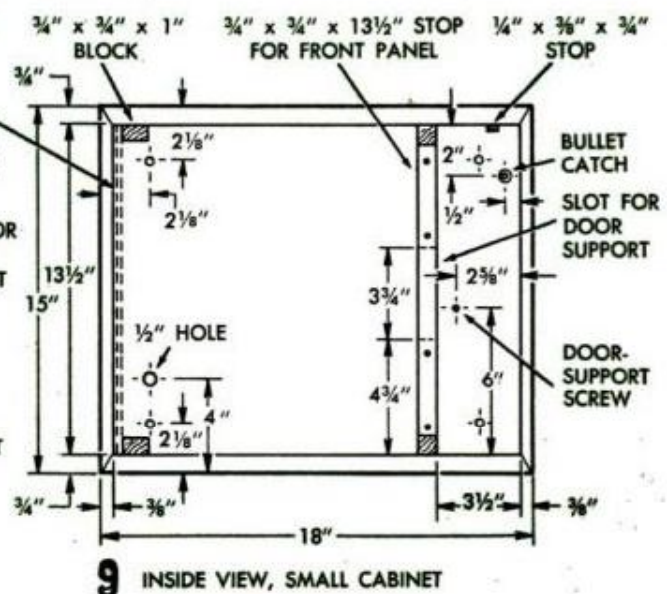


ROUTER JIG in use. Care must be taken to set it so that edge of laminate will be trimmed flush, no more

THESE DETAILS become clear when you connect them with the assemblies shown in Figs. 10 and 11. Slide-out shelf, or easel, top detail, is fitted under phono shelf as in Fig. 10. It's made from grained hardboard

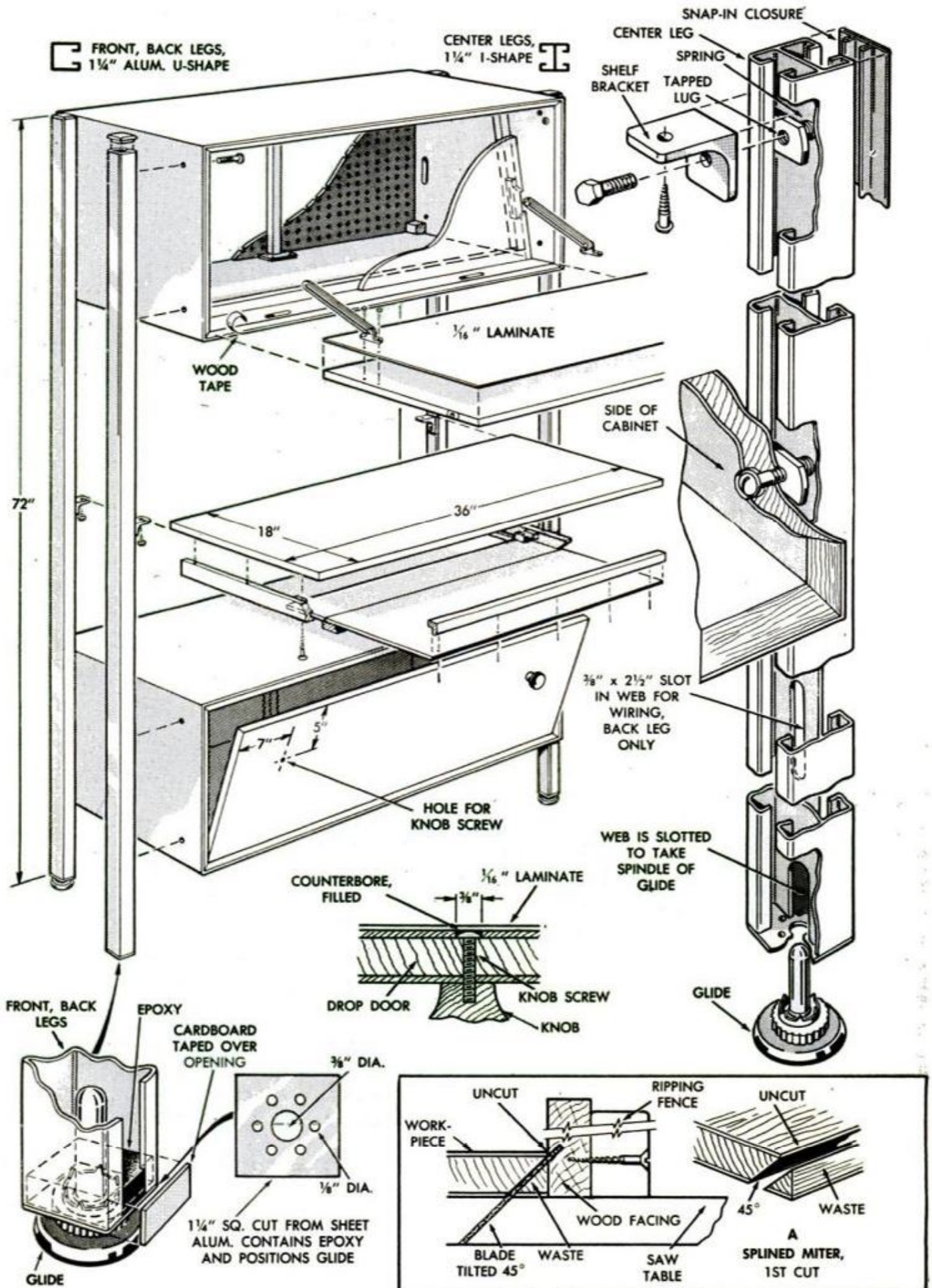


NOVEMBER 1962

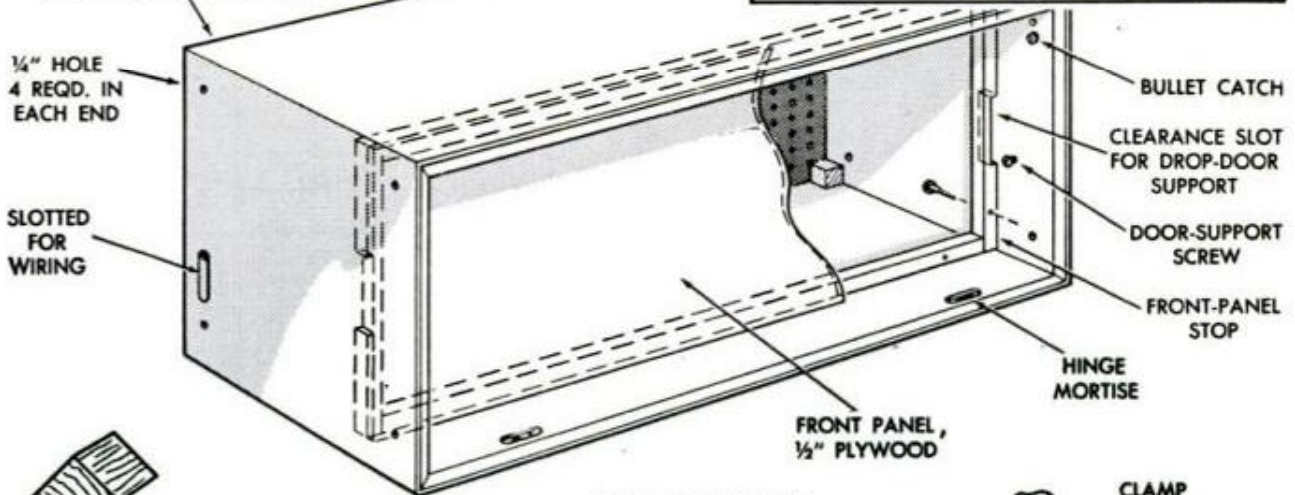
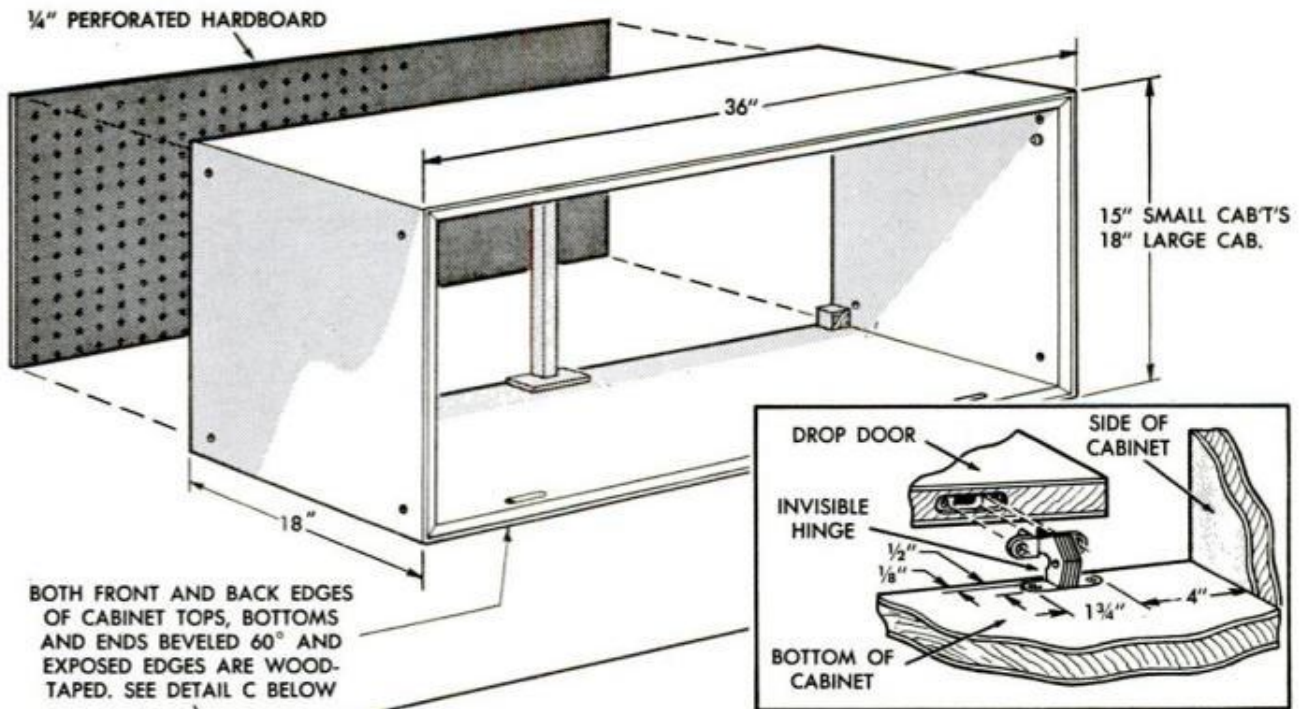


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10 MODULAR UNIT

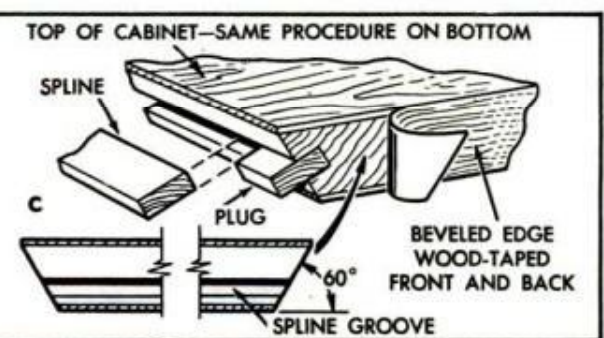
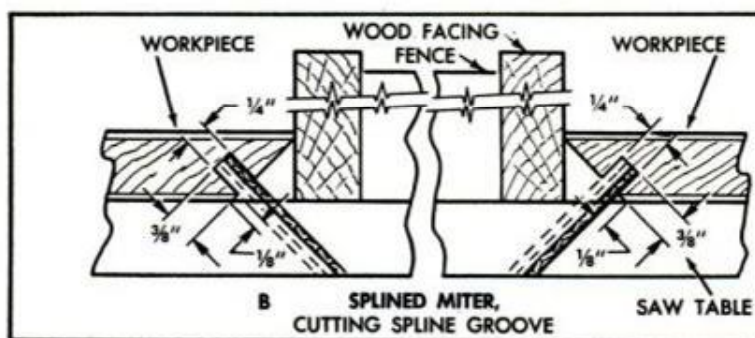
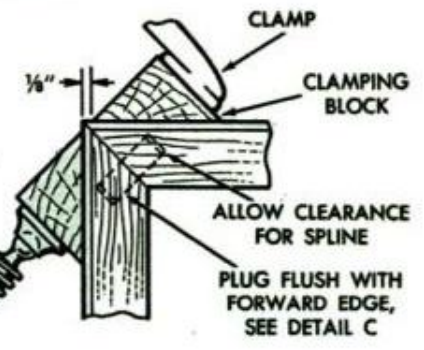
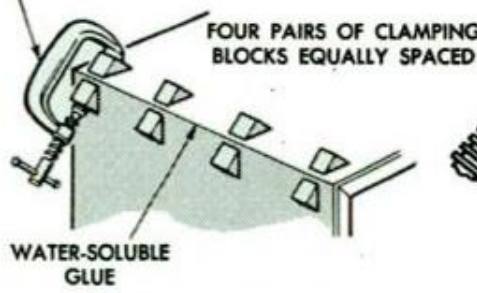
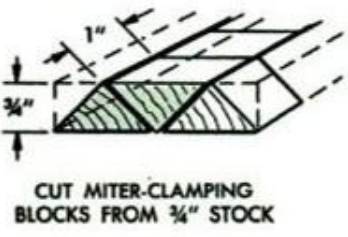


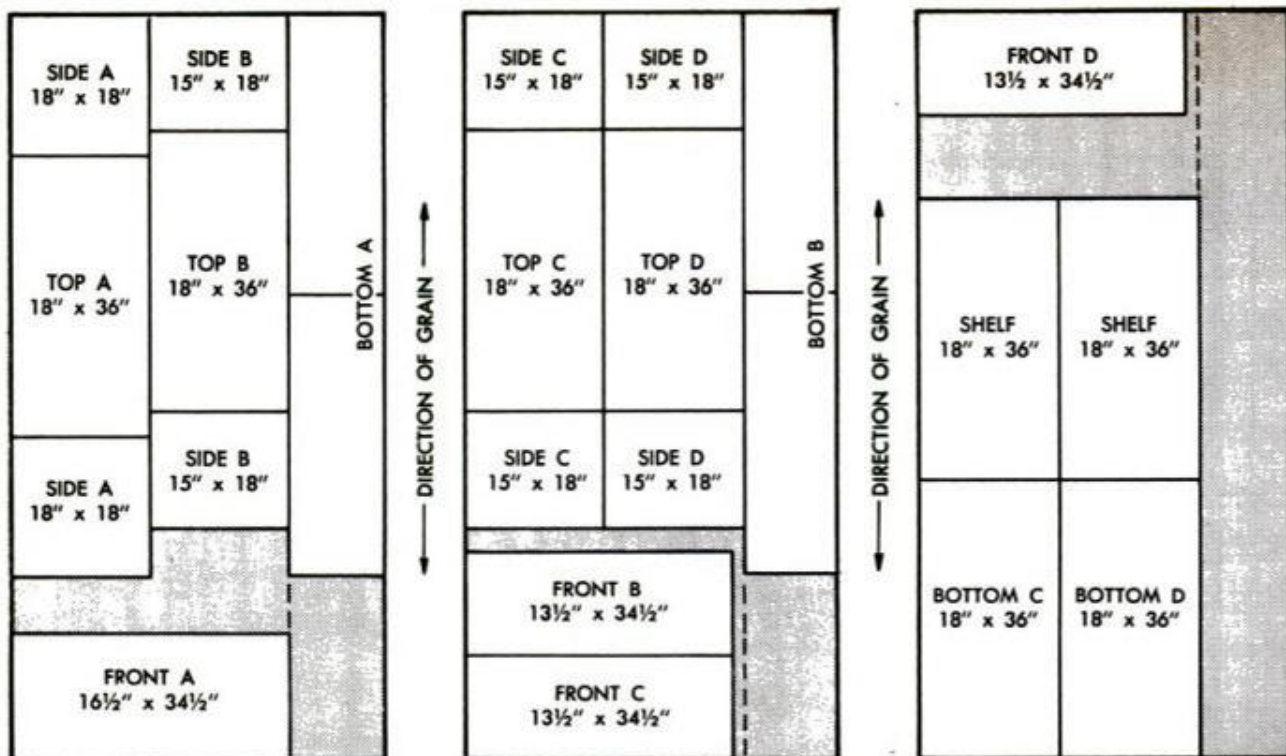
II BASIC CABINET



1 CLAMP TO EACH
PAIR OF BLOCKS

32 BLOCKS REQUIRED
FOR THE FOUR MITERED
JOINTS OF EACH CABINET





13 LAYOUT OF 3 PLYWOOD PANELS FOR CABINETS AND SHELVES
(EACH PANEL $\frac{3}{4}$ " x 48" x 96" LUMBER-CORE PLYWOOD)

show how to set up to cut these joints on your table saw. Note in the detail A, Fig. 10, that a wood facing is attached to the ripping fence and that the saw blade is raised until it cuts into this facing. Also note that the blade is adjusted for height to leave about $\frac{1}{32}$ in. or so of the workpiece uncut at the top edge of the miter. This gives you a bearing against the rip-fence facing when making the second cut on all pieces for the spline as in detail B, Fig. 11, also Figs. 3 and 4. Note that you keep the same setting whether the blade on your saw tilts right or left. Once the pieces have been mitered and grooved for the splines the edges are bevel-cut to 60 degrees, Fig. 11 and also Fig. 11, detail C. As

will be seen from detail C, the splines are not cut the full length, but are pieced out with a plug, or insert, which is more easily trimmed flush before taping the bevel as in detail C with a wood tape to conceal the exposed plywood edge.

