The More You Delay — The More You Pay

There's always danger ahead when piston rings wear out — danger of much greater expense unless new rings are installed promptly.

But if you do install new rings at the first symptom of wear, you can protect your engine and insure its long and economical life.

Check your own situation on the Danger Zone chart, with the help of your service man. This simple precaution may save you both money and headaches. For the more you delay the more you pay. And if you need new piston rings, get Hastings, the rings designed for replacement service. It's the best money you can spend on your car.

WARNING ZONE
Engine loses pep...

DANGER ZONE 1
Engine begins to smoke...

DANGER ZONE 2
Engine pumps oil badly...

DANGER ZONE 3
Destructive wear sets in...

Needs a tune-up
Clean, adjust and re-time ignition. Clean fuel supply and carburetor screens. Adjust carburetor. Adjust tappets and fan belt. Check compression and vacuum readings for symptoms of ring wear.

Needs new piston rings
Replace piston rings. Align rods. Adjust rods or replace rod bearings. Reset and reface valves. Tune engine. These repairs are comparatively inexpensive and put the engine back in peak condition for thousands of economical miles. Delay puts the engine in Danger Zone 2.

Needs new piston rings and minor engine repairs
Replace piston rings. Align rods. Adjust rods or replace rod bearings. Reset and reface valves. Tune engine. These repairs naturally cost more than those needed in Danger Zone 1, but they put the engine back in condition for thousands of additional miles of satisfactory service. Delay leads to costly Danger Zone 3.

Needs new piston rings and major engine repairs
Replace piston rings. Replace piston pins. Adjust probably replace — main bearings, Align rods. Adjust rods or replace rod bearings. Reset and reface valves. Tune engine. These repairs naturally cost more than those needed in Danger Zone 1, but they put the engine back in condition for thousands of additional miles of satisfactory service. Delay leads to costly Danger Zone 3.

Needs new piston rings and complete overhaul
Repairs cost three or four times as much as in Danger Zone 1.

HASTINGS
MANUFACTURING COMPANY
HASTINGS, MICHIGAN
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STEEL-VENT PISTON RINGS
TOUGH on Oil-Pumping • GENTLE on Cylinder Walls
Drive anywhere this summer

AND NEVER HAVE A FLAT TIRE!

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Exclusive design principle... perfected, proved, and patented by Seiberling... makes SEALED-AIR Tubes different from all others in the world... gives you more protection against troublesome flats and dangerous blowouts.

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City: ___________________ State: ___

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Available with V-8 or "Six" engine

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Carries 8 big people in comfort... handles half a ton of freight with ease, thanks to "Stowaway" center seat and "Flat-Deck," one level cargo space.

Just look...

1. It's got more flat carrying area than any other station wagon in its class. Simply remove rear seat—no tools required.

2. Lift and reverse center seat cushion with handy tab. Fold the "Stowaway" seat-back forward.

3. Slip insert panel in place and—presto—you have a continuous flat loading deck measuring nearly 9 1/2 feet to end of tailgate... 38.8 square feet of "level-loading" area.

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Where'd you get the orphan, Tom?

TOM: Orphan? What do you mean, Dad?
DAD: This chisel. There's no brand name on it.
TOM: What of it? Just feel that edge.
DAD: That's not much to go by when you're buying a chisel, son. Even a piece of cheese can have a sharp edge, you know.
TOM: You mean this chisel's no good?
DAD: I mean you can't be sure it's good. No brand name, no reputation to back it up. It's one of those bargain counter orphans—and they generally let you down.

TOM: Well, it didn't cost much, anyway.
DAD: Better get your money back—if you can. And then go over to the hardware store and buy a good chisel—one with an advertised brand name you can trust. The hardware man will always steer you right.

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THE EDITORS

We were naturally intrigued when we read a newspaper dispatch from Pearl Harbor last May 19 telling of the arrival there of two U. S. Marine Corps flyers who had been released after being prisoners of the Chinese Communists for 18 months. M/Sgt. Elmer Bender told the reporters that "their favorite reading matter during their long imprisonment was Popular Mechanics Magazine."

Well, we haven't been prying behind the Iron Curtain lately and we wondered just how Popular Mechanics got into their hands in Red China. We looked over our subscription list. It showed some 80,000 subscribers beyond the 48 United States, a lot of them in Australia and England, the Philippines and Hawaii. In China there were a few over 300. How the two captive Americans in China came upon our favorite magazine was a mystery worth looking into, so we asked Tom Stimson, our Western Editor, to talk to Sergeant Bender and Chief Electrician's Mate William C. Smith when they reached California.

The story of Sergeant Bender appears on page 98. Arranging to get it from the Marine sergeant, who had just re-enlisted, was, Tom Stimson wrote us, "a rigorous task, as you will appreciate when I tell you that today I had to take my wife and our four-year-old daughter down to Corona Del Mar, pick up Sergeant Bender and his cute wife and child, wait for Smith to show up, and drive down to the beach for a picnic lunch and watch the two four-year-olds disport in the sand and surf."

Our editors have a very hard life.

Letter to the Editor

Dear Sir:

Your article "Hall of a Thousand Illusions" in the April issue describes the Radio City Music Hall organ as the "largest in existence." Apparently your writer is misinformed.

The only way to judge the size of an organ is by the number of speaking pipes it contains, not by the elaborateness of its console or the loudness of its voicing. I believe the Music Hall organ was the largest ever built by the Wurlitzer company, however.

There are literally hundreds of organs in churches all over the country with many
To the man who wants to enjoy an ACCOUNTANT'S CAREER

GOOD SALARY  FINE CAR  A NICE HOME  BANK ACCOUNT

IF you're that man, here's something that will interest you.
Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.
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Name........................................ Age..............................
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City, Zone & State...............................
more pipes than are in the Music Hall organ. In fact, I have worked on some of them myself.

For your information, the largest organ in the world is in the Convention Hall at Atlantic City, N.J., and contains over 32,000 pipes. A close second is the organ in Wanamaker's store in Philadelphia, which has 30,000 pipes. The Music Hall organ is reported to contain about 3300 pipes.

C. Jason Tilton,
1817 Tennessee St.,
Lawrence, Kans.

Mr. Tilton is right. Wurlitzers tell us the Music Hall organ ranks as the "biggest theater organ in existence."

* * *

Circus Fat Man

Hurry — hur-ry — hurr-ry-ry! See the bearded lady and the fat man! This is Freddie, the circus fat man, carved by Paul Caster of Des Moines, Iowa, whose miniature circus is one of those pictured in our color section starting on page 81. It's the story of a fascinating hobby that requires infinite artistry and time without end.

* * *

Letter to the Editor

Dear Sir:

I beg to call your attention to a new type of electrical heating in Norway . . .

The system . . . consists of two plates of wallboard which are nailed up on the ceiling. The upper plate is a porous one, and below is a hard plate . . . On the inner side of the hard plate the elements are glued up,
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GOOD LUCK!

I was a World War II pilot...

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Back home, I was hired by National...

IT WOULD HAVE TAKEN ME YEARS TO LEARN THE HARD WAY WHAT I GET EASILY FROM I. C. S.

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I'd doubled my earnings since I began my I. C. S. studies. And I'm going to keep right at it.

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Name: ____________________________ Age: ______

Home Address: __________________________

City: ____________________ State: ________

Employed by: __________________________

Present Position: __________________________

Enrollment under G. I. Bill approved for World War II Veterans. Special tuition rates to members of the Armed Forces.

Canadian residents send coupon to International Correspondence Schools, Ltd., Montreal, Canada.

AUGUST, 1959
and they consist of usual aluminum foils.

In a room, the whole ceiling is covered with these double plates, and all plates are connected in series. When you put on 220 volts . . . the whole ceiling is heated up to say 35 degrees Centigrade . . . The system is regulated either by a thermostat or by a three-pole switch, in connection with a transformer; by this way, the whole ceiling is always heated but at different voltages, thus regulating the heating.

I have installed the system in my home, and believe it or not, but the floors are warm and we feel much more well than with other heating systems.

The system is patented in the U.S.A. and an article in your magazine would perhaps make someone interested in starting a factory.

Perhaps a manufacturer of wallboards would be interested, as the factory of this kind only requires a minimum of machinery but a very great deal of wallboard.

In a house equipped with this electric heating you can see nothing, no fireplaces, no radiator, only a usual painted ceiling. You can place the furniture just where you like it, no dust, no noise and no smell, fireproof and everlasting.

F. W. Gjersoe,
Faberg in Norway.

---

**Ever Hunt Fish With Balloons?**

Fishermen, here's a tip on how to find schools of crappie. Smiley Burnette, singing comic of western movies, says he fishes for crappie with very light tackle, and takes along about 10 feet of string in his pocket, and a few rubber balloons. When he catches the first fish, he fastens the string through its mouth and gill, ties an inflated balloon on the other end of the string, and tosses the fish back. It swims right back to school, and Smiley follows the balloon and starts hauling in crappies on all sides.
WHAT AUTO MECHANIC Wants to Know

A motor vehicle is a machine of many parts, each part designed and constructed for its own special function. All good mechanics, like good doctors, should know the working theory and operation of each part and understand what causes trouble and how to remedy it.

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How to fit pistons—How to locate engine knocks—How to fit connecting rod bearings—How to service main bearings—How to recondition valves—How to fit and adjust fan belts—How to adjust carburetors & choke—How to use automatic transmissions—How to service brakes—How to adjust steering gear—How to cope with ignition troubles—How to service distributors—How to tune:up an engine.

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Also available in Canada

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BE A SUCCESS AS A
RADIO-TELEVISION
TECHNICIAN

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FREE BOOKS
SHOW HOW
MAIL COUPON

HURRY
VETERANS

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Offers You All Three
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neighbors' radios in spare time. The day you
enroll I start
sending you SPECIAL BOOKLETS to show you how
to do this. Test you build with parts I send helps
you service sets. All equipment is yours to keep.

