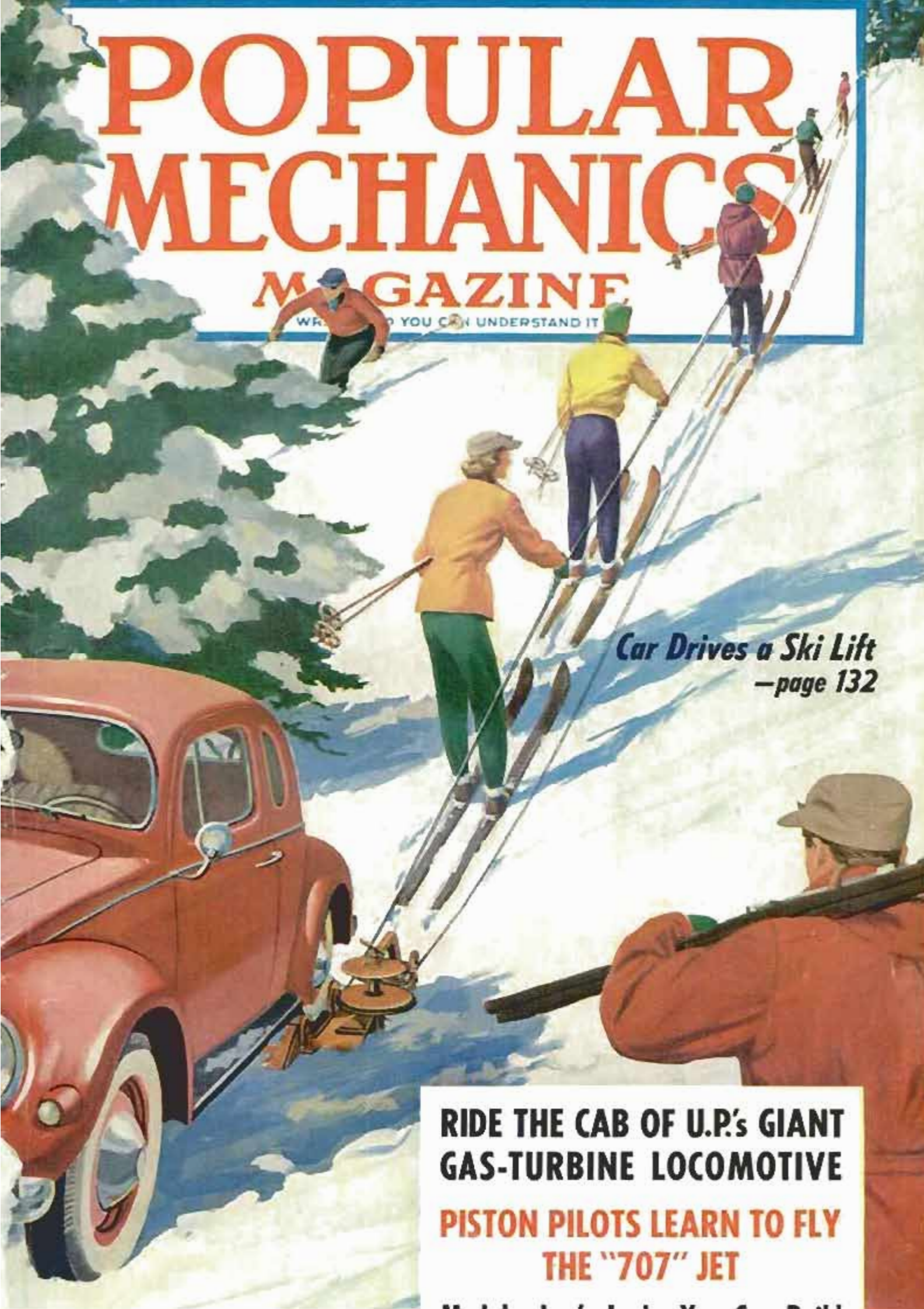


POPULAR MECHANICS

MAGAZINE

WHAT YOU CAN UNDERSTAND IT



Car Drives a Ski Lift
—page 132

**RIDE THE CAB OF U.P.'s GIANT
GAS-TURBINE LOCOMOTIVE**
**PISTON PILOTS LEARN TO FLY
THE "707" JET**



MORE PLEASURE! MORE FEATURES! MORE VALUE!

more to be proud of in your new '59 Evinrude

Compare features against any and all comers... measure performance under normal boating conditions where it counts... and you'll know these Golden Jubilee Evinrudes set the pace for '59!

Start with Starflite's *V-Block engine*... smoothest, most advanced outboard motor yet produced! Delivers effortless high-torque power at moderate RPMs for better performance under all load conditions... and longer engine life.

Not 2, not 3, but one *single twin-barrel carburetor* feeds the V-4s with fool-proof efficiency. Lark and Big Twin have full-range automotive type carburetion.

Biggest "break-through" in years... thermostat-controlled engines! Now thermostatic control is built into every Evinrude from 5½ to 50 hp! Field tested by commercial fishermen from coast to coast... control tested by engineers... these "hot-blooded" engines proved their superiority in fuel economy, smoother operation, longer spark plug life, longer engine life!

Sound-sealed cushioned power... top to prop... now on all Evinrudes from 5½ to 50 hp! We bottled the sound and sealed it to give you a "magic carpet" of quiet, smooth power.

Full gearshift on all models from 5½ to 50 hp! New *high torque starter*, which draws less current, starts with battery low. Trouble-free *sea-going magnetos* permit manual starting of electric models without battery... a safety feature other motors lack. Rugged new dent-proof, high gloss *fiberglass hoods*.

These and many other features and refinements you'll find in the '59 Golden Jubilee Evinrudes. See the finest motors in 50 years at your Evinrude dealer. Look for his name in your phone book under "Outboard Motors." Ask for free '59 catalog, or write: **EVINRUDE MOTORS, 4394 N. 27th St., Milwaukee 16, Wisconsin.**

A Division of Outboard Marine Corporation
In Canada: Mfd. by Evinrude Motors, Peterborough



EVINRUDE

QUIET OUTBOARD MOTORS

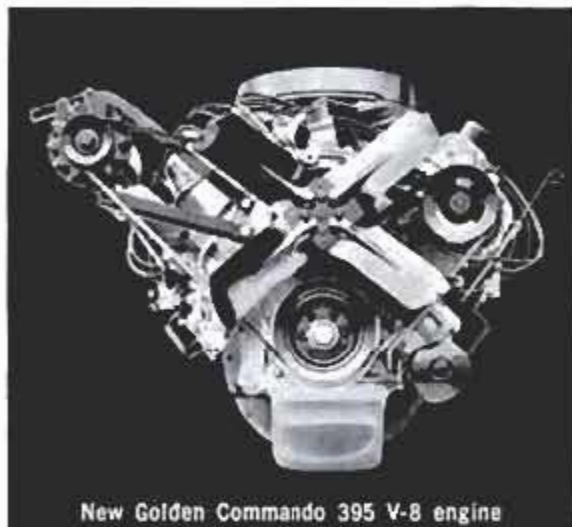
NOW PLYMOUTH OFFERS THE BIGGEST V-8 IN ITS CLASS—AT A REDUCED PRICE!

Meet the New Golden Commando 395—bigger and quicker than its 1958 counterpart—yet lower in price! You can get this giant 361-cubic-inch engine with stick shift or new water-cooled TorqueFlite Drive.

Best news about the New Golden Commando 395 is, of course, that lower price. But there's plenty more to gladden your heart, too. For one thing, this special V-8 is now available even in the lowest priced Savoy Sedans and in popular Plymouth wagons, too. For another, there's the astonishing new smoothness and cat-quickness of this engine. For still another thing, it's got the highest torque per cubic inch of any engine built by Chrysler—395 ft. lbs. at 3000 RPM!

Bore of the New Golden

Commando 395 is 4.12 inches; stroke 3.38 inches; compression ratio 10 to 1. Maximum horsepower is 305 at 4600 RPM. There's a special high-performance camshaft, 4-barrel carburetor, low-restriction dual exhaust system, positive pressure lubrication system and all the other features you expect in a specially-engineered power plant from Chrysler Corporation. See your Plymouth dealer and test-drive the New Golden Commando 395 in one of his sleek, sure-footed new Plymouth models soon!



New Golden Commando 395 V-8 engine

TODAY'S BEST BUY . . . TOMORROW'S BEST TRADE

Plymouth



FEBRUARY 1959

This One



Popular Mechanics Magazine

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Volume 111			FEBRUARY 1959		Number 2

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Next Month...

... brings the ANNUAL BOATING SECTION—24 pages of special material for the week-end skipper and his family. A boating authority made a nationwide survey to help him select the "10 Best Boating Vacations," with details on fishing, sight-seeing and side trips. An editor presents his how-to-do-it plans for a versatile pontoon boat, the ideal craft for the entire family... Also in the March issue, the "Owners Report on the '59 Buick."

"MIRACLE MILD" PHILLIES

Now-The Best Selling Blunts in the U.S.A.

The advertisement features a central image of a pack of Phillie Blunts. The pack is white with a black spine that says "PHILLIES" vertically. The top of the pack says "BLUNT" in large, bold letters. A circular window shows four blunts with "PHILLIES BLUNT" labels. Below this is a large orange oval with "PHILLIES" in white. At the bottom of the pack, it says "MIRACLE MILD" and "Blended with Havana" in a cursive font. A large, detailed image of a single blunt is positioned horizontally across the bottom of the pack. To the right of the pack is a black and white photograph of a man in a suit holding a large trophy. A black price tag with white text is overlaid on the pack, stating "NOW 39¢".

"MIRACLE MILD" Phillies Blunts — the first cigar mild enough for *all* smokers. Never before has smoking offered so much pleasure for so little cost. Pick up a pack today!

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5 for 39¢

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YOU
CAN BE
A
VALUABLE
MAN
IN THE
NEW
AGE OF SPACE**



**TRAIN
IN
THE
U. S. AIR
FORCE**

As a man of mechanical ability, you face a future of unlimited opportunity. This is the Age of Space, and *the valuable man is the man who combines mechanical ability with sound training.* Where can you best get this training? In the U. S. Air Force—where the Age of Space is *reality.* Here, Airmen work, day to day, in actual Space Age specialties: rocketry, supersonic aircraft, advanced electronics—and soon: manned flight in outer space. In short, the Air Force offers you the broadest, most complete range of Space Age specialty training available today. For details, see your local Air Force Recruiter, or mail the coupon.

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World's favorite spark plug—engineered for every car built by Ford, General Motors, Chrysler, American Motors, Studebaker-Packard and every major foreign maker.

CHAMPION

ACROSS THE DESK



PM Jewelry Set

You might call Karl Keeler, Jr., a "sandwich man" but he probably wouldn't like it. He does his advertising in a more dignified, subtle way. Karl is one of *Popular Mechanics*' advertising salesmen at Los Angeles. He carries his enthusiasm for the magazine with him in the form of cufflinks and tie clasp (right) bearing the familiar logotype of *Popular Mechanics*. Made for him by a California jeweler, they are of silver or gold, plated over copper. They're \$19.19 a set including that federal luxury tax. If you like 'em, or maybe a set with your own company's name, drop a line to Gray Products, 2073 Maycrest St., South Pasadena 2, Calif.



To the Editor:

There are some things that have not yet been invented. For example, the U. S. Patent Office has yet to issue patent papers on these:

The Farmer's Friend Poultry Calculator.
For counting chickens before they're
(Continued to page 10)



**WILDROOT
CREAM-OIL
HAIR TONIC**

FOR
HANDSOME
WELL-GROOMED
HAIR



Hair problem got you in the doghouse?



Get Wildroot Cream-Oil Charlie!



Just a little bit of Wildroot and... WOW!



To those who want to enjoy
an ACCOUNTING CAREER



FREE SAMPLE LESSON

IF you're that person, here's something that will interest you.

Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.

Of course, you need something more than just the desire to be an accountant. You've got to pay the price—be willing to study earnestly, thoroughly.

Still, wouldn't it be worth your while to sacrifice some of your leisure in favor of interesting home study—over a comparatively brief period? Always provided that the rewards were good—a salary of \$5,000 to \$10,000 and up?

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Do you feel that such things aren't for you? Well, don't be too sure. Very possibly they *can* be!

Why not, like so many before you, investigate LaSalle's modern Problem Method of training for an Accounting position?

Just suppose you were permitted to work in an accounting firm under the personal supervision of an expert accountant. Suppose, with his aid, you studied accounting principles and solved problems day by day—easy ones at first—then more difficult ones. If you could do this—and could turn to him for advice as the problems became complex—soon you'd master them all.

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Public Accountants among
LaSalle alumni

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Your progress is as speedy as you care to make it—depending on your own eagerness to learn and the time you spend in study.

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City, Zone & State.....



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2 A CAVE-IN PUT ME SIX FEET UNDER FOR SIX LONG MINUTES



3 IN THE HOSPITAL, I HAD PLENTY OF TIME TO THINK



4 I'D PASSED OVER DOZENS OF I.C.S. ADS IN POPULAR MECHANICS. BUT I SAW THIS ONE IN A NEW LIGHT



FREE!

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get all three books

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 21626B
SCRANTON 15, PA.

HOW'S IT GOING, DARLING?

FAST! I'M INTO HYDRAULICS ALREADY. AND I THOUGHT I WAS TOO OLD TO LEARN

5 SIGNING UP FOR THAT I.C.S. COURSE WAS THE SMARTEST THING I EVER DID

6 ONE MONTH LATER...

GOOD TO SEE YOU BACK ON YOUR FEET, JIM. IT'LL BE AWHILE BEFORE YOU'RE BACK IN THE FIELD. SO WE'LL FIX A TEMPORARY DESK FOR YOU IN THE OFFICE WHEN YOU'RE READY

I'M READY NOW, MR. WALSH

7 THEY GAVE ME SOME SIMPLE ASSIGNMENTS... AND I SURE SURPRISED THEM!

SAY, WHERE DID YOU LEARN ABOUT PUMPS?

SAME PLACE YOU DID, JOE... I. C. S.

8 THEN A FEW DAYS LATER, MR. WALSH CALLED ME IN...

JIM, I'M KEEPING YOU HERE AND PUTTING YOU ON SALARY. YOU'LL BE GETTING ABOUT \$20 MORE A WEEK. AND AT THE RATE YOU'RE GOING, I EXPECT I'LL HAVE TO RAISE THAT IN SIX MONTHS

9 THAT EVENING, JANE AND I WENT HOUSE HUNTING

OH, JIM! IT'S A DREAM HOUSE!

AND THANKS TO I. C. S. IT'S A "DREAM" THAT CAN COME TRUE!

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A 32-page gold mine of ideas

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Opportunities in the field that interests you most

3 SAMPLE LESSON (MATH)
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Blueprints <p>ART</p> <ul style="list-style-type: none"> <input type="checkbox"/> Commercial Art <input type="checkbox"/> Magazine Illus. <input type="checkbox"/> Show Card and Sign Lettering <input type="checkbox"/> Sketching and Painting <p>AUTOMOTIVE</p> <ul style="list-style-type: none"> <input type="checkbox"/> Automobile <input type="checkbox"/> Auto Body Rebuilding and Refinishing <input type="checkbox"/> Auto Engine Tuneup <input type="checkbox"/> Auto Technician 	<p>AVIATION</p> <ul style="list-style-type: none"> <input type="checkbox"/> Aero-Engineering Technology <input type="checkbox"/> Aircraft & Engine Mechanic <p>BUSINESS</p> <ul style="list-style-type: none"> <input type="checkbox"/> Accounting <input type="checkbox"/> Advertising <input type="checkbox"/> Business Administration <input type="checkbox"/> Business Management <input type="checkbox"/> Cost Accounting <input type="checkbox"/> Creative Salesmanship <input type="checkbox"/> Managing a Small Business <input type="checkbox"/> Professional Secretary <input type="checkbox"/> Public Accounting <input type="checkbox"/> Purchasing Agent <input type="checkbox"/> Salesmanship <input type="checkbox"/> Salesmanship and Management <input type="checkbox"/> Traffic Management <p>CHEMICAL</p> <ul style="list-style-type: none"> <input type="checkbox"/> Analytical Chemistry <input type="checkbox"/> Chemical Engineering <input type="checkbox"/> Chem. 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(Continued from page 6)
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☆ ☆ ☆

To the Editor:

Enclosed are pictures of the runabout *Swish*, plans of which appeared in March, April, May issues of *PM*. Steve Denker, 17, and Paul Schuster, 16, shown in photos, are the proud builders.

The boys named the runabout *Zeus* and boast of speeds up to 30 m.p.h. with the aid of a 35-hp. Johnson. The runabout cost approximately \$225 and is built entirely of



raw stock lumber (not a kit). This includes a '54 Olds steering wheel, homemade triangular anchor and Plexiglas windshield; motor and controls extra.

The maneuverability is excellent, properly due to design, and handles well even in choppy waters. The boys' playground is all points between Atlantic beach bridge (Reynolds channel) to the Jones beach inlet (including quite a bit of the ocean).

As the father of one of the boys, I'd like to mention that your magazine with all its variety of things to build, has been solely responsible for an interest which the boys eagerly pursued. And I feel grateful that their energies were not wasted throughout the summer months.

W. Denker,
Elmont, N. Y.

(Continued to page 16)



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INVENTORS

Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

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U. S. Forest Service photo

Do You Know These Old-Timers?

Two guesses here. One ancient truck stuck in the mud one July day in 1920, and a familiar old shape at the right that didn't get stuck. Why the truck left that perfectly good highway—the Grand Canyon Trail in

Kaibab National Forest—for the questionable mire is a question we can't answer. Try your luck at identifying the two vehicles and then turn to page 230 for the answers.

Draw Lincoln

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Please enter my attached drawing in your contest. (PLEASE PRINT)

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City _____ Zone _____ County _____

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DRAW LINCOLN'S HEAD

5 inches high. Use pencil. Drawings for March 1959 contest must be received by March 31. None returned. Winner notified. Amateurs only. Our students not eligible.

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25
BIG KITS



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—E. E. Hughes, Chicago . . . "Have my own business. Only problem is: Too much business!"
—Conrad King, Cynthia, Ky. You can do as well as these men!

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Flying Carpet

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and B 'Torp 35' engine using Supersonic 100 fuel. . . . It actually flies, proven in public at an A.M.A. sanctioned model meet at Pittston, Pa." Eddie is 17 years old, and he and his father spend a good deal of time teaching "anyone who is interested, how to fly combat, rat-racing, etc."

☆ ☆ ☆

To the Editor:

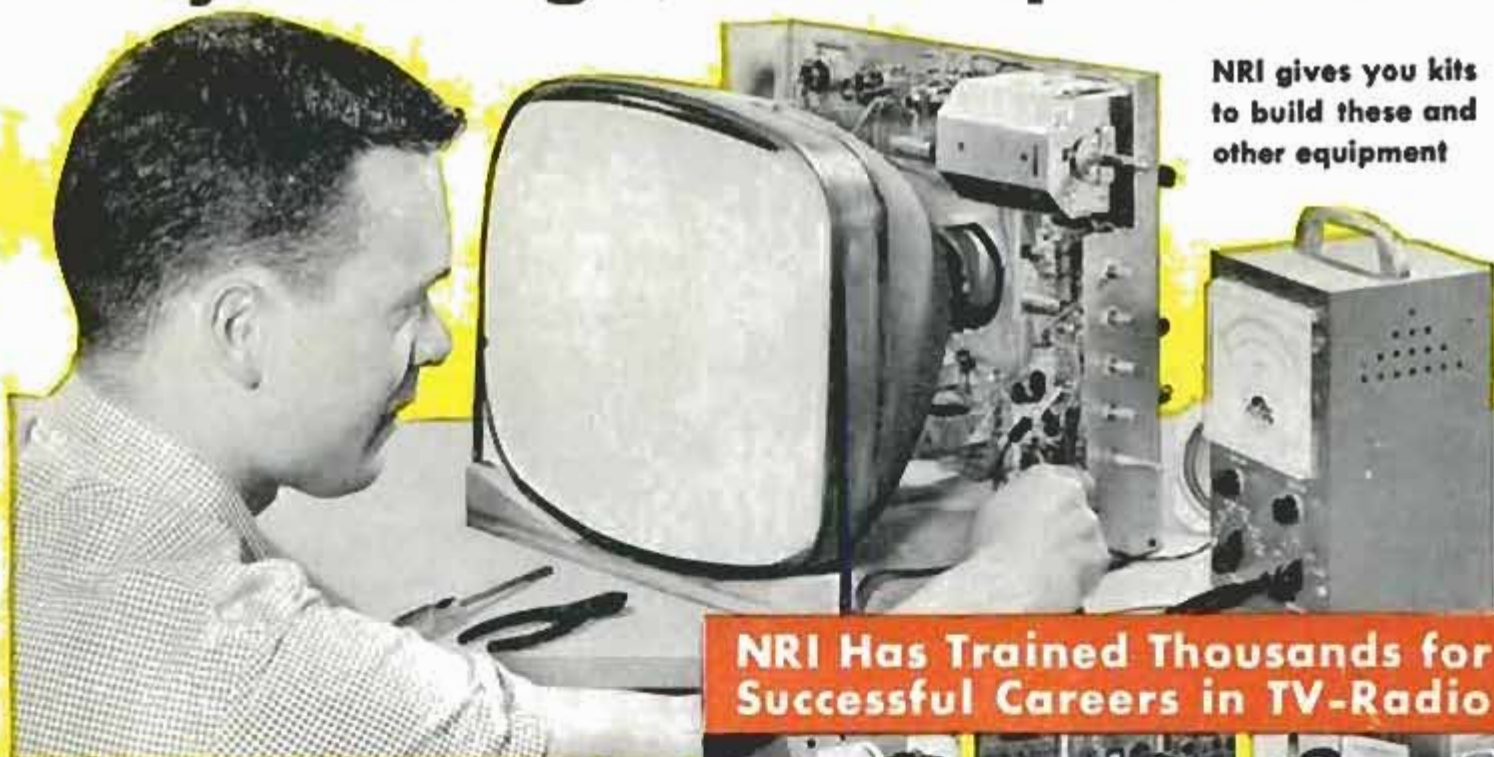
For many a long year I have been a newsstand fan of *PM*. At home in Shawneetown, Ill., there are a couple of boxes of them waiting to be scanned for the hundredth time. At present, I take a monthly excursion to the *Stars and Stripes* newsstand for your product. You probably get many good words from readers but I have a bug for science and I know from experience good material and bad. Your material is all good but among the good are jewels.

My brainstorm is the product of a soldier's eternal pastime of counting the days to "go." Counting over a whole calendar or picking months and multiplying runs into quite a job. It occurred to me that a decimal fraction of a year ought to do in rough calculations involving time.

(Continued to page 24)

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Servicing or Communications
by Practicing at Home in Spare Time



NRI gives you kits to build these and other equipment

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INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you:

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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Mail your disclosure to the registered patent attorney or agent whom you select to assist you, together with a letter authorizing him to conduct a

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(Continued from page 16)

The system ought to be useful in everyday life, too. I found that a system could be set up. I use the scientifically correct year of 365.4 days. Divided into twelve equal parts, this year is exactly twelve months of 30.45 days each. There are 4.35 weeks in a month, 52.2 weeks in a year, 8769.6 hours in a year, 730.8 hours in a month and 168 hours in a week. So far I have always been able to come within hours of a correct answer. With meticulous care, one could come within minutes of an exact answer. It is probably obvious that it is easier to extract units of time from the calendar than it is to apply the units to the calendar and come up with the proper day or time of day. When working from units of time or decimal days, I simply extract so many hours per day or minutes per day and days per month. After the decimal units are broken up into months, days and hours, it is simple to count off to the day of the month. Excluding leap year makes the system applicable to long periods of time and doesn't seem to detract from short-time accuracy.

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6 inches, weighing 394 pounds empty. Powered by a 1937 model 2-cylinder, 36-horsepower Aeronca engine, the plane cruises at 80 miles per hour and can land at 32 miles per hour, using 2½ gallons of fuel per hour. The fuselage is of wood.

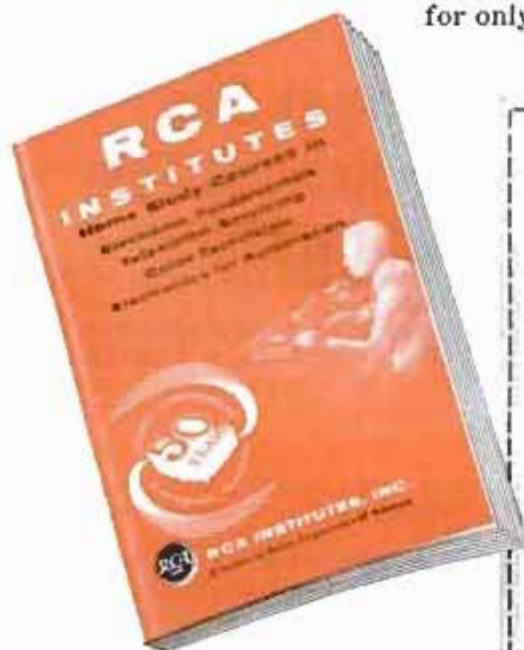
(Continued to page 260)



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"You see, this idea has caught on like wildfire in my town. Not a day goes by without my phone ringing with women calling for appointments. The beauty of it is that once a woman becomes my customer, she calls back year after year. Not only that, she tells her friends, too, and they call me. Before I know it I'm swamped with work. (And at \$7.50 an hour net profit it doesn't take long before my bank account is really mushrooming.)

"Funny thing, but back last year, before I started, I never realized the money there was in this business waiting for someone to come along and collect it. Just think: every house in town has furniture and most have rugs or carpeting. I concentrate on just the better homes and have more work than I can handle. You know why? Because women are fussy about their furnishings. Can't stand to see them dirty. That's why they call me over every year.

"The average job is worth \$25.00 to me and takes a little over 2 hours. Out of this, after paying for materials, advertising and other expenses I net about \$15.00 clear profit. This means I need just 3 jobs a day to clear \$11,250.00 in a year. Frankly, since this will be my first full-time year I'll be glad to hit the \$10,000 mark. But after that this business should grow larger each year until I have to hire men to help me handle the business.

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"The portable machine you see is just one of the electrical machines I use. It manufactures a light aerated foam with a peculiar action chemists call 'peptizing'. It means that instead of being scrubbed deep into the fabric, dirt is gently ABSORBED by the foam, leaving the fabric clean all the way down. Women can't believe their eyes when they see how it works. Colors appear bright again, and rug pile unmat and rises like new. I don't have to soak rugs or upholstery to get them clean, which ends the problem of shrinkage, and means the furnishings can be used again the very same day. This alone has brought me a lot of customers.

"As a Duraclean dealer I make money with four other services, too: **Duraproof** . . . which makes furnishings immune to moth and carpet beetle damage (it's backed by a six year warranty). **Durashield**, a brand new dirt-delaying treatment. It coats fabrics with an invisible film that keeps dirt out. **Duraguard**, another new service, flameproofs draperies, upholstery and carpets to reduce charring

by
**Harold
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and the tendency of fires to flame up. And **Spotcraft**, which consists of special chemical products for removing stubborn spots and stains. On jobs where I perform all five services, I multiply profits!

"One of the nicest things about being a Duraclean dealer is that I get continuous help from Duraclean Headquarters. My services are nationally-advertised in famous magazines like McCall's, House Beautiful and many others. I also get a complete advertising kit prepared by experts. (There's even a musical commercial!) I get a monthly magazine full of methods to build business and I can meet with other dealers at Duraclean conventions. I'm also backed by insurance. In fact there are over 25 regular services I get under their unique System.

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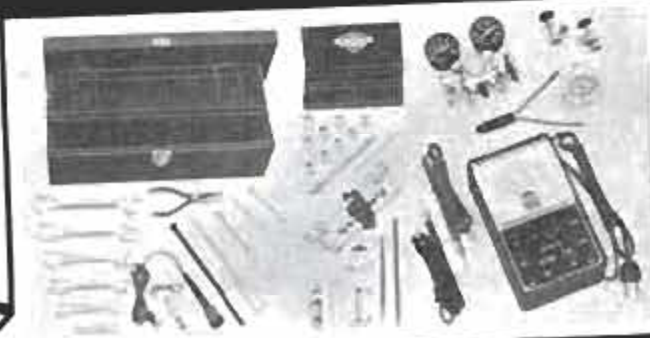
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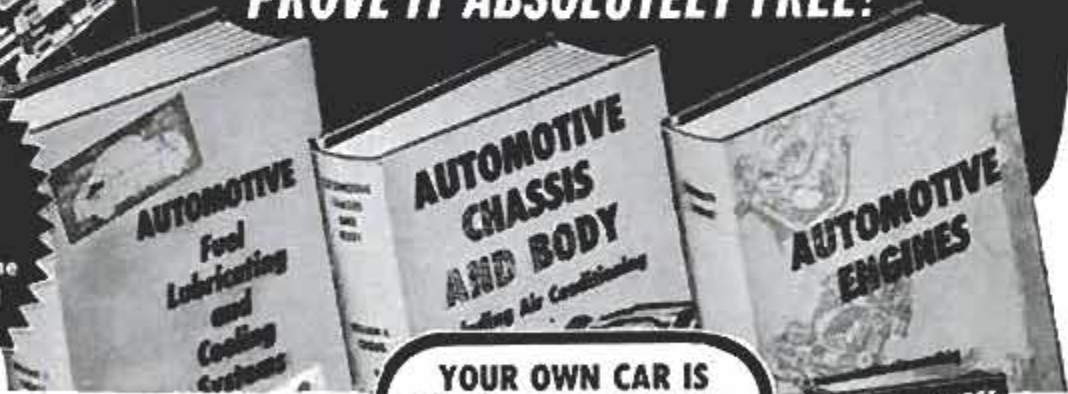
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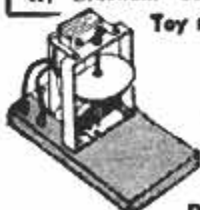


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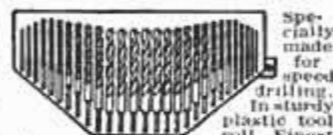
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A New Pill That Helps You Quit Smoking

Science at Last Tells You What to Do if You Want to Stop Smoking

By George Clark

THE INABILITY to give up smoking is one of the more curious idiosyncrasies of 20th century man. Ever since Sir Francis Drake in 1586 brought tobacco back to England from Virginia and the habit of smoking was reimported to America by the Pilgrim fathers, the "noxious weed," as an eminent Victorian referred to it, has had half the world in its grip.

There are signs that this grip is at last being loosened. It is being loosened by a harmless little white pill. The story of how this little white pill was discovered is a curious one.

In 1947, doctors composing a research team at Chicago's Loyola University, set out to study gingivitis, a rather unpleasant inflammation of the gums that bedevils mankind. It had long been theorized that smoking contributed to this inflammation. But would stopping smoking help? In true scientific fashion our researchers decided that half of their patients should stop smoking to see if they showed any improvement over the other half.

But what could they give a patient that would help him to stop smoking quickly and easily? Up to that time medical experience showed that there was no easy, pleasant way to stop smoking. Years before, some experimental work had been reported with a drug called Lobeline Sulphate. This curbed the desire to smoke; but in doses large enough to be effective, it produced various unpleasant side effects. Here at least was a starting point.

Soon the tail was wagging the dog and the project of finding a way to help people conquer the tobacco habit had become the all-important problem. After months of research and experimentation, our scientists hit upon the solution. The addition of two common antacid ingredients to Lobeline Sulphate accomplished two things. First, any unpleasant side effects were eliminated; secondly, the amount of Lobeline Sulphate necessary to do an effective job was greatly reduced. The



result was a harmless little white pill which, when given to test patients, enabled them to stop smoking in 5 days!

What made it work? Lobeline Sulphate is extracted from the Lobelia plant which is sometimes called "Indian Tobacco." It is a first cousin to nicotine, mimicking its action but without its harmful effects. It works by removing the craving for nicotine in the system and not by making smoking unpleasant or intolerable.

The footnote to this story is an interesting one. It turned out that smoking did irritate the gum tissues. Those gingivitis patients who, with the help of the little pill, stopped smoking, showed a marked improvement over the smoking half.

And of course there was a sequel. The university realized that in this little pill they had something that thousands longed for. Here was something that would really help anybody who wanted to free him or herself from the smoking habit. More research was carried on, more tests were made on hundreds and hundreds of patients. It was proved that 83%, more than 4 out of 5, of all people who wanted to stop smoking, could do so easily and pleasantly in five to seven days with the help of the little pills. Significantly, it was found that those who didn't stop completely had cut down their smoking drastically.

This new discovery was soon reported in medical journals; demand for it came overnight from every corner of the globe. The Campana Company of Batavia, Illinois, was chosen to market these amazing pills. Today you can buy them at any drug store in the United States, under the name of *Bantron*, for only \$1.25 a box. They are also available in Canada. *Bantron* has been proven so safe, it can actually be bought without a doctor's prescription.

Of course, *Bantron* can't do *all* the work for you alone. It will not tie your hands behind your back. But if you really want to stop or cut down smoking, it can be a powerful helper.

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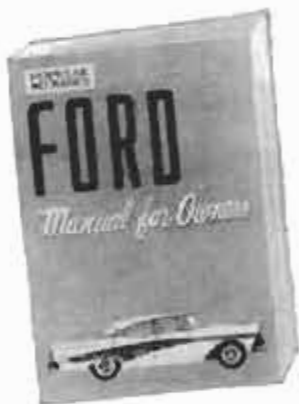
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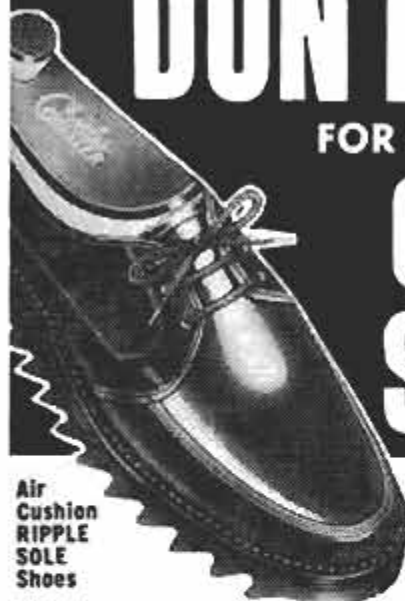
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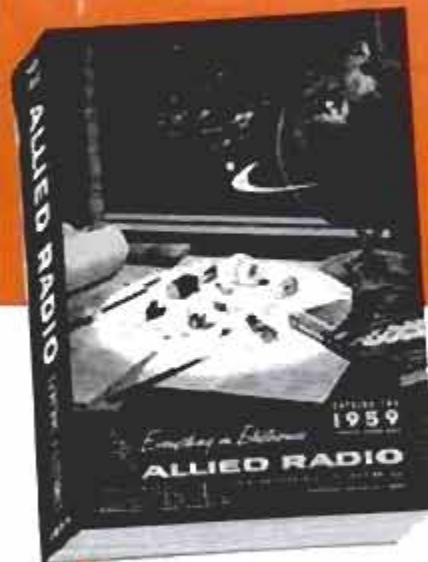
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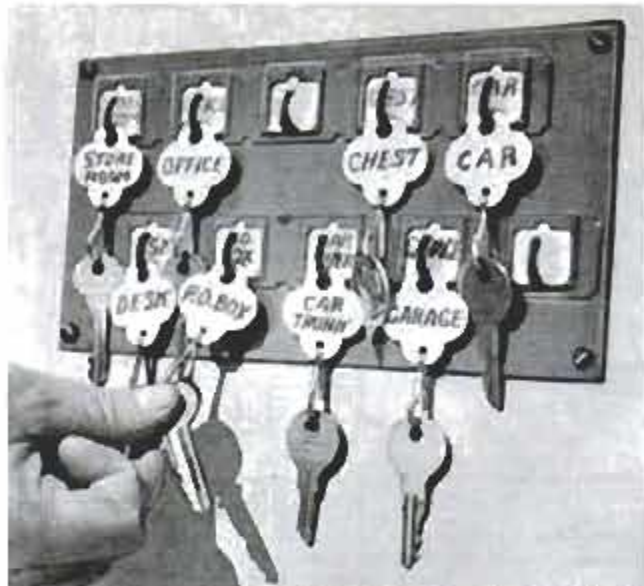
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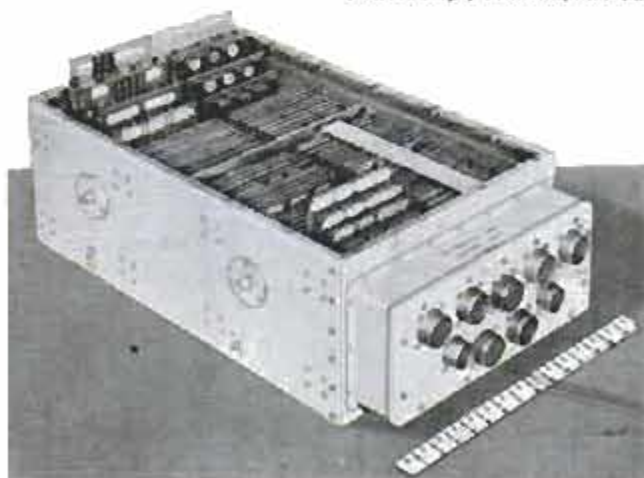
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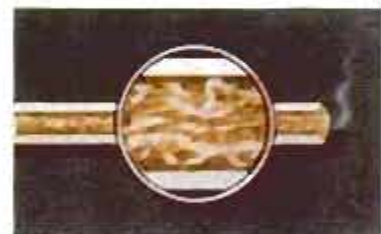
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By *Thomas E. Stimson, Jr.*

Author Tom Stimson drives the new gas turbine during part of the mountainous run from Ogden to Echo

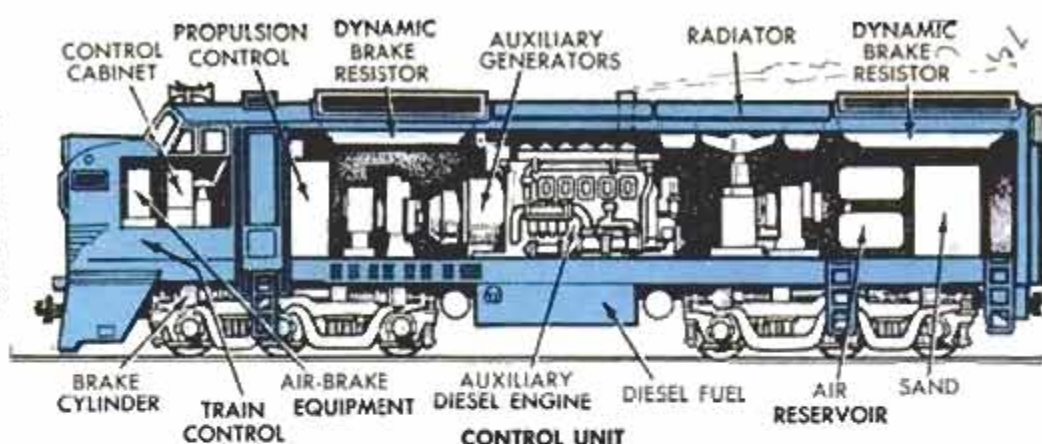
IT WAS NO ORDINARY freight rolling up Weber Canyon, eastbound out of Ogden, Utah.

This was Union Pacific's "Extra 3 East" hauling 68 gondola cars loaded with iron ore, plus nine empties, a total weight of 6611 tons.

With a load like this, railroaders would expect to see the train laboring behind six powerful diesel engines with a helper boosting from behind. But there was only one locomotive at the head end: the most powerful self-contained railroad engine in the world, the brand-new 8500-horsepower



Cutaway shows the three sections of gas-turbine power plant. The 850-horsepower auxiliary diesel is in front and the fuel tender is coupled at rear



turboelectric locomotive that Union Pacific is just putting into service.

"Clear block!" called Fireman S. J. Kennedy.

"Clear block!" echoed Engineer E. R. G. Pope, moving the throttle a couple of notches as we began rolling.

I rode the cab of this sleek streamlined monster for part of a day, from Ogden to Echo with grades as steep as 1.14 percent, then on up Castle Rock hill to Wahsatch, the summit, and east to Evanston in the Wyoming mountains.

This engine is so big that it hauls an 850-horsepower diesel around simply as an auxiliary, to serve as a starting engine and to run the compressors for the air brakes. The diesel is also used as a hostler engine for moving the locomotive at slow speeds in the yards. Including its immense tender, the turbine locomotive takes up 178 feet of track.

There was plenty of room for me. On my left sat the fireman and Brakeman A. E. Barnes; on my right was the engineer. Beside me stood Bill Alberts, road foreman of engines, who was along to coach the engineer on this newest form of motive power.

This was railroading deluxe, with foam-rubber seats for the crew, a tinted safety-glass "picture window" windshield, indirect overhead heating, and a ride that approached that of a railroad lounge car. The whole locomotive rests on bonded-rubber sandwiches and the only metal-to-metal connection with the running gear is an electrical ground strap. Coil springs and airplane-type hydraulic shock absorbers, mounted in vertical and horizontal attitudes, also help make the ride a soft one. And it's quiet. You can barely hear the rumble of the diesel auxiliary through the insulated walls of the cab.

On the steepest part of the grade

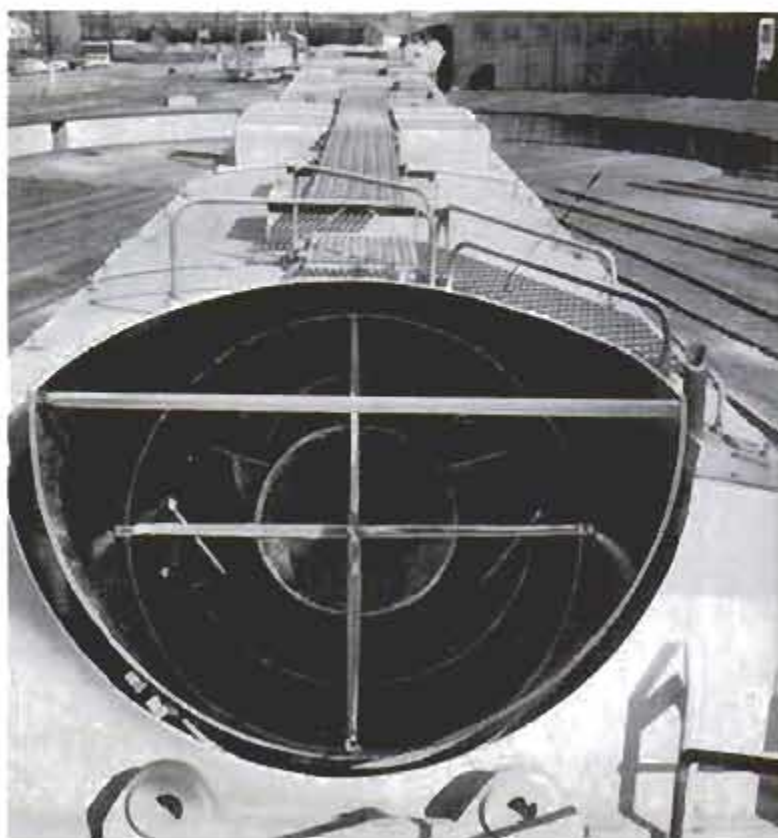
Pope kept the throttle in the last notch, the 20th position, and the speedometer was reading 18 miles per hour. We were using a steam helper, a big 3700-class locomotive at the rear of the train, three quarters of a mile behind.

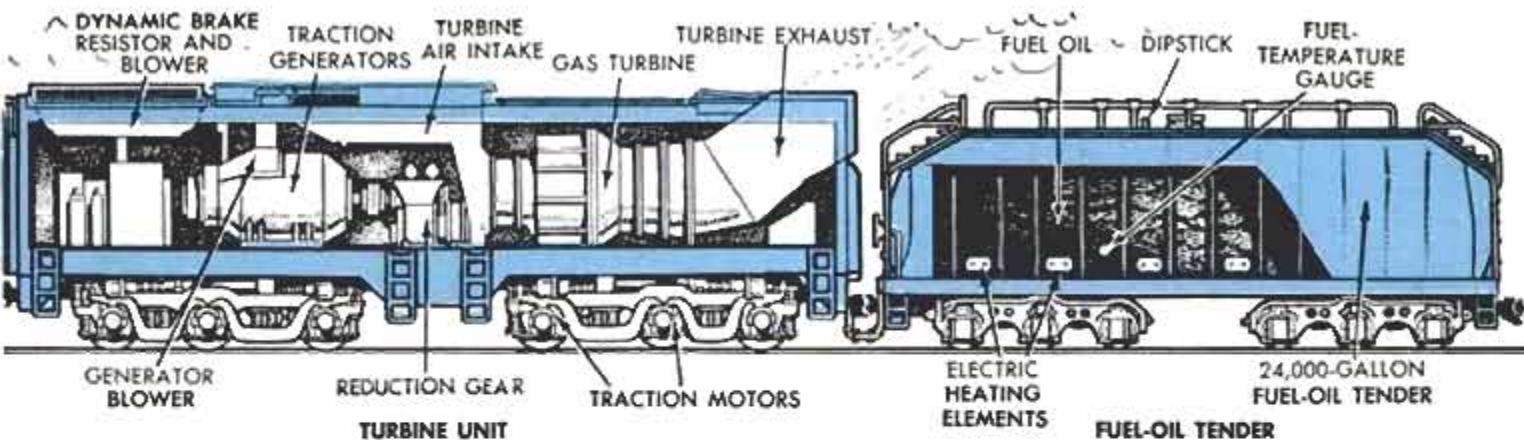
"Do we really need the helper?" I asked. Bill Alberts said it helped, that with it we would never drop below 18 miles per hour and we would often creep up toward the 25 miles per hour speed restriction that was in our train orders. At Wahsatch we would drop the helper and continue east under turbine power alone.

I had a chance to drive this locomotive. Maybe there's a regulation against it somewhere but I could do no wrong, not with Pope standing right beside me and with Alberts at my back. "Just keep your foot on the deadman's pedal," Pope cautioned. "If you lift your foot the brakes will automatically stop the train." I put both feet on the pedal to be doubly sure.

The engineer's controls resemble those

Enormous exhaust opening of the 8500-horsepower gas-turbine engine is almost as wide as the powerful locomotive itself





of a diesel engine. At my left was the master controller pedestal with the throttle, the reverse handle, and the selector handle that is used for dynamic braking.

In front of me were the two air-brake stands, one for the locomotive brakes, one for operating all the brakes of the train. There were dials on a front panel, too, some showing pressures in the air-brake system, some the condition of the turbine.

Looking at the speedometer above the controller pedestal, I saw that the train had worked itself up to 19 miles per hour. Then suddenly the needle shot past 22 miles per hour and a buzzer sounded. "You've got wheel slip," Alberts directed me. "Give it some sand." He pointed to the sanding valve. I shoved it forward. The speedometer went back to 19 miles per hour and the buzzing stopped. "Have to use sand on every one of these curves," Bill commented.

There was no way of telling, sitting there at the controls, that you were pulling a record tonnage up the grade and doing it easier and faster than trainmen had

thought possible a few years ago. There was nothing in the cab to indicate the tremendous strength of the turbine.

Only when you looked in the outside rear-vision mirror on a long curve and saw the steam helper at the end of the train did you get an impression of the power being exerted in shoving the tonnage up the hill. The helper was swathed in a cloud of steam and its stack was ejecting a tall column of smoke. You couldn't hear its bellowing but you could see how hard it was working.

Until a few years ago the pride and joy of Union Pacific was a group of giant steam locomotives known affectionately as Big Boys. These 4000-class engines are the largest and heaviest of their type ever built. They are so long that they are hinged, or articulated, in order to bend around some of the curves. They are an awe-inspiring sight on the rails. Their starting tractive effort is 135,375 pounds, a third greater than the big 3700-class locomotives.

Then the diesels came along. The diesels

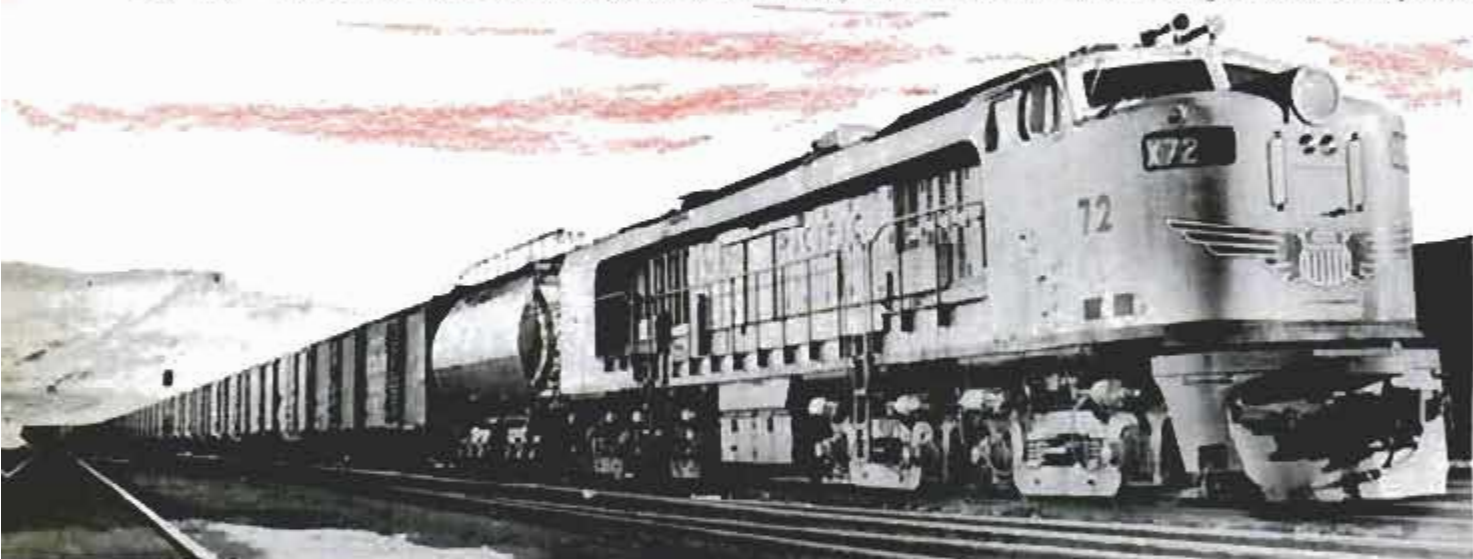
William Alberts, road foreman of engines, inspects electric cables between the turbine unit and the diesel auxiliary

Alberts checks level of oil in diesel auxiliary; engine keeps up pressure for the brakes





Big Boy — one of the class of most powerful steam engines ever built; it has a rating of 6000 horsepower



Union Pacific's first successful gas-turbine locomotive (above) has been in service several years; it has 4500 horsepower. Below, new 8500-horsepower turbine makes a stop at Evanston, Wyo., for change of crew





Engineer E.R.G. Pope is about to start train by moving throttle handle back. Three gauges show air pressure in reservoir and part of brake system. Dial at upper left alongside whistle cord is the speedometer

were smaller power packages, to be sure, but a number of them could be hooked together and controlled as one unit.

After that, Union Pacific sponsored the first gas turbines, 4500-horsepower locomotives that could almost outpull a Big Boy. The system has 25 of these turbines in service now; as well as 1182 diesels. The first turbines were so successful and trouble-free that Union Pacific asked General Electric to design a really big turbine, an engine that would develop 7000 horsepower at the rail. These are the ones now

being broken in on freight service. Each of the big turbines has close to 100,000 pounds more starting tractive effort than a Big Boy. To put it another way, the new turbine can haul 5000 tons at 18 miles per hour up the same grade that a Big Boy can haul 4000 tons at 15 miles per hour, both pulling without helpers.

The big turbine engine actually consists of three separate units. The "A" unit in front contains the operating cab with all controls, the diesel auxiliary and the air

(Continued to page 262)

Steam helper behind long freight was used for grade out of Ogden. The new turbine could have done job alone, but the helper gave train greater speed





DETROIT LISTENING POST

By Art Railton

IF YOU WANT to get rich, buy yourself an aluminum company. In the years ahead, the auto industry is going to gobble up a lot of lightweight metal.

Not only for engines, but for other parts as well. The forthcoming aluminum General Motors engines, designed particularly for the revolutionary small car, will require plenty of metal, but so will the big cars.

You'll see cast-aluminum wheels on some 1960 models. These will reduce weight while providing stylists with a way to combine function with flash. Wheels will become as important to stylists as taillights. The heat-transfer properties of aluminum will help solve the brake-cooling problem.

Aluminum bumpers (now on Greyhound buses) may be here by 1960. They solve the rust problem and also reduce weight on the front end. Stylists will have fun working the tractable metal into exciting shapes.

The lightweight metal may cost more to buy, but it is expected to reduce production costs. Doors can be made in one piece, saving costs. The outer surface of the die casting will be smooth, ready for paint, while the inner surface will have the ribs and brackets for strength and hardware mounts. Complete doors will pop out of the production dies like bottle caps once the machinery is set up. Use of die-cast aluminum in trunk lids and hoods is expected to follow with revolutionary effects.

Secret of the cost saving is hot-metal delivery. The auto maker builds his plant next door to the aluminum company (or vice versa). Molten metal is delivered to him by insulated pipe, like water.

The auto maker doesn't have to heat ingots to get the metal ready for casting. When he shuts down the plant at night, he turns off the faucet and the meter stops running. Thus the foundry (with all its mess) is gone and the plant becomes as neat and orderly as a candy factory. More important, of course, is the absence of a fuel bill for metal melting.

The lightness of the cars of the future (and not too distant future) will make today's 4000-pound monsters as anachronistic

as the old flatiron that women thought smoothed clothes by weight when it actually did it by heat. Today women use feather-weight irons. Tomorrow we'll have feather-weight cars, confounding all those who still believe that heavy cars last longer, ride better or are safer.

The lightness will make the horsepower race even more ludicrous—so much so that the industry will be forced to give it up. Six-cylinder aluminum engines will be powerful enough to give the light cars the getaway of today's peppiest. Gas mileage will soar by today's standards.

Industry observers eagerly await the new GM small car to see if the giant corporation has solved the problem of stability in a rear-engine car. If it has eliminated the cross-wind wander, it will have done something European designers have never been able to do in any "big" rear-engine car.

Europeans have never gone for rear-engine cars of more than 100-inch wheelbase (except the Czech Tatra). The supposition is that at about 100 inches, the rear-engine design develops impossible problems of stability. GM is coming into the field above this limiting 100 inches.

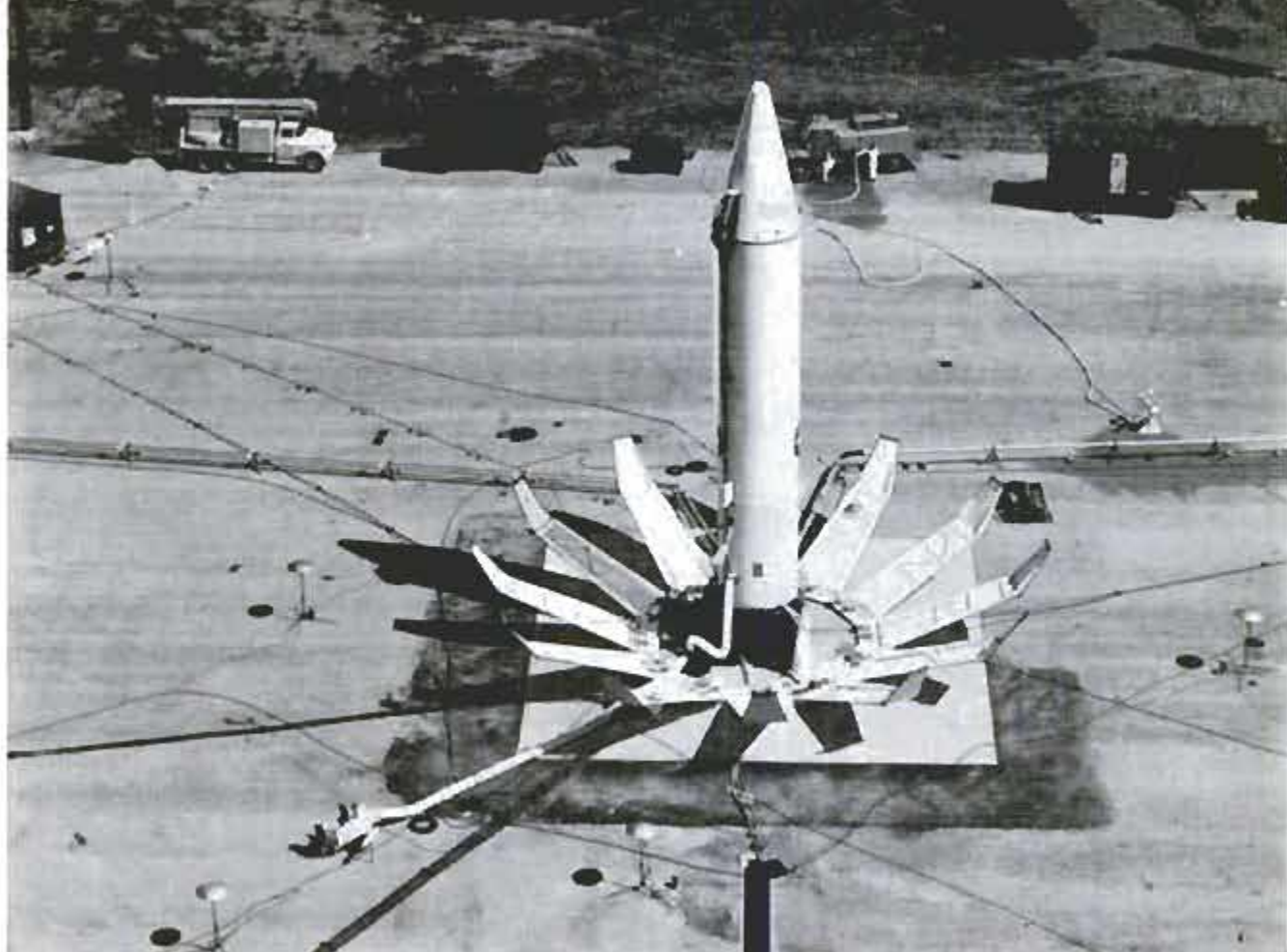
General Motors probably has the solution. Its Firebird III must have been a big help in solving suspension problems, it being a fabulous laboratory on wheels. GM certainly didn't spend all that money just to prove that a turbine works.

Ford and Chrysler prefer a conventional approach to the "small" car with front engine, rear drive. There is talk, however, that Ford hopes to have a front-wheel-drive car within a few years. This would solve many problems, including that of passenger space—the real bugaboo of today's big cars as well as future smaller cars.

Front drive gives a no-tunnel flat floor. It does away with the space-taking rear axle and makes the trunk virtually bottomless. It has so many advantages, there is no doubt that it's coming. Its disadvantage: Cost. But that will be licked.

Chrysler's all-new big cars for 1960 are said to have a modified unit body. There is to be (rumor) no continuous frame from stem to stern, and the body shell will be unitized as far forward as the windshield. Separate front ends will be designed to be welded on to suit the wheelbases of various divisions.

American Motors does the same thing with its Ambassador. For 1960, AM, too, will have an all-new car. It won't be as off-beat as its 1956 models (its most recent all-new body). AM learned then that for the small guy to succeed he must be unobtrusive. Fins will be retained for 1960, but not with flamboyance. They will fold over and lie quietly horizontal.



Jupiter Missile Shelter Opens Like Flower Petals

VERTICAL MISSILE SHELTERS that open like the petals of a flower will be blossoming soon at Jupiter launching sites. Purpose of the portable, stand-by shelters is to protect the Jupiter missiles from inclement weather during the "waiting" stages. When a missile is ready to be fired,

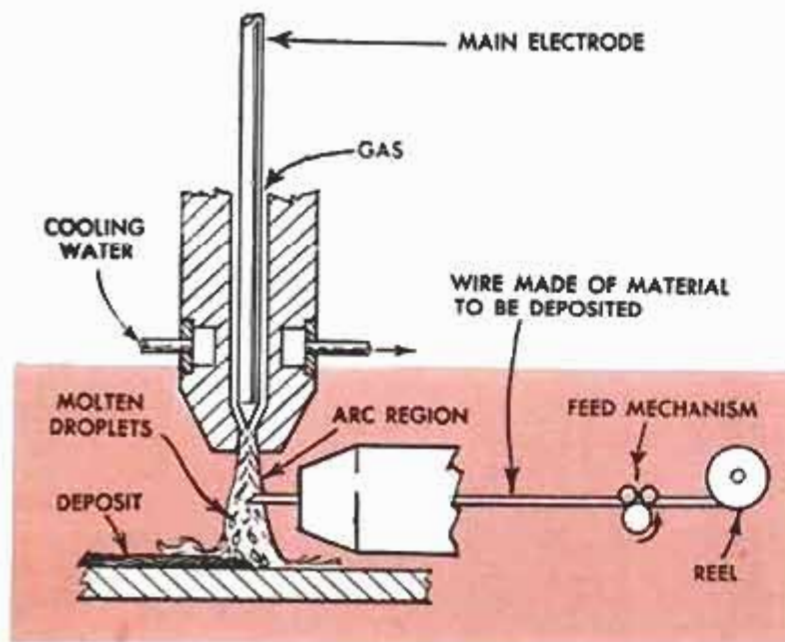
the "rose petal" shelter's 12 sections unfold from the base of the weapon. Eight of the petals are made of paper-honeycombed aluminum sheet. The others are of weatherproof and fireproof plywood and can be replaced after several firings. There's enough room inside the shelter for missile workers.

Designed by Barnes & Reinecke, Inc., for the Army Ballistic Missile Division

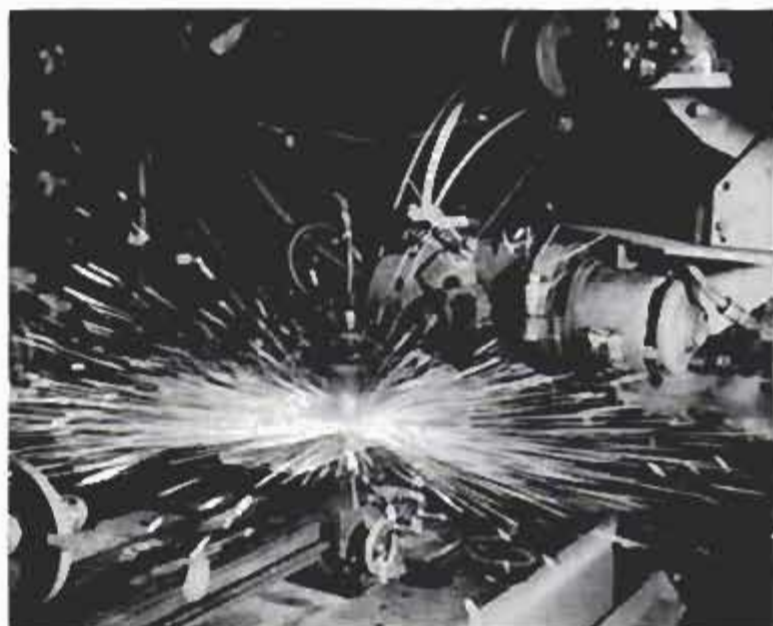




Nose cone for a missile, above, is given a heat-resistant tungsten coating with Plasma Arc Torch which harnesses highest temperatures used in industry, up to 30,000 degrees Fahrenheit. Diagram below shows how torch applies surfacing material

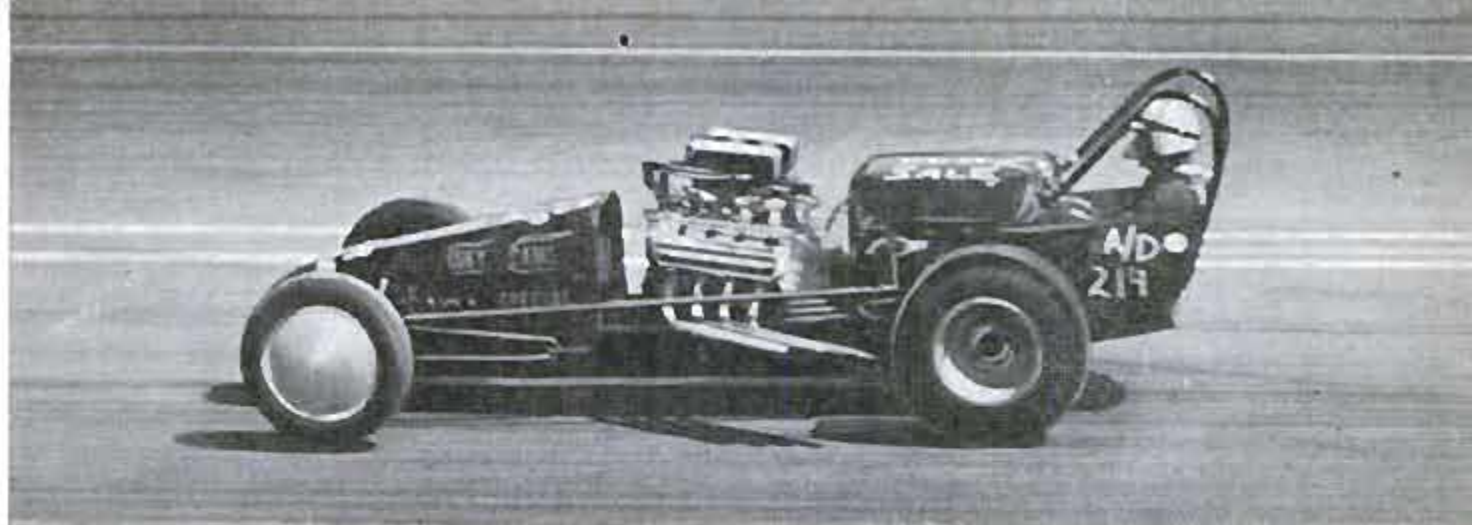


Rocket nozzles, nozzle liners, crucibles and vacuum-tube-grid cages, below left, are among products fabricated or coated with torch. Photo to the right shows stainless-steel coat being applied to aluminum plate



Torch Creates Superheat To Melt Hardest Metal

NOSE CONES, jet vanes and other rocket and missile parts subjected to extremely high temperatures are being fabricated with a Plasma Arc Torch. The torch, developed by the Linde Company, makes it possible to work with the toughest materials known in controlled temperatures up to 30,000 degrees Fahrenheit. The material to be worked is prepared in either wire or powder form and fed into the intense arc of the torch. Because of the high heat of the arc, the material is changed into a fluid state. Inert gas flowing at high velocity through the torch forces the molten material against the surface of the object being fabricated or plated. The force with which the material is deposited assures a firm bond. Separate torches are needed for wire-fed and powder-fed materials. Stainless steel usually is handled in wire form while tungsten and the carbide materials are powder-fed. When tungsten is fabricated into a nozzle liner for a rocket engine, the Plasma Arc Torch is held over a spinning mandrel. Molten tungsten particles are deposited at near-sonic speeds in successive layers on the mandrel, until the desired thickness is reached. The mandrel is then dissolved in acid, leaving the nozzle liner. Besides rocket parts, the torch is used to make electronic components.



Winner of 1958 national championship drag races was this slingshot with nonsupercharged Chrysler engine

"Slingshots" Pace the Drag Strips

By Ewart Thomas

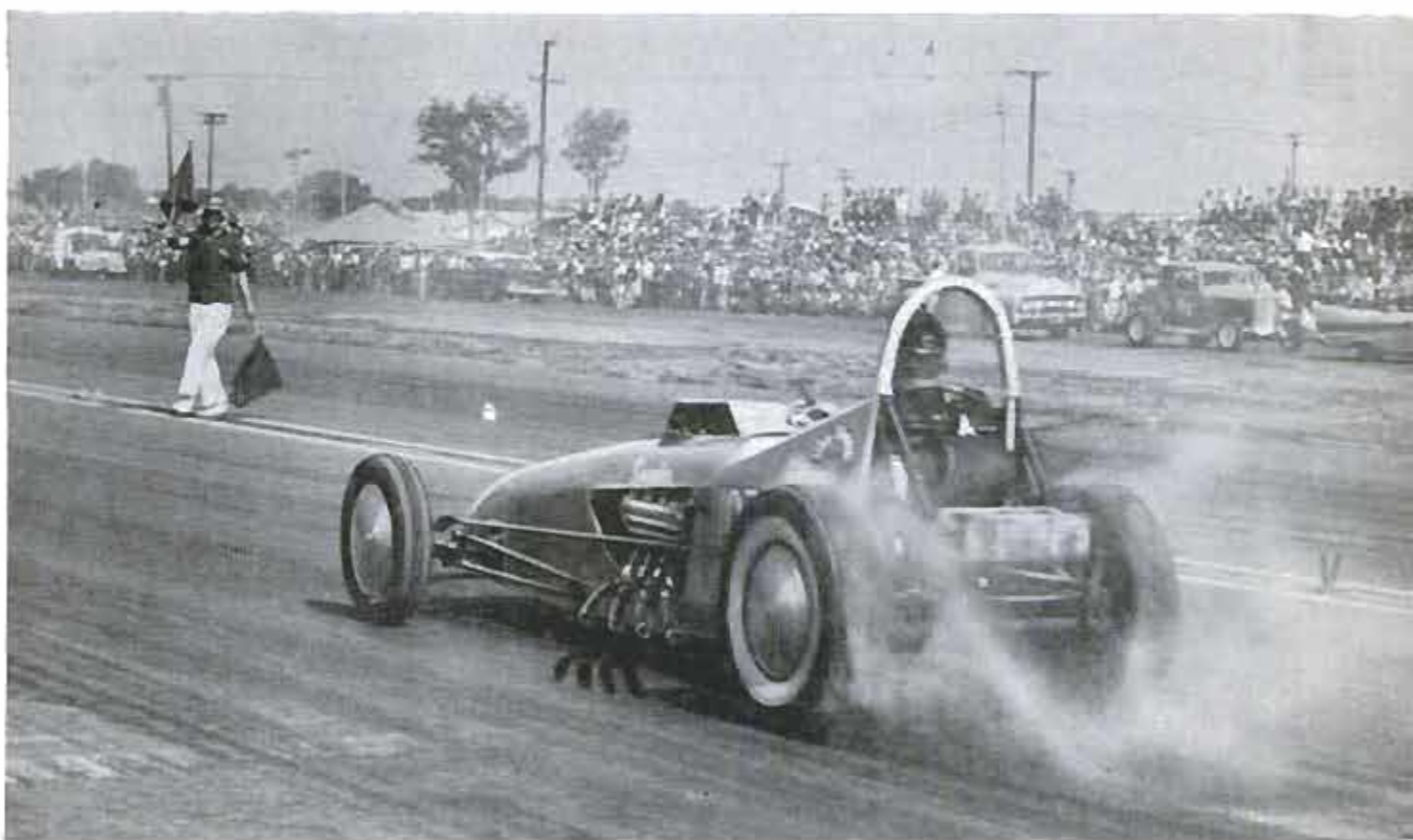
HOT-ROD ENTHUSIASTS have come up with a brand new breed of competition car that they call the "slingshot" because of its odd appearance. The driver sits behind the rear wheels, sometimes just a few inches off the ground.

These weird vehicles must be pushed by another car to start the engine. Clutch action is so stiff that it takes much of a driver's strength to depress the clutch pedal. The engine won't idle below 1500

r.p.m. and a driver must continually pump the throttle to avoid stalling while waiting for the green flag. The engine would freeze up solid if driven much more than a mile, for it does not have a conventional cooling system.

Sometimes the clutch and flywheel explode into shrapnel. As a safety precaution the flywheel assembly must be enclosed by an armored scatter shield to protect the driver. Most of the car's weight is on the

Slingshot dragster below burns rubber from spinning eight-inch-wide rear tires at the start of time trials





Driver sits in engine compartment of coupe, above. Rear view of slingshot racer below has parts labeled

SMALL MOTORCYCLE-TYPE FRONT WHEELS

CHEVROLET ENGINE WITH SIX CARBURETORS

TACHOMETER
WATER TEMPERATURE

OIL PRESSURE
FUEL PRESSURE

TUNED EXHAUSTS

CLUTCH PEDAL

HAND BRAKE

ACCELERATOR PEDAL

AIRCRAFT-TYPE
STEERING WHEEL

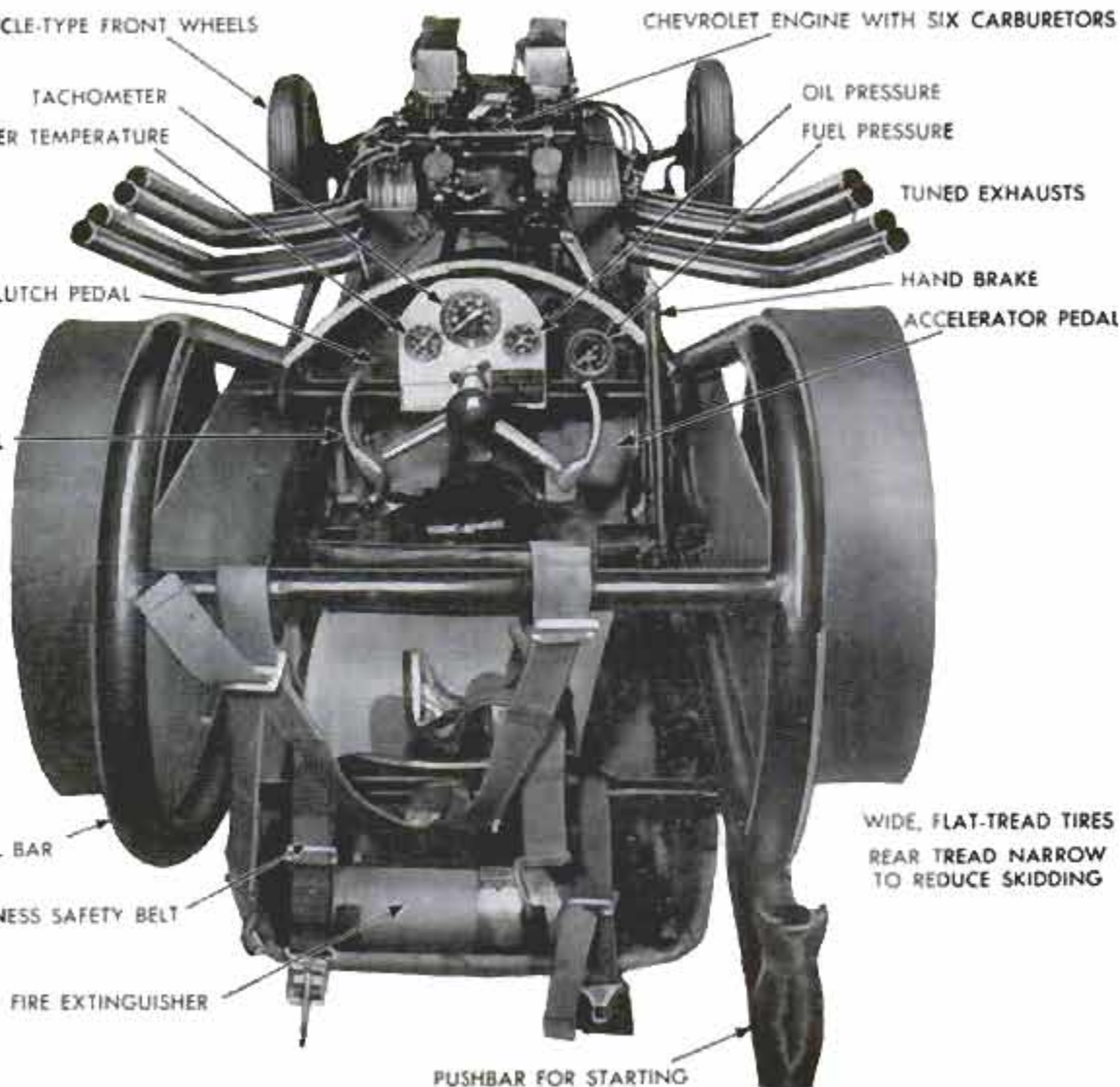
CAGE-TYPE ROLL BAR

WIDE, FLAT-TREAD TIRES
REAR TREAD NARROW
TO REDUCE SKIDDING

SHOULDER-HARNESS SAFETY BELT

FIRE EXTINGUISHER

PUSHBAR FOR STARTING



ing is quick and very tricky.

In spite of these handicaps the slingshots are the champions of the drag strips. From a standing start they can cover a quarter of a mile in 10 or 11 seconds. At the end of the quarter they may be traveling at the rate of 130 to 150 miles per hour.

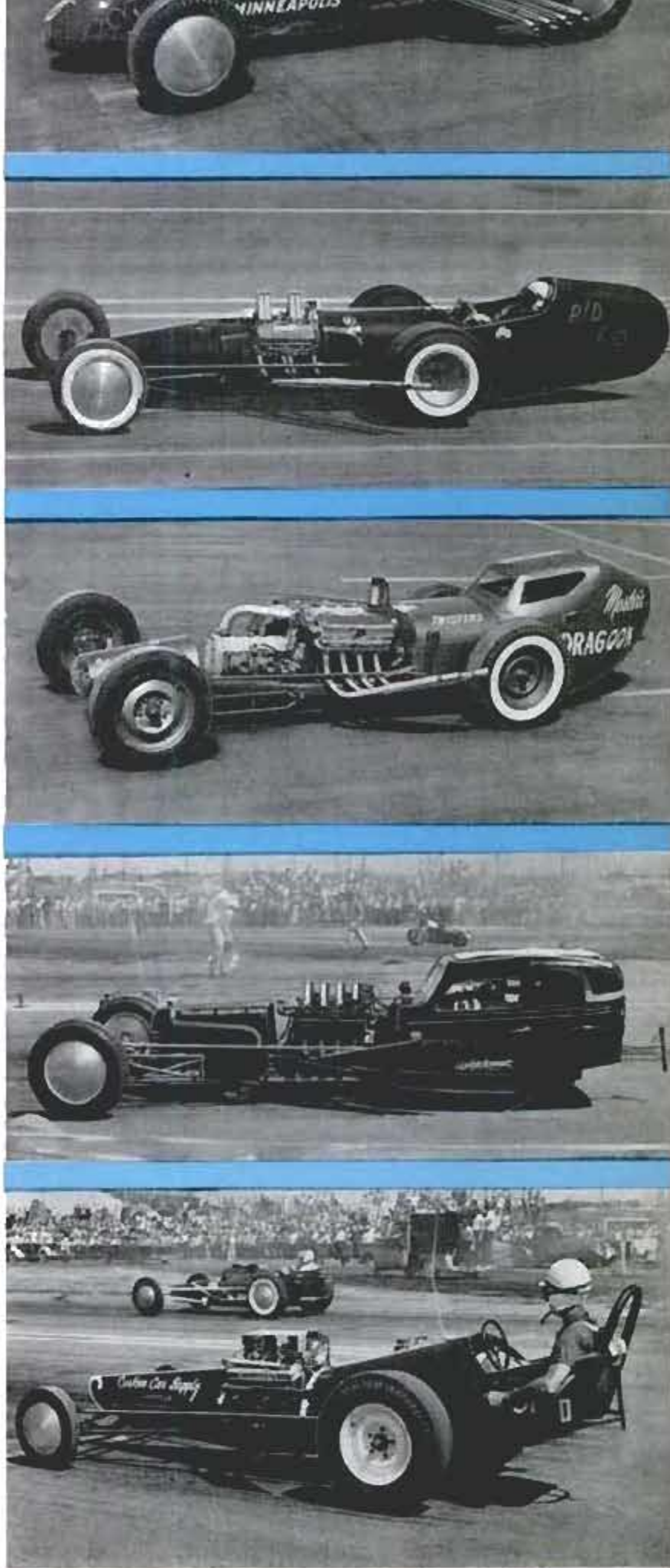
They are the fastest sprint cars in the world.