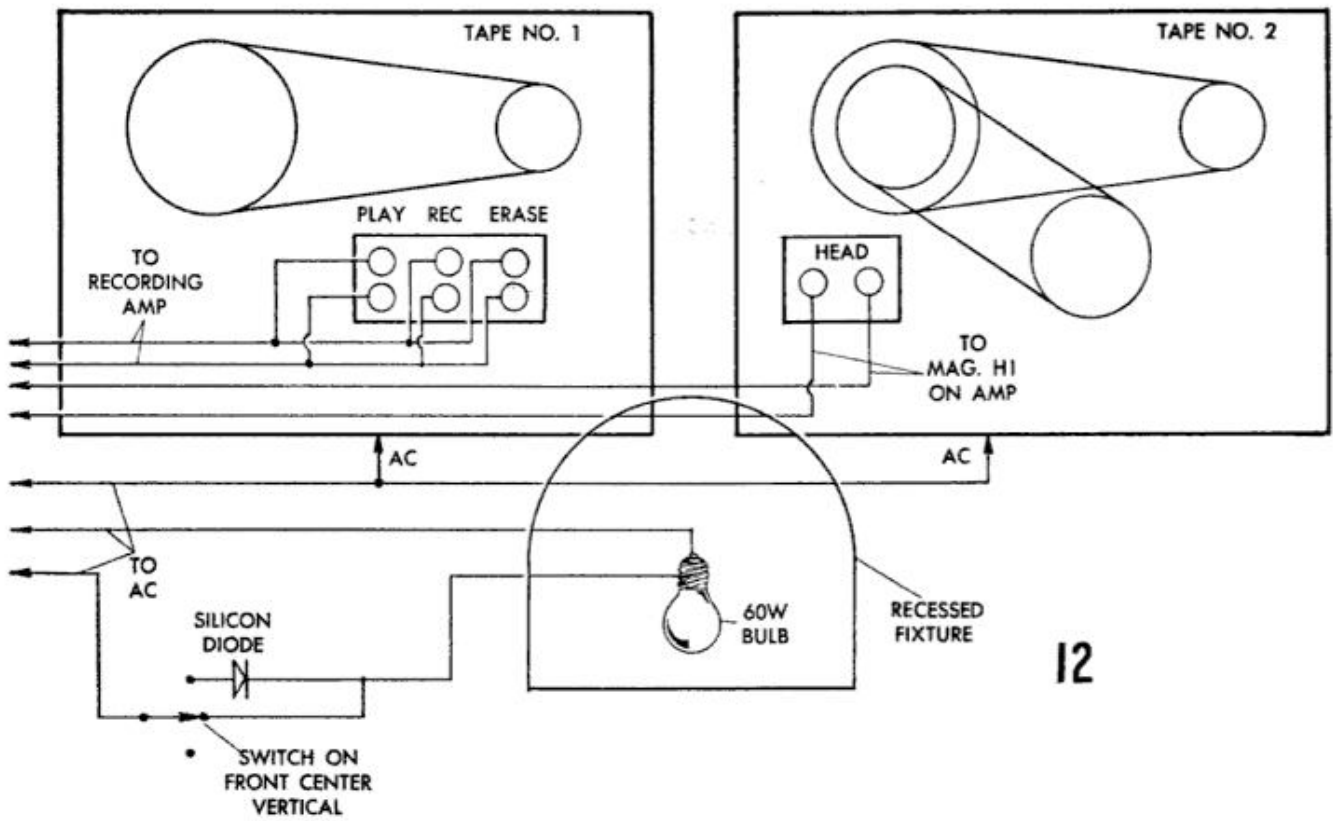
The mitered joints are glued and clamped as in the three details in Fig. 11. Triangular clamping blocks are cut from $\frac{3}{4}$ -in. stock and glued to the ends of the panels forming the tops, bottoms and ends of the cabinets. The blocks are equally spaced, four pairs to each joint, as in one of the details, also Fig. 5. Use a prepared hide glue for attaching the blocks, but use water-soluble glue in the miter joints. The clamping blocks are easily removed without damage to the

14. HERE'S THAT EASEL you've seen detailed in Figs. 7 and 10. Note raised lip at lower edge for jackets

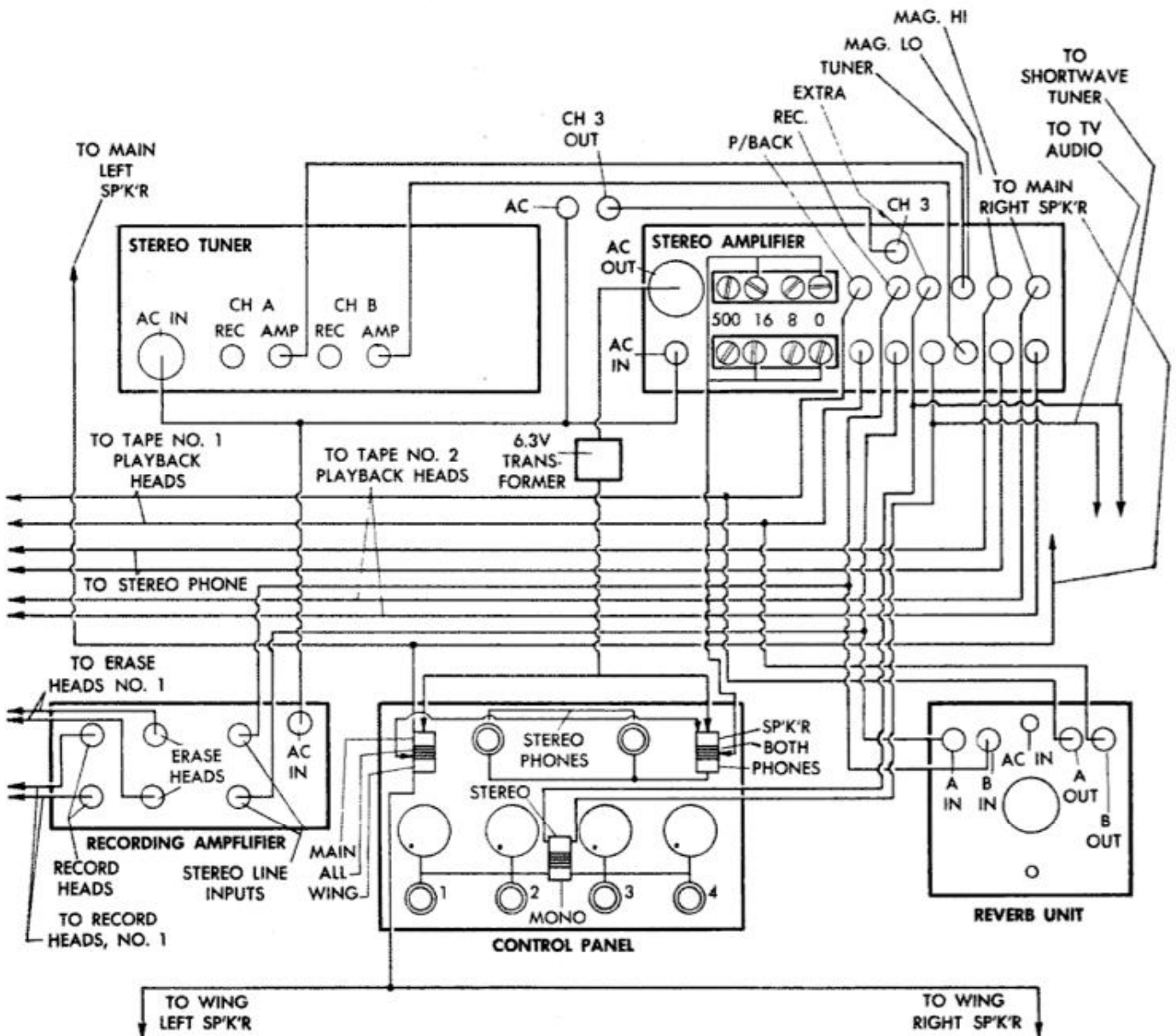


15. THERE'S PLENTY OF SPACE for your phonograph of whatever type. Note that edge of shelf is taped





12



MATERIAL LIST

(All dimensions in inches)

No.	Dimension	
WALNUT PLYWOOD		
10	$\frac{3}{4}$ x 18 x 36	Tops and bottoms of cabinets—shelves
2	$\frac{3}{4}$ x 18 x 18	Sides—large cabinet
6	$\frac{3}{4}$ x 15 x 18	Sides—small cabinets
1	$\frac{3}{4}$ x 16 $\frac{1}{2}$ x 34 $\frac{1}{2}$	Drop front—large cabinet
3	$\frac{3}{4}$ x 13 $\frac{1}{2}$ x 34 $\frac{1}{2}$	Drop fronts—small cabinets
1	$\frac{1}{2}$ x 16 $\frac{3}{4}$ x 34 $\frac{1}{2}$	Front panel—large cabinet
1	$\frac{1}{2}$ x 13 $\frac{1}{2}$ x 34 $\frac{1}{2}$	Front panel—small cabinet

PERFORATED HARDBOARD

3	$\frac{1}{4}$ x 13 $\frac{1}{2}$ x 34 $\frac{1}{2}$	Back panels—small cabinets
1	$\frac{1}{4}$ x 16 $\frac{1}{2}$ x 34 $\frac{1}{2}$	Back panel—large cabinet

HIGH PRESSURE LAMINATE (COUNTER TOP)

3	$\frac{1}{16}$ x 13 $\frac{1}{2}$ x 34 $\frac{1}{2}$	Drop front—small cabinets
1	$\frac{1}{16}$ x 16 $\frac{1}{2}$ x 34 $\frac{1}{2}$	Drop front—large cabinet

ALUMINUM CHANNELS AND RELATED HARDWARE

4	$1\frac{1}{4}$ x $1\frac{1}{4}$ x 72	Aluminum U Channels—front, back legs
2	$1\frac{1}{4}$ x $1\frac{1}{4}$ x 72	Aluminum I channels—center legs
20	$\frac{1}{4}$ x 20 (long)	Spring nuts—for U channels
20	$\frac{1}{4}$ x 20 (short)	Spring-nuts—for I channels
6	$\frac{1}{4}$ x $1\frac{1}{4}$	Aluminum channel end caps
27'	$1\frac{1}{4}$	Aluminum closure strip
8	$1\frac{1}{4}$ x $1\frac{1}{4}$	Aluminum 90 deg. inside braces
32	$\frac{1}{4}$ x $1\frac{1}{4}$	Round-head machine screws—plated
8	$\frac{1}{4}$ x $\frac{5}{8}$	Flat-head machine screws—plated

HARDWARE (GENERAL)

8	10"	Plated lid supports
8	$\frac{1}{2}$ x $1\frac{3}{4}$ or $\frac{3}{8}$ x $1\frac{11}{16}$	Invisible hinges
8	$\frac{3}{8}$ x 7 $\frac{1}{16}$	Bullet catches
16	$\frac{3}{4}$ x 8	Oval head wood screws—per hardboard backs
16	Stop bead	washers for $\frac{3}{8}$ x 8 oval-head wood screws
40	$\frac{5}{8}$ x 6	Oval-head wood screws—hinges on cabinets, lid support brackets, shelves
16	1 x 6	Oval-head wood screws—hinges on edge of drop fronts
8	$\frac{5}{8}$ x 10	Round-head wood screws—lid support arms
20	1 x 6	F. H. wood screws—stops, front panels

MISCELLANEOUS

- 1 lb. Can plastic resin glue—(powder)
- $\frac{1}{2}$ to 1 gal. Danish oil finish
- 2 pts. Contact cement
- 12 1 x 8 Ft. rolls walnut edging tape
- Furniture wax
- 1 Can metal lacquer (clear)

16. HERE BACK OF CABINET is being fitted. Perforated hardboard panel is screw-fastened to blocks



panels by striking each one a sharp sidewise tap with a hammer. Overall sizes of the original cabinets and end dimensions are given in Figs. 8, 9 and 11.

Drop doors of the cabinets are faced on the back side with a white plastic laminate. The laminate is cut slightly oversize and attached with contact cement. After the cement has been allowed time to age somewhat, the overhanging edges of the laminate are trimmed flush with a special jig fitted to a router as in Fig. 6. As will be noted this provides an adjustment for trimming the laminate flush with the edge of the panel. After trimming the laminate, the exposed edges of the doors are veneer-taped to conceal the lumber core of the plywood. Edges of the shelves are also veneer-taped.