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Your next step is a good job installing and servicing
Radio-Television sets or becoming boss of your own
Radio-Television sales and service shop or getting a
good job in a Broadcasting Station. Today there are
over 81,000,000 homes and auto radios. 2700 Broad-
casting Stations are on the air. Aviation and Police
Radios. Micro-Wave Relay, Two-Way Radio are all
expanding fields making more and better opportunities
for servicing and communication technicians and FCC
licensed operators.

3. BRIGHT FUTURE!

And think of the opportunities in Television! In 1949
almost 3,000,000 Television sets were sold. By 1954
authorities estimate 20,000,000 Television sets will be
in use. 100 Television Stations are now operating, with
experts predicting 1,000. Now is the time to get in
line for success and a bright future in America's fast
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You Practice Servicing or Communications with
MANY RADIO KITS
Keep your job while training at home. Hundreds
I've trained are successful RADIO-TELEVISION
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ence. Many sold more than grams after education.
Learn Radio-Television principles from
Illustrated Lessons Get PRACTICAL EXPERI-
ENCE—build valuable mastertester for conducting
tests. You practice servicing Radios or operating
transmitters—experienced with circuits common to
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OFFICE, SHOP AND STORE
Handy masking-tape "dispenser" provided by plastic sheet. □ Portable garage light utilizes goose-neck lamp and brake drum. □ Low-cost shop heating system. □ Pegboard arm has glass insert for frame.

OUTDOOR RECREATION
Gun used to ignite campfire. □ V-bobs serve as boat-dock tender. □ Ice-cream freezer is carried in modified suit case. □ Miniature spot for close-up work utilizes coffee maker bowl. □ Photographer's prop stand. □ Paper clip on print tongue hooks over tray edge.

PAINT AND PAINTING
Disposable liner for paint tray saves cleaning time. □ Wax for removing saw marks from glass match colors professionally. □ Ink bottle in pint size sprayer saves cleaning cup.

PHOTOGRAPHY
Board supported by camera tripod forms collapsible utility table. □ Wetting-agent dispenser. □ Quartz or carbon-arc sun lamps print excellent proofs. □ Slide film carried in metal case for protection.

TOOLS

MISCELLANEOUS

Radio-Television, Electronics

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AUGUST 1950 61
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AUTOMATIC FLASHER LANTERN

CONSUMER DEMAND RUNNING WILD ON SPECTACULAR ONE SECOND DEMONSTRATION—A "GOLDMINE" FOR SALES MEN AND DISTRIBUTORS

So new only a handful of salesmen have it—yet such crazy things are happening it is unbelievable. Graham, a spare-time salesman, ordered six. He unpacked them at work and the other employees were so thrilled by HANDILITE that all six were sold in his own office. In 10 minutes he made $14.70 and had to order 12 more. Dunlop walked into a large office building with the red flasher "on." Within a half hour, he had sold 5 to building employees before even hitting the offices. He sold twelve—all he had—within the hour! But it is no wonder people buy HANDILITE as soon as they see how it works—what it does!

Now at last roadside accidents can be averted when car owners are forced to park their cars at night for tire changes or emergency repairs. For the first time, a vivid F-L-A-S-H-I-N-G R-E-D signal light has been incorporated in a portable, battery-powered electric lantern. The amazing one-second "Wordless Demonstration" makes sales as fast as you turn the switch. Irresistible appeal is already sweeping thousands of Salesmen and Distributors to new money-making successes.

THOUSANDS WANT IT

FORTY MILLION MOTORISTS need and want HANDILITE. TRUCK and FLEET OWNERS, VACATIONISTS, SPORTSMEN, HOMEOWNERS and FARMERS want it as perfect emergency light. A perfect warning light—also unequalled as a general purpose lantern—as boat light, for hunting, camping. A thousand uses—in garage, basement, attic—for night-time trips to barn buildings, as tractor or farm wagon light—for summer homes and summer resorts.

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Make no mistake. HANDILITE is no novelty invention by a hopeful unknown. It is produced by the same manufacturer whose products are already standard with the mighty railroads of the country.

Selling HANDILITE is not like selling anything your have ever sold before. Here is a dazzling, convincing new product that literally sells itself. Walk in anywhere. Flip the switch—immediately your prospect sees the vivid red signal light flash its warning—visible a mile away. A second turn—on comes the white light casting a brilliant beam for 1,000 feet, while the red light continues to blink. A third turn—and the red light goes off, leaving only the white lantern beam. A fourth turn—all lights are off. WITHOUT SAYING A WORD, YOU HAVE THE MOST COMPELLING SALES TALK you've ever given!

MAKE AMAZING EARNINGS SELLING DIRECT & TO STORES

Write at once for complete facts. Learn how you can sell direct at Big Profits—Then, after clearing up in a territory, sell stores big quantities for resale under a proven plan that moves HANDILITE fast. The first man to open up is going to clean up. So get the facts, quick. Already territories are going fast. Write, wire, or airmail the coupon—but do it this minute. Every minute is precious.

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The Handilite Co., Dept. 48 Sturgeon Bay, Wisconsin

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PA's CRIMP CUT MAKES IT EASY TO ROLL A FINE CIGARETTE!

THE NATIONAL JOY SMOKE!
More than a dozen drivers await their turn for a snarling dash down the salt flats in a race against a stop watch

Hot-Rod Derby on the Salt Flats

By Ewart Thomas

ON THE Bonneville Salt Flats in Utah late this month you'll be able to see the oddest collection of fast automobiles ever assembled.

Some will be “competition coupes” with cabs which appear to be squashed flat, one or two may be “twin tank” jobs that resemble a wartime P-38 with the driver in one compartment and the engine in the other. Some will be flat streamliners not much more than knee high.

Each represents its builder's ideas on how to design the world's fastest car, in its class, with the funds available.

One of the cars is nicknamed the Ant-eater because it has a snout projecting...
Another belly-tank hot rod streaks through the time trap at Bonneville. Two runs are made and the times averaged for official record.

Some of the cars sport Model-T bodies and appear to have been built 30 years ago but even these cars, beneath their hoods, have snarling, hopped-up engines.

All of the cars are classed as hot rods because they are home-built creations, but the hot rods have grown up. Amateur automobile testing has become a recognized sport and most of the rods are pure racing machines of advanced mechanical design.

The occasion for the meet is the second annual running of the Bonneville National Speed Trials and the dates are August 21 to 27. The place is the table-flat expanse of hard salt on which John Cobb set his automotive world record for the flying mile at 403 miles per hour.

Cobb's record won't be threatened, of course, for he had 2400 horsepower under the hood, and few of the home-built cars can develop more than 225 or 250 horsepower. The present hot-rod record of 193 miles per hour (or 189.78 miles per hour average for two runs in opposite directions) was set at the salt.
flats last summer by a streamliner with a Mercury engine which had been souped up to produce 225 horsepower.

Alex Xydias and Dean Batchelor of Burbank, Calif., who own the car, hadn’t expected that their Special would go that fast, and they first used tires that were guaranteed for speeds of no more than 175 miles per hour. Both front tires lost their treads at about 190 miles per hour and the bodywork was slightly damaged. The car was brought to a safe stop and later, using Indianapolis-type tires, set its present record. Two professional race cars that were clocked at the same meet last year made top speeds of only 136 and 144 miles per hour.

This year Xydias and several other owners of streamliners are hoping to do 200 miles per hour or better. A typical car that is being put together especially for Bonneville is a rear-engine streamliner from Pasadena, owned by Marvin Lee, that was clocked at 151 miles per hour, both ways, on the salt last year. This summer a new body was designed for it, and the Chevrolet-six engine that last year developed 243 horsepower at 4400 revolutions per minute has been additionally reworked to turn up 5000 revolutions per minute. Straight alcohol is used as fuel, metered through a high-pressure injection system.

Lee’s new and narrower body was designed with the help of an aerodynamicist friend who took special pains to obtain a minimum frontal area. To avoid building wheel housings that might be larger than necessary, for instance, wheels and tires were whirled in a special test rig at 2800 revolutions per minute, roughly equal to 230 miles per hour, to learn the amount of centrifugal growth that occurs at that speed. Measurements showed that the tires expand 1 7/8 inches in diameter at that speed and the dimensions of the wheel covers...
were accordingly laid out to allow for that growth.

Hot rods fall into two broad groups—the street jobs or highway cars that are used for ordinary transportation as well as time trials, and the special racers that are used only for time trials and that are towed or trucked to the scene. Cars in the latter group usually have no starting mechanisms and must be pushed. In these cars the nose is completely cowled to reduce wind resistance. An oversize water tank replaces the radiator and no cooling fan is used. The engines don’t overheat because the cars are driven no more than five miles at a time.

The street jobs, too, usually dispense with the fan to reduce horsepower wastage and many of them use two radiators, one behind the other, to insure proper engine cooling in traffic. Many of the cars have quick-change rear ends or gearboxes so that a gear combination can be installed to fit a tire size that is being tested or for driving against a heavy wind.

Engines are completely reworked and the changes may include special ignition, special intake manifold with up to one carburetor per cylinder or a fuel-injection system, high-compression heads, enlarged cylinders to take oversize pistons, "stroked" crankshafts to permit the use of longer connecting rods, and superchargers. In southern California, center of the hot-rod sport, a number of speed shops cater to hot-rod owners, providing them with special equipment that adds to an engine’s power.