Some were built for as little as \$1500, some have cost more than \$5000. Possibly 2000 of them have been built in the last few years, each representing an owner's idea of how to travel a quarter of a mile in the shortest possible elapsed time. His goal is to combine maximum power, maximum traction and minimum weight in the same vehicle.

Maximum power often means a Chrysler or Chevrolet engine that has been bored and stroked for greater displacement, balanced, equipped with "wild" full-race camshafts and with fuel injectors or as many as six carburetors, and possibly supplied with a supercharger. Special manifolds are used. Individual exhaust stacks are tuned, each having exactly the same length and shape as the others. This detail can add five or more horsepower to an engine's output at certain r.p.m.s. Fully reworked, an engine may develop 500 to 600 horsepower, as much as twice its original factory rating.

The desire for maximum traction accounts for much of a slingshot's peculiar appearance. With the engine placed amidships and the driver in the tail, as much as 80 percent of the car's weight rests on the rear wheels. This weight distribution increases the traction between the rear tires and the track surface. Ordinary tires would spin, scream and burn up when power is applied. To avoid this, special dragster slicks are used. These are recaps of soft,

Dragster lineup, starting at top, shows: Six-carburetor job with magnesium wheels; streamlined tail behind Ford engine; engine and supercharger exposed for maximum cooling; rear wheels inside body, fuel-injection Chrysler engine, and light-weight model with Crosley front wheels

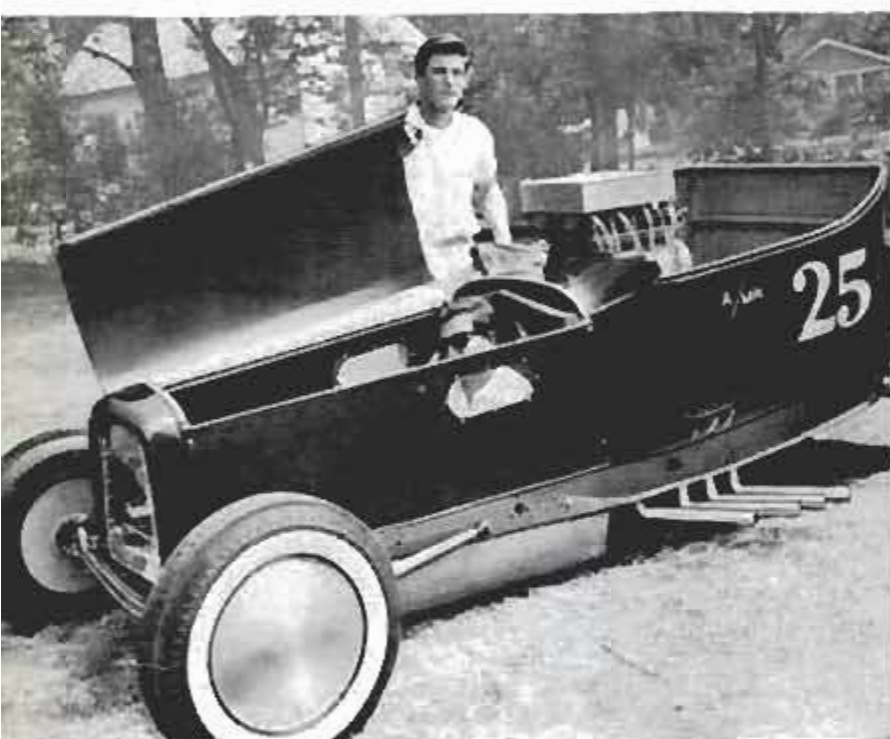




spongy cold rubber, eight inches wide and with a slightly dished surface. They flatten out under the car's weight and present maximum gripping surface to the track. In many slingshots, the rear wheels are placed as close together as is practical to reduce the chances of going sideways while spinning the wheels.

Minimum weight is the reason why a slingshot often uses small motorcycle wheels and tires in front, with lightweight magnesium racing wheels in the rear. It's the reason no starter or battery is carried and why the cooling radiator and fan are left off. This is the reason, too, why a flywheel may fly apart at any time. Most of the flywheel's weight (and much of its strength) have been machined away, leaving little more than a face for the clutch to seat against. Most slingshots weigh from 1300 to 1600 pounds and a shrewd driver figures that for every 100 pounds of weight that he can eliminate, he chops several thousandths of a second from his time.

You don't climb into a fast slingshot without plenty of previous drag-strip experience. One of these cars can get away from an

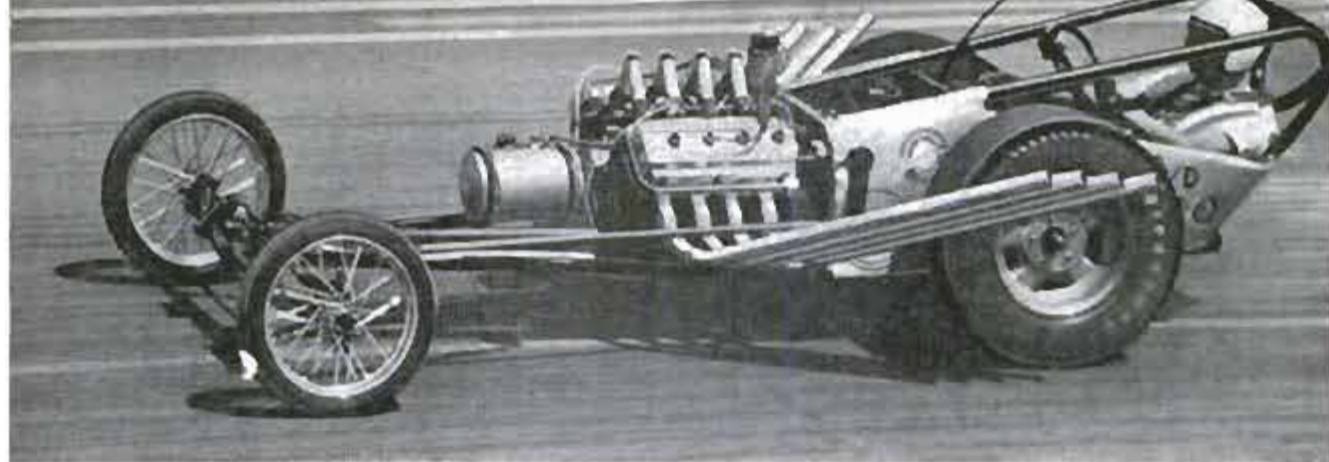


Hot rod at top right looks like a "runaway" but driver Don Mitchell actually is at controls beneath hood. Plastic insert in 1932 Ford grille shell is windshield. Openings in side panels permit driver to look out either side. This unique model has been clocked at 123 miles per hour over a quarter-mile course. A Chrysler V8 engine produces 410 horsepower at the flywheel



Photos on this page by Robert Hegge

Mitchell demonstrates tight squeeze for driver between modified frame rails from 1932 Ford. Engine has eight carburetors and a GMC 6-71 blower, plus a Chrysler 300-B camshaft and a Plymouth flywheel



Fuel-injection Chrysler engine develops 550 horsepower for this 1200-pound slingshot with tuned exhausts unskilled driver. Even an experienced driver flinches as he lets out the clutch, for he is literally hammered into the back of his seat by the tremendous acceleration. He pulls a G load all the way to the finish, then surges forward against the harness when he lets up on the throttle.

Most dragsters have been using a two-speed shift and when a driver is racing against elapsed time he stays in the lower gear until his engine revolutions reach peak power, then he shifts into high. But if he is trying for record speed at the finish instead of the shortest elapsed time he shifts into high only 50 feet or so from the start. The engine lugs for a bit, then accelerates to top speed.

It isn't always the car with the most power that gets to the finish line first. An unblown engine usually accelerates at a fairly constant rate all the way to the finish, while a supercharged engine is apt to

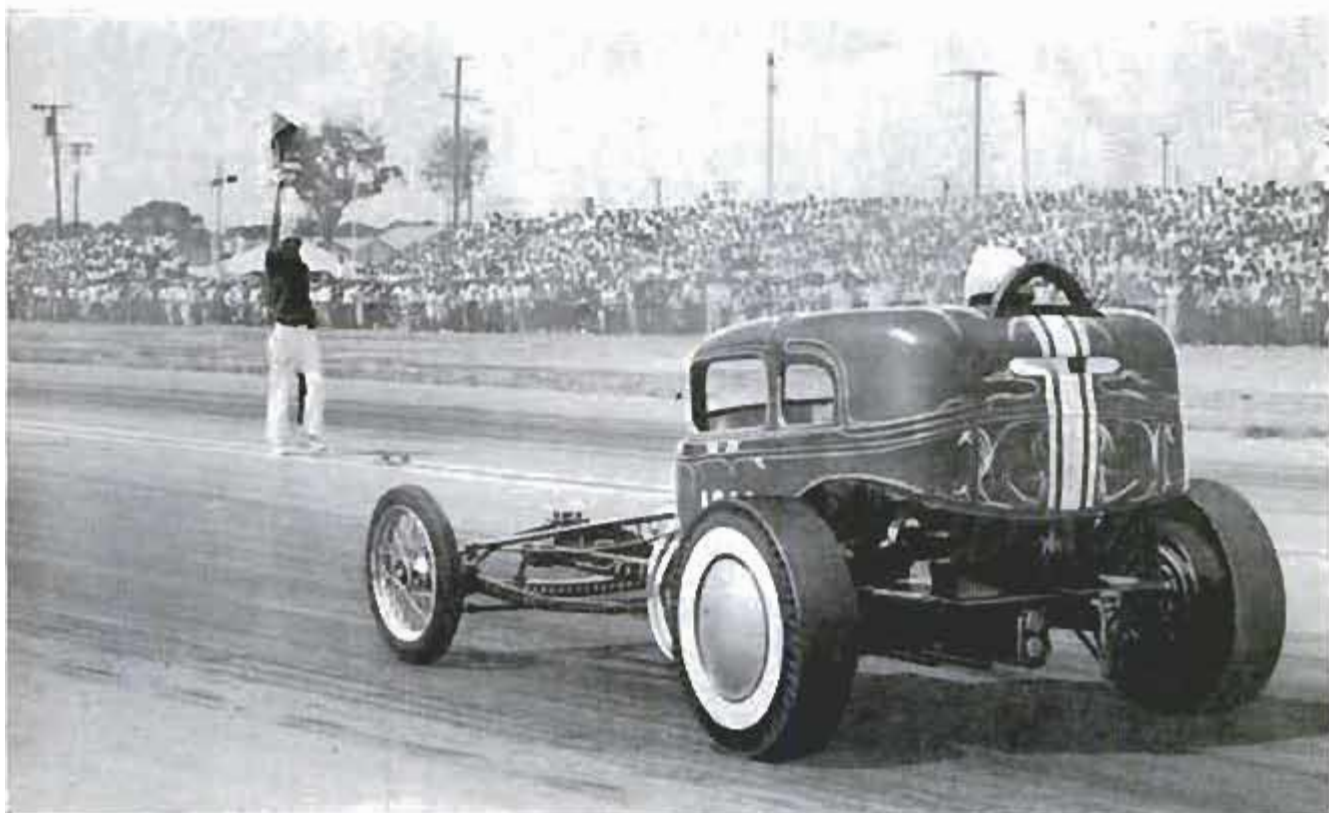
accelerate slowly until it builds up engine speed. Then it begins to fly. The supercharged car can be going the fastest when it hits the finish, though the nonsupercharged car may get there first.

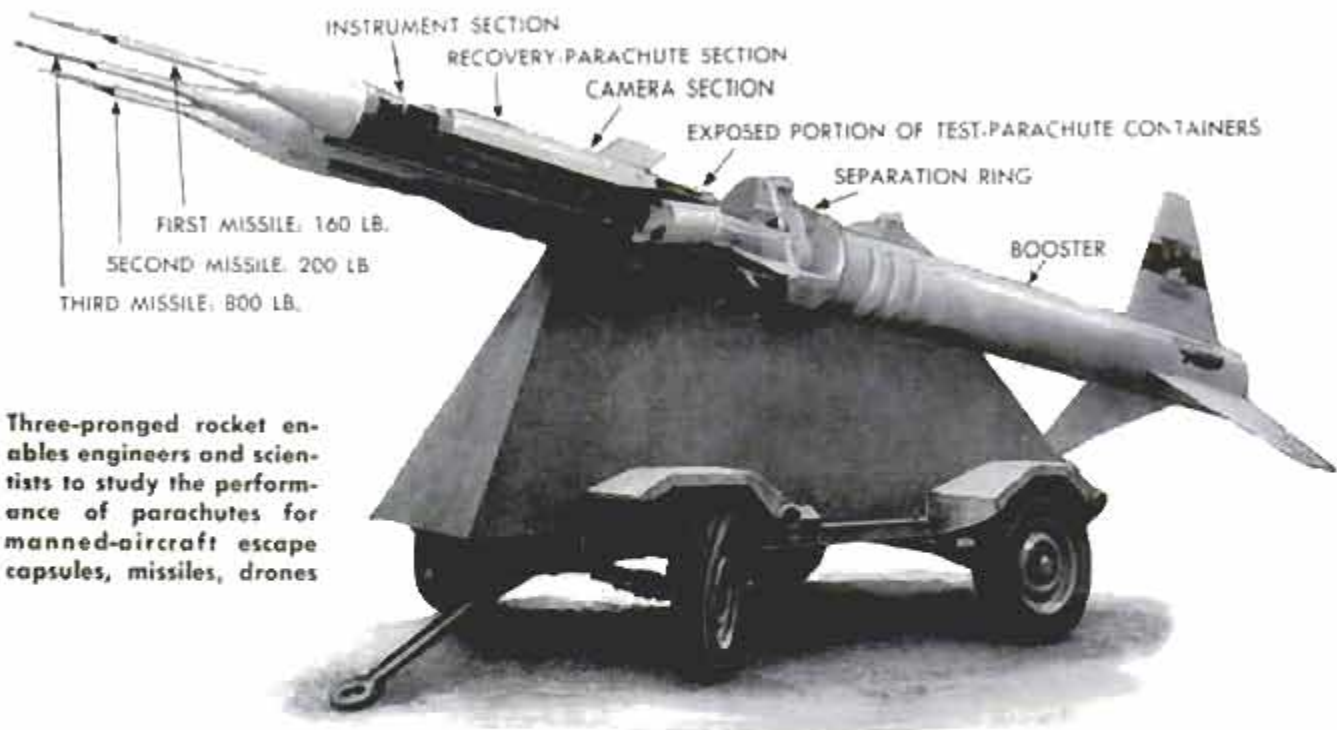
The most recent trend is to a direct drive with no shift. This eliminates the weight of the gearbox and saves the slight pause that occurs when shifting gears. With direct drive, a car is always equipped with a quick-change rear end so that one set of rear-end gears can be used for fastest elapsed time, another set of gears for top speed.

The word "drag" is a descriptive term for an acceleration contest and a drag race is simply a match race between two vehicles to see which can cover the quarter mile in the shortest time. Drag racing is continuing to grow in popularity because it has all the thrills of big-time competition,

(Continued from page 242)

Driver sits above engine, his head sticking through hole in roof of coupe body on the dragster below





Three-pronged rocket enables engineers and scientists to study the performance of parachutes for manned-aircraft escape capsules, missiles, drones

ROCKET TESTS PARACHUTES

THREE PARACHUTES at once are tested by a rocket missile nicknamed the "Cree." It is composed of three missiles mounted parallel and propelled by a ground-to-air booster unit. The center missile mounts on the booster. In the air, the two outside missiles separate from the center one and timers on each then release test parachutes. The actions of the chutes are recorded by cameras focusing through

the tails of the missiles. Thirty seconds after the chutes open, the nose cones drop off, exposing the blunt surfaces of the missiles and slowing them down. Timing mechanisms in the missiles then release 12-foot recovery parachutes that lower the units gently to the ground. The Air Force is conducting the tests at altitudes between 30,000 and 150,000 feet and at speeds from 1520 to 3040 miles per hour. ★ ★ ★

Each missile goes through three stages in the test. The parachute container pops out, a camera films performance of the chute and, finally, a recovery chute lowers missile to the ground



NOSE CONE DROPS OFF, PROVIDING DRAG AND SLOWING DOWN MISSILE



CAMERA INSIDE MISSILE RECORDS PARACHUTE'S REACTION



RECOVERY-PARACHUTE COMPARTMENT DOORS

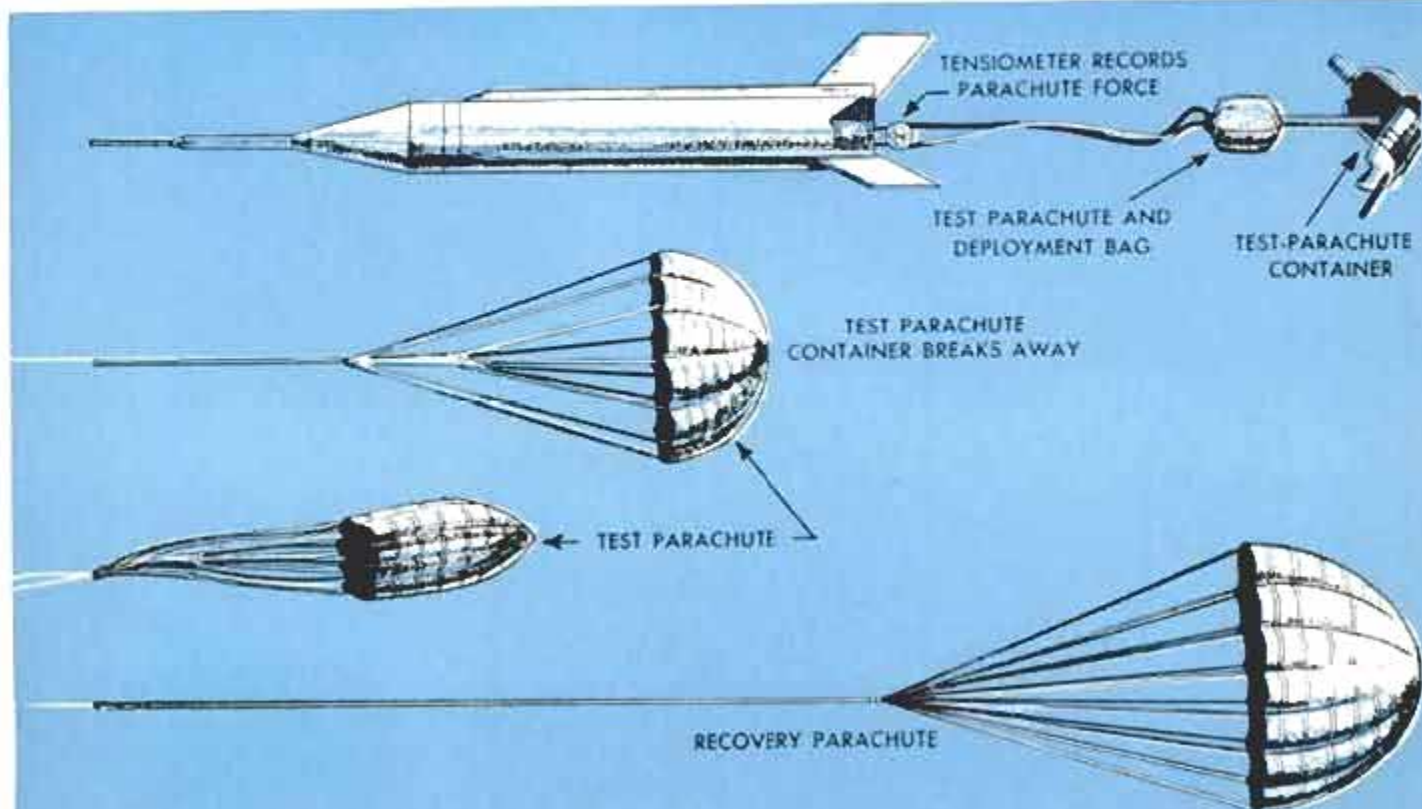
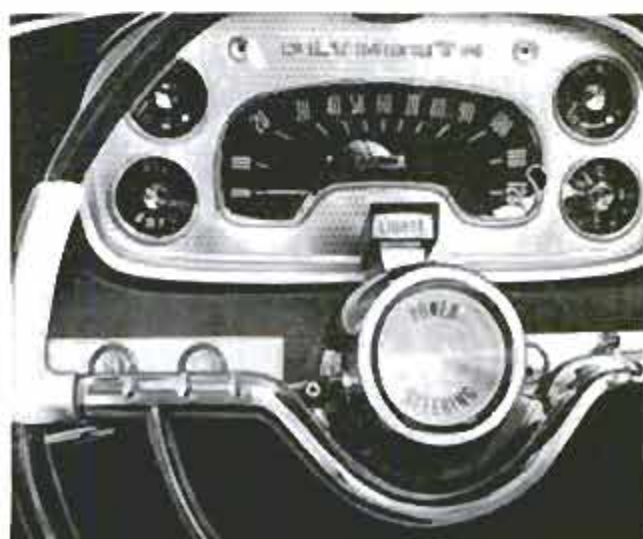
Clothes Clips Can be Hung On Housewives' Fingers

Housewives who can't carry as many clothespins in their hands as they would like to when hanging wash on the line will be interested in new plastic clips that can be strung conveniently on their fingers. The clips, made by combining two molded pieces of plastic with a one-loop wire spring, are said to be unbreakable, non-splintering and nonstaining. They are equally good for holding heavy and light clothes. The clips can also be used to hold several sheets of paper together, close partly emptied plastic food bags and suspend envelopes, photo negatives and other objects from nails and hooks. The clips are available in several different colors.



Dial Reminds Motorist He Forgot to Douse Lights

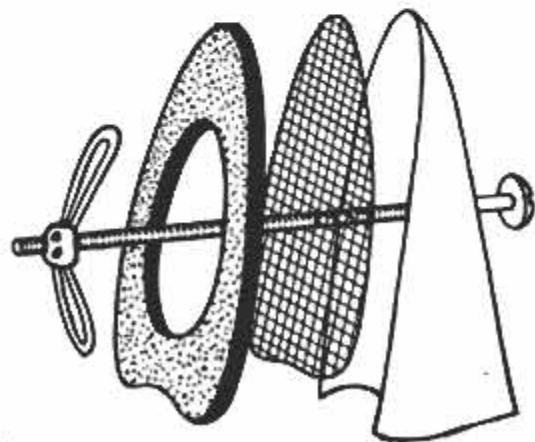
If you frequently forget to turn out your car lights after parking, a new electronic accessory may help solve the problem. As soon as the engine is shut off, this device automatically illuminates the word "Lights" on its dial if the bright lamps, dimmers or parking lights are on. Called the "Light-Minder," the accessory contains no moving parts and is installed easily on the steering column or instrument panel without changes to original wiring. The Light-Minder can be installed on any automobile or truck that has either a 6 or a 12-volt electrical system.





TV Protects Drivers At Rail Crossing.

German Federal Railway is experimenting with television as a means of protecting motorists at a busy train crossing. A TV camera atop a tower scans the highway on both sides of the track. The camera is connected by cables to two screens in the gateman's house. The gateman, who operates the crossing gates electrically on signal from approaching trains, is aided by observing auto traffic on the screens. The gates can be seen on the screens, and their position is also indicated by lights.



Ventilator for Concrete-Block Walls

Dead-air spaces in concrete-block walls can be eliminated by installing a pair of patented ventilators at 48-inch intervals along the wall. One of the ventilators consists of a curved piece of aluminum, a wire screen and a gasket, all held in place by a toggle bolt. They are installed in a plumb line, one inch below window-top level and one inch above floor level. Air circulates inside the wall, from bottom to top, preventing dampness and other dead-air faults.



Army's VTOL Craft Changes Flight Direction by Rotating Ducts

It can hover like a helicopter, but it can also do some things a copter can't do. The Army's Doak 16 can take off horizontally as well as vertically, and it can fly forward like a conventional plane—with much high-

er speed and longer range than a helicopter. The pilot of the unusual craft merely points the ducted propellers straight up for vertical takeoff, then rotates them forward for horizontal flight.

Rubberized-Fabric Tanks Are Marines' Portable Filling Stations

When the Marines have landed, the fuel situation should be well in hand. For the Leathernecks now carry their own filling stations—collapsible 10,000-gallon rubberized fabric tanks. Each tank weighs about

600 pounds, less than a tenth the weight of a standard steel tank. The tanks can be folded into compact packages for transport. When filled, the tanks are 40 feet long, 11 feet wide and four feet high.





It's metal content, not the design of scrap, that interests sculptor who finds raw material in junk yard

Scraps From the Junk Yard Are Welded Into Works of Art

By Rafe Gibbs

TOOLS OF A MECHANIC and the soul of an artist, plus coat hangers and junk-yard metal scraps, are all that are needed today to produce objects of art that will pass Michelangelo's famed test: "If it can roll down a hill without breaking, it is good sculpture."

Working with an oxyacetylene torch—generally at 6000 degrees Fahrenheit—George Roberts, art instructor at the University of Idaho, is turning out sculpture that is exhibited in New York, Chicago, Detroit and other major art centers. Main substance of his sculpture is steel, but Roberts may also add a dash of aluminum, concrete, ceramics, wood or brass.

"I guess I use about everything except the kitchen sink, and the reason I don't use that is because it is made of cast iron,

which is not easy to weld," said Roberts. "My wife is a lapidarist, and every now and then I manage to talk her out of one of her prize stones to work into a sculpture."

One of Roberts' sculptures, recently exhibited in New York's Audubon Show, is his impression of an Oriental city gate. He felt it needed a certain something—particularly one of his wife's agates. He got it.

Haunting a local junk yard, Roberts finds odd pieces of metal, worn beyond original purpose but still of sound substance. Often picked up by Roberts, for instance, is an old disk plow.

"Good steel goes into a disk, and it is easy to work with," said the sculptor.

He stresses that pieces should be selected for their materials and for their application to a particular creation. If unlimited funds



The sculpture of a bull about to charge was fashioned by the artist from a bunch of clothes hangers

were available, Roberts said it would probably be better to purchase new stock. On the other hand, he feels that there is a bit of a challenge in seeking out just what is wanted amidst the maze of a junk yard.

A sculpture of modernistic design—"ebbing moons pyramiding into more ebbing moons"—was formed almost entirely from an old piece of steel pipe.

"With an oxyacetylene torch, you can peel a section of pipe as you would an orange," Roberts explains.

Perhaps his main material comes from clothes closets—his own and friends'. He uses metal coat hangers by the dozens.

"Drops of metal fall from them nicely," says Roberts, "but perhaps most significant is the fact that your material costs you nothing—if you can train your friends to take their clothes to the dry cleaners in bundles and then bring them back with wire hangers."

A bull sculptured by Roberts' torch has about 90 percent coat-hanger content. It was no trick at all to form the ribs of the

Roberts uses oxyacetylene torch to add finishing touches to his conception of ancient Oriental gate





Old water pipe becomes a piece of abstract art, above, while a piece of rusted steel, below, takes on new beauty as a sail of an old Chinese dragon ship



bull from bits of wire clothes hangers. Producing works of art from steel or iron is far from new. Oxidized remains of ornamental iron beads, dating back to 4000 B.C., were found in an Egyptian cemetery at Gezirah. Decorative art with iron was known to the Celts in Britain long before the Roman invasion. In the Middle Ages, the ingenuity of the swordsmith was woven into various forms of ornamentation. An early English swordsmith had on the point of his anvil as his trademark, a beautifully sculptured head of an ox.

Pablo Picasso also works in the medium. He once took a piece off a stove and entered it in an exhibit as sculpture. Critics accused him of poking fun at art. But Picasso proved his point that art is where you find it—and it can be of materials other than the conventional ones.

Generally, the great works of sculpture have been of stone, marble, wood or cast bronze.

"But you must remember that the oxyacetylene torch is a relatively new development of the 'Mechanical Age,' and sculpturing in steel or iron was difficult before its development," Roberts points out. "There is the arc welder, too, but I prefer the oxyacetylene torch. It's more versatile. With the torch you can puddle your metal—work it around. Too, you can see better what you are doing."

When Roberts studied art at the University of Wisconsin he was looking for a medium he could consider exciting. He found it in steel and iron.

"With this medium there is the excitement of drawing in space," he says.

Roberts, who also paints in oils, feels that drawing in space "is much more fascinating than painting on canvas." He adds:

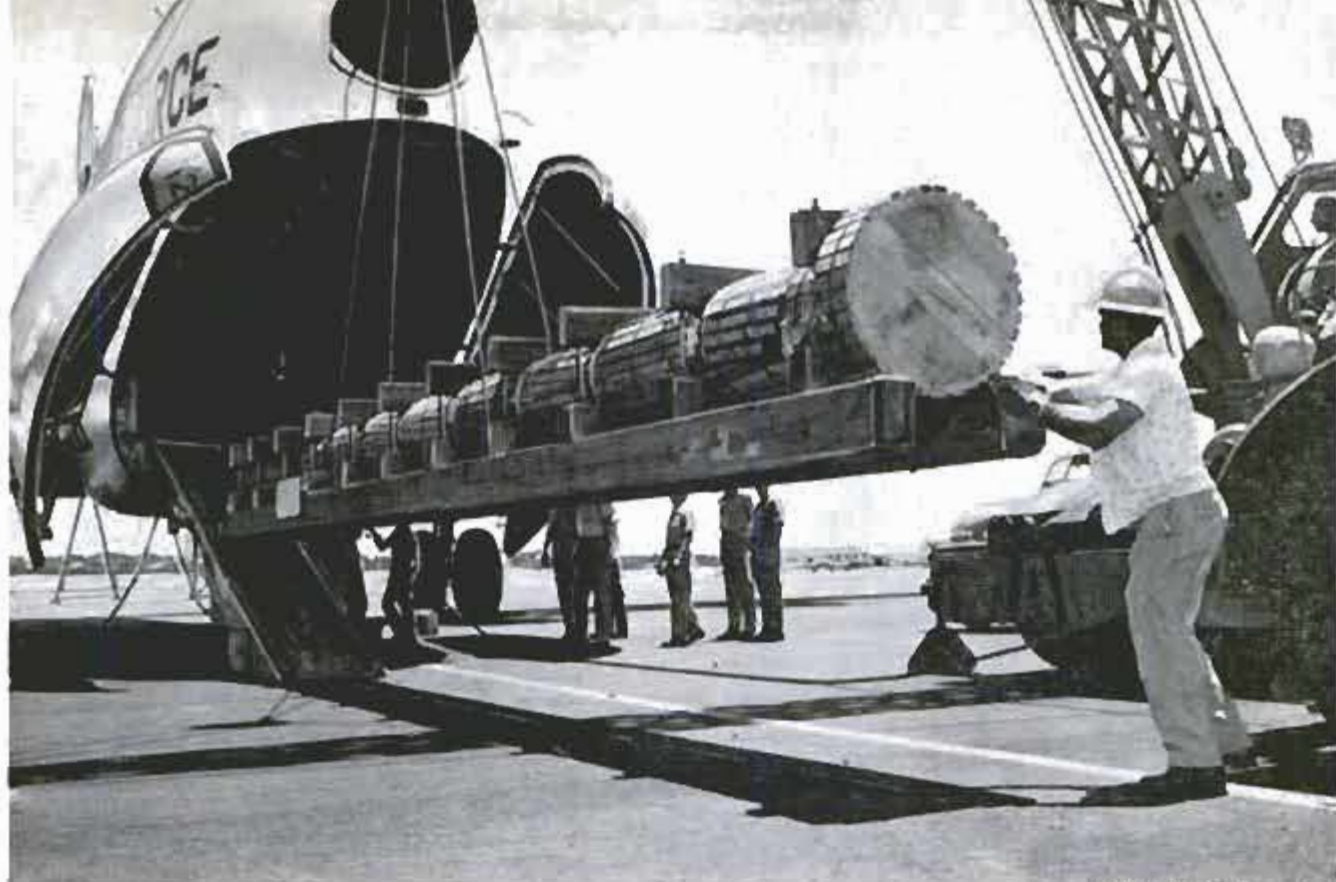
"Working with a torch on metal, you can do things that you never could do with a chisel on stone. Art today is dramatic—sometimes even melodramatic. When sculpturing with a torch, you can achieve some effects that would not be possible in any other art medium."

Roberts points out that hot steel is almost as plastic as clay. You can alter it, add or subtract. He warns that some metals such as brass should be given only a "touch of heat." Brass melts at lower temperatures than steel.

Mistakes can be "erased." If there is too much metal in one spot, it can be burned off.

The sculptor's final admonition:

"Good art is good whether it is realistic or abstract. Create as you choose—just don't get too sentimental, for sentimentality can destroy art. And, working in metal, remember that art is creating—not just doing tricks with pieces of junk." ★ ★ ★



Official U. S. Navy photo

Cargo Plane Opens Wide to Swallow Destroyer's Propeller Shaft

What's the hauling capacity of a C-124 Douglas Globemaster? In Pearl Harbor, one of these giant cargo planes was used to transport a destroyer's propeller shaft. The

shaft, 40 feet in length and 30 inches in diameter, weighed 23,000 pounds. A crane was used to hoist the load, and two fork-lift trucks eased it into the plane.

Portable Radar Unit Tested by Signal Corps

Soldiers at Fort Huachuca, Ariz., have been experimenting with a lightweight radar unit that is carried on the back. The experimental equipment was developed by the Army Signal Corps. The goal is a compact detection unit that is highly mobile.



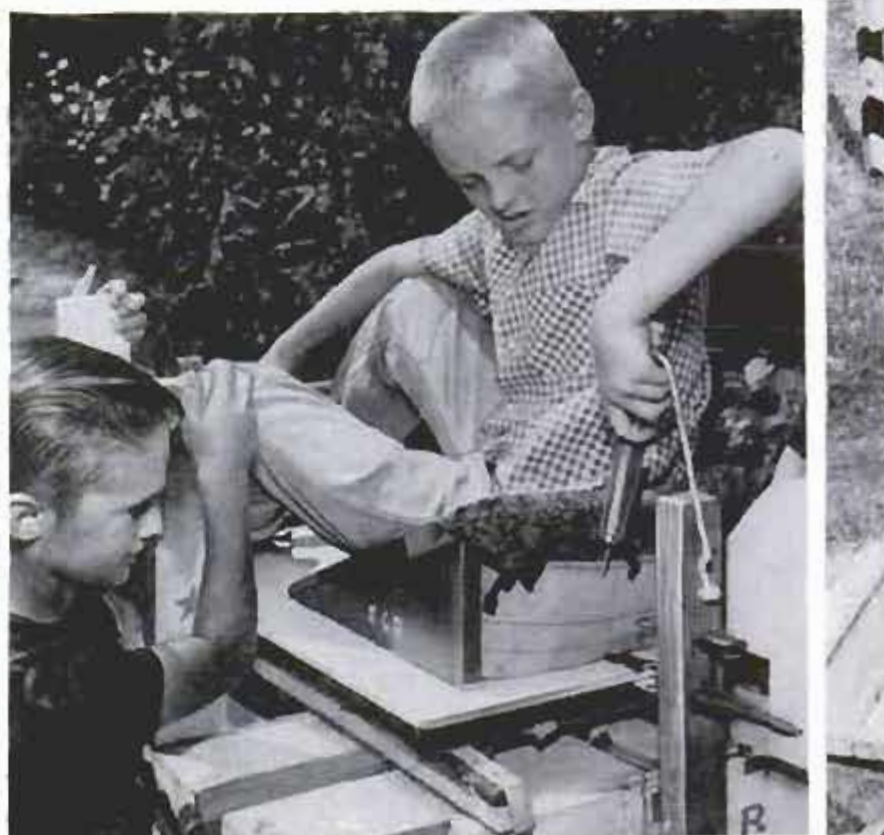
VTOL Jet Soars 30 Feet In First Free Flight

In Belfast, Ireland, the SC-1 vertical-take-off jet did something akin to a child taking its first steps alone. It made its first free flight, soaring 30 feet vertically. Previously the plane had flown vertically only while "tethered" in a gantry.

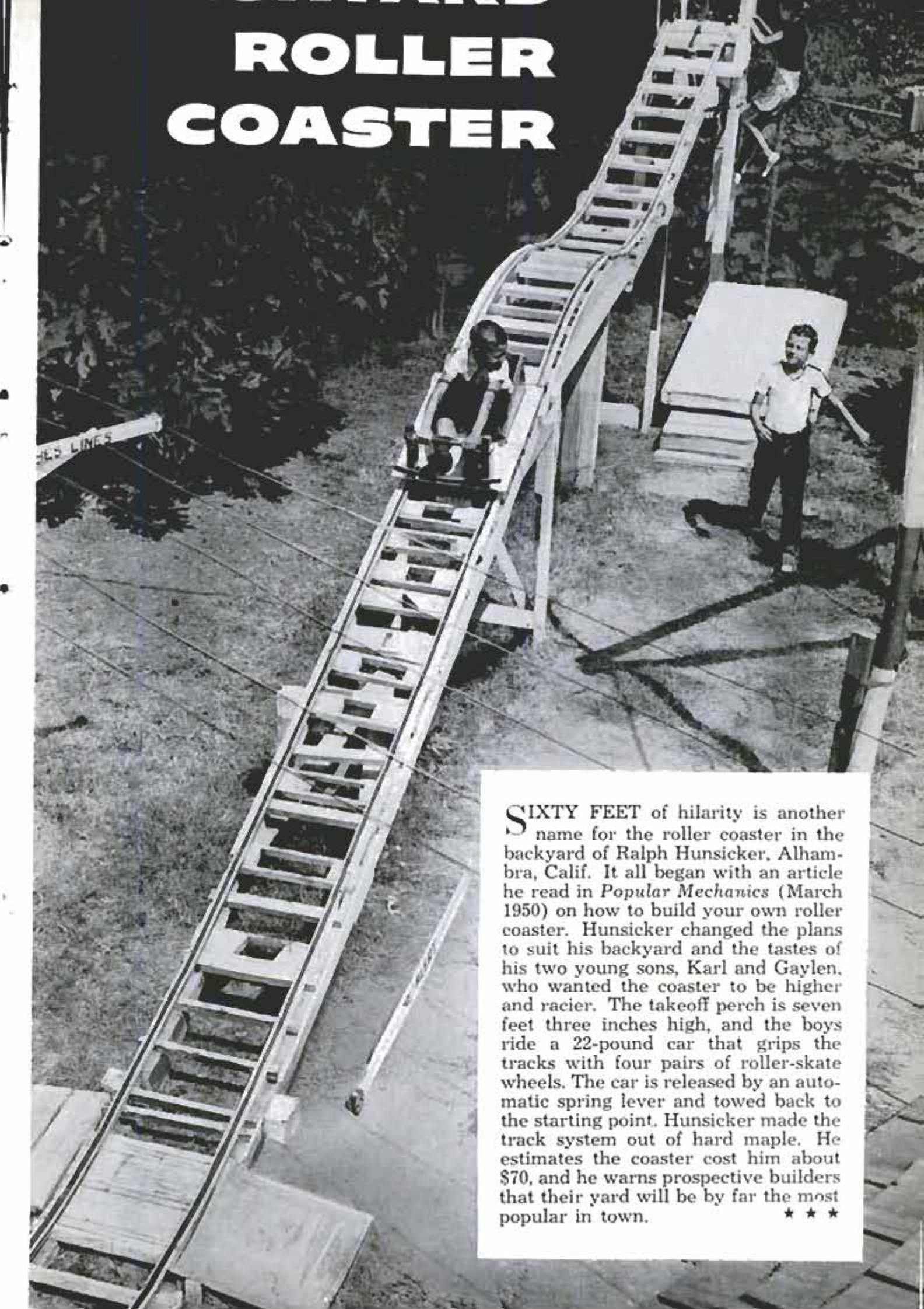




With a good grip on the hand bar, a neighbor child enjoys thrill on Hunsicker's homemade roller coaster. Below left, builder oils wheels, Son Karl, below right, pulls safety pin before takeoff as Gaylen looks on



ROLLER COASTER



SIXTY FEET of hilarity is another name for the roller coaster in the backyard of Ralph Hunsicker, Alhambra, Calif. It all began with an article he read in *Popular Mechanics* (March 1950) on how to build your own roller coaster. Hunsicker changed the plans to suit his backyard and the tastes of his two young sons, Karl and Gaylen, who wanted the coaster to be higher and racier. The takeoff perch is seven feet three inches high, and the boys ride a 22-pound car that grips the tracks with four pairs of roller-skate wheels. The car is released by an automatic spring lever and towed back to the starting point. Hunsicker made the track system out of hard maple. He estimates the coaster cost him about \$70, and he warns prospective builders that their yard will be by far the most popular in town. ★ ★ ★



Army's Aerial "Jeep" Leaves Ground Vertically and Flies Forward

Army airmen now have an aerial "Jeep." Able to rise vertically from the ground on two columns of air and hover under its own power, the craft can hug the ground, fly under bridges and wires, and operate in heavily congested areas that are inaccessible to other vehicles or aircraft. The

aerial Jeep, designed and built by Piasecki Aircraft Corporation, has two horizontal-ducted propellers located within the body to provide both vertical lift and forward flight. The props are shielded on all sides. Piasecki is developing a similar craft for civilian use. It will be called the "Sky-Car."

This Kitchen Sink Cleans Dishes With High-Frequency Sound Waves

Your kitchen sink of the future may contain a device that will clean the dishes by ultrasonic vibrations. Westinghouse scientists have built an experimental sink in which an ultrasonic transducer has been installed. The transducer converts electrical pulsations into sound waves above the

range of human hearing. The high-frequency sound waves cause the rapid formation and collapse of tiny bubbles in a liquid. This "cold boiling" action has the effect of microscopic scrubbing that reaches every crevice of a surface. The tumbler in the photo is being cleaned by ultrasonics.





Huge Swamp Buggy Carries Drilling Rig Through Everglades

Seven hollow steel wheels, each seven feet in diameter, move a massive drilling rig through the Florida Everglades where a new canal is being built. The canal is in a remote section of the swamp where the

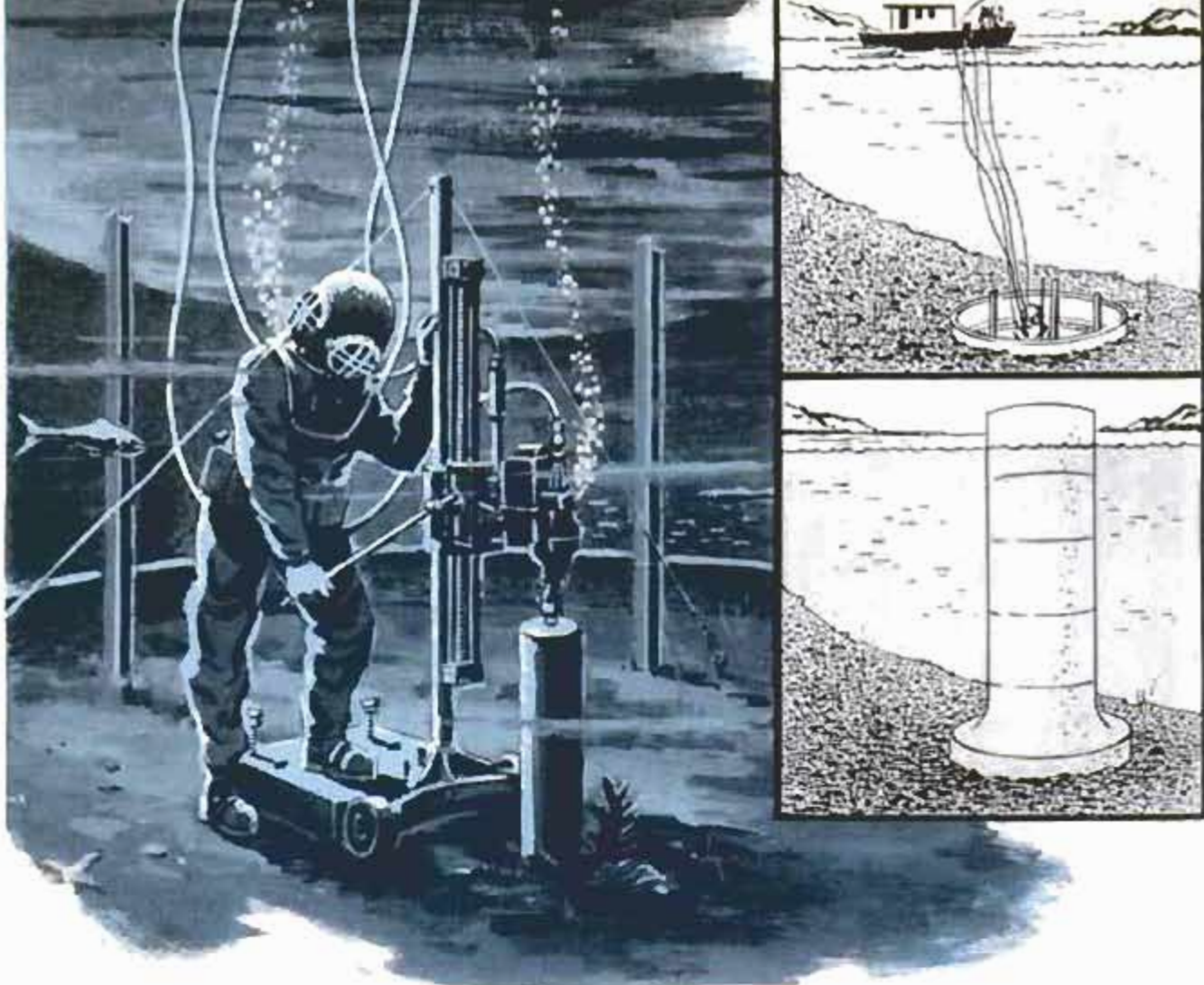
only surface travel is by air boat or out-board skiff. The "drill buggy" is maneuvered by two Ingersoll-Rand air motors geared to two of the wheels. The strange vehicle carries five 24-foot rock drills.

Platform on Motor Scooter Converts It for First-Aid Service



Platform area can convert a standard three-wheel motor scooter into a handy emergency vehicle that can speed immediate assistance for nearby first-aid calls. It carries such things as fire extinguishers, fire-fighting tools, grappling poles, first-aid kits, a resuscitator, gas mask, stretcher and a ladder extendable to 14 feet. A walkie-talkie, shown at left, is extra equipment.





"Blind" Divers Bore Holes in Bedrock With Conventional Drill

Divers working blindly in 65 feet of turbulent water recently bored accurate holes in bedrock with a conventional diamond drilling machine. The holes were made for steel H-beams. Concrete pedestals then were lowered around the beams to support

two new piers off Texada Island, 85 miles north of Vancouver. The 10 holes, eight inches in diameter, were drilled to a depth of five feet. The divers, blinded by the turbulent waters, located the drill-hole centers by a template positioned by instruments.

Next month . . .

ANNUAL BOATING SECTION

PM's big bonus for boaters—

—24 pages packed with feature articles, shorts, how-to-do-its of special appeal to the amateur skipper and his family

- An authoritative survey of the "10 Best Boating Vacations" . . . where to go, what you'll see, the fish you'll catch, side trips of special interest
- Take-apart pontoon boat: Complete how-to-do-it plans for building an inexpensive but versatile craft that's ideal for family fun afloat
- What's new in boats and accessories
- What's new in water skiing
- How to choose the right propeller

. . . Don't miss this big bonus in March!





Here's Where Pilots' Lives Are Saved

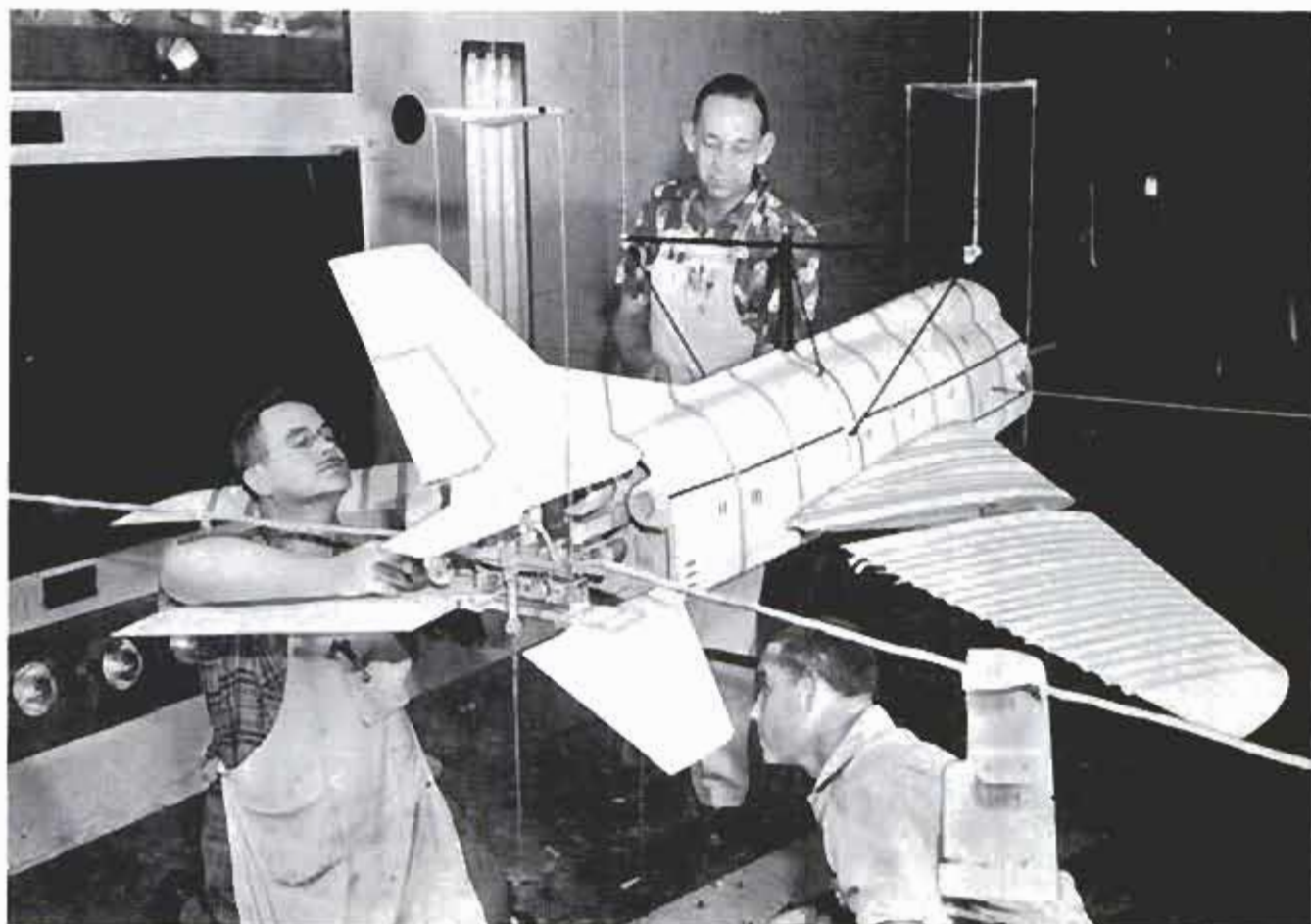
By David Kenyon Webster

MORE PILOTS owe their lives to tiny airplane models than to all the parachutes and life jackets in the world today. The importance of these models, which are flight-tested in wind tunnels long before the actual plane is built, was recently highlighted by the opening of North American Aviation's \$5,000,000 trisonic wind tunnel in El Segundo, Calif.

One of the largest precision instruments in the world, this facility, like all of its predecessors, was designed solely to test

advanced aircraft and missile models in "flight" and thus improve them so that the actual planes and rockets will fly safely and with accuracy. Such testing provides a mass of information that cannot be obtained in any other way. Today, research with models is done in greater volume than with regular aircraft, and without risk to human life. The savings in the development of missiles are tremendous. With proper correction, interpretation and application, the data so obtained are accurate.

In North American Aviation's subsonic tunnel, a flutter model of F-100 Super Sabre is rigged for tests





This is the control console during a test blow. The model airplane is viewed on the screen in the center

Wind-tunnel models are one of the most interesting and least-publicized aspects of our defense industry. Fantastically accurate miniatures of the actual plane, missile or component, they are built by skilled craftsmen working with jewel-like precision to tolerances of $\frac{1}{1000}$ inch in wood, metal or plastic—at costs above those of earlier airplanes. The average supersonic airplane model with a four-foot wingspan,

for example, costs about \$50,000, while some run higher than \$250,000 each, or twice the cost of a full-size World War II fighter plane, without engine. When a new series of aircraft is begun, the total investment in models can sometimes run into millions of dollars.

There are two basic types of wind-tunnel models: Static and dynamic. To the layman's eye, both frequently look much alike, for the difference is in their purpose more than their design. Each is built to explore a particular type of information that might pertain to the design of life-size airplanes.

Static models are the most common. Of relatively rigid construction and mounting, they have little "give" or flexibility under test conditions and are used to measure such things as the aerodynamic forces on the model and local pressures on its surfaces. Static models can be complete or partial, large or small, and low subsonic, high subsonic or supersonic. Power plants, external stores, duct inlets, ejection seats and internal-flow models are examples of a few partial-static models.

Duct-inlet models of the air openings for jet engines are so important that about half the country's current wind-tunnel work is with them. Getting an efficient air inlet for a jet engine at high speed presents a staggering problem because of the inter-



A half model of the F-100 is used for testing aerodynamic characteristics at supersonic speeds



In test section of trisonic wind tunnel, a technician rigs a supersonic model on the sting, or support
 ference of shock waves at speeds of Mach 3 (thrice the speed of sound) and above. Duct-inlet models range in length from about 20 inches to 20 feet.

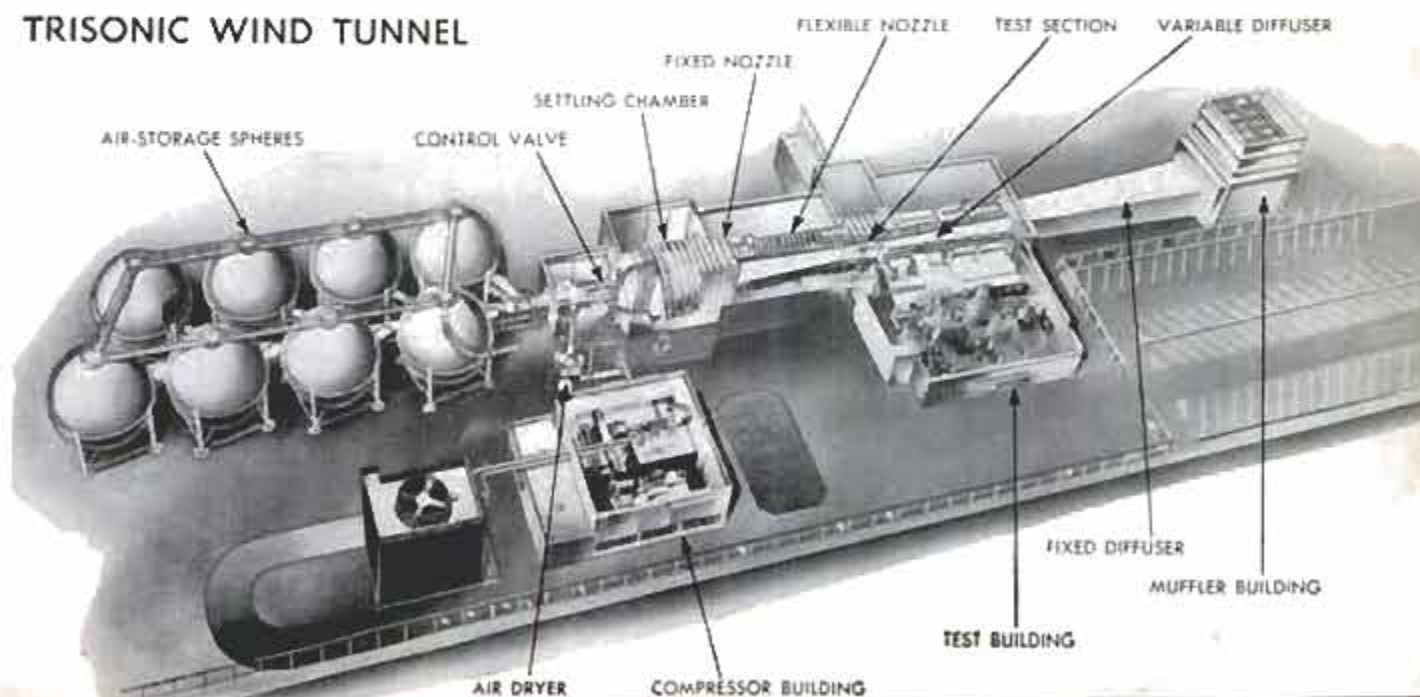
Cameras Record Tests

Dynamic models are rarer. They are also more flexible and often require special tunnels for testing. All have a certain freedom of movement; some rotate, while others actually fly on the proper air stream. Dynamic models may be restrained by springs, as in the case of dynamic stability and flutter models, or they may be free-flight devices, as in the case of spin models, which are dropped into vertical wind tun-

nels to see whether the proposed plane can work itself out of a spin. This category also includes models of stores like rockets and bombs or crew members, all of which are jettisoned into the roaring air stream from a complete model. Twenty or thirty models of external stores were built and tested not too long ago for one aircraft, the F-100 Super Sabre. Motion-picture cameras are used in most cases to record data from tests in which these dynamic models are involved.

Testing the model of a new aircraft is an extremely lengthy and involved process. Here's how it's done at North American, as good an example as any, since they have

TRISONIC WIND TUNNEL





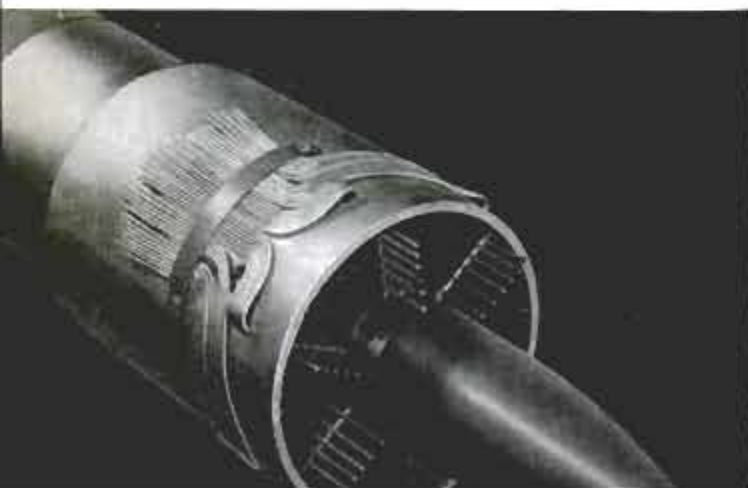
Low-speed models like this one of the T2J jet trainer are built of wood and plastic on a metal frame

built more planes than any other company in the world. The procedure they follow is typical.

First, a simple, small, preliminary full model is built of metal and wood, or all metal, and tested through its entire speed range in the company's 16-inch supersonic tunnel. This takes about two months and shows what modifications are needed.

While this is going on, a larger preliminary model is made of metal and tested over a period of about four months for aerodynamic characteristics that determine stability, control and performance. These models are tested and modified until the best possible airplane design has been evolved. A more detailed metal model is

This tiny model of a duct inlet has internal flow and dozens of pressure tubes, .064 inch in diameter



then constructed with high-lift devices, instrumented and adjustable control surfaces, instrumented speed brakes, landing gear, an internal duct with flow-instrumentation and other devices.

One Engineer to Three Craftsmen

To build a model takes a proportion of about one engineer in the design group for every three craftsmen in the shop. It has been found over the years that architects and mechanical engineers are better suited for model work than experienced aircraft designers. It has also been found that for the actual construction, experimental machinists are superior to tool and die makers in the metal division, while experienced patternmakers are best for woodworking. In most companies, all work together in a "model group." A small, independent factory within the main plant, this organization usually has its own shop, administration, scheduling and design, structures and time-accounting units. It works to the order of such units as the aerodynamics, thermodynamics, wind tunnel, and flutter and vibration groups. At North American, the model group has designed items ranging in size from models with wing panels no larger than a thumbnail to the million-pound variable nozzle now in action in the trisonic wind tunnel.

Once the model has been completed, it is taken to the trisonic tunnel (if designed for that purpose) and set up for a test. This takes four or five men several hours. About as long a time is consumed in dismantling the model afterward, for the wiring attached to it is amazingly fine and complex and must be handled very carefully. Up to 200 or more wires from various recording devices within the model run down through a hollow support and out to the control room. An equal number of tiny metal tubes .064 inch in diameter follow the same route from the model's surfaces to pressure transducers within the tunnel, which convert pressure to an electrical voltage. Wires then carry these voltages to the control room, where they are automatically recorded. Though pictures are also taken during a test, they are secondary in importance to the automatic recordings provided by the wires and tubes, the total number of which can run as high as 300 on a single model.

In the average model, most of the fuselage is taken up by an extremely sensitive balance that records forces and movements, while space in the wings and tail is occupied by various strain gauges. The model's attitude is changed during a blow, and the position of certain movable components is often varied.

Flutter models, being suspended from springs, are the only kind that move as a whole, responding to the force of air with considerable motion. To watch one, an observer gets the impression that the plane, though restrained, is in actual flight in air.

Models of jettisonable stores like drop tanks and rockets, as well as models of crew members for seat-ejection tests, have the most action of all. They are used to determine the flight path of a body from an airplane to see whether it will

(Continued to page 246)



Looking downstream inside the \$5,000,000 wind tunnel, a model is shown being rigged for a test in the subsonic-transsonic section. The average supersonic model costs about \$50,000, but findings based on tunnel tests have saved countless lives



Halfway through construction, a flutter model of a fuel drop-tank has the fragile delicacy of a cocoon. On the workbench, behind a model drying in the mold, is a finished one. It is made of glass fabric stretched over thin plastic bulkheads

Improved ejection seats have resulted from tests made with pilots that are barely three inches tall





Eyeglass Frames Molded to Fit Area Behind the Ears

Now you can get custom-fitted eyeglass frames that will hold your glasses in place even while you're diving into a swimming pool. S/Sgt. Cecil T. Butler of Walter Reed

Army Medical Center developed the method for making molds of the areas behind the wearer's ears. The frames are then produced from the molds.

Camera-Shaped Microscope Magnifies 1000 Times

Designed for fieldwork or expeditions is a Japanese microscope that has the shape and size of a small camera. It will magnify objects up to 1000 times. A built-in lamp operates on flashlight batteries. A wheel on the front changes the focus.

Station Wagon Seats Fold Into the Floor

Rear seats fold into the floor of a station wagon recently introduced by Citroen, the French auto manufacturer. It is one of four new utility-type Citroen vehicles. The others include a family car, a light pickup truck and an ambulance.





John S. Kelley photos

Electronic Starting System Thwarts Jumping of Gun

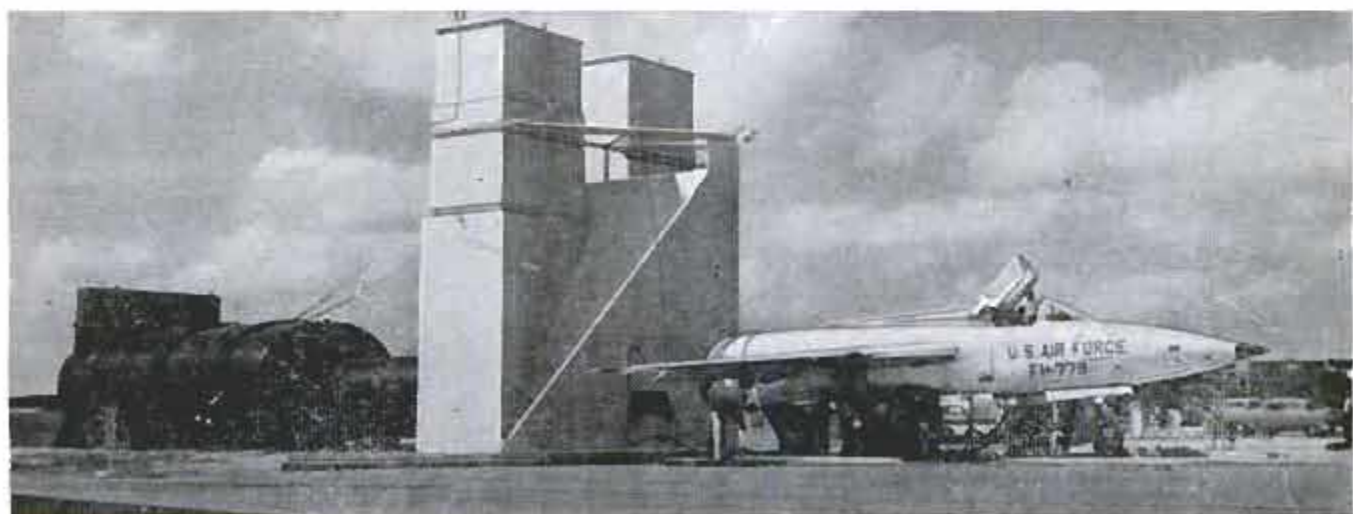
Runners can't jump the gun when a new electronic starting system is used. Each runner rests his thumb on a pad connected to a control panel. When all pads are pressed, the gun is fired from a button on the panel. If one or more of the runners gets away too soon, a horn sounds and the gun won't fire. Buttons indicate which runners are the offenders.



Two-Story Muffler "Tunes" Jet Noise From Loud Roar to Low Moan

In a specially built muffler, roars of the F-105's 20,000-pound-thrust jet engine are reduced to a low-pitched moan. The two-story front section has a metal liner backed

by glass fiber. The liner absorbs most of the sound. What's left is funneled through the pipelike structure to a muffler tank. Gases are blown out the smokestack.



Supersonic Baseball With a Live Artillery Shell

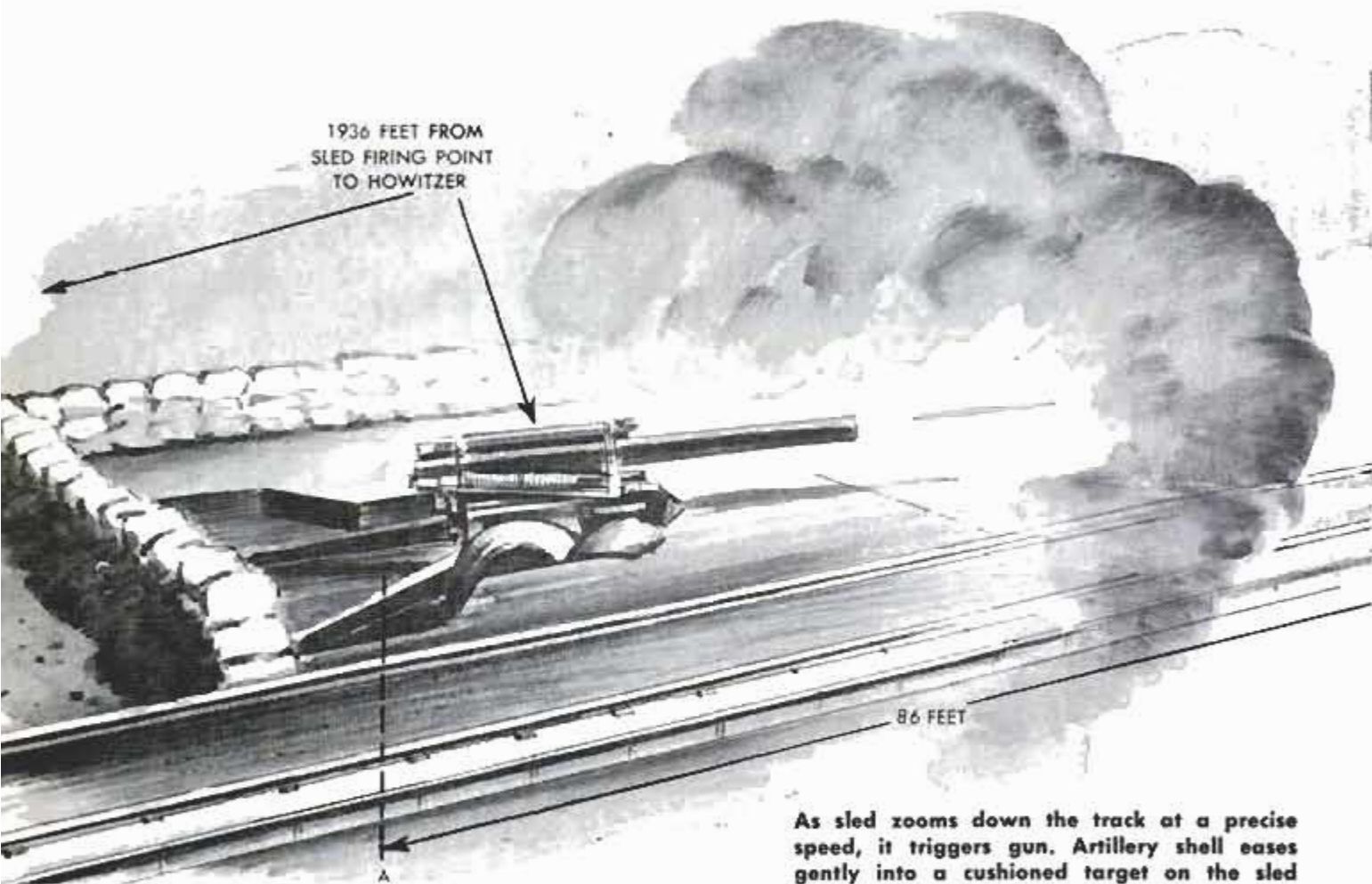
THEY PLAYED a strange kind of supersonic baseball at Holloman Air Force Base recently. The code name of the project was "Catcher's Mitt," and the aim of the game was to snag live artillery shells without damage.

Ordnance experts long have been trying to determine firing effects (entirely separate from impact effects) on a live shell. The 35,000-foot captive-missile test track at Holloman seemed to offer possibilities. A 155-mm. howitzer was brought to the

track, and a sled designed to catch the shell.

The sled's rockets developed 200,000 pounds of thrust for each run. The sled itself, dubbed the "Monster," was 19 feet long and weighed more than 10,000 pounds. The catcher's mitt on the sled was a compartment packed with foam rubber and foam plastic.

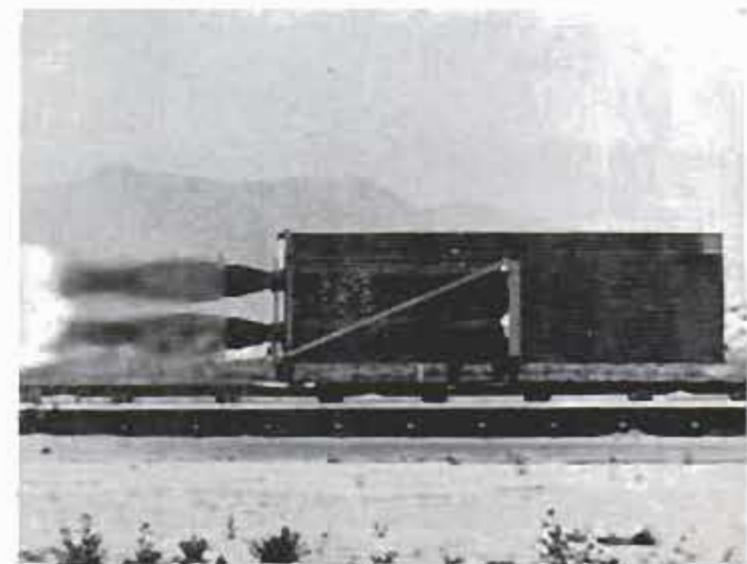
The gun mount was sunk 39 inches into the desert floor to keep the shell's peak trajectory within the limits of the moving



As sled zooms down the track at a precise speed, it triggers gun. Artillery shell eases gently into a cushioned target on the sled

Special target sled was built for the experiment. Its rocket motors develop 200,000 pounds of thrust

At its maximum speed the 10,000-pound sled rushes down the long track at more than 1000 miles per hour

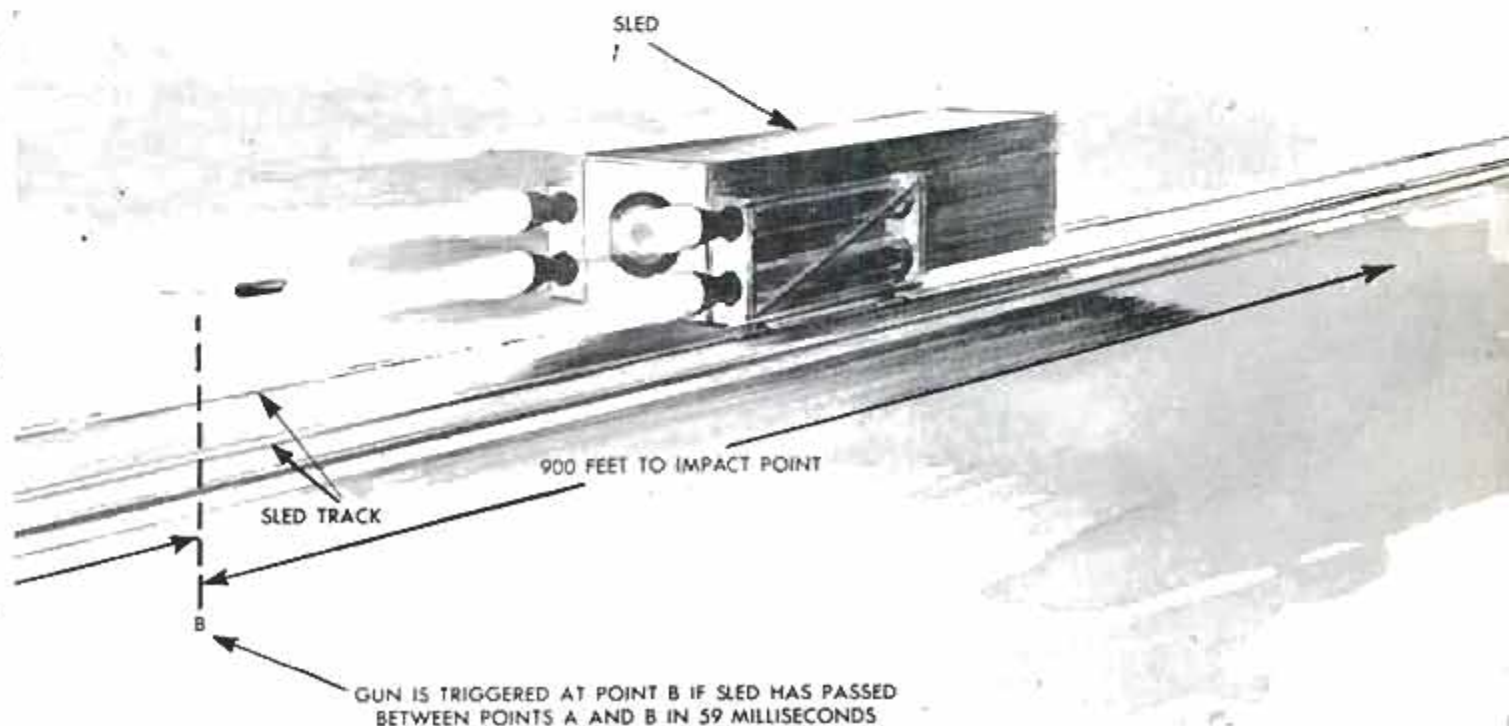


aimed at a slight diagonal. This meant that the shell and sled had to come together at a precise instant or they never would meet.

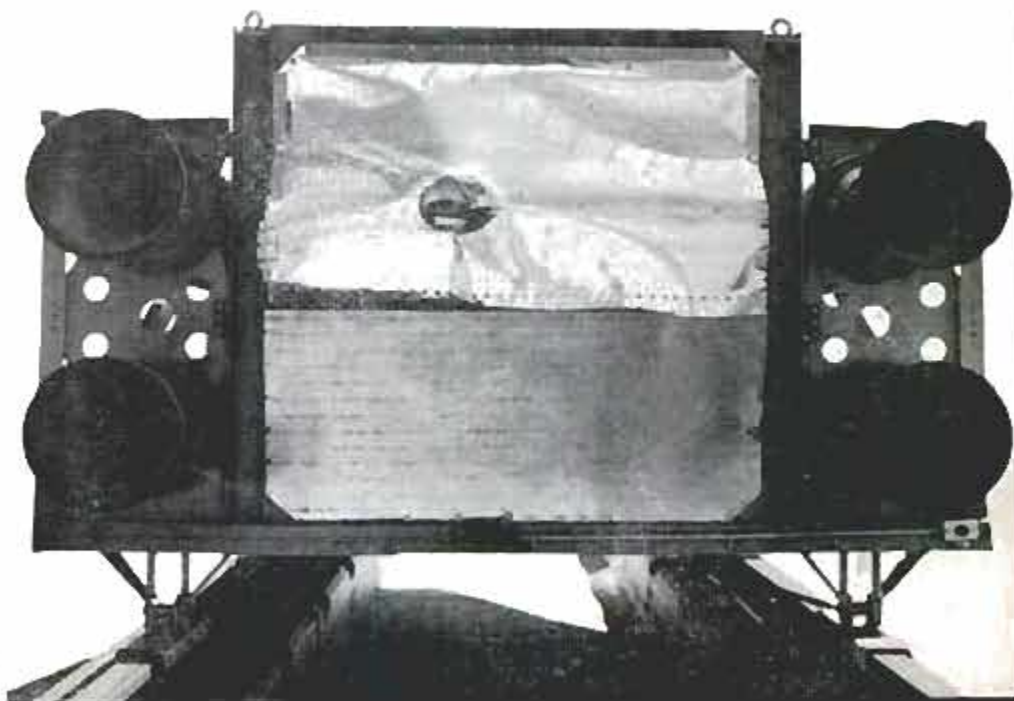
The shell traveled 1650 feet per second (1100 miles per hour). A timing mechanism was rigged so that if the sled passed between two points 86 feet apart in 59 milliseconds, the gun would be triggered.