The drop doors fit with the outer face flush with the inner edge of the bevel when hinged, Fig. 10. Each is fitted with two knobs located as in Fig. 10. The screw of each knob is countersunk as in the sectional detail, Fig. 10, and the counterbore is filled and sanded flush before application of the laminate. The doors are hinged with two invisible hinges each, located and installed as in the detail, Fig. 11. Each door is provided with two lid, or door, supports and is held in the closed position by means of a bullet catch located as in Figs. 8 and 9. Notice in both Figs. 8 and 9 the location of the door-support screws and the slots in the cleats which allow the door supports to attain the full closed position without interference. Note also that in the small cabinet the cleats which back the control panels are set vertically, Fig. 9, while in the large cabinet, Fig. 8, the cleats are inclined at a slight angle. For the

(Continued on page 212)

17. FINE FINISH is obtained on walnut-faced plywood by using a prepared oil-finishing material





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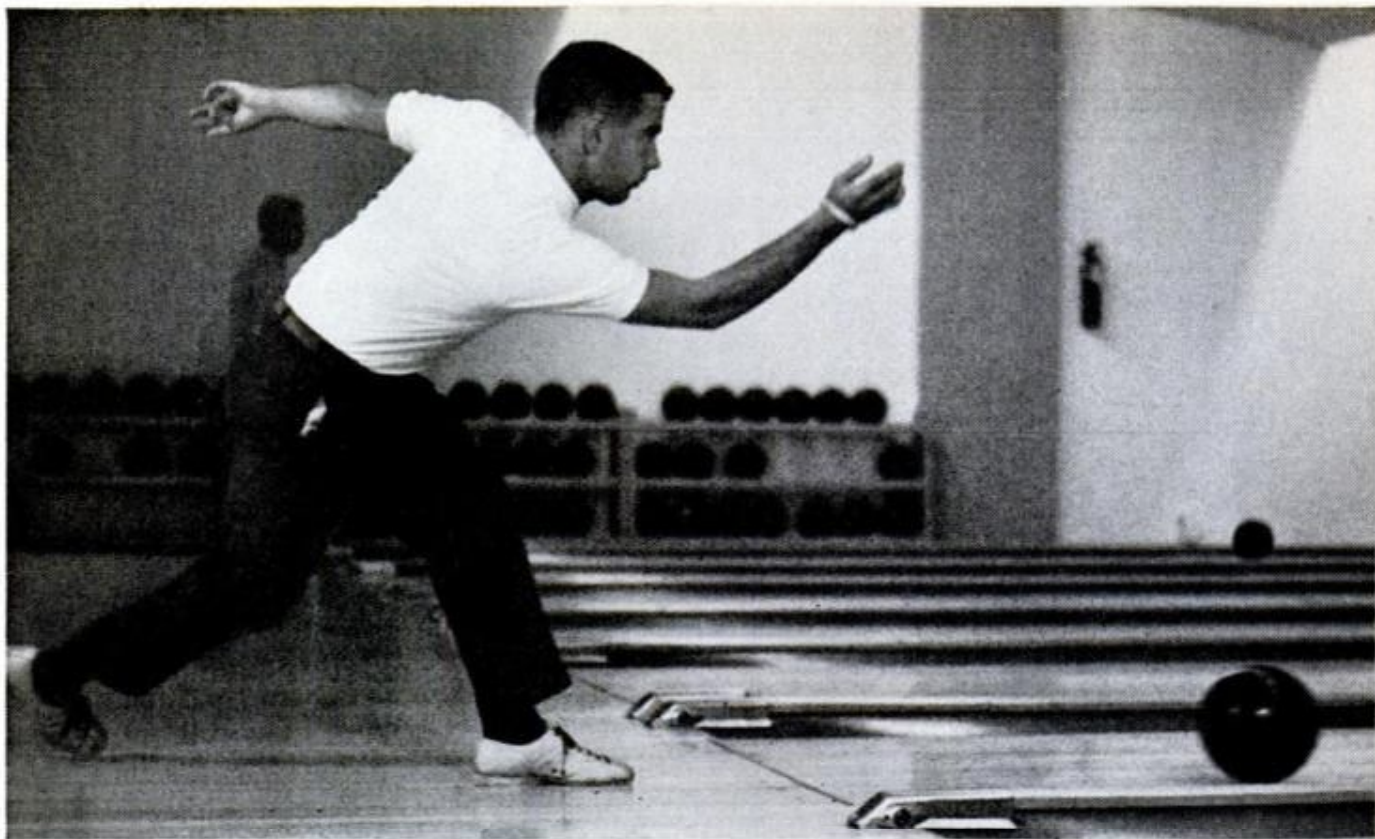
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CLINIC FOR HOMEOWNERS

Packaging Foods

Q—I recently purchased a home freezer and I'd like to have you tell me what are the best ways to package foods for freezing. What containers are best for the purpose? How does one pack the various containers in the freezer compartment? I've been told that glass containers, such as Mason jars, can be used. Is this true?

—L.S., Ga.

A—If you bought the freezer new, then most, if not all, the information you need on packaging foods came with it, or should have, as a service of the manufacturer. Space does not permit a complete outline of all the approved methods of preparing foods for freezing but in general the first essential is that all wrappings and containers be scrupulously clean and they must be as near moisture and vaporproof as possible, also they must be easy to handle and of a material that can be sealed tightly. Ready-made containers are available in a large range of sizes and types. We do not recommend use of glass containers, although it is true that glass jars of various types and sizes are used. Metal containers are sometimes recommended for preserving colors of certain fruits and vegetables. Plastic bags and foils, generally of aluminum, are recommended widely for wrapping vegetables, meats, and any other item which is of irregular shape. We suggest that you contact the dealer from whom you purchased the freezer, or the manufacturer, for informative booklets on packaging which are available free or for a nominal charge.

Putty Hardens

Q—What does one do to keep left-over putty from hardening? I think I've tried everything, or have I? But still the stuff hardens in whatever I put it in. Is there something I haven't tried?—W.R., Mass.

A—Possibly. When you purchase putty, that is, ordinary glazing putty, take it out of whatever container it came in and after you have used a portion of it, wrap the remainder in a metal foil such as that used in packaging foods for freezing. If you are careful to wrap the putty in the container in such a way as to exclude the air it will keep almost indefinitely. Or, place the unused portion in a plastic bag (the kind that is sealed at the seams, not sewed) and then seal the open end of the bag, the putty also will keep for long

periods of time. Add a little linseed oil and work the putty before storing.

Extra Early Garden

Q—I've heard that if you plant garden seeds in a shallow trench late in the fall and then cover with straw you can have fresh vegetables as much as three weeks earlier than usual. Has this sort of thing ever been done?—H.K., Ky.

A—Of course. Nature does it every season, with certain modifications. Yes, it has also been done by gardeners experimentally, but we wouldn't go so far as to say that you'll harvest three weeks earlier than normally. Perhaps one week to ten days earlier would be possible, but it should be remembered that usually it is the season that governs; not so much the method or precise time of sowing the seed. But there's no reason you can't try out the stunt, and have fun doing it. Just sow the seeds in much the regular way, covering with pulverized soil as you would in spring sowing. Then cover with straw, or any loose, fairly fine compost, to a depth of 6 to 10 in. (It will settle to half this thickness) and leave until the temperature reaches say 60 or 70 degrees come spring. Then remove the covering from the row only; do not remove it entirely as it can be utilized as a mulch.

Soundproofing

Q—In our first-floor apartment we always hear the lengthy piano practice of the growing family upstairs. It becomes pretty trying at times. Is there any inexpensive way of soundproofing the ceiling?—P.L., New York

A—Unfortunately not, as complete soundproofing would be difficult to carry out in a building already constructed. However, there is acoustical ceiling tile that will reduce sounds from above to a level below the objectionable, assuming, of course, that the tiles are properly installed and that the building is of standard construction. Most acoustical tile can be installed simply by applying a special adhesive to the plastered ceiling and pressing each individual tile into contact.

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"Thinking Factories"

(Continued from page 92)

rescue him?" The analyst has done half of the job by framing an answerable question from the vague query. Often the answer shows itself once a person trained in scientific thinking has rephrased the question to make the goal clear.

In order to crank a solution from his desk computer or slide rule—once a solvable equation has been formed—the analyst has to take into account all of the factors that he has been observing first-hand during his field duty. Some are obvious, such as the speeds of search planes, whether they are available, the times and conditions when they can search effectively and the nature of their search equipment such as radar. Some factors are not so obvious, such as what fraction of the time the planes and search radars work and how much duplicate equipment is needed to cover failures. And then the analyst even has to include mathematical values for the way a plane turns when it reaches the end of a search leg and whether while turning it loses potential radar contact with the downed aviator. The analyst has to know how radar operators observe their screens and how they rest their eyes, and account for these seemingly minor human variants in recommending the best search plan.

Solving Spare-Parts Problems

The largest of the thinking factories is the RAND (Research and Development) Corporation of Santa Monica, Calif, which does thinking for the Air Force.

RAND's work, like OEG's, is often an examination of alternatives. However, the problems are usually longer range and the alternatives to choose from may be whether to destroy enemy cities, or aim at missile sites instead. Nearly 10 years ago, RAND developed some of the Strategic Air Command plans that are in use now.

They showed the Air Force how to overhaul its spare-parts purchasing program to save up to 40 percent of the \$1-billion annual outlay. RAND calculated the time when a particular weapon would be obsolete and the Air Force bought only enough spare parts to last to that point. Before RAND made its study, enormous inventories of spares had piled up only to be junked when weapons were replaced.

The Army's thinking factory also has studied spare-parts problems. The operations Research Office (ORO) of Johns Hopkins University showed the Army that it is better to replace damaged or worn

(Continued on page 208)

REPAIR SPORTS GEAR—OR FRAME PICTURES

With a Weldwood Fix
and Finishes shelf
in your workshop



REPAIR FISHING TACKLE. Bond metal to fiberglass on your favorite fly rod with Weldwood® Epoxy glue. Seal oil or gas lines on your outboard. Bond almost any material. Supports tons—waterproof.



MAKE PICTURE FRAMES easily and simply. Mount pictures on plywood, frame them and cover the edges with Weldwood Flexible Wood-Trim®. Use Presto-Set Glue for both picture and frame.



MOUNT YOUR SUMMER SNAPSHOTS with Weldwood Presto-Set® Glue. It's quick and clean. Dries fast, and won't stain. In bellows-action squeeze bottle with spreader top.

You can never tell when you'll have an hour or two to catch up on the projects you've planned. So be ready with the materials you'll need. Pick them up on your next shopping trip—a full selection of Weldwood finishing materials—Deep Finish Firzite and White Firzite® and Satinlac®. They're available at your local lumber yard and at paint and hardware stores.



Products of United States Plywood
55 West 44th Street, New York 36, N. Y.

WORKING REPLICA OF EDISON'S
ORIGINAL GRAMOPHONE



Gifts worth giving...

NEW SCIENCE SETS BY LIONEL

Learning becomes an exciting adventure as your youngster probes the mysteries and wonders of science. Lionel provides all the equipment he needs to transmit his voice over a beam of light... turn on a TV set with a flashlight... build a tape recorder that actually works! He can launch rockets... make weather forecasts... even manufacture plastic products! Hundreds of fascinating things to build and do! Hours of fun for years to come! These new Lionel Science Sets are at your dealer's now! See them... *give* them!



FAMOUS INVENTORS SERIES. Build working replicas of Edison's Gramophone (left), Hooke's Microscope (above), Cartwright's Power Loom, Bell's Telephone, Gutenberg's Printing Press, Morse's Telegraph, Edison's Electric Light, Galileo's Telescope, Hero's Steam Turbine. Build them! They're authentic! They work! Under \$10.00 each.



WEATHER STATIONS. All the professional equipment needed for accurate weather forecasting. Electronic wind direction and wind speed indicators, aneroid barometer to measure atmospheric pressure, rain gauge, cloud charts, special equipment and computers to check humidity and THI. 3 sets—\$9.95 to \$29.95.



COMMUNICATIONS LABS. Build radio receivers, a transmitter, an intercom, a public address system, a tape recorder, a "phone" that transmits voices over a beam of light, a speaker device that lets a group of people carry on a telephone conversation simultaneously from anywhere in the room! 4 sets—\$9.95 to \$39.95.



ELECTRONICS LABS. Special sensing devices are used to build a burglar alarm, a rain detector, to turn on a TV set with a flashlight, or to wire an air conditioner so that it goes on automatically when the temperature rises! Hundreds of safe, easy-to-perform experiments with electrical circuitry! 4 sets—\$9.95 to \$25.00.



MICROCRAFT LABS. Finest, most complete microscope sets made! Five-turret metal microscope magnifies up to 750 times! Binocular eyepiece attachment, projector for group viewing, dissecting kit, slides, electron film strip, shrimp hatchery, specimens, special electronic stage, and much more! 8 sets—\$5.95 to \$39.95.



CHEMCRRAFT LABS. Over 1,000 exciting experiments in chemistry and atomic energy! Launch rockets! Make a pen that writes with invisible ink! There's a power agitator for mixing and blending, a centrifuge for separating solids and liquids, a balance so precise it can weigh a feather! Much, much more! 7 sets—\$2.95 to \$39.95.

SEE THE ENTIRE LINE IN THE NEW LIONEL CATALOGUE...AT YOUR DEALER'S NOW!

jeeps than to try to keep hundreds of parts stocked in supply lines that often are very long and may be subject to interruption by an enemy. Until then, the Army tried to make major overhauls in the field—an undertaking that ORO proved was more costly than simply getting new jeeps.

Last year, the Army reorganized its thinking factory to allow it to grow larger and handle longer-range problems. A nonprofit Research Analysis Corporation (RAC) was built around the former ORO. Defense Department limited-warfare expert Frank A. Parker, Jr., was brought in as president. He replaced the generally acknowledged "Grand Old Man" of military operations research—stubby, bouncy, dynamic Ellis A. Johnson. It was Dr. Johnson who first took ORO analysts to Korea in 1950. There they got themselves bombed, ambushed by guerrillas and shot down in planes. But they always managed to get the first-hand information that they needed for their studies.

ORO analysts saw the Army dropping leaflets that urged the North Koreans to surrender so they could live in a democracy and vote. General Walton Walker's interpreter, Jimmy Kim, told an opsearcher, "This is for the birds; the Army can't get those guys to come over with that line."

Free Rice Beats Free Vote

What kind of a line *would* work? Analysts began interrogating prisoners in great detail and soon they had the picture of a hungry man who wanted the rice that he knew the Americans had, but who was afraid to surrender because his officers had told him that the Americans would shoot him on sight. ORO learned that North Korean soldiers had never heard of "democracy" or "vote."

The analysts went to Bell Telephone Laboratories' Dr. William Shockley, who had won a Nobel Prize for development of transistors, and tossed him an idea. Shockley was in Korea with the Weapons System Evaluation Group, a thinking factory working on the Defense Department level. With him was Gen. James Gavin.

They got on a telephone and managed to talk themselves into a connection with Bell Labs in New Jersey. "Build us a loud-speaker that will operate on a C-54 at 10,000 feet but can be heard clearly on the ground," they shouted over the transoceanic circuit. "And now while we've got this line, connect us to Laurie Norstad down in Washington."

Five days later, the super bull-horn arrived in Korea on a plane hastily arranged

by Gen. Lauris Norstad. Tape-recorded messages offering rice and safe conduct, blared down on North Koreans who certainly could listen. Within a few months, at least 20,000 North Korean soldiers carrying illustrated safe conduct leaflets designed by ORO came over to the United Nations.

To find out what weapons were effective against tanks—rather than what the troops just *thought* were bringing results—opsearchers pierced deep into enemy territory to examine and photograph every damaged tank that they could find. Often they followed tank battles so closely that they were able to get pictures of tanks exploding from direct hits. The study showed that over 40 percent of the tanks were knocked out by Air Force planes, mostly using napalm; nearly 40 percent were knocked out by U.S. tanks; most of the remainder had suffered mechanical failure or had simply run out of fuel; almost none were victims of the highly touted bazooka.

Thinkers Hit the Field

Opsearchers went on to prove that the 2.36 bazooka was purely a suicide weapon. This study spurred production and delivery of the somewhat better 3.5 bazooka.

Opsearchers' studies led to the concept of Special Forces teams to train native troops. While America's attention was still riveted to Korea, and Indochina had not yet become Vietnam, Laos and Cambodia, ORO was recommending foreign-language training for Special Forces.

Keeping ORO—now RAC—up to date on Southeast Asia are analysts who bring back data from trips that they can discuss publicly only as "a vacation in Canada," or "a post-graduate course out West." From time to time, other opsearchers come back from "vacations in Florida" prepared to brief the Army on the alternatives attached to possible actions in Berlin.

Thinking factories do not limit their work to grand strategy, nor even to military operations. The classic example of O-R at the individual soldier's level is one that is typical of O-R performed for private business. An opsearcher, once assigned to evaluate field exercises, noticed a long line of soldiers waiting to wash their mess kits after eating. He also noticed that there were two tubs for washing and two for rinsing.