Special fuels and carburetion often add many miles to a car’s top speed; even the mixing of about 10 percent of water to the gasoline has been found a help. The trick here is to pour the water and gas into cans, shake the fuel vigorously, dump it into the tank and take off at once, before the two liquids have a chance to separate. More commonly used is methanol or wood alcohol. Fuel lines of up to 1/2-inch inside diameter are used with alcohol, as are special jets in the carburetors. Instead of supercharging their carburetors, some enthusiasts use "ram tubes" to pack more air into the intakes. The tubes may project up like the pipes of an organ or they may protrude out in front of the car.

One of the rules on the California dry lakes where many time trials are held is that in trying for a two-way record a car must make its second run in the opposite direction within 15 minutes of its first run. This allows enough time for the driver and a couple of helpers to change the tires all around. It is the custom to use the largest-size tires that the owner has when running with the wind and to change to one or (Continued to page 238)
Driver sits in one belly tank and the engine is in the other, in novel streamliner. On opposite page, same car partly disassembled for work on springs

Present record holder is a flat streamliner that hurtled across the salt flats at 193 miles an hour. The car is powered with reworked Mercury V-8 engine.

Driver, about to try for a new record for the flying mile, straps himself in the cockpit and mechanics replace the hood.
Leg Rest for Drivers

Motorists get relief from the physical strains of long-distance driving with an adjustable rubber rest bar that fits just above the accelerator pedal. It provides a comfortable and secure resting place for the fore part of the foot, while the heel presses down on the accelerator. Alternating use of it with the usual ball-of-the-foot-on-the-pedal method avoids the fixed position that causes leg cramps and fatigue when driving for long periods.

Senator-Inventor

To plot the complicated schedule of eight baseball teams in the Western League, Senator Edwin C. Johnson of Colorado invented a schedule board. It looks like a cross between a giant cribbage board and a piano keyboard. The senator, who is also president of the baseball league, uses the peg-studded board to read the current 154-game schedule at a glance.

Paper Drop Cloth

Made of heavy pliable paper, an inexpensive drop cloth covers floors and furniture during home decoration. The paper covering, measuring almost 9 by 12 feet, enables homeowners to protect their furnishings without buying expensive drop cloths. It may be reused many times and will serve as a picnic or beach blanket or garage-floor covering during car repairs.

Treadless Home Loom

One handwheel on a new home loom replaces the eight treadles formerly required, thereby making weaving a hand operation entirely. The loom is designed primarily for those who wish to make weaving a part-time, money-making hobby. A yard of 38-inch material an hour can be woven on the loom, which handles silk, cotton, linen, worsted or wool. The frame of the loom is made of aluminum-alloy tubing and the entire machine weighs only 35 pounds.

Falling at Potter, Neb., on July 6, 1928, the largest recorded hailstone weighed 1½ pounds.
House Follows Job

WHEN James G. Mitchell, traveling engineer for a construction firm, is ordered to a new job, he doesn’t worry about a house for his family of five—he takes it with him! And the house is no crowded trailer. It’s a comfortable five-room home complete with shrubbery and a trim fence for the yard.

Mrs. Mitchell designed the portable house after convincing her husband that a family of five is a little too big for trailer life. The home is built on heavy oak skids and is 33 feet long and 12 feet wide. It weighs about 30,000 pounds and is strong enough to withstand frequent trips aboard a huge trailer. Whenever they move, the Mitchells rent a piece of ground, preferably near a school for the children. The trailer pulls up, unloads the house and in an hour the plumbing and electricity are hooked up. Then the family settles down to get acquainted with the new neighbors.

Below, who would guess that this neat house was “on the road” a few days ago? Shrubbery and fence traveled with the building. Right, Mitchell and daughter sit down with the paper. A spinet piano is to the left.
FROM HUGE tank-farm drums, sitting atop the coastal peaks like squat pill-boxes against the Venezuelan sky, thick crude oil slid by gravity through the 20-inch pipes snaking down the hillsides. In the mountain-bound harbor of Puerto La Cruz, it gushed into the cavernous belly of the super-tanker SS Amtank, monster oil ferry carrying million-dollar cargoes to the States from the Sinclair Refining Company’s Venezuelan fields.

All night long the Amtank had been taking on crude through the three 10-inch rubber hoses attached to her deck manifold. The black boa-constrictor-like tubes surged and hummed in their rope slings under the pressure of 17,000 barrels per hour of the black gold racing through them.

When the ship started loading at midnight, her gangplank was almost vertical. Now, loaded close to capacity, she had gained a little weight—23,000 tons—and her fat hull settled 20 feet in the bay. Her decks were flush with the dock and the gangway was a horizontal plank. On the flying bridge, Capt. Harold H. Mathis stood.
ready to cast off. Another half hour and the ship would be on her 4½-day, 1800-mile trip back to the States with enough oil to keep 1000 American homes warm all winter, run 7000 cars for a year and have enough low grade left over to run the Queen Mary for a week.

Today, ships running oil across the seas are a far cry from the old barques that first lugged it in leaky wooden barrels and periodically exploded at sea from fumes ignited by galley embers or sparks struck on brightwork. The modern tanker was born in 1885 when a German shipowner, sick of losing his barrel-toting tubs, bought an old U. S. Civil War ship, stripped out her hull and fitted her up with 72 steel tanks capable of holding 700,000 gallons.

Super-tankers coming off the ways in 1950 range up to 630 feet in length and carry cargoes of 10,000,000 gallons. From Middle Eastern Saudi Arabian oil fields and the north coast of South Africa, great fleets of them ply back and forth to U. S. ports, hauling oil cheaper than it would cost to buy it domestically and pipe it to markets in other parts of the country.

The Amtank was among the first of these postwar mammoths. Trimmed for action and oil, her wheelhouse is long and narrow to cut wind resistance. An unsupported flying bridge juts from each side of it like a pair of wings to give the skipper his over-side view for docking. Virtually no superstructure obstructs the sweep of wind...
across her flat decks except low nubbins of oil hatches, breather pipes and brightly colored valve wheels. She measures 556 feet long and 80 feet abeam, and while she weighs only about 7000 tons empty, she'll tote four times her weight in cargo—about 200,000 barrels, or 9,000,000 gallons. A mighty 15,000-horsepower, 21-jet geared steam-turbine engine sends her along at a sound 17 knots. She's done better than 20 with a tail wind and a shove from the Gulf Stream.

Like any tanker, she is not just a big hollow bathtub with a deck on top. Her hull is neatly sliced into nine welded-steel sections which give her structural support and keep her temperamental cargo from sloshing around. Each section is divided in thirds by two fore and aft bulkheads. If you could lift off her top decks, she'd look like an overgrown egg box. On the tank bottom rests a network of pipes, valves and suction heads, all feeding from the pump room, aft. By maneuvering the valves, which are activated by long-stemmed wheels on the decks, any combination of tank sections can be connected together by pipe lines, disconnected or blocked off for loading or unloading.

It takes a total of 43 officers and men to handle the Amtank, plus a sharp skipper who knows what he's doing. The biggest headache, however, is nursed by the chief mate. Cargo is his baby, and he can start worrying the minute it comes aboard. It's messy, explosive, heavy and it moves fast. It can break up a ship if not loaded properly. When handling a single cargo like crude, some mates simply open all valves and let the oil swish through the entire ship until it's almost full. Then everyone races around like mad shutting down valves. Not on the Amtank.

When the big hoses are hooked on at Puerto La Cruz, inspectors stroll casually from hatch to hatch, measuring ullage (the air space between the top of the oil and the top of the tank) with a long rule. Others drop a tape to the tank bottom. The tape has a white paste on it which turns gray when touched by salt water. Thus, the amount of salt water or "thievery" in the tank bottoms is accurately determined. Meanwhile, valvemen walk around the deck swinging wheels. All but the center tanks are blocked off. These fill first. Then oil surges into the outboard sections, or "wings." This way the ship stays on an even keel. Chief Mate Bob Warrick usually leaves wing tanks 6, amidships, empty to eliminate strain and sag in the center of the ship when she's under way. Last of all, wing tanks 8 and 4 are filled to trim the ship fore and aft, so her bow rides a little higher for easier and faster cruising. Harbor depth permitting, a three-foot drag is desirable.

It's no job for amateurs to swing the big wheels that open and shut valves 40 feet deep in black oil as a tank comes full, and flow must be switched to other tanks. This is "topping off"—a tense moment in cargo loading, since those tanks are filling at a rate of 12,000 gallons a minute! The valveman starts "squeezing down" as the oil comes near deck level. If the mate forgets to watch his ullage for a few seconds, or misses his guess, he'll get a spill. Two hundred gallons of oil per second will geyser 20 feet in the air from the ullage plugs.

Scraping decks is daily but potentially dangerous job. Pneumatic, nonsparking metal brushes are used before cleaning a tank, a crewman drops a hose from a gasometer inside and checks air for deadly fumes.
Photo from forepeak shows the “flying bridges” which give Amtank’s skipper an unobstructed view of deck.

This is more spectacular than healthy. Mates in charge who let it happen, automatically quit on the spot. It happened unavoidably once on another ship to Clarence Stewart, the Amtank’s second mate, when a valve stem wrung off in a valve-man’s hands as he started to shut down. “Never saw such a mess in my life,” he recalls. “In a couple of seconds, the deck was ankle deep in oil and we were skittering around like drunken skaters. Worst of all, we couldn’t swab down until we left port. Pollution laws.”

The boys tell about one spill-happy mate who was so disgusted he just left the geyser running, walked off the ship and was never seen again. Neither was a lot of oil.

In emergency, when there’s no time to clear tanks of gas, crewmen wear fresh-air masks for repair work.

Under way, things calm down. The 30,000 tons of ship and oil plow along like a semi-submarine, two thirds underwater. There’s only about eight feet of freeboard on a loaded tanker. Her nose digs into waves which sweep over her decks like surf on a beach. Foc’sle, wheelhouse and after house just like islands from the sea.