Everything ready, the researchers sent the sled zooming down the track. It attained its speed precisely, triggered the gun, the shell met the sled and eased unharmed into the cushioning material!

Some ball game!



Miraculous catch is made in "catcher's mitt"—and close to center of the target. Timing had to be accurate to 1/1000 second to enable the streaking sled to snare the artillery shell in mid-air

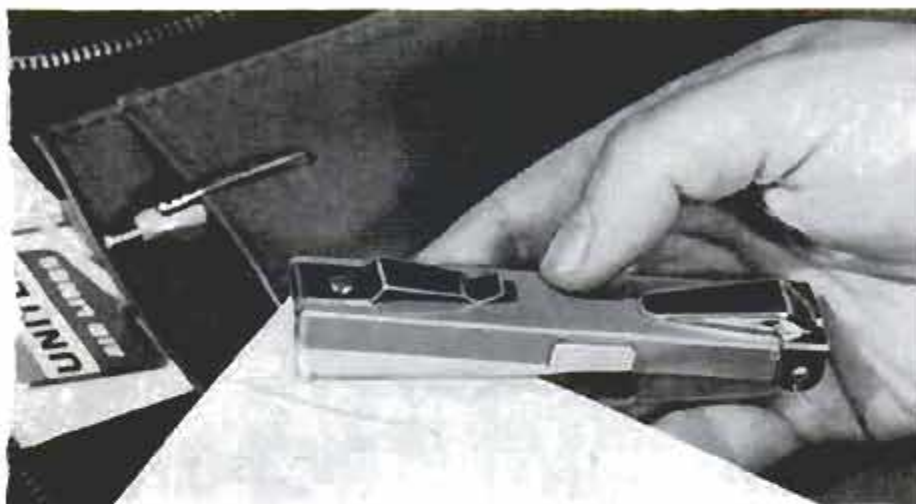




Sonar for Small Boats Helps Locate Fish

Even the small-boat fisherman now can use sonar to spot individual fish and determine their depth. The transducer of the instrument is held by suction cups on the

side of any boat. It sends a high-frequency sound wave down through the water. The echo of the wave bounces off fish and the bottom, and shows up as lines on the dial.



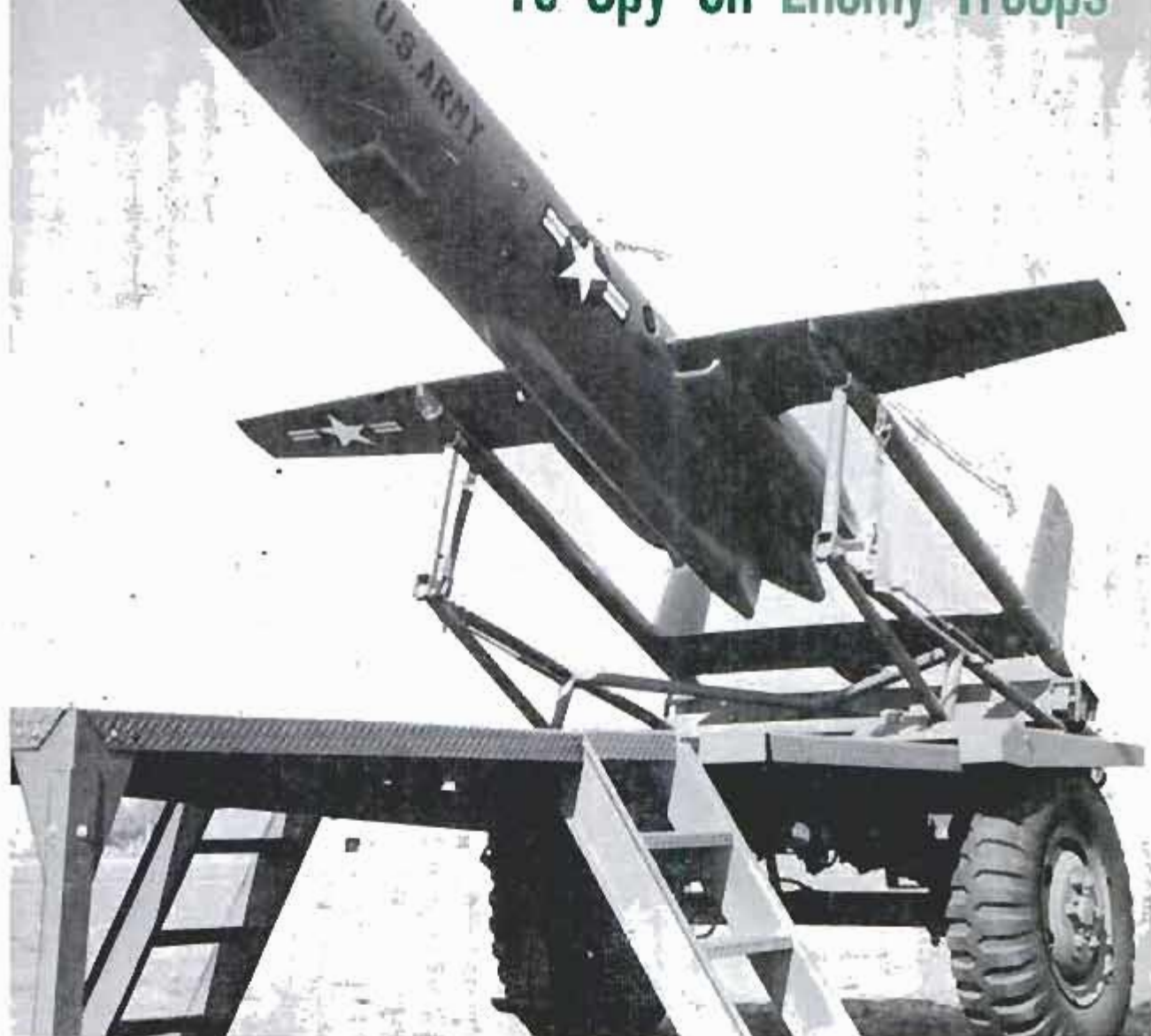
Versatile Stapler Clips to Pocket

Designed for use by businessmen and students, a new pocket-size stapler can be opened up for tacking jobs—such as fastening papers to a bulletin board. It also has an attachment which can be used to remove staples. A clip at one end permits the owner to carry it in his pocket.



Bowling Bag Has Shoe Shelf

Separate compartments for ball and shoes are provided in a bowling bag with zipper openings on both the top and front. This permits the bowler to place either his shoes or the ball in the bag first. The shoes rest on an offset bridge frame of aluminum which can be removed to make an overnight bag.

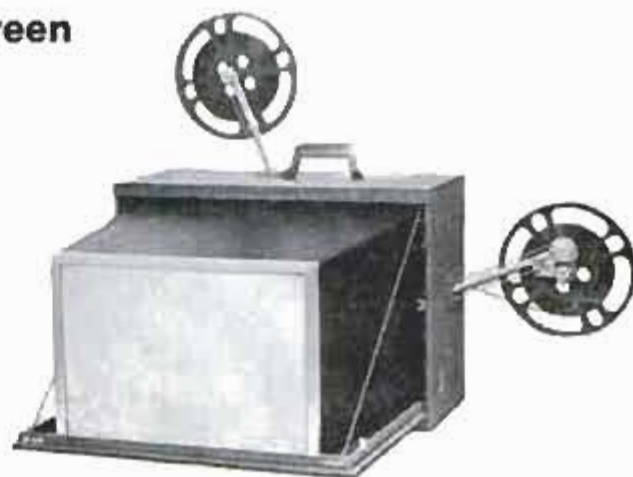


Army signalmen will use a pilotless, recoverable drone to perform aerial reconnaissance in any future war. Employing advanced sensory devices such as infrared, radar and an air-to-ground television sys-

tem, the propeller-driven drone is recovered by parachute. There are two models of the drone: SD-3, above, manufactured by Republic Aviation Corp., and the SD-2, made by Rheem Mfg. Co.

Projector Has Built-in Movie Screen

Capable of both front and rear projection, a 16-millimeter projector can show movies either on a wall or portable screen, or on a built-in screen that measures 18 by 13 inches, equivalent to a 21-inch TV screen. To convert from rear to forward projection, the operator swings a mirror out of the light beam and replaces the lens with a normal two-inch-focal-length lens. An eight-inch speaker is positioned so that the sound comes from behind the screen. Packed for carrying, the unit measures 2 feet long, 1½ feet high and 10 inches wide.



WHAT'S NEW FOR Your Home



CABINET DRAWERS that deliver the goods to your fingertips are produced in nearly a dozen different shelf arrangements. One drawer unit stores two cases of canned foods, another stores cans on one side and packages on the other. Each of the gliding drawer units is 20 inches deep and 26 inches high

EZ Reach Mfg. Co., 1773 N. Second St., El Cajon, Calif.



BUFFING MACHINE that weighs only 40 ounces can be used for all sorts of household polishing jobs, from furniture and wood paneling to shoes and cars. The buffing bannet can be slipped off and washed. A hand strap helps the user get a firm grip. A speed regulator prevents overheating of the electric motor

Howard Houseware Div., LaPointe Industries, Inc., Rockville, Conn.

RIBBED PLASTIC SHEETING is available in lightweight, narrow widths for shelf lining and heavier, 30-inch widths for floor protection. Each kind is made in a variety of decorator colors. The heavy sheeting can be used as door mats or under flower pots. It can be cut with scissors, cleaned with a damp cloth

Gering Products, Inc., Kenilworth, N. J.

GAME TABLE ON WHEELS provides regulation 5 by 9-foot playing surface when opened for table tennis, but it can be folded in the middle and rolled away for storage. It can be stored in an area only 18 inches deep. The surface is finished in flat green, with white court lines. Table won't move during play

Stee Mfg. Co., Inc., Dept. KP, 5215 Eden Ave. S., Minneapolis 24, Minn.





SHOE POLISHER, with a bristle brush on one side and a polishing bonnet on the other, is powered by an electric motor. You don't even have to bend over to turn it on—just touch the switch with your foot. Large rubber suction cups hold it in place

Dremel Mfg. Co., Racine, Wis.

PULL-OUT OVEN, featured in one of the new 40-inch electric ranges, is intended to reduce the time spent in kitchen cleaning chores. The entire oven can be removed from the cabinet. When the top is removed, the oven interior is completely exposed

Frigidaire Div., General Motors Corp., Dayton 1, Ohio



CANNED FOOD RACK, designed to fit a standard-depth kitchen cupboard shelf, allows you to store up to 15 cans in a space where only eight could be stacked by conventional methods. As one can is removed from the rack, another rolls forward to take its place. The device is particularly handy for storing baby food, pet food or fruit juices. Rack is made of heavy-plated steel wire and has rubber-tipped legs

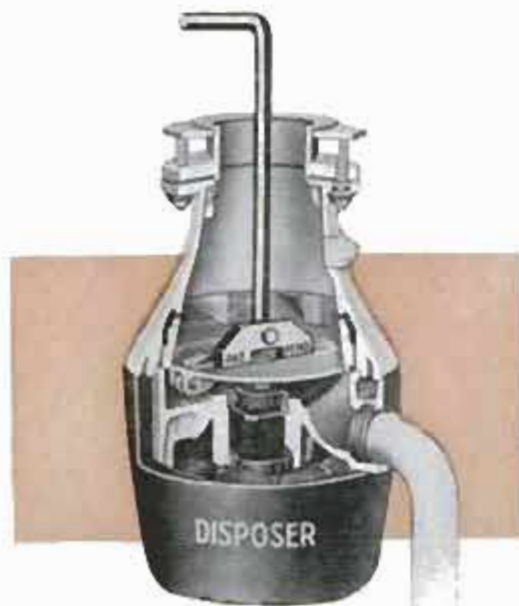
Kelly Co., 1021 Emporia, Muskogee, Okla.

DISPOSER CLEANER was developed by a plumber for the specific purpose of clearing jammed garbage disposer units. The tool is about two feet long with a short crossbar attached at the bottom with a rivet. The crossbar rests firmly on the bottom of the disposer and is turned to the right or left to break up the garbage jam. The tool is plated to prevent rust

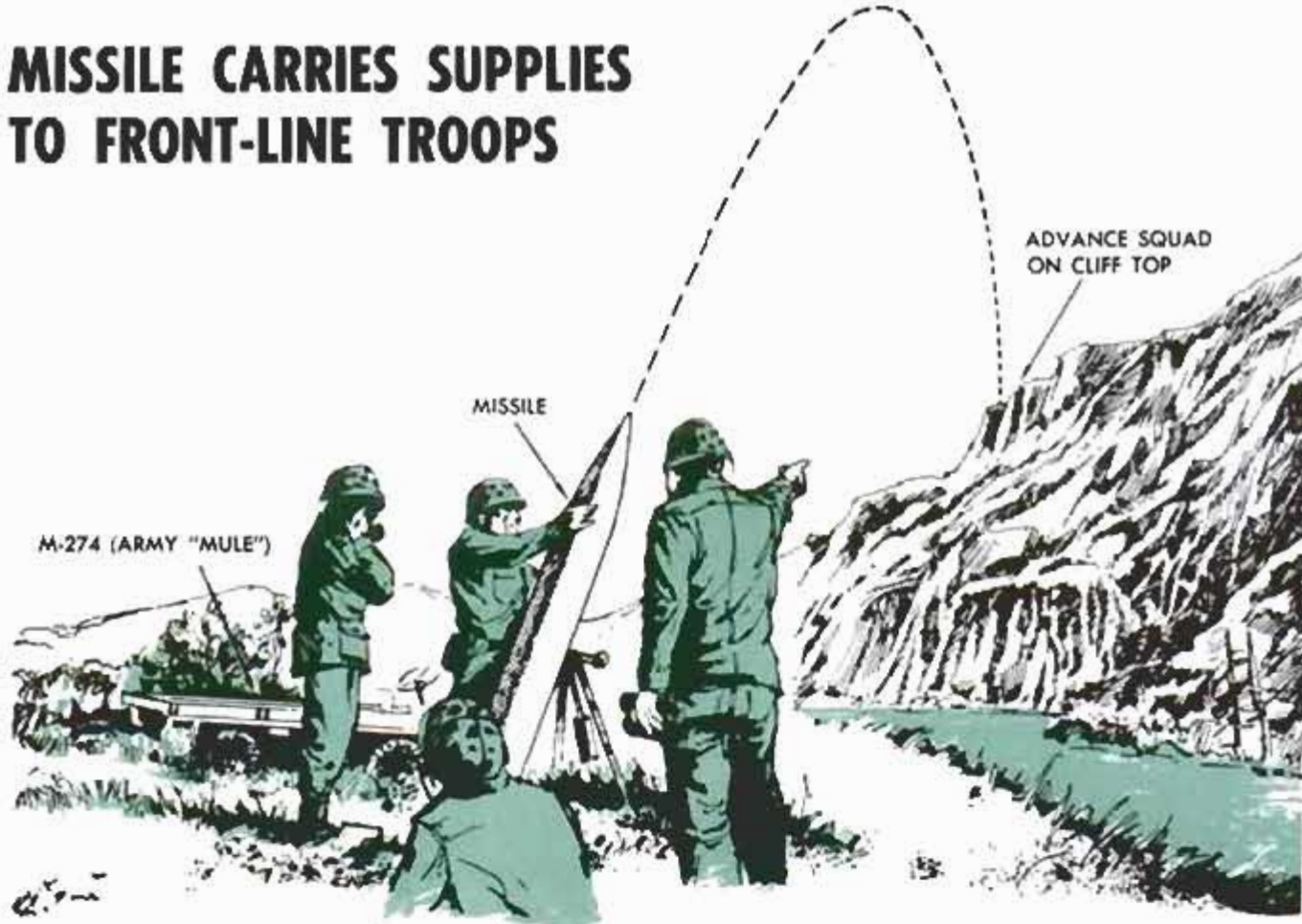
D. A. Bell Enterprises, Inc., 1016 E. Maryland Ave., Phoenix, Ariz.

VANISHING CLOTHESLINE can be installed in almost any wall with simple hand tools. A spring-loaded reel holds the line out of sight in a receptacle box inside the wall when it's not being used. Only a chrome-plated, tile-size plate and pull ring on one wall and a matching hook plate on the opposite wall are visible. The kit includes a heavy-duty line

Lotta Manufacturing Company, 714 Race St., Rockford, Ill.



MISSILE CARRIES SUPPLIES TO FRONT-LINE TROOPS



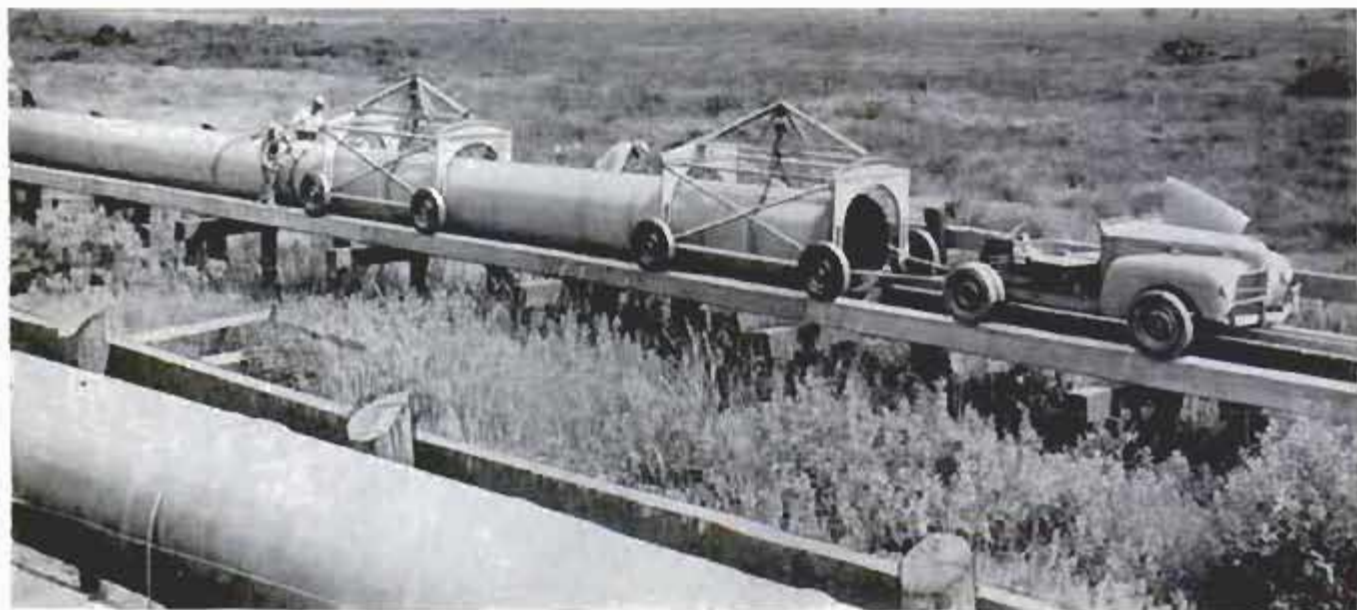
Front-line troops in any future war will be supplied by missile. Called the "Lobber," the missile is about nine feet long and ten inches in diameter. It has an effective range of six to eight miles and carries up to 30 individual meals or an equivalent amount of ammunition or medical supplies.

The missile is lowered by parachute. It can be carried by three men in the field. Besides having the advantage of speed, the Lobber can be employed when bad weather prevents or restricts air drops, or when airspace over a combat area is under enemy control.

Improved "Train" Hauls Pipe Sections on Trestle Above Marshes

Laying water pipe across the marshy Snohomish River flats just southeast of Everett, Wash., presented a problem. How could the heavy sections of piping be moved from the unloading point to the place where they were to be installed? The problem was

solved by improvising a "train"—two carriages and a cut-down jalopy. Using the trestle framework as a road bed, the carrier moved the 8800 feet of steel piping above the marshes into exactly the right position for installation.





HOMEMADE RIVERS IRRIGATE THE WEST

By F. Leland Elam

THE UNPLEASANT REALITY that one fourth to two thirds of our water is wasted through leakage and seepage has at last been realized by technologists who are trying to stop such waste by developing machines and materials that will bring about satisfactory control.

Today, in many areas, water for agriculture and industry is a scarce commodity. Farmers must dig deep for it and water thus obtained is expensive. Cities and states spend billions of dollars to trap water and transport it to users. The federal government is financing multimillion-dollar reservoirs to supply water to parched farmlands. If much of this water is lost during transportation the value of these projects is diminished.

One important development to conserve water during its transportation is the continuous jointless concrete pipe. Realizing the need for a leakproof concrete pipe for water, Elmer Tunsen of Yuba City, Calif., worked for 10 years on the idea of a cast-on-the-spot jointless pipe.

"This continuous concrete pipe has many advantages," Tunsen explains. "Connections and curves are simply made. Expansion and contraction troubles that often cause leakage are minimized by the bond between the pipe and trench which restrains movement. A five-man crew is all that's needed to lay continuous concrete pipe as compared to 19 men for conventional pipe-laying techniques."

A ditch-digging machine excavates a

This multiple-use machine rejuvenates an irrigation canal by scraping the weeds and moss from the sides and bottom of the ditch





Steel sloper blade, above, is used to clean and re-shape the side walls of a canal. Dirt is carried to top of bank where lister spreads it behind tractor

trench with a semicircular shape and a self-powered steel sled carries the forming devices needed to make the pipe.

The sled fits closely into the trench. It carries electrically operated shovels and vibrators that put the concrete in its circular form after it has been poured. The shovels in the traveling form move the concrete down and around the circumference of the pipe. The vibrators compact the concrete.

A cable drum moves the sled. As the form is filled with concrete the drum winds up the cable, pulling the sled forward. Collapsible metal forms are fed into the front of the sled assembly and are hooked together as it moves forward. The forms support the top and sides of the pipe. After the concrete has set, a truck hooks onto the outermost form and pulls the entire line out so they can be used again.

Another method of conserving water in transit is by use of jointless concrete canal lining. The ditch is first shaped, then steel reinforcing mesh is laid in it. The concrete



Boom on the machine at left pushes huge shovel which is held in line by steel sled. Boom then pulls in shovel which bites into ground at the right depth. It leaves behind smooth ditch walls



When shovel is filled, the boom is lifted and swung to one side. Shovel then is tilted and dirt is dumped beside the new ditch. When machine moves ahead, shovel is positioned for next bite



Ditch left by huge shovel can be surfaced with concrete by machine that travels behind the ditch digger

is mixed and sent by compressed air through a hose. The concrete comes out at a rapid rate and is forced into a mesh mat.

To give proper placement, the mesh is raised to the desired position with a hooked bar. The concrete is "shot" first at strategic points on the reinforcing mat to hold the mesh in place. Then the areas between the "chairs," or strategic points, are filled to the required thickness.

"Airblown concrete gives a good clean job," according to California's State Water Development Committee. "There are no joints from which leaks can begin. The surface is smooth and water flows swiftly and without any impediments."

Asphalt panels are being used to put leakproof linings in both old and new irrigation ditches. The reinforced molded panels are laid directly on old cracked surfaces or on earthen excavations. As a liner for water-storage or water-carrying facilities, the panels are flexible and crackproof. They hold their form in any climate and are not bothered by frost.

This paneling is made of five protective waterproofing materials. Its center is a thick core of ductile airblown asphalt, fortified with certain minerals and reinforcing fibers. The mixture is compounded and molded under pressure and heat into panels of the desired thickness and length. On both sides of this core is a layer of asphalt-impregnated felt. And added to both sides as the outside surface is a protective coat of waterproofing asphalt.

Bentonite, a mineral clay, sometimes is used to seal dirt surfaces. The material swells up to many times its original size when it contacts water. It is mixed with the surface soil by raking and rolling it to

a depth of three to four inches. Thus it fills the natural voids between granules of soil and stops water seepage. Once applied it carries on its sealing function indefinitely. It is not affected by repeated dryings and wettings.

Since costs quite often control the methods of constructing ditches, especially on ranches, some do not have waterproof linings. As a result, weeds grow inside and

Reinforced asphalt panels, made of five layers of materials, also are used as leakproof ditch lining





Continuous concrete pipe is produced in ditch which has curved floor. Fresh concrete runs from truck into hopper at rear of form-packing sled

it of bulrushes and other weeds while re-shaping it.

This ditcher constructs a flat-bottom ditch of uniform width and slope. It has three blades on each side, all of which are easily controlled by hydraulic rams from a control board in front of the operator.

The rams can work the blades in many positions, making it possible

to slope the sides to meet any standard shaping specifications. The blade units can be adjusted to different positions to control the width of the ditch.

Still another recent development in ditch diggers is a giant machine built by A. Teichert and Son, Inc., of Sacramento, Calif. It has on its front a shovel that works back and forth on a heavy boom which pushes, pulls and swings.

Machines, materials and methods are helping overcome the multitude of water problems associated with the rapid utilization of both urban and rural land. These water problems reach deep into the taxpayers' pocketbooks.

In California alone, over \$6,000,000,000 has been spent on water projects in the past 75 years. "Yet, in spite of the efforts of the agencies planning and building water projects," says Harvey O. Banks, Director of California's Department of Water Resources, "we are losing the race to keep pace with the booming growth in population, agriculture and industry. We must take every means available to keep from wasting water." ★ ★ ★

outside the ditches. Any obstruction or depression in the surface impedes the flow of water, causing a drop in capacity and setting the stage for erosion.

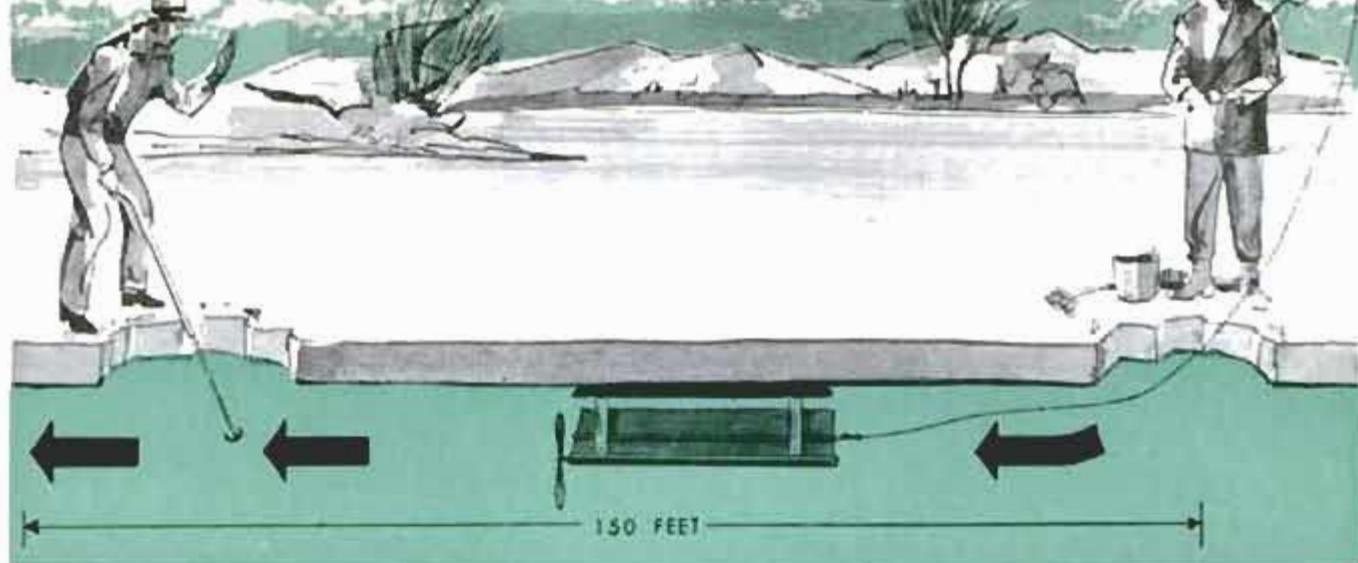
"These conditions bring a major maintenance problem," reports an official of the U. S. Conservation Service. "But today the problems are being simplified by new ditch building and cleaning tools."

One such tool fits on the side of a tractor. It was developed by Briscoe Manufacturers of Kerman, Calif. It is a 21-foot-long steel sloper blade hinged to the back of a tractor. The blade is lowered, to rest on the slope of the ditch bank. As the tractor moves forward, it cleans the wall of weeds and moss and smooths the surface. When the blade is filled with plant material cables pull the blade to the top of the bank where the material is deposited. A wing behind the tractor spreads the dirt to prevent its falling into the ditch.

The same firm has developed a multiple-use machine that makes, shapes and cleans ditches. It will work its way through a field, digging a ditch of nearly any size. Or it will pass along an old ditch, cleaning

Butane flame thrower with five nozzles is employed to burn weeds which retard the flow of water in irrigation ditches





Sled Delivers Ice Troll Line

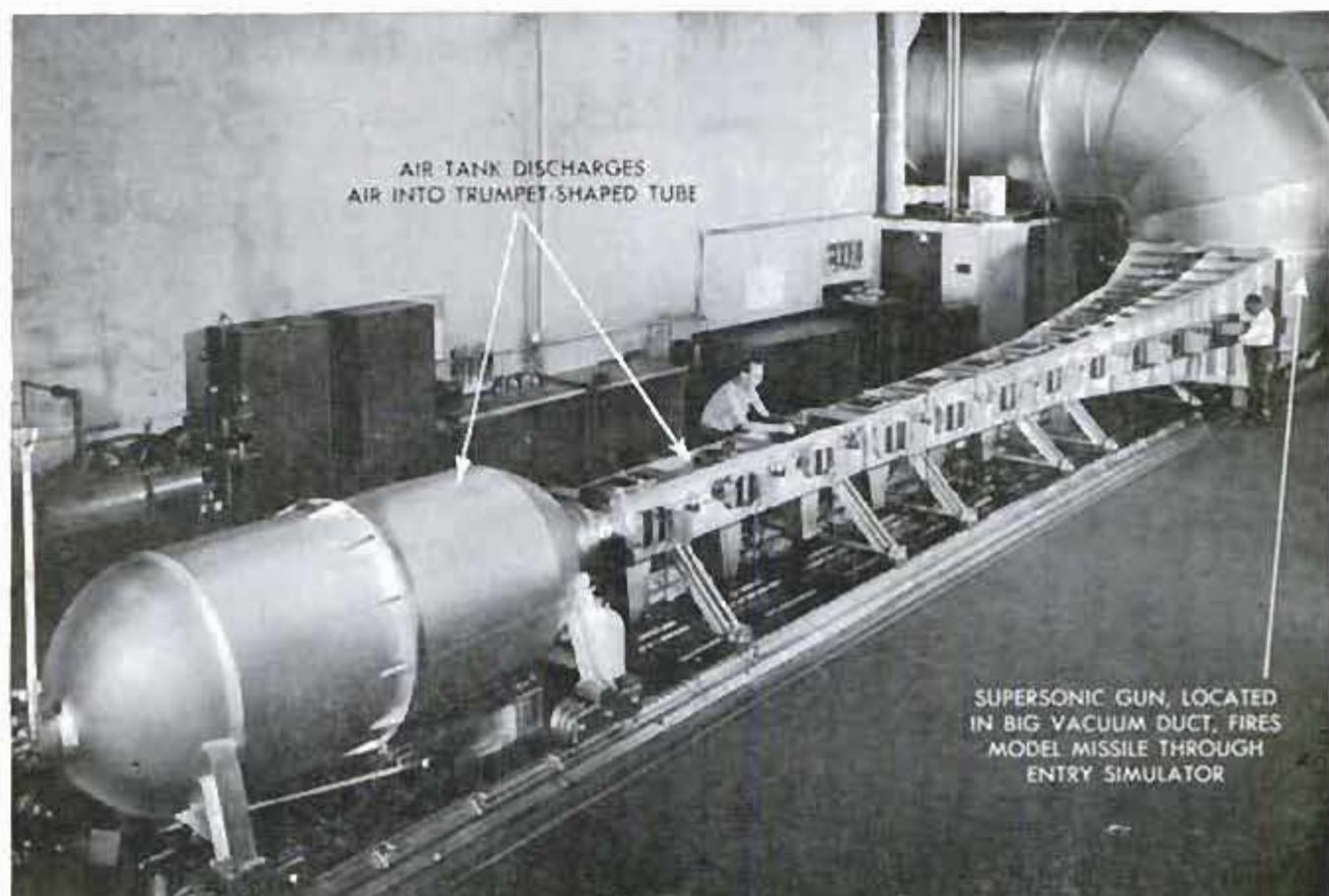
Fishermen can now set up trolling lines in ice-covered lakes and streams with the help of a rubber-band-powered sled. The sled doesn't do the actual trolling; it merely pulls a line from one ice-fishing hole to another. The fishermen then attach the bait or lure and troll the line back and forth. The sled travels 150 feet.



Simulator Determines Whether Missile Can Survive Atmosphere Re-Entry

Flight of a missile as it re-enters atmosphere can be duplicated by a simulator with a trumpet-shaped nozzle and a high-speed gun. The gun fires a model missile through the nozzle while high-pressure air

flows into the nozzle from a tank. Shadow-graph pictures record the flight. In a few thousandths of a second, the model experiences decelerations, stresses, pressures and temperatures of actual re-entry.





Resin Holds Creases in Cotton

Both of the cotton cord coats in the upper left photo have been washed and tumble dried. The coat on the left has been treated with a newly developed resin solution which makes the garment wrinkle-resistant. Photos at the left and upper right show garment being soaked in the solution and then spun dry. Cleaners with standard equipment can use the new process.



Pitched Roof Sections In Prefab Panel Package

Two men can erect a garage, tool shed or similar building in a matter of hours with 10-foot panels of 24-gauge galvanized steel. The panels are reinforced by an angle-iron frame. The pitched roof is assembled from V-shaped steel strips. The roof sections and panels are fastened together with bolts. The structure can be dismantled quickly and moved to another site. Wall panels are 6 feet 8 inches high, with windows or doors already installed.





Revolving Brush on Tractor Sweeps Away Snow

Snow can be removed quickly from sidewalks, driveways and skating ponds by using a power tractor equipped with a revolving brush. Two different types of brushes

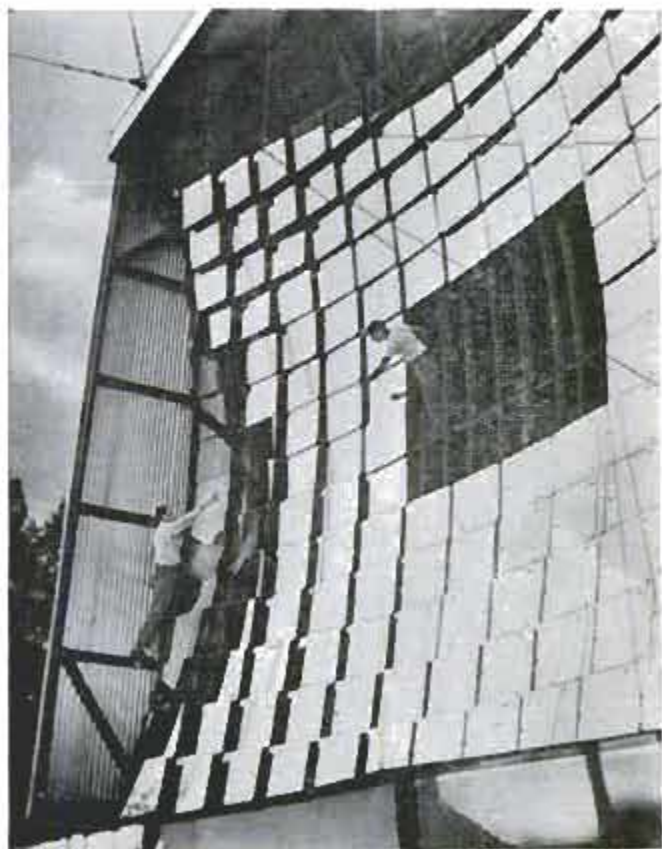
are available: One fits straight across the front of the tractor and sweeps an area 42 inches wide; the other, an angle brush, covers an area 38 inches wide.

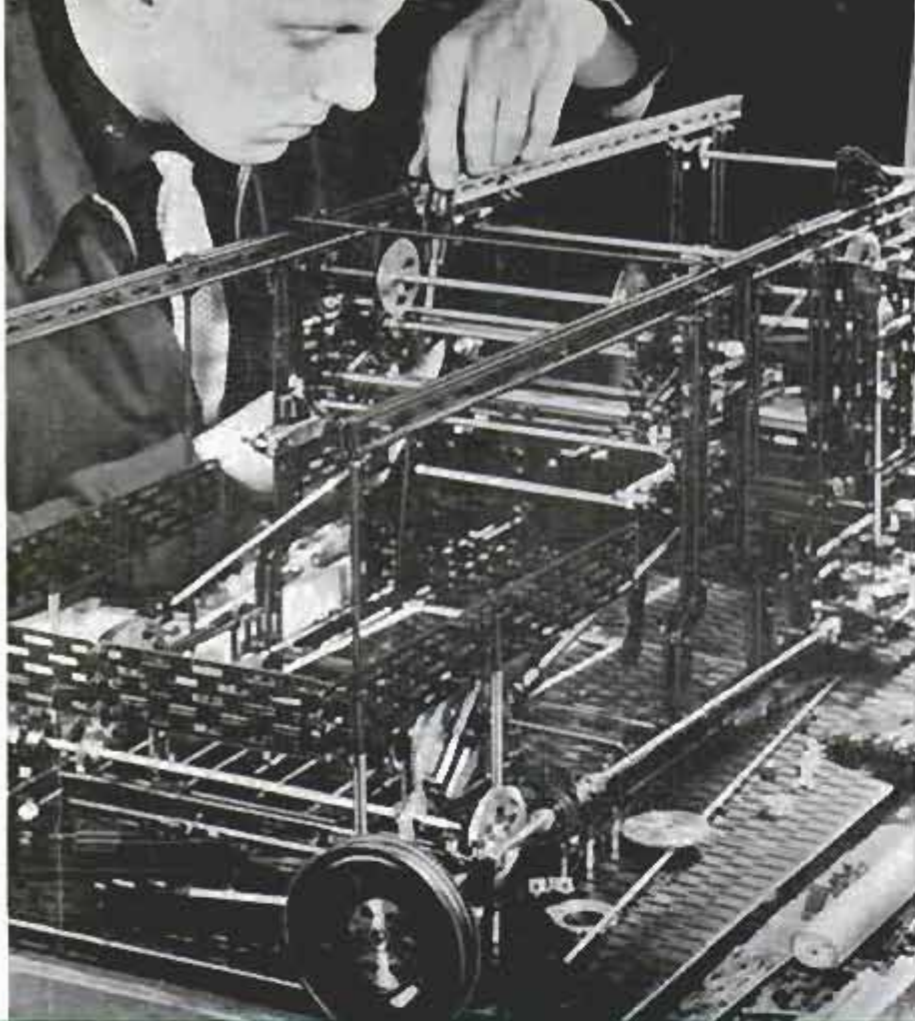
Chemical Reaction Makes Electricity

Hydrogen and oxygen, the gases that form water, can react with a catalyst to make electricity. Allis-Chalmers Manufacturing Company has developed a "fuel cell" that yields 24 volts when oxygen and hydrogen react with its electrodes.

Furnace of 180 Mirrors Simulates Nuclear Heat

Composed of 180 spherical mirrors, the nation's largest solar furnace will test materials designed to protect soldiers against thermal effects of nuclear weapons. The furnace can produce temperatures near 5000 degrees F.





Parts include several kinds of connectors for making almost any type of strong framework



←Working model of a rotary printing press takes shape from standard precision parts of kit

PRECISION PARTS FOR WORKING MODELS

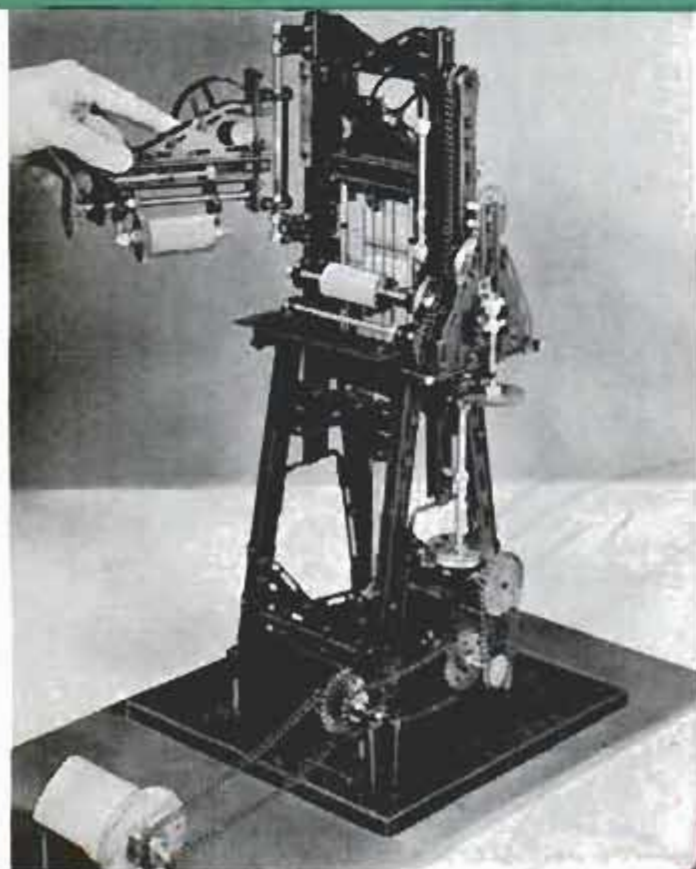
By Chris Edwards

AT FIRST GLANCE the photos on these pages appear to show a glorified construction toy. Actually the set was developed for professional engineers, designers and inventors. It consists of thousands of precision parts which can be assembled into smoothly working mechanical models. Thus the user can test and alter his plans as he works, before building an expensive scale model.

Two sets are available, one containing 2700 parts, the other, 4700. Included are gears, sprockets, pulleys, sheaves, couplings, wheels, disks, bearings, universal joints and structural parts.

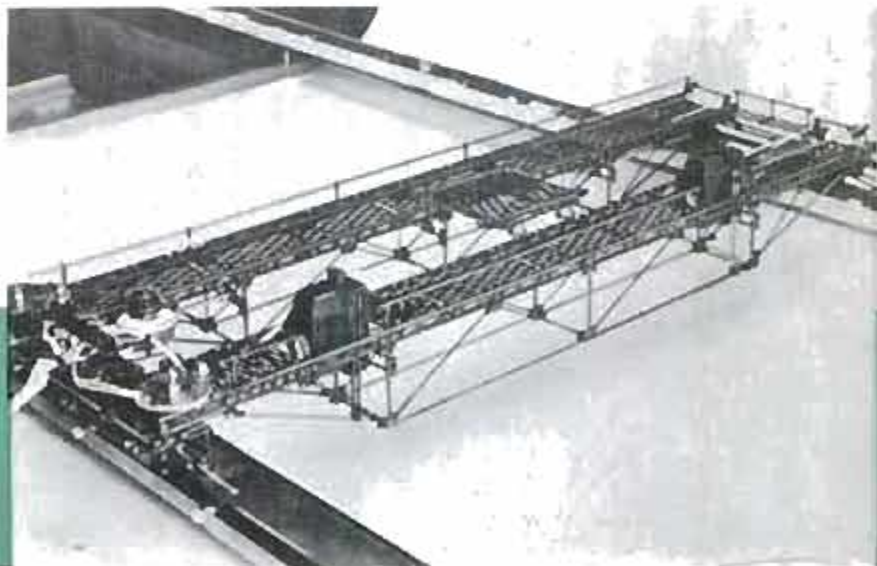
The construction set was developed in Sweden. All the parts are designed according to metric dimensions. However, those dimensions are multiples of two basic modules, permitting almost un-

Operating model of gang log saw permits design problems to be ironed out during blueprint stage





Here a vehicle's undercarriage and chassis-drive system, complete with differential, is ready for testing before elaborate scale model is made



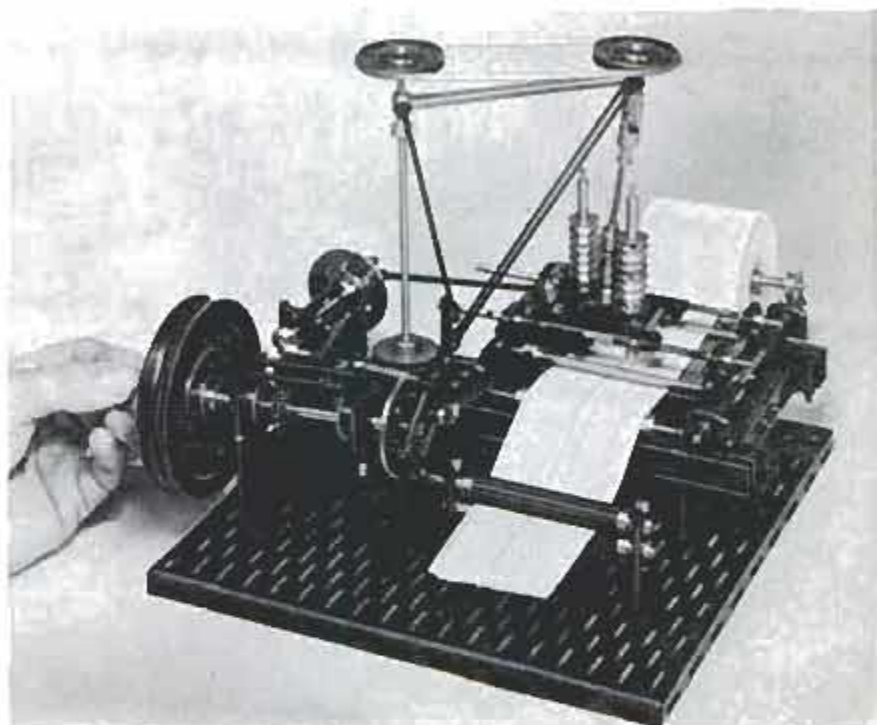
Motorized traveling crane has moving carriage and rolls along side rails. Machine actually performs life tests on two to four ballpoint pens

limited flexibility in the construction of models.

Precision shafts and the parts that fit those shafts, such as wheels, gear-wheel hubs, bushings and ball bearings, are manufactured to such close tolerances that they can actually be assembled into small machines to perform useful work.

Mechanical movements that can be constructed with the kit include reciprocating motions, slide motions, geared transmissions, differentials and rolling stock.

In each kit, the parts are selected on the basis of use-frequency calculations. Individual parts can be purchased to enlarge the kits. ★ ★ ★





Wing-tip tank for North American's T2J jet trainer is formed by exploding charge inside of special die



Above, cone is placed in die. Below, finished curved section of tank is shown alongside straight-walled original cone blank



Explosion Forms Jet Fuel Tanks

NORTH AMERICAN Aviation is using high explosives to form aircraft fuel tanks. The technique employed is familiar to anyone who has ever lighted a firecracker under a tin can and observed how the can's ends bulged out after the explosion. Industrially, the technique is simply a way of controlling explosive force. North American is using "explosive forming" to make 12-foot wing-tip fuel tanks for the T2J jet trainer now being built for the Navy. In forming the two-piece fuel tank, a cone-shaped sheet of metal about $\frac{1}{16}$ inch thick is placed inside a die of the desired shape. The cone is cut off at one end. The die is filled with water, and the air is pumped out, creating a vacuum between the cone and the sides of the die. A high explosive is then fired inside the cone, the water acting as both a force-conductor and shock-dampener. The finished tank section is removed from the containing die in the shape of the prescribed, curved mold line.

Forming with explosives instead of with conventional heavy machines simplifies production of aircraft components. North American has established a production line for the new technique: Parts and dies are wheeled down inclined rails into a water-filled pit. The forming charge is automatically fired as soon as the tool and part are in position.



Lunar Power Station

Now scientists have made complete plans to "farm" electrons on the moon. The scheme was devised by Westinghouse scientists to provide electricity for a possible lunar station. The moon, they point out, has a vacuum such as that in an electronic tube. A wire mesh similar to window screening could cover a plastic sheet coated with a light-sensitive chemical. As sun rays struck the sheet, the chemical would emit electrons which would be collected by the mesh.



Flashing Signal Light Guides Car in Garage

If you have trouble aiming a car into your garage, you can get an assist from a device that flashes a light when you drift too close to the door opening or garage wall. The light signal is actuated by a length of flexible rubber hose placed on the garage floor. The unit can be installed in 30 minutes.



Vandalproof Street Lights

Unbreakable globes for street lights are being manufactured from polyethylene, a flexible plastic material.

Embosser Labels Plastic or Metal Tags

Metal or plastic tags can be embossed on the spot with a portable labeler that's just 10½ inches long. It is operated by dialing letters and numbers, then squeezing the handle. The strips are ½ in. wide and are housed in the handle. Self-feeding through the unit, the labels are backed with adhesive.





The rear wheels of the ski-lift-driving automobile rest on cylinders placed at each end of the rotating shaft

Four skiers hitchhike by cable to a hill-top. The automobile is on the road below



AUTO DRIVES

EVER HAVE a skiing holiday spoiled because you wore yourself out trudging uphill? A young Austrian engineer has invented a solution to this problem: A "pocket" ski lift that fits into the trunk of an automobile. The device weighs only 145 pounds and is capable of lifting 150 persons an hour on any grade up to 30 percent. The inventor uses his car as a motor to drive a drum, around which a steel cable is wound. The car is jacked up on wedges, lifting the rear wheels off the ground

The front wheels are underpinned and stabilized while the rear ones drive the axle that transfers motion to the cable drum





After the cable is unwound, it is carried to the top of the hill and anchored either to a tree or pole

A SKI LIFT

and transferring their rotation to an axle, which in turn transfers it to the cable drum. The inventor then takes one end of the

The car wheel drives the drum, while the unwound cable moves freely between the car and the hilltop

cable to the top of the hill and anchors it to a pole. The cable is moved upward and downward by the motor's rotation. ★ ★ ★

Each skier holds onto this handle while being drawn uphill. The lift accommodates 150 skiers an hour



PISTON PILOTS GO TO JET SCHOOL



Author (right) and Captain Bittner, one of first pilots to take jet training, study four wheels on one unit of landing gear

THE LARGEST AIRPLANE ever used in passenger service—the Boeing 707 jet—may be moving high over your head at this moment. American Airlines now is flying this new turbine transport coast to coast on a regular schedule.

The huge plane will bring tremendous changes in air travel, changes not only to passengers, but to crew members as well. It carries up to twice as many passengers at almost twice the speed of our present airliners. Even the size is something new to a pilot. The 707 is 35 feet longer than a DC-7 and weighs twice as much. Its fuel capacity—15,500 gallons—is three times greater than that of the DC-7, and its engines deliver twice as much power.

During the training, Captain Bittner, left, is checked out in the cockpit of the 707 by author Ted Melden



Sure you can teach an old dog new tricks. Pilots with thousands of hours of flight time now are learning how to make "wet" takeoffs and what to do if a flame-out occurs

By Capt. Ted Melden

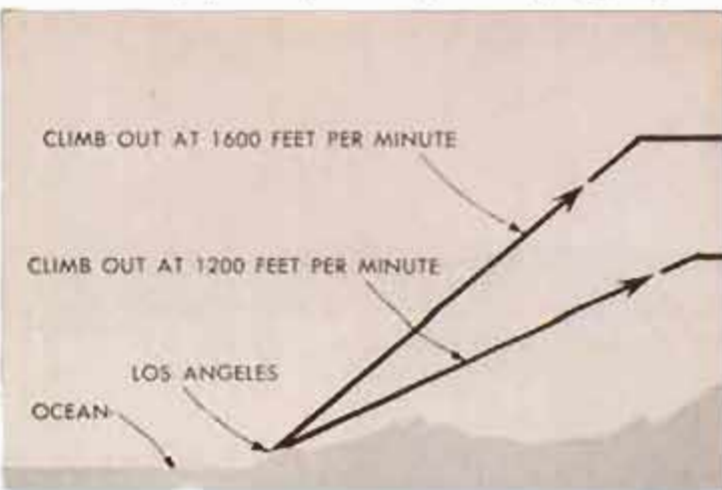
WESTERN REGIONAL MANAGER OF FLYING OPERATIONS, AMERICAN AIRLINES

There were a lot of behind-the-scenes preparations for the jet service; among other things, our veteran American Airlines piston-engine pilots had to go back to school.

The pilots had to learn the special techniques of flying the big sweptwing transports. They studied the procedures for handling them with maximum efficiency and safety. Each pilot had to pass a stiff flight examination by a Civil Aeronautics Administration official, who checked his competence under every operating and emergency condition before he was certified for jet operations.

To learn some of the new techniques, let's sit at the elbow of Capt. Si Bittner, one of

Comparative chart shows typical coast-to-coast altitudes flown by jet transport and piston-engine plane





Black smoke is caused by water pumped into the four jet engines during a "wet" takeoff on a warm day

the line pilots, while he plans today's east-bound jet flight, nonstop from Los Angeles to New York. He'll be carrying 112 passengers and 12,000 pounds of mail and baggage. Counting the 50 tons of fuel, his airplane will weigh 247,000 pounds at the head of the runway.

"That gross weight and a ground temperature of 76 degrees call for a wet takeoff," Bittner decides. "We'll reach V-2 at 7000 feet of runway and climb out at 1600 feet per minute. Cruising altitude: 28,000 feet."

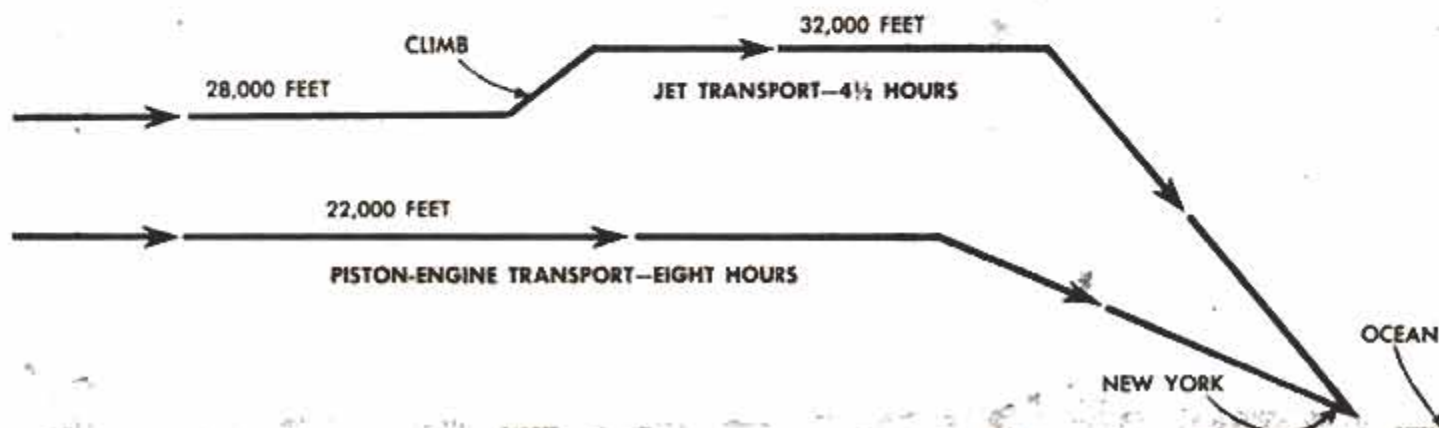
Marking all this on his flight plan, Bittner looks over the latest report on upper-air winds and temperatures. "Too cold today at 28,000 feet to use maximum cruise thrust. We'll save fuel by cruising at constant Mach instead, reducing our thrust as our weight goes down while maintaining the same speed.

"An hour and a half after takeoff we'll climb to 32,000. We'll burn less fuel at that altitude and will average 484 knots.

"We'll start our high-speed descent 99 miles out of New York and will be down close to the field in 12 minutes, right on schedule, 4½ hours out of Los Angeles."

Captain Bittner has been flying DC-7s and other transports for American Airlines and its predecessors for 30 years. He has rolled up 31,000 hours of flight time. For the last three years he has been on our nonstop transcontinental Mercury run. He is typical of the line pilots who are now flying the jet equipment.

His transition training began about eight months ago with a home-study program. His reading included a review of the behavior of high-speed aircraft, the fundamentals of jet propulsion, upper-air meteorology, and the operating procedures for





If decompression should occur, individual oxygen masks automatically drop down in front of passenger seats

the 707. That gave him the fundamentals.

More recently Si started intensive training. Six flight crews in Los Angeles and six in New York spent three weeks in ground school, with the flight engineers receiving an extra week of special instruction. Supervisory pilots, including myself, were the instructors. We had been thoroughly drilled on all aspects of the 707 at Boeing's Seattle and Renton plants this past summer. In brief, ground school consisted of detailed studies of the aircraft's structure, power-plants, and its various systems. Emergency procedures were outlined and the various standby systems were explained.

Simulator Practically Flies

Then Bittner and the others put in 13 hours in a 707 flight simulator, a mock-up of the 707 cockpit that is so complete it practically flies. If you move the controls to put one wing down, the imitation terrain that you see through the cockpit windows actually rises just as it would during a turn in the air.

In this simulator the crews rehearsed the procedures for lighting up the engines, taxiing, taking off and maneuvering. They practiced various cruise procedures just

as would be necessary in actual flight.

Later, each flight crew spent 12 hours in the air in a 707, half the time doing the actual flying and half the time observing while another crew was at the controls. Finally, each flight-crew member underwent the two-hour CAA certification examination and the final AAL equipment check-out.

Basically, the crews learned that flying a turbine-powered transport is about the same as flying a piston-engine plane. In detail, however, there are quite a few differences.

Warm Weather, "Wet" Takeoff

One example is the way that power is built up to takeoff rating. In warm weather a pilot will take off "wet," pumping 4000 pounds of demineralized water into the engines during the first two minutes of flight. The reason for using water injection is that on a warm day the air is less dense than on a cold day, and the engines don't develop as much power. By using water, a denser air flow is created in each engine, allowing it to develop its full 13,000 pounds of thrust.

Any time you see black smoke pouring from the engines of a jet airliner during takeoff, the takeoff is wet. After climb-out

the pilot jettisons any water remaining in the tanks to prevent its freezing at high altitude and clogging the lines.

Low temperature on the ground provides good thrust for takeoff but low temperature at high altitude causes high fuel consumption. Our line pilots study the forecast of temperatures they will encounter at high altitude to help decide the cruise procedure they will select for a flight.

If the temperature is relatively warm, say 35 degrees below zero, they will fly at maximum cruise thrust. This gives reasonable fuel consumption and allows the plane to fly continuously faster as the weight of its fuel is burned.

But if the temperature is below minus 48 degrees the pilot probably will select a different cruise procedure. He may use the constant Mach method that Si Bittner chose above, or he may go for a constant altitude, long-range cruise. This is a fuel-saving method that is favored for long overwater flights or against strong headwinds. The best cruise procedure can save as much as two tons of fuel per hour. Pilots aren't worried about the cost of the fuel, of course; they merely want to retain a surplus beyond the CAA reserve that is required in case the plane must be diverted to an alternate field or must delay its landing on account of traffic.

An important part of pilot training is a study of the medical aspects of high-altitude flight. At 30,000 feet the air pressure is less than a third the pressure at sea level and there isn't enough oxygen to keep you conscious for long.

The airplane is pressurized to equal an altitude of 3500 feet, so passengers and crew are perfectly comfortable. The fuselage is built like a spaceship, a pressure vessel, to withstand this difference in pressure. There's virtually no chance of leakage; nevertheless precautions are taken against what is called rapid decompression.

Oxygen Mask Drops Into Place

First of all, if cabin pressure ever drops below 14,000 feet, an oxygen mask automatically drops from overhead in front of every passenger seat. All a passenger needs to do is pick up the mask and hold it

(Continued to page 232)



Noise suppressors on each engine materially reduce amount of noise reaching the ground during the takeoff run and climb

Flight engineers, along with Boeing and American Airlines officials, study mockup of the jet's surface-control system



Family enjoys the flight in one of the luxurious lounges of the huge new jetliner. Windows are triple-paned for safety





Radar for British Jet Fighter Fits Inside Air Intake

Housed in a bullet-shaped container, Britain's newest airborne radar fits inside the air intake of jet fighters. The equipment gives navigational instructions to the

pilot, enabling him to intercept the target and lock the beam onto it. Then the radar tracks the target, feeding information to the equipment's sighting system.



Locomotive Tipped Over To Instruct Crew

When officials of the German Federal Railways wanted young train crews to get practice in putting an overturned locomotive back on the rails, they didn't wait for an accident to happen. Instead, they steamed an old iron horse out of retirement and tipped it over. The crews, training for future rescue work, placed hydraulic presses under the 70-ton locomotive and had it back in position within 60 minutes — standard time for such an operation. As was expected, the most ticklish part of the job was getting the wheels exactly in place.

How Deep Is the Ocean?

Deepest ocean depth plumbed by the U. S. Coast and Geodetic Survey is 25,093 feet below sea level, south of the Aleutian Islands. It was measured by a sonic depth recorder.

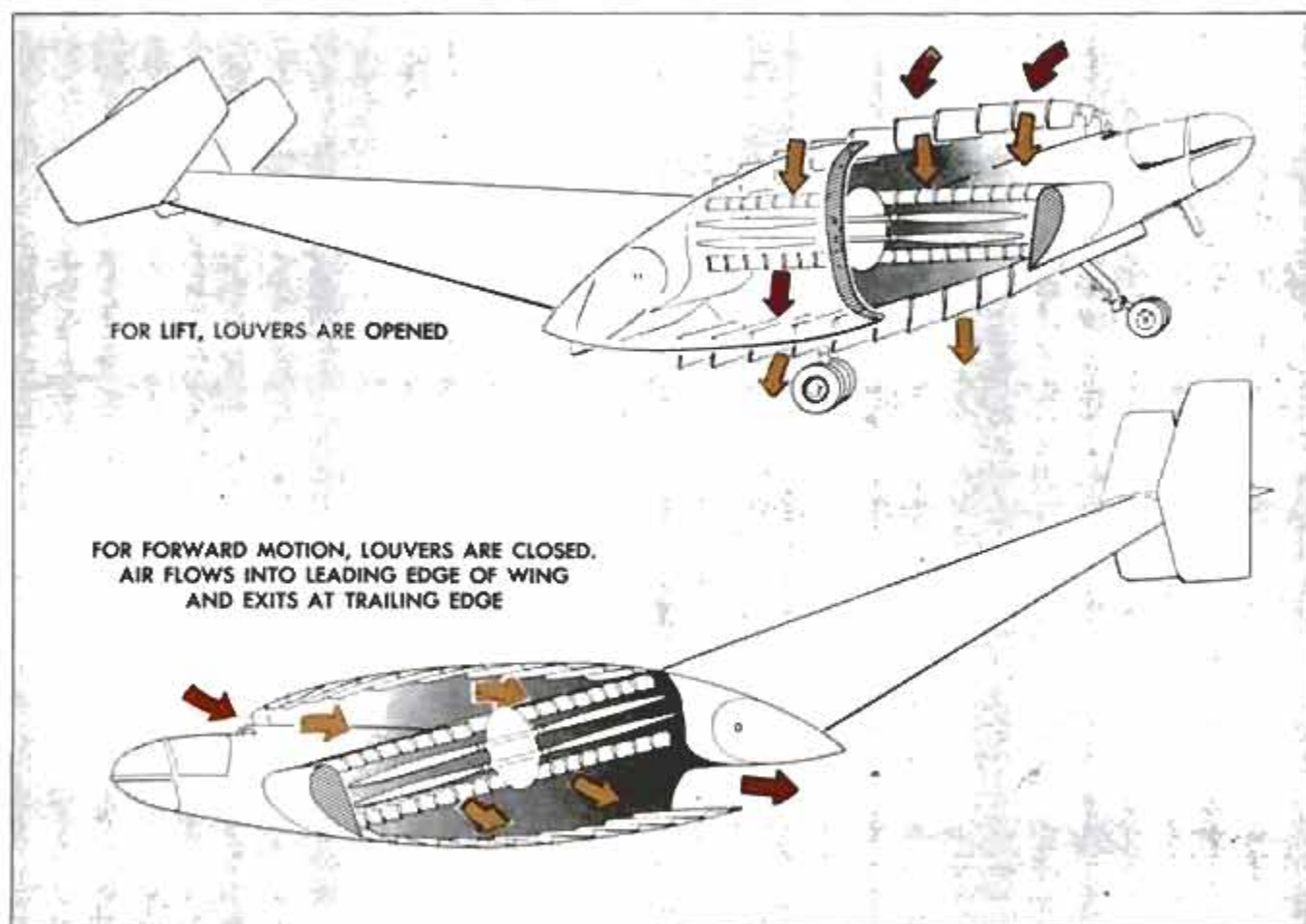


Courtesy Goodyear Aircraft Corp.

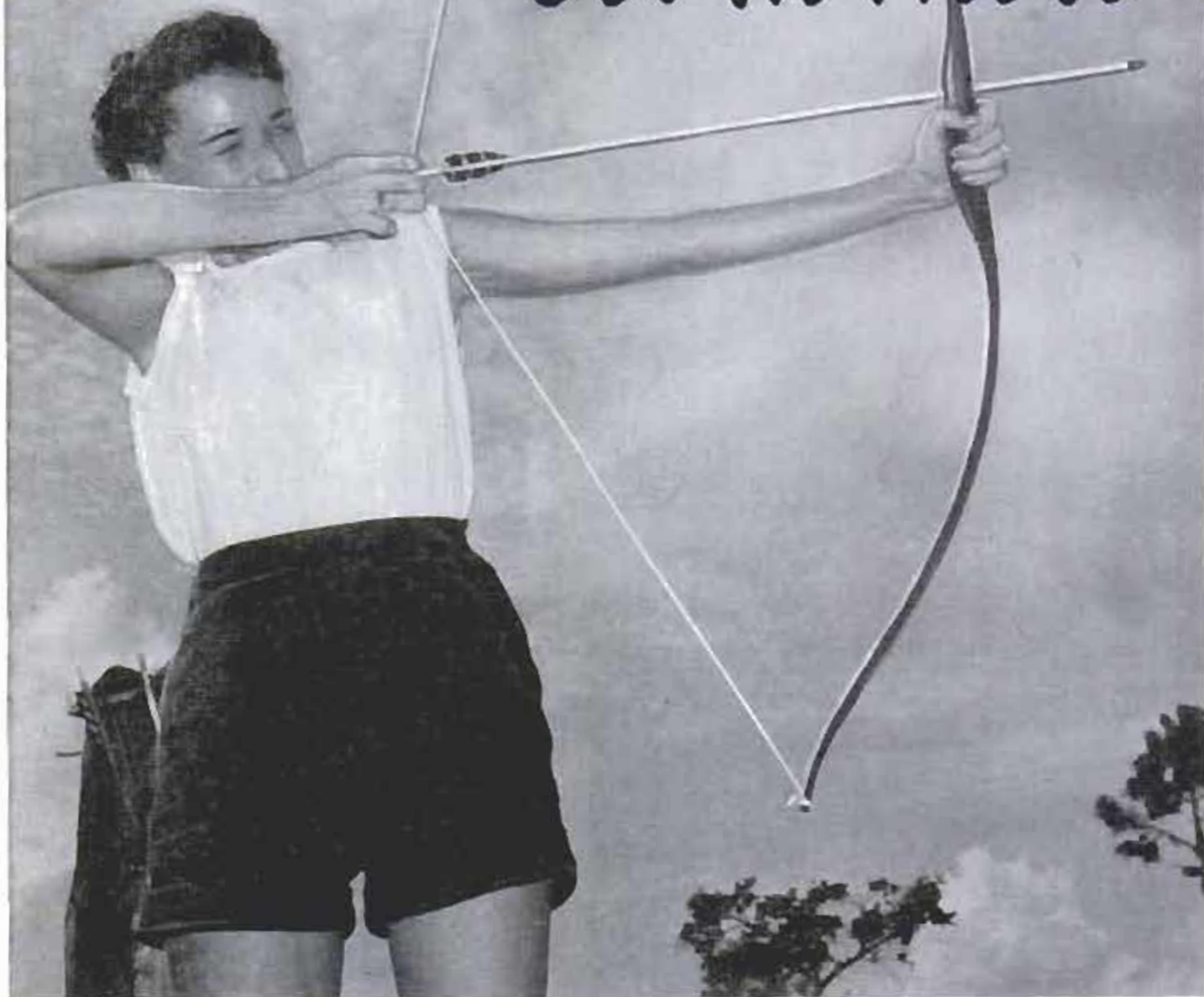
"Helicopter Plane" Has Wing Louvers

BY SIMPLY CHANGING the direction of air flow, a plan for a new type of Army aircraft combines helicopter and airplane characteristics. The Convoplane, as the craft is called, would be powered by two large rotors housed in the combined wing-fuselage area. To fly vertically, the pilot would open louvers or slats on the wings, allowing air to flow vertically as in a heli-

copter. In forward flight with louvers closed, air would enter at the leading edge of the wing, be directed through the rotor blades, and exit at the trailing edge. Small vanes would aid in changing the direction of flow. The Convoplane can be designed as a small, light plane for reconnaissance, or it can be built larger and used to transport materiel.



Here's a Get In There



At Weapons of the World near Winter Haven, Fla., a guest tries a bow reminiscent of Robin Hood's day

By Max Hunn

HAVE YOU ever wanted to swing a Civil War cavalry saber? Fire a cross-bow? Or perhaps crack a bullwhip?

Those who have such desires will be interested in a new attraction near Winter Haven, Fla., where visitors can wield these strange weapons or use blowguns, slingshots, a battering-ram, a catapult, knives, bows and spears.

This unique establishment is not a museum, although many of the weapons are ancient enough to warrant museum interest. Instead, it's a place where the visi-

tor is urged to participate, whether it be shooting a longbow, tossing a spear or javelin or using blowguns or boomerangs.

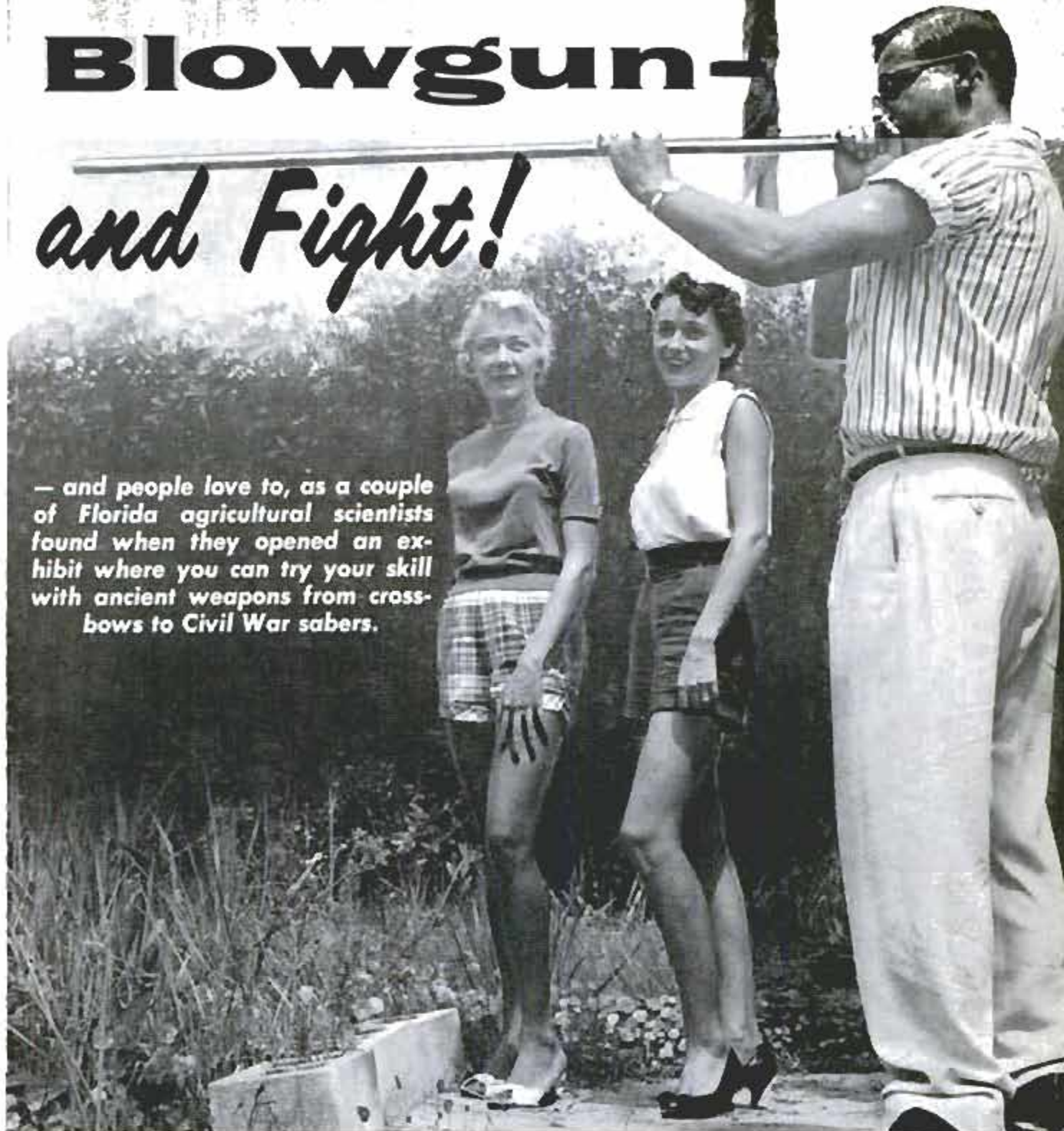
Known as Weapons of the World, it's the brain child of two Ph. D.s, neither of whom previously had any experience or interest in weapons of any type. Martin Muma, Ph. D. in entomology from the University of Maryland, and Joseph McBride, Ph. D. in chemistry from the University of Delaware, are the originators.

Weapons of the World is a part-time project with Muma and McBride, who

Blowgun-

and Fight!

— and people love to, as a couple of Florida agricultural scientists found when they opened an exhibit where you can try your skill with ancient weapons from crossbows to Civil War sabers.



Puffing a blowgun is one of the rare experiences a tourist can have at the unique Florida weapons exhibit

earn their living as scientists with the University of Florida citrus experiment station at Lake Alfred, Fla. But when not engaged in studying scientific problems connected with Florida's citrus crop, they're busy supervising their new business, repairing broken equipment, replenishing their supply of darts and arrows, and now and then taking a turn at guiding visitors around the establishment.

They've collected their unusual assortment of weapons from all over the world. The insect expert, Muma, has just finished collecting specimens

Martin Muma repairs a 17th century crossbow. Muma and a fellow scientist, Joseph McBride, originated the exhibit

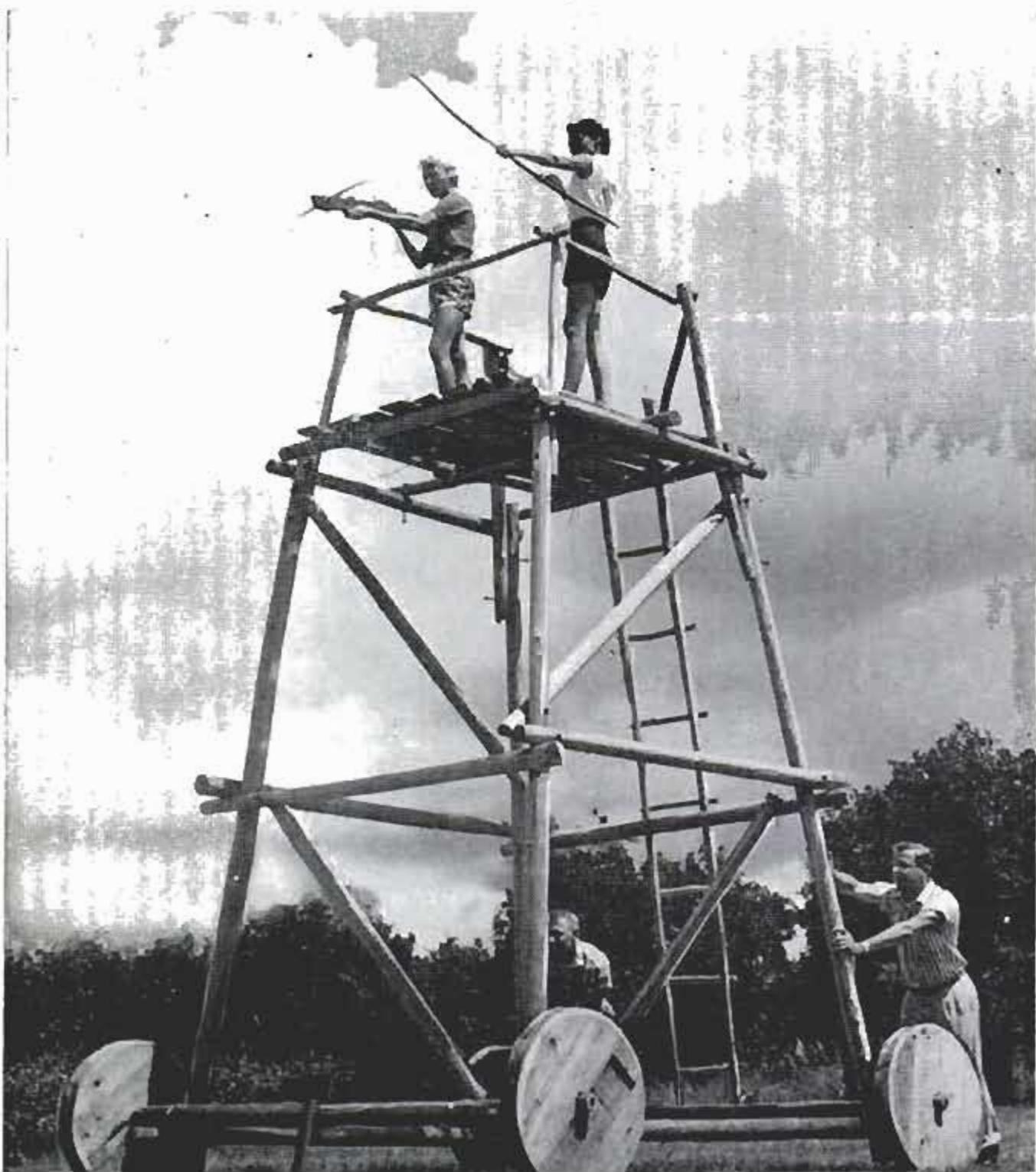




Those who like to swing the Civil War cavalry saber have a post to slash. The post has to be replaced about twice a month. At the right, a guest demonstrates the proper crouch in firing the Pygmy bow



The Romans didn't have such attractive warriors, but they did have assault towers like the one shown here



While they've bought some weapons — including the 17th century crossbow—most of their prizes have been obtained from friends in such distant places as Rhodesia, Thailand and Japan. John Hamlet, of Ocala, Fla., the famous falcon trainer, has provided them with a complete assortment of Philippine blowguns, krises (daggers) and similar weapons.