Following a hunch, the analyst checked the operations with a stop-watch. As he had guessed, the washing operation took three times as long as the rinsing operation. He

(Continued on page 210)



Pontiac Motor Division - General Motors Corporation

*optional at extra cost **up to 166 bhp at extra cost

I'm sure it's a lovely car, Destry, but in the bedroom . . . ?

Some cars have personality. They're the kind you hate to leave out in the rain (and not just because you're too lazy to start polishing all over again). The kind that bring back a long-disremembered sensation: That excitement you felt when you bought your first car. The new Le Mans is like that.

It isn't just the way it looks; there are other cars almost as good-looking as the '63 Tempest Le Mans. It isn't just the bucket-type seats or the floor shift or the extra-cost-option tachometer; other cars have pretty reasonable versions of this pizzazz.

It's when the thing is turned on and set in motion that the new Le Mans starts to worm its way into your affections,

develops that personality we were speaking about.

Some of it comes from the way our new 326 cu. in. V-8 rouses its 260 bhp and makes tracks (our 115 hp 4** with gentle thirst and the manners of an 8 is still standard equipment). Still more of it comes from the way the new rear suspension handles the handling. You point it, it goes that way, and no shilly-shallying.*

The quieter, more positive shifting automatic, the self-adjusting brakes, the 20-gallon gas tank (up from 17), the beefier differential unit, they're all nice. But it's the personality we like best about our new Le Mans.*

Pontiac Tempest

... the Newest **FREE**
Service to Car Owners...

Instant tests

...for **BAD** brakes

...for **BAD** balance

...for **BAD** steering

NEW BEAR SAFE-WAY SYSTEM OF BRAKE SERVICE

IF YOU CAN'T STOP YOUR
CAR, DON'T START IT!



includes free instant brake test that can save you a costly accident; if brakes are found dangerous, the Bear System assures you of new brake safety with economy!

Vibration wears the life
out of tires and
vital steering parts!

New Bear-Matic
balancer includes
a VIBRATION TEST
that SHOWS YOU IN-
STANTLY if wheel
balance is needed.



It's 3-to-1 your
car suffers from
TIRE SCUFF... this
INSTANT TEST IS FREE.
With the Bear Drive-Over
Test and Tire Waste Fore-
caster, your Bear Service-
man can show you in sec-
onds just how much tire
scuff is costing in wasted
tire mileage.

Only $\frac{1}{8}$ inch
MALADJUSTMENT can
Scuff away 50% tire life



Look for the sign of the
BEAR[®]
the sign of safety service

BEAR SCHOOL AND NEW BUSINESS
OPPORTUNITIES OPEN TO
MECHANICALLY MINDED MEN.

Write your name and address below and mail to
Bear Mfg. Co., Dept. P-10, Rock Island, Illinois

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suggested using three of the four tubs for washing and just one for rinsing. From that time on, there were no more long lines.

This is the type of O.R. that analysts very often perform for private business. Much of it involves "queuing theory" or the theory of waiting lines to locate check-out points in new supermarkets and to assign toll-booth operators at bridges and tunnels.

One private thinking factory, Operations Research, Inc., used queuing theory as a tool to show an Eastern railroad that it will never need to double-track its main line. The waiting (queuing) time on sidings for the longest trains that the line will ever need to run—even considering maximum prosperity—was calculated. ORI showed railroad officials that double schedules could be met with the single-track.

To make sure that he knew what he was talking about, ORI vice president Harold O. Davidson first followed some good op-searcher practice. He and a team of scientists donned coveralls and hard hats and climbed loading ramps, walked miles and miles of track, rode hand cars and worked in the yards to learn the operations.

Almost every operation that repeats itself is fair game for O-R. Forest fires, for example, repeat themselves seasonally. (It is not necessarily the same fire in the same place, but there are repeating similarities among most fires.)

The U.S. Forest Service recently adopted O-R to study fire fighting operations in California where the annual toll runs \$40 million. O-R is showing where a certain piece of equipment will buy more fire fighting than will other equipment.

Public health is a field where O-R is coming into its own and some thinking factories are turning in this direction. Repeating outbreaks of a disease are epidemics and O-R techniques can alert physicians to epidemics when only a few cases have actually appeared. Opsearchers at the U.S. Public Health Service's communicable-disease center epidemiology branch spotted the 1957 Asian flu epidemic more than six months before it got a solid footing in the U.S. The Public Health Service was able to warn localities, route vaccine shipments and help schedule hospital staffing on the basis of reports from its small internal operations research group.

What about the fear that thinking factories will replace human judgment?

Says one opsearcher:

"We don't make decisions, and computers can't make decisions, but we and our computers can certainly *help* executives and commanders make their own decisions faster and better." ★ ★ ★



It pays to keep your Chevy the Chevy-est

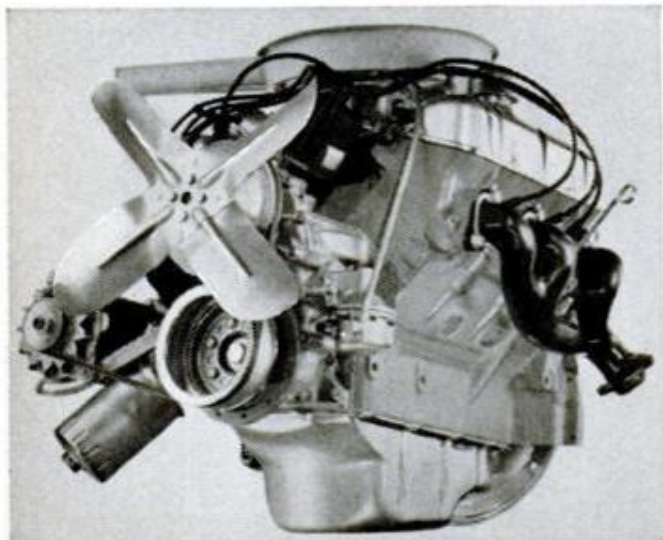
WITH GENUINE GM CHEVROLET REPLACEMENT PARTS

Naturally you care what parts go into your Chevrolet—because your Chevy does! Whether your pride and joy is a new Chevrolet or an older vintage model you're keeping in mint condition, the important thing is to use only *genuine* GM Chevrolet replacement parts. That way you're sure of maintaining the dependability that makes a well-cared-for Chevrolet such a pleasure to drive. The reason, of course, is that genuine GM Chevrolet parts are built *especially* for Chevrolets to fit right (for easy, fast installation) and work right for a long time to come. They're available at your Chevrolet dealer's and at leading independent garages and service stations. . . . CHEVROLET DIVISION OF GENERAL MOTORS, DETROIT 2, MICHIGAN.



Test your automotive I.Q!

QUICK QUIZ BY QUAKER STATE



1. What is significant about this motor?



2. What does this symbol stand for?

This is the new V-6 engine developed by Buick. The life preserver at bottom stands for Quaker State Motor Oil—because it is the best engine life preserver. Made from 100% pure Pennsylvania Grade Crude Oil, Quaker State keeps your car on the road, out of the repair shop. Insist on Quaker State—the best engine life preserver.



QUAKER STATE OIL REFINING CORP., OIL CITY, PA.

Add-On Entertainment Center

(Continued from page 198)

sake of appearance and for the practical purpose of heat dissipation in those cabinets housing electronic equipment, the backs of all cabinets were made from 1/4-in. perforated hardboard. Notice that the hardboard panels are installed with a center support, Figs. 10, 11 and 16, but that blocks instead of cleats are used at the ends as a screw base. The backs are then covered with grille cloth, rubber-cemented in place.

Home recordists have the problem of space or work area for the splicing, mending and editing of tape. This is taken care of by the smooth laminate-surfaced areas of the drop doors. Likewise, there's always the question of where to put the album jackets when listening to the phono. This problem has been solved by the provision of a unique pull-out drop shelf, or easel, which fits under the phonograph shelf, Figs. 14 and 15. It's detailed in Fig. 7 and shown in relative position in Fig. 10. It consists of a pair of grooved cleats screwed edgewise to the underside of the phono shelf. These grooved cleats serve as a slide for a hinged, divided shelf of 1/4-in. hardboard, cut and hinged at the point indicated in Fig. 7. In use the whole thing is pulled out to the stops. At this point the hinged portion drops to form an easel having a lip at its lower edge, Figs. 7 and 10, which prevents records, jackets and any other small objects from falling to the floor. Lift the easel to the horizontal position and the whole thing slides back under the phono shelf, a neat and satisfactory solution to a rather troublesome problem.

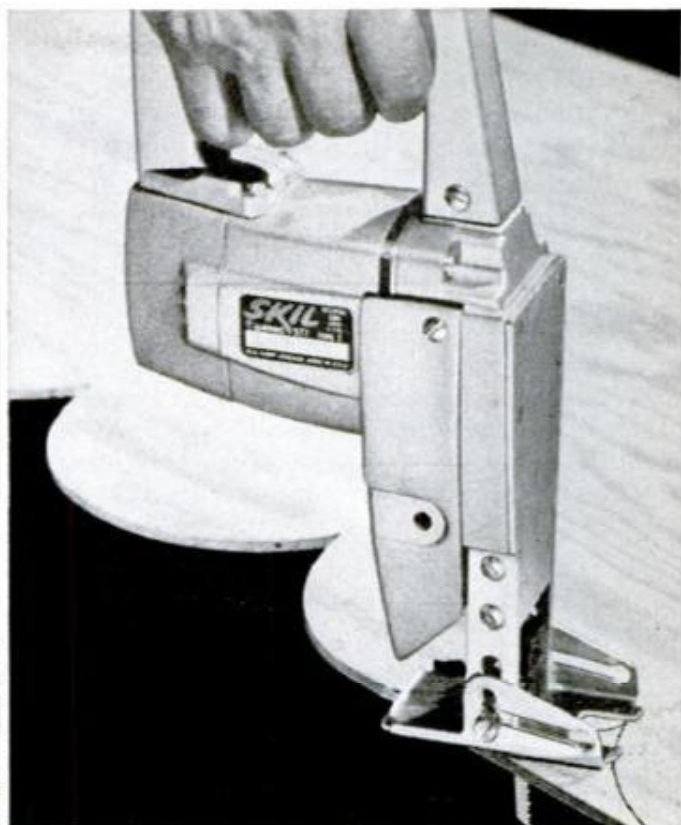
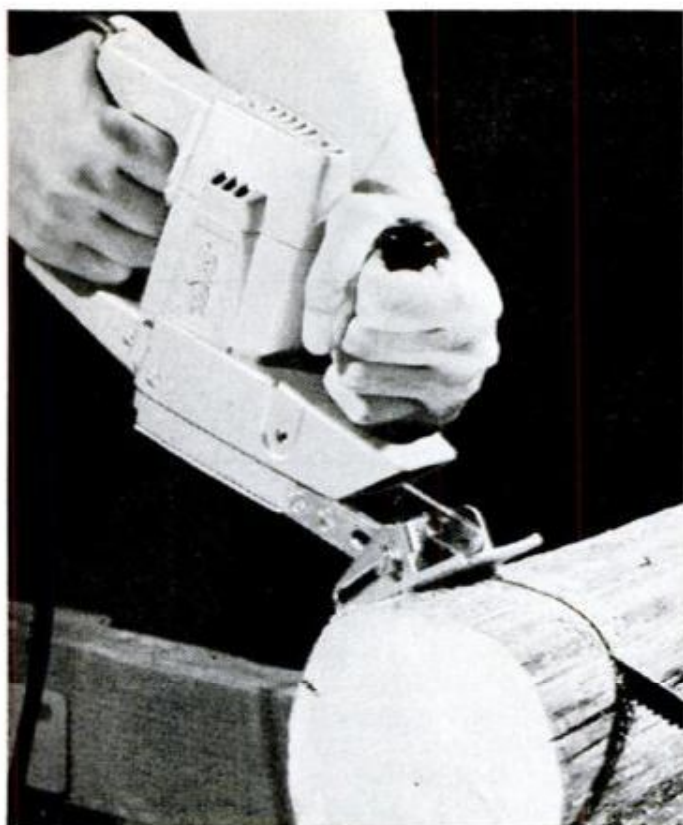
Finishing

The original cabinets, as noted in Fig. 13, were made from lumber-core plywood panels walnut-faced with ribbon-stripe veneers. After a careful sanding, with special attention to the edges which were only slightly and uniformly rounded, all exposed surfaces were coated with a prepared oil finish, Fig. 17. This was applied in accordance with instructions on the container and produced a most attractive finish on walnut.

Should you use other woods, such as curly-birch or rift-sawn oak-faced plywoods, you can obtain most attractive effects by judicious use of the many stains available for toning and coloring these fine cabinet woods. Run tests on waste pieces of the same wood until you are certain that the stain will produce the color and tone desired.

(Continued on page 214)

NEW KIND OF POWER SAW



Skil Recipro Saw makes any cut from 6" fence posts to fancy patterns!

The Skil Model 577 Recipro Saw is the *first* portable power saw with almost unlimited cutting capacity! It'll cut thin sheeting or thick wooden posts . . . or steel pipe, sheet metal, aluminum, plaster, wall board, plastic laminates, you name it!

It's a coping saw, hacksaw, scroll saw, jig saw, crosscut saw and rip saw that'll make you twice the craftsman you ever thought you were! You can buy it at better hardware and lumber dealers everywhere. Priced under \$50 (slightly higher in Canada).



Bevels, Miters



Cuts in Walls, Floors



Cuts Metals



FREE OFFER! Metal utility case and 8 blades if you buy the Model 577 now. Hurry! Limited time offer at most dealers.

SKIL
POWER TOOLS

WATCH PRO FOOTBALL HIGHLIGHTS SPONSORED BY SKIL ON NBC-TV, EVERY SATURDAY AFTERNOON, SEPT. 22—DEC. 22

Looking now at the equipment installed in the dual unit, Fig. 1, you'll see that the cabinet can be adapted to any hi-fi equipment you now own. You can mount your equipment in one of two ways. If there's an overhang, or lip, around the chassis you cut the mounting hole only slightly larger than the chassis size less the lip. This permits you to drop the chassis in place and attach with screws through the lip. If this is not possible, then remove the dress panel, take off the knobs and touch the ends of the control shafts with oil paint. Then imprint the inside surface of the wooden panel by pressing the ends of the control shafts against it lightly. This will spot the 1/2-in. holes for the shafts. Use extended-shank knobs when reassembling the units. Another way to do this is to use the dress panel as a drilling template.

Wiring

Once you have the equipment mounted the next step is the wiring. For this use the shielded hi-fi cable now available in colors, which greatly simplifies the problem of determining where each lead comes from and where it is to be terminated. Similarly, the loudspeaker connections are made with miniature zip cord which is tinted red for left, blue for right. This cord also has one lead tinned, the other bared copper. This helps in eliminating phasing tests for the loudspeakers. By leading wiring through the openings in the center legs and cabinets the "spaghetti" is easily kept within bounds. The wiring diagram, Fig. 12, shows how the complex of source sounds is wired into the minimum input jacks of the Scott stereo amplifier used in this installation.

Control Panel

The only device in the setup which is non-standard is the control panel. This actually is a composite of two separate devices with two separate functions. First, it's a Switchcraft amplified mixer. It contains four level controls and four input jacks. You simply remove the mixer from its cabinet and rewire it to permit plugging in four microphone or other magnetic sound pickups at the front panel. You can set the levels individually and use as four mono inputs or two stereo inputs. The output connects to the auxiliary input on the amplifier. These inputs are also used with a Y-connector for the short-wave tuner on one channel and the TV audio on the other. Being a high-level input no hum results from the extra wiring connected to the channel which is not in use.