Officers eat aft, and must dash across the open trunk deck for 75 yards to get chow. In a heavy sea, with decks rolling 35 degrees, it’s as easy as walking sideways across a ski slide. To keep from losing crew to the big briny, the Amtank boys have rigged a life line—a long steel cable running head-high between bridge and after house. From it dangle rope handles.

Weapon? Yes, against corrosion. Rotating pressure nozzle spews water through tanks to peel off rust.

From wheelhouse to after house is 75 yards of rough weather. Cable helps crew negotiate the tilted deck.
shaped like upside-down subway hand straps. In heavy weather, a hungry officer grabs a handle and runs like a jack rabbit. If he times his dash between waves, he may not get wet.

If the chief mate has done a good job of loading, cargo presents no problems at sea. But plenty of unpleasant things might happen. Captain Mathis, gazing at the scud out over the plunging bow of his ship, can recite a string of probable hazards that would stand your hair on end.

"You can plow into a minor collision in a fog and blow everything to Kingdom Come," he says. "Or you can break her apart by keeping full speed in heavy weather."

"If oil is loaded cold and the ship runs into hot weather," he points out, "the stuff will expand like yeast. If the mate forgot to leave enough ullage, he'll have oil spurting from every plug and cranny in the decks."

During the war, a lot of tankers plowed the ocean with the hallmark of green crews plastered all over them—masts and deckhouses smeared to their pinnacles with stains, where expanding gasoline or oil had burst from hatches and sprayed everything. "How those guys lived so long is a mystery," marvels Mathis.

There are plenty of things for a good tanker skipper to watch at sea. Cargo must be shifted from tank to tank continually on the trip. The big boilers use 100 tons of water and fuel a day from the after tanks. This does things to the trim. Left alone, the ship would arrive in port 24 to 30 inches higher in the rear and down in the bow, than when she started on a four-day voyage. Inches count when you're running from salt ocean to a fresh-water harbor channel, where a ship like the Am-tank sinks an extra eight or nine inches due to buoyancy change. "There are skippers," says Mathis, "who don't move 10 tons of their cargo from tank 1 to tank 8 each day. That's all it takes to raise the bow and sink the stern one inch. One man ran an off-time skip into fresh water and missed his harbor channel course by a few yards. He hit a sandbar at 17 knots and sheared off half the bottom."

If the weather gets rough, so does the skipper's job. That 17,000-ton, million-dollar cargo can pack an awful wallop slamming against steel bulkheads. "It costs $2000 a day to run this ship," says Mathis, "whether she's moving or not. It's tough to figure when it's smarter to stand still at that cost or keep moving and maybe bust up a $5,000,000 ship."

Mathis can tell by the "feel," he says. "Her bow digs in, she slows down like a sled hitting a snowdrift and you can feel the torque along her big keelson. If you don't slow down, you can bust her in two—which one eager skipper did do."

To illustrate this, Mathis tells about riding in a North Atlantic convoy during the war. Sixteen tankers rolled and pitched through a four-day storm, while the leader
During his trip to Venezuela our roving and slightly green editor rode out the worst storm the Amtank ever encountered, a hurricane off Hatteras that sent the seas crashing over the tanker's deck every few seconds. The Amtank, loaded, has only eight feet of freeboard. During a storm, sloshing oil could pound ship to pieces.

Cutaways of Amtank show how bulkheads divide the tanker's hull lengthwise and crosswise into individual tanks. Ingenious piping system permits the shifting of cargo from one tank to another to keep the ship in trim.
kept top speed. “You could hear half-inch-steel tank bulkheads fracture and rip in those ships as the cargo slammed, beat, twisted and tore them loose from welded corners, then the jarring thud as partitions broke loose and fell to the bottom.” Mathis brought his ship about, slowed to two knots and came in whole. All 15 others were badly damaged.

When different grades of cargo are being carried by a tanker and bulkheads break, the oil must be re-refined. Owners don’t like that. But worst is the loss of stability in the ship. The oil is free to slosh around. If you ever tried carrying a big tippy dishpan full of sloshing water, you know what happens. In a rough sea, a loaded, badly damaged tanker can capsize.

Once at Marcus Hook, Pa., her home port, the Amtank makes short shrift of her oil. Again inspectors with their rules and tapes measure the ullage and theftage. Hoses are coupled to the manifold. Forty feet below decks in his pump room, the pumpman starts his big centrifugals whirling at 1750 revolutions per minute. Oil gushes out at 3000 gallons per minute. Again tanks are blocked and emptied in series to keep the ship on an even keel. Since the suction heads are one inch off the tank bottoms, some oil is left. The after tanks are emptied last so that, toward the end, the empty bow of the big ship tips clear of the water until she resembles a rowboat with a fat fisherman sitting in the stern. Dregs from the forward tanks seep aft through open sluice valves and the last of the oil is sucked from the ship by two reciprocating “stripping” pumps, which won’t lose suction like the centrifugals if a little air comes through the lines.

Once dry, the ship is off for another load, taking on sea-water ballast in some of her tanks as she goes so she’ll ride solidly and not kite all over the ocean.

On the empty return, the crew immediately charges into its never-ending fight with rust. Scale and corrosion (from sour crude), must be stripped from tank sides and the bottoms cleaned of sludge, salt water, sand, scale and carbon. This can be dangerous, since empty tanks generate poisonous explosive gases. The special hatch-cover wheels are spun open, the gas hisses and roars like a subway train around the edges of the big steel lids.

Sometimes a ¾-inch steel steam hose hooked to a big blower is stuck into the tank. Steam is blown in, gas out. The Amtank is equipped with a built-in gas ejector, too—a Venturi affair hitched to the tank pipe system. Engine-room steam, forced through the Venturi, sucks gas from any tank with open valves. But the system uses too much fresh water—a precious commodity—so it’s seldom used. Instead, the boys use the Butterworth Machine, an overgrown version of a self-swirling garden-hose nozzle, hitched to the end of a two-inch rubber tube. The double-barreled nozzle, geared to rotate in two planes at once, is dropped into an open cargo hatch. Four hundred gallons of water per minute, heated to 180 degrees, are pumped through it at 190 pounds pressure. The big nozzle

(Continued on page 230)
Three-Cylinder Car

German motorists attending the Leipzig Spring Fair looked enviously at a sleek convertible that will be manufactured principally for export. Built for economical operation, the car has an unusual three-cylinder engine rated at 28 horsepower. It will sell abroad at an estimated price of $1200. Called an IFA, the car is produced by a state-owned trust that includes the former DKW and Horch auto factories.

Aerial Cable Car
Is River Ferry

When you cross the Fraser River in eastern British Columbia, Can., you go by aerial ferry, swinging across the 1000-foot-wide chasm in a metal basket. The ferry, which accommodates a truck, car, team of horses or 40 passengers, is supported by a pair of cables, each a shade under two inches in diameter. A donkey engine on one bank pulls the towing cable. Two men operate the ferry, the purser who rides the basket and collects the fares and the engineer who operates the engine on signals from the purser. Normally, the basket rides about 80 feet above the river, but in the spring of 1949 the river rose to within two feet of the floor of the car, forcing interruption of the ferry service for nine days because of high-floating debris.

"Waffle Iron" Roller
Packs Road Harder

Individual steel pads that leave a waffle design are used instead of the conventional smooth wheel on a new road roller. It gives twice the compression by reducing the bearing surface. A smooth rear wheel wipes out the waffles by packing down the untouched sections left by the front roller.

Department of Agriculture officials figure that the 12,000,000 gallons of frozen concentrated orange juice marketed in just one season would form a "golden glacier" sixty feet wide, five feet deep and a mile long.
KITE + BALLOON = KYTOON

ON CALM DAYS, kite enthusiast Dominia Jalbert felt frustrated. Although he had kites of all types, he simply couldn't make one fly when there wasn't any breeze.

This frustration led to the Kytoon, a hybrid sky rider that combines the best features of the kite with the best of the balloon. Even the name, Kytoon, is a combination of kite and balloon. By adding the kite's ability to "climb" the wind to a lighter-than-air, helium-filled balloon, Jalbert produced a "sky hook" that flies virtually motionless above its mooring. Unlike a kite, it won't nose dive, being lighter than air. Yet it won't drift downwind like a captive balloon because its fins make it rise into the wind.

Its extreme stability makes it an ideal way to elevate radio or TV antennas. It supports advertising signs over business districts and carnivals. So stable is it that it can be used as a sighting target on large-scale surveys or to carry cameras aloft for low-level aerial photographs.

Kytoons were packed in rubber life rafts to elevate the radio antennas of wartime flyers downed at sea.
The love and care that hobbyists lavish on their miniature world is a source of continual amazement. Take now the case of the

HOME-OWNED BIG TOP

By Hank and Vera Bradshaw

WANT TO OWN a circus? Then get busy and start building one of your own. Right now, there are at least 500 miniatures under construction—and completed ones are rare. That's the report from the Circus Model Builders and Owners Association. The association's unusual admittance rules require that each member have under construction a miniature circus, or that he own one. Many of these are authentic reproductions of circuses no longer in existence.

Basements and garages are the workshops for this remarkable hobby; unused attics sometime serve as the necessary "winter quarters" for the little circus folk.
Sixty vehicles have been unloaded and the “biggest show on earth” is about to begin. An uncle-nephew team in Baltimore built this big top with all its paraphernalia, scaled to perfection at ¼ inch to the foot.

Membership in the Circus Model Builders and Owners Association spreads across the United States, up into Canada and even boasts brethren in Surrey, England. It’s a unique organization composed of men and women who not only love and admire the big top but seek to preserve in miniature its spangles and breath-taking thrills.