What they haven't been able to buy or borrow, they've reproduced themselves. An assault tower of the type used by the Romans to storm walled cities has been reproduced, with solid wooden wheels. They've also built a crude battering-ram, used to knock down a specially made wooden door. People like to engage in this unorthodox type of door knocking. A homemade catapult lobs coconuts instead of rocks or dead animals, as was customary during the days when this was a mighty weapon of warfare.

Operating the unusual establishment has resulted in a quota of unusual incidents, and has led Muma and McBride to revise their estimates of what the public will do.

They've found they always encounter a psychological block when the visitors first arrive. Conditioned by years of "don't touch" signs, the average visitor is at first reluctant to handle a weapon, let alone operate it. This is especially true of adults. But once the ice is broken, young and old waste no time in accepting invitations to use the various weapons.

Muma and McBride have found

Shooting a crossbow is an exciting experience. In fact, it's the favorite weapon of both men and women who visit the exhibit



Using coconuts instead of rocks, Martin Muma shows how war-makers of old used to catapult objects inside a walled fortress

The proprietors of Weapons of the World set up this battering ram and door so guests could take part in "storming a fort"





McBride, shown here, and Muma manufacture their own arrows and darts. Patrons use 1000 a month

that their guests use an average of a thousand darts and arrows a month.

In studying their visitors, Muma and McBride have discovered that the popularity of the various weapons varies with the sexes. Men generally prefer the crossbow, throwing knives, longbow, blowgun, bullwhip and saber in that order. The women, on the other hand, prefer the crossbow, blowgun, longbow, throwing knives and modern pistol crossbow. ★ ★ ★

Weapons have been collected from all over the world. Right, a visitor hurls an African broad-leaf spear

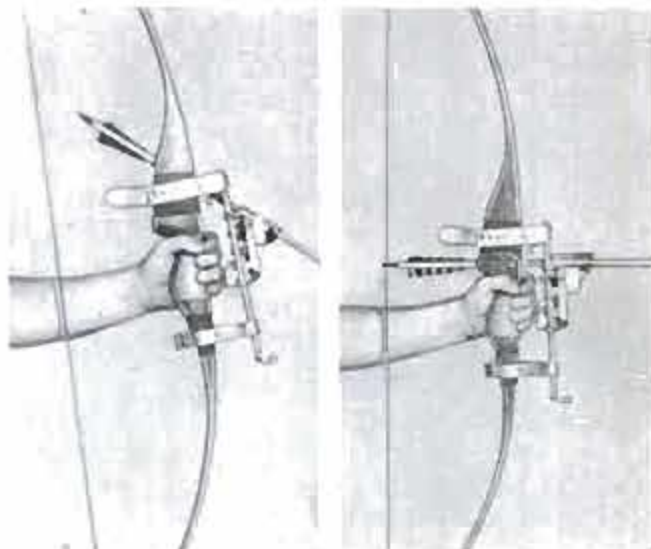
Bullwhips have all but disappeared from our society. At Weapons of the World you can still crack one





"REPEATING" BOW

Archers can get off two arrows in short order with an "automatic loader" attached to the bow. The loader is clamped to the handgrip and the spare arrow is slipped into a holder, which pivots to a vertical position. The archer then holds another arrow in the normal hunting position. Upon spotting the game, he shoots the first shaft. The "kick" of the first arrow trips the loader, which instantly swings the second arrow into the bowstring. As this arrow is drawn, the holder is released and drops from view. The automatic loader is installed with aluminum mounting straps.



German Microprojector Permits Group Viewing and Accurate Tracing



Several persons can study microscopic subjects at the same time with a new microprojector designed in Hamburg, Germany. The picture is projected on a screen. A mirror attachment can deflect the picture downward onto a sheet of drawing paper so that accurate tracings can be made. The subjects can be photocopied in a darkroom by using the projector and a plate film. In the daylight, photocopying can be done with the projector and a special camera attachment. The mirror of the microprojector absorbs the infrared rays generated by the lighting unit. The result is a practically heat-free light for projection, thus, delicate living microorganisms can be studied.

CRASH SEAT

ERNIE CLEMMONS has had more than 200 head-on collisions, and he hasn't a scratch or bruise to show for them.

Ernie works for the Protect-O-Matic Corporation of Tonawanda, N. Y., an automotive safety-research organization that uses human drivers instead of electronic dummies in test crashes.

What saves Ernie Clemmons as he rams his automobile head-on into another at a speed of 50 miles per hour? A simple device that upon impact tilts the car's front seat backward instantly to a 30-degree angle, preventing the driver and passengers from being thrown forward into the steering wheel, dashboard or windshield.

Here's how it works: A trigger bar, resembling a chrome bumper guard, is mounted on the front of a car in the same manner as a bumper guard. When the bar is struck at speeds exceeding seven miles per hour, hydraulic fluid flows through steel tubing and moves two scissorslike linkages into action under the front seat. These mechanisms pull the seat forward on

slides and tilt it back 30 degrees. On impact, then, the driver and his passengers "sit out" the crash as if they were sitting back in an adjustable lounging chair. The force of the impact is absorbed by hips and thighs.

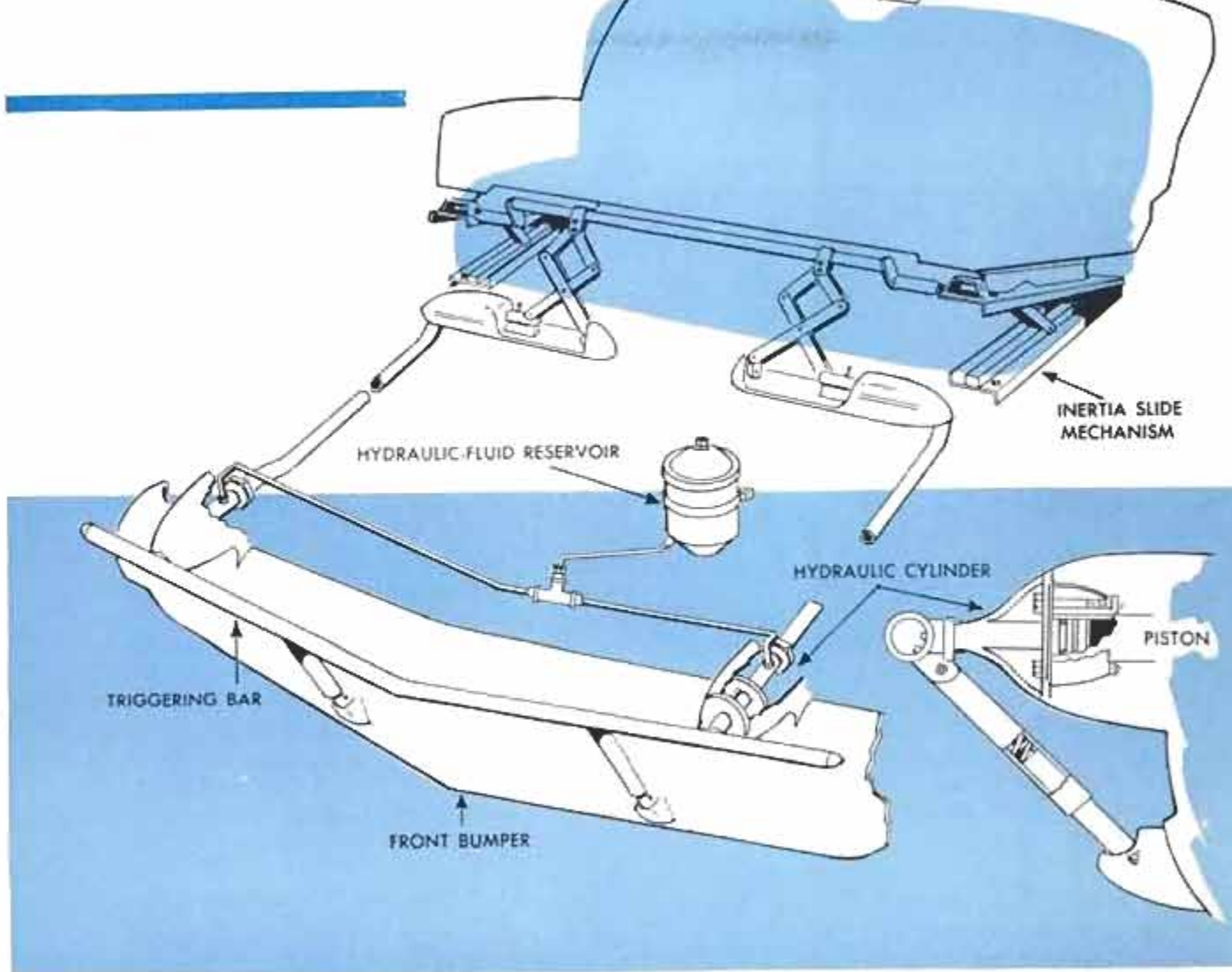
The system can be installed so that it automatically turns off the ignition and applies the brakes when activated. In a 50-mile-per-hour crash, says Protect-O-Matic Corporation, the driver and his passengers are placed in protective position within .0031 of a second.

Neither safety belts nor helmets are needed. Except for the trigger bar, a car equipped with the new safety device appears no different from any other. The steel tubing and a reservoir the size of an oil filter are placed under the car's hood. The two steel slides and steel linkages cannot be seen under the front seat.

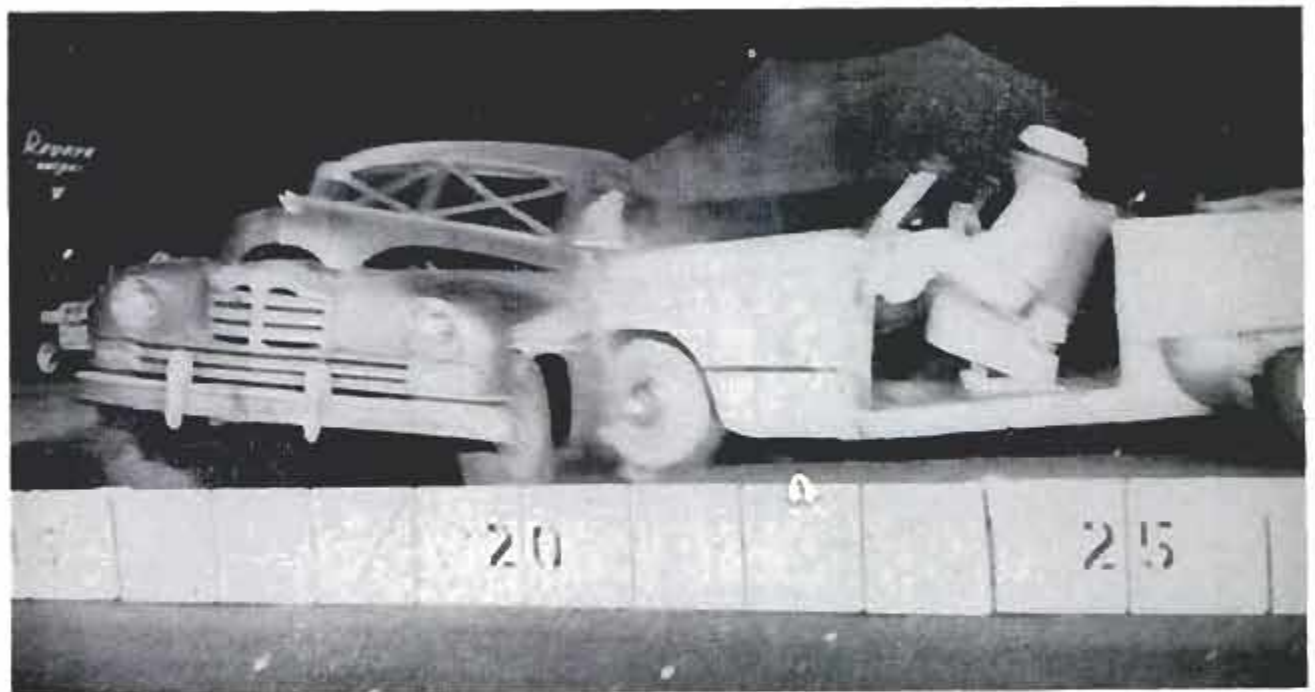
The unit weighs 85 pounds. It can be installed in about two hours. The hydraulic system is self-bleeding to insure that it's in working order when needed. ★ ★ ★

Passengers in crash position. Seat tilts within .0031 of a second following 50-mile-per-hour head-on





Using the crash seat shown above, test driver Ernie Clemmons has survived 200 crashes like the one below





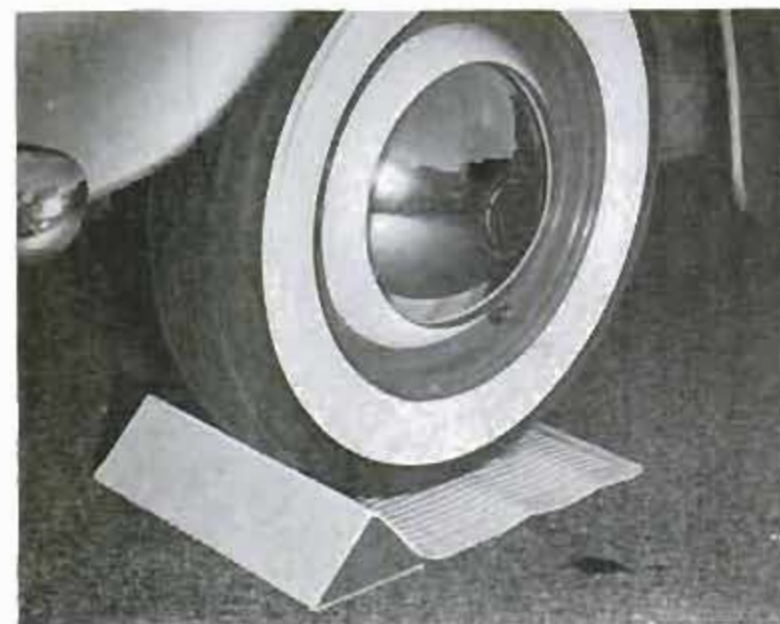
Foamed Aluminum Handles Like Wood

So light that it will float like wood, a new metal called foamed aluminum may be used as a basic construction material. After the molten aluminum is poured, hydrogen bubbles form. On cooling, the metal is honeycombed with gas cells, resulting in a light, strong material that can be sawed, nailed, cemented, screwed or bolted.



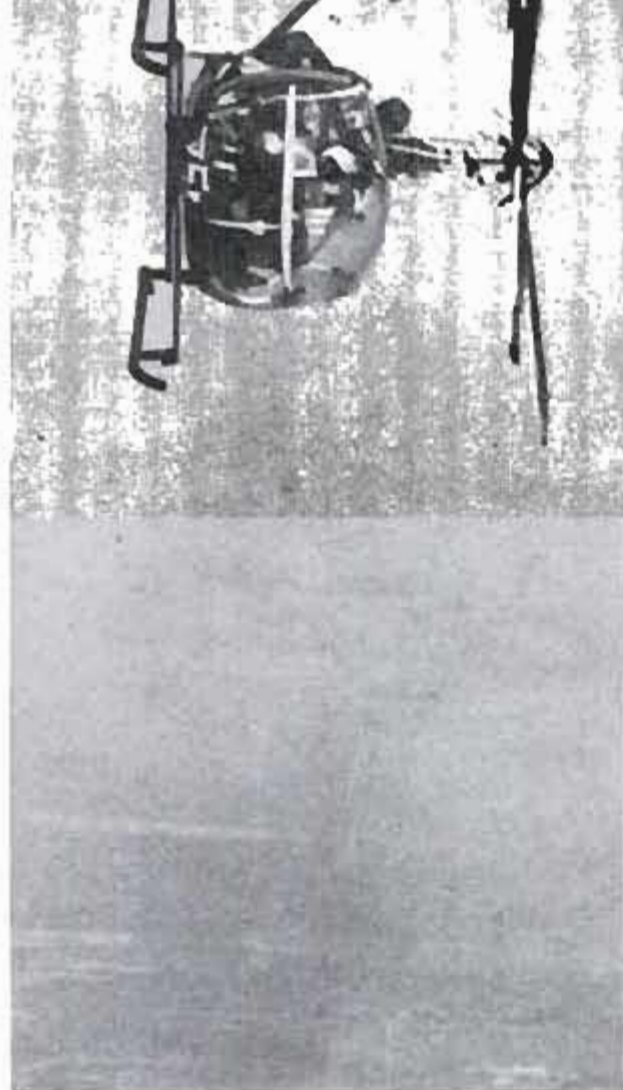
Rocket Gliders Could Circle Globe

Piloted, long-range rocket gliders that can circle the globe at near-satellite speeds are within technical reach. Ryan Aeronautical Company's design studies indicate that present-day structural designs, metals and rocket power plants are capable of hurling gliders around the world in little more than two hours, at altitudes of 40 miles or more. Such a rocket glider would hit its high point of flight three minutes after take-off. The gliders would put men into space for extended periods so that effects of space travel could be studied.



Rubber Stop on Floor Prevents Garage Damage

When you drive into the garage, do you sometimes edge the car too far forward? A rubber stop helps prevent damage to lumber, garden tools, bushel baskets and other things that are directly in front of the car. You align the stop with a front tire, leaving enough room between the bumper, fenders and garage walls for walking space. The car rolls to the marker and then stops. The marker will not slip. It is colored a high-visibility yellow and has red reflectors for after-dark guidance. Ribbed design enables marker to be cleaned easily.



The 12E has demonstrated great maneuverability and 24 percent more power than any other light copter

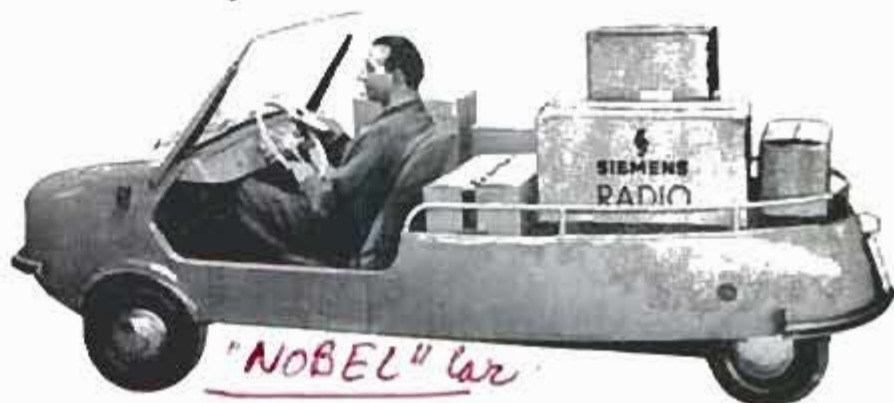
Hiller's Light Helicopter Is Highest-Powered in Its Class

With a 305-horsepower engine, Hiller Aircraft's new 12E helicopter becomes the highest-powered copter in the light class. The three-place utility craft is expected to be a popular seller in the civilian market.

It is a higher-powered version of the H-23D Raven, which the Army is using for observation, light utility and as a trainer for helicopter pilots. The 12E has 24 percent more power than any other in its class.

Build-it-Yourself Auto Travels Nearly 100 Miles to the Gallon

Now you can buy a car in a kit and build it yourself. Packaged in Britain, with a German engine, the car comes in sedan and truck-convertible models. Its top speed is 50 miles per hour and it goes nearly 100 miles on a gallon of gas. The engine has a British rating of 10 horsepower.



FEBRUARY 1959

149
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 1, GT. CUMBERLAND PL.
 MARBLE ARCH, LONDON W. 1

'Round the clock, huge construction crews are tearing down slums, building skyscraper homes and blasting superhighways through the mountains to herald a

Big Change

By Clifford B. Hicks

PART II

IN A BREAKNECK RACE to lift themselves into the jet age, impatient Venezuelans are altering the face of their country overnight. Particularly is this true in Caracas, the nation's capital, and other large cities. As you ride through Caracas, bizarre and richly colored skyscrapers on every side give you the feeling that you are riding through the city of tomorrow.

The skyline represents oil—oil transformed into lofty buildings. Venezuela is determined to raise its standard of living pronto, and is financing its incredible effort with income from vast oil deposits.

Consider the matter of housing. For decades, workers in Caracas have lived in tiny shacks of mud or scraps of wood, carved into the mountainsides. Sanitary facilities have been nonexistent, and water has been toted up steep slopes in tin cans.

Then came the world's biggest slum-clearance project, completed in three leap-frog phases.

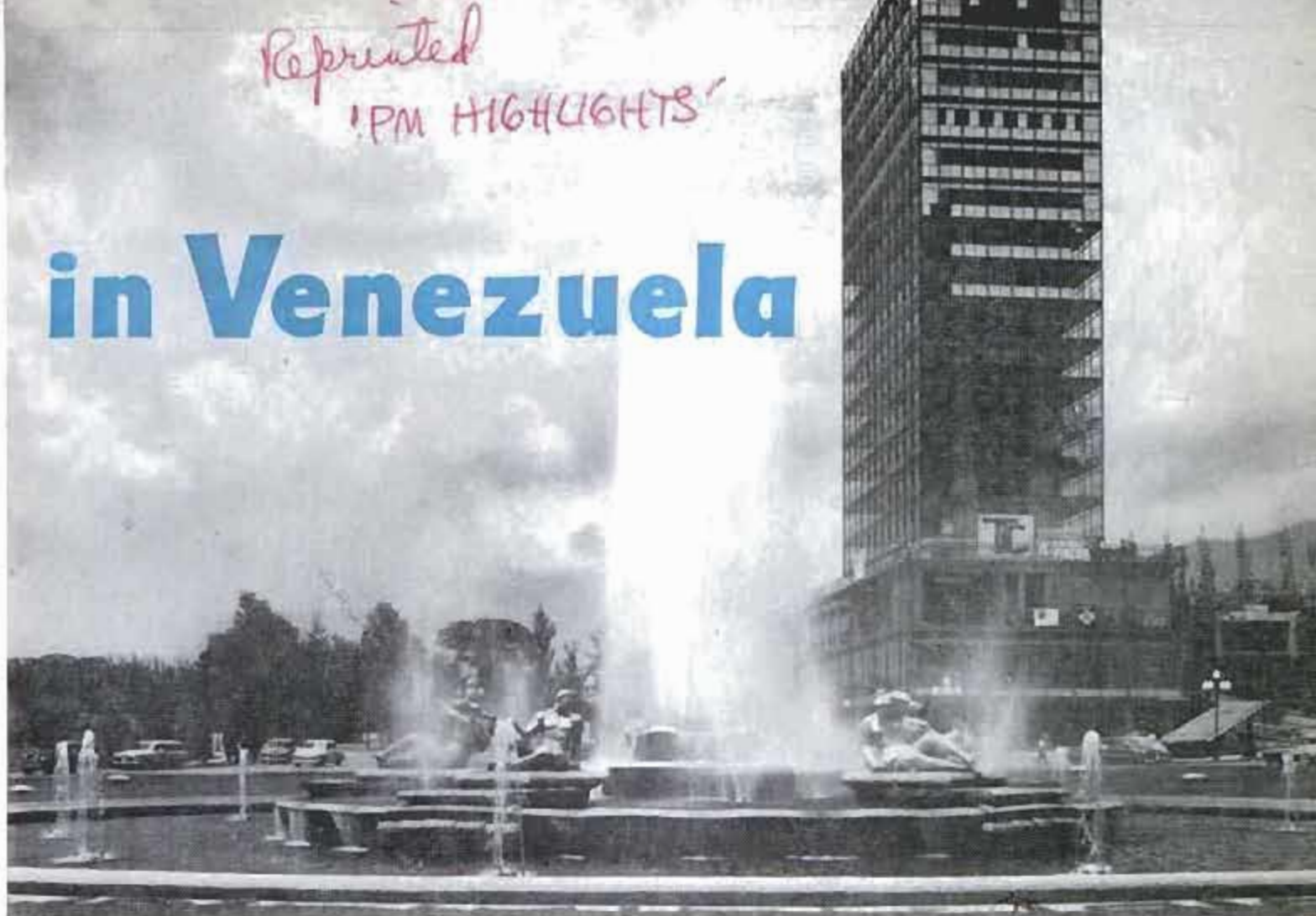
In the 1955 phase, bulldozers rumbled into action, scraping away the entire side of a mountain. By the first of July the site was cleared and ready. From then on, the speed of construction was unbelievable. By

←Some natives still live in vilages built above the water, walking to and from shore on high stilts



Reprinted
'PM HIGHLIGHTS'

in Venezuela



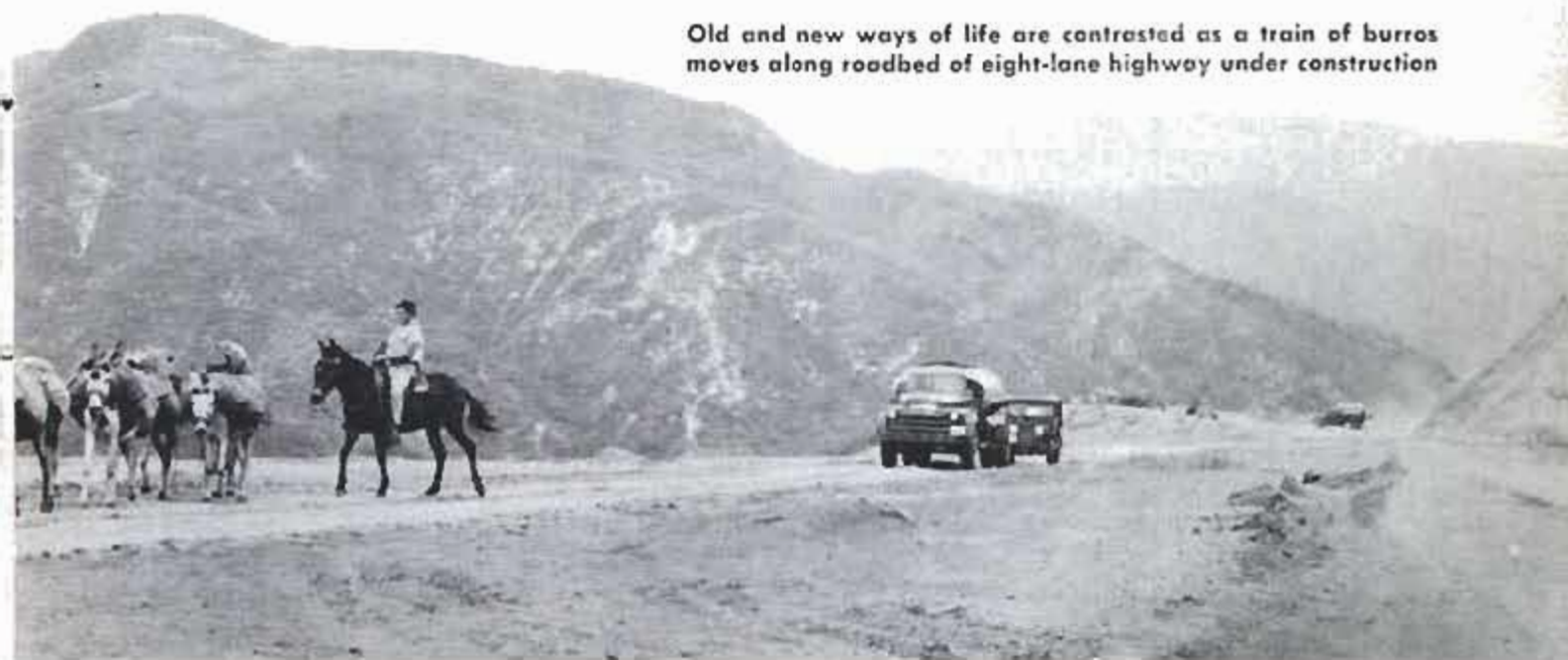
Towering skeleton of steel was erected in Caracas, then big office building grew floor by floor overnight

the second of December, 13 magnificent apartment buildings, each 15 stories high and 10 apartments long, complete with elevators, were ready for occupancy. Many four-story apartment buildings also were built. Workers from an area of concentrated slums quickly were moved into the 2366 attractive and spacious four and five-room apartments.

Immediately, bulldozers moved in to smash over their former homes. Again in

1956, by the first of July, this area of slums had been cleared and was ready for construction. By December, 16 new apartment-skyscrapers were ready for occupancy. As soon as these were occupied, more vacant shacks were razed to make room for the third project. It was completed in 1957 and consists of 20 super-apartment buildings. The speed of construction is phenomenal on such projects. There are three shifts of workers, thousands of men to each shift,

Old and new ways of life are contrasted as a train of burros moves along roadbed of eight-lane highway under construction





Amazing rate of construction is illustrated in two photographs, taken just five months apart in Caracas





Oil—oil by the millions of barrels—is pumped up from beneath Lake Maracaibo to pay for the big change

and the buildings actually appear to grow, floor by floor, overnight.

Six more 15-story blocks are under construction. Other housing projects are under way both in Caracas and in other cities, but Venezuela admittedly has a long way to go to clear its vast slum areas.

The buildings are daring, both in design and appearance. For the most part they are sparkling white, but huge panels, painted at random in bold hues, produce a stark and colorful effect. Sections of construction tile, set on their sides, make a lacy mosaic up the sides of the buildings. These open tiles form the open walls of the apartment kitchens, providing air conditioning in a climate that approaches the ideal anyway.

Nestled around the tall buildings are schools, theaters and shopping areas, all built simultaneously with the apartments. And there's a whole series of "beisbol" diamonds, for baseball is the national sport of Venezuela, too. (In fact, baseball is almost a cult. The banner headline on the front page of one of the Caracas newspapers during my visit concerned the record of Saturnino Orestes Minoso, better known as Minnie throughout the beisbol-playing world.) The huge new baseball stadium in Caracas seats 35,000 spectators,

Complicated but efficient cloverleaf serves traffic entering Caracas from section of Pan-American Highway





Daring in design is the Helicoid, being built in spiral around a small mountain. Shoppers will drive up "through" the building

and there isn't a post to obstruct your view in the entire structure.

By 1960 the existing skyscrapers of Caracas will be overshadowed by a new building still more daring in design and unique in concept. This 25-story structure will be built in a spiral around a mountain. The "Helicoid" or "spiral in space," built with private funds, will cost \$25,000,000. Already the miniature mountain has been bulldozed into the shape of a cone with a spiral up the side. When the Helicoid is finished, shoppers will be able to drive up a spiral road right "through" the building, and shop on both sides of the ramp.

Venezuelan architecture, bizarre in appearance, features sheer walls, elaborate

mosaics and panels painted in brilliant colors. For the most part, the new buildings have skeletons of reinforced concrete. Curtain walls of concrete block or glass are built up around the skeletons. This type of construction, along with the highway-building program, has produced a soaring demand for cement. The ideal occupation in Venezuela would appear to be that of cement salesman. The largest cement company in Venezuela is raising its capacity from 2780 to 4600 tons per day!

Auto traffic, that bane of the high-speed world, is causing growing pains in Venezuela, too. Caracas, like a jewel in an exquisite setting, lies in a beautiful mountain valley only nine miles from the seacoast, but the elevation of the city is 3000 feet. A mountain

range intervenes between the city and the coast. Five years ago the only access to the city was via a perilous two-lane road that wound for 21 miles and 365 curves through a spectacular but dangerous spur of the Andes. Accidents were common, and an accident could well send you tumbling down 1000 feet of mountainside. Today you can travel the six-lane Autopista from the coast 11 miles into the center of the city, where you pick up another superhighway that slices through central Caracas, dipping right under the two 30-story towers of Bolivar Center.

Southeast of Caracas 300 miles, in an area that was virtually uninhabited a few

(Continued to page 226)

Administration building of petrochemical industry is typical of ultramodern architecture of the new Venezuela





Miniature Electric Motors Develop High Speeds

Tiny electric motors built by Joseph d'Haens of Belgium run on either a.c. or d.c. They draw one to four volts with speeds up to 6000 r.p.m. The coin in the photo is three fourths of an inch wide.

Closed-Circuit TV Patrols Stream

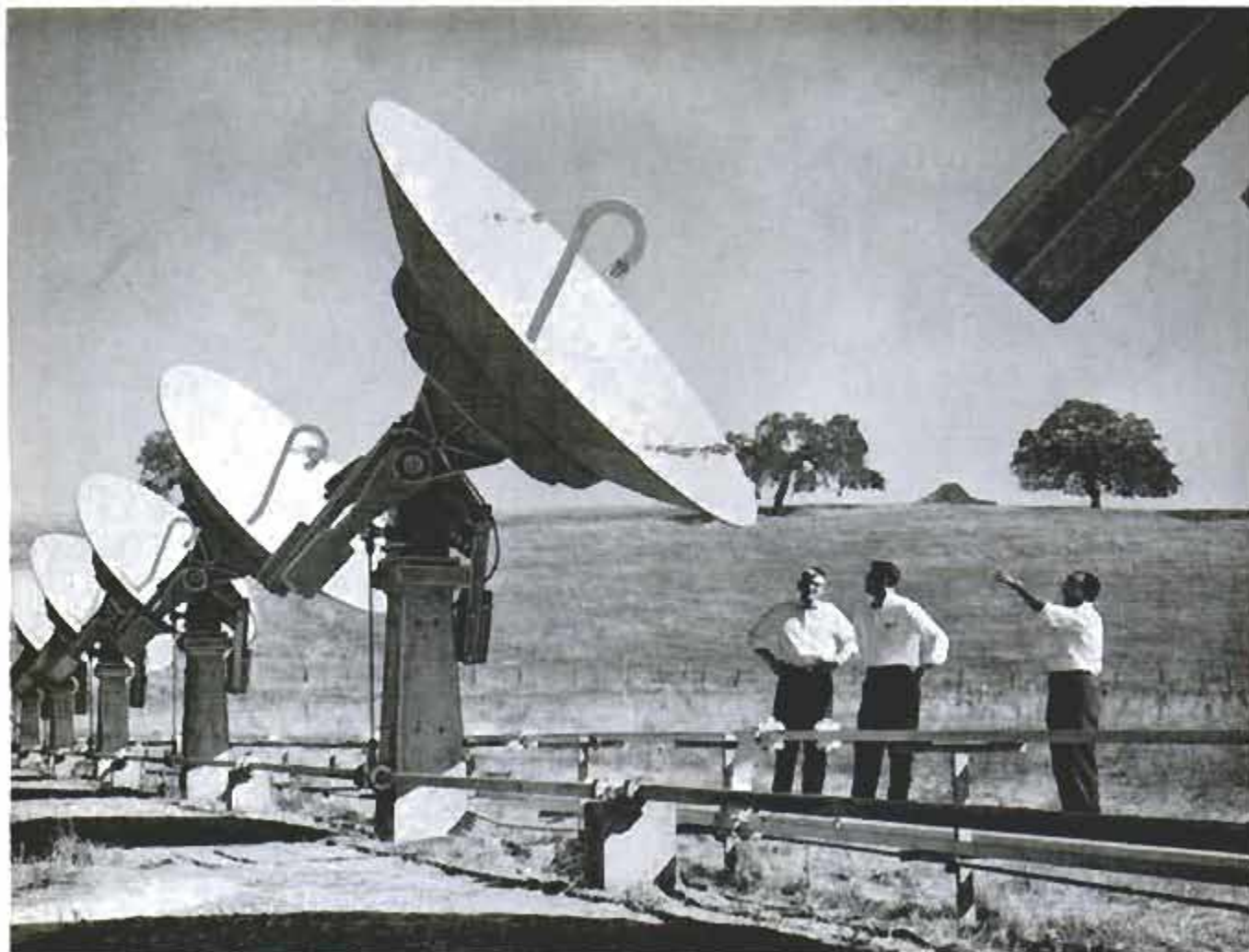
TV has been demonstrated as a safety measure against drownings in treacherous Onondaga Creek, near Syracuse, N. Y. Four cameras brought a winding, 800-foot stretch of the patrolled stream—otherwise out of sight—into view on a 21-inch monitor. The TV "lifeline" would be used with a loudspeaker to warn children.



Portable Missile Uses Solid Fuel

Designed for use against tanks and similar targets, a portable missile made in England is powered by solid fuel and sustainer rocket motors. It's guided to its short-range target by signals passed through thin wires from a control the soldier holds in his left hand and works with his thumb. The operator views the flight of the five-foot long missile through periscopic monoculars with high and low power vision.





Lineup of 32 Dish Antennas Will Study Sun and Stars

When Stanford University's radio telescope is completed, it will have the highest resolving power (focal clarity) of any radio telescope in the United States. The device will be used to study the sun and stars by "seeing" their invisible electromagnetic waves just as optical telescopes see their visible light waves. The "eye" of a radio telescope becomes sharper as the antenna

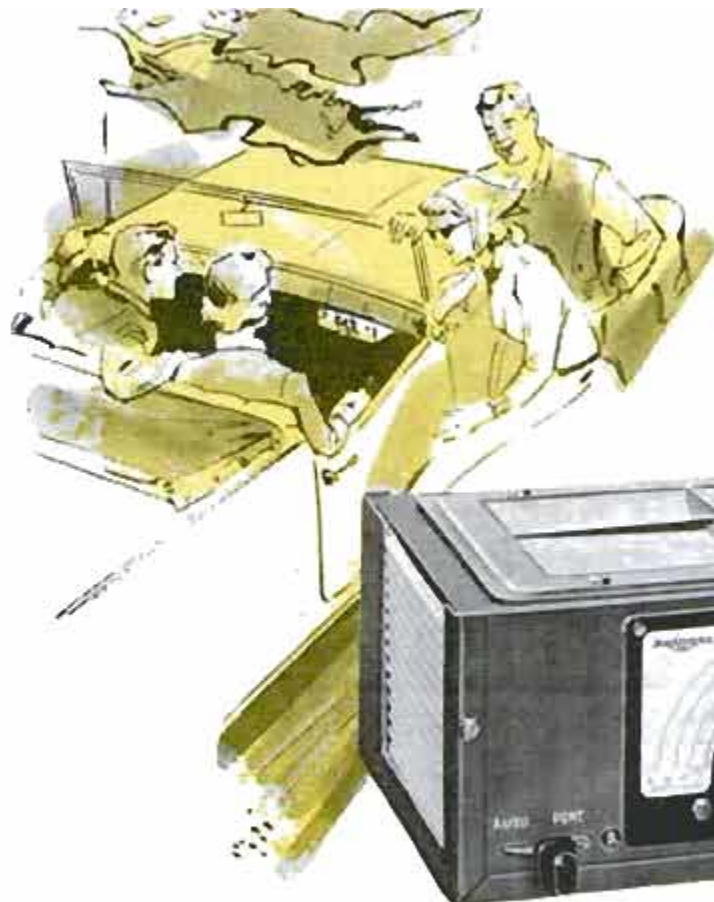
increases in size. The Stanford antenna will be equal to a single "dish" 375 feet in diameter. However, since a saucer-shaped antenna of such magnitude would be impractical to build, the device will be constructed in the shape of a cross. Each arm of the cross will have 16 aluminum "dish" antennas, each 10 feet in diameter. The 32 dishes will scan the sky in unison.



Copter Can Carry Heavy Pylon

It may look like a skeleton craft, but England's Westland Westminster flying crane is powerful. It has a six-ton lift that's equal to the chore of transporting a steel pylon to its construction site. The Westland Westminster's five-bladed rotor is powered by two shaft-driven turbine engines mounted on top of the craft's tubular frame. The rotor of the "prehistoric flying monster" measures 72 feet in diameter.

Radio Television Electronics



TRANSISTORIZED CAR RADIO DOUBLES AS PORTABLE

(A CONSTRUCTION PROJECT FOR ADVANCED EXPERIMENTERS)

By Peter Otto

IF YOU'VE BEEN thinking of building a radio for your automobile, why not build one which will do double duty? Triple duty, in fact, because there is no reason why a single receiver cannot be equally at home in your car, your house and on the beach.

Transistors provide the bridge for spanning the design differences between various types of radios. The appearance of reasonably priced power transistors permits the design of a single receiver which has the power output required to overcome the high noise level in a moving car, the low battery drain essential for portable use, and the sound quality expected of home radios. The unit described here combines all three of these essential features.

Design Principles

At first glance, the design of this receiver (see schematic diagram on page 158) does not appear to be extraordinary. Its r.f. and i.f. sections are, in fact, entirely conventional. There is the usual converter stage, TR1, followed by two stages of i.f. ampli-

fication, TR2 and TR3, and a detector diode, CR1. The two i.f.s (three i.f. transformers in all) impart excellent selectivity and sensitivity to the receiver.

The audio section of the radio, however, differs considerably from that of other transistor radios. While not apparent from the schematic, the push-pull-connected output transistors, TR5 and TR6, are high-power units as compared with the low-power transistors normally employed. As a result, the audio amplifier provides in excess of 4 undistorted audio watts—which is considerably more than many car radios, whether transistor or vacuum-tube operated.

But the mere use of power transistors does not mean that these must actually be employed as such. After all, even transistors draw considerable battery current at high audio-power levels. When operated with less than optimum bias current and an increased load impedance however, they act much like ordinary low-power transistors and provide similar performance.

To provide for two power-output levels

LIST OF MATERIALS

RESISTORS: (All $\frac{1}{2}$ -watt, $\pm 10\%$ carbon unless otherwise stated. K=1000 ohms.)

R1=33K; R2=8.2K; R3, R4=5.6K; R5, R10, R14, R19=22K; R6, R9=100K; R7, R11=820; R8, R12=1K; R13=5K pot. audio-taper w. switch; S1; R15=2.7K; R16=470; R17=220; R18=750; R20=6.8 ohms wirewound; R21, R22=0.47 ohms, 1 w., wirewound; R23=100; R24, R25=10K.

CAPACITORS: C1=100-mmfd. mica; C2, C3=tuning cap. w. trimmers; C4=6.8-mmfd. ceramic (see text); C5=.001-mfd. ceramic; C6, C18=.01-mfd. ceramic; C7, C10, C13, C17=.05-mfd. ceramic; C8, C11, C16=50-mfd./25-v. electrolytic; C9, C12=.1-mfd. tubular; C14=6-mfd./3-v. electrolytic; C15=90-mfd./3-v. electrolytic.

TRANSISTORS and DIODE: TR1=RCA 2N140; TR2, TR3=RCA 2N139; TR4=RCA 2N109; TR5, TR6=RCA 2N301 (power); CR1=Type 1N34A diode.

TRANSFORMERS: T1=25000:600-ohm i.f., Miller 2041; T2, T3=25000:1000-ohm i.f., Miller 2042; T4=500CT:5000CT-ohm interstage, Stancor TA-4; T5=400CT:4/8-ohm output, Thordar-

son TR-22; T6=48CT:8/16-ohm output (5-w.) Stancor TA-11.

MISCELLANEOUS: L1*=loopstick; L2*=osc. coil; S1=s.p.s.t. switch on R13; S2=4-pole, 2-position lever switch (only 2 poles used); J1=shorting jack for external 8-ohm speaker; J2=12-contact socket, Cinch-Jones S-312-AB; P2=matching plug, Cinch-Jones P-312-CCT; J3=antenna jack, (use ordinary phono jack); SP1, SP2=3.2-ohm PM speaker, $3\frac{1}{2}$ -in. square, Quam 3A07; batteries=Burgess Z4, (2).

HARDWARE: Aluminum "Minibox," 8 x 6 x $3\frac{1}{2}$ -in., Bud type CU-2109; leather handle; vernier dial; knob for vol. cont.; transistor sockets, (4); material for power-transistor mounting (see text); decorative speaker grille Allied Radio No. 82D252; aluminum for r.f. and audio chassis and brackets (see text); assorted terminal strips, solder lugs, screws, nuts and lock washers; hookup wire; rosin core solder.

* Select component designed to track in the broadcast band.

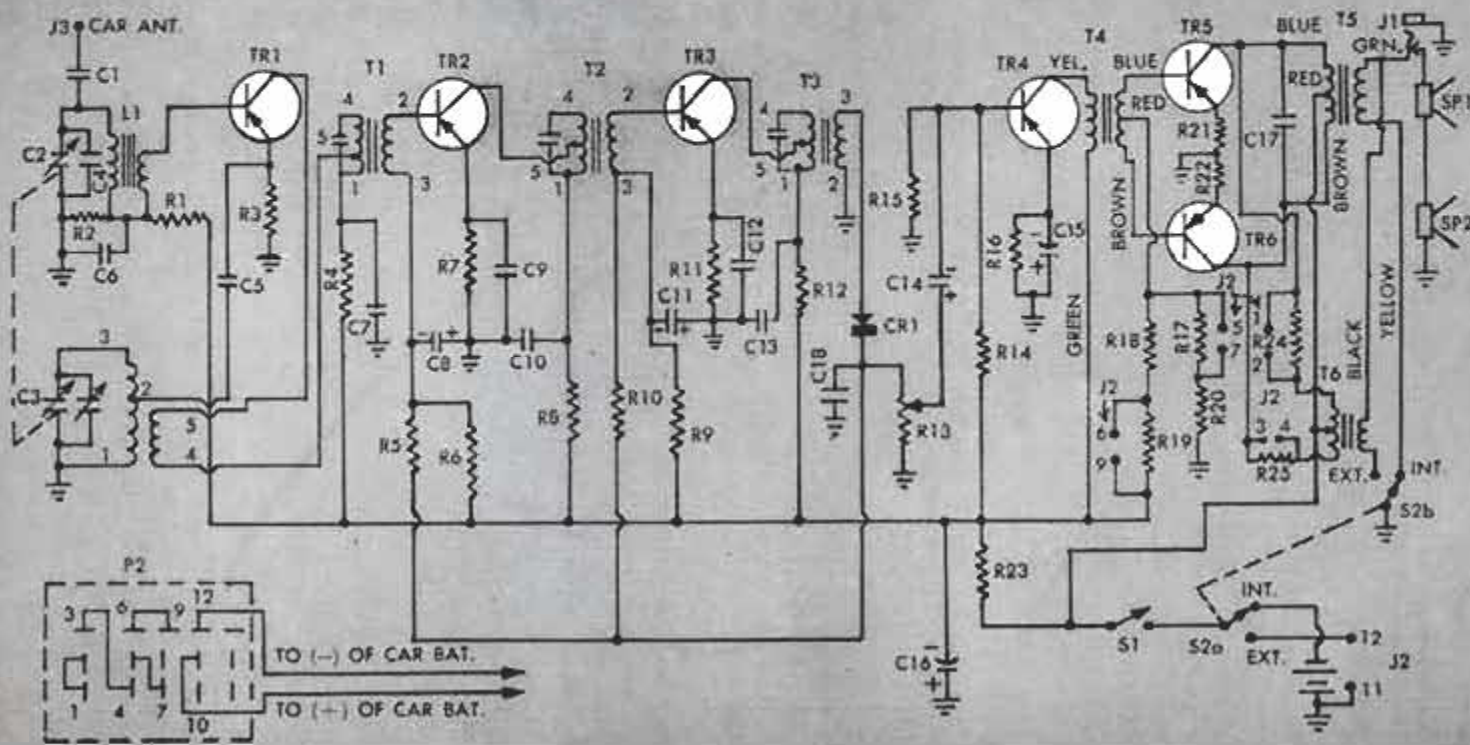
(one for portable and home use and the other for automobile use) two different output transformers, T5 and T6, are employed. The primary windings of both are connected to the output transistors, although the high-power transformer is isolated from the transistors by resistors R24 and R25. Both secondary transformer windings are connected to section "b" of switch S2 which, depending on its setting, connects either the low-power transformer, T5, or the high-power unit, T6, to the speakers. Simultaneously, section "a" of S2 applies power to the radio from either the built-in batteries or from the automobile battery.

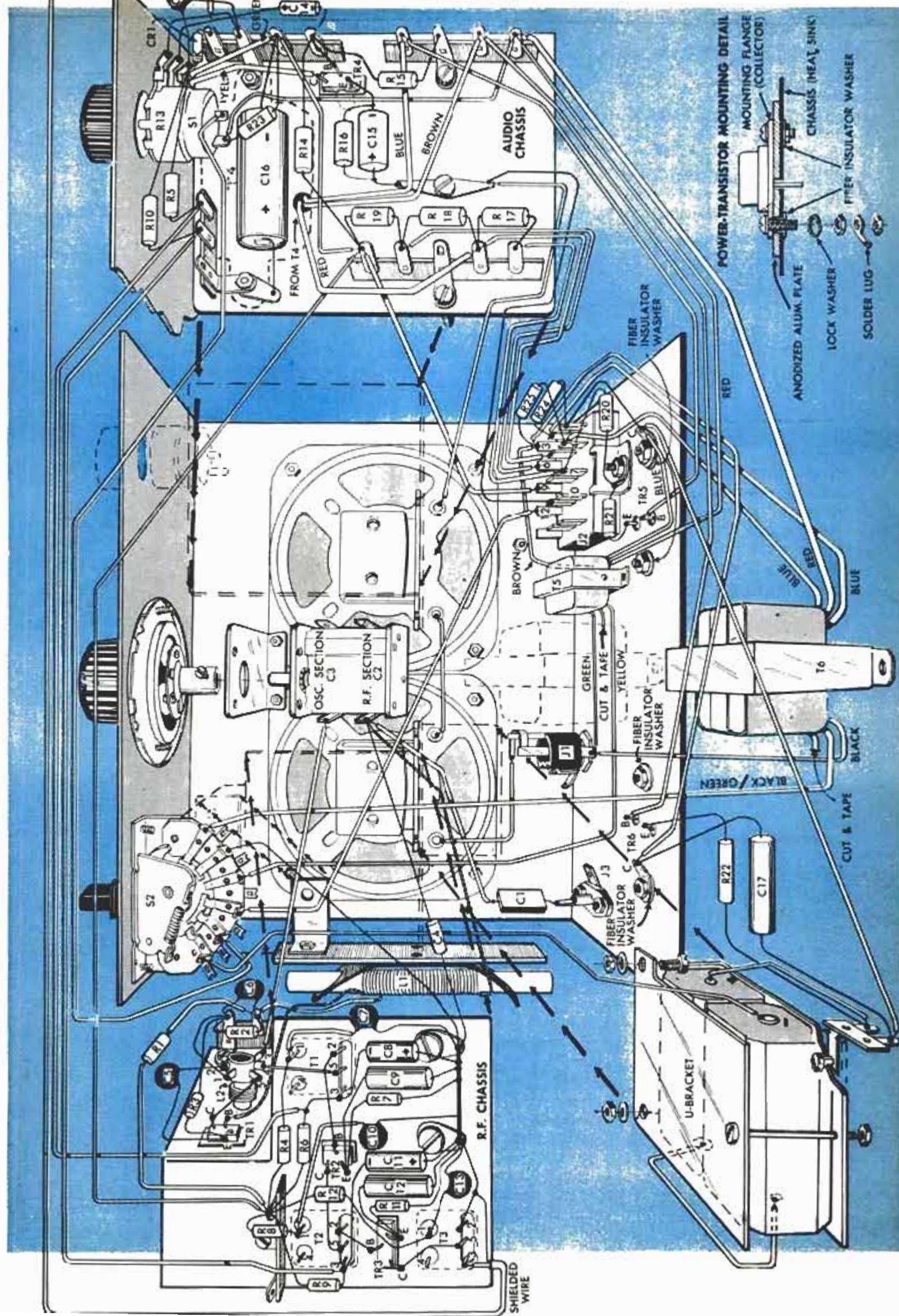
When the receiver is used as a car radio, operating power is applied from the car battery through plug P2 which must be

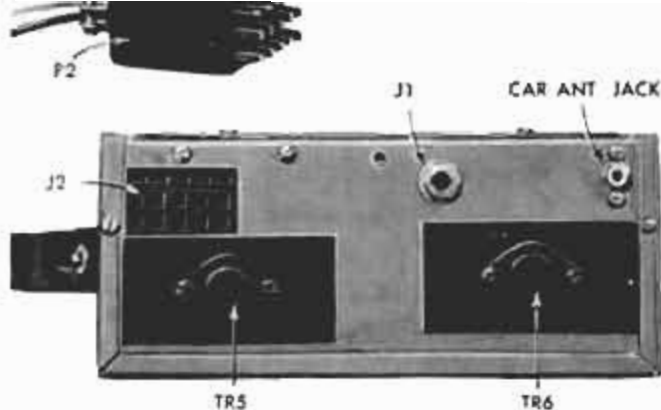
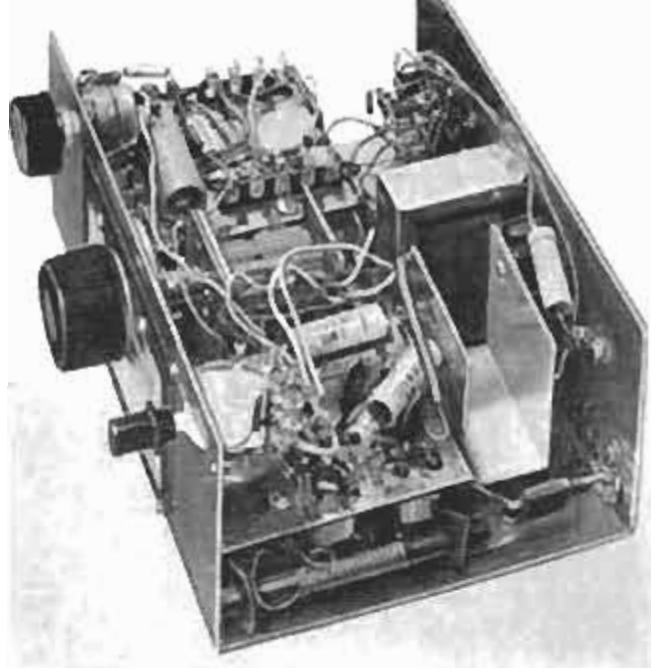
plugged into socket J2 mounted on the rear panel of the case. This multiprong socket has certain of its pins connected to biasing and stabilizing resistors R19 and R17, and to the two transformer-isolating resistors R24 and R25. Plug P2 has jumper wires connected across correspondingly numbered prongs so that, when the two are mated, the above-mentioned resistors are shorted out. This changes the operating characteristics of the output circuit to provide the necessary audio power output for car installations.

When used as a portable or home radio, plug P2 is removed from the socket and S2 is set to the PORT. position (marked INT. on the schematic). Changing the switch setting connects the low-power transformer to the speakers and connects the internal

Schematic diagram of radio for car or portable use. Dotted box shows wiring of car-battery connector







Rear view of receiver illustrates power-transistor mounting. Two wires from plug P2 lead to car battery. Internal wiring of plug is shown in schematic

Left: Inside the case, all parts fit neatly, though compactly, in place. U-shaped bracket, lower right, will hold two built-in batteries, for portable use. Batteries are wired into circuit to insure good contact

batteries to the radio. Removal of the plug increases the total bias and stabilizing resistance values in order to conform with the altered load impedance and to reduce battery current drain.

Although little more than $\frac{1}{4}$ watt of power is available for portable applications, this is more than enough for ordinary needs. The two 4-in. speakers and the relatively large enclosure give much greater volume and far better sound quality than normally is attributed to transistorized portables.

Construction

Building this radio requires careful attention to layout details if all of the parts are to fit neatly into the recommended 8 x 6 x 3 $\frac{1}{2}$ -in. aluminum case. Before beginning the actual construction, assemble all of the required components and place the case-mounted parts in the approximate positions shown in the pictorial diagram (page 159). Components mounted on the rear panel (T5, T6, J2, etc.) must be placed close together to provide room for the battery holder. Transformer T5 and socket J2 are placed near the bottom of the case so that they do not interfere with the mounting of transistor TR5 on the outside of the case. (A 15-lug socket is shown for J2. Actually, a 12-lug socket will suffice.)

Mounting details for the power transistors are shown in the diagram. The mounting of these units can be greatly simplified through the use of a Motorola No. MK-10 mounting kit currently available from a number of radio parts distributors. The kit includes a power-transistor socket and the necessary washers to give electrical insulation while providing for sufficient heat transfer to the chassis. All electrical connections are then made to the socket lugs rather than to the transistor leads.

Parts mounted on the front panel should be mounted as close to the top edge as possible without interfering with the lip on the case cover.

The two speakers are fastened to the bottom of the case after the necessary speaker cutouts have been made. Speakers are centered in the case, approximately $\frac{3}{8}$ in. from each open edge. A decorative grille (see title photo and parts list) protects the speaker cones against damage from the outside.

A homemade bracket, fastened to the bottom of the case underneath two of the speaker mounting nuts, holds the tuning capacitor (C2-C3) in place. Particular care must be used in the placement of the panel-mounted vernier dial, or in the placement of the capacitor bracket, to make sure that the hole in the bracket is perfectly aligned with that in the dial bushing. If a vernier dial is not desired, the capacitor may be fastened directly to the front panel of the case.

Another homemade L-bracket is used to fasten the antenna loopstick, L1, to the bottom of the case. The loopstick comes mounted on a fiber back for easy chassis installation. Make the short end of the L-bracket just long enough to permit the bottom edge of the fiber back to rest against the bottom of the case.

Two tapped holes in the back of each of the suggested speakers are used for the eventual mounting of the fully wired r.f. and audio chassis. Each of these chassis is a flat 3 $\frac{3}{8}$ x 2 $\frac{3}{4}$ -in. aluminum plate. The right-front portion of the r.f. chassis, to which transistor TR1 and oscillator coil L2 are fastened, is bent downward at a 60° angle, as shown. The front edge of this chassis rests flush against the front panel to allow sufficient space for the U-shaped

(Continued to page 236)



Two TVs and only one antenna? Even 20 or more TV and FM receivers can be serviced by one antenna in a normal-signal area. New Wizard electromagnetic TV-FM coupler simply attaches to existing antenna lead-in and couples signal to an additional set without materially reducing signal strength or creating a mismatch. Ideal for apartments and motels, too



How much recording or playback time is left on your tape reel? Even recorders with footage indicators don't give an immediate answer. But this simple, graduated plastic rule does. Accurately calibrated for all types of tapes, it shows at a glance how much time is left on a 7-in. reel. Available separately or permanently mounted on 7-in. plastic reel

New Products Solve Old Problems

Tired of fussing with your car aerial? Here's a high performance remote-controlled antenna which rises automatically when the radio is turned on and retracts smoothly when radio is turned off. Can be installed by any car mechanic without tampering with the radio

How to receive special broadcasts is no longer a problem with inexpensive, self-powered converter. This one covers the 2738 and 2638 kc. marine bands and simply connects between antenna and any ordinary radio. Similar units for police, fire, aircraft and other special frequencies are available. Does not prevent broadcast-band reception

No telephone facilities? Try radio for short range point-to-point communications. Transmitter-receiver combination operating in new exam-free citizen's band has range up to 10 miles. For either fixed or mobile operation, units are available with 115-v. a.c., 6-v. d.c. or 12-v. d.c. power supplies





CAPTAIN'S CHAIR IN MODERN

Modern version of popular Captain's chair makes it a companion piece for the smart drop-leaf dining table presented last month



BROUGHT UP TO DATE, minus turned legs and bow back, the captain's chair becomes a chair that can take its place among modern furnishings. In its modified version, this Early American favorite can be reproduced with hand tools alone and its padded arms and seat provide accents of color in keeping with modern decor.

The front and back legs are made in pairs and differ only in their length and the angle at which they are cut off at the tops. You will notice that only the inner adjacent faces of the legs are tapered, be-

MATERIAL LIST

CABINET WOOD

- 2 pcs. $1\frac{3}{4}$ " x $1\frac{3}{4}$ " x $27\frac{3}{4}$ "—Front legs
- 2 pcs. $1\frac{3}{4}$ " x $1\frac{3}{4}$ " x $28\frac{1}{4}$ "—Back legs
- 2 pcs. $\frac{3}{4}$ " x $2\frac{3}{4}$ " x $16\frac{3}{4}$ "—Side seat rails
- 2 pcs. $\frac{3}{4}$ " x $2\frac{3}{4}$ " x 19"—Front and back seat rails
- 2 pcs. $\frac{3}{4}$ " x $1\frac{3}{4}$ " x $19\frac{3}{8}$ "—Arms
- 1 pc. $\frac{3}{4}$ " x $3\frac{1}{8}$ " x $22\frac{1}{2}$ "—Top back rail

HARDWOOD

- 1 pc. $\frac{3}{4}$ " x $1\frac{1}{2}$ " x $17\frac{1}{2}$ "—Seat cleat

PLYWOOD (FIR)

- 1 pc. $\frac{1}{2}$ " x $20\frac{1}{2}$ " x $22\frac{1}{2}$ "—Seat and arm upholstery boards

MISCELLANEOUS

- 3 pcs. $\frac{5}{8}$ " Dia. x $11\frac{1}{2}$ " wooden dowels or brass tubing
- 4— $\frac{5}{8}$ " Dia. furniture glides for legs

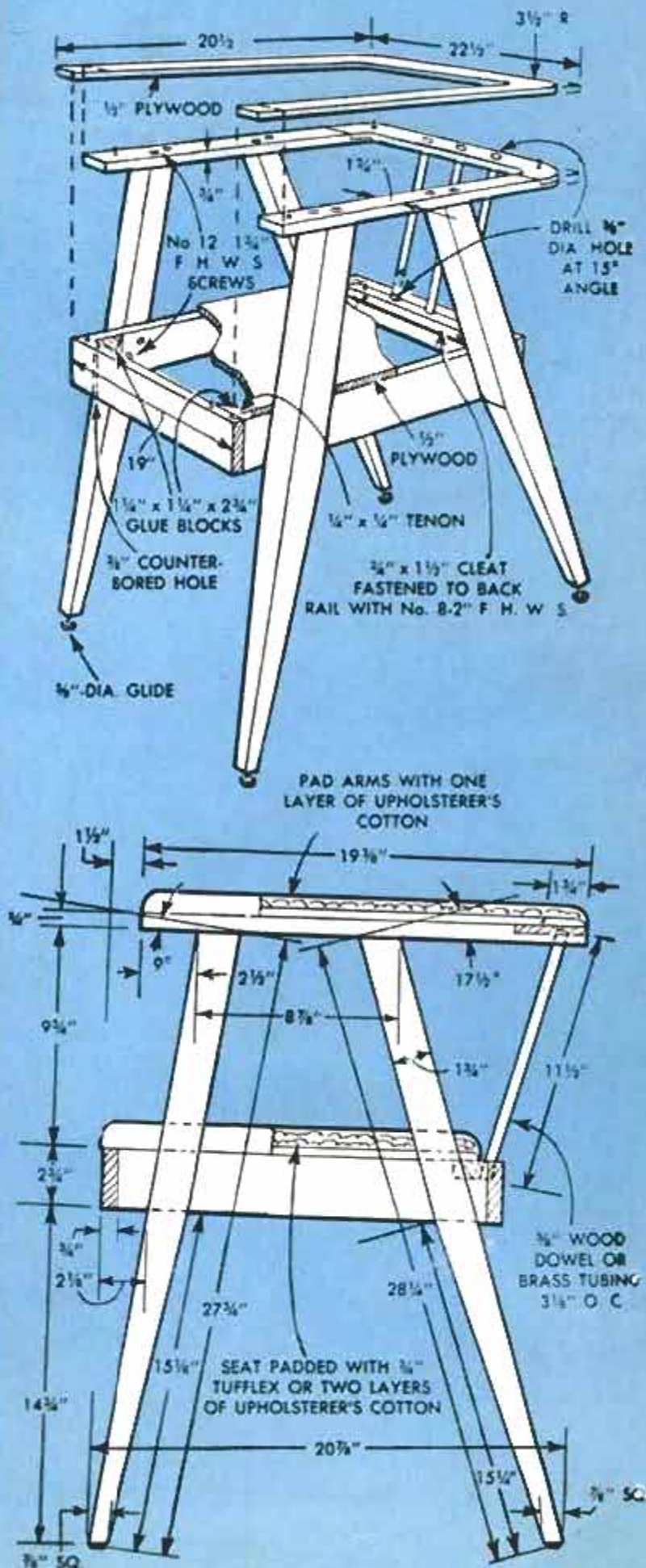
By John Bergen



DESIGN

ginning from the lower edge of the seat downward. The padded seat board is supported by a simple boxlike frame, which is strengthened at the corners with glue blocks, counterbored for screws and fastened to the legs with screws driven from the inside. A cleat across the back of the seat frame permits holes to be bored at a 15-deg. angle for the dowel or brass tubing members. In studying the side view you will see that the holes actually straddle the joint. The U-shape frame that is screwed to the tops of the legs consists of three pieces half-lapped at the corners and rounded. Holes for the dowels are bored completely through it. One piece of plywood provides the padded seat and arm boards, the latter being formed by sawing around three sides of the plywood piece. Upholsterer's cotton or foam rubber is used to pad the seat and arm boards, after which they are wrapped with fabric and tacked neatly to the underside. ★ ★ ★

The CRAFTSMAN





Calking Tips Stored in Water

It is not necessary to clean the removable tips of a calking gun each time during interrupted use if the tips are dropped into a jar of clean water. Stored in water this way the calking compound does not harden, but remains in its original consistency. This stunt is ideal for the home craftsman who must take several days to do the job of calking his home. After the job is done, of course, both the gun and tips should be cleaned. This idea also applies to the cartridge type of calking gun.

R. Hanscom, Elmhurst, Ill.

Saw Blade Filed While in Table

When you want to just touch up the teeth of a circular saw with a file, it is not necessary to remove it from the arbor. Clamp a length of 1-in. stock alongside the blade as shown and file the teeth that project above the strip. The clamp is loosened each time and the blade rotated to bring another portion of the blade into position. When clamping the blade, keep the clamp pads inside the teeth to avoid altering the set in the teeth.

G. E. Hendrickson, Argyle, Wis.



Increase Uses for Hay Barrack

Covering two sides of a hay barrack with sheets of corrugated roofing nailed to 2 x 6 cross members extends the usefulness of this structure to year-round use. It now is used at times for machinery storage and for storing baled hay. Feeder cattle also are penned in the building, plank rails being nailed across the corner posts to prevent the stock from pushing out the sides of the building. Used roofing is ideal for this purpose if available.

A. M. Wettach, Mt. Pleasant, Iowa.

Angle-Cutting Duplicate Pieces

Angle-cutting the ends of a number of pieces of lumber that are to be identical in length can be done quickly on a table saw with the aid of a simple jig. The jig, clamped to the saw table as indicated, is a block of wood in which an accurate right-angle cut is made. The block is positioned to hold the lengths of stock at the correct angle and length, so they can be held firmly—or clamped, if the miter gauge is so fitted—against the miter gauge and run through the saw. Make sure the blade is sharp.—J. C. Roby, San Diego, Calif.



5 ft. high from wagon bed to the top. The sides of the feedbox are supported by steel angles salvaged from a windmill tower. Lengths of angles tie the uprights to other angles bolted across the bed of the wagon. The feeder can be filled in the field with a forage chopper or hauled to a silo chute, then moved to a feedlot.

A. M. Wettach, Mt. Pleasant, Iowa.



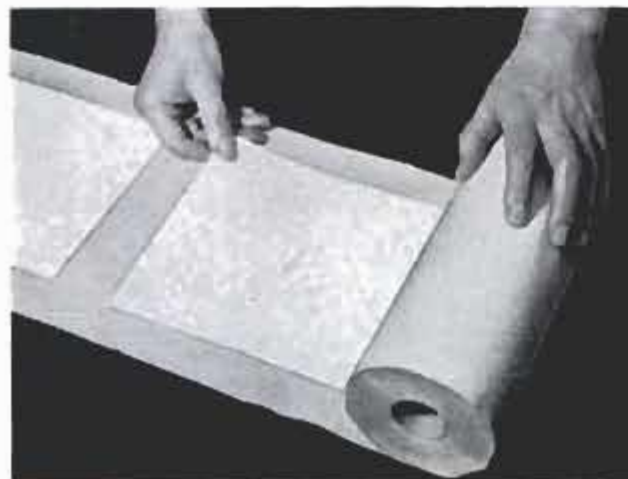
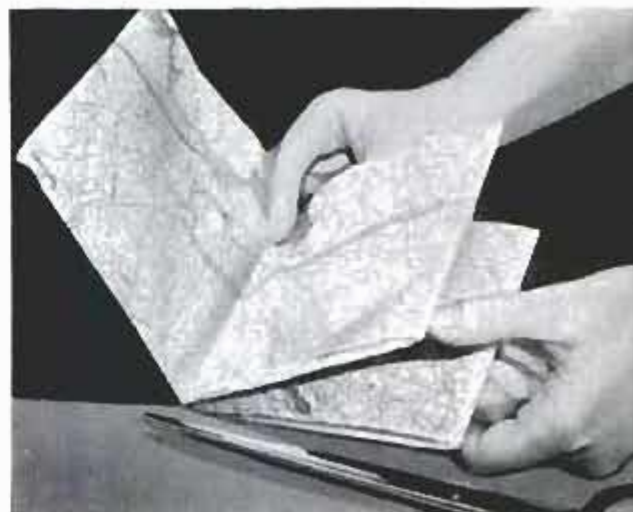
List of Tab Stops Saves Time

If you frequently type out forms that require a number of tabulator-stop settings, time can be saved by taping a list of the stops to the typewriter in an easily seen location. If several different forms are often needed, make a list of the forms by number or description, along with the required stops, and fasten it to the wall above the typewriter desk, or on the dictation slide of a regular desk.

Frank A. Javor, Newark, N. J.

Strip Map Easier to Handle

There will be no awkward folding and unfolding of a road map on your next auto trip if you carry, instead of an entire map, a strip about 6 in. wide cut from the map, showing your route. Folded accordion fashion, the narrow strip is easy to handle. A full map should be carried in the glove compartment, should a detour or change of plans, such as a side trip, require it. Marking the route with a colored pencil is an additional aid. If your trip is a long one and the route extends over two maps, cut both maps and glue the strips back to back.



Removing Curl From Photoprints

Do your prints curl up in a roll when you take them off the ferrotype plate? Here is a way you can take the curl out of them: First dampen the backs of the prints with a sponge dipped in water. Then place the prints face down on paper toweling and roll them up in the roll. The curve of the roll will counteract the reverse curl of the prints. Let the prints remain rolled up for eight hours. When removed, they will lie flat. You should use a full or nearly full, roll of paper toweling.

Russ Whitaker, Altadena, Calif.

MAKE ONE OF THESE EACH EVENING—

A serving tray to save steps, magazine rack, telephone stand and an end table with shelves for newspapers

By Ted Fenn

HERE ARE THREE pieces of occasional furniture and a serving tray, any one of which can be made in a few hours using inexpensive materials and tools that most home craftsmen own.

To make the serving tray, first cut out the $\frac{1}{2}$ x 12-in. plywood disk to be used for the bottom. Then cut a disk of the same diameter from sheet copper and cement it on top of the plywood one. Next a 1-in.-wide strip of sheet copper is nailed to the edge of the bottom with copper nails, after crimping the upper edge to produce a rolled edge as shown. The handle consists of two wooden arms shaped as shown in the detail and screwed to the edge of the bottom at opposite sides, after which a length of hardwood dowel is glued in holes drilled in the upper ends of the arms.

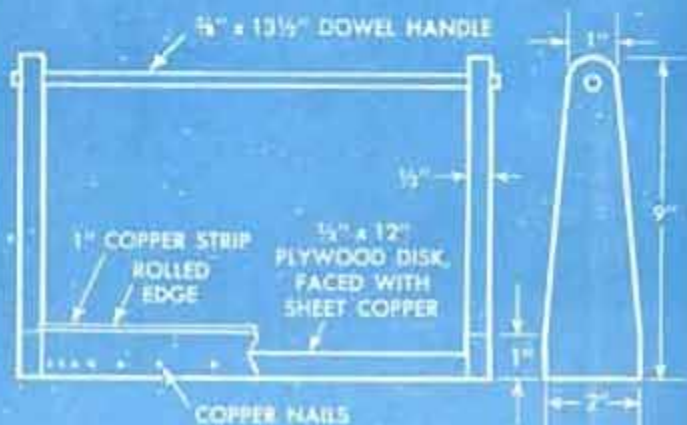
Construction of the end table is so simple that a pair of them can be made in little more time than it takes to make one. The top and shelves are cut from the same pattern so that only one full-size pattern need be made for all three pieces. To assure proper alignment of the holes that take the legs, clamp the top and shelves together when drilling them. Note that the holes in the underside of the top are drilled only to a depth of $\frac{3}{8}$ in. The legs are cut to length from hardwood dowels and assembled with glue and screws as shown. Brass ferrules glued on the ends of the legs add a touch of quality.

The magazine rack is easy to construct and can be made longer if desired to accommodate more magazines than the one shown. The bottom and back pieces of the rack are cut from $\frac{3}{8}$ -in. plywood and the ends are cut from $\frac{3}{4}$ -in. plywood according to the dimensions given in the drawing. Glue and screws are used for assembling it. Make certain the blind holes for the dowel ends of the handle are drilled before assembling the ends.

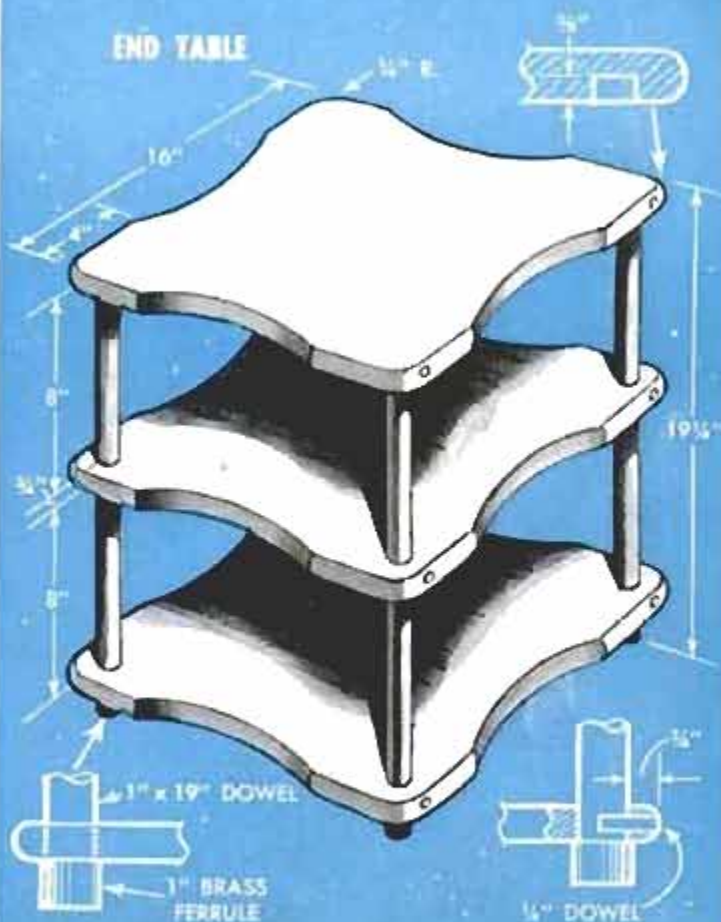
The combination telephone stand and cabinet not only is a handsome piece of occasional furniture but it provides ample enclosed storage space for directories and other references. It can be made of plywood, knotty pine or other woods as shown in the drawing and details.