Switching of the output on the control panel is provided by two Switchcraft Lev-R-Lite switches. These are three-position switches with toggles that light up in three colors, depending on the switch position. Six-volt current for the bulbs is obtained through a filament transformer plugged into the switched receptacle on the amplifier. This also provides "on" indication when the amplifier is switched to the on position. The audio input from the amplifier is first led to one of these switches which chooses either phones, speakers, or both. In the phones position the audio is applied to the stereo earphone jacks at the front panel. In both it goes to the second switch as well as the phone jacks. In the speaker position the audio is applied only to the second switch. The second switch selects either main, thus transmitting the audio to the uppermost jacks on the verticals for the main speakers, or wing for the lower jacks, feeding only the remote speakers, or both, to all speaker jacks.

Other minor installations provide the operator with additional conveniences. A simple a.c. accessory outlet on the front panel permits use of a work light or a demagnetizer. The silicon-controlled rectifier is mounted with a recessed phono lamp to provide a half-bright position. An a.c. outlet and a phono jack in the rear center vertical permits use of a reverberating loudspeaker to fill a derived third channel.

Using the System

With the two tape decks you can copy tapes, edit without a splicer simply by playing the unedited tape into the second machine. Just start, stop and rewind the second machine to make a corrected and edited tape. For home recordings, set up the microphones and make the voice recording first. You can listen to the recording over the phones to monitor it as the deck is a three-head type. Then using either the phonograph or the other tape deck you can dub in musical backgrounds or other sound effects as desired.

When you get around to editing tape, use the system practiced in most recording studios. You switch to fast forward and to rewind you cue the tape. In this process the sounds emanating from the speakers are anything but pleasant. However, you just plug in the phones and switch to phones only. Then no one hears the sounds but you. Others can listen to TV while you do your work. Often when a good FM program parallels a desired TV program, you can tape the FM and watch the TV at the same time! ★★★



When
a
cigarette
means
a lot...

you get Lots More from L&M

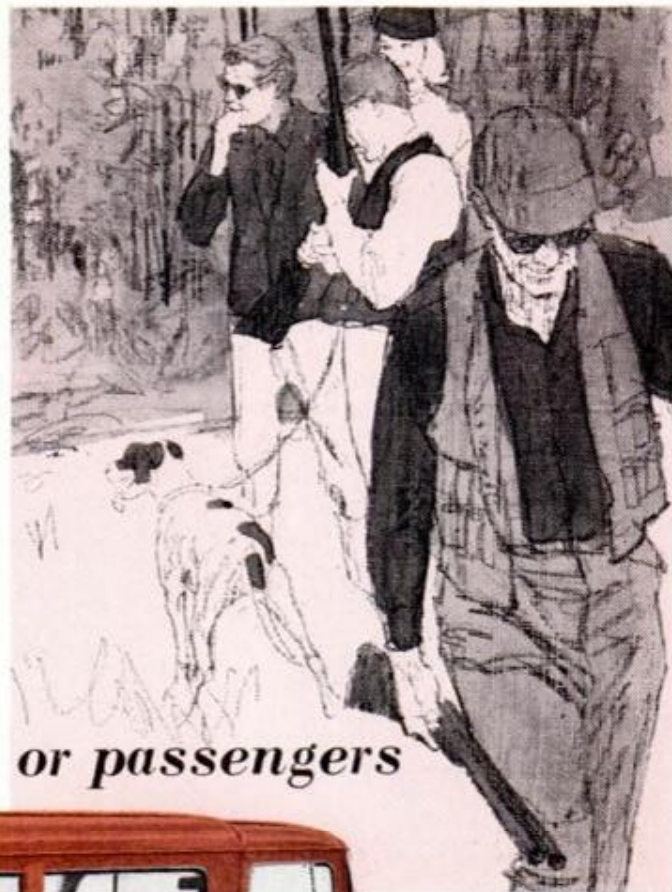
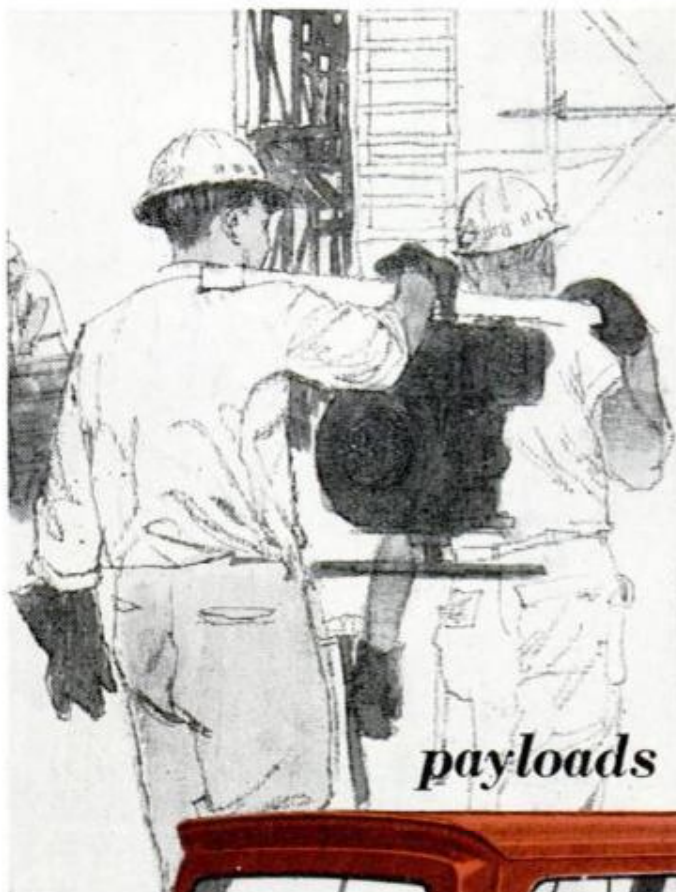
more body in the blend... there's a special rich-flavor leaf — and more of it — among L&M's choice tobaccos.

more flavor in the smoke... every puff is heartier, for L&M has more longer-aged, extra-cured leaf than even some unfiltered cigarettes.

more taste through the filter... L&M's filter is the modern filter — *all white* inside and outside — so only pure white touches your lips.

• **It's the rich-flavor leaf that does it!**



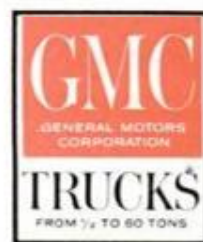


payloads or passengers



... HANDLE BOTH WITH FAMILY-CAR DRIVING EASE
in a GMC Suburban with Power Steering!

The versatile GMC Suburban Wagon with power steering is a multi-duty vehicle for the businessman who's a sportsman or family man! The Suburban with power steering lets you haul work loads with as much as 83% less steering effort! You can devote *more* energy and time to business. The Suburban's power steering makes leisure-time driving—and parking—as easy and enjoyable as if you were handling a passenger car! Get in touch with your GMC dealer when you're considering the purchase of a business-and-pleasure vehicle. Then take a *lighter* turn at the wheel of a GMC Suburban with power steering. GMC Truck Power Steering is a product of Saginaw Steering Gear Division, General Motors Corporation, Saginaw, Michigan.





Driverless Tractor Goes to Work at Steel Mill

Believed to be the first remote-controlled tractor used for construction work, a 41-ton crawler tractor shovel was put to work removing slag at a steel mill. It was operated by a radio-control panel.

Called the Spook, the Allis-Chalmers creation is also expected to have applications for military and civil-defense use, fire-fighting, handling radioactive materials and other dangerous operations.

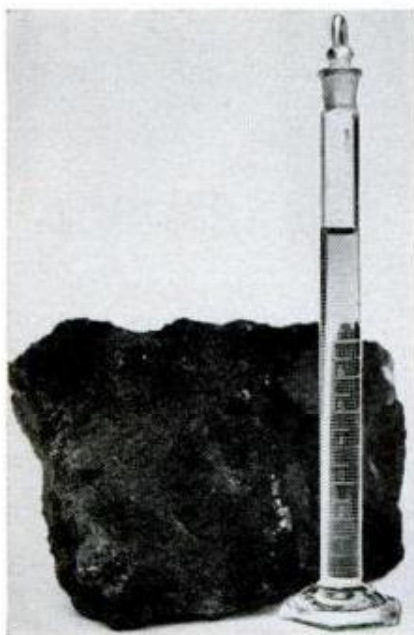
Men on Moon May Get Water and Air from Rocks

"Wringing out" rocks to get water and oxygen may be the answer to supporting life for tomorrow's men on the moon.

Earth rocks (believed to be similar to lunar rocks) are subjected to intense heat in a solar furnace. The sun is simulated by an arc light; its beam is gathered by a

large, curved mirror and focused on a spot that reaches 10,000 degrees F.

The rock literally boils away and yields water, oxygen, other valuable gasses and a glasslike material that may be used for construction purposes, say scientists at Aerojet General Corp., Azusa, Calif.



Unknown Menace:

(Continued from page 129)

Only during the fiery re-entry would germs perish — and then only those at the nose of the space ship (and if the ship bounce-skips back into the atmosphere, the germs are home free).

Dr. Phillips takes a different view toward what these space germs could do to us. He agrees with Dr. Lederberg that it is highly unlikely that germs from other planets could produce disease in earth people. That's because germs are highly specialized as to what they live on.

It's true that bacteria can infect every living thing on earth, and viruses can live in every kind of living cell. But it takes exceptional germs—such as those producing parrot fever and anthrax—to live in both man and animal. And not one of the germs that infects plants can infect man.

But, Dr. Phillips points out, it isn't always the murderer that poses the greatest threat. A life form that outeats, rather than outbites, can be even more dangerous. He refers to Darwin and the constant struggle for survival of the fittest. "The perilous knife-edge balance maintained by such competing forms is never more evident than when a new form is suddenly introduced," he says.

A germ from outer space that competes

with earth bacteria in the soil for free nitrogen, as an example, could destroy our food crops and just as surely kill us as, say, some creature from Mars. Dr. Phillips points to the Japanese beetle which somehow got into the United States and destroyed fruit crops. And the lions in Africa have never threatened to overrun their continent as have the rabbits in Australia. Not one rabbit has bitten a sheep, yet rabbits have just as surely killed herds of sheep by devouring whole fields of grass.

In the U.S., according to the Department of Agriculture, plant diseases destroy \$3-billion worth of crops a year. There are plenty of examples in the past where a new disease, by wiping out a crop, threatened human lives. In 1845 and 1846 almost all of Ireland's potato crop was wiped out, and over the next 15 years a million Irish died from starvation or from diseases brought on by malnutrition. Blight destroyed a third of Germany's potato crop in 1917 and was one reason for its defeat in World War I.

While germs that cause plant diseases can't infect us, they can kill us indirectly. Take ergot, caused by a fungus that infects cereal grains. In ergot is a powerful nervous-system poison that can cause gangrene, convulsions and death. In Europe in the

(Continued on page 220)



CRESCENT SNIPS

GIVE YOU A KEENER CUTTING EDGE

You can tell it's a CRESCENT snip the way it bites decisively into the toughest metal . . . or cuts cleanly around the tightest corners.

CRESCENT snips are designed from the start to help you do a faster, better job in cutting sheet metal, wire screen, linoleum, canvas, cardboard, plastics, etc. Blades are precision ground by machine to a keen cutting edge . . . then electronically hardened for long lasting service. They're shaped exactly for the job . . . with leverage and balance designed-in to make your work easier.

You can find a CRESCENT snip in any size or pattern you need. Look for the special display of quality CRESCENT snips at leading hardware stores.

Next time you buy hand tools, buy the best . . . buy CRESCENT!

CRESCENT 

CRESCENT TOOL CO., JAMESTOWN, N. Y.

WIDEN YOUR FUN HORIZONS

... GO

HARLEY-DAVIDSON IN

'63!



Go see your dealer now for a look at the spanking new Harley-Davidson line. You'll find a set of wheels to take you *wherever* you want to go, to wonderfully widen your fun horizons! Now at your dealer . . . new, free full-color literature . . . easy-pay terms . . . help in getting insurance . . . and the great Harley-Davidson get-up-and-go line for '63 . . . DUO-GLIDE, SPORTSTER H, SPORTSTER CH, SPRINT, SPRINT H, PACER, SCAT, TOPPER H. See the Yellow Pages under "Motorcycles" and "Scooters" for the name of your Harley-Davidson dealer.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee 1, Wisconsin



what a
SNOW THROWIN'
family...

MOTO-MOWER SNOW THROWERS

20" BIG DAD — I'm the heavyweight of the family, because I eat more . . . up to 20" of even packed, crusted snow. I chew it up and spit over 18,000 cubic feet per hour right to the spot. See my chute? It revolves 90° left or right with a touch of that big fist-grip control. My big 4½ HP engine is winterized . . . completely shrouded . . . with a float feed carburetor that won't freeze up. And my deep tread tires really grrrrriipp. I'm big with the boys at the parking lot too.

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15" SMALL SON
I haven't got my dad's mouth or my brother's twist, but I do my share...and with your guidance . . . yours too!



Look the whole family over at your Moto-Mower Dealer today.



MOTO-MOWER, INC.
Richmond, Indiana
A Subsidiary of the DC Dura Corporation

Middle Ages, thousands of people died in epidemics spread by ergot-infected rye.

Mars' lowly plants could well harbor such germs that could destroy our crops and poison our food.

According to President Kennedy's timetable, we'll put a man on the moon by 1970. We won't send a man to Mars, or even Venus, and bring him back for about 20 years, according to plans of the National Aeronautics and Space Administration.

NASA scientists have just begun to think about what to do about space germs. And they rely heavily on Dr. Phillips. For the past few years he's served through an inter-governmental agency agreement as an advisor to NASA on "exobiological safety."

Dr. Phillips's ideas for controlling space germs stems from BW research — kill or contain. Here, step by step, is how we will prevent any invasion of the earth by other-world microbes, yet still be able to study bits of these other worlds in our laboratories.

These principles are set forth in a newly issued NASA-Ft. Detrick movie called "Exobiological Safety." The film has had limited showing, and this is the first time these plans have been presented in a national magazine.

The space ship has just landed on the moon. The astronaut opens a door and steps into the combination air-and-germ lock. He closes the door. Sterilizing gas hisses into the lock and soon completely fills it to prevent contamination of the moon by any earth germs.

The astronaut's air-tight space suit protects him from the gas. His breath is passed through a special filter to trap earth germs before being exhaled.

The astronaut opens the outer door and steps down the ladder onto the soft lunar dust.