Some members have become so enveloped in their hobby that it has been transformed into a full-time bread-and-butter earner; but most are using it as an exciting, spare-time adventure. Hours are spent carving, painting, stitching and designing—working toward the enviable day when there’ll be a “circus to show.” There is a relentless search for appropriate materials, experimenting, a hunt for seldom-made items and patient work to make the unobtainables—minute galvanized water buckets, table settings and Lilliputian folding chairs. Some plans are so extensive it will be 10 or 15 years before the creator will realize his dream. Actually, a lifetime is involved.

This construction of miniature circuses is not a hit-and-miss affair; there is no guesswork. Replicas of the big top from the barking deer to the mess wagon are true copies, exquisitely carved. A passion for accuracy and exacting duplication sends members searching through newspapers, old records and pictures; to interviews with old-timers of the sawdust trail,
magicians, aerialists and explorers of the jungle; as well as out to attend every circus that comes their way. The result is that they are producing almost priceless miniatures, ranging in scale from 1/8 inch to three inches to the foot.

Among exhibitors, J. Harold Dunn of Wichita, Kans., is probably one of the best known. He has spent 18 years building a tiny show that is constantly in demand.

These fascinating, colorful little big tops are real spectacles, and organization members are often called upon to display them in business establishments. Maxine and Harry Chalfant, Colorado Springs, Colo.

Hurry! Hurry! Hurry! The big show is just starting! In Ed Hollis' circus all the performers actually move—powered by a motor from a record player.
Joe Taggart touches up a spectacular wagon. Each 16-spoke, iron-rimmed wheel has more than 100 parts.

set up their 3/4-inch Parago circus in a local shoe store. The layout centered their banner line (advertising for side show), fronted by three ticket boxes and two stages. Two savage head-hunters occupied one stage while the second held the leopards, a mermaid and a half-girl. Ticket sellers were in the boxes and a barker was on one stage hawking the side shows.

Inside the animal cages were were zebras, llamas, camels, ostriches and monkeys. The show’s bull elephant “Snyder” was in harness dragging poles, and the smaller elephant “Babe” was chained to her stake.

Five clowns added to the scene—one had a trained pig, another gallantly rode in a hippo cart with a duck.

Ed Hollis of Salem, Ind., found business a little slow one day and started carving a circus. He is now three fourths finished with a Hagenbeck-Wallace model. The “Five Graces” bandwagon is complete with band and 10 horses. His figures are distinctive in that each expresses some action—a man holds a bottle of pop, a child eats a hot dog. Circus hands sleep in the shade of a baggage wagon, but the blacksmith is shoeing a horse. Hollis is now carving the Clyde Beatty animal act.

The association takes pride in stimulating interest in the circus, but its greatest service is providing its members with authentic diagrams, information and pictures from which to work—even going so far as to supply (Continued to page 224)
Joe Taggart touches up a spectacular wagon. Each 16-spoke, iron-rimmed wheel has more than 100 parts.

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Inside the animal cages were two hyenas, a mother kangaroo with a baby in her pouch, a tigress and two cubs, two polar bears and cubs, and five lions. There also were zebras, llamas, camels, ostriches and monkeys. The show’s bull elephant “Sny-der” was in harness dragging poles, and the smaller elephant “Babe” was chained to her stake.

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Side show being built by Paul Caster will be 13 feet long. Already completed are Freddie, the fat man, a magician’s act and a knife-throwing act.
Complete to a jeweled dome is this wagon for the ibex, one of 350 vehicles fashioned by Joe Taggart magicians, aerialists and explorers of the jungle; as well as out to attend every circus that comes their way. The result is that they are producing almost priceless miniatures, ranging in scale from 1/8 inch to three inches to the foot.

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Hurry! Hurry! Hurry! The big show is just starting! In Ed Hollis' circus all the performers actually move—powered by a motor from a record player.

Paul Caster works out details of a model. Gilded wagon in foreground is one of the most valuable in existence. Below, refreshment stand even has cash register.
BUICK will introduce the first tinted-glass windshield in the industry this fall. Charlie Chayne, chief engineer, has been working on the device for some time, not so much in the development of the green-shaded windshield, as to get the state vehicle administrators in the various jurisdictions to accept it.

Sixteen states have okayed the windshield, which will do away with the sunshades and the interior sun shields. The states include Michigan, Ohio, Indiana and Illinois. New York is still one of the holdouts against tinted glass.

The new windshield glass, in which the tinting is impregnated during manufacture, will be made exclusively for Buick by Libbey-Owens-Ford in Toledo. The tinting is graduated from top to bottom and is very easy on the eyes when driving into the sun, whether it is high or low.

Chayne has been experimenting for more than a year with the tinted windshield on his own cars with good results. Buick has made studies of the effects of the glass on driver fatigue and reports astounding results. The tinted windshield will eventually find its way into all General Motors cars, when more states approve its use.

Chrysler is not only planning the new V-8 high-compression engine but is now testing a new six of the overhead-valve type. The new engine is reported to have shown more than 150 horsepower in its early tests.

The company is calling on some of its aviation-engine technique from war days in the finishing of the combustion chambers. Instead of being rough, they are polished up. It will be some time before the testing is completed on the new engine and Chrysler decides what to do with it. As it takes about 18 months to bring out a completely new engine, it looks like the six will be for 1952 production, at least.

The so-called hard-top convertible (which does not convert) is here to stay. Buick's experience, which is typical, insures this styling continuance for next year.

Buick is currently delivering about 45 percent of its total production in its Riviera model, which comes both in two-door and four-door sedans. Most of the demand is for the coupe but because of a great backlog of ordering, the four-door Riviera is finding its way into many customers' hands.

Hydra-Matic transmissions, the first of the fully automatic devices in the field, are far from being made obsolescent by the newer torque converters. In fact, Hydra-Matic has spread far beyond General Motors, which pioneered and developed it.

Hudson will be the newest addition to its list of outside customers. It probably will be unable to supply the independent until late in the fall or perhaps when Hudson decides to introduce its 1951 models.

Already, besides Oldsmobile, Pontiac and Cadillac, Hydra-Matic is being sold to Lincoln, Kaiser-Frazer and Nash. Rumor has it that Cadillac will blossom out with its own transmission, which will leave capacity to supply the outsiders who have contracted with GM for the device, rather than go into an expensive tooling program.

Meanwhile, Ford is pushing its own transmission plant in the Cleveland area. That, with the new engine plant, is going to run the company into many millions for its post-war expansion and decentralization program.

Packard spent $7,000,000 to build its Ultramatic. Other independents may be better fixed financially than Packard but none wants to follow its trail blazing.

Ford officials are a trifle discouraged by the slowness of Borg-Warner in getting into production on its new drive. Borg-Warner, however, has run into tooling troubles.

While Ford envisioned first deliveries by midsummer with Mercury getting a few into customer's hands first, it looks like fall now before Borg starts shipping.

Chevrolet has ironed out its production and technical difficulties on its Powerglide and is in full production in the Cleveland plant. It is turning out 1000 of the automatic transmissions a day and, by September, will double the output. Ed Kelley, chief engineer of Chevrolet, has his staff working on advances which will not only step up its efficiency but add to its economy features.
Stenographer, truck driver and businessman—all kinds of people—show Simon and TV audience their “pet ideas”

TV SHOWROOM FOR INVENTORS

When Ernie Simon, pioneer Chicago TV announcer, was telecasting an interview program one evening, a man pulled out an invention and demonstrated it. Simon was entranced, and it occurred to him that almost everyone from housewife to businessman has a “pet idea” he’ll “do something about someday.” An offer to show inventions on the program brought an avalanche of useful and weird contrivances. The inventions have made the telecast one of the most popular interview programs. Many inventors receive a mailbox full of orders following their appearance. A manufacturer once called while the program was on the air and offered to buy the invention that had been shown by an enterprising housewife, spot cash.

Inventor brought a knock-down screen frame. Assemble it, tack on screen, take it apart for winter storage.

Another shows off swinging record rack which exhibits the titles on both sides of individual records.
Anybody want to buy a one-man band? Surprisingly, 15 people did after inventor showed it on television.

Upper, right, saw blade is claimed to outlast conventional types 100 to 1 because teeth have carbide tips.

Right, program director looks over a recorder. When electric eye is tripped, it plays advertising message.

Below, right, glass-topped table holds real or artificial flowers, spectacularly lighted from below.

Clever housewife popped up with screwdriver with one spring which holds head while screw is started.
STEREO-TELEVISION FOR ATOM LAB

Television in three dimensions has been developed by engineers at the Argonne National Laboratory near Chicago. Used along with electronic remote-control devices, it enables atomic scientists to conduct experiments at a safe distance from deadly radioactive materials. When operating a mechanical hand, three-dimensional views are almost essential in grasping beakers and performing infinite precision tasks behind the lead shields. Dr. H. L. Hull, director of Argonne's remote-control engineering division, has devised two types of stereo-television. Both use the double-lens camera. One receiver presents two nearly identical pictures on the television screen which must be viewed through prismatic glasses to get one three-dimension picture. The other projector superimposes one image on top of the other and looks out of focus until viewed through polarized spectacles.
Bomber for Smallest Carriers

Built to operate from the smallest carriers, the Navy's new Skyshark turboprop bomber will fly over 500 miles an hour. It is equipped with a T-40 Allison twin turbo-prop engine of 5500 horsepower, driving two contrarotating propellers. It will carry a greater pay load than any jet fighter or bomber known for the same expenditure of fuel. Once airborne, the plane can increase its range by flying on either turbine.

Fertility Detector Uses Electricity to Test Hens' Eggs

Electronics may soon tell poultry farmers which eggs are fertile, thus eliminating the present trial-and-error method of incubation. All that is needed, according to Karl Norris of the Department of Agriculture, is an instrument to measure minute differences in response to electric current. Fertile eggs respond differently from nonfertile eggs. Modern electronics may soon produce a practical device for measuring the few millionths-volt difference that shows fertility, Norris says.