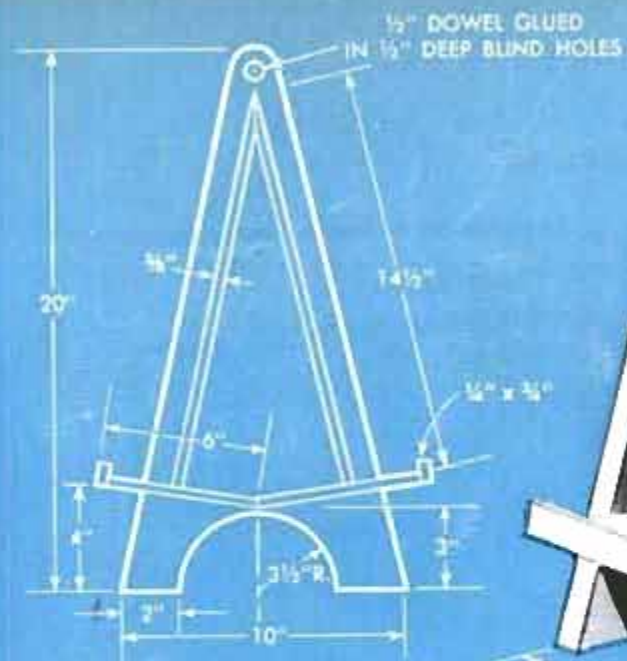


SERVING TRAY

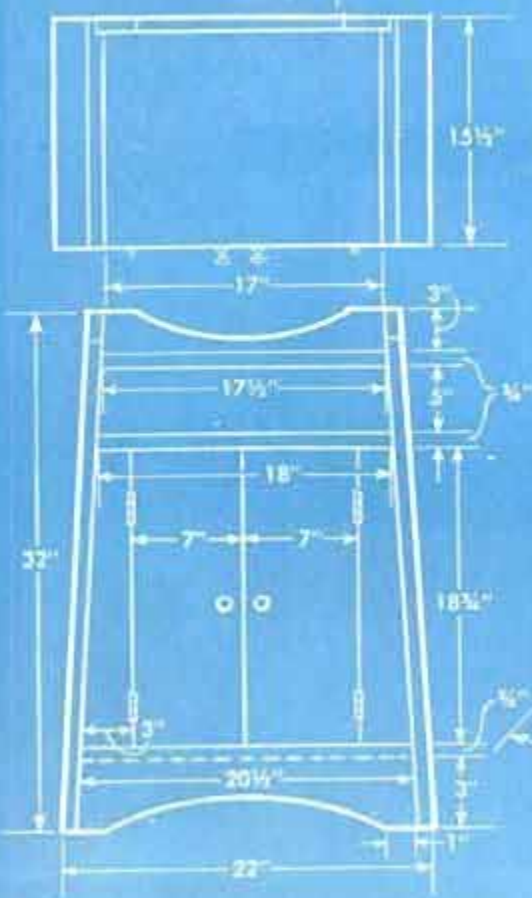
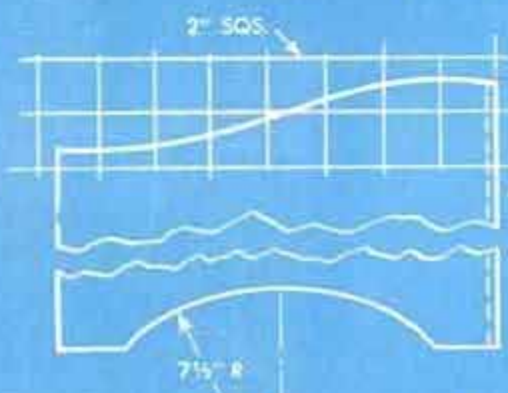


END TABLE





MAGAZINE RACK



TELEPHONE STAND

Fowl Prevented From Flying By Taping One Wing

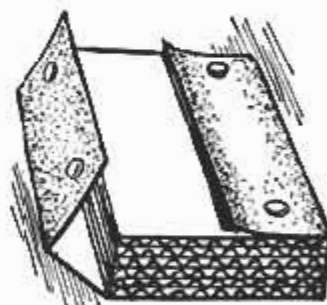
If one or more chickens or other fowl have acquired the habit of flying over the fence of the yard in which they are kept, a strip of adhesive tape will keep them grounded. Wrap the tape around one wing of the bird so the flight feathers are bound. When the bird attempts to fly it will circle and never reach its objective. The tape does not injure the bird or damage the plumage.

Brush "Seals" Corrugated Joint

When lap-soldering two pieces of corrugated metal, an ordinary stiff scrub brush can be an invaluable tool. The bristles of the brush will bend to conform to the shape of the corrugations when pressure is applied to its back, and thus will hold the irregular surfaces firmly together to assure a tight, easily soldered joint.

Robert M. Beasley, Jackson, Mich.

Cardboard Used as Sanding Block



Hand-sanding a crowned surface is much less of a problem if the sanding block consists of several layers of corrugated cardboard stapled together. The block is firm enough to hold the paper in full contact with the surface, yet is resilient enough to conform to the contour of a curved surface.—Ray Wencil, Chicago.

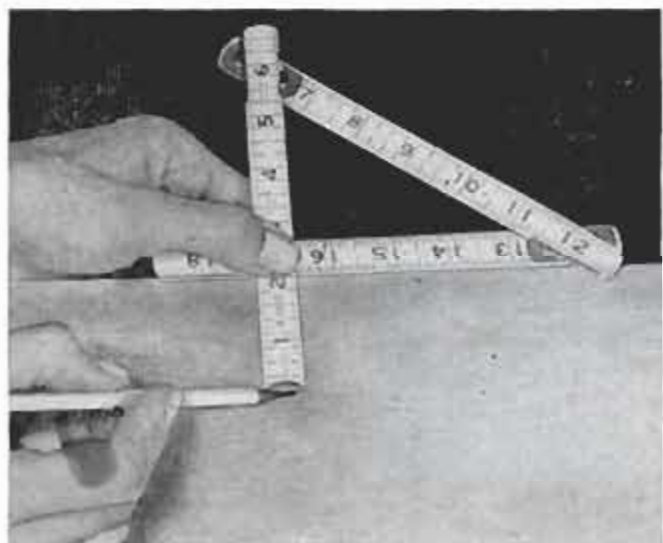
Handy Marking Gauge Improvised From Ordinary Folding Rule

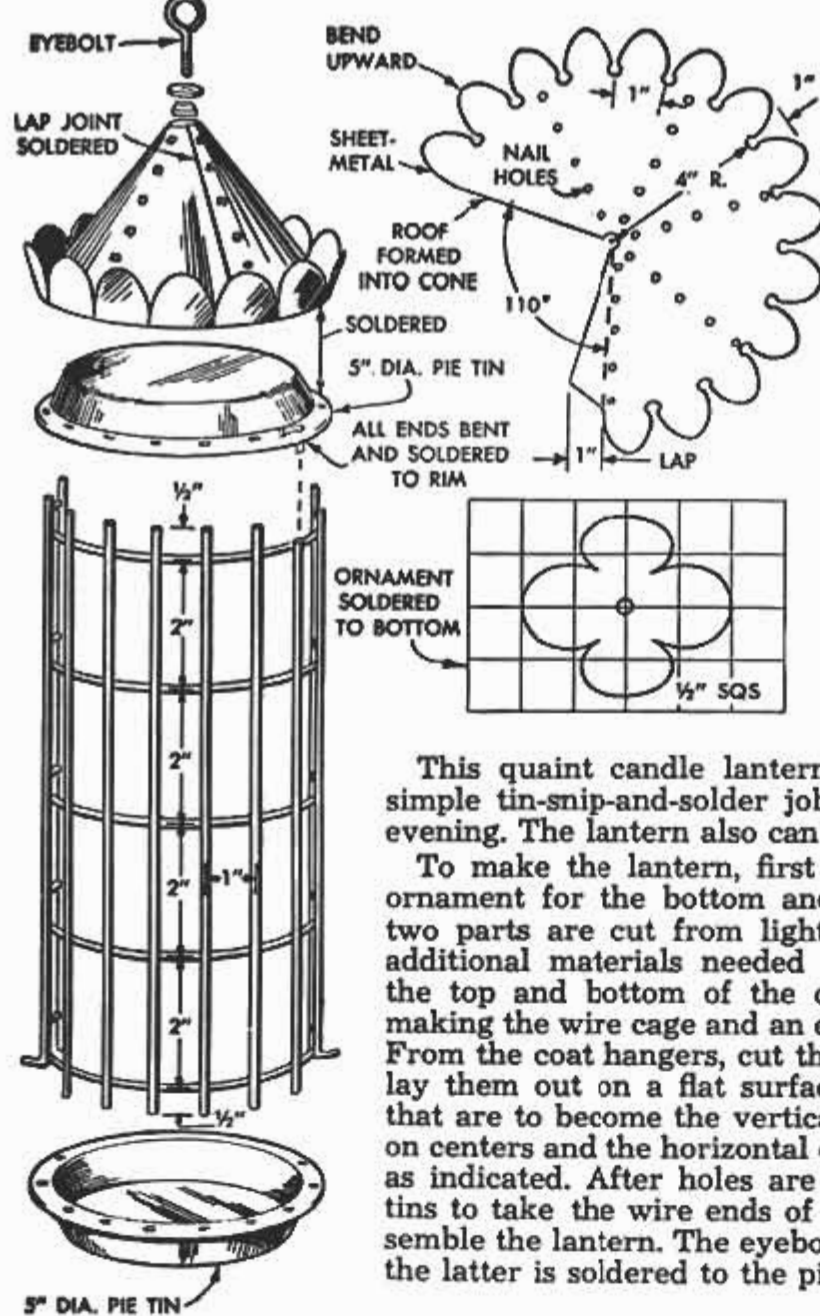
Adjusting a folding rule as shown in the photograph permits it to be used as a marking gauge, or for checking one measurement against another with reasonable accuracy. The body of the rule is placed on the edge of the work and the vertical section of the rule is held firmly to the body with one hand. Although only one section of the rule is used in the illustration, two or more could be extended to increase the usable length of the gauge. Of course, this may affect accuracy somewhat, especially if there is a loose joint in the sections.



Installing Battery Correctly

It is important when replacing a battery to install it correctly. Note which of the two battery terminals has a cable that is bolted to some part of the engine or transmission. This will be the ground terminal. If a car is fitted with an ammeter, an incorrectly installed battery will show full discharge when the engine is running. If there is only a warning light, ground the positive lead of a voltmeter and momentarily touch the negative lead to a spark plug. The meter should read up-scale, as negative voltage is delivered to the plugs, no matter which side of the battery is grounded. If the scale reads down, reverse terminals.





This quaint candle lantern from below the border is a simple tin-snip-and-solder job that can be completed in an evening. The lantern also can be used as a planter if desired.

To make the lantern, first draw full-size patterns of the ornament for the bottom and the cone-shaped roof. These two parts are cut from lightweight sheet metal. The only additional materials needed are two 5-in.-dia. pie tins for the top and bottom of the cage, several coat hangers for making the wire cage and an eyebolt for hanging the lantern. From the coat hangers, cut the required lengths of wire and lay them out on a flat surface to form squares. The wires that are to become the verticals of the cage are spaced 1 in. on centers and the horizontal ones are spaced 2 in. on centers as indicated. After holes are drilled in the rims of the pie tins to take the wire ends of the cage, you are ready to assemble the lantern. The eyebolt is attached to the roof before the latter is soldered to the pie tin at the cage top.

Hi Sibley, Nuevo, Calif.

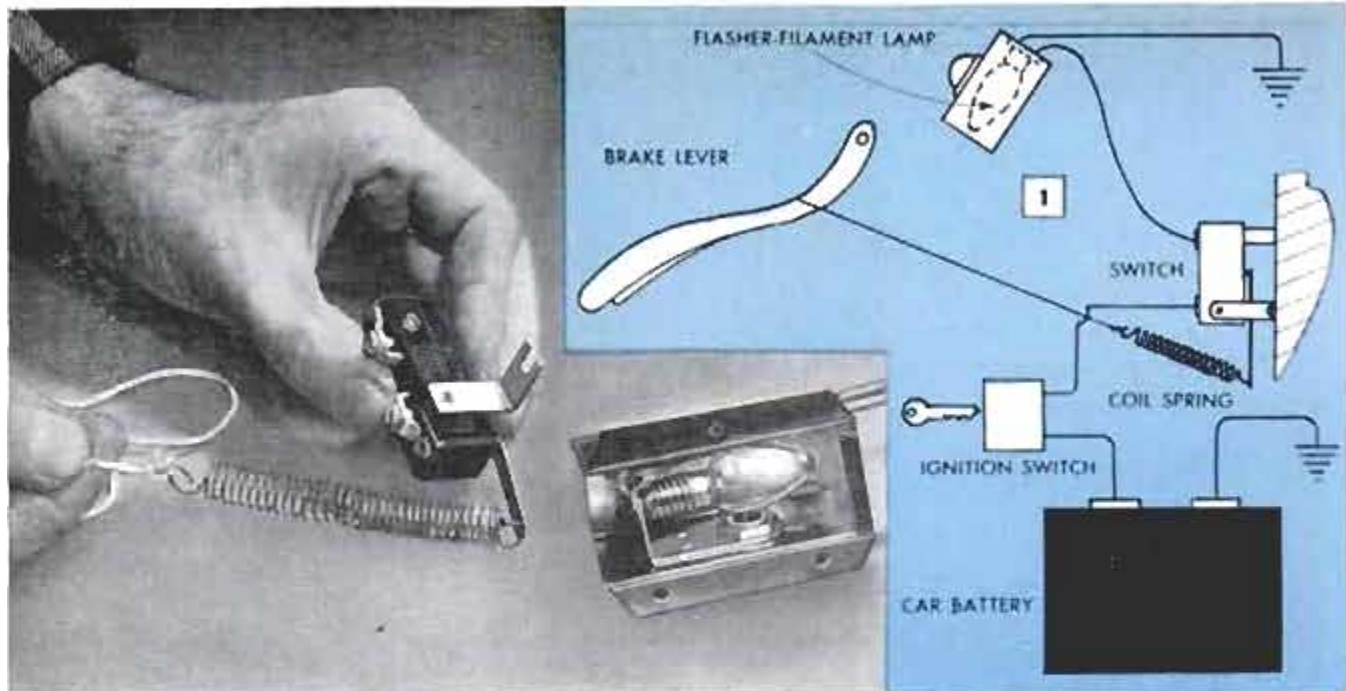
Aspirin Box Keeps Lens Brush Free of Dust While in Storage



For dustfree storage of a lens-cleaning brush, cut out one end of the lid and bottom of an aspirin box and cement strips of heavy felt to the lid and bottom as shown. The brush is placed in the box so that when it is closed the felt strips clamp the flat part of the ferrule to prevent dust from reaching the bristles. A small-size box is best for this purpose.

Ken Murray, Colon, Mich.

☞ To remove stains on the cement between ceramic tiles, use fine steel wool. Be careful not to leave steel-wool particles behind as they will form rust spots.



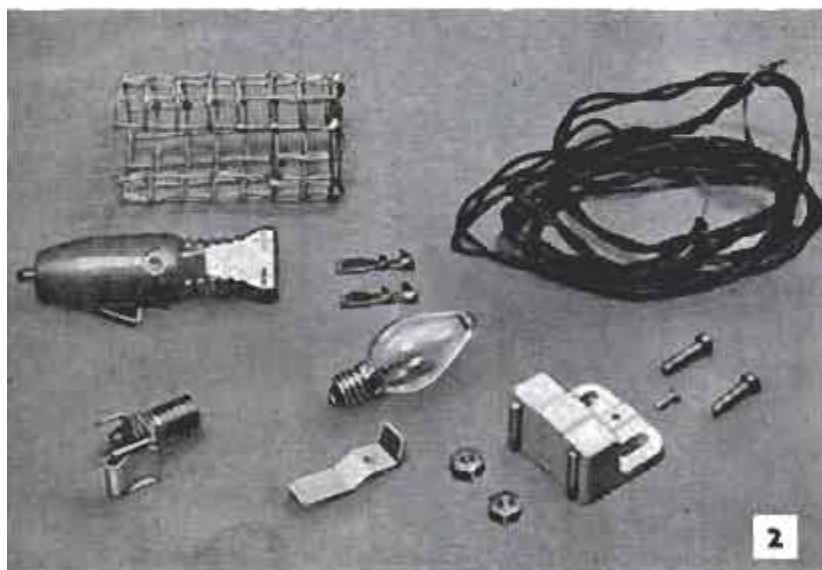
Flashing Lamps Catch the Eye

By *Walter E. Burton*

THERE IS NO DOUBT that a flashing light is more effective as an "attention getter" than one that burns steadily. This factor is utilized every day in store signs, theater marquees and in turn indicators on automobiles. Although automatic, momentary-contact switches are used in these applications, a craftsman or hobbyist who has need for a flashing light can assemble one with only an off-on switch in the circuit. Incandescent electric lamps are available that have an automatic "switch" in the filament to make and break a circuit. Because the lamps require only from about 4 to 6 volts (12-volt lamps are to be available soon) they can be used in portable setups powered by dry cells or an automobile bat-

tery. For permanent installations, house current can be reduced with a stepdown transformer for the low-voltage lamps.

If you have ever driven with the parking brake of your car pulled on, you will appreciate the warning lamp shown in Fig. 1. When the brake handle is pulled, a spring-loaded, momentary-contact switch is closed and a light flashes on and off until the brake handle is moved to the "release" position, or the ignition switch is turned off. Switches of the type shown can be purchased at radio-supply houses, or regular parking-brake warning-light switches can be obtained at some auto-supply houses. A piece of sheet aluminum is shaped into a box that contains a socket to receive a G-E

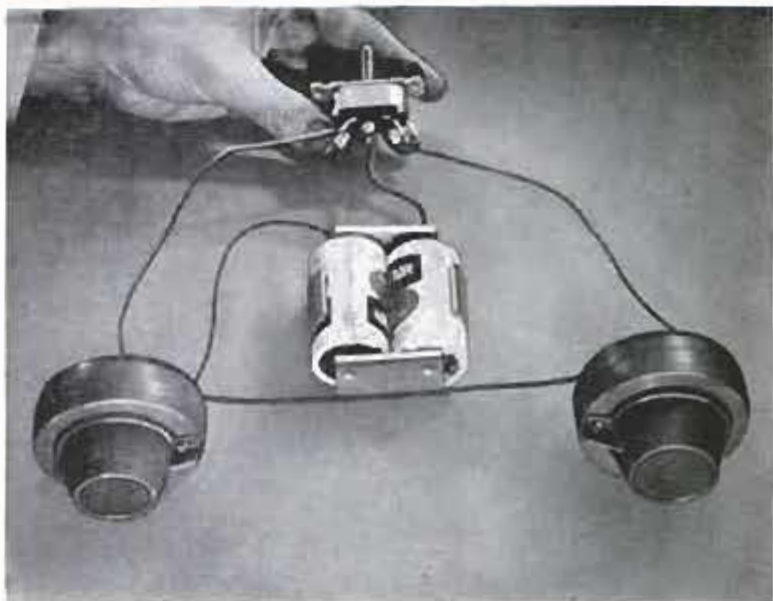
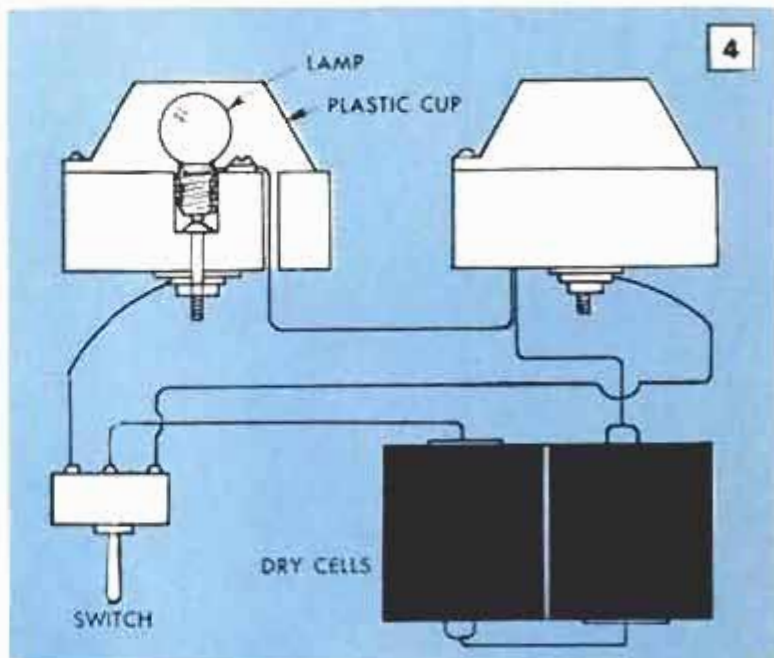


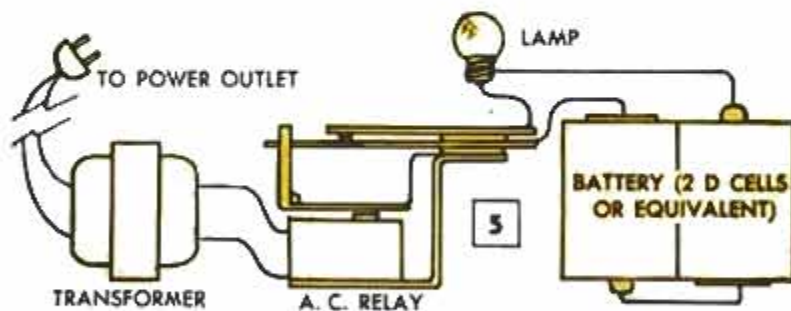
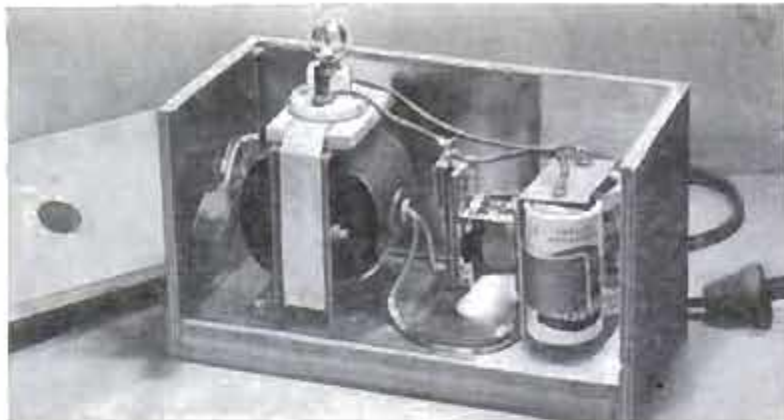


No. 405 flasher-filament lamp. If a 12-volt lamp is not available, a 30-ohm, 2-watt resistor can be wired in series with a 6-volt lamp when used in a car with a 12-volt ignition system. The box is attached to the lower edge of the instrument panel where it can be seen by the driver. The switch is mounted on the fire wall and is actuated by means of a length of fishline. A spring between the cord and switch prevents damage to the switch.

Figs. 2 and 3 show another application for flasher-filament lamps. In this auto-emergency light, a G-E No. D-25 lamp is used, it being available in colors. A No. 405 lamp also could be used if covered with a colored glass or plastic housing. The light itself consists of an L-shaped bracket to which is fastened a socket of the type used for radio pilot lights. The bracket is screwed to a magnetic cabinet latch which positions the light vertically when the unit is placed on a horizontal metal surface, such as a car roof. A piece of hardware cloth is shaped as a shield to protect the lamp. An 8-ft. length of 2-wire cord and an auto-accessory plug that fits the cigarette-lighter receptacle provide battery current to the lamp.

Youngsters with sidewalk cars want their vehicles to be as much like real cars as possible, and flasher-filament lamps can aid this wish for realism. Fig. 4 shows how two





G-E No. 406 lamps are employed as turn-indicator lights for a miniature car. Translucent red or amber plastic cups are screwed to wooden disks as "lenses" for the lights. The wiring diagram shows how the lamps are wired through a single-pole, double-throw switch that automatically returns to the center "off" position when released.

The diagram and photos in Fig. 5 illustrate a use for a flashing lamp to indicate when there is a power failure. Plugged into the same receptacle as, for example, a food freezer or water pump, it will warn when current stops flowing to the unit so steps can be taken to correct the situation. Inside a wooden cabinet—used for sake of appearance—is a transformer that is wired to a relay. A G-E No. 406 or 407 lamp is wired to the opposite side of the relay as

indicated. The relay is of the type that keeps the contact points open as long as current flows through it. When the current stops, the contacts close and the flasher-filament lamp then is energized by the dry cells. For the No. 406 lamp, two size-D dry cells are required. A 6-volt lantern battery is used with a No. 407, and this latter setup will last approximately twice as long.

Where a warning light is needed, for example, to indicate that someone is using the bathroom for a darkroom, the pin-up light in Figs. 6 and 7 does the job. A transformer reduces household current to 6 volts to power a No. 405 or D-25 lamp. An L-shaped bracket supports a socket of the type used for illuminating radio dials, and is fastened to an aluminum disk for a "pin up lamp" appearance. A small shade would make the lamp even more attractive. ★★★



Farmers who sometimes find it necessary to make frequent trips over a barbed-wire fence for temporary periods of time not long enough to warrant installing a gate, will find this stile ideal. It is made from a section of an old windmill ladder, which is heated and bent to the shape indicated. The stile is light in weight so that it can be moved about as needed. If the ladder ends have a tendency to sink into soft ground, metal pads may be welded to the ends of the rails. If pads 8 to 10 in. long and 4 to 5 in. wide are used, the stile will be stable enough to be used as a stepladder when picking fruit, etc.

Dusty spider-web cross hairs in surveying instruments can be cleaned by using an ordinary soda straw. After the eyepiece is removed to expose the cross hairs, blow gently through the straw to remove the dust. Be sure not to touch the hairs with the straw, as they can be broken easily, and are difficult to replace.

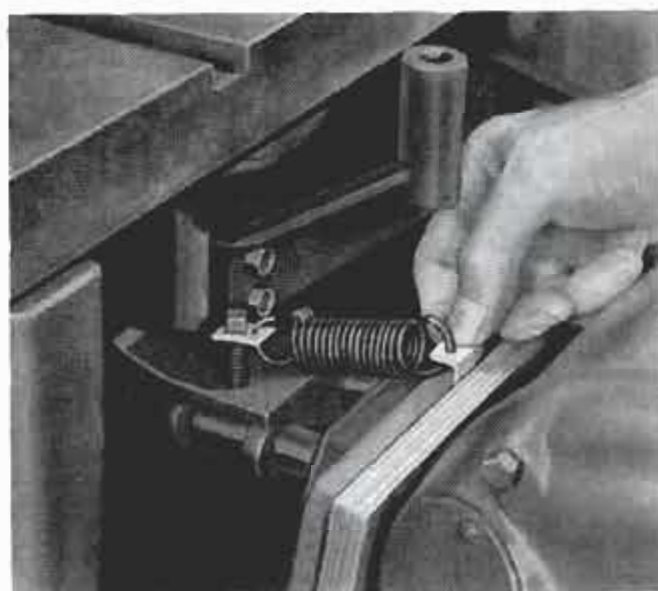
Henry S. Jansen, Baltimore, Md.



Spring Supports Motor Mount to Relieve V-Belt Tension

Maintaining tension on the V-belt between the pulleys of a motor and circular saw, or other power tool, usually is accomplished by mounting the motor on a hinged platform. The V-belt then supports most of the weight of the motor. In some cases this method produces excessive wear on the belt and on the motor bearings. One method of reducing this problem is to fit a spring between the motor and a convenient spot on the frame of the power tool. The spring should be of sufficient strength to support most of the weight of the motor, yet still allow sufficient tension on the belt. If a spring is slightly stronger than required, stretch it, then cut off enough of the coils to permit it to be used.

R. Hanscom, Elmhurst, Ill.



Wheels on Cattle Chute "Retract" When Axle Is Rotated by Lever

Rotating the axle under this cattle chute 90 deg. by means of a hand lever raises the chute up onto the wheels for towing. The retracting-wheel effect is obtained by using a curved front axle from a truck. It is fitted into notches cut in the upper edges of the skid timbers, and held in place by steel flats bolted to the skids. Rotating the axle to offset its curve raises and lowers the wheels just a few inches, which keeps the center of gravity low for ease of towing.

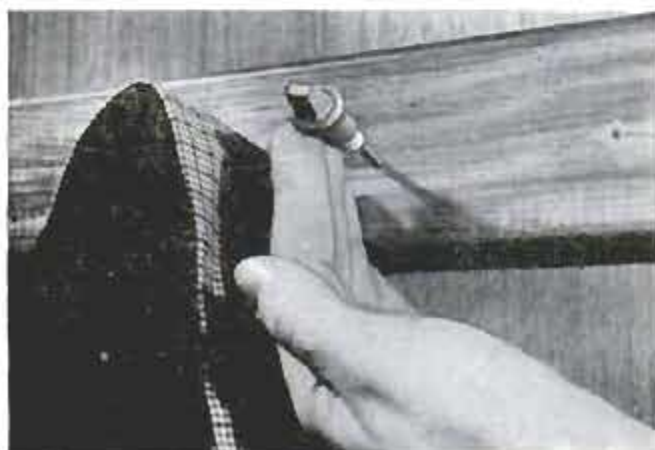
A. M. Wettach, Mt. Pleasant, Iowa.



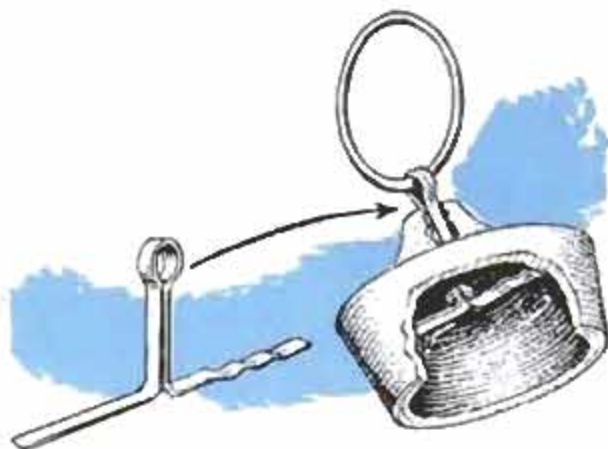


Solving HOME PROBLEMS

DOUBLE BOILER can be made from two saucepans of different size by resting the smaller pan on three fruit-jar lids placed in bottom of large pan



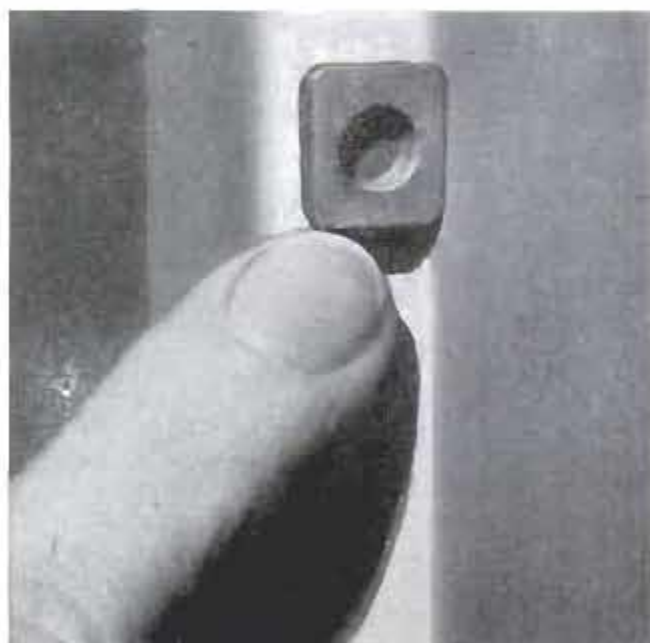
BOBBY PIN comes to rescue in reattaching chain and ring to broken drain stopper. Fit pin over ring, push through hole in stopper and bend ends up

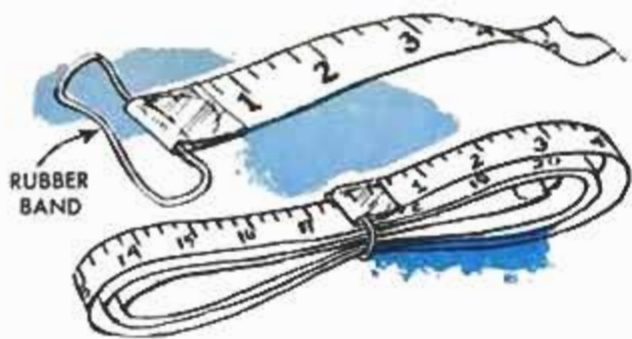


SLIP-ON PENCIL ERASERS placed over nails on which garments are hung will eliminate chance of tearing clothing. Nail diameter is first built up with tape

COLORED TAPERS take on novel decorative touch when dimpled with $\frac{1}{2}$ -in. drill. Series of shallow depressions expose white wax under surface color

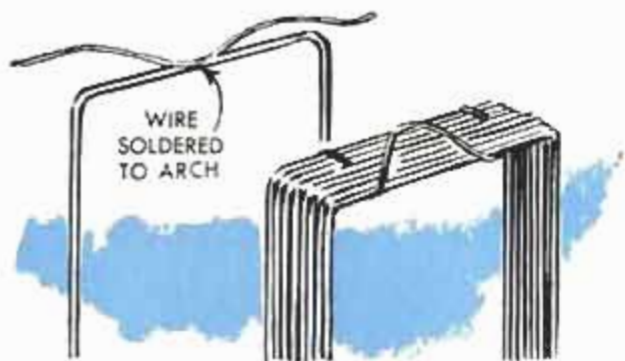
ANNOYING DOOR RATTLE against steel frame is silenced by cementing piece of rubber to doorstep. A slice from center of a slip-on eraser was used here



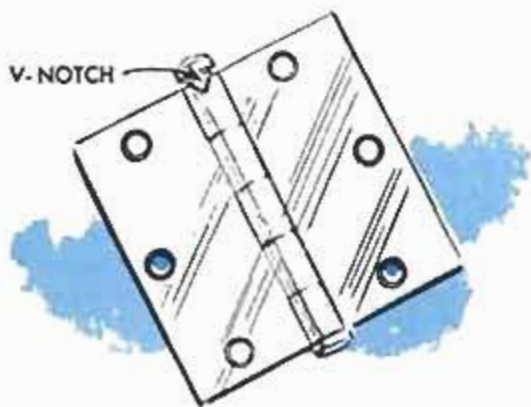


CLOTH MEASURING TAPE stays folded in sewing box when small rubber band is taped to end. Folded tape is inserted through rubber band to hold it

MISPLACED CROQUET ARCHES are a thing of the past when a length of soft iron wire is soldered to one of them. Store arches by twisting wire around others



HINGE PINS ARE REMOVED at future times with less effort if V-notches are filed in the ends so that the blade of a screwdriver will fit under the pins



SLIDING HEAVY GARMENTS back and forth on a closet pole to make additional room requires little effort when pole is waxed. Makes hangers slide freely

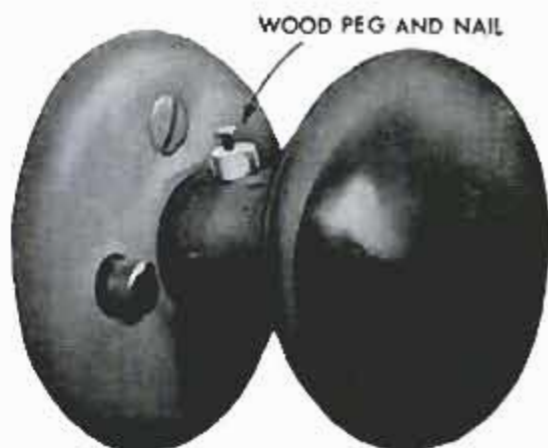


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A DAY BED OR COUCH won't creep away from a wall, yet can be moved, when hooked to the baseboard. Put the screw eye into the back of the couch leg

IF SETSCREW FALLS OUT of doorknob and becomes lost, you can hold knob in place temporarily with a wooden peg, reinforced through center with nail



DON'T THROW AWAY the foil containers in which frozen foods are packaged. They make dandy disposable pans for paints, brush cleaners and other uses



175

Improved Soft Hammers for Xylophone Give Muted Tones



Both regular and toy xylophones, chimes and some other percussion musical instruments respond with pleasing, muted tones when played with these soft hammers. To make each hammer, cut off the head and point of a No. 8 plastic knitting needle and then cut the remainder in half to make two handles, each $6\frac{3}{4}$ in. long. Press a $\frac{5}{8}$ -in. Fuller ball on the end of each handle. If longer handles suit you best, use two needles, cutting each to the length desired.

Art Trauffer, Council Bluffs, Iowa.

Auto hose clamps of the adjustable type will prove helpful when gluing round, hexagonal, or octagonal shapes for lamp bases, clockcase columns or similar projects. Hose clamps of the type which are adjustable within a wide range have a maximum capacity of about $3\frac{1}{2}$ in. To be most effective, the clamps should be spaced 2 to 4 in. apart and should be drawn to a uniform tension to assure sound glue joints.

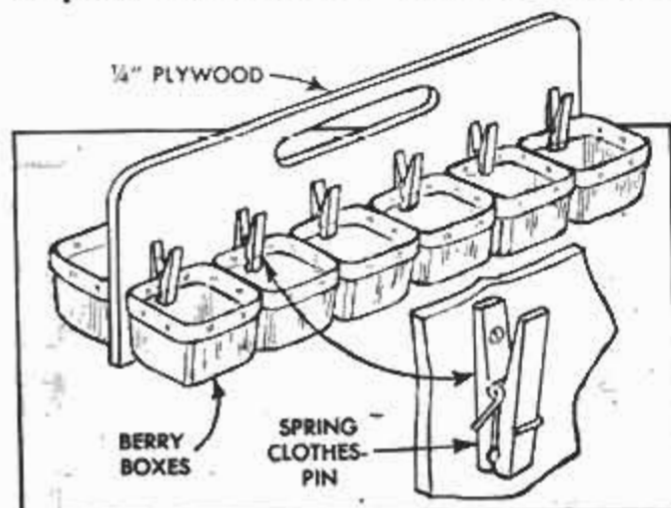
Accurate Point Ground on Center Punch When Chucked in Drill



Holding a center punch by hand when grinding a point on the end can result in only a fairly accurate job. A much better way is to use your electric drill to hold the punch. With the center punch chucked in the drill and both the drill and the grinding wheel rotating, a perfectly centered point will result every time. Let the punch rest on the grinder steadyrest in the manner shown, and hold it at an angle which will produce the desired degree of point. Rod stock can be pointed in the same manner and in duplicate lengths by providing a stop to limit the grinding.

Rex Bush, Columbus, Ohio.

Clip-on Tote Handle Carries Dozen or More Berry Boxes



The difficulty of holding and carrying a number of berry boxes when picking strawberries and other small fruits is solved when you use this novel carrying handle. It is nothing more than a piece of plywood cut out to fit the hand and fitted with a row of spring-type clothespins on each side. The boxes are clipped to the clothespins.

Minor floor squeaks often can be silenced by squirting powdered graphite in the joints between the boards. If this doesn't work, try pouring hot liquid soap in the joints to lubricate the rubbing parts.

New Beauty for **DATED WALLS**

Plain walls become walls of distinction when decorated with a new wall covering called Decorator Motifs. Comes prefinished, ready to be glued to any wall surface with cement

YOUR DRAB interior walls are in line for a decorating "pick me up." A new concept in 3-D wall coverings offers the discriminating homeowner the choice of unusual wood textures, the art of ancient cultures and the exciting forms of contemporary design. Available in the form of interlocking and lapping plastic panels, this new dimensional wall covering can be applied to almost any surface by anyone. Not only is it easy for the do-it-yourselfer to apply, but the completed wall is washable and grease and stain-resistant.

Among the unusual patterns from which to choose are: Bamboo, Aztec Stone, Driftwood, Rafted Bamboo and Contemporary Grid, any one of which will transform an uninteresting wall into a stunning and elegant focal point. Departing from the traditional stone and brick effects, the covering is enhanced by color highlights which include gold on black, gold on white and variations of grays and natural tones. The Aztec Stone sculpture pattern is an authentic reproduction of ancient archeological findings.

The panels range in sizes from 23 x 38 in. to 24 x 48 in.,



Photos courtesy The Decor-Wall Corp
Gold-on-black Aztec Stone forms a most distinctive background

RAFTED BAMBOO



AZTEC STONE



DRIFTWOOD



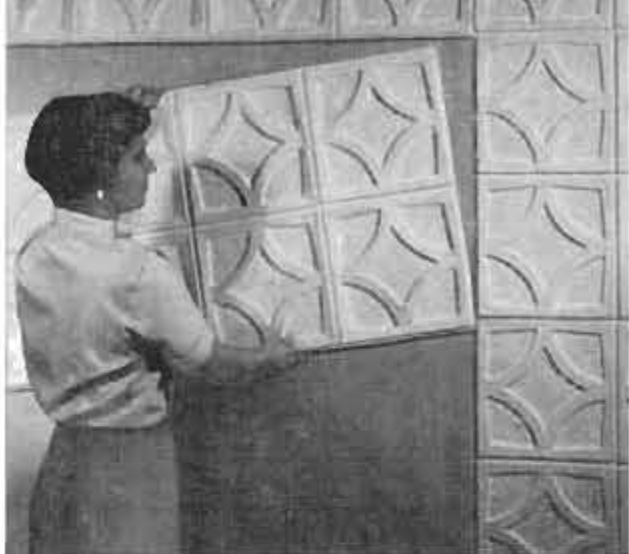


CONTEMPORARY GRID—Unusual pattern inspired by the timeless Taj Mahal for the contemporary mood. **BAMBOO**—A touch of exotic Orient for smart living



which makes them easy to handle and fit when applying. Some are die-cut to interlock; all lap in a continuous matching pattern. Although it is of paper-thinness, the vinyl material produces an exceptionally tough and durable surface covering. The Contemporary Grid pattern is made eight grid squares per panel and comes in two colors, white and sand. The Aztec Stone pattern has four plaques per panel and is available in gold on white, gray or black, and plain sand color. The Driftwood pattern comes in gold on gray or on white, as well as plain white, tan and gray. You have a choice of white and natural in selecting the Bamboo patterns.

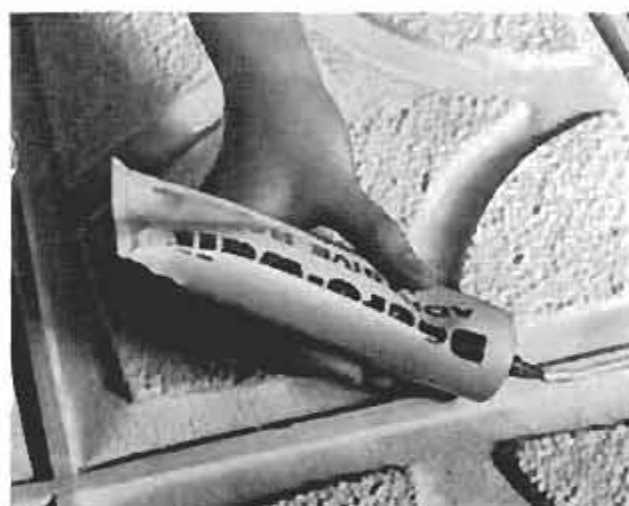
The adhesive that is used to cement the panels to the wall comes in tubes and is gently squeezed in long beads directly onto the back of all mortar lines or the ridges that are pressed into the material. Panels are applied one at a time and pressed in place immediately with the fingers. Where a panel is to interlock, the die-cut sections are broken out. In all cases, succeeding panels lap those already mounted. ★ ★ ★



Start at center of a wall so you will have uniformity at the corners. The panels lap the edges of one another rather than butt, and in the case of the Driftwood pattern, the panels interlock at ends

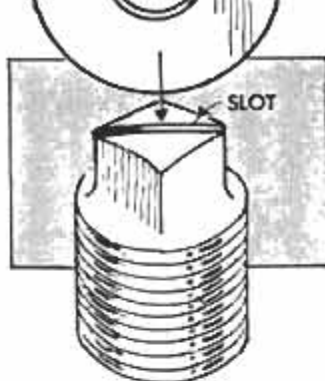


Above, the paper-thin, yet tough, material is easily cut when necessary with common household scissors. Below, cement is squeezed from tube onto the ridges on the backs of the panels in long beads. Apply immediately to wall and press ridge lines with fingers



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sumps of gear housings, reduction drives and other equipment having enclosed power-transmission units, are difficult to reach and remove with a wrench. Removal and replacement can be made easier by simply slotting the square head of the plug with a hacksaw and welding a washer in the slot as shown. If desired, cut the washer in half to form wings like those on a wing nut.



Hugh Lineback, Stillwater, Okla.

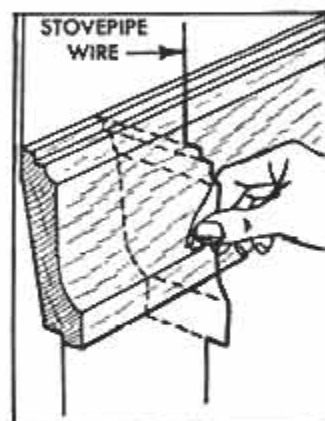
Poultry Apply Own Mite Dust

In tests conducted at a large poultry ranch near Anaheim, Calif., it was found that the hens would dust themselves when boxes filled with 4 percent of malathion dust were provided. Described as being 20 percent less expensive than conventional spraying in the ridding of mites, the self-dusting method also was found to avoid the costly emotional disturbance caused among hens when they were sprayed. White leghorns, for example, accepted the dust-bath boxes quite readily, dusting themselves enthusiastically and applying the insecticide as they did so.

John Bunker, San Diego, Calif.

Transferring Molding Contour

Have you ever tried to reproduce a piece of irregularly shaped molding that could not be traced, and it was not desired to remove it for this purpose? One of the simplest ways to transfer such a shape to drawing paper is to first form a pattern of the molding by bending a length of stovepipe wire carefully and then tracing it on paper. A straight portion of the wire should be left extending above and below the molding. Handy when fitting a bookcase over a baseboard so it will stand against wall.



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PICTURE-FRAME "DOCTOR"

HOW DOES AN EXPERT repair an ornately carved, gilded frame of the type in which are displayed priceless paintings in museums and art galleries? Would the same skills enable anyone to repair an equally ornate, though perhaps not so valuable, frame they own? Shown on these pages in step-by-step photos is the method used by Mr. Edward Santrucek, picture-frame "doctor" for the New York Historical Society.

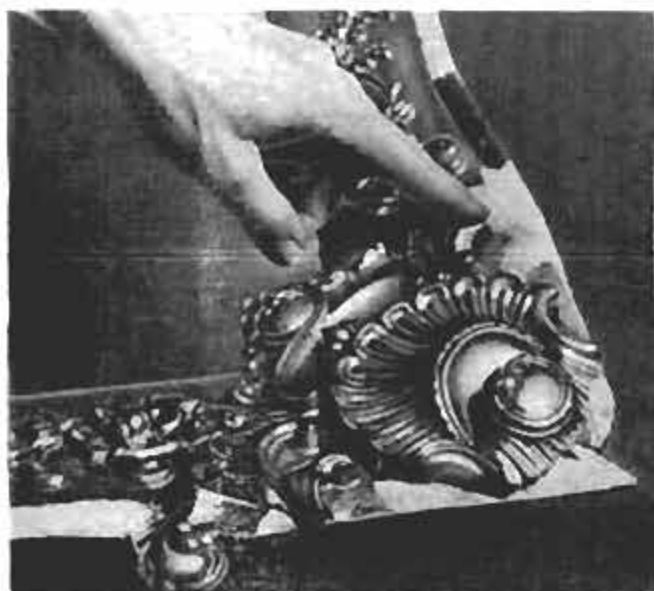
His method is to obtain a mold from an undamaged section of the frame, taking advantage of the fact that most such frames are symmetrical. Casting a replacement piece from the resulting mold assures a duplicate of the carving done by the original artisan. By carefully duplicating this method, and with persistence and patience, any home craftsman can make a similar repair. Applying gold leaf is not a well-known skill, although some commercial artists occasionally practice this age-old craft. If you do not have a friend who is a gilder, it is suggested that you purchase a copy of a book on applying gold foil. It also is possible that some hobby shops might have the foil and tools for application, as well as an instructor in this skill. If not, they may have the name and address of such an instructor you could contact. Where foil has been used on a frame, its replacement assures a perfect match.

★ ★ ★

First step is to press modeling wax onto undamaged section of frame that is duplicate of part needed to make repairs on the damaged corner of the frame



Above, picture-frame "doctor" in his workshop. Below, damaged corner of ornate, hand-carved picture frame illustrates type of repairs that are required



Below, after skillful replacement of damaged sections, frame is restored to original appearance so it matches diagonally opposite corner of frame





Above, wax mold now is removed from frame, coated with parting agent and filled with plaster of paris



When plaster has dried, above, finished casting is removed from mold, trimmed to fit missing section



Above, cast pieces are trimmed and fitted in place. Below, tissue-thin gold foil is slipped off heavy paper with brush made magnetic by static electricity



Above, completed frame is shellacked or varnished to waterproof it. Below, after gold foil is in place it is brushed to contact fully all frame irregularities





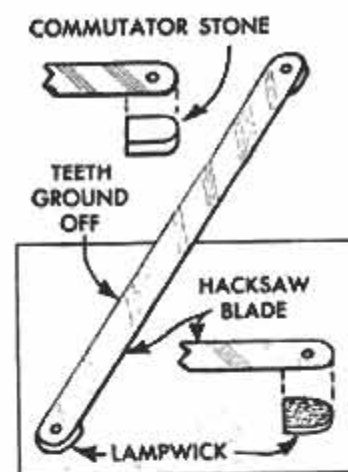
Threaded Pipe Held for Sawing On Steel Rod Clamped in Vise

When cutting short lengths of small, threaded pipe, such as frequently are used in the assembly of electric fixtures, slip the pipe over a piece of steel rod clamped in a vise. The rod will support the pipe without damage to the threads. Small-diameter tubing that would be crushed or damaged if clamped in a vise for cutting can be supported by using the same method.

Paint Labels Kept Spatter-Free

Do you have cans of paint on the workshop shelf with labels so paint-smearred that you cannot determine kind and color without removing the lids? Avoid this problem by removing the labels the first time the paint is used. Fold the labels, printed side in, and tape them to the lids. The lids, of course, are always removed and are away from any spattered paint.

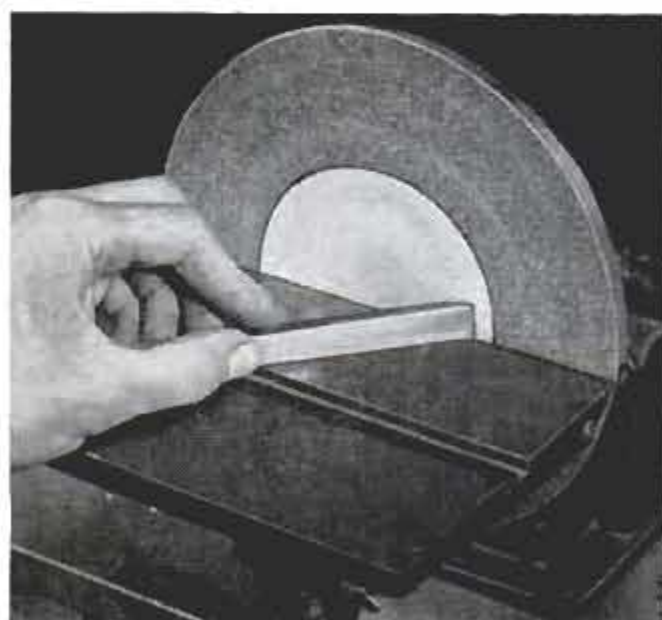
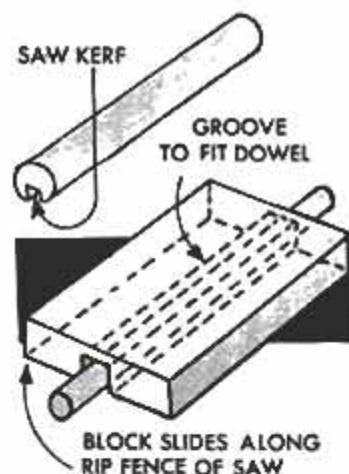
Handy Generator Touch-up Tool



For quick generator touch-ups, one mechanic uses a hacksaw blade, to which is cemented a piece of commutator stone and a piece of lampwick. The wick is soaked in carbon "tet" to clean commutators polished with the stone.

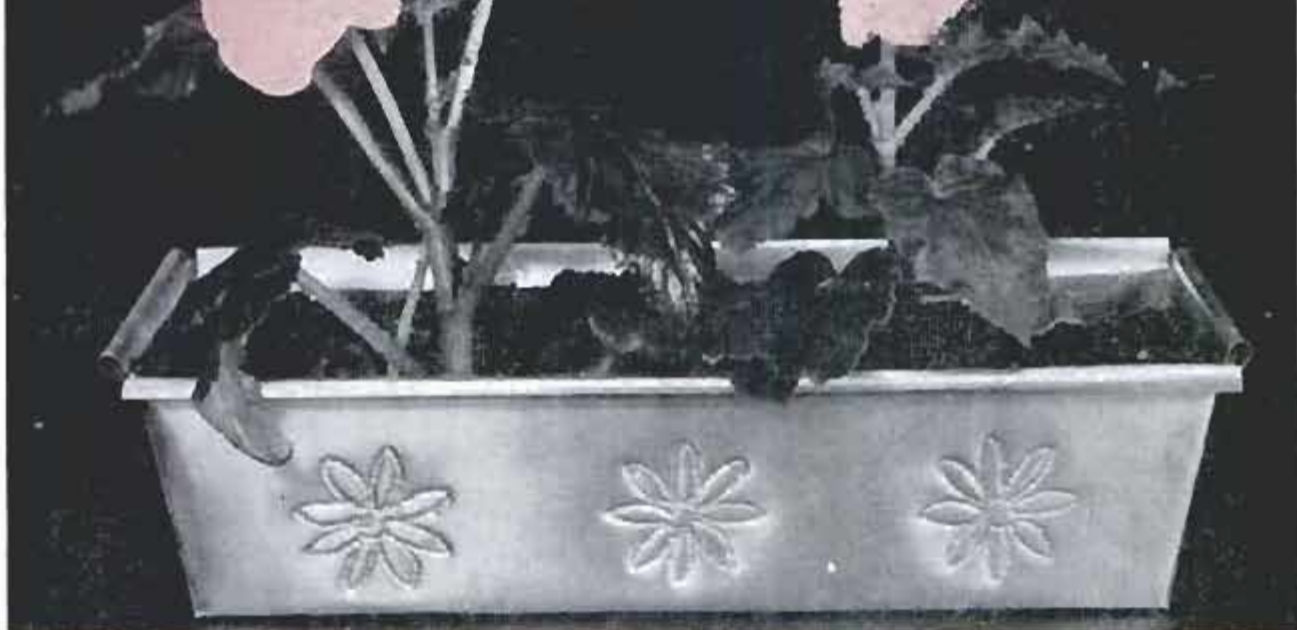
Dowels Grooved Lengthwise

Instead of planing a flat on a dowel to provide a vent for excess glue to escape when driving it into a hole, saw a lengthwise groove in it. Groove a block to hold the dowel snugly while it is passed over a circular saw to cut the groove.



Combination-Grit Sanding Disks Have Fine and Coarse Paper

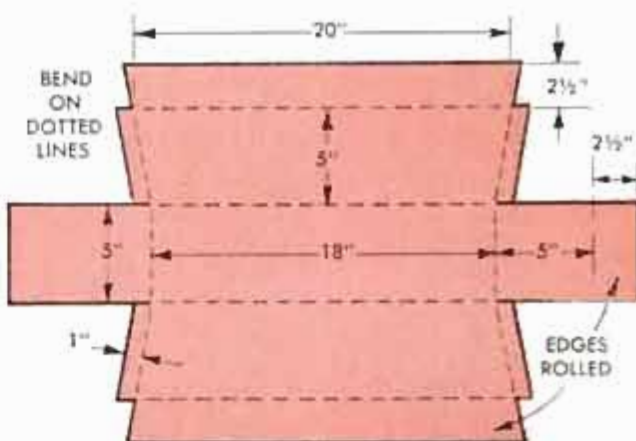
Often it would be an advantage to be able to fine-sand a number of small parts on a disk sander without the need for changing disks. One way to do this is to cut out the center of a large disk of coarse paper to accommodate a smaller-diameter disk of fine paper. Reverse the large disk on the sander, rotate it by hand and cut out the proper-size area with a razor blade. Now, cement the small disk in place, then fit the large disk around it to provide, in effect, two grades of paper on the same disk. Save the disk cut from the coarse paper and use it for an alternate coarse-fine combination on some other job.



Hand-Shaped Metal Planter Is Assembled With Cement

By Jerry Parker

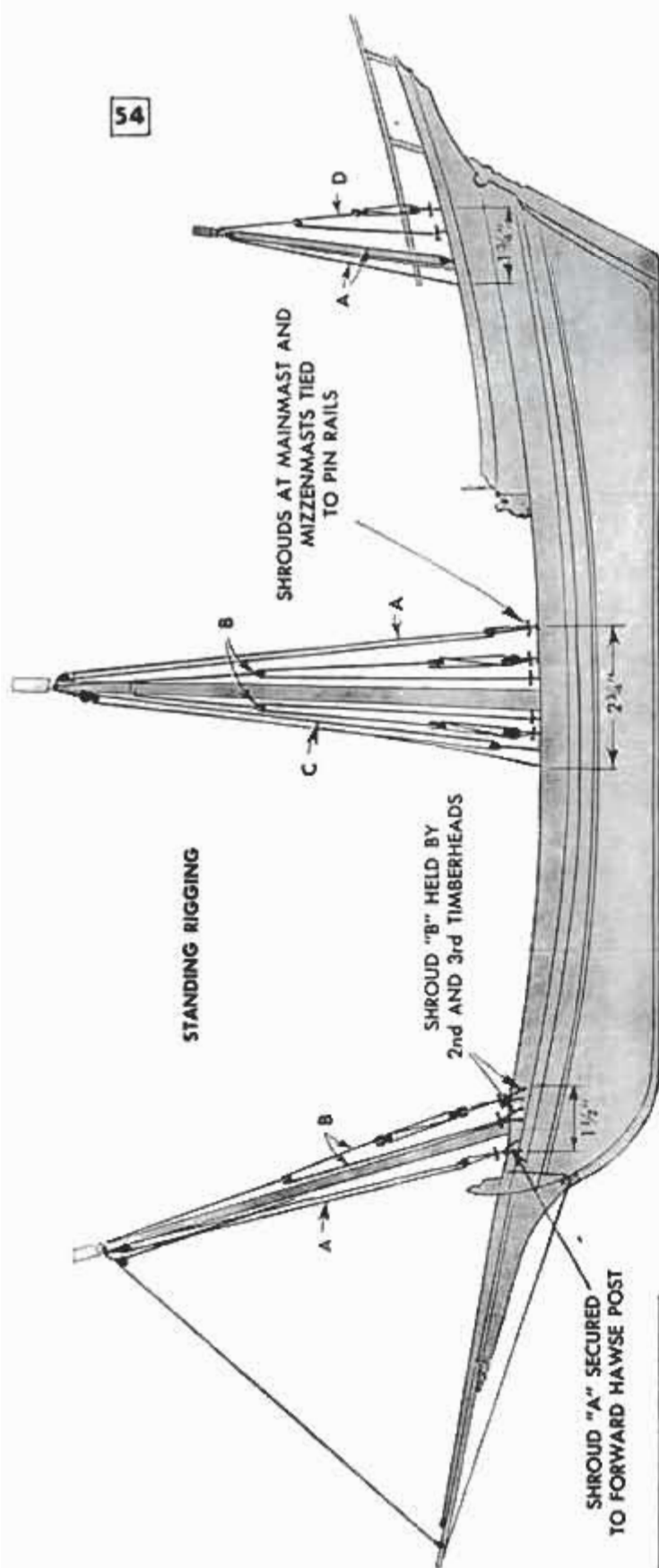
NO RIVETS, screws or bolts are used to assemble this attractive aluminum planting box. The aluminum is the type manufactured especially for do-it-yourselfers, so it is formed easily with hand tools. Use the pattern on this page for cutting out the box, then stamp designs on one or more sides by using a hammer and blunted nail, as in lower left-hand photo. The next step, center photo below, is to roll the edges with the aid of a slotted dowel. To make the bends, clamp the metal between two strips of wood and use a third strip and hammer to form the metal evenly. The ends and flanges of the box now are coated with con-



tact adhesive, right-hand photo below, and joined. Because some soils have an acid or alkali condition that would corrode the aluminum, coat the inside of the box with asphalt paint up to the soil line. Place gravel in the bottom of the box before adding the soil, to assure proper drainage.

Photos show step-by-step how single piece of aluminum is embossed, shaped and cemented to form planter





STANDING RIGGING

PORTFOLIO OF PLANS

Popular Mechanics offers the serious modelmaker plans for building four other famous French ship models, namely *La Sablaise*, a sailboat, *Jeanne D'Arc*, a training cruiser, *Marie Jeanne*, a fishing boat and *Le Terrible*, a light cruiser. For a free descriptive brochure on these plans and their prices, write to Popular Mechanics Co., Dept. 80, 200 E. Ontario, Chicago 11.

MODELING THE FRENCH CHEBEC

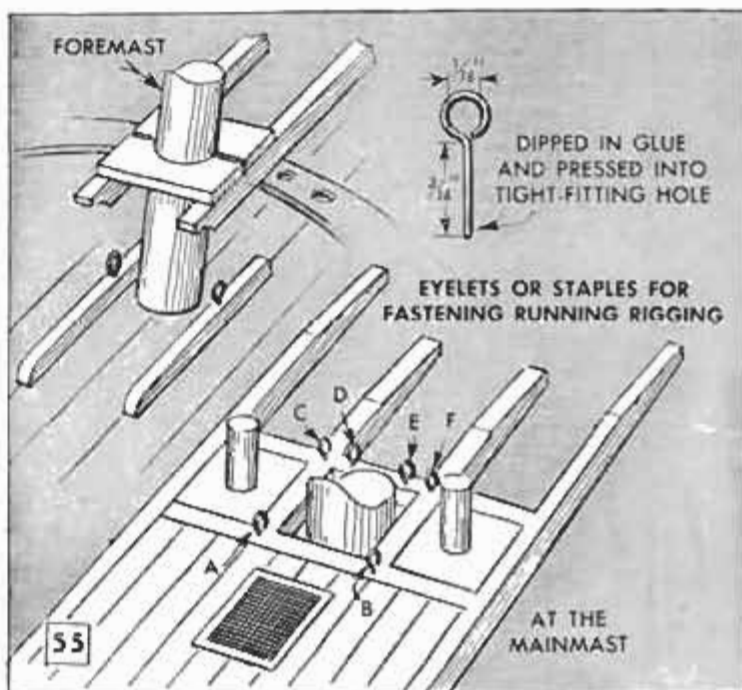
PART IV

Standing rigging and sails

ALTHOUGH THE RIGGING of this model may appear somewhat complicated, it is actually quite simple when undertaken step by step. First comes the standing rigging, shown in the port view, Fig. 54. This braces the masts, as distinguished from the running rigging which serves for handling the yards and sails. Start with the standing rigging at the bowsprit and work aft.

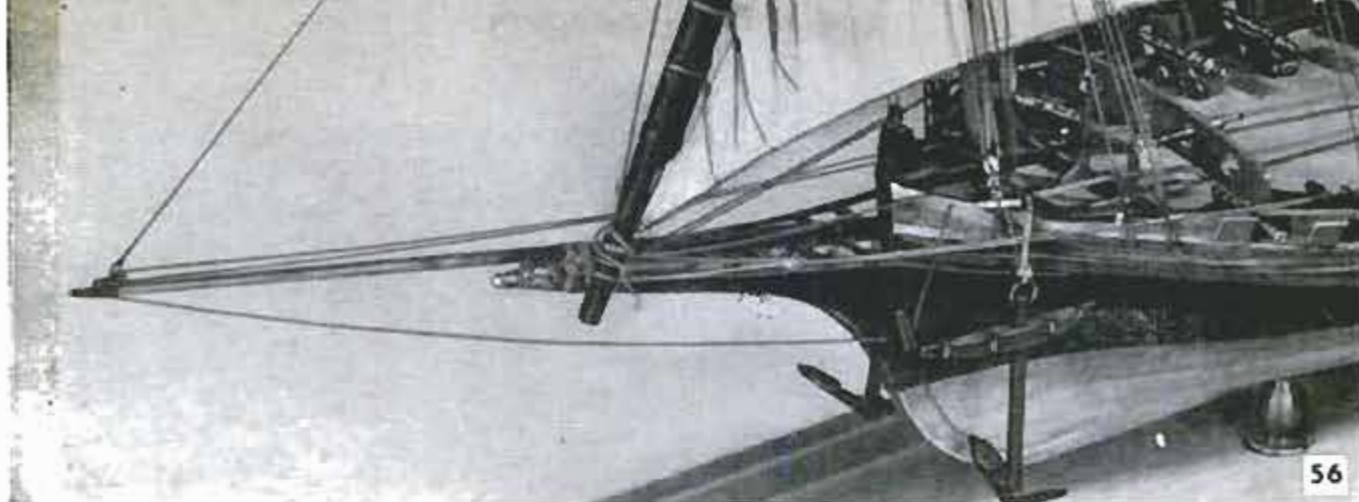
Materials for Rigging

With the exception of the black-thread woodings that hold the two members of each yard together as shown in Fig. 53 of Part III, all the rigging lines and cordage of this model should be a light coffee shade. Hard-twisted-linen line, which resembles rope in miniature, is best as it does not change appreciably in length because of temperature and humidity variations. Impregnating it with beeswax increases the dimensional stability. After rubbing wax on the line, wrap it



53

AT THE MAINMAST



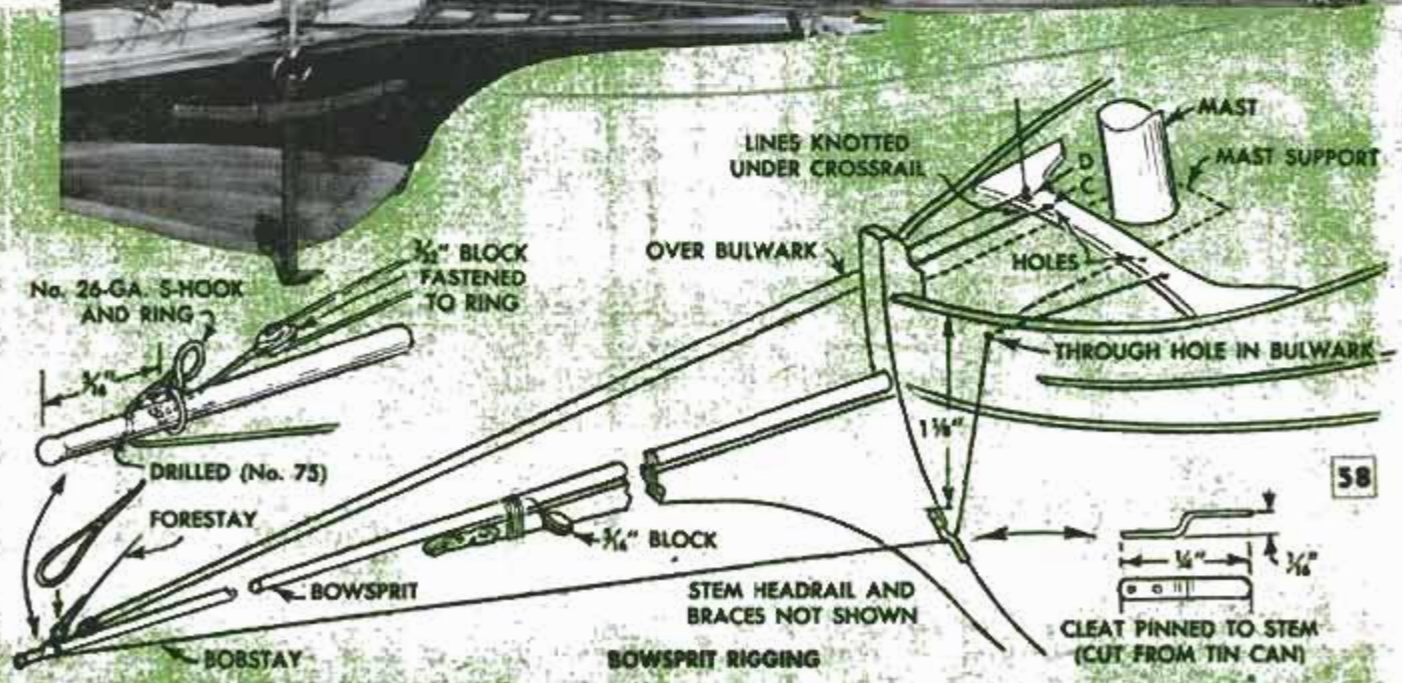
around a tubular electric bulb, the heat of which will cause the wax to be absorbed. However, cotton line is claimed to have satisfactory dimensional stability when it is thoroughly impregnated with beeswax, which also eliminates the surface fuzziness. Nylon line and thread expand and contract much more but still can be used for very short lengths like reef points, for lines that must be kept slack and for lashing and seizing.

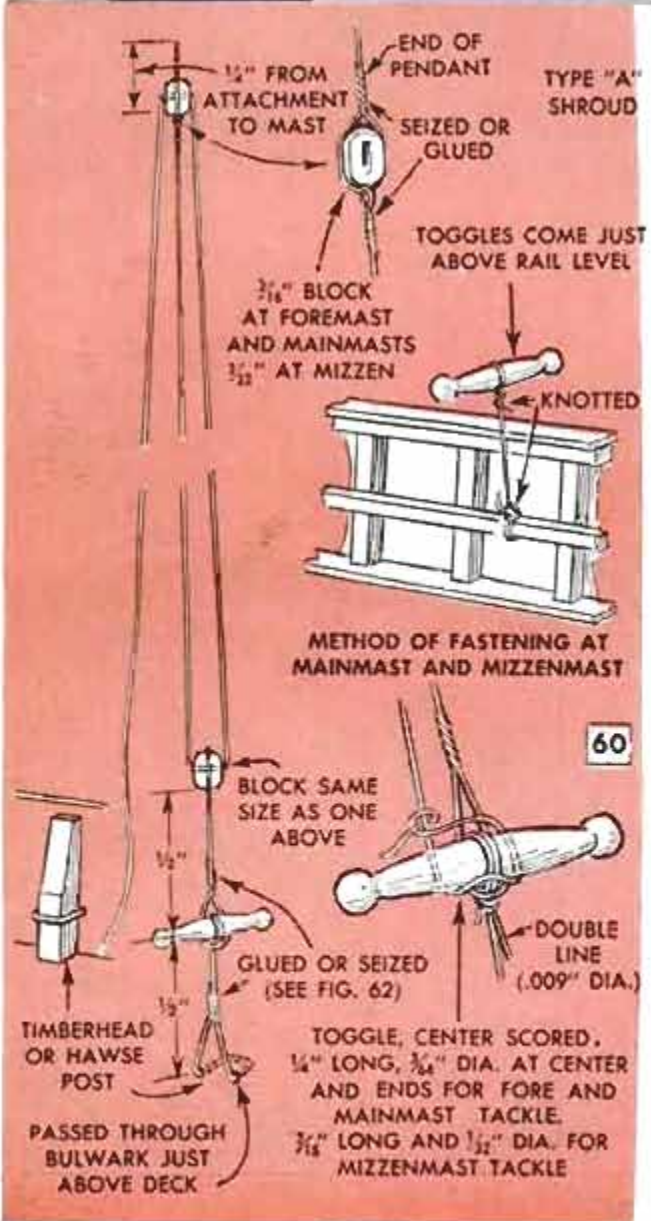
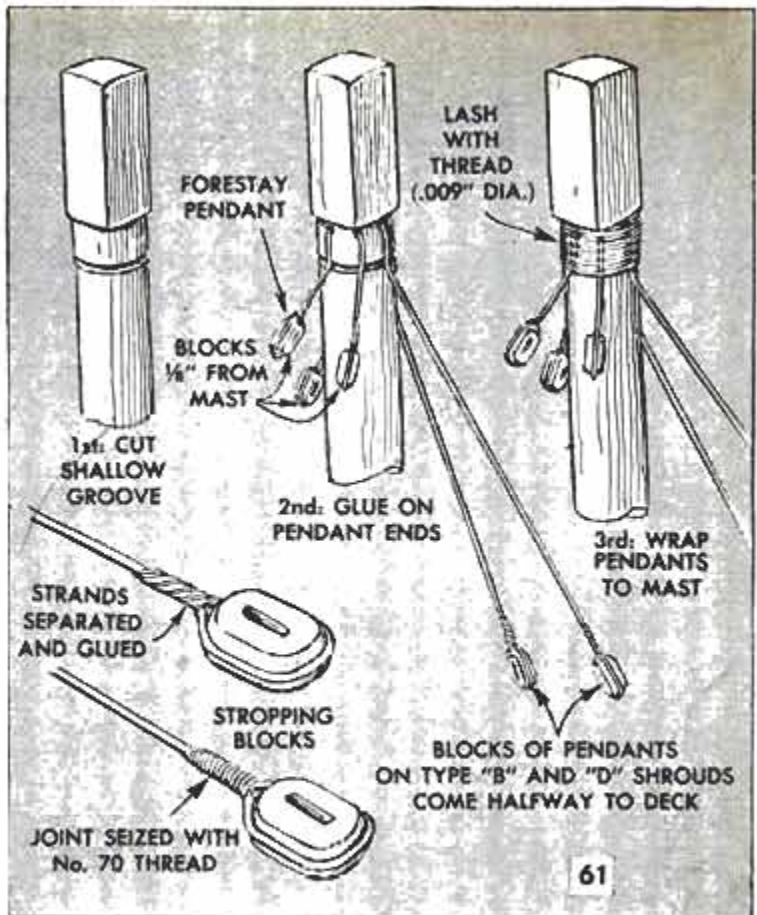
Size of Rigging Lines

All of the standing and running rigging lines of this model are approximately .018 in. (a trifle more than $\frac{1}{64}$ in.) in diameter, except where other sizes are specified. The

sizes will be given in decimals of an inch since suppliers of rigging line refer to size only in terms such as heavy, medium, fine and very fine. That called fine by one may be the same size as that called medium by another. Line of .018-in. thickness corresponds to No. 18 upholsterer's linen thread, which you may be able to obtain and can be used for rigging. However, it is relatively smooth and therefore has less resemblance to rope than the hard-twisted-linen rigging line.

For bolt ropes on the sails use line from .018 to .025 in. in diameter. For lashings to the masts and yards, for reef points, flag halyards, brails, parrel lines, tackle of the yard runner ties, and also for the double





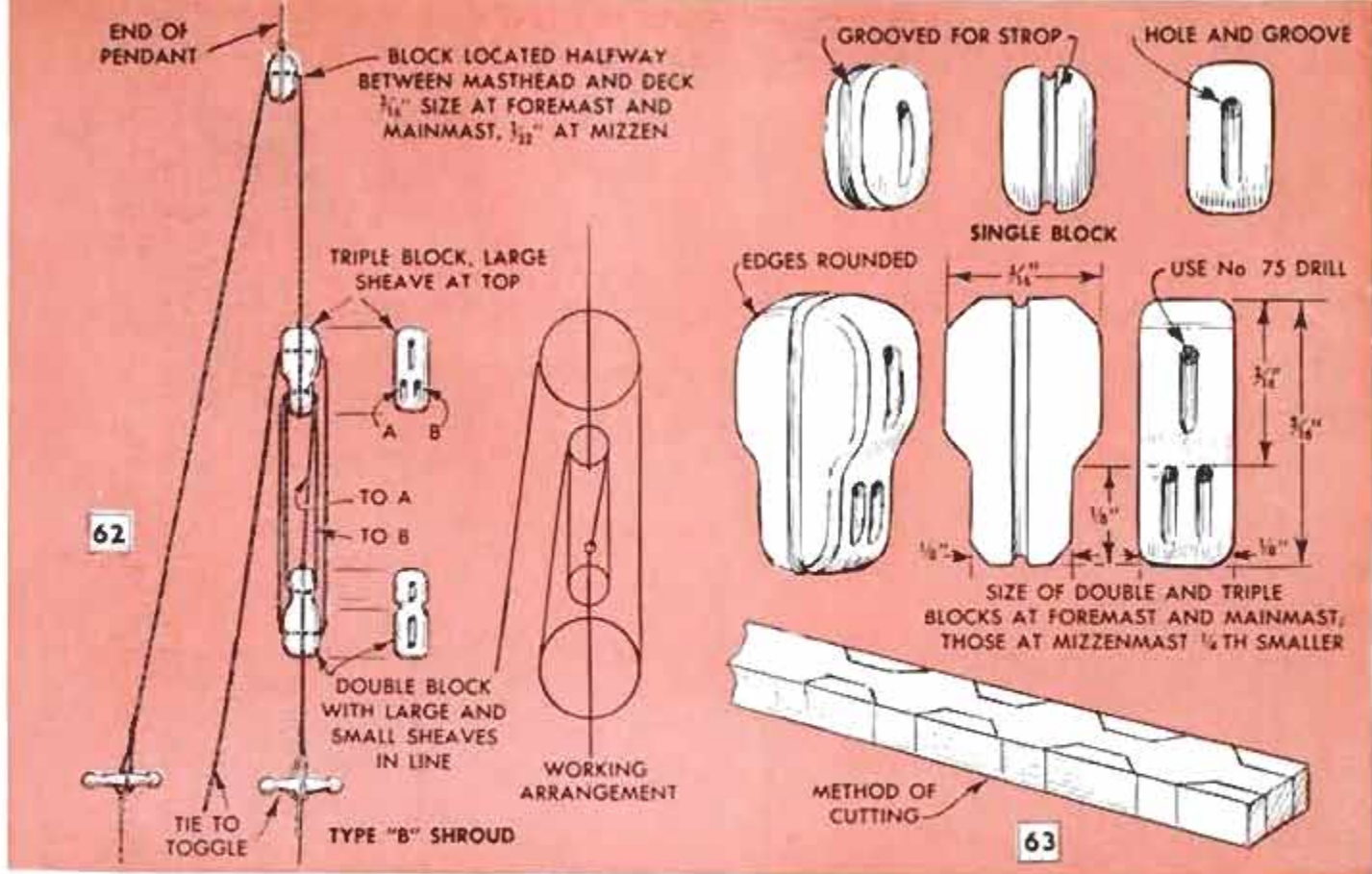
lines that hold toggles to which shrouds are attached, use line .009 in. in diameter. For seizing lines, as at blocks and sail clews, use No. 70 to No. 50 thread which runs from .004 to .006 in. in diameter.

Bowsprit Rigging

Before you start on the rigging, install the tiny eyelets or staples at the base of the mainmast and foremast as detailed in Fig. 55. The bowsprit rigging is shown in Figs. 56, 57 and 58. Note the tiny ring with attached hook, and also the cleat that is pinned to the stem almost straight below the stemson. These parts are made first.

Instead of using belaying pins on the crossrail at the foremast to fasten a number of lines, the latter are attached in two ways to avoid a bulky appearance. Some go through holes in the crossrail and are knotted under it while others are simply tied on. The bowsprit lines go through tiny holes C and D, Fig. 59, and are knotted underneath. The line passing under the cleat serves as a bobstay. After knotting one end, thread the line up through hole A, forward through the bulwark, then under the cleat and up through a No. 75 hole drilled in the bowsprit. Draw the line up moderately taut and glue it in the hole. Keep the line taut until the glue dries, then seize it to the lower end of the hook and apply a spot of glue.

The line from hole D in the crossrail passes through a block attached to the ring on the bowsprit and returns to hole C in



the crossrail. The forestay, which runs from the bowsprit hook to a block on the masthead, and then down to the crossrail at D, is added after the foremast shrouds are in place. Note that the lower end of the forestay forms an eye which engages the hook on the bowsprit. The block attached to the lashing midway on the bowsprit is to be used for the truss line of the foreyard, which is running rigging, but can be fastened in place at this time.