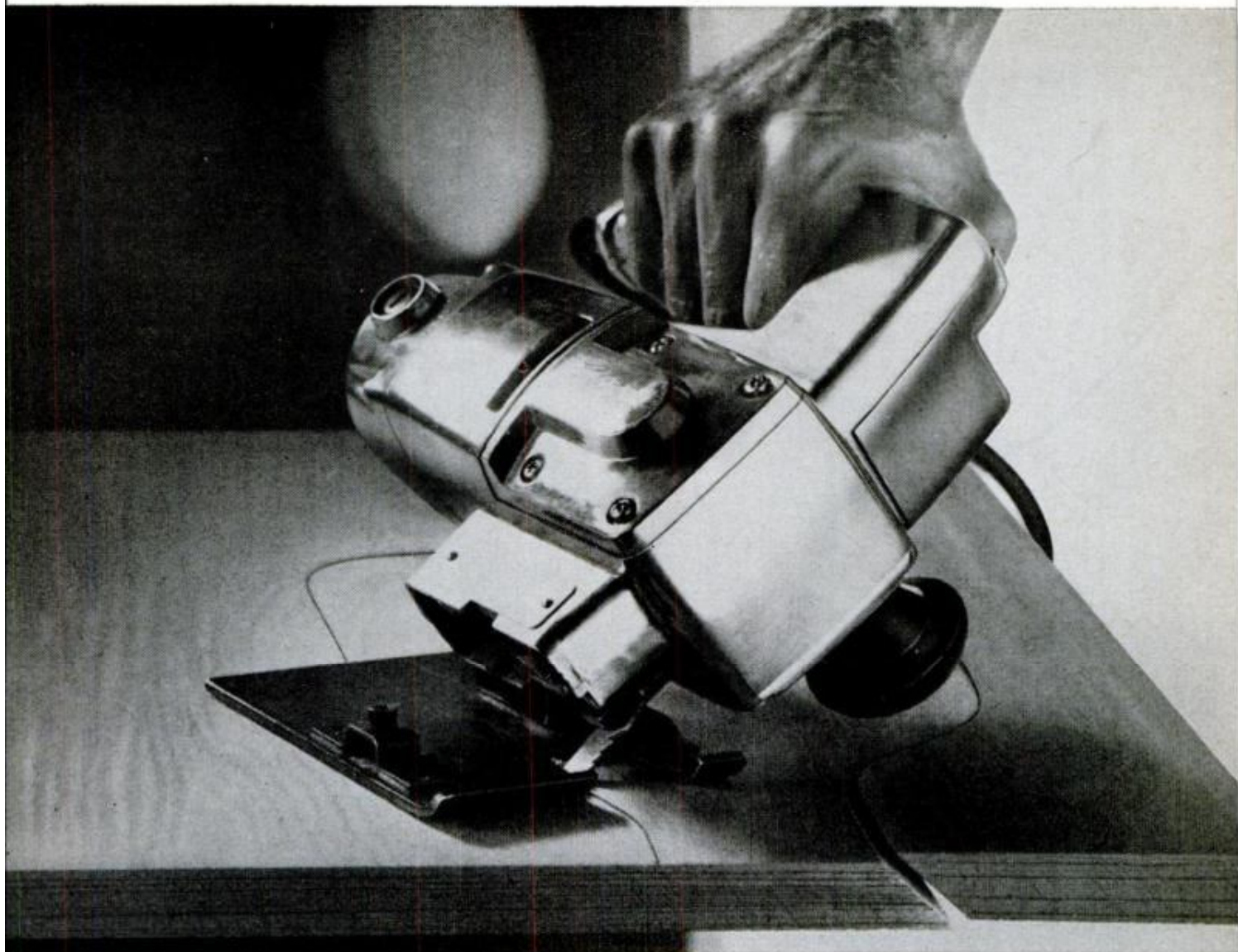
On the moon, with the earth looming large and bright above the horizon, the astronaut carries out the duties he has been trained for years to perform. Among these is the gathering of samples of lunar dust and rocks. Here could be the priceless evidence of life beyond earth.

The astronaut seals the lunar samples into a germ-tight container. He returns to the ship, and climbs up the space ship's ladder, opens the outer door and steps into the air/germ-lock. He closes the outer door. Sterilizing gas again floods the chamber, killing any microscopic forms that may have clung to his space shoes, suit or the container in his hand.

After a while, the gas is pumped out and the inner door to the space cabin opens.

(Continued on page 222)

So you want to buy a saw



Meet the new Porter-Cable Bayonet Saw —fastest-cutting saw of its type



SPECIAL INTRODUCTORY PRICE

Model 300 Bayonet Saw
cuts 2½" wood, ½" aluminum, ¼" steel at
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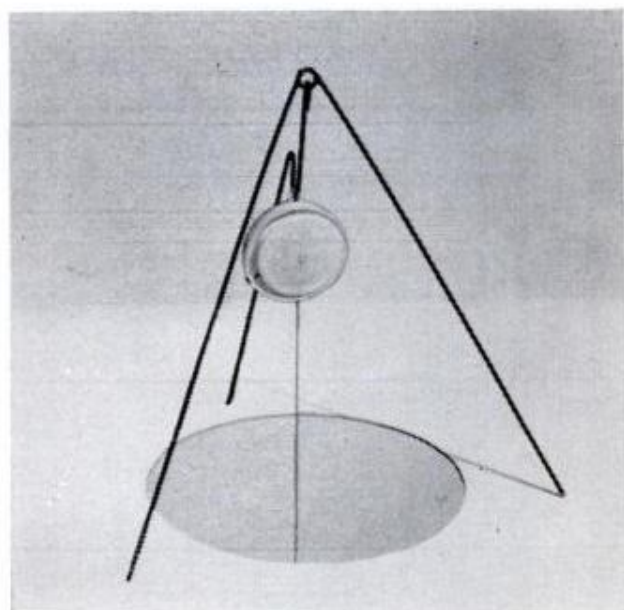
The astronaut buckles himself down in his seat, and the ship blasts off for earth.

Back home, the container is placed in a Ft. Detrick-like germ-proof chamber and opened. The samples of rock and dust are chemically analyzed, dropped into "germ food" cultures, and injected into animals—all under the safety of the proven BW methods.

As for the space ship, some germs that might have clung to it were killed during re-entry. As soon as the ship touches the landing area—probably in Texas or Arizona—it is enclosed in a shroud (such as that used to sterilize it before it left earth) and sterilized.

In the precious moments before the ship is sterilized, experts agree, some space germ spores might float into the air, just as they might during the slow descent to earth. This is one problem that still has to be solved. It may never be resolved.

As we said, while it's still doubtful that there is any life on the moon, we're more sure of life on Mars. So we'll have to be even more careful there. Thanks to what we've learned in BW research, life on earth should be spared the agonies of any invasion from outer space that we brought back ourselves.



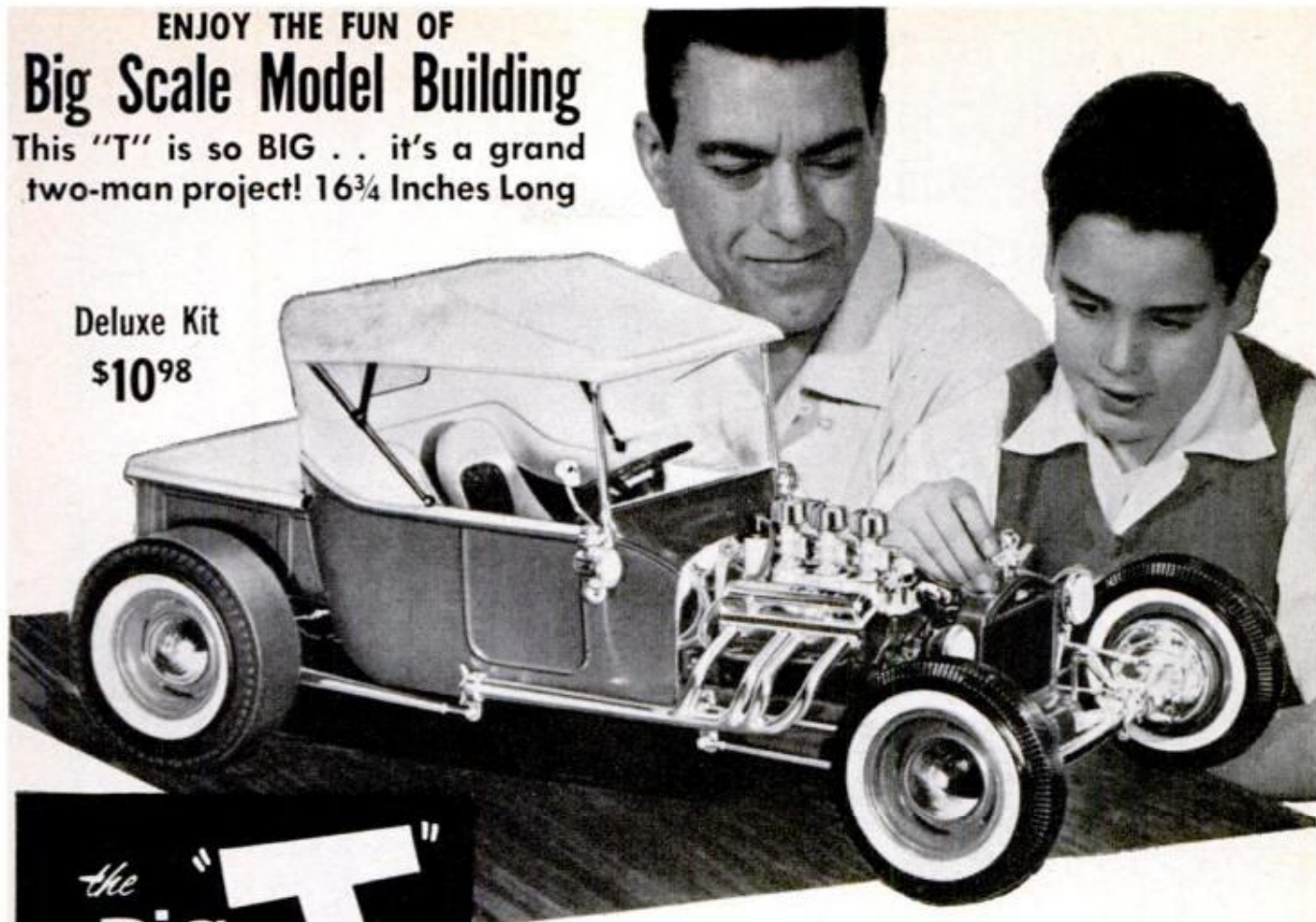
Automatic Under-Ice Fisher

Fish are automatically hooked and held by a new ice fisher when the bait is taken. A tug on the line sets the hook and a spring keeps the line tight on the fish. The unit is set by pulling out the line to the desired depth and pressing a button to engage the trigger mechanism.

It costs about \$1.50 and is made by Ritchie Mfg. Co., P.O. Box 711, 3194 E. Bdwy., North Little Rock, Ark.

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Big Scale Model Building
 This "T" is so BIG . . . it's a grand
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Deluxe Kit
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Ford Custom "T" Street/Show Pick-Up

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Extra Parts for Interior Variety. This interior has center console, Corvette shift lever, telephone, radio, TV, Stewart-Warner instruments, overhanging clutch and brake pedals, custom carpet and simulated Naugahyde sides.



Choice of Radiator Shells and Grill. Make your Big "T" with chopped '24 or '32 Ford shell and with Ford radiator or custom grill. Two shells, radiator and grill included in kit.

For home shop or kitchen table assembly—the Big "T" is magnificent fun. Big 1½ inch scale and amazing detail provide model building enjoyment in an entirely new dimension. This Monogram Street and Show Pick-Up model is built around the prized '24 Ford Roadster body and is customized with parts scaled from ten other cars and loads of special custom goodies. One-eighth real car size.

You make the Big "T" in the best customizing tradition—as you like it best—with choice of interiors and

front end. There's a custom 283 Chevrolet engine with three carburetors and all the trimmings, soft pliable and realistic tires and slicks, bucket seats, tools, trophy and "show" accessories. Model steers like a real car and can be motorized for electrical operation with \$1.49 power kit.

Big deluxe kit contains 203 precision-molded parts in 5 colors of plastic. 97 of the parts are in gleaming chrome plate. No painting required. 24-page assembly guide with 108 pictures makes assembly easy.

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For the time of your life and a beautiful show piece, get the Big "T" kit at hobby shops and other stores in your neighborhood. Watch for the Monogram display with the Big "T" in a "show setting." Don't accept a copy or substitute. Ask for it by name—the Big "T" by Monogram.

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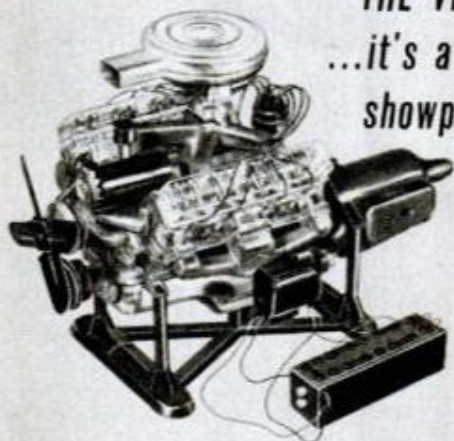
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it really

works



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CRISIS! How Can We Store Human Knowledge

(Continued from page 110)

slant. NCR hopes to develop modules that will enable smaller companies to begin to mechanize their IR problems before they become completely out of control. Such modules might be simply micro-image viewers to begin with. Such a viewer might also have a means for making prints. Storage would be accomplished by a simple three by five manual card file.

A good many thoughtful Americans are wondering whether or not we still have the prerogative of proceeding slowly in the area of data storage and retrieval. Allen Kent, associate director of the Center for Documentation and Communication at Western Reserve University, said recently, "The Soviet Union has mounted a massive effort to 'brainpick' the world's recorded literature in order to assure a more effective scientific and technical effort on their part. We, too, must go in this direction, and our 'brainpicking' efforts have been desultory."

That's why the micro-image process may turn out to be a vitally important discovery. It seems almost incongruous to suggest it, but it's possible that the cold war might be won in a filing case. ★ ★ ★

Frozen Bands Ring Saturn

Saturn's rings are coated with frost crystals, reports Dr. V. I. Moroz, State Astronomical Institute, Moscow. They consist of chunks of cosmic material ranging from four inches to three feet in diameter.

The frosty bands were discovered by using a 50-inch reflecting telescope and an infrared spectrometer. Previous studies in the U. S. have indicated the possibility of frost, and Dr. Moroz' report confirms it.

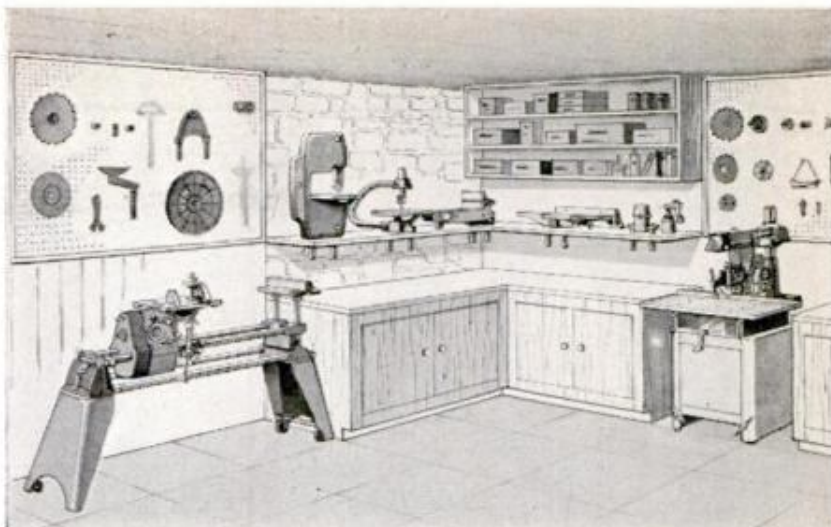
Moon Ice May Furnish Water

Frozen lakes locked in dark moon craters may be the source of water for the first astronauts who land there. At the lunar poles, the sun barely rises above the horizon which keeps the crater temperatures very low. Under these conditions, it would take billions of years to evaporate a thimbleful of water.

"The presence of ice on the moon would make it possible to substitute important scientific instruments for water supplies on lunar spacecraft," said Dr. V. D. Davydov, State Astronomical Institute, Moscow.

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A Star Is Born—Less Often

Men who look to the stars in years to come will have a less brilliant array to study than we have today. That's the conclusion of Dr. Maarten Schmidt, astronomer of Mt. Wilson and Palomar Observatories.

He found that small stars in the Milky Way galaxy—the shroud of billions of stars in which floats Earth and other planets of the solar system—are being formed at a lower rate than they previously have been.