Lure Holds Live Lightning Bugs

One night an Indiana fisherman was having trouble persuading the fish to strike even though they were leaping out of the stream to snap at lightning bugs. The following night the angler returned with a small glass bottle to which he had wired some hooks. He put a half-dozen lightning bugs in the bottle and used it as a lure with good results. Now the idea has grown into a new transparent-plastic lure which can be unscrewed and lightning bugs inserted for night fishing. The lure can be used where fishing with artificial light is prohibited, according to the manufacturer.

Rated the world's most compressible substance at very high pressures is the rare metal, cesium, which is reduced to only three eighths of its original volume by a force of 34,000 pounds per square inch.
“Bowling” Down

Mow down a forest like it was a field of wheat? Not even the legendary Paul Bunyan could do that.

But wait—up in northern Montana a couple of ingenious engineer-contractors have built mowing machines that slash through timber just the way a threshing machine moves through a grain field. Trees 100 and 150 feet tall topple over like straws. Between breakfast and lunch two men and their equipment can mow down as much as 100 acres of virgin forest. Then the clanking, roaring “stacking cats” move in...
Forests for a Super Dam

and rake the fallen trees into windrows.

These Gargantuan operations are taking place in the reservoir area back of Hungry Horse Dam which, when completed in 1953, will be the fourth largest concrete dam in the world. The reservoir site is 34 miles long and up to 3½ miles wide, some 35 square miles in all. Before the clearing operations began it was covered with a thick forest of pine, fir, larch and spruce.

The area contained 80,000,000 board feet of merchantable timber and the first task was to log these trees, saw them up and haul the lumber out. This left hardly a dent in the thick forest.

Every tree that remains, almost every twig, must be removed and the ground scraped clean before the site can be used as a reservoir. Otherwise trunks and limbs would be floated by the rising water and would drift down and clog the debris booms and the trash racks that will guard the intakes of the 285,000-kilowatt powerhouse.

When the Bureau of Reclamation asked for bids for removing the first portions of the 25,000 acres of forest, smart engineers from as far away as Louisiana and California tried to figure out the cheapest way of clearing the trees.

Twin rig for clearing away fallen trees is made of two tractors that push a 21-foot rake with 13 teeth
Chopping down the trees one by one would take too long and be too costly. Burning the forest as it stood would be dangerous to the surrounding timber and would leave a litter of charred debris. Pushing the trees over with track-type tractors would be simpler, for a powerful diesel can walk right through brush and trees and knock down everything as it goes.

Pondering over these ideas last year, S. L. Wixson and John H. Trisdale of Redding, Calif., wondered if a steel line rigged between two tractors could knock down trees as effectively as does a tractor’s bulldozer blade. The two clearing contractors knew that a pair of tractors working in unison can exert a terrific pull. The idea might work and so they tried it out.

They placed two tractors about 100 feet apart and connected them with a steel line 200 feet long. Then the tractor team headed into the forest on parallel courses. Each tractor bladed down the trees in front of it, slack was taken up on the line and the tractors moved ahead. Then the forest began tumbling down! Every tree between the tractors was caught by the steel line and pulled over. Some of the trunks were snapped off short, larger ones were levered
bodily out of the ground, and only the light brush bent under the line and swayed back into place. The two tractors had more than enough power for the job.

Last winter the men worked out a refinement to the original idea. They needed something to hold the wire a minimum of four feet off the ground so the wire could avoid being hung up on the stumps that remained from the recent lumbering operation. Scattered through the forest, these obstacles could slow down the whole job.

The contractors designed a hollow steel ball, eight feet in diameter and weighing 4½ tons, and attached it by means of swivels to the middle of the line, halfway between the two tractors. The ball rolls along over the ground and serves its purpose perfectly. It does better than anticipated, in fact, for it not only carries the line over the stumps but holds the line high enough to provide extreme leverage against a tree. The shallow root system is forced up out of the ground and a big tree simply tips over. Too, the weight of the ball prevents the line from riding too high when a stand of immature and willowy trees is being knocked down.

Last year Wixson and Trisdale jointly cleared 7210 acres of forest. This year they are operating as separate contractors and, with the new equipment, each is clearing approximately as much acreage as both together were able to handle last year.

Trisdale estimates that two tractors with a ball and line can do as much work as a dozen “cats” equipped only with blades. Too, he says, it’s a safer operation because the tractor operators are always far in advance of the timber that is crashing down behind them.

This is an artist’s conception of how the 2115-foot-long Hungry Horse Dam will look when finished in 1953.
A typical forest mowing machine consists of two HD-19 Allis-Chalmers tractors, each of 145 horse-power and each with 400 feet of 1 1/4-inch cable on its winch. The end of each cable or line is connected to one of the huge swivels and from the swivel 100 feet of 1 1/2-inch line leads to the giant ball. Thus, as much as 1000 feet of line is available for the big loop behind the cats, with the ball at the center of the loop.

Ordinarily, the two tractors now work about 500 feet apart. Each one beats down its own path through the forest and the loop meanwhile pulls down everything between them. If the trees are too big and thick for this operation, each tractor can anchor itself behind a convenient tree or stump and then winch in on its end of the line. This multiplies the pull and makes it possible to yank down trees that may be two or three feet in diameter. When all the line is winched in, the operators slack off and move their rigs ahead, then make another pull.

After two "cat skinners" have worked together for a couple of days they learn to understand each other perfectly. If the line behind one rig gets hung up on a stump, the operator can increase his winch speed to pull the ball over on his side. This rides the line up higher so that it clears the stump. His companion may be far out of sight in the forest but he can tell from the pull what the operator wants and he slacks off his end of the line to allow the ball to travel.

The mowing machines leave behind them a jumble of trunks, limbs and roots that appear almost impossible to clean up. That's where the stacking cats come in. These are D-8 Caterpillar tractors equipped with 14-foot blades and with nine pronged teeth under the blade. Working in teams of two or three units side by side, sometimes in teams of five, the cats drop their blades and move into the tangled timber.

Trunks slowly turn over, sometimes upending themselves, and gradually the mass of trees is pushed and jockeyed into huge piles 30 or 40 feet tall. All small trees and brush are swept away in

(Continued on page 246)
Foam-Plastic Model Plane Flies Like the Real Thing

Youthful flying enthusiasts can put together a solid, scale-model airplane in a few hours and make a successful flight the first time they wind up the propeller. Sold as a kit, the flying model is precut of a plastic-foam material that is three times lighter than balsa. The assembled plane weighs slightly more than one ounce. All parts are cut so that perfect balance is automatic, eliminating the tricky job of balancing a conventional flying model. The plastic is strong enough to take hard landings and the wings flex like a spring to withstand damage. The rubber-band motor fits inside a hole in the fuselage.

German Iron Lung

Even though a new German iron lung is opened for examination and treatment of the patient, there is no interruption in breathing because his head is enclosed in a plastic hood where oxygen is forced into the lungs. This eliminates the need for giving treatments through small ports in the chamber wall. The lung is driven by a hydraulic motor and respiration frequency can be adjusted from 6 to 30 breaths a minute. Demonstrated in Frankfurt, Germany, the lung sells for about $2000.

Rolling Cutter Trims Lawn Edges

Grass which grows out across the edges of sidewalks and flower beds is trimmed neatly and easily with a new no-stoop garden tool. Rolling its rubber-tired wheel along the lawn or sidewalk causes the circular cutting blade to rotate against two stationary blades, trimming the grass. The edger cuts when rolled in either direction and can be held at any desired angle to trim the grass around buildings, stepping stones, fences and trees.

Popular Mechanics provides two sources of further information concerning articles published in each issue: the WHERE-TO-BUY-IT INDEX, which starts on page 12, and the WHERE-TO-FIND-IT LIST, available to readers without charge. For your copy of the WHERE-TO-FIND-IT LIST, just send a postcard to Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11, III.
Rambler Station Wagon

Five passengers and a big pile of luggage or sports equipment are accommodated with ease in the Nash Rambler custom station wagon. The two-door, all-steel car has interior space of 8 feet 11 inches and with the back seat shoved forward cargo space measures 6 feet 5 inches. The station wagon is mechanically the same as the convertible model and is powered by an 82-horsepower 6-cylinder L-head engine. It has a wheelbase of 100 inches, over-all length of 176 inches and height (empty) of 62 inches. Seat-cushion upholstery is easily unhooked for dry cleaning. The factory delivered price of the car ($1808) includes radio, air-conditioning system, directional signals, foam cushions, wheel disks, courtesy lights and electric clock.

Excessive Speed Is Biggest Cause of Highway Deaths

Excessive speeding by motorists was a greater factor in traffic casualties in 1949 than in any previous year, according to a survey made by The Travelers Insurance Companies. Accidents due to speeding resulted in 10,100 deaths and 398,700 injuries. There were 890 fewer deaths among pedestrians in 1949 than in 1948, but 180 more persons were killed while jaywalking between intersections than during the previous year. For the first time since the war, the percentage of 18 to 24-year-old drivers involved in accidents took a downward turn. However, youthful drivers are still involved in many more accidents than their number warrants, the report states.

Weed Guard for Fish Lures

Underwater weeds are brushed aside by a new guard, attached in front of any fishing lure to prevent snagging the hooks. Made of bronze, the guard has several swept-back prongs which spread the weeds to make a hole through which the lure can pass. The guard is permanently installed on its own leader and can be slipped forward on the leader to permit easy removal of fish.
Above, easily taken apart for cleaning, the igniter is sturdy made. Above, right, to start a fire, you spread charcoal on the igniter and plug in the cord. In 15 minutes the fuel is ready to burn. Right, the igniter makes a convenient hot plate during the meal.