Shroud Pendants

Mast-bracing lines that extend from the bulwarks to the mastheads are called shrouds and consist of pendants (shroud hangers) and tackle. The pendants are the upper portions from which the tackles hang, and are lashed to the masts as shown in Fig. 61. A shallow groove cut around the mast serves to prevent the lashing from slipping down in case it should become slightly loose. Before attaching the pendants, fit them with blocks of proper size as given in the details of the shrouds. Then glue the ends of the pendants to the mast vertically just above the groove, after which the lashing is applied. The ends of the lashing are self-held as already detailed in Fig. 53 of Part III. Apply a coat of glue over the lashing for added strength and as a protection against moisture. The foremast has five pendants, four for shrouds and one for the forestay tackle.

After pendants have been attached, rig

the shroud tackle. There are four variations referred to as types A to D inclusive. All these types are shown in Fig. 54, and they are detailed separately in Figs. 60, 62 and 66. Those on one side of a mast are identical to those on the other side. Start with the forward starboard shroud of the foremast. Starboard is the side of a ship on your right as you face forward; port then is on your left. Next, do the forward port shroud and continue aft alternating from side to side to equalize the slight pull on opposite sides.

Note from Figs. 54, 59 and 60 that the shrouds of the foremast fasten to toggles held by double lines, three on each side. These pass through the bulwarks after





which one goes around the forward hawse post, and the other two around the second and third timberheads. The approximate spread of the shrouds at their fastening points along the bulwarks is given in Fig. 54. The free or "fall" ends of type-A shrouds at the foremast and the mainmast are secured to the toggles, but at the mizzenmast this ties to the pinrail. Those at the mainmast and mizzenmast fasten to the pinrails.

A closeup view of the mainmast shrouds (with background blocked out) is shown in Fig. 64. These include two type-A shrouds, four type-B shrouds, Fig. 62, and two type-C shrouds, Fig. 66. The shroud assembly at the mizzenmast also is shown in Fig. 66. This includes two type-A shrouds and two type-D shrouds, the latter being detailed in Fig. 66. On type-B and type-D shrouds the blocks of the pendants come about halfway between the masthead and deck.

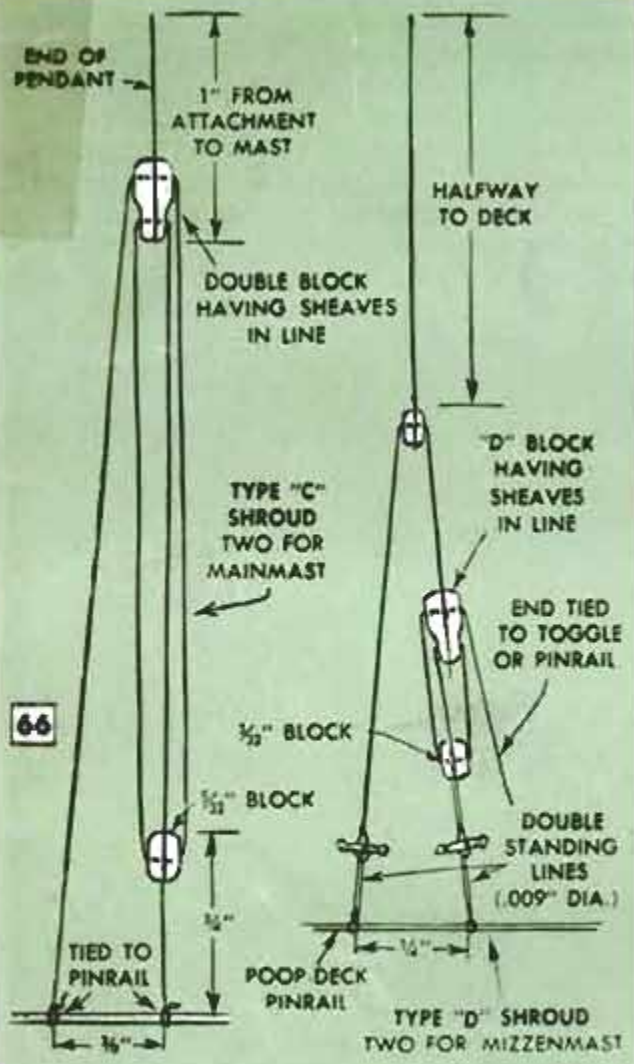
About the Blocks

For both standing and running rigging purchase the following blocks: 20 single $\frac{3}{32}$ in., 10 single $\frac{1}{8}$ in., 23 single $\frac{5}{32}$ in., 15 single $\frac{3}{16}$ in., and 4 double $\frac{5}{32}$ in. All blocks referred to are single-sheave blocks of wood except where other types are specified. Most multiple-sheave blocks used on this model will have to be made. Double and triple blocks for the shrouds are detailed in Fig. 63. There is a difference in the size of these blocks also. Those at the mizzenmast are about one fourth smaller than those at the foremast and mainmast. Boxwood is the best wood for making blocks and other small fittings. A broken carpenter's rule provides a good source. Drill the holes and form the grooves before severing the blocks from the strip.

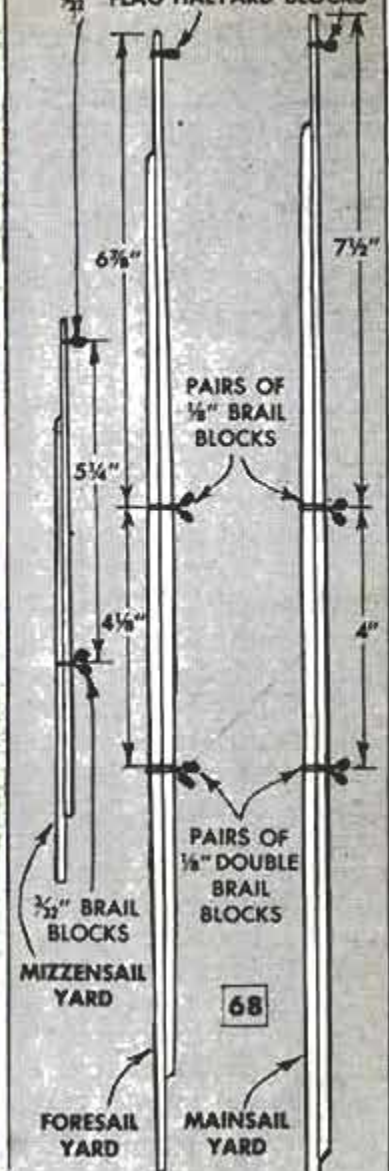
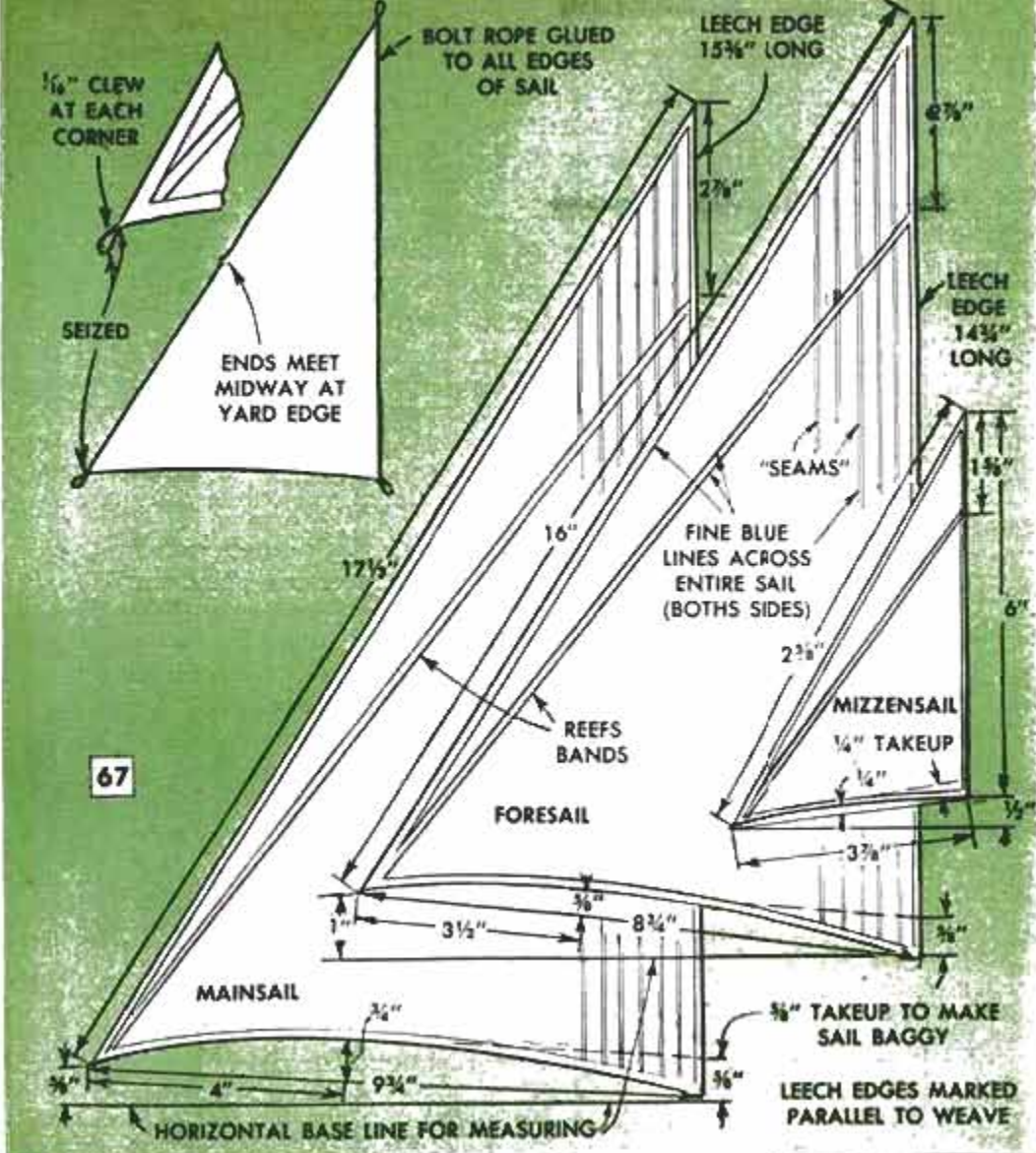
A strop is the end of a line wrapped in the peripheral groove around a block to hold it. To strop a block as shown in Fig. 61, wrap the line around it once tightly, and glue the loose end to the line. Separating the strands of the line before gluing will produce a less bulky joint. For added strength and durability, you can wrap, or seize, the joint with fine thread, which also is coated with glue.

Finely woven white linen cloth such as can be obtained from a discarded shirt, a pillow casing or from some handkerchiefs, is used for sails. All three sails of this model can be cut from a 16 x 20-in. piece. After ironing the cloth to eliminate all wrinkles, mount it on a smooth backing such as a piece of hardboard or plywood. Stick the edges down with draftsman's removable tape, taking special pains to get the material moderately taut with the weave running perfectly straight in both directions. Next make patterns of heavy paper or light

65



66

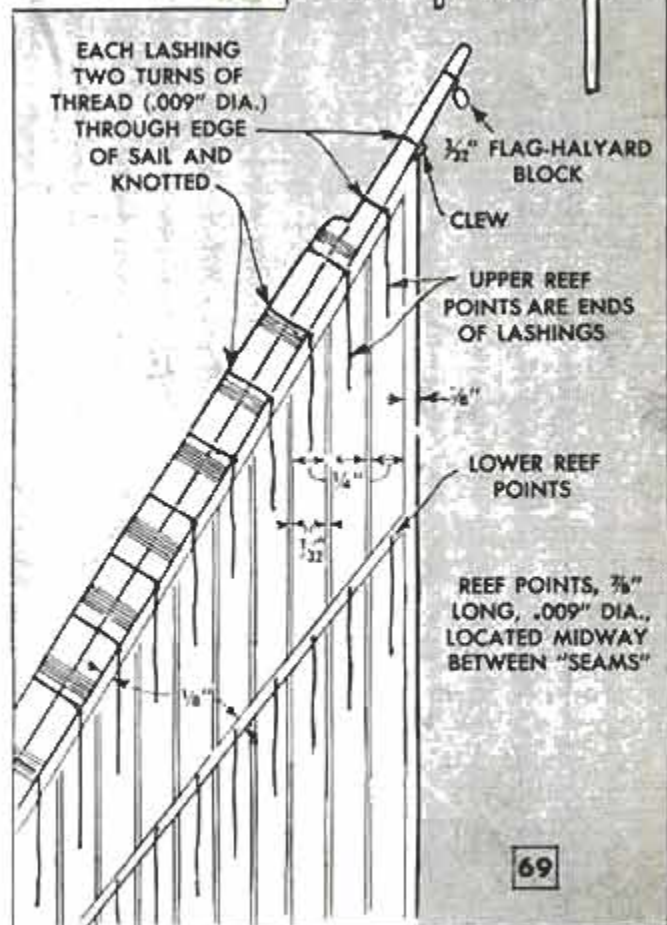


cardboard to dimensions as given in Fig. 67. Lay the patterns on the cloth so that the leech or aft edge of the sails will be parallel to the weave.

Ruling "Seams" With Ink

To represent reef bands and seams of the sails rule fine lines with blue ink, using a fine-pointed fountain pen, which is drawn along the edge of a straight ruler or draftsman's curve as required. Experiment on some waste cloth to ascertain the right speed at which the pen must be drawn along without letting ink spread in the cloth. It can be done quite slowly. Avoid going over a line a second time or it will become too heavy.

Start with ruling lines $\frac{1}{8}$ in. inside the sail edges and parallel to them. Use the draftsman's curve along the foot edges. Then rule the reef band, following this with the vertical "seams." Two lines spaced $\frac{1}{16}$ in. apart represent a seam, and the seams are spaced $\frac{1}{4}$ in. The ruling is duplicated on the other side of the cloth, making it necessary to remove it from the backing, turn it over and refasten it. Don't



pull the tape off the cloth but use extra strips for fastening it down again. If you tape the cloth this time to a large window pane, the lines already made will be visible through the cloth making it easy to rule directly over them.

Bolt Ropes Glued to Sail Edges

Next, with the cloth still mounted on the backing, glue the bolt ropes (.018 to .025-in. dia.) along the edges of the sails. These go on one side only. Use a single length for each sail, starting and stopping about midway along the head or yard edge of the sails. At each corner loop the bolt rope to form a "clew" or eye which is seized. See Fig. 67. Apply glue to the sail edges and also to the rope, and press the two together firmly when the glue becomes tacky.

To produce the desired bagginess in sails, which in real ones allows them to belly in the wind, the leech edges are gathered up uniformly while the bolt rope is being attached. First loosen the tape holding the cloth at points in line with the leech edges to relieve tautness. With tweezers, pull the leech edge up the required takeup distance as given in the drawings, and then spot-glue the rope, while holding it taut, to the lower corner. Spot-glue the center of the rope to the center of the sail edge to produce equal slack on either side. Continue dividing the remaining distances and spot-gluing the cord to distribute the takeup evenly. The bolt rope should be glued to the sail along its full length for greater strength.

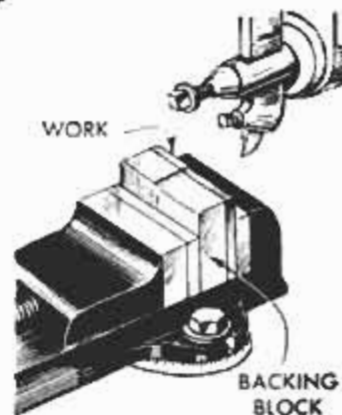
Reef Points and Lashing to Yards

Cut out the sails alongside the bolt ropes with a sharp razor blade after the glue has dried. Spot-glue the reef points, which are $\frac{7}{8}$ in. long and .009 in. in diameter, to the reef-band markings on each side of the sails as shown in Fig. 69. The reef points are located midway between seams. A second row of reef points is located along the yard edge. These are the ends of lashing that hold the sails to the yards as shown in Fig. 67. For each lashing, bring the thread through the sail with a needle and wrap it around the yard twice, after which you tie a knot. The thread goes through the same hole three times, which leaves the thread ends on opposite sides of the sail. Also lash the clews to the yard. Next, fit on the flag-halyard blocks and pairs of brail blocks as shown in Figs. 66 and 67. The lower brail blocks of the foremast and mainmast are double to accommodate both upper and lower brail lines. The mizzen yard has only one pair of single brail blocks.

(Continued next month)

Steel Plate Braces Light Stock While Machining It

When shaping, planing or milling comparatively light metal, it is difficult to prevent the material from being flexed or distorted by the cutting tools. This trouble can be avoided if the work is clamped in a vise along with a piece of heavy metal plate, the plate being placed behind the work as indicated to provide solid support. — Federico Strasser, Santiago, Chile.

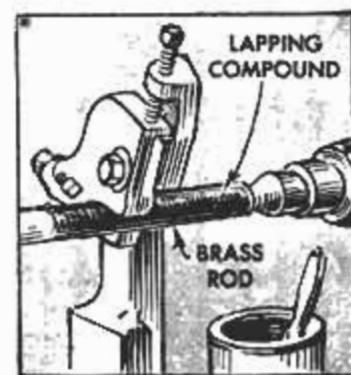


Isolated Burning of Spark Plugs

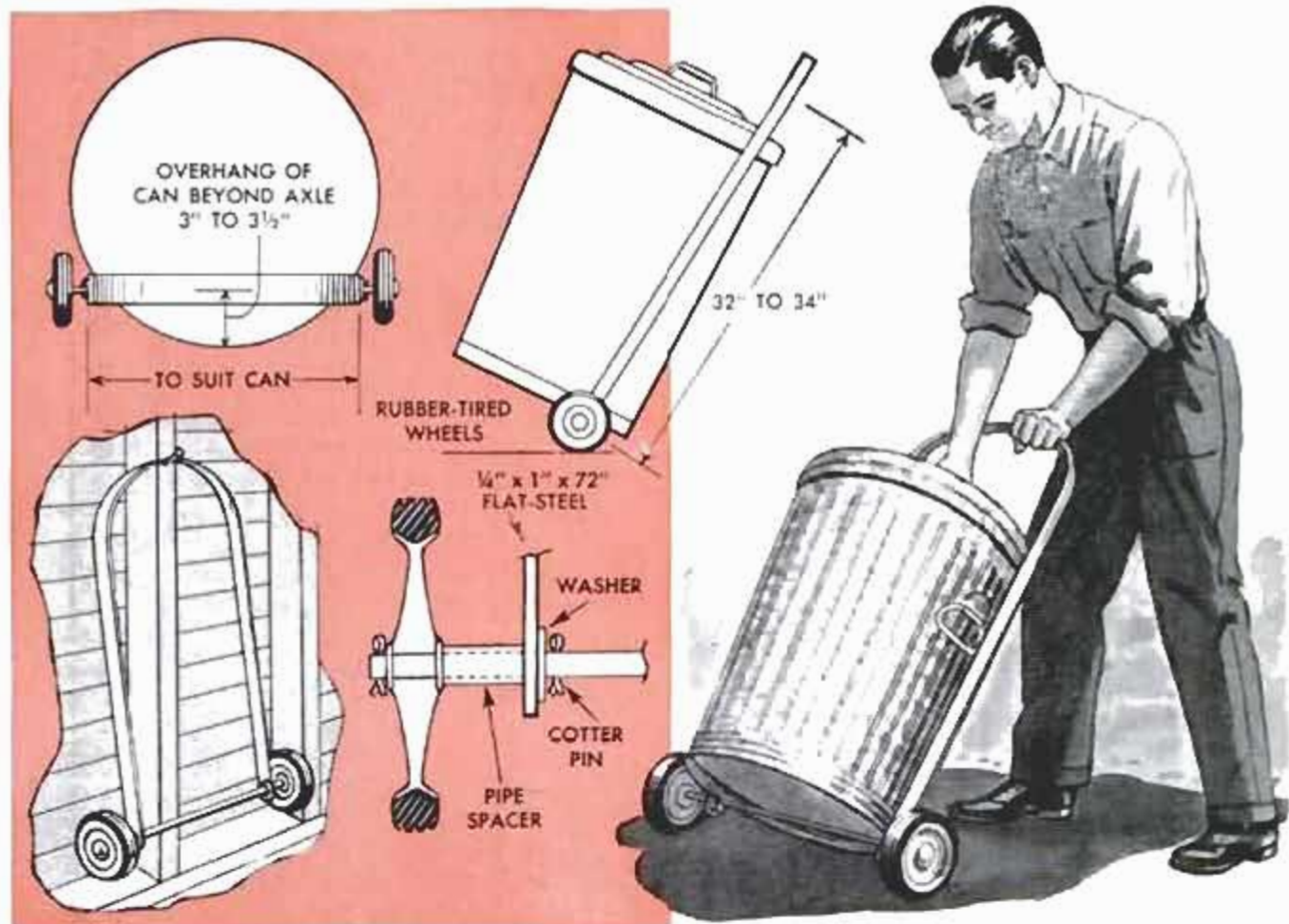
Occasionally, when removing and examining spark plugs, you will notice that certain isolated plugs will be burned, while others are firing normally. This may be due to variations in the distributor-cam lobes which cause certain cylinders to fire sooner than others. According to engineers of Champion Spark Plug Co., valves and intake-manifold leaks are usually blamed for this condition when cam-lobe variations may be the cause. To check for this, observe the firing pattern on an oscilloscope or use a regular distributor tester. If variations of more than two or three degrees are found between the cylinders it is best to service or replace the distributor.

Lapping-in a Follower Rest

To assure satisfactory service from the follower rest on his lathe, one machinist reconditions the jaws occasionally by lapping to a predetermined radius. A brass rod is mounted between centers and turned to a diameter slightly greater than the average diameter of the work on which the rest is to be used. This is then coated with a fine abrasive compound and used as a lap. With the lathe running at its highest speed, the rest is brought into contact with the lap and the carriage is hand-fed left and right with a uniformly slow motion. Jaws of a rest lapped in this manner will not score the work and will give full support throughout their width.—H. Gerber, Stillwater, Okla.



Wheeled Frame Simplifies Moving Refuse Containers



Carrying trash or refuse cans to the street curb, a job done weekly by many homeowners in neighborhoods that have no alleys, need not be awkward and difficult. All you need is a simple wheeled frame like the one shown, that can be hung up on a fence or garage wall, or merely placed behind a trash can, when not in use. The frame consists of a U-shaped length of $\frac{1}{4}$ x 1-in. flat steel having the ends drilled to receive a $\frac{1}{2}$ or $\frac{5}{8}$ -in. axle.

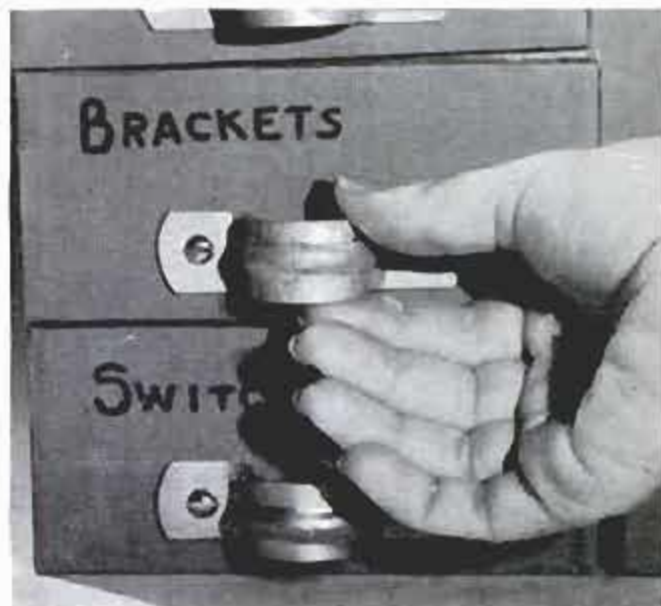
The axle is held in place in the frame by means of washers and cotter pins, and is fitted with small rubber-tired wheels such as those from a discarded coaster wagon or other toy. A trash can to be moved is tipped slightly to permit the axle to be pushed under it. Then both the frame and can are pulled back so that the can is raised above the ground and becomes wedged slightly between the sides of the frame, which provides the required rigidity.

Pipe Straps Used for Pulls On Small-Parts Drawer

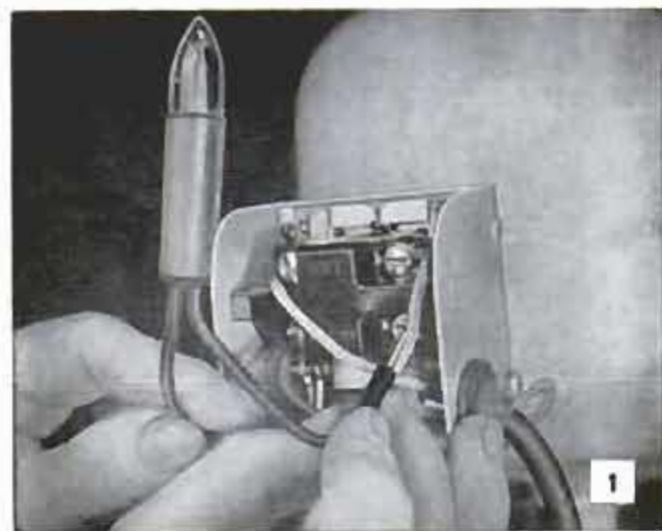
Small-size pipe straps are ideal for pulls on small-parts drawers that are made from cigar boxes or other suitable containers. The straps are attached to the front of the drawers by means of $\frac{1}{8}$ -in. roundheaded stove bolts as indicated in the photo at right. Use flat washers under the nuts.

Frank A. Javor, Newark, N. J.

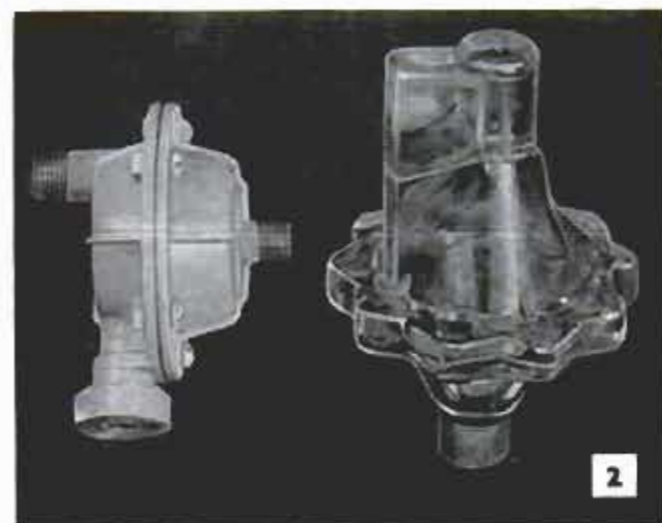
☞ To provide a convenient means of hanging lingerie in a bathroom, place several extra shower-curtain hangers on the rod. Then drill a hole in one handle of each of the same number of spring-type clothespins and slip them on the hangers.



TROUBLE-SHOOTING HINTS



Above, testing continuity of circuit through pressure switch determines if that component is working. Shown below are two types of air-volume controls



Below, centrifugal governor is spring-loaded device at center, internal switch is V-shaped object above it. Cylinder is capacitor, overload switch is below



ALTHOUGH THE JET PUMP used in most home water systems is a reliable unit that will run for years with very little attention, it will pay the homeowner to know something about its operation. Then, when the pump stops running—inevitably this will be on a week end or at night when no service man can be reached—he can do something about restoring this service.

Basically, a jet pump, Fig. 4, is a centrifugal pump in which is included an orifice that discharges part of the water pumped by the impeller through a venturi. This action creates a vacuum, increasing the capacity of the pump. A shallow-well pump has the jet cast into the pump body, while a deep-well pump has the jet located outside the pump itself. If your pump will not shut off and produces only low pressure, check the jet. If it is clogged with scale or dirt it will not work properly. A centrifugal pump without a jet will produce only about 25 lb. of pressure. As the pressure shutoff switch on a jet pump is adjusted to start the pump at 20 lb. and shut it off at 40 lb., the low pressure simply will not actuate the switch.

If the pump motor does not run, first check the fuses and power supply. Next, remove the cover on the pressure switch, Fig. 1, and check for continuity of circuit. A neon-type test light, such as shown, is ideal for this. Now check the internal motor switch, which is located at the end of the motor housing, Fig. 3. This switch, one arm of which carries the numeral 5, works in conjunction with a centrifugal governor, its purpose being to change the motor from the start winding to the run winding at the proper speed. If the switch points are dirty, or if one of the springs is missing or broken, or if the switch is not adjusted properly against the governor, no current will flow. A capacitor and an overload switch also are located on this end of the motor. Check these by bypassing them with a jumper wire. Do not run the motor very long with no water in the pump. Most shaft seals are water-lubricated.

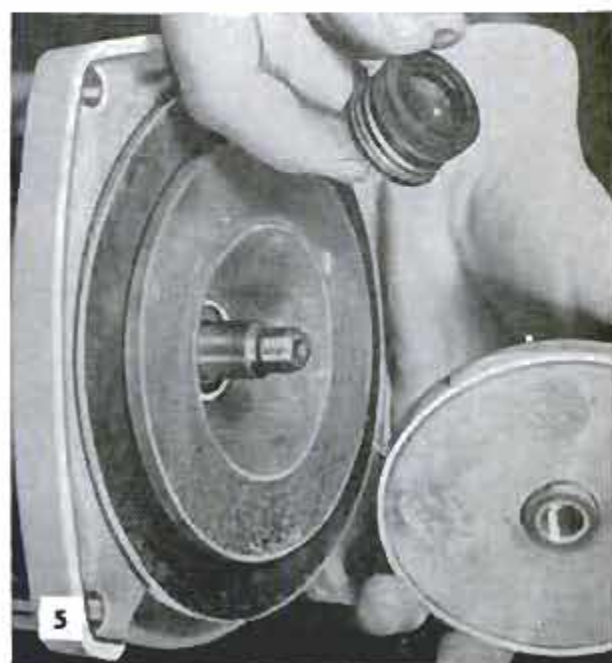
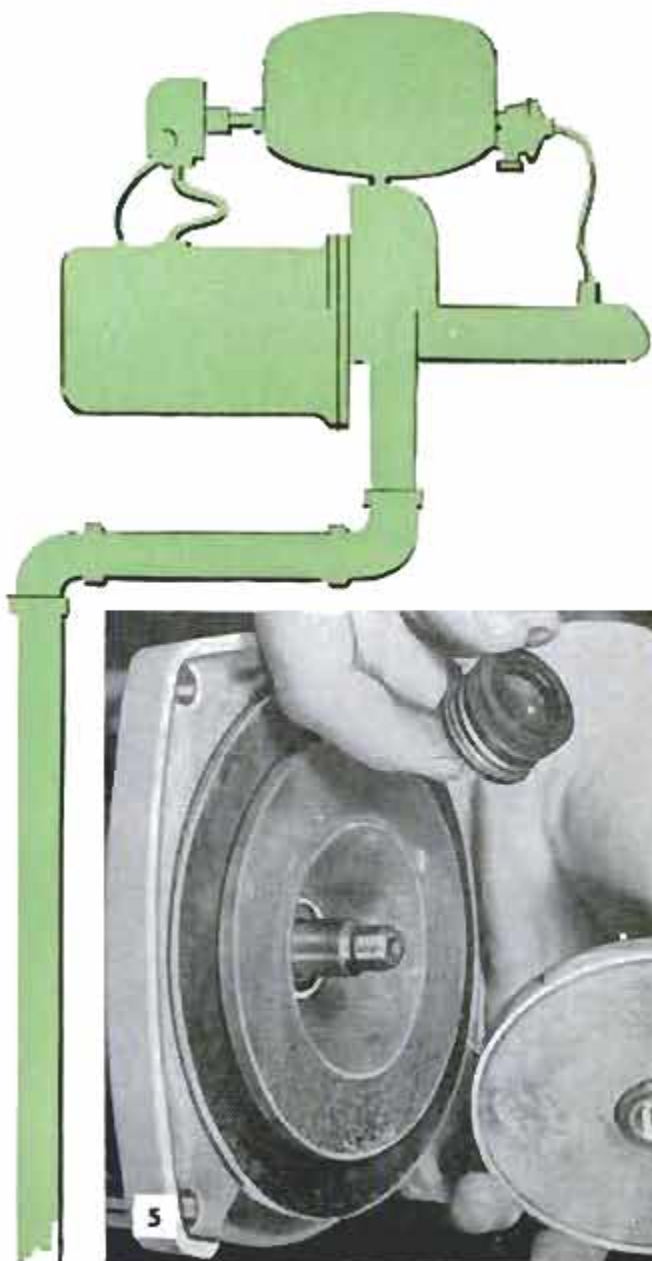
If a pump loses prime, or cannot be primed, check the foot valve, located at the lower end of the suction line. Whether gravity type or spring-loaded, this valve must close tightly when the pump is not running. If a pump loses prime while it is running, make sure the foot valve is submerged. A small-diameter drilled well may have too slow a recovery rate during dry spells to keep the valve submerged. If a

FOR JET PUMPS

By Lynn Brueback



pump runs even when no water is being drawn, it is due to a leak in the pressure side of the system. Check all connections and the pump seal, Fig. 5. Water-logging of a pump can be traced to a faulty air-volume control, Fig. 2, or to continuous running for long periods. Most air-volume controls draw in air only when the pump is not running. The water-volume control is also adjustable, being located between the pump and tank on the pressure side. For adjusting this, use a vacuum gauge, connected to the pump at the air-volume control. Start the pump and adjust the water-volume control until the gauge reads about 22 in. of vacuum at sea level. ★★ ★





"Measuring Tape" Labels on Bins Indicate Lengths of Contents

Matching a bolt, pipe nipple or other fitting from a supply in stockroom bins can be done quickly and without the need for measuring if each bin is marked with a strip of masking tape that is the same length as the items in the bin. When a part is to be matched, it is compared to the lengths of tape until one is found that is the identical length. The part in the bin also will be the correct length.

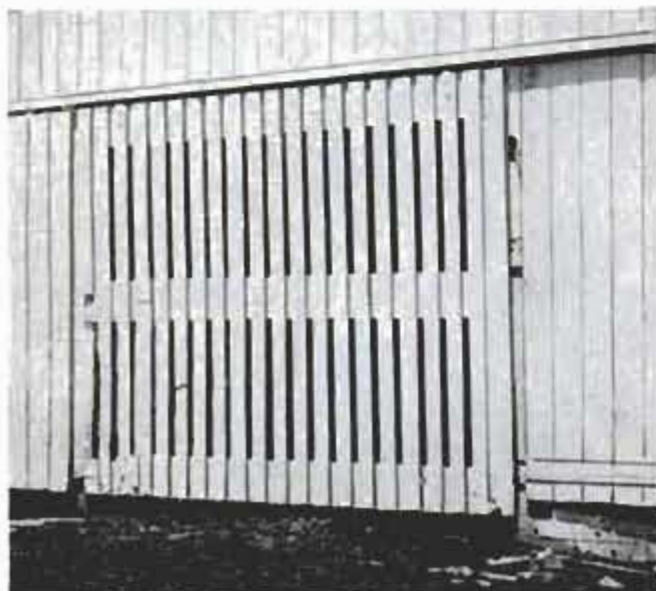
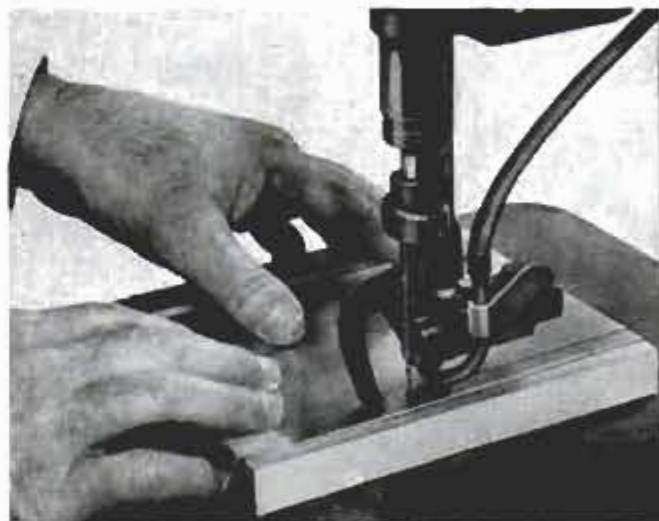
To increase the idling speed of his car engine to aid in charging the battery is done by one motorist with a brick placed on the accelerator pedal. As with most late-model cars, there is no hand throttle, and adjusting the idle speed at the carburetor takes time and could mean getting dirty. The brick also is useful to block a wheel when changing a tire.

Robert V. Thompson, Clinton, Iowa.

Sheet Metal Cemented to Wooden Block for Jigsawing

When light sheet aluminum, copper or brass is cut on a jigsaw, the metal has a tendency to move up and down with the saw blade, resulting in a ragged-edged cut. The flexing metal also binds on the saw blade, snapping off teeth, if not breaking the blade. To avoid this trouble, attach the metal to a piece of wood with rubber cement. Intricate cuts can be made without the metal flexing. After the cutting has been done, pry up the metal at one point, and "peel" it off the wood. Fine sections of the metal may have to be loosened with a putty knife. Rubber-cement solvent can be used to remove cement from the metal.

H. J. Gerber, Stillwater, Okla.



Usefulness of Barn Extended With Dual-Purpose Doors

Two sets of doors are used at each end of this barn, the inner sets being made of heavy slats, while the outer doors are solid. The slat doors provide ventilation when sheep that have been sheared early are kept in overnight. These doors also provide ventilation and keep out stock when men are working inside the barn. The solid doors are used, of course, to close the barn.

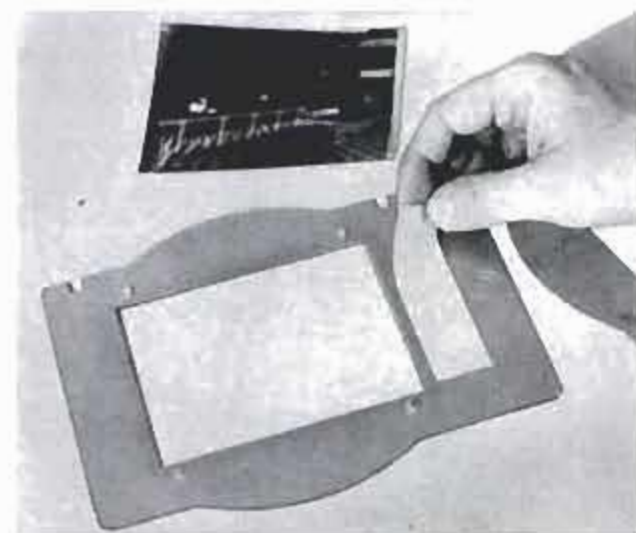
☞ A mascara brush is ideal for cleaning rings and other jewelry as it is small enough to reach in around prongs and settings for thorough scrubbing.

to be painted on a signboard, use a small level for a straightedge as shown in the drawing at right. The bubble in the transverse glass is centered when drawing vertical lines and the bubble in the level glass is centered when drawing the horizontal ones.—G. E. Hendrickson, Argyle, Wis.

Paint overspray on ignition wiring and spark-plug insulators of an auto engine that has been reconditioned and painted may cause misfiring under load when voltage requirements are highest. To avoid such trouble, the service department of Champion Spark Plug Co. recommends removing the paint from these parts as soon as possible, using a solvent that will not damage the rubber insulation on the wires.



Tape Stop Centers Wet Negative on Enlarger Carrier



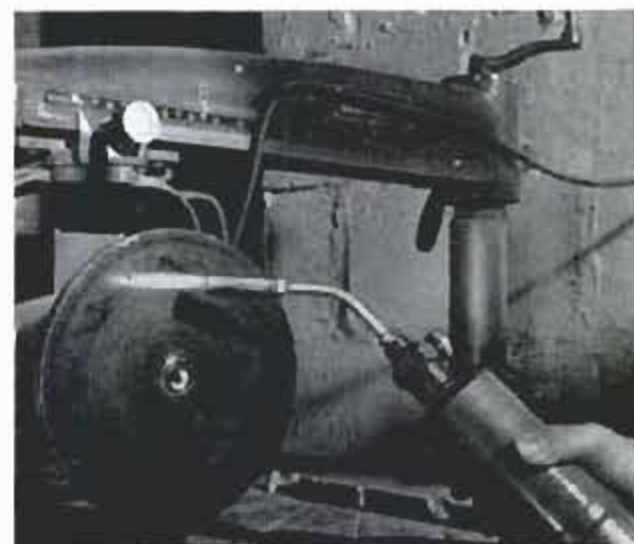
When prints are needed immediately after developing sheet film, here is a quick and positive way of centering the wet negatives on the enlarger carrier even though the darkroom is dimly lighted by just a safelight. Simply apply a small strip of masking tape to the lower member of the carrier so that it is located $\frac{1}{4}$ in. from the side of the opening shown in the photo at left. The tape acts as a stop against which the right-hand edge of the negative is butted when sliding it into position between the guides of the carrier. Also, the tape prevents the negative from sliding to the right when the carrier is inserted in the enlarger. Replace the tape when the edge that contacts the film becomes worn.

P. G. Gordon, North Miami, Fla.

Sanding Disk Warmed With Torch Before Applying Stick Adhesive

To permit faster and more uniform spreading of stick adhesive on a sanding disk, warm the disk while it is rotating, using a propane torch as indicated in the photo at right. By prewarming the disk in this manner, the adhesive is softened so that it spreads in a uniform coating to which the abrasive disk will adhere readily. The disk may also be warmed by friction, although it is a slower method. To do this, hold a wooden block against the rotating disk for a few minutes and then apply the adhesive immediately.

Lucien R. Greif, Thornwood, N. Y.



POPULAR MECHANICS SHOWCASE OF TOOLS

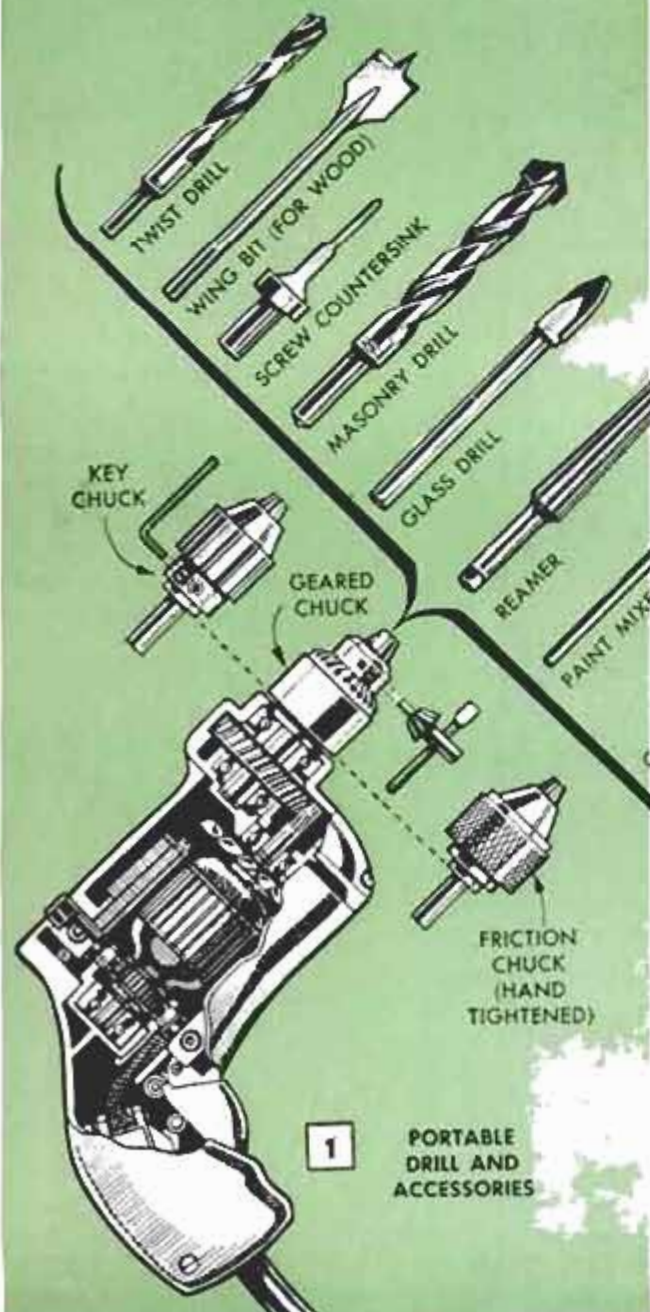
In this, the fourth installment of our Showcase of Tools, we present a number of portable electric drills with their general specifications. These tools are shown only as a shopping service to give you an idea of the many sizes and types available



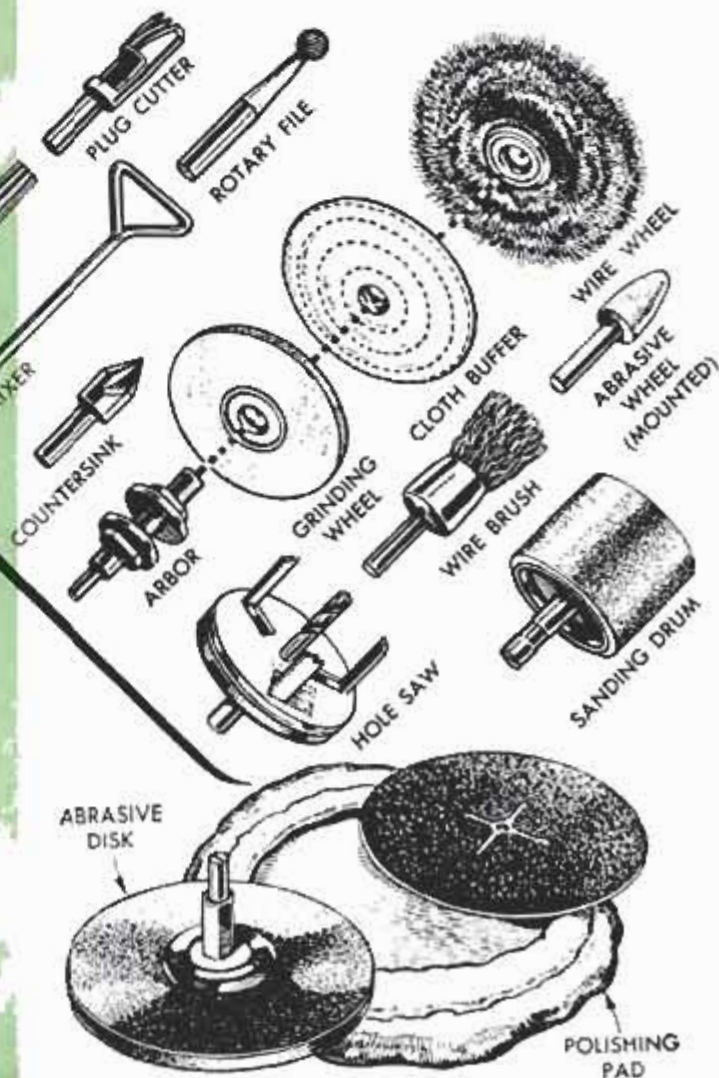
Photo Courtesy Millers Falls Co.

METAL-DRILLING LUBRICANTS

Metal	Lubricant, First Choice	Lubricant, Alternate	Speed
Hard steel	Turpentine	Kerosene	800 r.p.m. or less
Malleable iron, Wrought iron	Soluble oil, Lard oil	Soluble oil	1500 r.p.m.
Brass, Aluminum	Paraffin, Kerosene	Dry, Soluble oil	2000 r.p.m. or more



1 PORTABLE DRILL AND ACCESSORIES





2

Photo Courtesy Pioneer Gen-E-Motor Corp.

PORTABLE ELECTRIC DRILLS

By E. R. Haan

THE WORKHORSE of all the portable power tools, the electric drill is second to none in versatility. Besides its regular use for drilling holes in almost any material, when fitted with a suitable bit, it will operate countersinks, plug cutters, hole saws, wire brushes, grinding wheels, sanding and polishing disks, and sanding drums as indicated in Fig. 1.

Stands, Fig. 3, convert portable drills into bench power tools. Other attachments and accessories, Figs. 5 to 10 inclusive, transform a portable drill into a portable circular saw, saber saw, power plane, belt or pad sander, and hedge trimmer. A drill also can run a small bandsaw, Fig. 4. Some special accessories in addition to those illustrated also are available.

Sizes, chucks and speeds: Light and medium-duty, $\frac{1}{4}$ and $\frac{3}{8}$ -in. portable drills are most popular for home and workshop use. A number of these made by various manufacturers are shown on succeeding pages. All drills have a trigger switch conveniently located in the handles. Some switches are the spring-loaded type that keep the drill going only while depressed. Nearly all small drills are available with acces-

sories in kit form, Fig. 2, which costs less than buying the items separately. The size of a drill is designated by its maximum chuck capacity. The sizes range from small $\frac{1}{4}$ -in. light and medium-duty drills, weighing as little as 3 lb., to the heavy-duty drills having a 1-in. capacity and weighing as much as 16 $\frac{1}{2}$ lb.

There are three types of chucks which hold tools, Fig. 1. These are the friction or hand-tightening chuck, the geared chuck which is tightened with a key, and the hex-key chuck. Many manufacturers give the maximum capacity of a drill for holes in metal and holes in wood. The no-load speed of most $\frac{1}{4}$ -in. general-purpose drills varies from 1600 to 2500 r.p.m. and that for most $\frac{1}{2}$ -in. general-purpose drills ranges from 400 to 600 r.p.m. However, special-purpose drills may have speeds ranging from 275 to 5000 r.p.m. Small drill bits require high speeds to work efficiently.

Electrical data: Three-wire cord, with which most drills are equipped, has a ground wire, usually green, which should be used at all times. The three-prong plug of the cord is plugged into an adapter, which in turn is plugged into an ordinary



BLACK & DECKER MFG. CO.



SEARS, ROEBUCK & CO.



MILLERS FALLS CO.



PORTABLE ELEC. TOOLS, INC.



MONTGOMERY WARD & CO.



PIONEER GEN-E-MOTOR CORP.

SPECIFICATIONS

TRADE NAME, MANUFACTURER AND DRILL NUMBER	SIZE AND CAPACITY IN STEEL (in.)	CAPACITY IN WOOD (in.)	NO-LOAD SPEED (r.p.m.)	FULL-LOAD SPEED (r.p.m.)	WEIGHT (lbs.)	LENGTH (in.)	BEARINGS
Black & Decker Mfg. Co. U-3	1/4	1/2	2700		3 1/8	8 1/4	
"Craftsman," Sears, Roebuck & Co. 9A770 pistol grip and 9A771 saw grip	1/4		1900	1200		7 1/4 and 10 1/2	B
"Cummins," John Oster Mfg. Co. 305	1/4	1	1800		3 1/2	8 3/8	B
Dormeyer Corp. 5-2400	1/4	1/2	2200			8 3/4	B
"Dyno-Mite," Millers Falls Co. 814 pistol grip and 1614 spade grip	1/4	3/4	2500			8 3/32 and 10 7/32	B
Portable Elec. Tools, Inc. "Shopmate", (2-Speed)	3/8	1	2000	1200	6	10 1/4	B
"Mall," Remington Arms Co	1/4	1/2	2500	1500	3	8	B
"Manning Bowman," McGraw-Edison Co. 1153	1/4	1/2	2100	1200			
Milwaukee Electric Tool Corp. 250	1/4	1/2	2000		3 1/4	8 1/2	A
"Pincor" Pioneer Gen-E-Motor Corp. 120G	1/4	1/2	1600	900	3 1/4	8	B
"Powr-Kraft," Montgomery Ward & Co. 9305 (2-speed)	3/8		1000 2000	600 1200			A
Ram Tool Corp. R250	1/4	1/2	2000	1200	3 1/2	9	A
"Sioux," Albertson & Co., Inc. RC 1885	1/4	3/4	2250	1350	3 1/4	7 1/4	
Skil Corp. 549	1/4	1/2	2500		3 1/2	8 3/4	
Stanley Electric Tools H 132	1/4		2500		3 1/4		A
Sunbeam Corp. 70	1/4	1	2200	900		7 3/4	B
Thor Power Tool Co. 23	1/4	1/2	2400	1600	4	9	B
Wen Products, Inc. 808 (2 speed)	3/8	3/4	1000 and 3000				B

NOTE: Most manufacturers make many other models and sizes than those shown on these pages and listed below.
A—All ball bearings. B—Ball-thrust bearing on spindle and other self-lubricating bronze bearings



CUMMINS-JOHN OSTER MFG. CO.



MALL TOOL CO., DIV. OF
REMINGTON ARMS CO.



RAM TOOL CORP.



SKIL CORP.



SUNBEAM CORP



DORMEYER CORP.



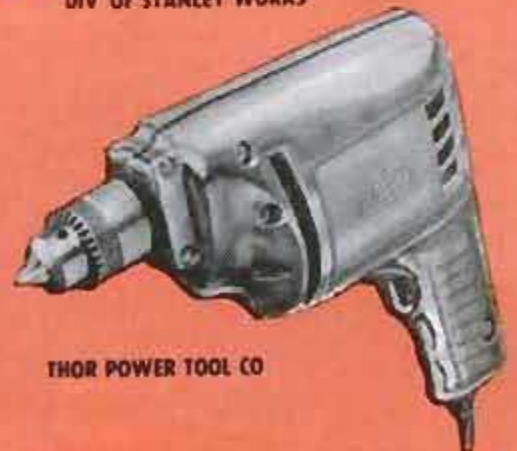
MILWAUKEE ELEC. TOOL CORP



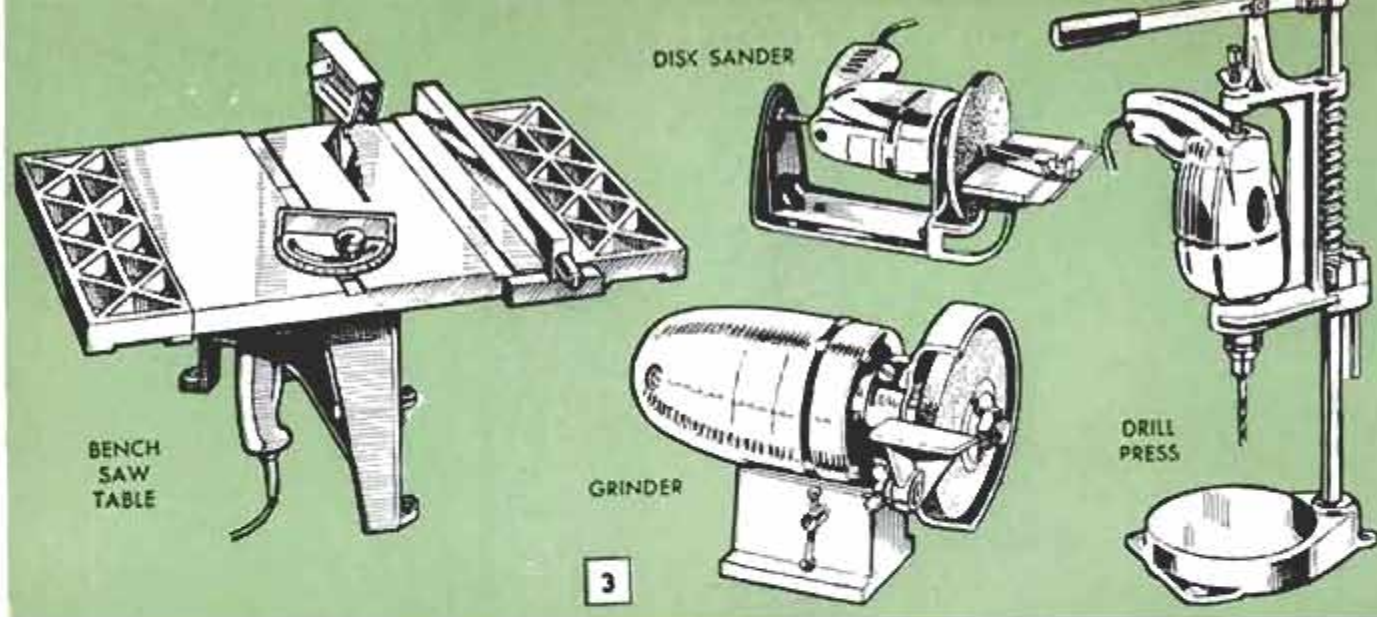
ALBERTSON & CO.



STANLEY ELEC. TOOLS
DIV OF STANLEY WORKS



THOR POWER TOOL CO



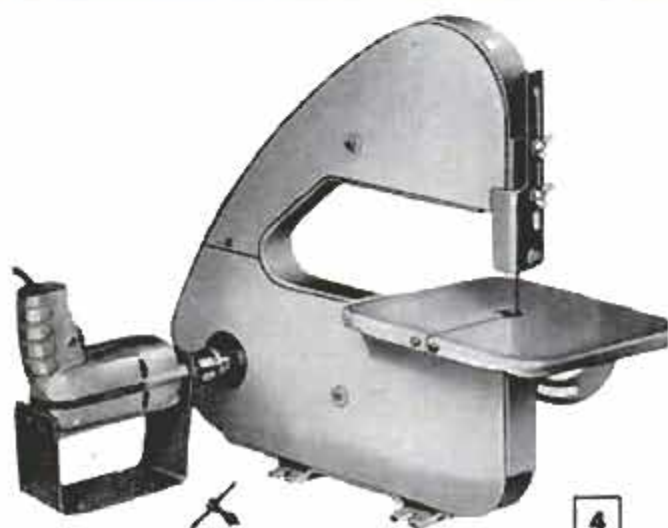
BENCH
SAW
TABLE

DISK SANDER

DRILL
PRESS

GRINDER

3



4

Photo Courtesy Pioneer Gen-E-Motor Corp.



WEN PRODUCTS, INC.

McGRAW-EDISON CO.



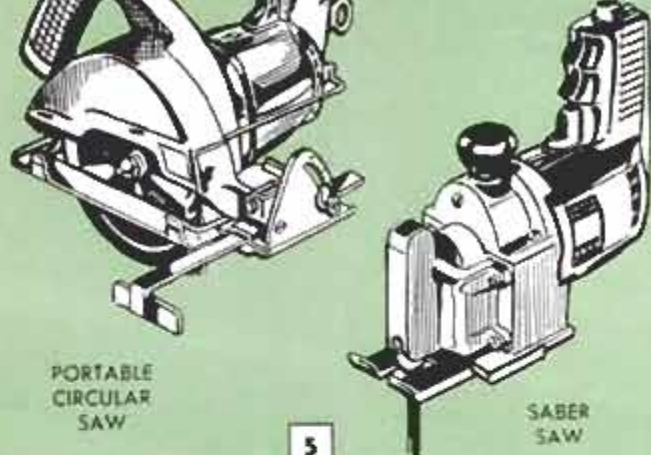
wall outlet. The green wire of the adapter then is connected to the outlet-cover screw. When a drill is connected to a long extension cord, this also should be of the three-wire type. An extension cord 50 ft. long, supplying a 1/4-in. drill, should have No. 14 wire conductors. If the cord is more than 50 ft. in length the wire should be at least No. 12, or better, No. 10.

Drilling procedure: Before drilling in any material, you center-punch the exact spot to be drilled. This prevents the drill from drifting. The center-punch "dimple" should be slightly larger than the drill point. While drilling any kind of ferrous metal except cast iron, keep the drill well lubricated, using the lubricant listed in Fig. 1 for the type of metal being drilled.

When drilling sheet metal, place it on a wood backing piece to prevent the metal from buckling under pressure of the drill. Be sure to clamp down small pieces of sheet metal. This prevents the work from turning with the drill and possibly causing injury. Be sure to tighten the chuck. Hold the drill at right angles to the work, in the center-punched dimple, before you start the motor.

Apply pressure on a drill in a straight line with its axis. Any side movement or sway that occurs while drilling may bend or break a small bit. Ease up the pressure just before the drill bit breaks through. This avoids binding in metal and excessive splintering of wood. For wood, you can use twist drills or round-shank auger bits that have a brad point. Always back up wood being drilled with a piece of waste stock to prevent any possibility of splintering caused by the drill breaking through.

Avoid overloading a drill: Don't use twist drills or wood-boring bits that are beyond the capacity of the drill even if they have



PORTABLE
CIRCULAR
SAW

5

SABER
SAW



6

Photo Courtesy Sunbeam Corp.

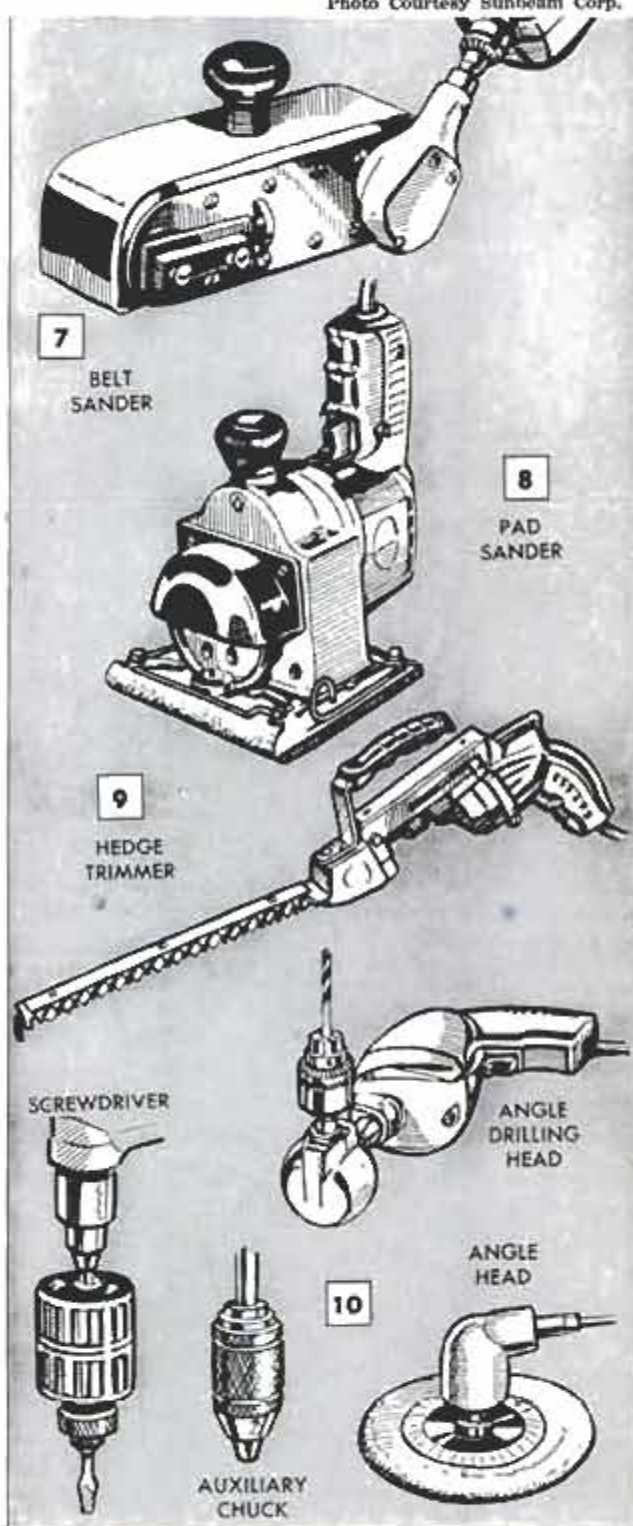
shouldered shanks which fit the chuck. This is likely to overload the motor. When drilling a large hole through tough or thick metal, first drill a small pilot hole. This not only serves to guide the large drill, but also reduces the amount of work it must do.

Twist drills should be kept sharp, for which many homeowners find a drill-grinding jig an aid to accuracy. High-speed twist drills retain their keen cutting edges much longer than carbon-steel drills, but they also cost more. Twist drills come in numbered, fractional and letter sizes. When a twist drill heats excessively, does not "bite," or seems to require excessive pressure, it is likely to be dull or possibly damaged. Repeated overloading will damage your portable-drill motor. Overloading is evidenced by slowing below the normal load speed or excessive heating.

Sanding, polishing and grinding: When using a flexible sanding or polishing disk, Figs. 1 and 10, best results generally are obtained by holding the disk at a slight angle to the work surface. A grinding wheel or a wire wheel is held by means of an arbor mounted in the drill chuck. For grinding and wire-brushing, it is generally preferable to mount the drill on a stand, Fig. 3, and feed the work against the edge. This is much easier than attempting to guide the drill freehand. When grinding or using a wire brush, always wear goggles to protect the eyes.

When a grinding wheel is to be mounted on an arbor, inspect it for possible fracture. A cracked wheel can break and cause serious injury. If possible, it is best to provide a guard over a grinding wheel mounted on a stand, Fig. 3. Light, steady pressure on work held against a grinding wheel gives the best results. Dip the work in water frequently to keep it cool. ★★★

FEBRUARY 1959



7

BELT
SANDER

8

PAD
SANDER

9

HEDGE
TRIMMER

SCREWDRIVER

ANGLE
DRILLING
HEAD

10

ANGLE
HEAD

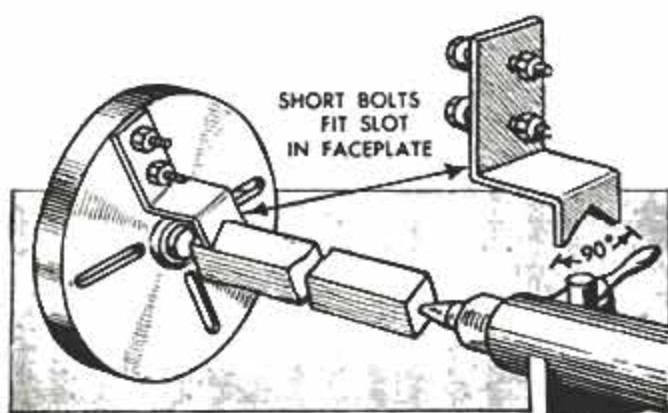
AUXILIARY
CHUCK



Portable Tool Box Is Stored As "Drawer" in Workbench

Rounding up your tools to make a repair somewhere in the house will be less of a problem if they are kept in this tool box that stores neatly under a workbench, like a drawer. The handle of the box is a piece of flat stock that extends beyond the vertical members to form "runners" that fit into rabbeted blocks screwed to the underside of the bench top. The center section of the handle is narrowed and smoothed to provide a comfortable handgrip when the box is carried.

When taking up baseboard quarter round for reuse or repositioning, it is almost impossible to pry it loose without breaking it. Avoid this by driving the nails through the wood with a slender drift pin. The quarter round then can be lifted easily. Projecting nails in the floor can be removed with nippers or diagonal-cutting pliers, or driven out of the way with a nail set.



Lathe Dog Holding Square Stock Saves Time on Duplicate Jobs

This lathe dog saves time when turning a number of duplicate pieces from the same size square stock, as it need not be removed from one workpiece and attached to the next like a regular lathe dog. The work is slipped into place under the V-notch of the dog which remains attached to the lathe faceplate. Two short bolts are used to keep the dog in position.

"Cornerless" Hay-Bale Stack Improvement Over Square One



Resembling a giant beehive, this round stack of hay bales is used by one farmer to eliminate the problem of having the corner bales in square and rectangular stacks give way and collapse part of the stack. Each level of the round stack is started by making a circle of bales, then filling in the circle with other bales. After two years of using the round stack, it has been found perfectly satisfactory.

C. F. Marley, Nokomis, Ill.

As a substitute for Prussian blue when scribing fine lines on metal, black or brown liquid shoe polish can be used. It dries quickly, providing an ideal surface on which to mark with a scribe, or even a lead pencil. After the work has been completed, if necessary the polish can be removed with turpentine or other common solvents used with paint.

On the MARKET

for Do-It-Yourselfers

1. PLASTIC "SOLDER" repairs holes, dents and rusted areas on a car body. To prepare material for use, equal portions from each container are mixed. Complete instructions are included for preparation

Co-Polymer Chemicals, Inc.
12350 Merriam Rd., Livonia, Mich.

2. GLUE IN STICK FORM can't stain or spill. Just rub on surface as you would mark with crayon. Used for mounting foil, paper, etc., on almost any surface. Mounted work can be peeled off without tearing

Gem Color Co., Inc., Paterson, N. J.

3. FLUORESCENT FIXTURE is only 1 in. in thickness, is designed for mounting inside cabinet or under shelf where space is limited. Takes 8-watt tube. Reflector, 5 x 12½ in., is ideal for small cabinets

Mutschler Brothers Co., Nappanee, Ind.

4. NONFLAMMABLE CONTACT CEMENT can be brushed, rolled or sprayed. Application equipment can be washed clean in warm, soapy water. No-smoking rules do not apply during application of cement

Formica Corp., 4614 Spring Grove Ave.,
Cincinnati 32, Ohio

5. SPECIAL PENETRANT and lubricating oil combined in a pressurized container make this a product of wide application. Loosens metal parts that stick; cleans and oils tools, guns, fishing tackle, golf clubs

Kano Laboratories, 1000 S. Thompson Lane,
Nashville 11, Tenn.





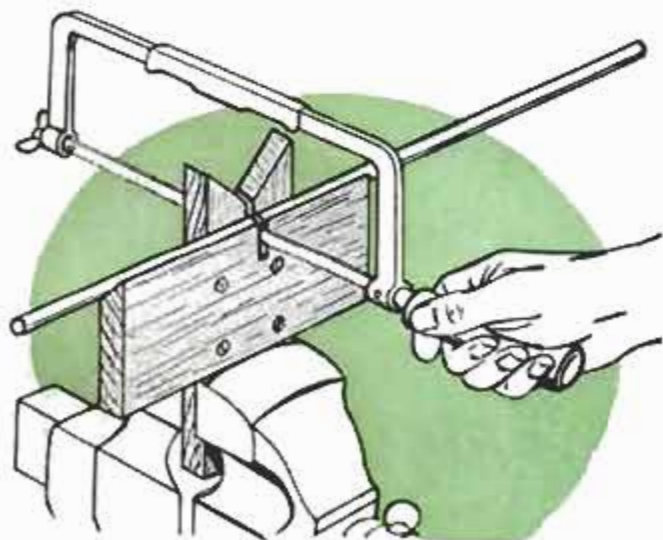
Slot in Sawhorse Aids Ripping Short Boards With Handsaw

Holding a board while ripping it with a handsaw is easy when it is placed on a sawhorse having a slot cut in the top member as illustrated. If the sawhorse is made of 2 x 4s, cut the slot in a 1 x 6-in. board instead and nail it to the sawhorse to provide a wider base for supporting the stock to be ripped. Position the board so the slot is adjacent to the sawhorse top.

G. E. Hendrickson, Argyle, Wis.

Fragments of metal that are not removed from newly cut pipe threads may prevent tight connections when the pipe is installed. To avoid this, clean the threads with a discarded toothbrush and use another one to apply the joint compound. The short bristles are ideal for cleaning such threads and permit even distribution of the compound.—M. R. Beasley, Jackson, Mich.

Jig Speeds Cutting Multiple Lengths of Rod or Tubing



Here is a jig that makes an easy job of cutting small-diameter rod or tubing when several lengths must be cut. It consists of two wooden blocks screwed together and clamped in a vise as shown. The beveled upper edge on the horizontal block holds the rod in position to be cut and the slots cut in both pieces serve as a guide for the saw blade.

To keep dust off the collar and the shoulders of a suit kept in a closet, use a dry-cleaning bag that has been cut to a length of 7 in. Place the cut-down bag over the garment as you would a plastic or cloth protector sold for this purpose.—C. V. Mathis, Wildwood-by-the-Sea, N. J.



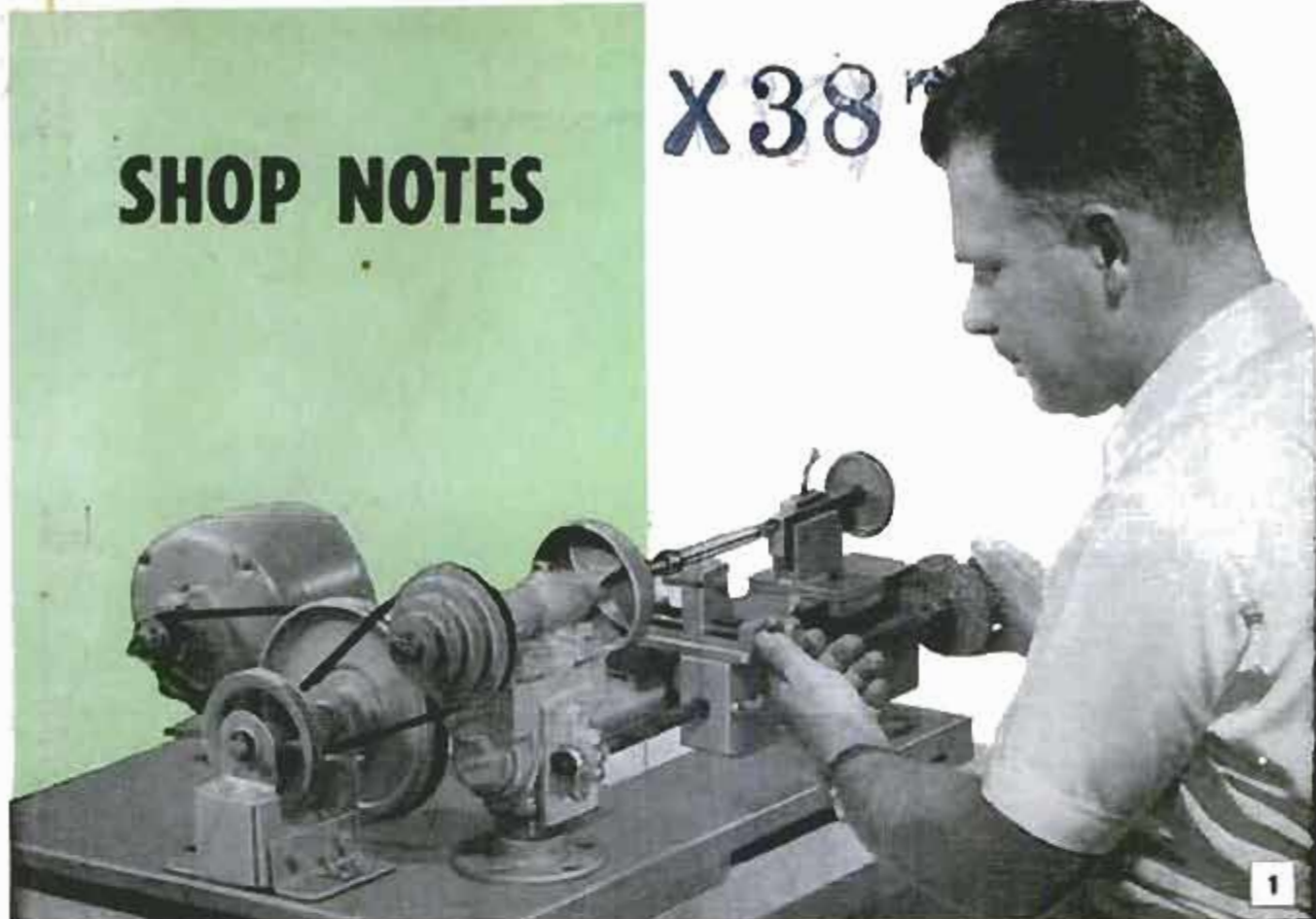
Shield Protects Radio Parts From Heat of Soldering Iron

When soldering resistors and other small parts into a radio circuit, the parts can be protected from heat that may travel along wire leads or terminals by shielding the latter with a slotted piece of sheet aluminum as shown. The slot permits contact with the terminal on three sides so that most of the conducted as well as radiated heat is dissipated by the shield before it can reach the part. The size and shape of the shield used will depend upon the working space available. Therefore it is a good idea to make a set consisting of several sizes and shapes for future use.

R. Hanscom, Elmhurst, Ill.

SHOP NOTES

X38



METAL-TURNING LATHE

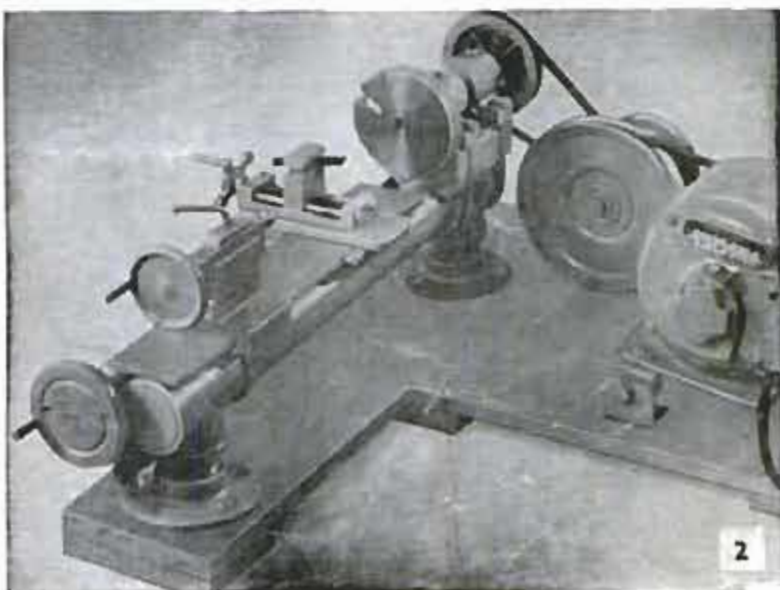
Built From Stock Parts

By Frank Beatty

USING STANDARD PARTS and stock materials that are available almost anywhere, you can build this metal-working lathe with only a few tools. Because of simplification of the assembly in order to make the unit easy for anyone to build, the lathe as pictured and detailed cannot be rated as a precision tool. It is simply designed to do practical work within reasonable limits. As detailed, the lathe swings $4\frac{1}{4}$ in. over the bed and takes 10 in. between centers. Standard pipe and fittings are used to form a frame on which the headstock, tailstock and bed are fitted.

The first step is to assemble the pipe and fittings. Do this before any other parts are made or stock cut to dimension. The reason for this first step is that in the manufacture of standard pipe there are allowable variations and some changes in dimensions of lathe parts may be necessary because of these variations. The pipe assembly consists of one 14-in. length of $1\frac{1}{2}$ -in. pipe, two close nipples, two

tees, two floor flanges and one pipe plug (optional) for closing the tee at the headstock end of the assembly. Screw the parts tightly together and then mount on a hardwood base as in Fig. 5. Later when the countershaft, motor and motor mount are added to the assembly, a second piece is attached to the first, making an L-shaped base as pictured in Figs. 1 and 2.