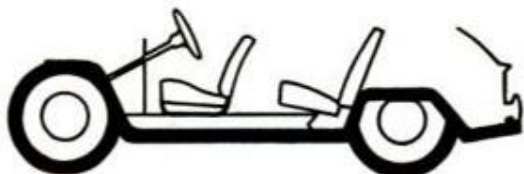
After studying the amounts of metals in the atmospheres of 56 small stars within a few hundred light years of the solar system, Dr. Schmidt determined some did not contain the amounts of metal they should have to be considered young.

The higher the metal content, the younger the star, because the interstellar material from which stars are formed is becoming increasingly contaminated with metals.

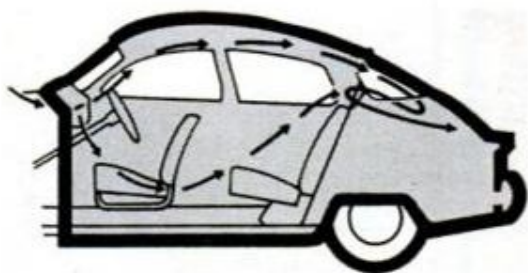
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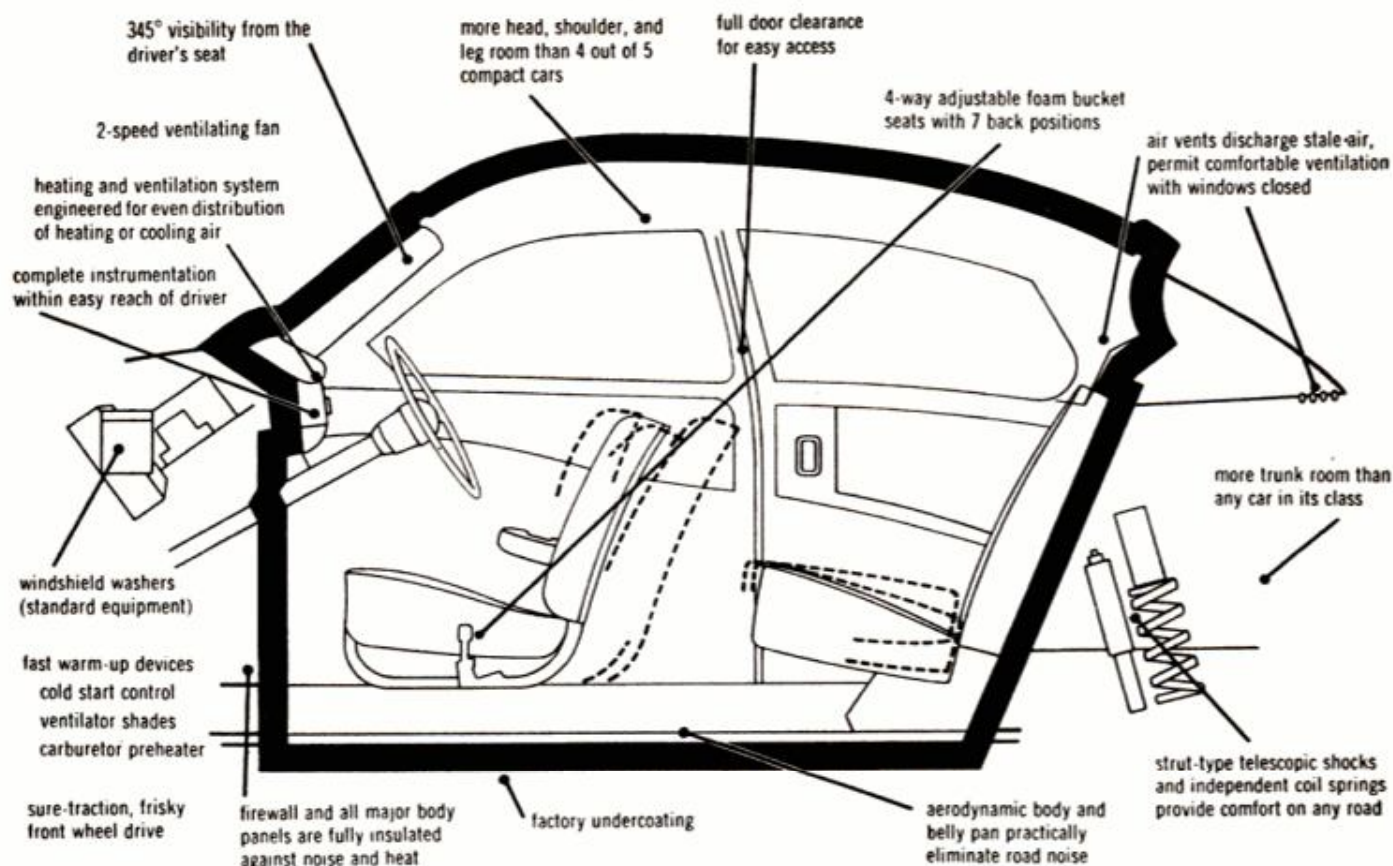


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Ford's Mustang

(Continued from page 94)

wheels. In effect, the engine was kept in the same position relative to wheels as in the Cardinal, but simply moved back to the rear axle. Transmission has four forward speeds.

There are several innovations in Mustang's design that will interest the racing world. First of all, driver and passenger seats are fixed parts of the frame structure itself enabling engineers to design the chassis for a permanent load distribution between the front and rear. Different-sized drivers are accommodated by moving steering wheel and pedals forward or aft.

Cooling chores are split between two small radiators on either side of body to which air is ducted. Electrically driven fans pull air through the radiators at slow car speeds when airstream is insufficient. Thus at high (racing) speeds, there is no power drain, as ram airflow is sufficient.

Suspension is by tubular A-arms connected to spindles via ball joints. Car weight is supported by coil-springs combined with adjustable telescopic shock absorber units. Brakes are spot disc at front, drum in rear.

Although the prototype has been fitted with built-in roll bars and a plexiglass competition windscreen, Ford designers have provided for a conventional windshield and roadster top.

According to Ford executives, there are no plans to mass produce Mustang at present. The car's future depends on public reaction. ★ ★ ★

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One spraying of the insecticide marketed by the American Cyanamid Co. remains deadly to flies for up to eight weeks or longer. It is also effective against insects attacking ornamental plants and seedling fruit trees; such plants are prey of about 20 common insects such as lace bugs, aphids and mites.

An unusual quality of Cygon, when applied to plants, is that it kills by both residual contact and systemic action. It becomes a temporary part of the plant and provides a protective covering to leaves and stems.

At present the compound is available only for use outside the house.

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COMPLETE ADDRESSES of manufacturers, inventors, and sources of information for items mentioned in the editorial pages of this issue are listed in the free WHERE-TO-FIND-IT list. Send self-addressed, stamped envelope to

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When this "protosun," as it is called, shrank so that its radius was 100 times the distance from the earth to the sun, it became unstable. The instability lasted until after the protosun had shrunk to a radius of about the orbit of Mercury.

This early history of the sun's birth and development was drawn from a study by NASA's Institute for Space Studies.

Underwater Rodeo

Scientists plan to place electronic saddles on whales and let the huge mammals carry the tiny transmitters down beneath the surface and send back signals.

Because whales can dive much deeper than submarines, the data they send back will be valuable to studies of antisubmarine warfare research.

The miniaturized electronic gear will be planted on the backs of surfaced whales from small aircraft. Then scientists on a floating laboratory will follow the whale's course and record the electronic feedback. Whales can dive 1000 feet or more.

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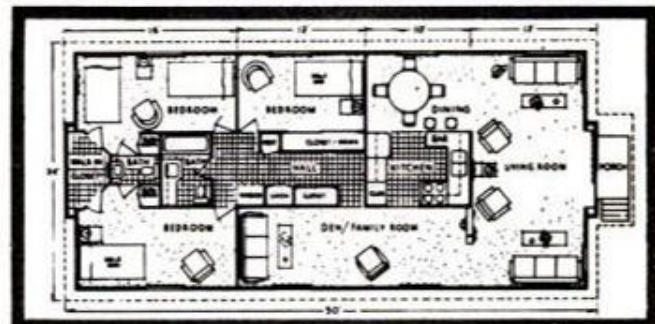
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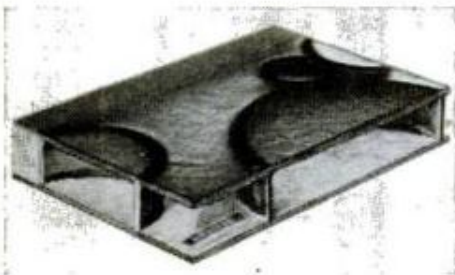
231



LUIS CARDENAS lays hoops on still-wet plastic sheet in pleasing arrangement



PLASTIC PANELS, shown here as room dividers, are also used as windows, doors or walls. Unless so ordered, no two panels are alike



HOLLOW CORE gives panels insulating qualities, plastic gives translucence

Imbeds Designs in Decorative Plastic Panels

Using a process that took six years to develop, Luis Cardenas, a South American art student now operating his own business in Seattle, Wash., makes custom panels by fusing a variety of materials into plastic sheets.

Leaves, butterflies, grasses, hoops, sea shells and champagne glasses are imbedded in the resin-reinforced glass fiber while it is still wet. When it dries, the new shapes are an integral, and artistic, part of the panels' design and structure.

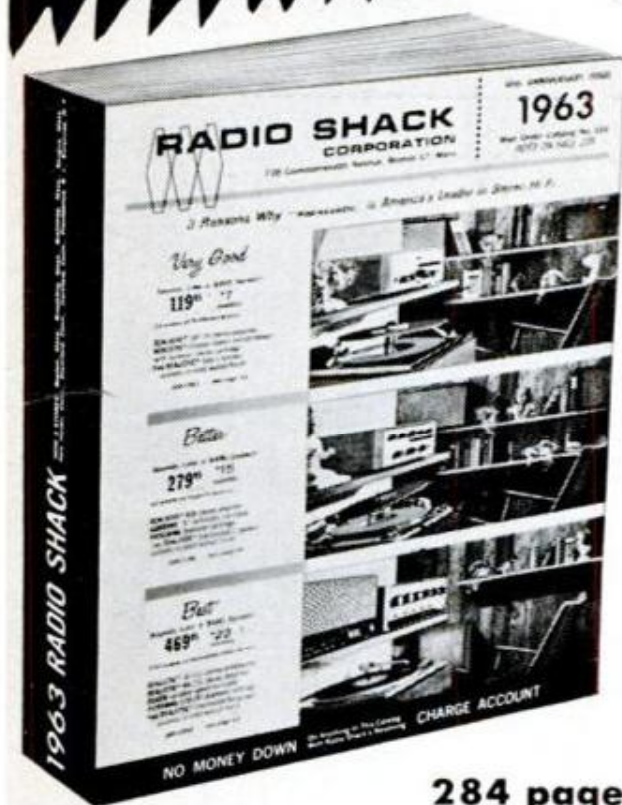
SEA SHELLS imbedded in plastic sheet make unusual wall decoration for bar



UNLIKE PANELS, such wall decorations use only one plastic sheet. Shells arranged on wet sheet become fused permanently when dry

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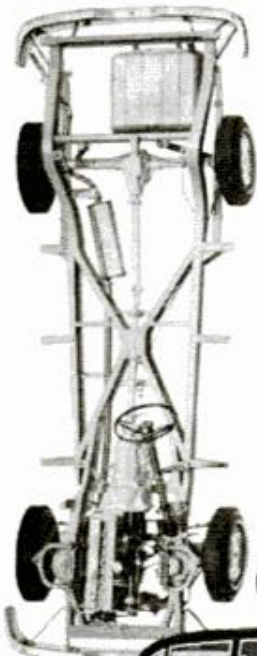
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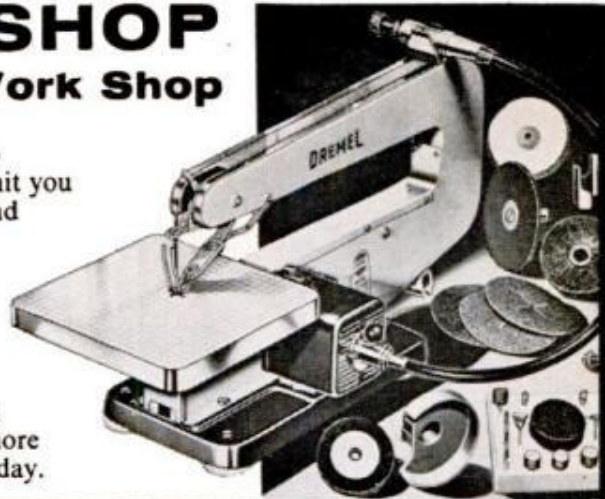
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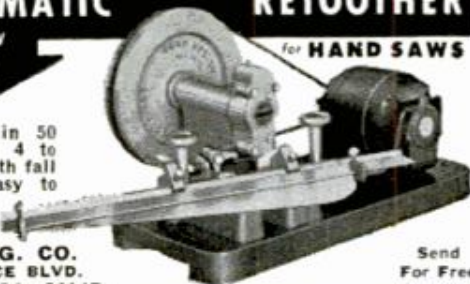
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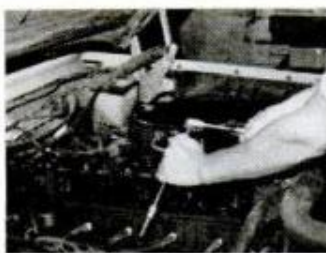
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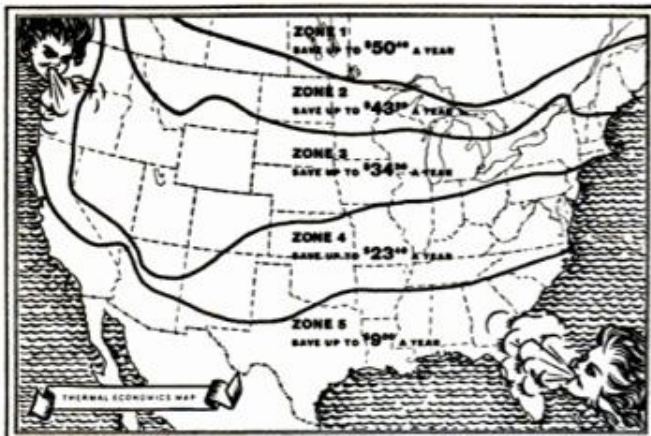
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The mice were placed in cages that spun continuously at high speeds, producing gravitational forces from four to seven times normal. They adjusted to this life easily, some of them living their entire lifespan, from birth to old age, within the cages.

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Businessmen may soon be able to carry computers around in their pockets to make lightning-fast calculations while away from their desks or offices.

The prediction is based on the recent development of a portable computer the size of a small suitcase, 18 by 12 by 20 inches, which can make calculations previously available only on giant computers.

Called SkeduFlo, the suitcase-size machine was introduced at a recent engineering convention by Dr. John W. Mauchly, co-inventer of Univac, the first commercial electronic computer.

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SPOTLIGHT ON THE **ALFA ROMEO 2600**

By Jim Whipple

IN A DAY when the roads are clogged with pseudo sports cars—sheep in wolves' clothing if you will, gussied up with fake wheel-spinners and imitation bucket seats done in imitation leather—it is indeed refreshing to drive a real one.

For indeed, Alfa Romeo's 2600 Sprint turns out to be an Italian wolf in sheep's clothing—the genuine article wrapped up in a neat, but not gaudy, package. At first glance, it looks like a well-finished economy car about the size of a Corvair Monza.

But appearances can be deceiving. Stand on the throttle for just 30 seconds and you'll put 11 out of 12 make-believe sports cars in your rear view mirror while the neat, white pointer on your speedometer dial comes to rest just below 130-mph.

To put the 12th car behind you, just wait for a narrow, winding, blacktop road and

you'll find yourself walking away from him with at least a 20-mph advantage.