Charcoal Igniter

Trying to get the charcoal burning is often such a chore that it takes most of the fun out of outdoor barbecues, but a new electric igniter solves the problem. The igniter, which consists of an electric heating element in a chrome-plated frame, preheats the charcoal or briquettes, assuring a good fire in just a few minutes. A stand is furnished with the igniter so it can be used as a hot plate to keep coffee and other food warm while the meal is being prepared on the fireplace grill.

"Dry Dock" Boathouse Has Battery-Powered Hydraulic Hoist

Your boat is hoisted out of the water, safe from dock damage due to wind and waves, in less than a minute by a battery-operated lift built into a canvas-topped boathouse. All you have to do is drive into the shelter, hook cables to the bow and stern and push a lever. The 6-volt battery, actuating a hydraulic pump, does the rest. There is very little battery drain, one charge lasting all season. The boathouse, fabricated in easily handled sections, can be put up by one man in a day. When taken down, the pieces pack compactly.
A COPY of Popular Mechanics Magazine that turned up miraculously in a remote mud village—that was a high spot in our 18 months of captivity by the Chinese Communists. How the magazine got into that part of China I have no idea but it was an old and welcome friend. We read it and reread it from cover to cover.

Chief Electrician's Mate William C. Smith and I were taken prisoner on October 19, 1948, when the light liaison plane I was flying ran out of gas and we had to land on an ocean beach. Ascribe that to a technical malfunction. The gas indicator showed that the tank was almost full even while the engine was turning over for the last time.

We sat down only 15 miles north of our home station, the Marine Air Base at Tsingtao on the Shantung peninsula, and we were surrounded at once. That same day we were hustled inland and turned over to a guard unit of the Chinese Communist army. We were held by that unit during our whole captivity while it slowly moved from one village to another.

We weren't treated badly. The Reds kept us under 24-hour guard and in each village we were confined to one hut much of the time, though often we were allowed to wander around the village when accompanied by a sentry. They gave us adequate quilted clothing and we ate as well, or rather as poorly, as everyone else.

Our standard diet was dark bread. Now and then when word of another victory over the Nationalists reached the village we all got a luxury meal of fish and rice. Even the best food was extremely poor by American standards.

Our chief troubles were worries about what was going to happen to us, and the fact that we had nothing to do. We didn't know if the United States was even aware that we had been captured. We received no news at all, month after month, and we began to think that everyone except our families had forgotten us.

The Chinese smoke a rough, uncured leaf tobacco and Smitty had been allowed to keep his pocket knife. We used up one week carving pipes for ourselves. We got hold of a block of reddish-brown wood and from it Smitty shaped a pipe with a curved stem and I carved myself a pipe with a flat stem, in two pieces and ornamented with a round brass band that originally may have been part of an electric fixture. It's a good pipe and I still have it.
We learned to speak a little Chinese and we spent a lot of time talking with Lieutenant Ho, one of the guard commanders who spoke fluent English. We became pretty good friends. Ho did his best to convert us to the Communist cause but we had one argument that he couldn’t beat. If the American system is so poor, we asked him, why is the average American the envy of the rest of the world? For myself I’d hate to trade life in America for existence in a primitive Chinese village.

Now and then in one of the villages a couple of old magazines printed in English would be located and brought to us. We’d spend a day looking them over. Mostly they were English editions of Chinese magazines that probably had been printed in Shanghai. Then one day Lieutenant Ho came into our hut with a smile on his face and a copy of Popular Mechanics in his hands. He’d found it somewhere and he knew we’d like to read it. He’d enjoyed it himself, he said.

It was the August 1947 issue, less than two years old, and we got a lot of enjoyable hours out of it. An article on the fine points of how to use a soldering iron interested me, as did a short description of the B-36 bomber. Smitty enjoyed the camera articles and the one on the sub-zero military testing laboratory in Florida. In the Seabees he had done some winterization work on electrical equipment. We both learned something from an article on weight-lifting, a kind of exercise we hadn’t tried before. From then on we practiced lifts with a stone grain grinder that the villagers used. It weighed possibly 50 pounds.

The Chinese, incidentally, are great weight-lifters. Vehicles of any kind are scarce, so if something has to be moved it goes up on a man’s back or at the ends of a pole that is slung across his shoulders. I saw one man staggering along with a good 500 pounds on his back.

Three months ago Smitty and I were beginning to think that we’d have to spend the rest of our lives in China. Nothing was happening and our guards acted as if they had taken on a lifetime job. Then, suddenly in May, we were taken down to the coast and released. The Navy flew us home.

I don’t think that captors ordinarily ask favors of their prisoners, yet Lieutenant Ho had one request that he made just as we were departing. It would be a big favor, he said, if we could find a way after we got back to the United States to forward him some more copies of Popular Mechanics!
Flat-Bottom Sailer Skims in the Breeze

Yachtsmen on California's lakes are bragging about a slender, flat-bottom sailboat that is so light on the water it skims along in the slightest breeze. It has a 350-pound cast-iron keel and carries 115 square feet of sail. Flotation tanks, fore and aft, make it safe even in rough water. With an over-all length of 20 feet and a beam of 4 feet, it is essentially a one-man craft. The flat bottom and narrow beam make it easy to haul on a trailer. The craft, called the Zephyr, is available in kit form or can be bought assembled and ready to sail.

Light as a feather on the water, the Zephyr will sail in a whisper of wind, above. It's becoming a favorite on California lakes. Below, flat-bottomed, the boat is easily hauled by trailer. It has a cast-iron keel.

Hot or Cold Weather, This Photo Film Doesn't Care

Working perfectly in temperatures ranging from 65 below zero to 140 above, a new photographic film has been developed by Armour Research scientists for the Army Signal Corps. Ordinary film is extremely fragile at 40 below zero and cannot be used in many cameras. The film base used is the cellulose derivative, n-propyl cellulose acetate. It was tested in a simulated camera apparatus which rolled the film back and forth over a series of sprockets. For the subzero tests, the entire apparatus was packed in a box with Dry Ice which lowered the temperature to 65 below.
Britain Exports

IDEAS IN MOToring

British auto engineers, seeking foreign buyers, have come up with some novel ideas in cars and buses. Above is a piggyback bus which gives passengers on the upper deck a complete view of the countryside. Luxurious interior furnishings cater to the passenger. Britain hopes to export the twin-deck bus.

Right, the Silverstone is a sports car with racing-car lines. An extra-wide chassis keeps the car stable even at high speeds. Racing models of this car have won many victories in Europe. Note the exposed front-wheel suspension system and headlights.

Below, the luxurious Aston Martin sports sedan has a long, curved hood. Its seats are covered with white leather. A four-cylinder engine powers the car. The Aston Martin, originally a racing car, has held European records for many years. This passenger model retains much of the racer's speed.
Spinning a Span To Foil the Wind

By Paul O. Anderson

It takes a lot of wire to build a bridge. Out in Tacoma, Wash., where engineers are building the third longest suspension span in the world across the treacherous Narrows, the John A. Roebling's Sons Co. has "spun" 104,667,656 feet of No. 6 wire in two 20\(\frac{1}{2}\) -inch-diameter cables that support the bridge roadway. These cables are being wrapped with an additional 4,832,000 feet of wire to protect them from the elements. The job is one of the final ones before the bridge is opened in September.

The 5979-foot structure replaces one that was destroyed by a windstorm in November 1940. Its 2800-foot central span is exceeded only by the 4200-foot Golden Gate span in San Francisco and the 3600-foot central span of the George Washington bridge in New York City.

Early in 1949 steelworkers started erecting the 507-foot main towers, using the old concrete piers with slight modifications. The towers were completed by mid-July and turned over to the Roebling's Sons Co. for cable spinning. But before the main cables could be spun it was necessary to string catwalks from shore to shore.

This work had to be carefully balanced, since the two tall towers are not embedded in the concrete piers, but stand on 3-inch-thick steel baseplates. The catwalks closely followed the planned curvature of the main cables so workmen could conveniently adjust wires as each cable was spun.

The hundred million-odd feet of wire used in the cables figures to 20,738 miles, or a long way from here to there if stretched out in a single line. The wire is slightly smaller than a lead pencil. Each cable contains 8702 individual wires made up into 19
strands. These do not contain 458 wires each, as you might think. The Roebling’s Sons Co. has learned it is best to lay 460 wires in each strand except those at the top and bottom. Engineers say the cable compacts to a more perfect circle if this is done.

Spinning the cable takes plenty of man power and machinery, but the fundamental operation is not too difficult to understand.

After the catwalks were strung, master wires were stretched across—one for each cable—and carefully surveyed. This was done at night to minimize errors introduced by heat waves. A theodolite was set up in the east tower leg directly below one of the guide wires and was sighted on a marker on the corresponding leg of the west tower. This horizontal line of sight was established 240 feet above the water, or just below the lowest point of the main cable sag at mid-span.

After dark surveyors took their stations. One stood at mid-span and lowered a target in the line of sight while another at the theodolite took readings to determine the actual height of the guide
Third longest suspension span in world, Narrows bridge has 2800-foot central span and 507-foot towers.

Wire. Engineers at the spinning control station on the east anchorage then compared the readings with proper values as determined through earlier calculations.

The difference of the actual reading, corrected for temperature, and the proper value next was multiplied by a coefficient to determine how much to let out or take in on the wire. With the job calling for perfect coordination, communications were all important. Walkie-talkie radios and an elaborate telephone system were used at the various stations. The operation was repeated for the other guide wire.

Prior to this, spinning machinery had been set up on the east anchorage. An endless tramway running rope operated from an electric motor at this point, across the top of the towers, down the other side and returning. On each side of the running rope was a spinning carriage: A triangular frame with two 4-foot diameter, freely rotating sheaves. The electric motor pulled this running rope in either direction. As one spinning carriage was hauled across the Narrows, the other was returning. Other parts of the spinning gear were a hydraulic unreeling machine, a counterweight tower and various guide sheaves.