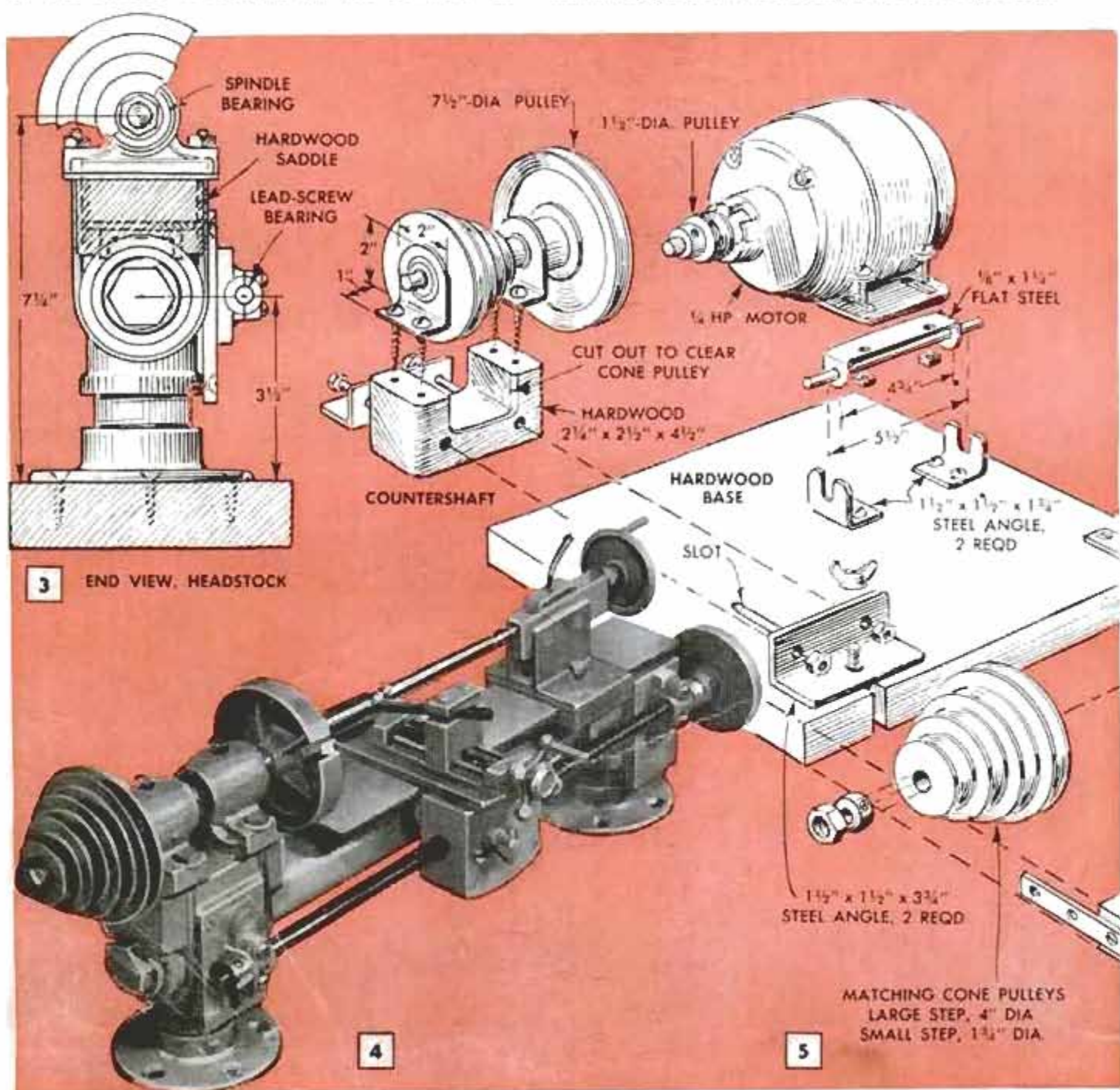
Also at the outset it should be noted that the spindle-thread characteristics are not given. The reason for this is that chucks are available to fit spindles threaded $\frac{1}{2}$ -24, $\frac{1}{2}$ -20 and $\frac{3}{4}$ -16. You can use a $\frac{1}{2}$ or $\frac{3}{4}$ -in. spindle and have it threaded to take any one of these chucks. The original lathe spindle was threaded $\frac{1}{2}$ -20 and is suitable only for light work. A solid spindle is, of course, much simpler and less expensive to make or have made than is a hollow spindle with a No. 0 or No. 1 Morse taper. For turning work between centers the solid spindle requires a special 60-deg. center with a driving pin, Fig. 5. This center and the spindle can be made in a machine shop at a very nominal cost.

The headstock-spindle bearings, Fig. 5, are held on the pipe tee by means of U-bolts and a saddle block of hardwood. One face of the saddle is shaped to the contour of

the tee; the other is faced with a $\frac{1}{8}$ -in. steel plate on which the pads of the pillow blocks rest. The purpose of the steel plate is to make it easier to align the bearing sleeves when the assembly is bolted in place. Cut the saddle about $\frac{1}{8}$ in. thicker (about $2\frac{1}{4}$ in.) than indicated. Then assemble the parts temporarily.

Next, build up the tailstock, assembling from parts as indicated in Fig. 5. Then assemble the bed on the pipe frame. Slide the tailstock onto the bed and check the alignment of the centers, both vertically and horizontally. Any misalignment can be corrected by reducing the height of the saddle and by tapping the bed lightly to shift it on the frame. Once the centers are aligned, tighten the parts permanently in place.

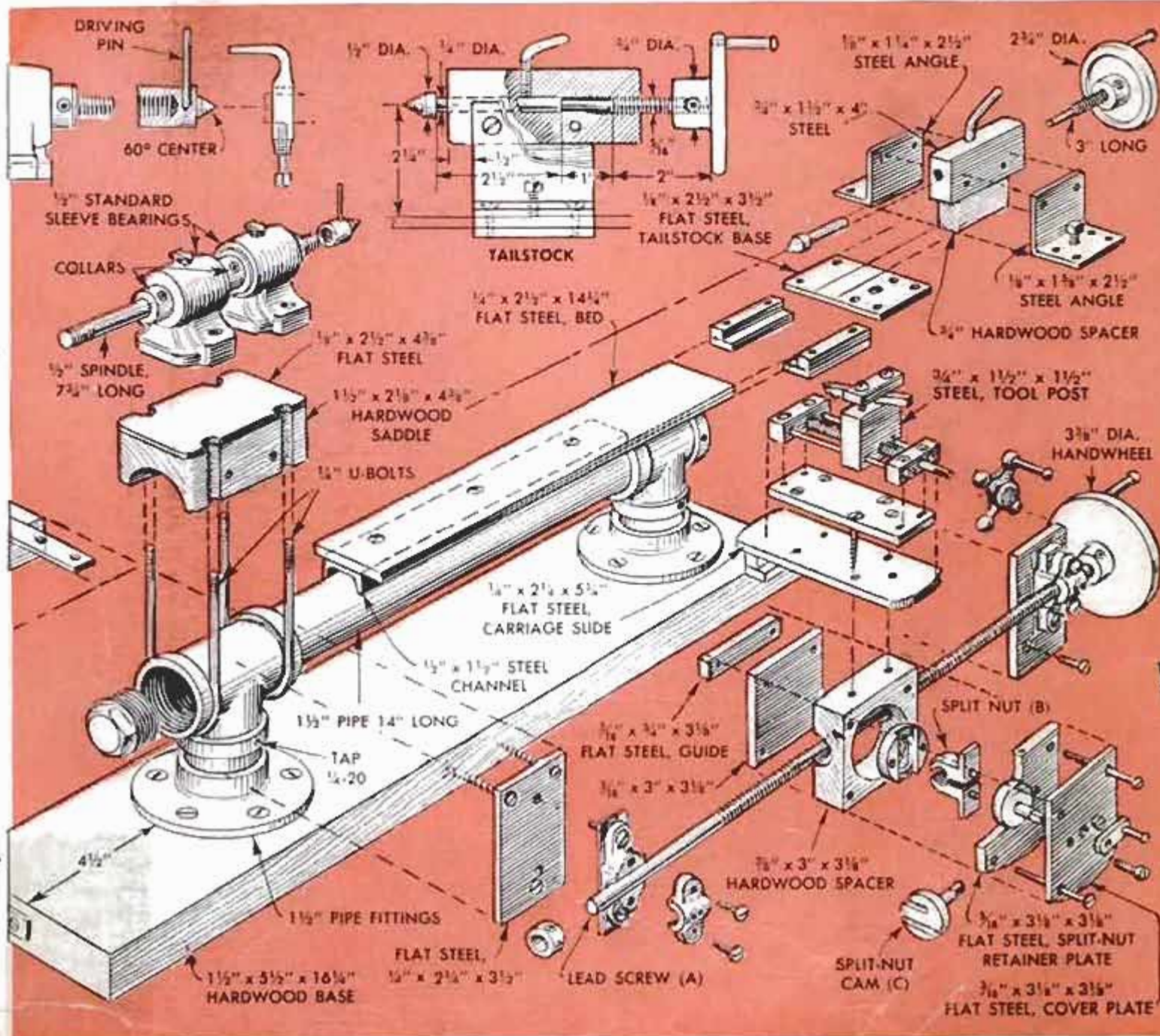
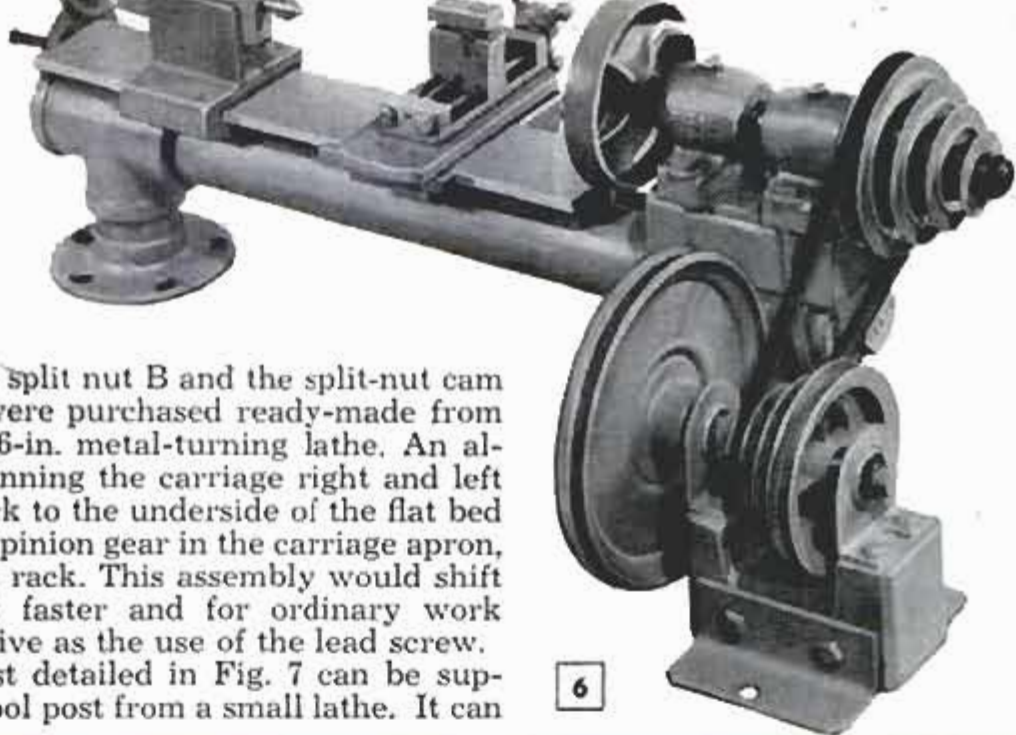
The tool post, tool-post slide and the actuating screw are shown in an exploded

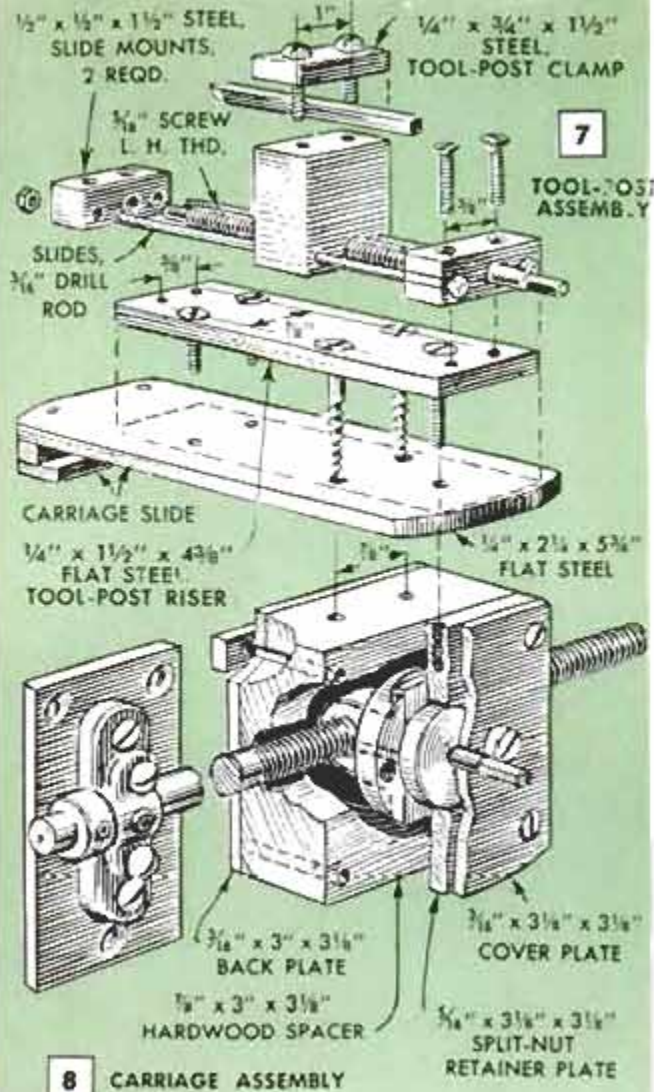


view at the lower right in Fig. 5 and are shown in more complete detail in Figs. 7, 8 and 9. In this assembly the tool is moved in either direction by turning the hand-wheel at the end of the lathe bed. The actuating screw consists

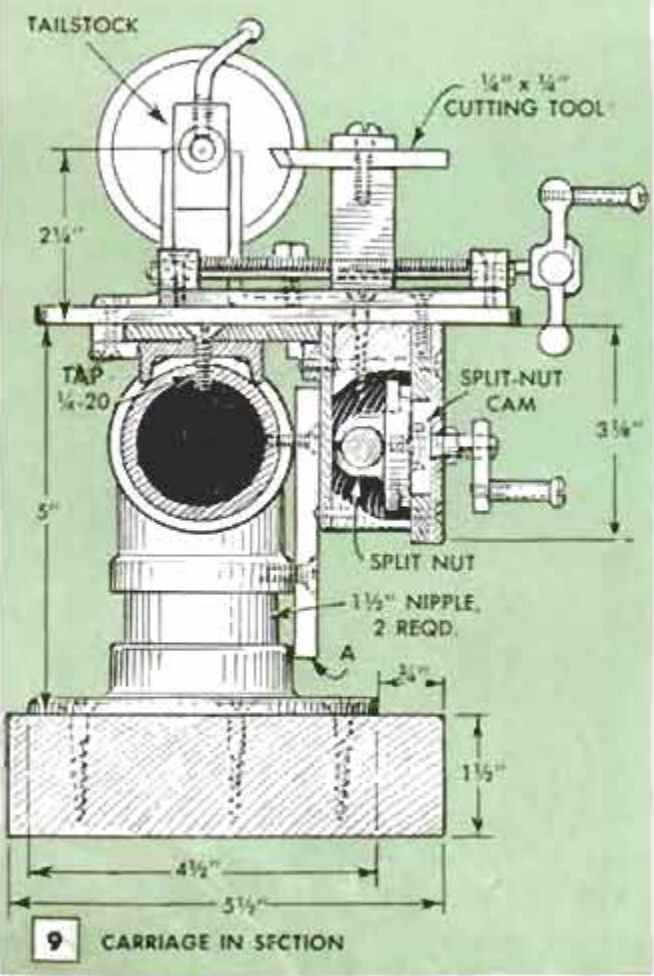
of the lead screw A, the split nut B and the split-nut cam C, Fig. 5. These parts were purchased ready-made from the manufacturer of a 6-in. metal-turning lathe. An alternate assembly for running the carriage right and left would be to attach a rack to the underside of the flat bed and fit a handwheel and pinion gear in the carriage apron, the pinion engaging the rack. This assembly would shift the carriage somewhat faster and for ordinary work would be quite as effective as the use of the lead screw.

Likewise the tool post detailed in Fig. 7 can be supplanted by a standard tool post from a small lathe. It can





8 CARRIAGE ASSEMBLY



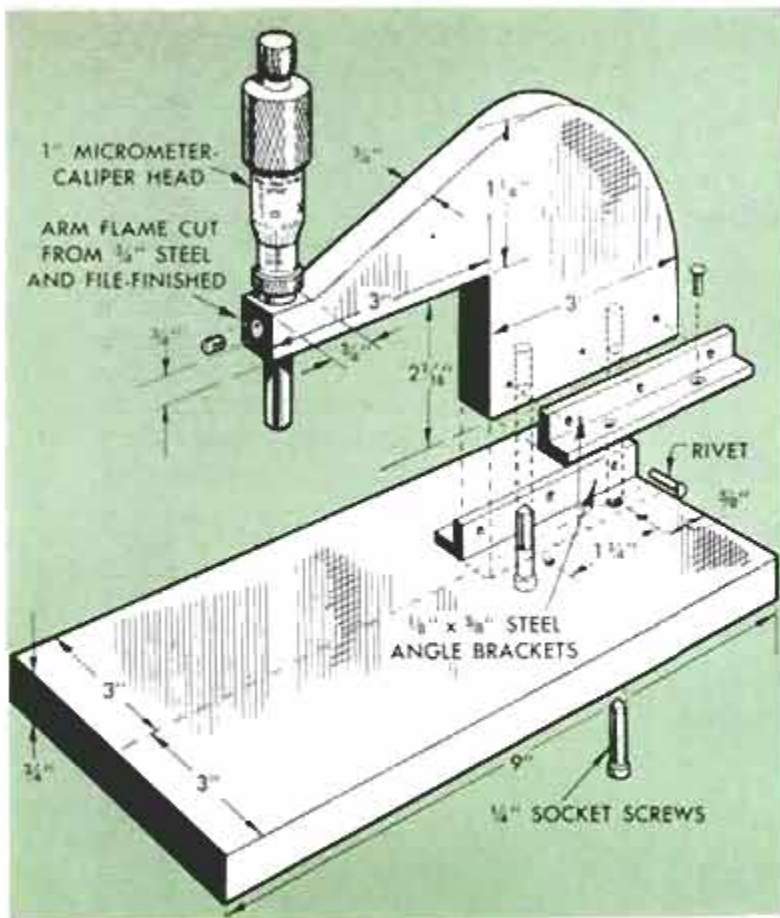
9 CARRIAGE IN SECTION

be mounted by having a small block-steel T-slotted at a local machine shop drilled and tapped for the guide rods and the screw. This assembly would, of course, allow more latitude in adjustment of the cutting tool.

In the original lathe the carriage consists of two steel plates stacked, and an apron built up from three steel plates and a hardwood spacer, the latter also serving as a housing for the split-nut assembly. Figs. 5, 7, 8 and 9 show quite clearly how the parts are assembled. Fig. 9, the sectional view, shows the relationship of the parts when the carriage is fully assembled. Note in Fig. 5 that the lead-screw-bearing plates are attached to the pipe tees with screws, the latter being turned into holes drilled and tapped into the pipe-tee flanges. These holes should not be drilled and tapped until the carriage is fully assembled with the lead screw in position. Only then can the bearing plates be accurately located.

Care must be taken to fit the carriage to the flat bed so that it moves along the full length of the bed without side play at any point. It is best temporarily to fit the parts tightly, then free them by polishing the edges and top of the bed with fine abrasive or with an oilstone. The same procedure should be carried out when fitting the parts of the tool-post assembly, Fig. 7, and the tailstock, Fig. 5. Hand fitting and hand stoning of the sliding parts give a smooth slow motion essential to the performance of the lathe and to accurate work. It is especially important that the tool post move throughout its entire travel without any tendency to rock on the supporting plate. It should move on the slides (rods) with a slight amount of friction and should seat firmly on the supporting plate.

The countershaft, Figs. 1, 2 and 6, is detailed in Fig. 5. It can be built from any parts at hand, or available, that will serve the purpose. Although the original countershaft was mounted in ball-bearing hangers, sleeve-bearing hangers will do quite as well. Standard shaft hangers having a range of adjustment sufficient to give clearance for the countershaft and drive pulley will eliminate the necessity of blocking up the hangers as detailed. Adjustable hangers can be bolted directly to the base. Construction time also can be saved by purchasing the cradle motor mount rather than making it up as detailed. Or, if desired, you can simply bolt the motor directly to the hardwood base and rely on the slotted motor base to provide adjustment for tensioning the belt. Pulleys of the diameters given will give ample speed range for turning nearly all metals. Use a motor of 1750 r.p.m. ★★★



Overarm Fixture Takes Micrometer Head

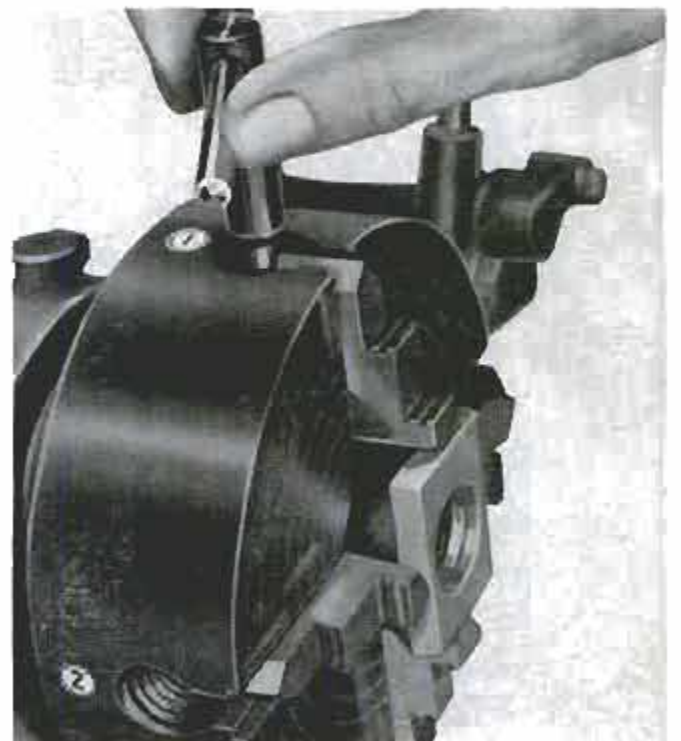
Precise measurements of finished or semifinished parts can be made at the bench with this fixture, or table, fitted with a standard micrometer head. As detailed, the base, or table, and overarm are flame-cut from mild steel and then squared and finished either by filing, or milling, if a milling machine is available. Of course, the parts

can be made from tool steel if greater accuracy is required. The dimensions given are optional and can be changed to suit the work requirement. If ground stock is used for the table and arm and if the bottom of the arm can be finished by milling, then the brackets, or braces, detailed will not be necessary.—C. W. Woodson, Chicago.

Numbering Chuck-Jaw Screws Aids in Centering Work

Centering work in a four-jaw chuck can be speeded up if you number the jaws as pictured. The numbers are especially helpful when partially finished work must be moved by adjusting the jaws in pairs. As a rule only two of the jaws will need to be numbered, but in some instances it may be helpful to have all four jaws numbered consecutively.—R. Hanscom, Elmhurst, Ill.

When hanging double doors in a closet and they must pass, keep in mind that they must overlap slightly when closed and that there is a visible space between the two doors. The trick is to hang the inside door on that side of the opening farthest from the entrance to the room. Then when the doors are closed you will not see the space between.



Tape Protects Legibility of Measurement Marks on Saw Table



Penciled measurement marks on the table of a jigsaw, required to assure accurate cutting of small lengths of material, will not be erased or smudged accidentally if covered with a strip of cellulose tape. The tape is thin enough to allow work to pass over it without interference, and can be removed in a moment when a particular job is done. Also, as shown in the detail, a strip of the tape could be used for inked measurement marks which, in some cases, might be more legible.

When you must cut caramels, marshmallows or other sticky confections with scissors for a dessert or cake trim, save time and temper by using powdered sugar. Dip the blades of the scissors into a box of the sugar frequently so the metal of the blades is "insulated" from the adhesive stickiness of the food being cut.

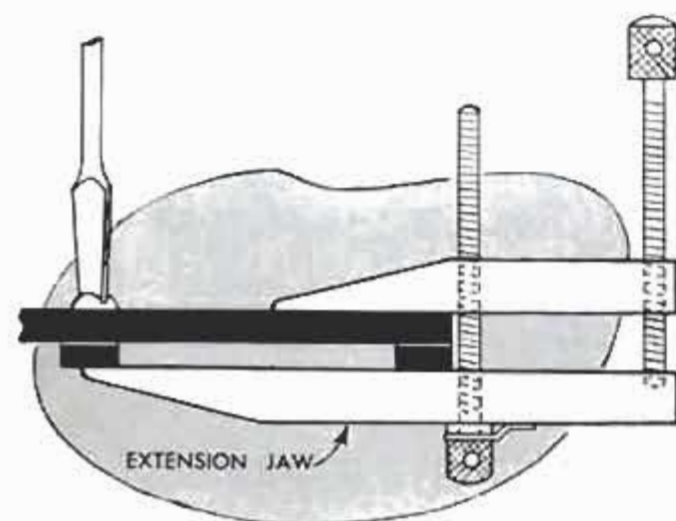
Boost Wiper-Motor Efficiency By Cleaning Felt Air Filter



Most vacuum-operated windshield-wiper motors have a felt pad that acts as a filter for incoming air. To assure maximum efficiency and power from the motor, occasionally remove the pad and clean it in gasoline or cleaning fluid to remove any accumulation of dust and dirt that tend to clog it. After the filter has been cleaned, remove excess fluid by draining and allow the filter to dry before it is replaced in the wiper motor.

Old wagon wheels used as garden decorations may be embellished with potted plants attached to the spokes with brackets.

Extension Jaw for Parallel Clamp Permits "Over Reaching"



Lengthening one jaw of a toolmaker's parallel clamp will increase its capacity and usefulness for holding together work that is to be drilled, tapped, machined in some manner or accurately assembled. The longer jaw is made from tool steel and is shaped to match the original jaw with an inch or two added to its length. The new jaw is drilled for the clamp screws as indicated, one hole being drilled all the way through the jaw to provide clearance for one screw. The other hole in the jaw is bored only $\frac{1}{8}$ in. deep, so that it merely engages the end of the other screw. Use the old jaw to locate the holes.

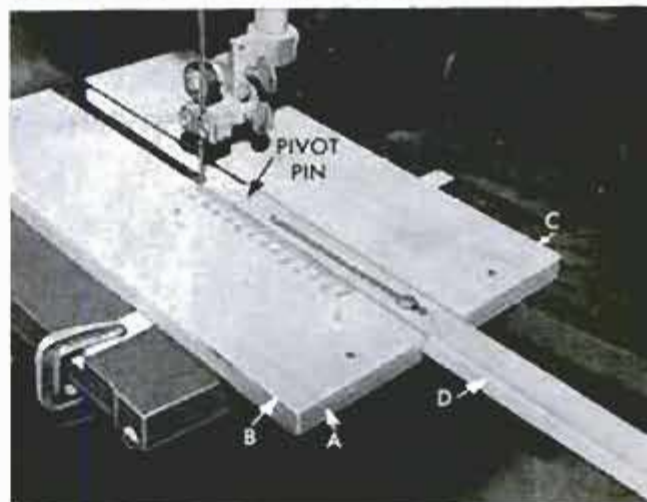
C. W. Woodson, Chicago.

CUT PERFECT DISKS ON YOUR BANDSAW

THIS JIG can be made to fit small bandsaws and enables you to cut one or more disks in the time normally required to set up the work on a lathe. The work is supported on a flat surface throughout the length of the cut, a feature which prevents binding of the saw blade due to tilting of the stock. It is not necessary to drill a center hole in the stock when cutting any disk up to 14 in. in diameter.

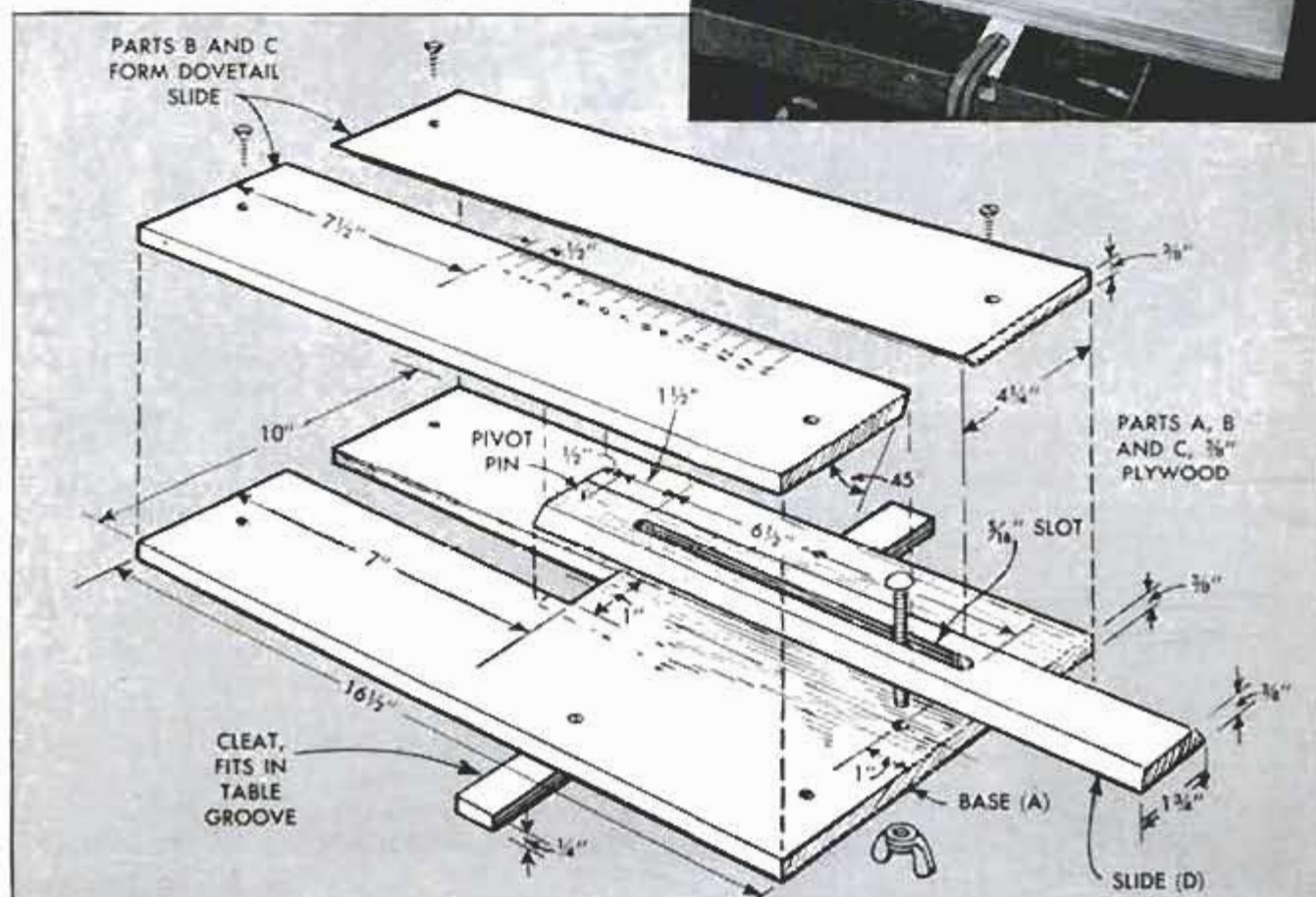
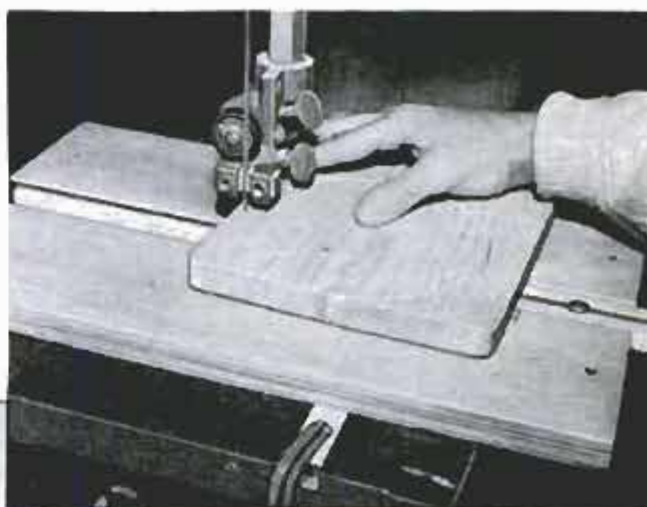
As will be noted in the detail below and in the upper photo at the right, the jig consists of the parts A, B, C and D, the inner edges of the parts B and C being cut at a 45-deg. angle. Corresponding cuts are made on the edges of the slide, D. This forms a single dovetail when the parts A, B and C are assembled. The part D slides in the dovetail. The pivot pin is made by cutting off the head of a screw and grinding the body to a sharp point. This is turned into a hole centered in the slide $\frac{1}{2}$ in. from the end. The point should project about $\frac{1}{16}$ in. above the surface. Lay off the graduations as indicated to give a capacity of 14 in., rising by eighths. On bandsaws having a grooved table, the jig is held in place by a cleat clamped in the table groove. On machines having no groove in the table, the jig usually can be clamped at the rear edge of the table, clearance being allowed for rotating the stock.

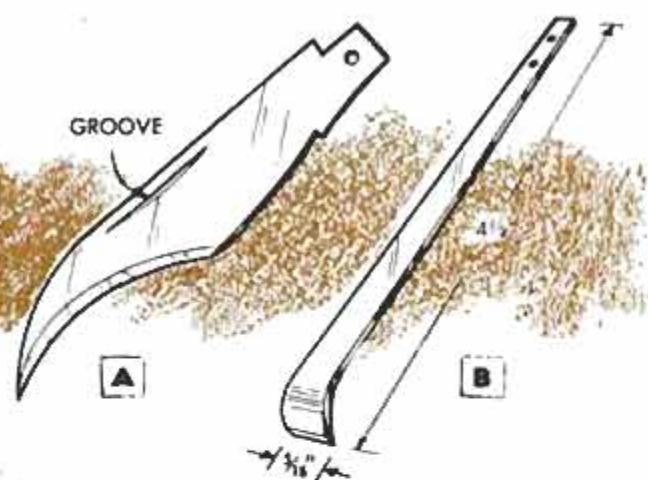
Wm. J. Kadi, Long Beach, Calif.



Above, circle jig gives full support to work, preventing tilting of work which causes saw to bind

Below, you merely turn stock on pivot pin to cut a perfect disk. Light sanding finishes edge smooth





IF YOU LIKE

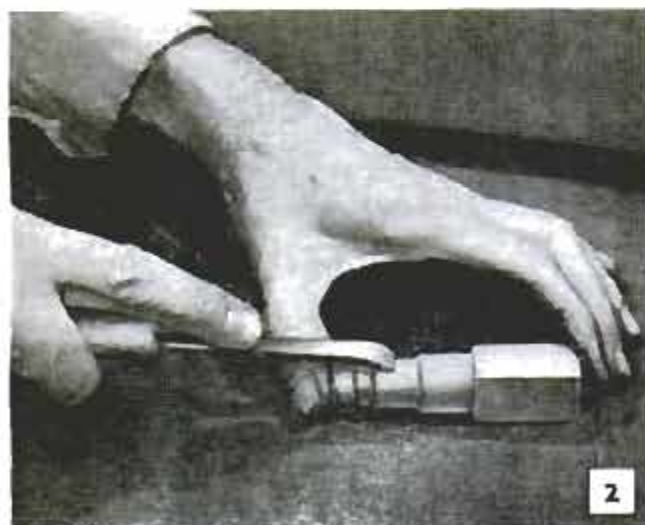
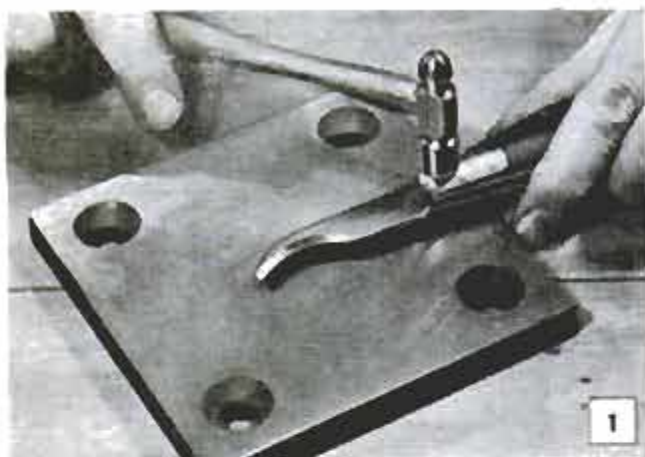
here are several unusual types good craftsmen find useful for hand work on wood, leather and plastic

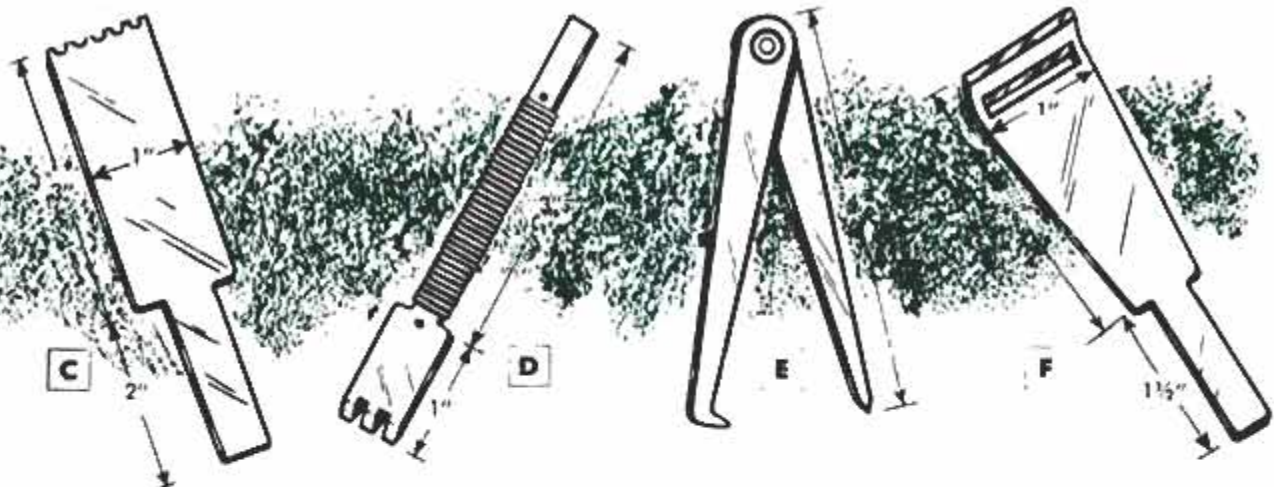
By Walter E. Burton

YOU WILL BE PROUD of hand tools you make yourself, either for regular uses or for a special purpose. That's because there is something individual about a fine handmade tool that delights the eye of a craftsman. Let's say, for example, you are a whittler and good at it. Usually such work is done with a pocketknife, but perhaps the standard shapes of pocketknife blades just won't do for your particular purpose. So you consider making a blade to suit and fitting it to the knife handle, Fig. 1, just like the original. It's easier to do than you might think.

The tool steel from which many types and sizes of hand tools can be made is known to the trade as ground flat stock. It is available in a wide range of sizes, generally comes coated and annealed for easy layout and workability. It can be sawed, filed, also bent to a comparatively short radius by heating. After oil-hardening and tempering, it will hold a razor-keen cutting edge. Instructions for oil-hardening and tempering usually come with the material or are available from the manufacturer. If you do not have facilities for this work it may be possible to have it done locally.

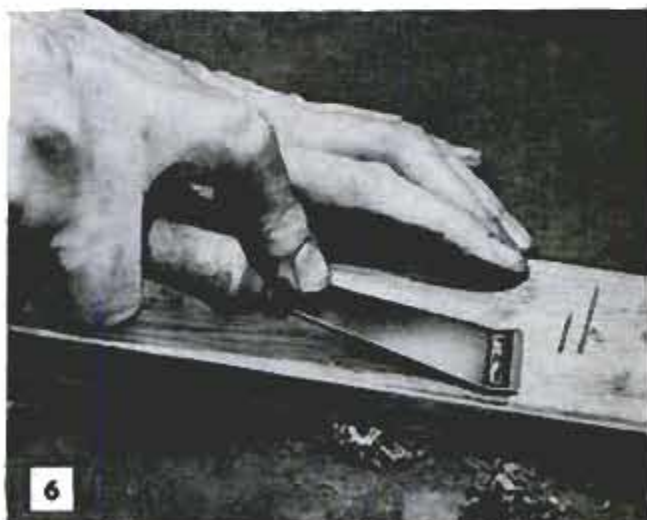
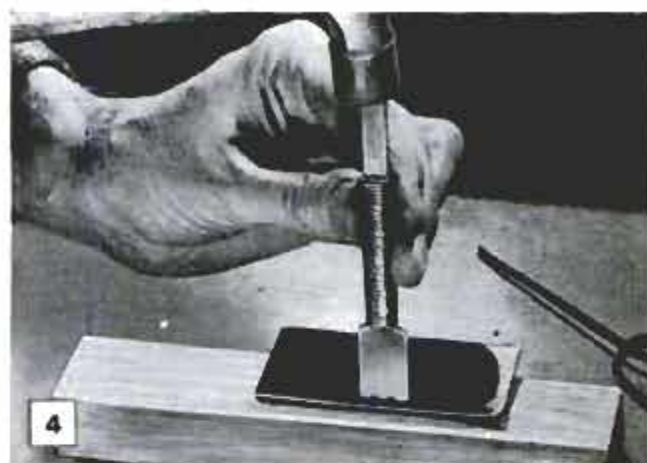
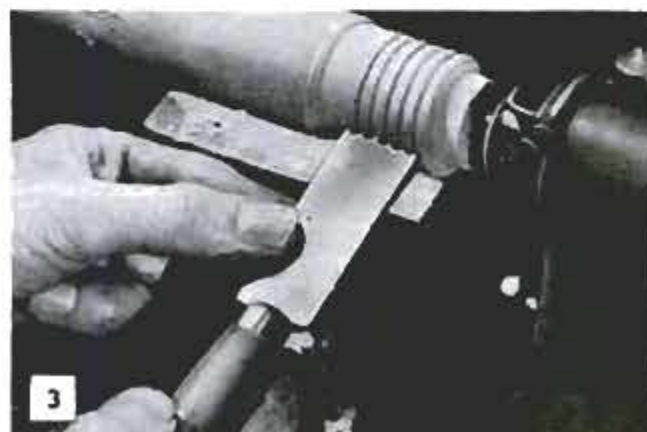
Details A through F, above, show typical tools that can be made from flat stock. Of course, there are many other applications, such as flat carving chisels, gauges, small machine parts and templates. The replacement knife blade, detail A and Fig. 1, can be made almost any shape to suit requirements. Modelmakers and others who work on small parts will find the tiny scraper, detail B and Fig. 2, a handy addition to the toolkit. It gets into places that





TO MAKE HAND TOOLS—

cannot be reached with conventional scrapers, even with a knife blade. A multiple-beading tool that wood turners find useful for running duplicate beads on older style turnings is shown in detail C and pictured in use in Fig. 3. The round-bottomed grooves that form the beads are made with a round file and the edge is beveled before hardening. Thonging chisels for leatherwork come in various sizes but nearly all experienced leatherworkers prefer a three-prong chisel, especially for following curved edges. The three-prong chisel is easily made from flat stock as in detail D. The handle, or handhold, is simply a wrapping of light-gauge wire. The chisel is shown in use in Fig. 4. The caliper, detail E, known in shops as a hermaphrodite caliper, is handy for setting from the end of a scale, for working from an edge as in Fig. 5, and for transferring certain measurements. They can be made any length, the caliper dimensioned in detail E being of small size. The special tool in detail F can be used for scraping wood and scarfing leather and also as a spokeshave or draw knife as in Fig. 6. All tools should be fitted with turned wooden handles, preferably hardwood. ★★★



Efficient Paint Scraper Utilizes Adjustable-Wrench Leverage



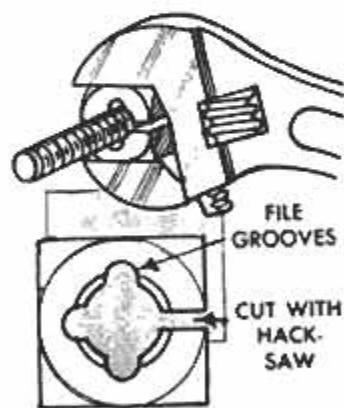
A scraper that will remove several coats of paint, even without the application of remover, consists of a broken flat file and an adjustable wrench. The end of the file is ground off square and at a slight bevel. When in use, the file is guided with one hand while downward pressure is applied

with the other hand on the wrench, which is clamped to the file as shown. For better control of the file, replace the regular round handle with a rectangular one made from wood or plastic.

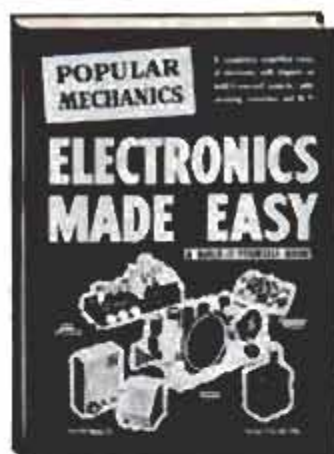
Robert L. Sargisson, Berwyn, Ill.

Grooved Nut Used to Clean Rusted Bolt Threads

When the threads of a number of bolts must be cleaned of rust and dirt which cannot be wire-brushed out, and a die of proper diameter and thread size is not at hand, try using a nut having a slot and grooves as shown.



A cut is made through the nut from one side, and three grooves are made across the threads with a file. The cut and the grooves will permit the nut to turn on the bolt and to collect the dirt and rust.



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H. A. Ness & Co., 5083 Elston Ave., Chicago 30

2. FLEXIBLE-SHAFT UNIT consists of high-torque motor and 30-in. flexible shaft designed for a speed of 3450 r.p.m. Nylon handpiece is fitted with a steel finger grip which enables operator to maintain precise control on close-tolerance operations. Handpiece takes 1/16, 3/32 and 3/8-in. collets. A number of attachments are available for converting unit to a bench grinder, buffer, shoe polisher and disk sander

Dremel Mfg. Co., Racine, Wis.

3. PLIER-WRENCH serves both as a wrench and pliers, and when supplied as a kit it comes with a universal jaw, pipe jaw, wire bender and tube cutter. Jaws are always parallel, from wide-open position to the tightly closed position, the movable jaw being actuated by a "gear" and rack with a shift, ratchet and lock. By means of the latter, jaws can be locked in any position and unit used as wrench

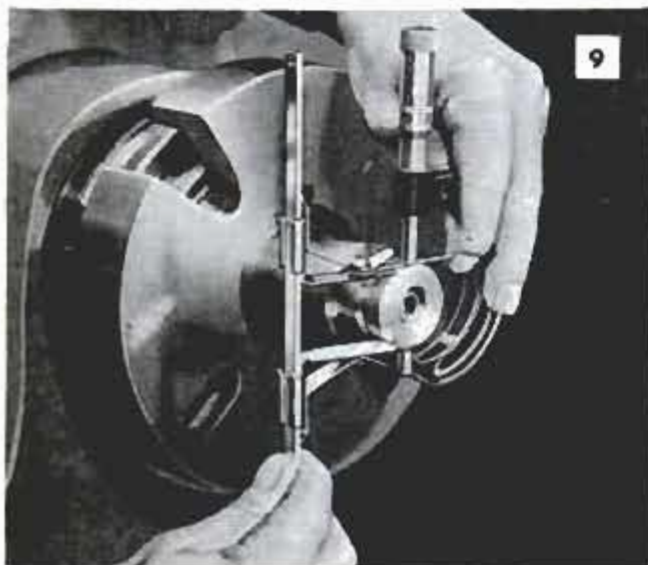
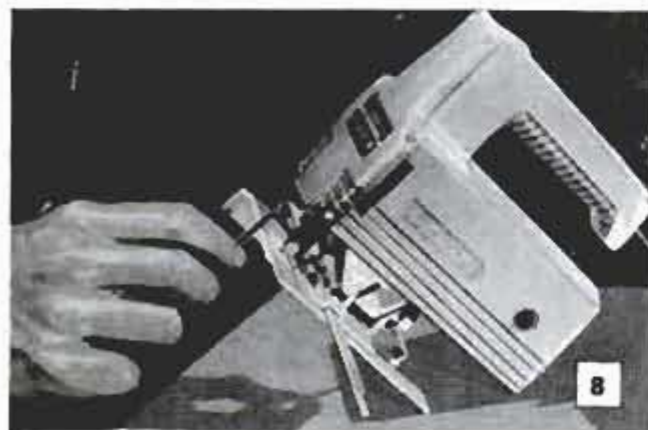
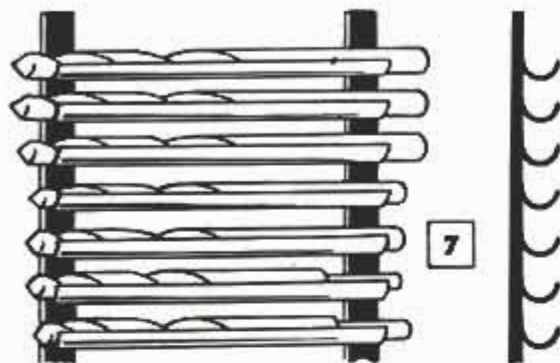
Plierwrench Co. of America, 4615 N. Ravenswood, Chicago 40

4. BEARING PACKER designed for use with either a hand or air grease gun, eliminates hand packing of bearings in autos, trucks, farm and industrial equipment. Cleans bearings automatically as the old grease is forced out as new grease enters the bearing under pressure. At the same time new grease is protected from contamination by dirt or grit that may possibly be contained in the old lubricant

Gordag Industries, Inc., 3945 Wooddale Ave., Minneapolis, Minn.



SHOPPING FOR TOOLS



5. ENGINE-DRIVEN CONCRETE SAW features a precision adjustment to compensate for variations in the hardness of the aggregate, cutting differences in the blades and for sawing on curves or slopes. Self-propelling drive is slipfree. Speed-control mechanism provides operator with fingertip control of the cutting speeds which range from 1 to 25 ft. per min.

The Robert G. Evans Co., 6024 Troost, Kansas City, Mo.

6. 5X MAGNIFIER comes with a swiveling clamp and stand which allows adjustment of magnifier to the most convenient viewing position. Clamp is made with a sleeve which takes 5/16-in. rod for attachment to laboratory apparatus. Lens is highly corrected for spherical aberration and to eliminate distortion. Lens mounting is vapor and dust-tight metal construction.

S. B. Logan & Co., Genoa City, Wis.

7. DRILL RACK saves tools and time in the toolroom and in the school shop. Large drill bits, taps, straight reamers in varying sizes, and small and medium-size end mills can be safely stored in the minimum of space with each item always visible for quick selection of the desired size and type. Fabricated entirely of metal, unit is light, exceptionally rigid.

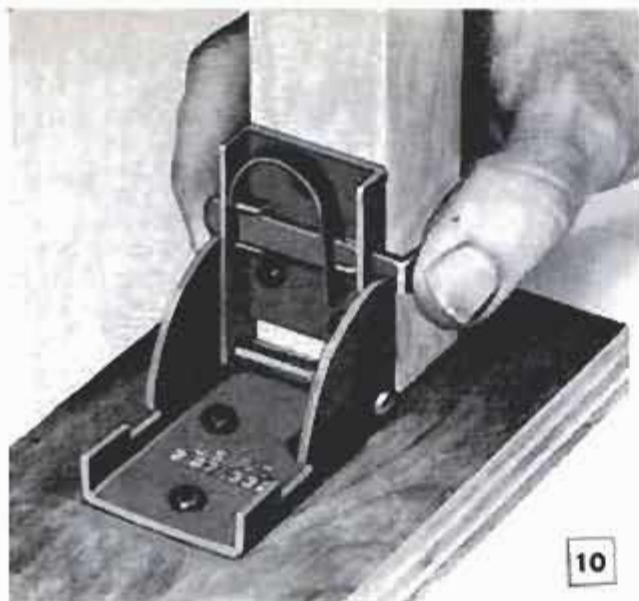
Lenox Tool Co., 3074 Caniff, Detroit 12, Mich.

8. SABER SAW has a comfortable handle for positive control when making straight or curved cuts. Shoe tilts right or left for angle cuts and can be locked securely at any angle. Built-in blower clears cutting line and reduces blade drag due to resinous sawdust. Cuts through 2-in. wood and also cuts plywood, plastic, leather and metal with special blades.

Cummins Portable Power Tool Co.,
Div. of John Oster Mfg. Co., Milwaukee, Wis.

9. WIRE HOLDER for thread measuring improves on the older, less certain 3-wire system where the wires must be hand-held while miking. This holder grips the 3 wires, holds them parallel in two sliding elements, or jaws, which are adjustable to fit work of varying diameters. The unit can be held in the hand, as pictured, or can be mounted stationary on bench.

Flynn Boring Tool Co., Ferndale, Mich.



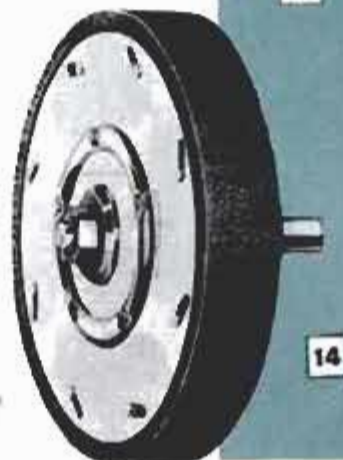
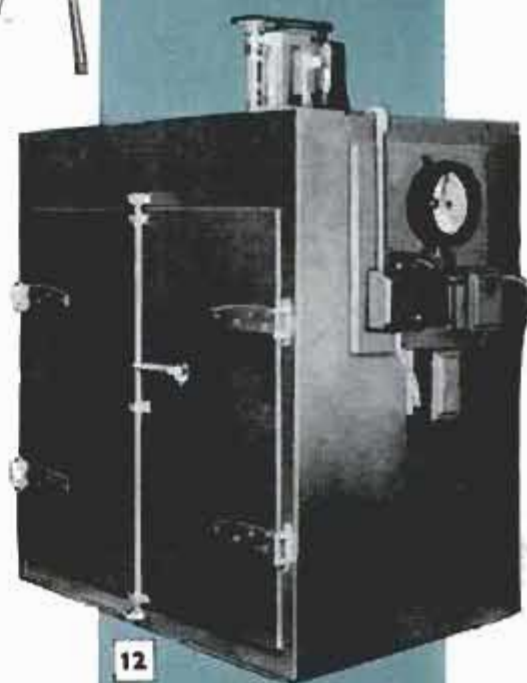
10. FOLDING-LEG BRACKET locks the leg rigidly in both the folded and extended positions. Just drive 6 screws to attach each bracket to leg and underside of table top. Makes any type of folding table a one-evening project for do-it-yourselfers, provides a quick, economical way of constructing duplicate banquet tables or light benches for industrial use
Royal Oak Tile & Paint Co., 611 S. Washington, Royal Oak, Mich.

11. LAWN AND GARDEN TOOLS in a new matched design feature a number of advancements in ease of operation and performance. Included are three types of hand pruners, two grass shears, lopping and shrub shears, grass whips and lawn and shrubbery rakes. Quality materials and the very best workmanship add to the list of outstanding features of these tools
The Stanley Works, 111 Elm St., New Britain, Conn.

12. DRYING OVEN for low-temperature operations is completely self-contained, operates at temperatures up to 300 deg. and is heated by elements of the fin-strip type. Chamber size is 38 x 36 x 48 in. and over-all cabinet size is 42 x 65 x 66 in. Unit is equipped with a 7-day timer and a circular-chart, recorder-type controller. Connected load is 9 kw.
Percy Equipment Co., 8101 Chambers Rd., Columbus 12, Ohio

13. TWO-SPEED DRILL features motor of full 3.5-amp. rating, has power to handle 3/8-in. twist drill in steel, 1-in. bit in hardwood. Two-position selector switch gives high no-load speed of 2000 r.p.m. and load speed of 1200 r.p.m. In low-speed position switch gives no-load speed of 1000 r.p.m., full load speed of 600 r.p.m. Length is 10 1/4 in. Net weight is 6 lb.
Portable Electric Tools, Inc., 320 W. 81st St., Chicago 20

14. EXPANDING WHEEL for grinding and polishing takes an abrasive sleeve 1 1/4 in. wide and 21 in. in circumference. Wheel consists of Neoprene disk, or core, faced with two steel flanges which are slotted tangentially. Pins passing through the Neoprene disk engage the slots. This construction gives the wheel a free-floating action, eliminating edge distortion
Miller Products Co., 1438 12th St., Box 325, North Chicago, Ill.

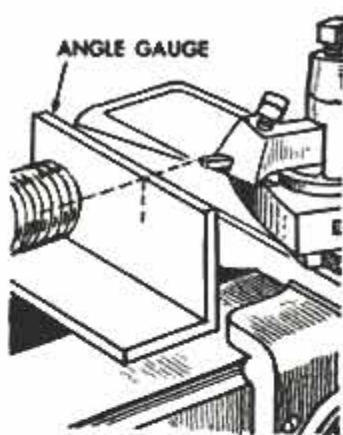




Heavy-Duty Shears From Steel Angles

Rather than discard two short lengths of 1 x 1-in. steel angle, one homeowner utilized them in making a pruning shears. The two pieces were each cut to 48 in. in length and pivoted web-to-web at a point 5½ in. from the ends, using a ¾-in. rivet (a machine bolt also can be used). Meeting edges of the webs were then ground to form cutting edges, and a round-bottom notch was ground in each as detailed. Hardwood handles were then turned and the square sections riveted to the opposite ends of the angles. — George H. Holden, Chesterfield, Derbyshire, England.

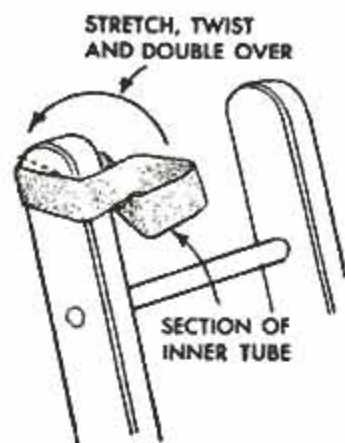
Lathe Tools Centered Quickly With Aluminum-Angle Gauge



When cutting threads, turning tapers and for facing operations, a lathe tool bit must be positioned exactly at lathe-center height. To make this adjustment quickly, a gauge made from a length of aluminum angle can be used. One leg of the angle is cut to be exactly at lathe-center height when the angle is resting on the lathe-bed ways, as indicated. The top edge of the tool bit then is aligned with the top edge of the gauge. C. W. Woodson, Chicago.

Rubber "Bumpers" for Ladder Prevent Scarring Paint

To prevent the ends of a ladder from marking or scarring paint on the outside of the house when putting windows or touching-up the trim, fit the ends with rubber bands cut from an inner tube. Cut the bands 3 or 4 in. wide, and twist and double them over as shown in the detail. The doubled bands provide two layers of rubber cushion and will be held on the ladder by their own tension. They also may be tacked in place.



E. R. Haan, Evanston, Ill.

"Break in" Fouling Causes Plug Misfiring in New Engine

Although alarming, spark-plug misfiring in the engine of a new car that has been driven relatively few miles is not serious. Called "break in" fouling, the condition can be caused by one of several factors. Usually it is the result of oil blowing past the piston rings before they are seated. Piston rings on late-model cars last much longer in service, but also require a longer

break-in period. Piston travel is reduced, due to the short-stroke design of modern engines, so more miles are required for break-in wear. Oil sometimes is introduced through the carburetor to coat the insides of new engines to prevent rust during storage. If your engine runs roughly, speed it up occasionally on the open road to burn off the oily deposits and clear the plugs.



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But *unlike* these costly sabre saws, only Stanley's H75 permits flush cutting; is lightweight and costs as little as \$54.50. See it before you buy *any* sabre saw. For free catalog write: Stanley Electric Tools, Div. of The Stanley Works, 622 Myrtle St., New Britain, Conn.

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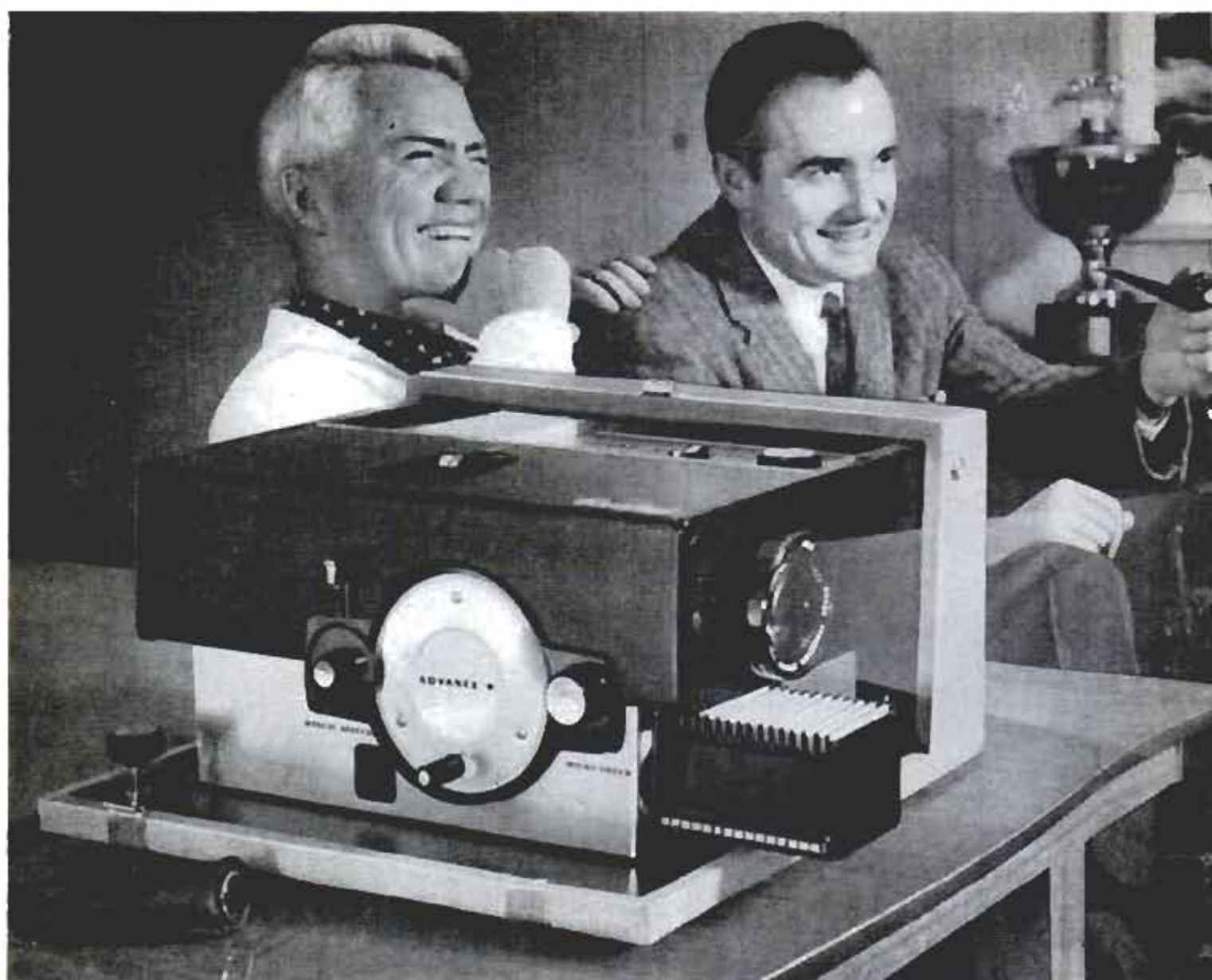
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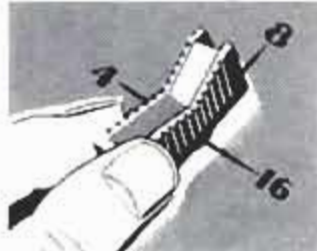
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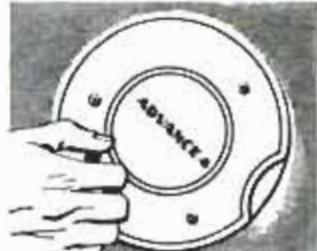
EASTMAN KODAK COMPANY, Rochester 4, N. Y.



You choose from 3 automatic slide change intervals: 4-, 8-, or 16 seconds.



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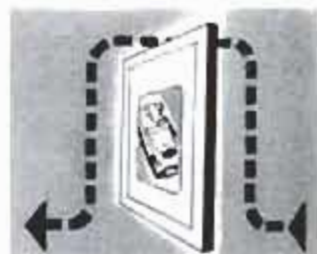
Forward or backward change by control wheel; pushbutton change, too.



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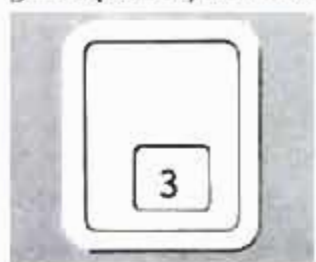
You can show any popular slide size. New steel guards protect your slides.



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You arrange and change slide order by checking index window number.



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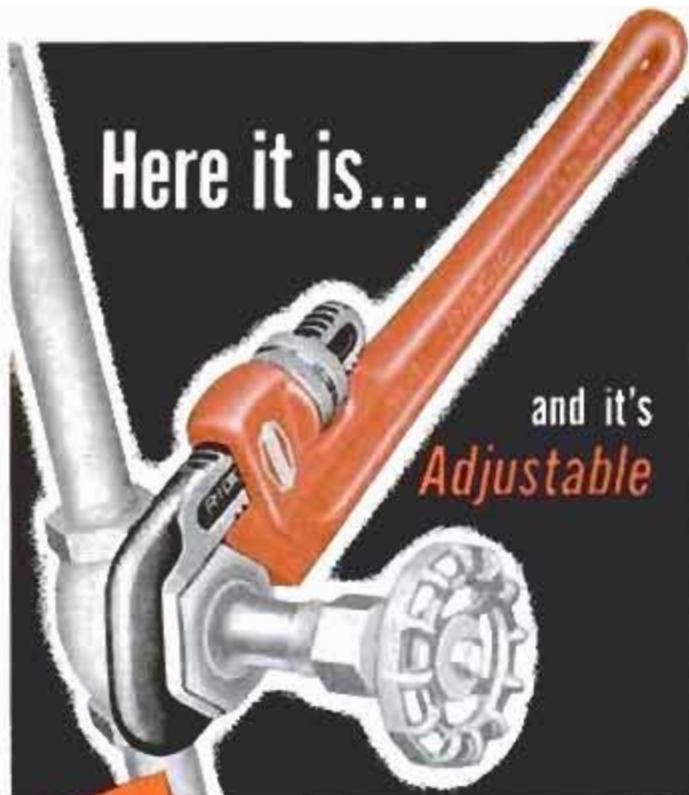


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Pruning Grapevine

Q—I have a grapevine on a large arbor which has deteriorated to the point where it is about to collapse. I'd like to trim the vine back and train it to grow on a new arbor. I don't know how or when to trim, or prune, the vine. Can you outline a procedure? — Y. L., Ohio

A—The vine should be pruned, or cut back, only while it is dormant and in your locality this usually means that the work should be done not later than February 15, earlier if practical, the date of pruning depending somewhat on the season. First step is to cut out all the dead wood and small shoots. Save the main trunk and arms but remove the long and extremely slender branches which have only a few short canes, or tendrils at, or near, their ends. These instructions are more or less commonly adhered to when reclaiming an old vine, but if the vine is very old, has several main trunks, and the live growth is exceptionally profuse, then it generally is best to plan to reduce the live growth not more than 25 percent the first pruning season. This usually can be accomplished by removing a few of the smaller live canes and cutting back the larger of those remaining about one fifth to one fourth the total length. When removing the vine from the trellis, and when dismantling the latter, be careful not to damage any of the live wood. It should be understood, of course, that this brief outline of a procedure is only a general first-season schedule for reclaiming an old and neglected vine and is not a method used when training a vine for maximum fruit production.



Length of Pendulum

Q—I've just acquired what appears to me to be a very old clock. It has a wooden movement but no pendulum. Case is pretty much of a wreck but the movement appears to be in fairly good condition. I'd like to try rebuilding this clock, get it running again. No one I've consulted can tell

me how long the pendulum should be. Is there a way to determine this?—H. S., N. Y.

A—Are you referring to a shelf clock or to a tall clock, commonly known in later years as a grandfather's clock? Both types of clock were made with

(Continued to page 224)

FREE PLAN shows you how to build this "Gay Paree" fun room



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(Continued from page 222)

wooden movements. You did not say which type you are referring to, so we'll assume you have what was known as a shelf clock. If the wooden movement is original (wooden movements are made and sold as kits at the present time) then it must be more than 100 years old and undoubtedly was fitted with a short, fast pendulum. Such movements usually were weight-driven, the weights rising and falling in channels built into the sides of the shelf-type case. Most shelf clocks having wooden movements of the period to which yours appears to belong were made with a 1/2-second pendulum which measured roughly 9 3/4 in. (9.78 in.) from the pivot point to the center of the bob, or weight, at the lower end. This weight was adjustable by means of a thumbscrew.



Finishing Door

Q—My outside doors, one front and one side door, are protected by canopies. One is of pine, the other birch. Both were sanded and finished with spar varnish less than two years ago. The pine door has darkened, one cross member having a very dark reddish-brown streak through the

center. The birch door shows dark spots in several places and the wood is rough. What happened and is there a way to remedy it?—G. H., Kans.

A—Pine tends to darken as you describe when finished in the natural color with a clear varnish, especially when exposed to light and to the effects of temperature and humidity variations. However, in most cases this tendency to intensification of colors inherent in the wood is not at all objectionable. If you use a clear finish, then there is little you can do to entirely prevent a slow change of color, other than staining the door a uniform shade at the time of finishing the new wood. You can remove the present finish, bleach the wood to some extent, stain to the desired shade and then re-finish with spar varnish or an outside clear finish made especially for outside application. Even then there is likely to be some change in the color over a period of time. Referring to the birch door, we assume you are describing the condition of the finish on a veneered door or a hollow-core door rather than one of solid-wood construction. In this case the darker spots probably are due to a vertical or near-vertical grain in the areas which seem to be affected. The fibers tend to swell when exposed to extremes of temperature and humidity and in time tend to break the finish film, permitting moisture to enter. In your case it probably will be best to remove the present finish, sand smooth and apply a mild oxalic-acid bleach to the dark areas. Finish with a sealer and an outside clear finish.

Cutting Glass

Q—I've always had trouble cutting glass. Just what is the correct procedure? In my experience the glass breaks, or it chips along the line of the cut, never breaking smooth and clean like I want it. I'm told it's very simple but I don't find it so.
—B. E., Ky.

A—The procedure is simple, that is, there is nothing involved about it, but it does require careful attention to details. First, wash the glass and wipe dry. Place the pane on a rigid, flat surface with two or more thicknesses of newspaper underneath. It's important that the surface on which the cutting is done be flat so that no undue stresses occur while the glass is being scored with the cutter. Although a yardstick can be used as a straightedge, a length of 1 x 2 in. stock is better as it is more easily held in position. Dampen the lower face of the straightedge so that it will "grip" the surface of the glass. Place a drop of light oil on the glass-cutter wheel. Hold the glass cutter in a vertical position against the straightedge. Hold the latter firmly in place and score the glass in one swift stroke from edge to edge of the panel. Lift one edge of the glass, grip it with a thumb and forefinger on each side of the score and exert pressure until it breaks along the scored line.



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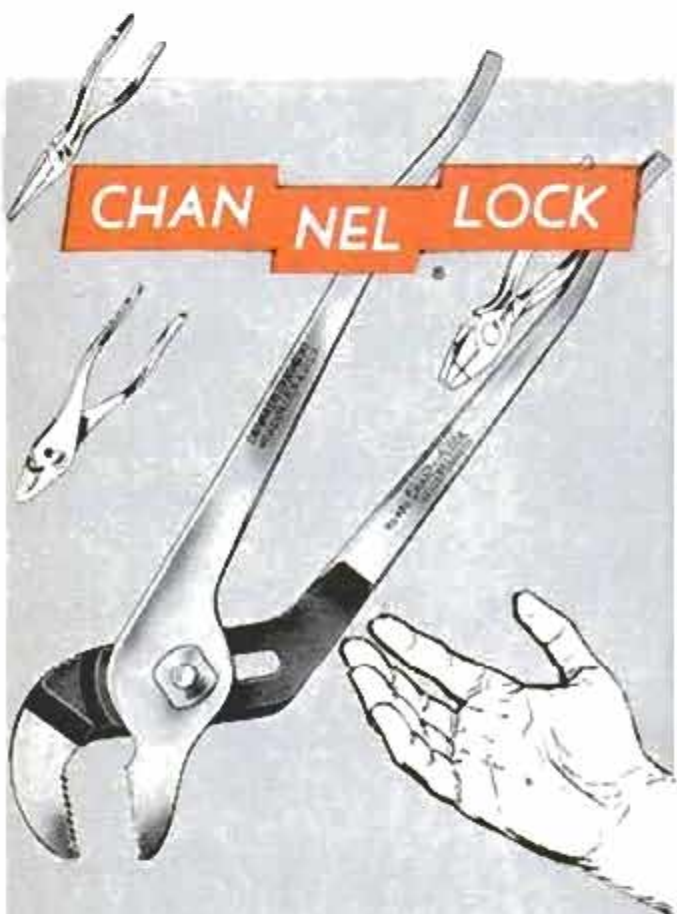
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Big Change in Venezuela

(Continued from page 154)

years ago, a huge new steel mill is rising that eventually will provide 1.2 million tons of steel annually. Nearby, on the turbulent Caroni River, electricians are putting the finishing touches on the powerhouse of a new dam, 165 feet high and 1165 feet long, which will power the steel mill. At present it is turning out 50,000 kilowatts, but this will eventually be expanded to 300,000.

Oil Derricks Cover a Lake

Over in the northwest corner of the country is Lake Maracaibo, one of the richest spots in the world because of its oil. The black gold, for the most part, lies in pools under the lake. Oil derricks punctuate the surface of the water like so many stakes marking off the plot of a real-estate development. Thousands of men are at work building a \$100,000,000 bridge across the lake, a bridge that will be carefully studied by engineers throughout the world, for it will be one of the longest prestressed-concrete structures ever built.

Throughout modern times, Venezuela has been forced to import a significant part of its food requirements. Now, thanks to a coordinated effort to solve the problem, Venezuela is raising 85 percent of its food. Farm lands rapidly are being upgraded through fertilizers and irrigation. Agricultural research and education are providing better crops and larger harvests. Twenty-one agricultural colonies have been established. In some respects the colonists remind you of our own settlers during the homesteading days, for colonists are given an opportunity to "prove up" or pay for their land. Homes, tools, seeds and schools are provided. As the settler brings in his crops, he uses the income to buy his land and home. At Turen, biggest of the colonies, 600 farm families are harvesting corn, beans and sesame in an area that produced nothing a few years ago.

Big Boom in Education

Improving the country is almost a bootstrap operation because of the former level of education. Even today, about half the population is illiterate. But the current administration has ordered construction of 223 new schools, and school registrations today are double what they were 10 years ago. Thousands of illiterate adults are awkwardly learning to hold pen and pencil as they squirm through classroom sessions at night in an effort to educate themselves comparatively late in life. You can't build

(Continued to page 228)

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a new country without learning how. Down in the tropical lowlands along the seacoast, a swarm of workers is putting the finishing touches on a huge dry dock, one of the few in Latin America. First step was simply the digging of a tremendous hole, 759 feet long, 111 feet wide and 40 feet deep, some 1½ miles from the sea. The reinforced-concrete dry dock was poured inside the hole. Then a channel for ships was dredged from the sea to the dry dock. An artificial lagoon gives vessels elbow room to turn around. In planning the dry dock, designers cocked an eye to the future. In a new building nearby is a "radioactivity room" for the decontamination of persons or objects exposed to the radioactivity of atomic-powered ships.

"Monument to the Dead Mosquito"

Drive just a few miles down the road from the dry dock and you'll come across a unique monument—a tall shaft of concrete with a steel sculpture at its base. The sculpture depicts a huge mosquito lying on its side, its legs curled up. A plaque on the shaft labels this the "monument to the dead mosquito." Venezuela has become a showplace of the world in the control of malaria. The program started in 1944. Every home in the country has been sprayed for insects, and men and equipment have sprayed vast swamps to kill off the malaria-bearing mosquito. The battle has been so successful that last year only nine deaths from malaria were reported. Prior to 1945 there were more than a million cases of malaria each year.

One thing you can't escape in Venezuela is the smell of fresh paint. If a stop watch could serve as an appropriate national symbol, a paintbrush could well be the great seal of the land. Everywhere you go you see Venezuelans wielding paintbrushes. Many of the jerry-built slum shacks are painted in clean, bright colors. Down along the seacoast I spotted a man giving the trunks of a whole grove of palm trees a coat of gleaming white paint. When I asked him why he was painting the trees, he thought a moment and replied, "Because they told me to." Then, gazing down the rows of white pillars, he added, "Looks most beautiful, doesn't it?" It did, too.

Thanks to Venezuela's booming economy, a large number of American companies have established branches there. In your wanderings through the countryside you spot countless well-known names atop industrial plants—Firestone, Chrysler, U. S. Rubber, American Can, Procter and Gamble, Pittsburgh Paints, Pure Oil.