Only the Corvette, and others of its breed, can lose you and they'll do it only by virtue of more powerful engines. The Alfa 2600 is a true sports car and handles as such a vehicle should. We didn't believe that it could be a full-fledged sports car at first, because it seemed too roomy and lavishly appointed. To top it all, who ever heard of a sports car with power windows?

It just doesn't seem natural for a car as comfortable as the Alfa 2600 to handle as well as it does. The interior is cloth upholstered with carpeting on the floor. Front seats are almost like armchairs taken from someone's living room. The foam padding, however, is properly firm and the seat backs are adjustable so that drivers of almost any size find a fatigue-free position.

PLAIN JANE look is a fooler in the sleek 2600 coupé. Its flat hood hides three carbs, 145 horses





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SAYS
YOU
CAN'T
WIN
'EM
ALL
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- Sports cars 0.2000 cc CLIMB**
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Sports cars above 2000 cc
 1st—Bob Donner
Stock Cars Division
 1st—Curtis Turner
 3rd—Parnelli Jones
 5th—Gayle Warren
 7th—Bob Betts

**JULY 4: GRAND NATIONAL NASCAR
FIRECRACKER 250**

- 1st—Fireball Roberts 4th—Jack Smith
 2nd—Junior Johnson 5th—Jim Pardue
 3rd—Marvin Panch 6th—Larry Frank

**JUNE 10: A. H. R. A. CHAMPIONSHIP &
NATIONAL RECORD DRAG MEET**

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| Top Gas Eliminator | Middle Eliminator |
| Top Time Fuel | Little Eliminator |
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| Low E. T. Gas | |

JUNE 10: ATLANTA 500*

- 1st—Fred Lorenzen
 2nd—Banjo Matthews
 3rd—Bobby Johns
 4th—Fireball Roberts
 5th—Troy Ruttman
 6th—Paul Goldsmith
 8th—Marvin Panch
 9th—Junior Johnson
 10th—Jim Paschal
 *Race halted by rain after 327 miles.

MAY 30: INDIANAPOLIS 500

- 1st—Rodger Ward, 140.293 mph. new record
 2nd—Len Sutton
 3rd—Eddie Sachs

MAY 27: CHARLOTTE WORLD 600

- 1st—Nelson Stacy, 125.552 mph. new world's record
 2nd—Joe Weatherly
 3rd—Fred Lorenzen

MAY 12: DARLINGTON REBEL 300

- 1st—Nelson Stacy
 2nd—Marvin Panch
 3rd—Fred Lorenzen
 4th—Jack Smith (John Allen)
 5th—Cotton Owens
 6th—Larry Frank
 8th—Bobby Johns
 10th—Jim Pardue

FEB. 3—FEB. 25: DAYTONA SPEED WEEKS

- Daytona 500
 1st—Fireball Roberts, 152.529 mph. new world's record
 Daytona Continental
 1st—Dan Gurney
 250 Mile Modified National Championship
 1st—Lee Roy Yarbrough, 146.723 mph
 First 100 Mile Stock Race
 1st—Fireball Roberts, 156.999 mph. new world's record
 Second 100 Mile Stock Race
 1st—Joe Weatherly

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The rear seat is a bench type with a center arm rest that folds down. It will hold two adults if their legs aren't too long, or three children if they aren't big ones. Headroom is good both front and rear, thanks to a longer roof-line or greenhouse that gives the coupe a side view much like a sedan's.

Driver vision is excellent through the steeply sloped, moderately wrapped windshield, and down over the short hood. Windshield wiper action is good, and after you interpret the mysterious Italian "directions" on the heating and ventilating control knobs, you can get excellent demisting or defrosting. In fact, there's even an effective demisting setup for the rear window.

All this comfort was built into the car for a good reason: the Alfa is a real road car in which you'd find a 600-mile day's drive a lot less tiring than in most conventional non-sports cars.

For one thing, noise level is low. Although the 145-horsepower, six-cylinder engine is a high-performance job with dual overhead camshafts, it is not at all noisy.

We found cruising at 100 m.p.h. or so would be practical if highway conditions permitted it. Engine vibration is not noticeable thanks to excellent workmanship, seven main bearings, and well-designed rubber mountings.

Having recently "discovered" the four-speed floor shift, some Americans may be baffled by the Alfa's five-speed, synchromesh transmission. The car has a rear axle ratio of 4.13 to 1 and a short-stroke engine (3.27x2.85) of only 150 cubic inches. In a 2700-lb. car, this means that five gears are needed to provide pulling power at 5 m.p.h. on a snow-clogged driveway, or up to a comfortable 120 m.p.h. on the flat straights. In third, for example, you can idle through traffic at 10 m.p.h. or blast up to 65 m.p.h. The traditional 0-60 acceleration takes but 10 seconds, and you can reach 100 in 23.5. Fifth gear is an overdrive (0.79 to 1) which permits you to ghost along the turnpikes at 70, ticking off better than 25 miles for each gallon of fuel you burn.

Alfa's brakes match the stopping to the going with caliper discs up front and drums on the solid rear axle. A heavy pedal foot isn't necessary, either.

Ride is firm, and thus free from swaying or pitching, yet there's never harsh, objectionable jiggling on rough surfaces.

At just under \$6000 complete, the Alfa 2600 Sprint is not everybody's budget cupcake. But for anyone who's about to spend that kind of money for a "sporty" U. S. bucket seater, the 2600 will give him all the comfort of the former plus race-bred abilities that the other one can't touch.

"SEE **Black & Decker**[®] - FIRST!"

It makes a lot of sense. Getting to be No. 1 in the power tool business just didn't "happen." When you buy Black & Decker—for Christmas or any time—you get more value for your money.

Did you know that Black & Decker makes hundreds of *different* types and models of power tools for every use and user? Both electric and air — portable and stationary?

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Are you looking for the best Radial Arm Saw on the market? Stop looking. The Black & Decker DeWalt Power Shop sets the pace for performance, power—and *pleasure*.

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That's important to *you*—because Black & Decker puts *know-how* into its tools that nobody else can touch. Testing metals for a Sabre Saw that can cut a house in half, for example, pays off in better performance for a Jig Saw you'd use to cut a valance at home.

What's more, there's a *quality guarantee* behind every Black & Decker tool. But should any tool ever need repair, you can count on factory trained men at over 100 conveniently located Service Branches and Stations to do the job right.

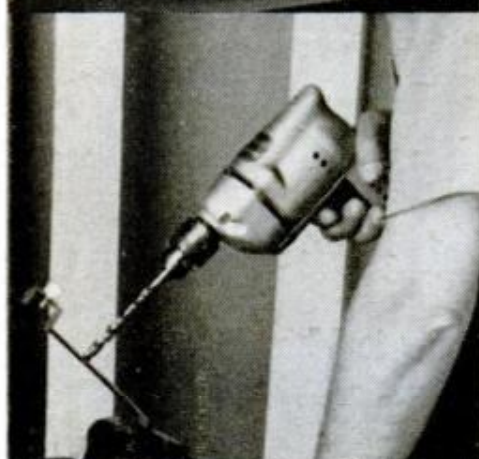
Yes, it makes sense to see Black & Decker—*first*. That means you get the widest choice—the finest features—the fullest value—and the surest satisfaction in power tools.

On the next pages are a few excellent suggestions. Go ahead and browse! And then see your Black & Decker, DeWalt, and Master Power Dealers. You'll find them by looking in the Yellow Pages under "Tools — Electric" and "Tools — Pneumatic." And—Merry Christmas!

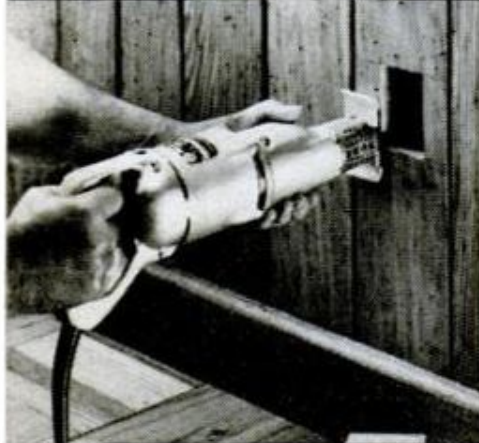




BIGGEST SAW VALUE—saw for saw, dollar for dollar. This 6½" Utility Saw weighs 10½ pounds and every ounce is muscle. You get the power, rugged construction, handling ease and job accuracy that has made the name Black & Decker famous the world over—plus all the modern safety and operating features. Get or give a *real* saw: Black & Decker! \$49.95 and up.



¾" DRILL—LOW PRICE TAG! This is no "warmed over" ¼" drill. It's a ¾" drill clear through with true double-reduction gears for extra power, terrific stamina. Drills up to ¾" holes in steel; ¾" in wood; ½" in masonry; 1½" Hole Saws. B&D's ¾" Utility Drill is a totally superior tool in its price range. Costs only \$26.95. Thirty-one other drills from \$16.00.



CUT OUT ANY POCKET—in any corner in any material with this super-powered Black & Decker Sabre Saw. Cut wood, plaster, metal pipe and sheet. Cut easy. Cut fast. Cut up, down, sideways—the blade spindle turns 90° to 180°. Long 1" stroke. Rock'n'lock shoe. Safeguard blade guide for up-front control. It's a brute for work on any job. See it soon.



TOP TORQUE IN SIX SECONDS! Black & Decker's Heavy-Duty Electric Impact Wrench (½" bolt capacity) packs more power and performance per pound than anything in its class. Drives home—or removes—nuts, bolts, cap screws or lag screws pronto. Get a free demonstration—or facts about electric and air impact tools. Call your Black & Decker jobber.

**DEWALT
15
POWER
TOOLS
IN ONE!**



1. Radial Power Saw



2. Saber Saw



3. Jointer



4. Drum Sander



5. Shaper



6. Surfacer



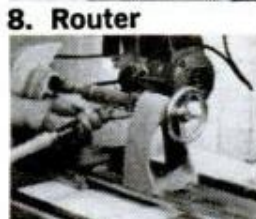
7. Disc Sander



8. Router



9. Horizontal Drill



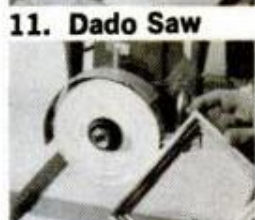
10. 12" Lathe



11. Dado Saw



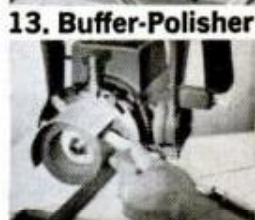
12. Tilt Arbor Saw



13. Buffer-Polisher



14. Metal Cutter



15. Grinder

"HOW TO CHOOSE AND USE POWER TOOLS," a highly practical, informative 180-page book for only 25c. Write to: The Black & Decker Mfg. Co., Dept. D-112, Towson 4, Md. In Canada: Brockville, Ont.

You name it—



Build a hutch cabinet . . . hobby room . . . or complete house.

THE NEW DEWALT POWER SHOP PUTS WOODWORKING MAGIC AT YOUR FINGERTIPS!

No other radial saw on the market performs like a DeWalt—for operating ease, accuracy of cuts, unlimited flexibility, professional results. And this new DeWalt is a *beauty!* New styling. New up-front controls. New features. Why, you can save hundreds of dollars in power tools, repair bills, modernization costs with a DeWalt.

Minute-magic changeovers give you 15 power tools in *one*. For example, check the numbers

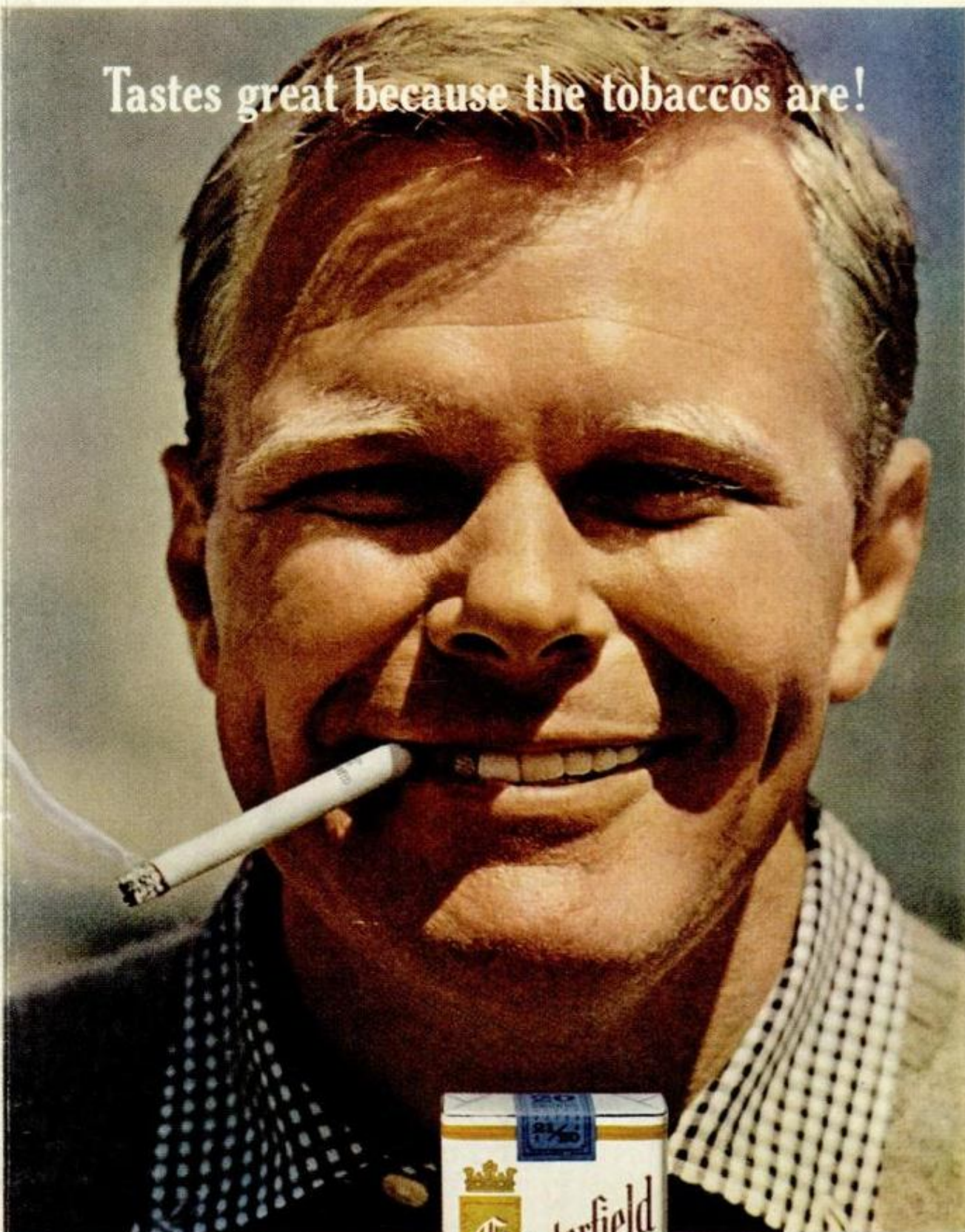
on that hutch above against the pictures of the DeWalt in *action* on the left. DeWalt does everything—sawing, sizing, boring, jointing, da-doing, shaping, sanding, curve work, routing, grinding, buffing, turning, surfacing, polishing—and *more*.

Ask your dealer for a demonstration. Or write for an eye-opening 16-page booklet—free—to: DeWalt, Inc., Dept. BH-361, Lancaster, Pennsylvania.



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GENTLER,
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ORDINARY CIGARETTES

ENJOY THE
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CHESTERFIELD KING

The smoke of a Chesterfield King mellows and softens as it flows through longer length... becomes smooth and gentle to your taste.