Venezuelans, perhaps, are proudest of

(Continued to page 230)

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their petrochemical plant. Three years ago the 750-acre site was nothing but untouched jungle and swamp. Overnight more than 3500 workers moved in with their families, built themselves a community and started erecting buildings. Today more than 20 huge factories dot the landscape and 10,000 people are living in a city that didn't exist three years ago. Already the plant is turning out fertilizer by the hundreds of thousands of tons, and soon it will produce plastics, artificial textiles, explosives, insecticides, synthetic rubber and vital industrial chemicals, all made from petroleum.

The health and wealth of this land of violent contrasts are of considerable importance to the United States. In the market for American goods, Venezuela ranks second only to Canada. In one recent year, Venezuela paid a thumping \$1,000,000,000 for U. S. products and another half-billion for intangibles such as ocean shipping and insurance. That's enough dollars to produce a profound effect on the economy of this country.

At this moment a middle-aged Venezuelan, newly introduced to the sight of jet planes and Jaguars, is tying steel rods into the forms for a new section of the Pan American Highway. Another middle-aged man is rolling out steel rods in a mill at Joliet, Ill. There's a direct connection between the two; the better one lives, the better the other is likely to live, too. ★ ★ ★

Rivers Are Higher on One Shore

According to the Coast and Geodetic Survey, a river is higher on one shore than the other because the deflecting force of the earth's rotation swerves any moving body—to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

Do You Know These Old Timers?

(Answers to quiz, page 14)

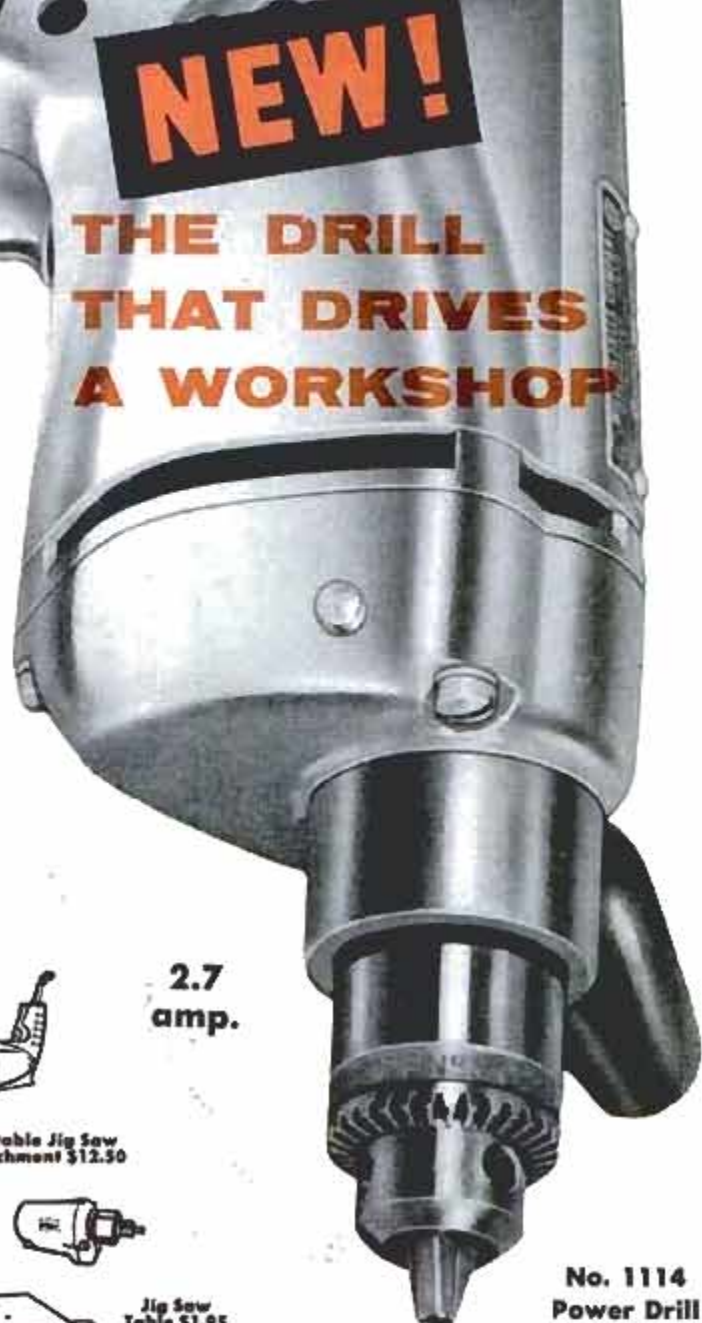


Left, Kelly-Springfield 1913 truck.
Right, 1917 Model-T Ford touring car.

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BUILDING BETTER TOOLS
SINCE 1906

Piston Pilots Go to Jet School

(Continued from page 137)

against his mouth and nose. He is immediately on 100 percent oxygen. Meanwhile, cockpit crew members are strapping on their demand-type masks. As a matter of fact, either the pilot or copilot wears a mask at all times at high altitude, or keeps it laid out in front of him ready for instant use.

The first thing a pilot would do if rapid decompression occurred would be to make an immediate rapid emergency descent to below 14,000 feet. He would get down there as fast as the Mach limit of the airplane would permit. All crews are trained in this emergency procedure.

The engines on the 707 are Pratt & Whitney JT3C-6 gas turbines, known to the military as the J-57. The commercial version is without afterburner, of course. They are so dependable that they go 1000 hours between overhauls in military use. On the 707 they are equipped with thrust reversers that do the same job as reversible-pitch propellers in reducing the length of the landing run. They also are equipped with noise suppressors that minimize exhaust noise on the ground while climbing out from an airport.

Pilots Study Jet Engines

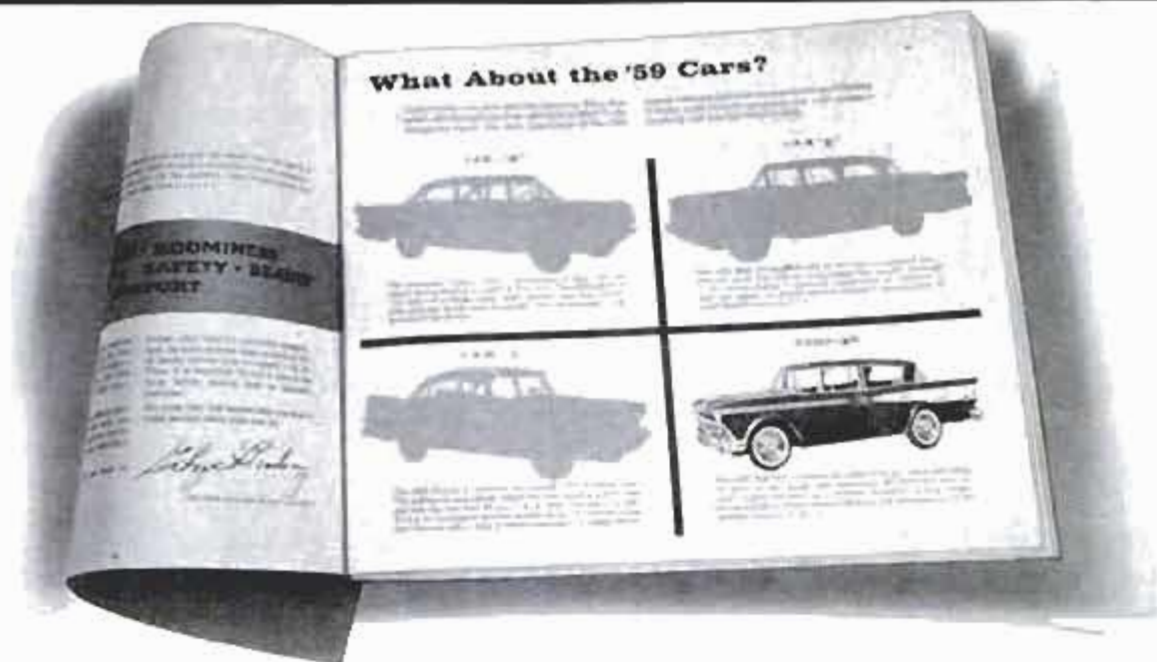
Part of pilot training is to become completely familiar with these power plants. Pilots learn it's never safe to stand closer than 25 feet ahead of an engine intake, or closer than 75 feet from the jet exhaust at takeoff power. They learn how to handle a hot start or a hung start when lighting up. They rehearse fire-fighting procedures, including engine shut-down, and the technique of getting an air start in case of flame-out. They learn to measure the amount of thrust developed by an engine by reading the engine-pressure ratio gauge on the instrument panel, and how to monitor the exhaust-gas temperature gauges.

Two other new, and important, instruments are the true-air-speed indicator and the Machmeter. The true-air-speed indicator makes its own corrections for temperature and altitude and always shows the actual speed of the airplane. It has become a basic flight instrument for takeoffs and landings.

When Captain Bittner was planning his takeoff he first used a chart to find the speed at which the plane would lift off the ground, based on its gross weight, pressure, altitude, headwind and a temperature correction. This takeoff speed is designated as V-2 and is 1.3 times the stalling speed of the airplane under the existing weight and

(Continued to page 234)

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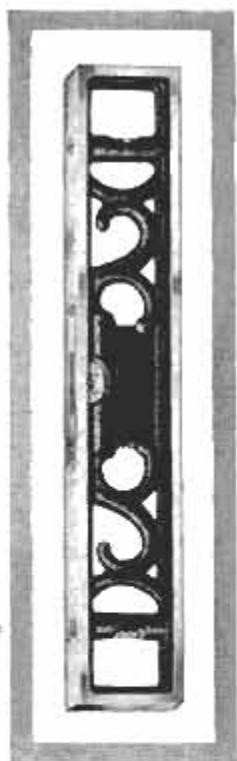
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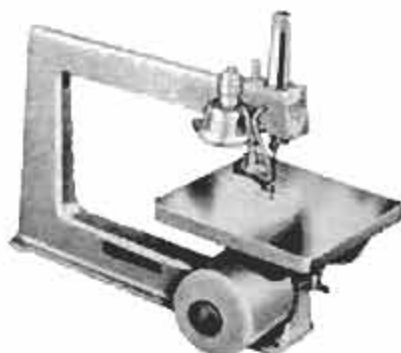
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Transistorized Car Radio

(Continued from page 160)

battery holder between the speaker and the parts on the back panel of the case.

Leave approximately 1/4-in. clearance between the front panel and the edge of the audio chassis to permit passage for the green and yellow leads of T4 which is fastened to the chassis from underneath.

The battery holder should be made just wide enough to provide a snug fit for the two batteries. A 1 1/2-in. machine screw and nut serve as a clamp to hold these firmly in place. Two holes near the bottom of the battery holder are used to fasten it to the bracket which is a part of the loudspeaker.

When used in a car, the radio will be subjected to considerable vibration. All parts mounted with screws and nuts, therefore, should be fastened securely and lock-washers should be inserted under each nut.

Wiring and Soldering

Wiring of the receiver is entirely conventional. Connecting points for all small parts and wires are clearly shown in the pictorial diagram.

Begin the wiring with the audio chassis and the parts mounted on the case. All wiring and soldering should be done before the transistors are inserted in their sockets. If the aforementioned power-transistor mounting kit is not employed, the wires to the emitter and base leads should be soldered as quickly as possible to prevent damage to the transistors.

Two 8-32 screws, the same screws which fasten the 5-lug terminal strip and the two ground lugs to the audio chassis, are used to fasten the chassis to the speaker frame. The chassis holes for these screws must be carefully spaced to coincide with the spacing of the tapped holes in the back of the speaker frame.

Like the audio chassis, the r.f. chassis should be completely prewired before being mounted to the second speaker. In fact, the entire receiver can be aligned before this chassis is finally mounted. To do this, the leads interconnecting the r.f. chassis with other components of the receiver are made somewhat longer than actually necessary, but these can be shortened after the final installation. Furthermore, the chassis will have to be grounded to the case before any adjustments can be made and, of course, the batteries must be wired into the circuit. Carefully observe battery polarity, as shown in the pictorial wiring diagram.

Alignment of a transistor radio is similar

(Continued to page 238)

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to that of a vacuum-tube receiver. If a signal generator is available, follow the alignment procedure outlined in the manual accompanying the instrument. But even without test instruments, the receiver can be aligned if there are stations in your area which operate near the top and bottom end of the broadcast band, 1600 kc. and 550 kc., respectively.

Alignment can be simple or difficult, depending upon the degree of matching between the components of the tuning circuits. Those used in the original model were not precisely matched, requiring the removal of a few turns of wire from the loopstick, L1, and the addition of capacitor C4 in order to obtain proper tracking. With matched components, including the loopstick, the oscillator coil, L2, and the tuning capacitor, C2-C3, this would not be necessary. Since matched components now appear in a number of radio catalogues, the following instructions assume that such parts are being used.

With the receiver fully wired and all parts interconnected, set switch S2 to the PORT. position and advance the volume-control setting to about three fourths of maximum. If there is a tendency towards audio oscillations, it can be eliminated by temporarily soldering a wire between a ground lug of the audio chassis and one on the r.f. chassis.

Now rotate the tuning dial across the band. You should be able to tune in some stations immediately although the volume may be low. If the receiver whistles when you tune past a station, oscillations in the r.f. chassis are indicated. You may be able to eliminate these by a slight adjustment of the i.f. transformers T1, T2 and T3. If not, replace R3 with the next lower resistance value.

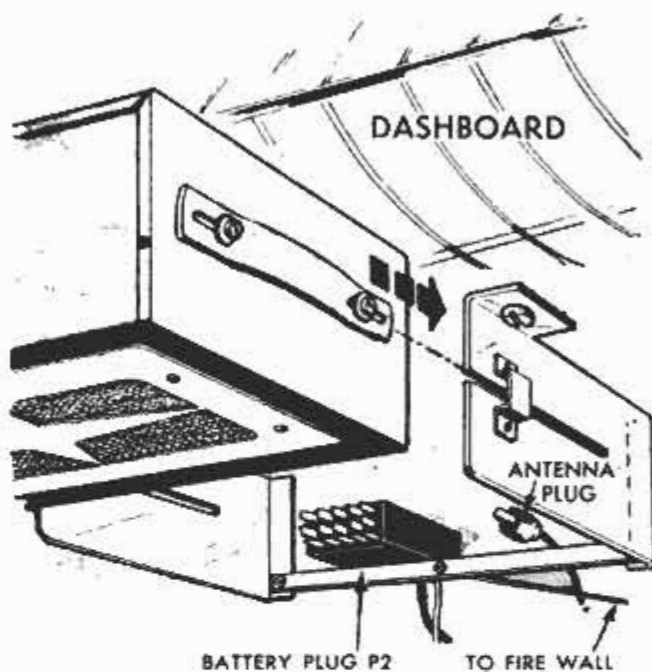
Tune in a station near the low-frequency end of the band and compare the dial setting of the receiver with that of any other radio tuned to the same station. If the dial setting is incorrect, rotate the dial to the correct position and adjust the screw or "slug" of the oscillator coil until the station is again audible.

Tune in a station near the high-frequency end of the dial and adjust the trimmer screw on the frame of capacitor C2 until the station comes in with maximum volume. Again compare the setting of the dial pointer with that of another radio tuned to the same station. If they do not coincide, rotate the dial to the proper position and adjust the trimmer on the frame of capacitor C3 until the same station is heard. Then retune the r.f. trimmer (on C2) for maximum station volume.

Finally, tune in a station near the center of the band and adjust the i.f. transformer cores for maximum volume. Repeat the previous checks and readjust the tuning capacitor trimmers if necessary.

Final Assembly

After the adjustment is completed, mount the r.f. chassis on the speaker frame. You may need a couple of 1/4-in. metal spacers between the chassis and the speaker to permit the i.f. transformers to clear the loopstick mounting board.



One possible method for mounting radio inside car. For cars with negative ground, mounting brackets must be insulated from dash with fiber washers

Though not shown in the pictorial, a heavy wire, or wire braid, should be soldered between the r.f. chassis, the tuning capacitor frame and audio-chassis ground.

To permit radio signals to reach the loopstick, an opening must be made in the case cover to coincide with the position of the loopstick (see title photograph). The opening can be covered from the inside with a thin piece of stiff plastic or similar insulating material.

A leather strap fastened to one end of the case cover serves as a carrying handle when the receiver is used as a portable.

Car Installation

Schemes for mounting the receiver in a car may be as varied as the automobiles themselves. One possible method is illustrated on this page. Here, two slotted brackets, spaced the width of the receiver, are fastened underneath the dash. The brackets are mounted so that they slope downward to the rear and they are fastened

(Continued to page 240)



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together at the back with a connecting bar. The bar is securely connected to the fire-wall of the car to support the assembly.

To use this arrangement, two binder-head screws are fastened to the end of the case cover, directly opposite those holding the leather strap. The screws are mounted with nuts and lockwashers both on the outside and inside of the case so that there is about 1/8 in. separation between the screwhead and the outside nut. The two sets of screws on opposite ends of the radio case fit into the slotted dash-mounted brackets for easy installation and removal of the radio.

External Connections

Two external connections, one to the automobile antenna and the other to the car battery, are required to operate the receiver in your car. Since complete antenna-installation instructions are supplied with each antenna purchased from a dealer, these need not be repeated here. Battery connections, however, are extremely important and the following directions must be explicitly observed to eliminate the danger of damaging the transistors or short-circuiting the car battery.

Battery connections are made through two flexible wire leads soldered to pins 11 and 12 of plug P2. Insulated 18-ga. wire is suitable for this purpose. The wire connected from pin 11 must go to the positive side of the battery while the wire from pin 12 goes to the negative side. Color-coded wires should be used to prevent a possible mixup.

But here's the important point. This receiver was designed specifically for a foreign sports model having a 12-volt ignition system with a *positive (+) ground*. Most American 12-volt ignition systems operate with a *negative (-) ground*. When the radio is used with a negative ground system it is essential that the receiver case be electrically insulated from the car frame or dash. If the radio is to be installed as shown, use insulating fiber washers (one flat and one shouldered) at each mounting screw for fastening the brackets to the dash. But whatever mounting method you decide to use, the receiver case should not be permitted to contact any metal part of the car under any circumstances. Moreover, if the antenna lead-in is a shielded wire, the shield braid should not be connected to the antenna plug.

With these instructions carefully followed, the receiver should provide excellent service both in and out of the car—a rewarding finish to an interesting project.

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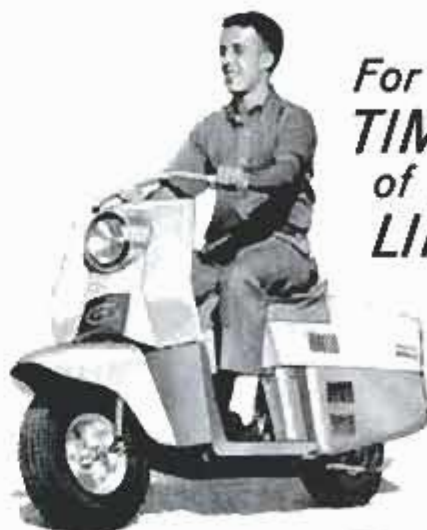
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(Continued from page 93)

doesn't need to cost very much, and when properly supervised is an extremely safe automotive sport. The National Hot Rod Association, with 33,000 members, enforces stringent safety rules at the approximately 100 affiliated drag strips. Safety helmets, goggles, belts and roll bars are required for all open cars and for all modified closed cars. Each car must pass a rigorous safety inspection by a technical committee before it can compete. There are numerous other safety requirements.

Class Distinctions

For competition, the NHRA divides cars into the following categories: Stock cars, to which very slight modifications are permitted; coupes, sedans and roadsters with reworked engines but that are still suitable for street use (fenders, headlights and mufflers are required); sports cars with street equipment; altered coupes, sedans and roadsters for which street equipment is not required; all-out competition coupes and sedans, and the unlimited dragsters themselves.

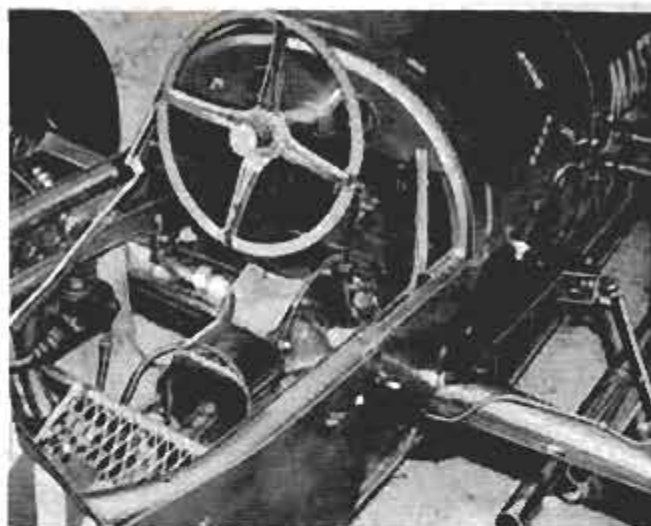
Each group of cars is further broken down into classes that depend on a car's weight divided by the cubic-inch displacement of its engine. All vehicles must run on service-station pump gasoline.

Ingenious builders find lots of leeway in the class rules and some of them come up with surprising innovations. Thus one competition coupe actually consists of a slingshot dragster having the driver's seat enclosed in an almost-stock coupe body. In some other competition coupes the usual locations of engine and driver are reversed, with the engine inside the body and the driver sitting in the conventional engine compartment. Sometimes, too, an engine is mounted sideways in a chassis, with a chain drive connecting to the rear axle.

Multiple-Engine Models

Two engines on two differentials, or two engines end-to-end and geared together for maximum power also have been tried. One driver mounted his single engine on tracks on the chassis so that he could move it back or forth between trial runs to find the location that gave the best distribution of weight.

One outstanding slingshot dragster, built by Mickey Thompson of Los Angeles, is powered by two reworked Chrysler engines that develop a total of more than 1000 horsepower. One engine drives the rear wheels, the other engine drives the front wheels. Last fall, Thompson set a new one-way speed record on the Bonneville Salt



Cockpit closeup of a slingshot shows fuel-pressure-pump handle in the center of the steering wheel

Flats with this car, going through the traps at 294 miles per hour. His two-way average might have been almost as fast except for the fact that one engine blew up and he coasted much of the way on his return trip. Even so, his two-way average speed of 266.8 miles per hour beat the previous record by a fraction of one mile per hour.

NHRA officials estimate that some 300,000 cars are driven on the drag strips every year, of which 60 percent are stock cars that average around 70 miles per hour at terminal speed. At most strips, races are held every week end except during inclement weather. High point of each year's activity is the annual national championship drag races, always scheduled over the Labor Day week end and for the last several years held at the Oklahoma State Fair Grounds at Oklahoma City.

Old Dragster Is Winner

Five hundred of the fastest cars in the country competed in the 1958 drag championships, and the event was watched by 70,000 spectators. Surprisingly, the car that whipped all others in a series of elimination matches was by no means the newest car or the one with the most power. The winner was an old slingshot powered with an unblown Chrysler that was entered almost as an afterthought by Ted Cyr and Bill Hopper of California. The two men were pinning their real hopes on a slingshot they had just finished, powered by a 1958 Chrysler engine equipped with a GMC supercharger. Cyr drove each of the two cars in the eliminations and actually got the most acceleration out of the old car, eventually winning the final runoff with it. ★★★

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- Careful *sanding* is important. Sand first with medium-coarse paper to remove any rough imperfections. Progress to 3/0 sandpaper for fine surfacing.
- In kitchens, bathrooms or basements guard against moisture. Apply *commercial sealer* to all sides, edges and ends of paneling.
- *Color* can be applied two ways. Brand name, ready-made stains in bright or pastel shades are easily applied, and available everywhere. To create your *own* shades, mix oil-base paint and mineral thinner, or "colors-in-oil" and mineral thinner. Brush onto the paneling liberally. Then rub off with a soft cloth. Before proceeding, always test your color on samples of the exact wood being treated.
- To *highlight knots and grain*, rub over the stain with fine steel wool until the desired effect is achieved.

- An ideal *finish coat* is lacquer-sealer over the stain, rubbed with 6/0 sandpaper. Follow with a minimum of two coats of clear varnish or shellac rubbed with 3/0 steel wool when completely dry. Or... a simple paste wax may be substituted for the above.

For traditional or contemporary decorating, a wide range of textures can be attained through different surface treatments of Western Pine Region woods. They may be purchased ready-planed to a smooth working surface, or "rough sawn." They can be dimpled with a ball peen hammer, striated with a stiff wire brush, or sandblasted for a driftwood texture.

Western Pine Region woods make any woodworking job a pleasure. Due to their even texture and soft grain, they take any paint, stain or surface treatment with ease, and are easily worked with hand or power tools. Western Pine Region woods have a reputation for precise manufacture, quality seasoning and careful grading.

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Here's Where Pilots' Lives Are Saved

(Continued from page 111)

strike part of the aircraft. Findings based on these tests have saved countless lives. They have also prompted modifications that prevented planes from being damaged by released stores.

A common test for jettisonable models is performed with external fuel tanks. Made of a glass-laminate plastic like glass fiber, these are built to scale and mounted below the wing on pylons in either the full, partially full or empty condition. During a blow, the tank is released by a spring-powered or gas-powered device, and its flight is recorded by high-speed cameras. Generally shattered in the process, its pieces are collected in a screen downwind. Partially filled tanks are used to determine the sloshing effects of fuel on the dynamic characteristics of tanks during tests.

From Simple to Complex

Models have kept pace with the increasing complexity of aircraft. Pressure on their surfaces in a test blow has risen in the last 50 years from about 10 pounds per square foot to more than 1000. Wings and other airfoils have become thinner and thinner, adding to the problems of the stress group and increasing the need for flutter research. As a result, models have progressed from simple ones of solid wood to highly complex ones of stainless steel. At the same time, the use of plastics has increased, both as a coating for wooden parts and as a replacement for aluminum alloy and magnesium castings. The plastics' strength is comparable to those metals; the finished part is as accurate, and construction time and cost are far less.

In the construction of a model, designers reduce airplane lines photographically to model scale and make drawings from these

(Continued to page 248)



These Super Sabres—F-100C, top; F-100D, bottom; and F-100F, middle—had their genesis in a wind tunnel



PAINT NEWS



New Du Pont Oil Stains in Vibrant Colors!

Here's the big decorating news of the year. Oil stains in *color* ... to give a modern brightness, yet let the natural beauty and grain of the wood show through. The latest thing for wood furniture, wood panel walls, wood trim and floors. Du Pont Satin-Sheen Oil Stains come ready mixed in all natural wood effects ... or you can create almost any color you choose by mixing Du Pont Custom Tinting Colors with Du Pont Satin-Sheen Platinum Oil Stain. Never before have you had such a wealth of unusual color effects to enhance the beauty of any wood surface. Full instructions for mixing and applying are right on the can!

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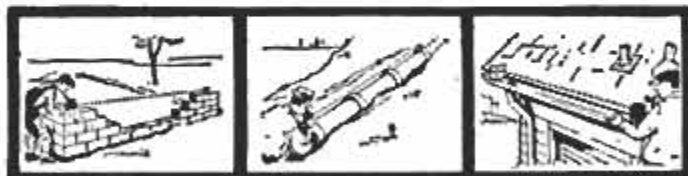
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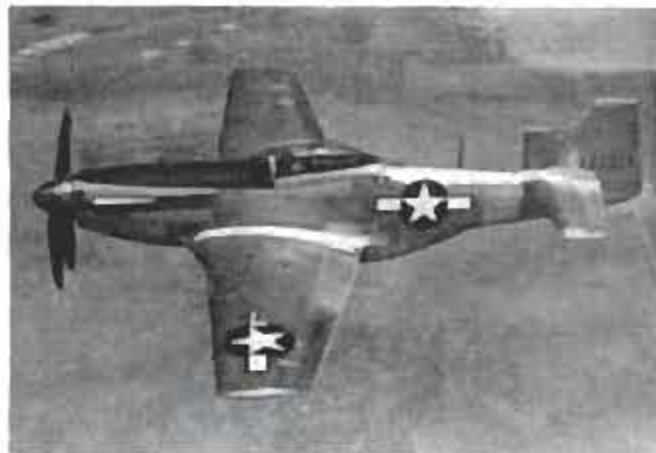
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Cost of wartime P-51's airframe was half that of
some models now being tested in U.S. wind tunnels

for the guidance of craftsmen in the shop. It takes three to nine months to design and build a model. By comparison, the famous P-51 Mustang fighter plane of World War II was designed and built in four months. Its model was designed and built in about two months.

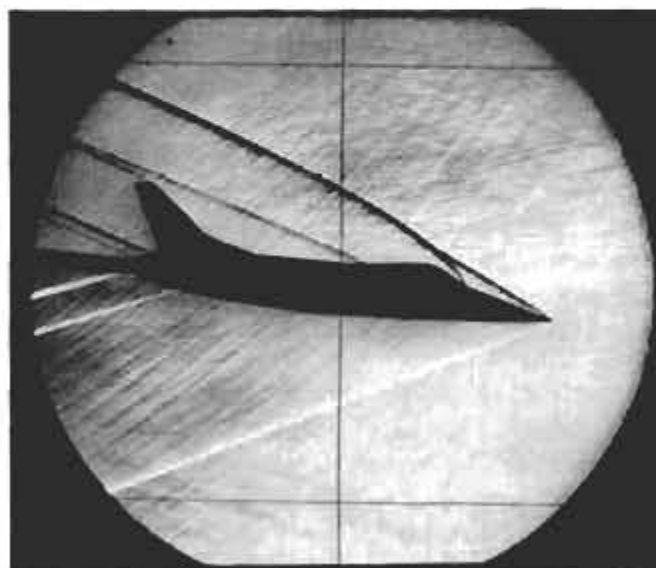
Work With Great Care

Once they get the plan, the builders set to work with great care, making the model's various components. Each man makes one part. He uses various machine tools as needed, instead of passing the part from one machine operator to another, as is done with a regular aircraft part.

Wood is still used for many of the smaller models and some of the larger ones as well. Blocks of white holly or laminated Honduras mahogany are screwed to a central spar of stainless steel that provides an anchor for the wing, empennage, and perhaps for the model-support connection. After it has been shaped to the proper configuration, the model is sanded and polished. Then a sanding sealer is applied. If

(Continued to page 250)

A photograph taken through a porthole in a wind tunnel shows a supersonic model plane in a test run



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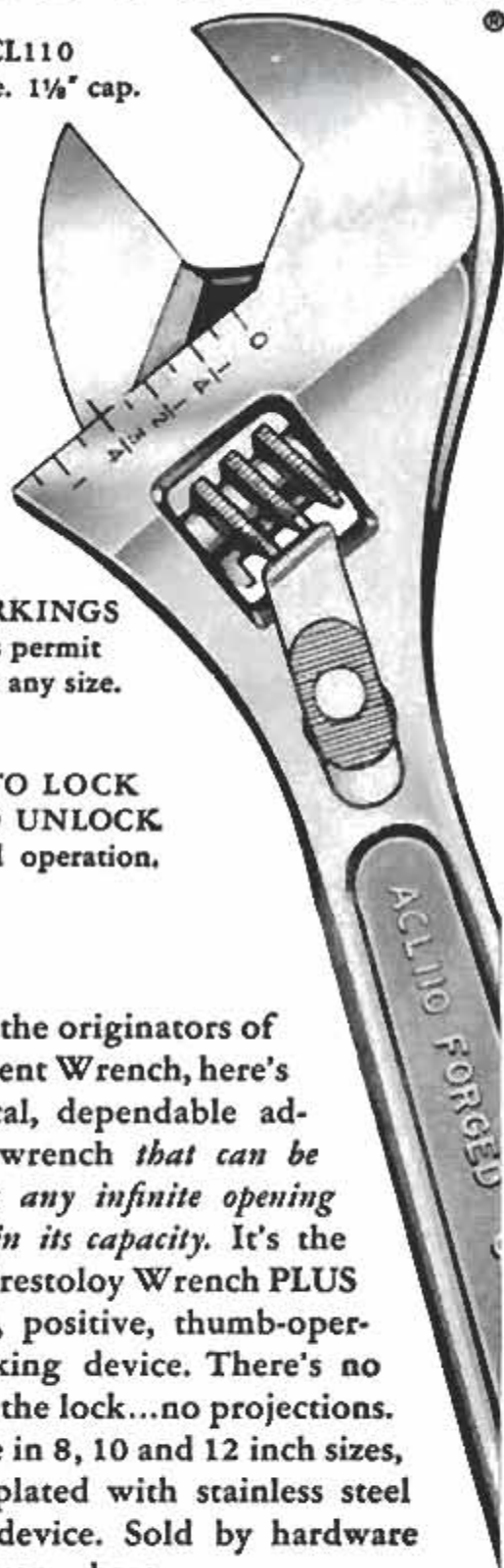


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intended for supersonic testing, protection from heat and abrasive action of dust in the air is often provided by a coat of glass-laminate plastic $\frac{1}{16}$ inch thick.

The same great care is given to missile models, for they have no pilot to correct any slight design errors that might creep into the finished version despite all the advance research and testing. If a missile ever gets to the moon, its successful flight through the immensity of space will have begun, as every manmade flight has in the past, in a wind tunnel with a model that most people would regard as nothing more than a shiny toy. ★ ★ ★

Fish Prefer Blue or Green Lights

Japanese fishermen have doubled their catches of lobsters and crabs by mounting bright lights, preferably blue or green, on their nets. Scientists along the Scottish coast have found, meanwhile, that whiting, young herring and sprats are susceptible to lights. However, the lights indirectly attract predatory fish which may destroy the catches.

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And Aid Maintenance Men**

Small pine trees planted alongside runways at Youngstown, Ohio, Municipal Airport enhance safety two ways when the field is covered with snow. In daylight landings, pilots use the trees to guide them onto the concrete strips. The trees aid night landings too. Each tree is planted near a runway light, so maintenance men seeking to brush snow off the lights have no trouble finding them under the drifts.



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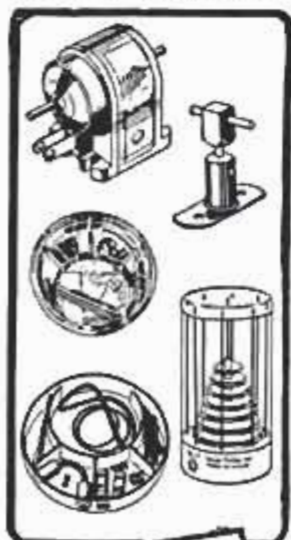


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HOME-STUDY COURSES

By Lawrence W. Tice, President
National Home Study Council



POPULAR MECHANICS takes pride in presenting for the information and guidance of its readers, this thorough evaluation and description of the home-study or correspondence system of education. The author is one of our nation's leading educators. Lawrence W. Tice, possibly more than any other educator, is in a position to know the advantages of taking home-study courses. His educational experience spans nearly 30 years and includes teaching positions in a resident vocational school, the University of Wisconsin Engineering Faculty and Extension Division, as well as more than 20 years as an executive and president of one of the largest home-study schools in the country. Mr. Tice is also President of the National Home Study Council. In this position, the highest elective position in home-study education, Lawrence Tice represents 53 of the finest private correspondence schools in our nation. Mr. Tice's article tells you exactly how home-study education works, and how it has trained and helped hundreds of thousands of people advance and succeed materially in their chosen occupations.

The alumni of home-study schools include names familiar to all of us—successful men who have distinguished themselves in every profession. At this moment 1,500,000 Americans are taking correspondence courses. Over six thousand business and industrial firms are using home-study courses to train their employees. The students of home-study schools today will be among the leaders of business and the professions tomorrow. They have planned their futures well, putting education foremost.

For years, the correspondence school has been a favorite subject for the gag writer . . . the correspondence school teacher receiving an apple by mail . . . the home-study student receiving a dunce cap from the postman. . .

But, to millions of Americans who have received the benefits of home study, correspondence education is no joke. That home-study administrators can laugh at the humorous aspects of home study is a sign that correspondence education has reached a well deserved and accepted place in the field of general education.

The reason correspondence education has been the butt of so many jokes is a misunderstanding of the exact nature of education by correspondence.

How the Home-Study System Works

Home study is amazingly simple. Every home-study institution follows the same basic operating procedures. This is true not only of those private home-study schools accredited by the National Home Study Council, but by the various Armed Forces correspondence schools and the college and university extension divisions.

In the home-study procedure, the student enrolls by mail or through local sales representatives. The application is then submitted for approval by the Registrar and the Director of Education of the school.

If approved, the first instruction texts are sent, usually with a booklet on how to study by the correspondence method. This

booklet discusses a study pattern which, although advantageous to the student, requires a greater degree of concentration than is necessary in resident classwork.

After the student completes his first assignment, he mails it to the school for correction. Highly specialized, well trained instruction staffs grade the examination and return it with personal study advice. Although the type of examination offered varies from school to school, personalized instruction is a foundation of all home-study schools.

The student's grade is recorded on his educational record and the examination is returned by mail.

The student reviews the instructor's analysis and applies the principles learned to future assignments. In the meantime, his next examination is on its way to the school, completing the procedure for study by the correspondence method.

Personal Instruction Stressed

Like resident schools, correspondence education consists of a teacher, a textbook and a student. But, in home study, the teacher is built into the text, and instruction is by written communication rather than oral. Correspondence schools do not "teach by mail." Teaching is by the written word and personalized instruction, part of the traditional system of education. The mail is simply the carrier bringing written evidence of the student's understanding to the teacher.

CAN HELP YOU SUCCEED

Job-Related Training for Advancement

Not everyone can attend college or even high school. Many people would like more education so they could enter more profitable or interesting fields of work. But they can't afford to give up their present jobs. Many others have already started in their chosen vocations but need job-related technical training for advancement or pay increases. For these persons, correspondence education is often the best and possibly the only educational route to self-improvement.

Advantages of Home Study

Correspondence education has an edge on classroom-type training in many ways:

1) **The correspondence student always comes to class prepared.** The correspondence student must prepare and write out the answers to all important points in each assignment.

2) **Each correspondence assignment is carefully organized.** Each text is carefully checked by technical experts, educators and editors to make certain that it is technically and educationally sound.

3) **Progress is made at the correspondence student's own pace.** Every correspondence student is in a class by himself. He sets his own pace, "rings" his own school bell. If he is a fast learner he moves along as rapidly as he can master each assignment. If he must put more time on his studies than others, he doesn't have to worry about being left behind.

4) **Instruction is personal and individual.** Each student is in a class of his own and each student has a teacher for himself. The time of that teacher is devoted wholly to his problems, not the problems of 20 or 30 other students.

5) **The correspondence student is vocationally prepared for his studies.** The average home-study school offers job-related training. Students are adults (average age 25-27) with work experience, home responsibilities and definite training goals. Most of them study courses directly related to their jobs.

6) **The correspondence method prepares for life in the business and industrial world.** Each student puts into writing his own solutions to the questions and problems. Questions and problems used by the better schools force him to carefully reason, analyze, and evaluate to answer the question or solve the problem. Then he must shape his answer into presentable form.

These same good habits can later be put to use in the work world. Walter D. Fuller, Chairman of the Board of the Curtis Publishing Company, who as a young man studied and completed a home-study engineering course, had this to say:

"One of the great advantages of correspondence training is that it forces the individual to work his own way out of his problems. He must take the fundamental communication, the written or printed word, and from it translate into his own mind just what information is in the instructions. This is not always easy. Home study helped through the clarity and brevity of its instruction, but even then at times it was difficult for me to get the idea. But that very fact is one of the benefits of correspondence instruction, because once the problem is solved then it is never, never forgotten.

"Another great advantage is that the correspondence-school student must so organize his efforts that he can find time for his studying. The correspondence school habit, together with the necessity of the individual putting his nose to the grindstone, also develops a power of self-analysis which is of value all through life."

High School Diplomas By Home Study

Education in this country is currently being checked more carefully than at any time since Thomas Jefferson first proposed our public school system in 1779, for the "... education of the common people."

Approximately 40 million adult Americans have not completed high school, many through no fault of their own. This presents a serious challenge to American education. For these 40 million Americans, accredited home-study schools offer possibly the only chance to become high-school graduates.

Recent studies show that the typical high-school dropout is 16 years old and should be starting his junior year. About five out of every ten freshmen leave high school before graduation. This is a conservative estimate.

The person without a high-school diploma faces life severely handicapped. He is limited vocationally, economically and socially. He can apply only for jobs which do not require a high school diploma. And, in this age, these jobs are rapidly becoming nonexistent. The National Manpower Commission reported that there soon may be almost no place left for the unskilled industrial worker.

Education—Your Partner in Earnings

Possibly the most frightening point is that your lifetime earning power is controlled to a great degree by the amount of education you have.

In preparing the "Skills for America" series on education, *Popular Mechanics Magazine* came up with Department of Commerce figures showing that the average high-school graduate can expect to make almost \$50,000 more during his lifetime than the man who dropped out of school after the eighth grade. The college graduate can expect to earn \$100,000 more than the high-school graduate.

Thanks largely to correspondence schools which start a new "semester" every hour of every day, the doors to educational opportunity are always open.

New Skills—Knowledge for Millions

Today, more than 2,000,000 persons all over the world study by correspondence.

More than 750,000 new students—more than the total freshmen in all colleges and universities—enrolled in home-study schools in 1957, a four percent increase over the year before.

In the United States between 1,000,000 and 1,500,000 students study home-study courses each year. Significantly, 25 percent of all Certified Public Accountants and more than 10 percent of all engineers get their training through correspondence education.

Since it began almost 100 years ago, correspondence study has won an important and unique place in American education.

Home study is not too concerned with the 32 percent of the high-school graduates who will go to college. Home study is concerned with the needs of the vast majority who will not go on to college, and the millions who have not completed high school. It has and will continue to serve also the college person who wishes to supplement or continue his education.

As the Russians successfully launched their satellites, Americans suddenly became aware of some of our educational weaknesses. Educators began tallying some of the contributions of correspondence institutions, which have:

1) *Supplied education and training to millions who could not attend resident schools.*

2) *Taken the initiative in cooperating with business and industry in establishing employee-training programs.*

3) *Supplemented public-school programs through supervised study in small schools which could offer only a limited program.*

4) *Achieved an outstanding record in the nation's apprenticeship program.*

5) *Provided vocational, technical and business training for the millions who constitute the bulwark of the American labor force.*

Home-study administrators agree that there is no substitute for a good resident-school education. Home-study schools are not in competition with resident schools. Rather, they supplement the training offered by these schools.

For example, a trained engineer, after a few years in the field, finds himself in an administrative job. While his technical training is fine, he lacks training in supervision and management techniques. Unable or unwilling to return to school, his only solution is home study.

The typical home-study student is about 27 years old, married, has a home and family, is employed, and is a high-school graduate. He is seriously interested in getting ahead but can't quit work to return to school. Frequently, his financial status prohibits enrollment in a resident school. Or, perhaps there are no local classes in the subjects he needs at the hours he can attend.

For the ambitious student, these circumstances pose no great obstacle. For a single four-cent postage stamp he can get all the information he wants about the thousands of courses from home-study schools which are ready and willing to help him.

Choosing the Right School and Course

What subjects can you take by correspondence? It would be hard to list a subject that is not taught by correspondence. The subjects run the gamut from Absorption Apparatus to Xerography. By mail you can study almost anything in the technical and business fields.

Let's assume that you have decided that the correspondence method is the best for your particular situation. How do you choose the right school and course? If you can't go to a trained vocational-guidance counselor, here's a set of rules to help you. (Courtesy National Home Study Council, 1420 New York Ave., N. W., Washington 5, D. C.) Make sure the school of your choice:

- 1) **Has a competent faculty.**
- 2) **Has educationally sound and up-to-date courses.**
- 3) **Admits only qualified students.**

- 4) Provides satisfactory educational service.
- 5) Can demonstrate reliable student success and satisfaction.
- 6) Advertises truthfully.
- 7) Has reasonable tuition charges.
- 8) Is financially responsible and able to deliver a high quality of educational service.

Personal Rewards from Home Study

What are the rewards of persons studying through correspondence? You've seen ads promising: "Make more money soon"; "Train now for more success"; "Greater Security"; "Hold a good job"; "More Money"; "Bright Future." By asking correspondence school graduates themselves, a national magazine recently separated fact from fiction about these promises. The magazine's editors found that the majority of correspondence graduates reported that:

- 1) They got from the courses what they had expected to get.
- 2) Their earnings increased an average of \$22.50 per week.
- 3) They won promotions or found new and better jobs.
- 4) They were well pleased and even enthusiastic about the content of the courses and the home-study method.

The magazine survey revealed that 77 percent of the home-study graduates testified to making more money; 43 percent reported that they were much better off.

These are the tangible results. The by-products of correspondence education are perhaps even more important:

- 1) 64 percent reported more opportunities for advancement.
- 2) 36 percent revealed that they were given more and greater responsibilities in their work.
- 3) 30 percent told of a higher standing in the community.
- 4) 61 percent said that their work is more satisfying.

The final question asked was: "If you had it to do over again, would you take a correspondence course?" A resounding 85 percent answered: "Yes!"

More Education Required for Jobs

The President's Committee on Education Beyond High School points out that the educational level of our population is rising slowly. But, while the demand for trained manpower is growing rapidly, the demand for unskilled labor is slipping away.

The National Manpower Commission reported that skilled workers who used to measure with calipers and micrometers will soon have to learn to work with tolerances measured with light waves. *There may be almost no place left for the unskilled industrial worker.*

Home-study educators have analyzed the current needs of business and industry. They build their study content on this basis rather than from materials already published. Thus, some of the finest up-to-date instruction material related to technical and business knowledge has been produced for correspondence study.

In a series of articles in the Pittsburgh Press, columnist Gilbert Love posed two questions which readers of *Popular Mechanics* might ask themselves: 1) *What are you going to do if you can't get into a college or university because they are overcrowded?* 2) *What can you do if you are already out in the work-a-day world and find that your advancement is stalled because you don't have enough or the proper kind of education?* Mr. Love supplies the answer: "**You might take a correspondence course.**"

By 1970 U. S. population may be more than 200 million. The tremendous growth and change in our economic wants, standards of living, materials used in production methods, etc., demand a new breed of trained workers. While education will get more attention, the number of school buildings and teachers cannot keep up with the demand.

By 1975 we will need 75 percent more professional and technical personnel. Clerical and sales people must increase by 49 percent; craftsmen by 45 percent; operators of all types by 38 percent; service workers, 27 percent; proprietors and managers, 14 percent. On the other hand, the need for laborers, including farm workers, will decrease by 25 percent. In the next few years, 15 million more jobs will be available. At our current rate of progress, our public and regular resident schools can never train enough people to fill these jobs. With 15 years of manpower shortages behind us, it sounds odd to expect 10 million educationally unemployed in less than 10 years. But it may happen—and strangely enough while jobs are waiting for trained workers.

The scientist Huxley once said, "There ought to be an agency that would go up and down the world seeking out capable men wherever they may be found and turning them to account." Correspondence schools do exactly that!

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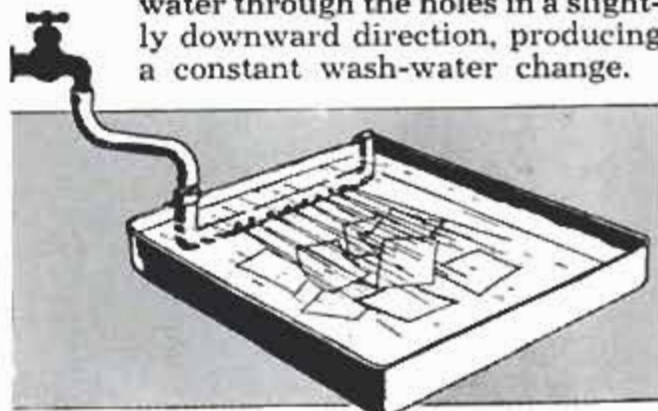


Dome-Shaped Phone Booth

Public telephone booths may acquire a "new look." Bell Telephone Laboratories are testing a number of new ideas in booth design. One, shown here, has an aluminum frame and flooring plus transparent plastic walls. A standard desk-model telephone is connected to the traditional coin box. This type of booth might be installed in an area protected from the weather, such as a railway concourse.

Plastic Tube in Tray Makes Photoprint Washer

Any tray with one side 10 inches or larger can be converted to a photoprint washer with a specially designed plastic washer. One end of the perforated tube is connected to a hose which can be attached to a faucet. Tap pressure forces water through the holes in a slightly downward direction, producing a constant wash-water change.



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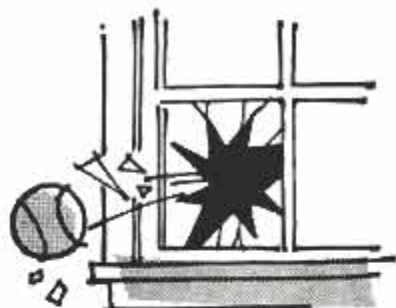
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(Continued from page 24)

Engineer's Holiday

Like the mail carrier going for a hike on his day off, a locomotive engineer drives his live steamer when he's off duty. In this case the Southern Pacific Railway engineer, Jack M. Fesco of Los Angeles, not only operates his miniature "iron horse," he also built it over a period of years. Actually, the cart came before the horse: He built the caboose first, then in 1944 began building the locomotive directly from blueprints of the original which he obtained

from his railroad. He scaled it $\frac{3}{4}$ inch to the foot.

"All the parts were fabricated or built up from the solid," says Fesco, "except the cylinders and driving wheels. The boiler is copper, superheated. It has roller-bearing driving boxes, rods and ball-bearing trucks, fully sprung and equalized. The locomotive will pull about 14 men. Fesco, who has both fired and run steam locomotives such as the big Mallets as well as the diesel-electrics, spent 6000 hours on the engine and 4000 on the caboose.



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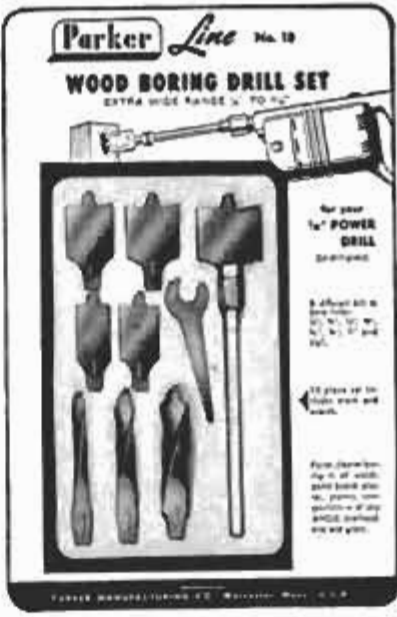
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Over the Pass With 8500 Horses

(Continued from page 85)

compressors and air-storage reservoirs. "B" unit is taken up entirely by the mammoth turbine and the electric generators that it drives. The generators produce the 800-volt current that powers the traction motors on the 12 axles of the two units.

Behind the power plant is the insulated tender that has a capacity of 24,000 gallons of black sticky bunker C. This residue of petroleum refining is cheap and, when heated, is an ideal fuel for a turbine.

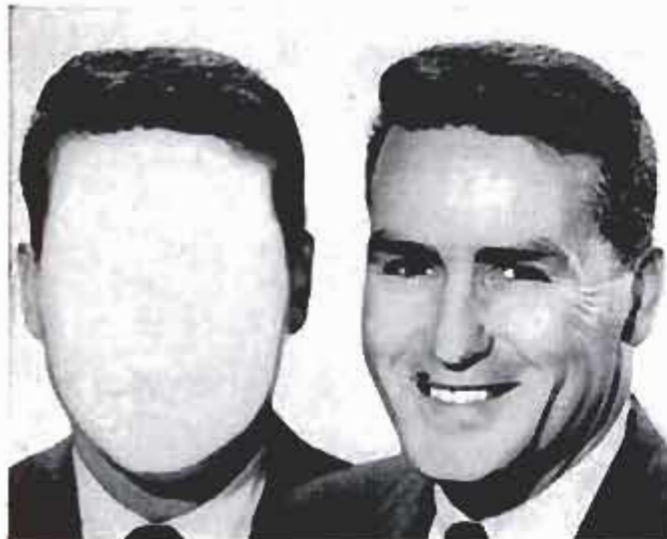
However, the turbine's 10 combustion chambers won't light up on bunker C. The turbine is started on diesel fuel, then automatically transfers to bunker C after the combustion process is going well. And the turbine never shuts down on bunker C. The stuff would clog all the lines and orifices when it cooled off. Part of the shut-down process includes a transfer back to diesel fuel.

All this happens automatically. To start the turbine the engineer presses a button labeled "turbine start-stop"; he holds the button down until a green light comes on, indicating that the robot turbine controller has taken charge. The controller starts cranking the turbine up to speed, switches on the ignition at the right time, opens the diesel-fuel valves to the combustion chambers, transfers to bunker C at the proper

(Continued to page 264)

Turbine technician adjusts pipe leading to combustion chamber; engine work cannot be done en route





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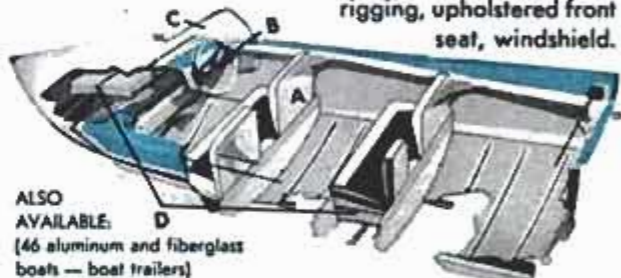
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point, and finally reports back to the engineer that the turbine is operating. The starting sequence takes seven minutes. When shutting down, the robot controller similarly performs the whole sequence of operations, even cranking the turbine over during the cool-down period.

Basically the locomotive turbine is the same as a jet-aircraft engine. It doesn't produce thrust through an exhaust nozzle, of course; its shaft is geared to the generators that create power for the traction motors. The turbine spins at a constant speed of 4860 revolutions per minute no matter what the load. When the engineer moves his throttle for more power he puts a greater load on the generators and this automatically increases the amount of fuel being delivered to the combustion chambers, thus maintaining the turbine's speed.

The locomotive doesn't sound like a jet. It produces about the same amount of noise as a diesel engine, a steady soft swoosh of sound. There's no loud compressor whine, no sharp exhaust roar.

The turbine is so sensitive to temperature changes that in hot weather it may temporarily gain considerable horsepower while passing under a dark, cooling cloud. Its power depends on the density of the air it uses, hence power drops off at high altitude or on a hot day. Knowing this, Union Pacific officials specified that the big turbine should develop its rated 8500 horsepower input to the generators at 6000-foot altitude on a day when the temperature soared to 90 degrees.

These big packages of power weren't built and tested without a few faults developing. No one before had designed so large a turbine, with so much power, and with such complete automatic controls. Naturally, there were a few bugs. General Electric made its own tests, ran into problems and corrected them, then turned over three locomotives to Union Pacific for final trials. G-E technical crews went along to make adjustments that might be needed in actual service.

At first the locomotives occasionally experienced a partial flame-out, a condition in which a few combustion chambers lost their fire and ejected raw fuel during the lighting-up process. This created a spectacular but harmless "fire in the stack" with flames rising out of the huge exhaust for a few seconds. That trouble was whipped and now the first group of locomotives is in steady service.

Union Pacific likes them so much that it has ordered 30 and is putting them to work just as fast as it gets deliveries. ★★★

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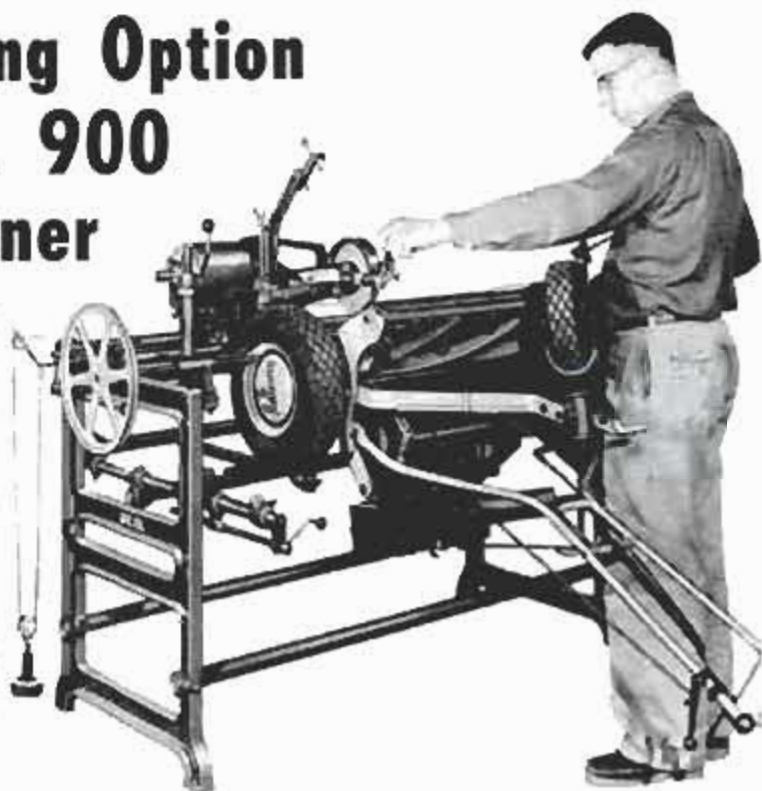


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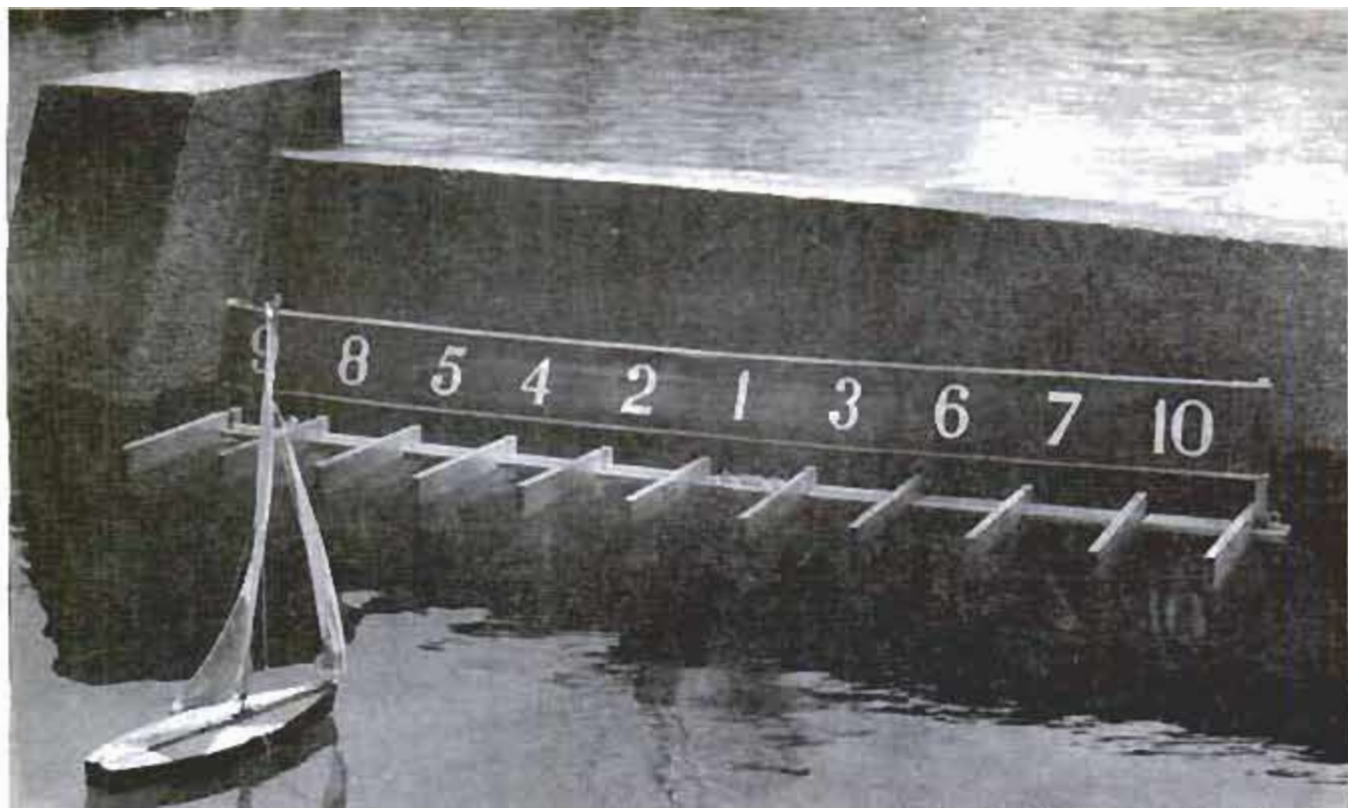
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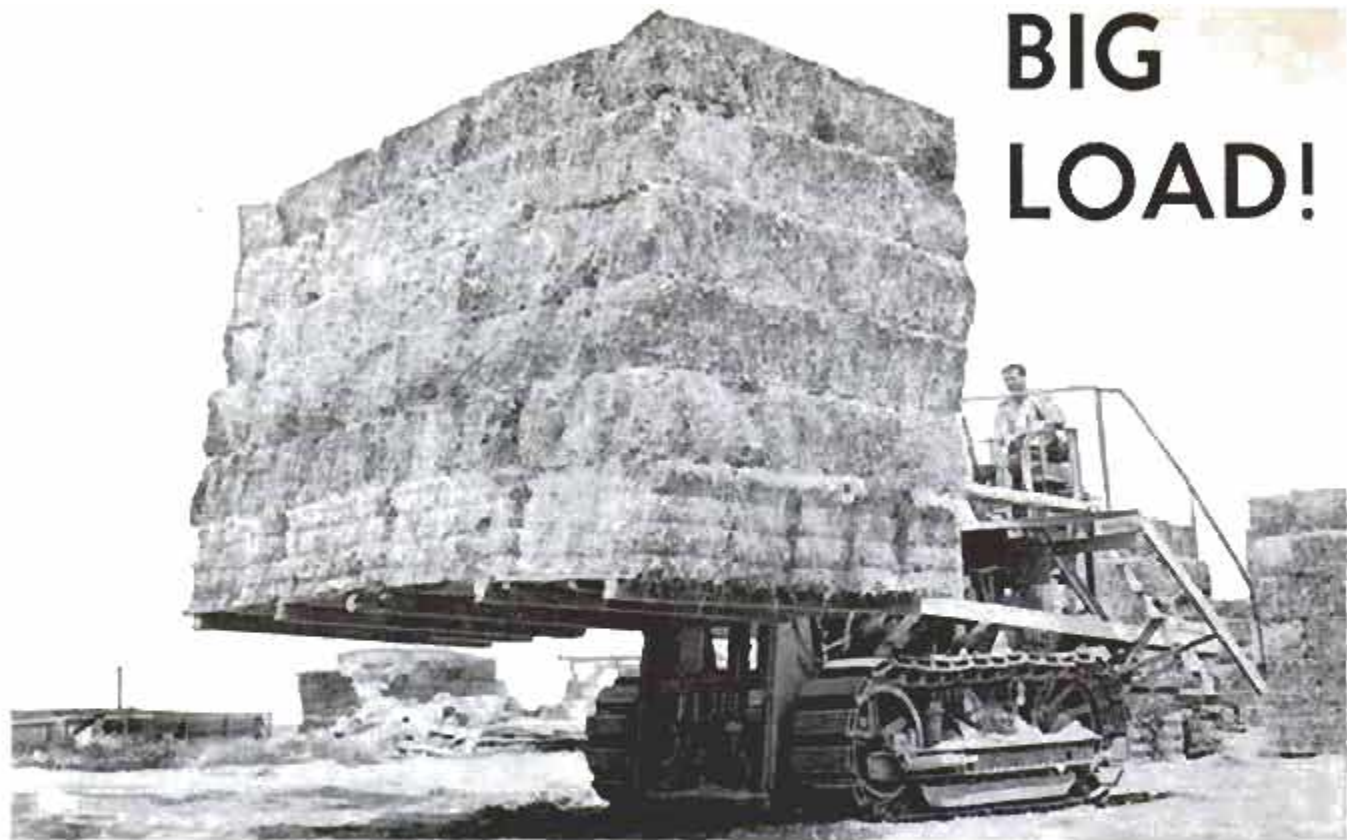
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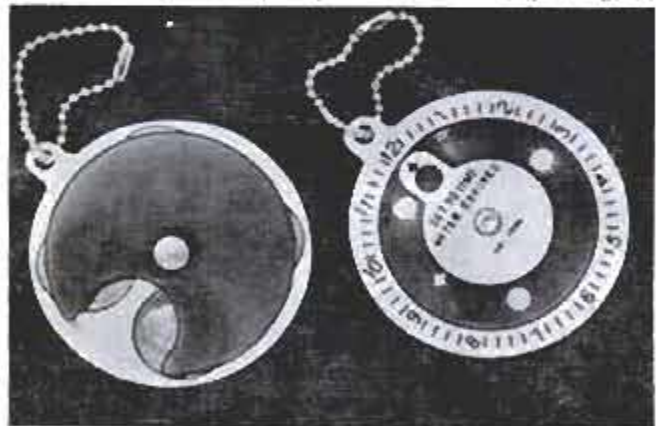
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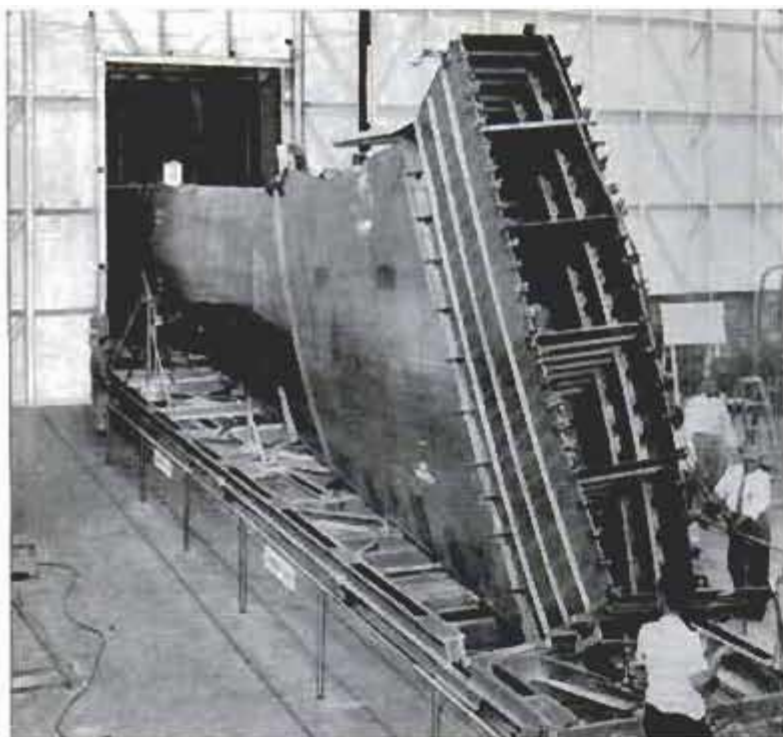


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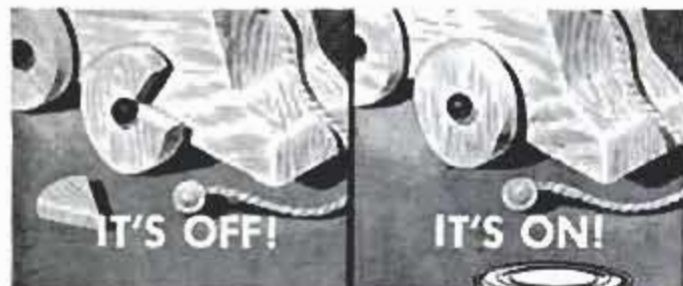
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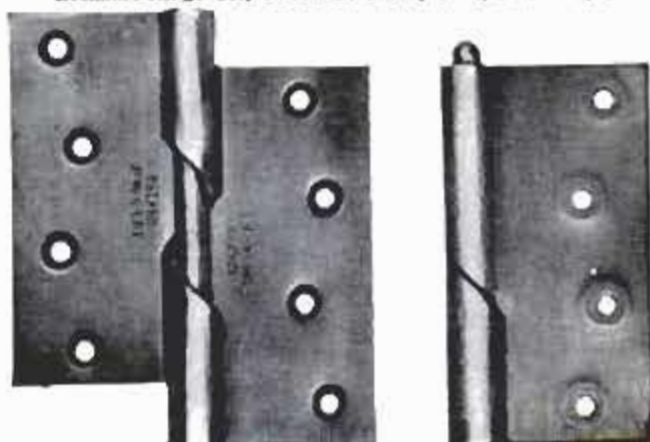
Purple-Tailed Squirrels Aid Wildlife Study

University of Florida wildlife-management researchers are tracing the migratory habits of game animals by dyeing their tails purple and tagging them. Among things they've learned so far: Squirrels have a particular territory in which they live, and don't wander more than 200 yards from that spot during their entire lifetime. Since squirrels are color blind, they don't object to the colored dye on their tails.

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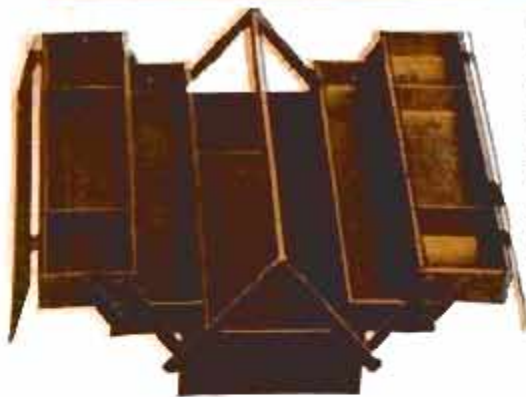
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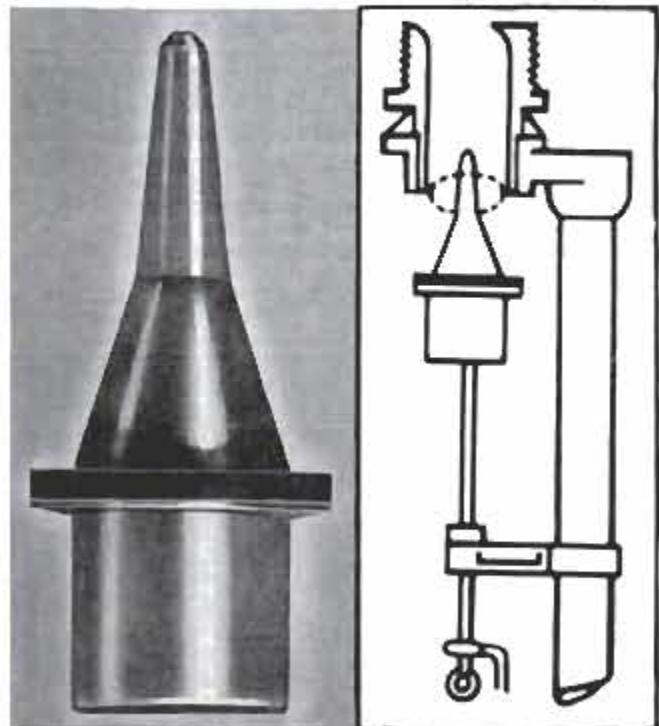
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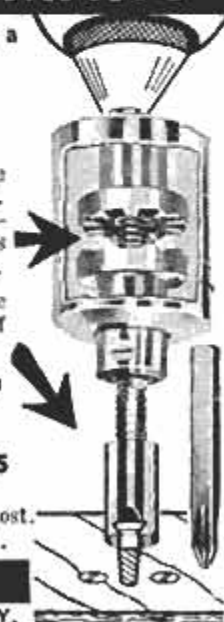
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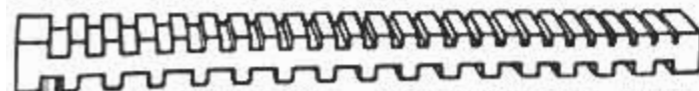


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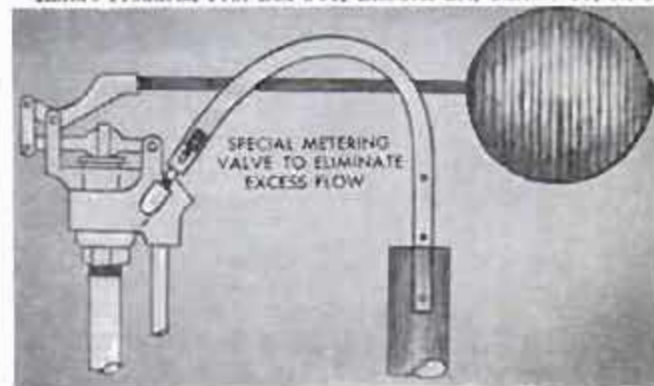
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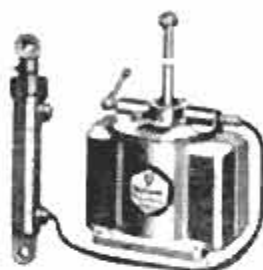
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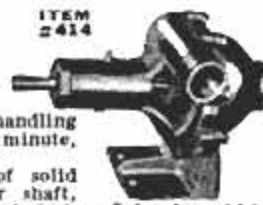
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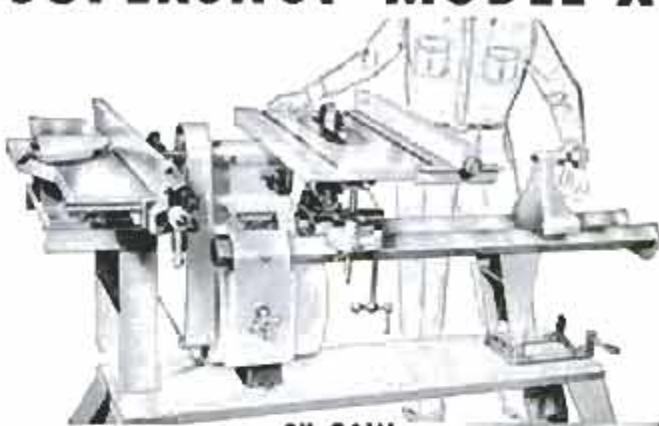
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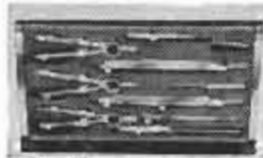
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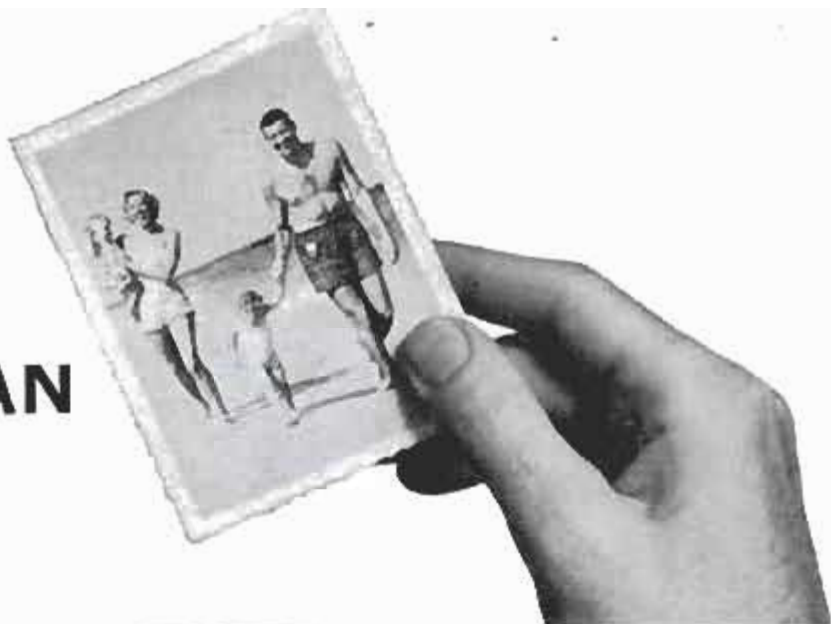
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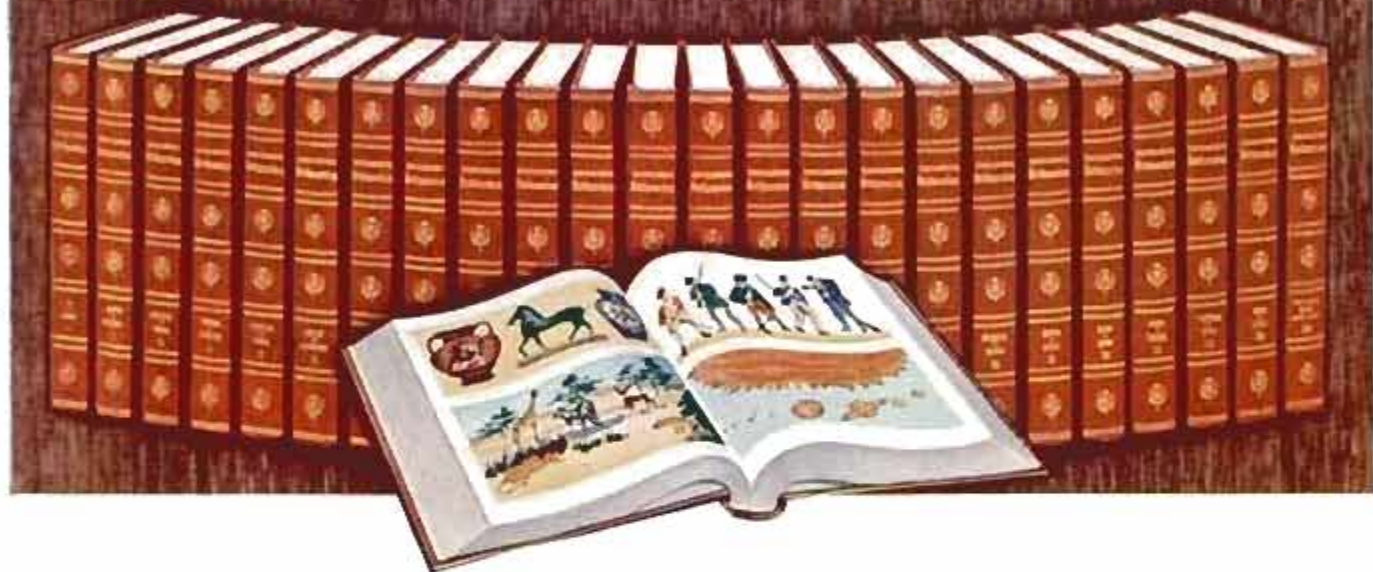
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