Reels of wire were placed on the unreel-

During construction catwalks of open mesh were assembled in sections and slid down the supporting ropes.
Photos and diagram below show the operation used in spinning over 100,000,000 feet of wire in bridge cables. Above, workmen in spinning pit put new wires on spinning carriage and send it on its way. The system of sheaves and guides used for spinning is complicated. A counterweight tower (left) keeps the wire at an even tension and shows the unreeling motor operator if his motor is synchronized with running rope motor.
ing machines. run through the counterweight tower, around the spinning carriage wheel and secured to an eye bar embedded in the huge concrete anchor block.

The tramway motor was started, carrying the spinning carriage on its way. The unreeeling machines operated in synchronism with the tramway motor. When there was a difference in speed of the two, an operator saw the counterweight rising or falling. A slight adjustment of the hydraulic motor kept the wire unreeeling evenly.

The tramway running rope traveled at 700 feet a minute, paying out 1400 feet of line a minute. As the spinning carriage approached the far side, a selsyn indicator warned the operator to stop. In the meantime an empty carriage arrived at the east anchorage and workmen slipped on loops of the stiff wire in a matter of seconds. A reversal of the running rope sent the carriage on its way.

Two strands were spun at once, taking about 44 hours for the job. The operation went on day and night, in rain and snow. The first two weeks of spinning saw only one strand completed, but before two months had passed, erection manager Robert Cole was grinning at the records made.

"You know," he said, "it's only possible (Continued to page 244)"
This young craftsman assembled his own blackboard and stool while the girl built herself a wheeled horse

Put-Together Toys From Plywood Parts

YOUNG roughnecks equipped with a new building set made of precut plywood parts can build their own large-scale toys, play with them and then knock them apart. The parts, consisting of wheels, dowels and odd-shaped pieces, fit together in ingenious ways to build several toys, satisfying both the creative and destructive urges of the youngster. There are no screws or bolts. Pegs serve as fasteners for the set. The youngster can make his own blackboard which can be converted into an easel, take it apart and make a desk, rocking horse or rolling cart. Other possibilities are a table, stool, bench, airplane, house, car and rocking chair. The set is available in three sizes consisting of 6 to 21 flat pieces. Sixteen toys can be made with the largest set.

Left, designer Anne Tyng, who developed the make-it-and-break-it toy, poses behind one of her kits. Right, the child-built car may not be streamlined, but it will roll and that will thrill any creative youngster.
The "BIG BLOW" Takes the Diesel's Challenge

There was almost a full mile of boxcars behind the X-50, running as an extra out of Los Angeles for Salt Lake City, when the big locomotive crept through San Bernardino and started up Cajon Pass grade. Engineers sometimes blew their boilers out on the Cajon hill when steam was king. It's the longest, toughest grade on the Union Pacific system. These days the standard power for a heavy freight is three diesel units at the head end of the train plus a diesel pusher behind.

Yet the X-50, the locomotive that looks like a diesel and sounds like a jet plane, was tackling the hill by itself with a single pusher at the rear of the train. The engine's high whine and its steady exhaust roar grew a little louder when it encountered the grade; aside from that the engineer could hardly tell that he was operating a new kind of engine that runs on wind and that may cause a revolution in railroading.

Sometimes called the "Big Blow," the X-50's power plant is a gas turbine similar to a jet-aircraft's engine. A jet airplane gets its propulsion from the thrust produced by hot, pressurized gases leaving the exhaust at high velocity. But in the locomotive the turbine itself makes use of the energy. The turbine shaft is connected through reduction gears to generators and the generators provide the electric power for the traction motors that turn the axles. There is no jet effect.

Built by the General Electric and the American Locomotive Company to test the possibilities of gas-turbine power plants for railroad use, the locomotive has been in heavy-duty freight service on Union Pacific's western divisions for much of the past year.

In essence the road was asked to regard the locomotive as equal in power to three diesel units and to use it accordingly. During the tests the X-50 has accumulated several thousand hours of main-line operation in temperatures as high as 110 degrees and at altitudes ranging from slightly above sea level to as high as 8000 feet with remarkably few difficulties. There have been a few minor breakdowns of auxiliary equipment, but failures of the main power plant have been negligible.

The initial testing period ends this summer and to date the turbine has amply confirmed its design calculations. It is in fact more efficient today than when it first went to work because several modifications suggested by operating experience have been made. One or more General Electric technicians ride the locomotive in addition to its regular crew, and an extra caboose is attached right behind the locomotive to carry the specialists and test equipment.

The X-50 is 83 feet 7½ inches long and weighs 250 tons. It develops 4500 horsepower for traction purposes and has a continuous tractive effort of 77,800 pounds at 18 miles per hour. It is geared for 69 miles per hour top speed. The power plant itself is amazingly simple and weighs six pounds per horsepower, about half the weight per
horsepower of a locomotive-type diesel engine. The gas turbine-electric locomotive develops 53 horsepower per foot of length as compared to 30 horsepower for a diesel-electric.

The turbine draws in 70,000 cubic feet of air per minute and compresses it to six times normal atmospheric pressure in a 15-stage axial-flow compressor. Burning fuel heats the air to about 1400 degrees in six combustion chambers. The hot compressed gases then expand through a two-stage turbine and are discharged upward through the locomotive roof. The exhaust velocity is 150 miles per hour and the volume of gas that is discharged amounts to 150,000 cubic feet per minute.

Two thirds of the power generated by the turbine are used to drive its compressor and one third is left for useful work. The total useful power is about
4800 horsepower, of which 300 horsepower is used to operate the auxiliaries.

The power plant was designed to operate for 15,000 hours between overhauls, about three times the working period of a diesel, and has only one major moving part. Vibration and mechanical stresses are low because of its lack of reciprocating parts. Such elements as combustion chambers can be easily replaced.

From the standpoint of fuel consumption the gas turbine is less efficient than a diesel and consumes one third as much fuel when idling as when under a full load. It idles at 5000 revolutions per minute and develops full power at 6700 revolutions per minute. On the other hand, except during the starting operation, the turbine uses just about the cheapest fuel available. It burns grade 6 or Bunker C oil, a tarlike refinery residual fuel produced in the process of refining crude oil. This substance is heated by steam coils, filtered and then additionally heated to 210 degrees. At this temperature it is liquid enough to be handled like diesel fuel and is injected into the combustion chambers in an atomized state. The locomotive carries 6600 gallons of Bunker C in tanks in its frame structure, a supply that is sufficient for 12 hours of operation at full load.

Active research is being carried on by some agencies in the development of a successful means of using powdered coal for fuel in gas turbines.

The power plant is only 19 feet long and occupies only a portion of the locomotive's engine room. The balance of the space is taken up by the traction generators, reduction gears, a small and compact steam boiler for heating the Bunker C oil, the electric-control equipment, lube-oil cooler and a 250-horsepower diesel engine. The diesel is used for starting the main power plant and for hostler service inside a yard when the turbine is shut down.

The X-50 can be warmed up, inspected and made ready to go in about 20 minutes. The starting operation consists of first starting the diesel auxiliary and then using the diesel to crank the power plant up to idling speed. To do this the diesel drives a generator which supplies power to one of the main locomotive generators that, for this operation, acts as a motor, turning the turbine shaft. During its acceleration period, the power plant burns diesel fuel and the change-over to Bunker C is made as
X-50 with its phenomenal power can pull almost a mile of cars up toughest grade on the Union Pacific system.

Cutaway shows the location of the powerful turbine and other main parts. The starting diesel engine is in the rear. Except for the turbine, most of the parts are standard components used in ordinary diesel-electric engines.
Vertical Broiler

You can broil steaks vertically alongside the fire in a new charcoal grill, thereby preventing fat from dripping down into the fire and causing sudden flare-ups. A narrow V-shaped pocket holds the charcoal. The meat is clamped in wire holders and suspended along the two sides as close to the charcoal as the chef desires. This leaves the top of the grill free to boil coffee or fry potatoes for the outdoor meal. The grill can be carried by the handle like a bucket or can be disassembled and packed flat in a carton.

Beet Thinner

Four rows of beets are thinned simultaneously by a new tractor-drawn machine which systematically rips out part of the vegetables in order to give the remainder more room to grow. As the machine is pulled down the field, its four cutting units whirl at right angles to the rows. Each cutting unit has eight knives which dig under the surface of the soil to cut out part of the beets, thus thinning each row. The machine can be used on beets of varying sizes and can be operated in any soil moisture condition in which a tractor can operate. It is estimated that the machine reduces thinning labor from one third to one half that required by conventional methods.

Film Labels

Photographers can see at a glance what kind of film is in each holder when they use adhesive-backed labels for identification. The labels come in five different colors, one for each of the basic film types. In addition, the trade names of the popular films are printed on the labels. Made of durable waterproof cloth, the identification labels are self-sticking and can be transferred from one holder to another easily.

Wings whose position can be altered in flight make it possible for the new Martin jet light bomber to use short air strips.
Aluminum Racer

Maintenance is just about zero on an aluminum-alloy racing runabout that is rustproof, leakproof and unaffected by sun or weather. The 13-foot boat has an exceptionally sharp turning radius and weighs only 800 pounds, including the inboard engine. It will pull several water skiers, can be used for racing or it will idle down enough for trolling. With the standard engine, the boat skims along at 32 miles an hour and this speed can be increased considerably for racing by "soup ing up" the engine. The craft is available in kit form, which includes a completely fabricated hull, a 60-horsepower marine engine and hardware. If the buyer prefers, he can buy it completely assembled.

Raspberry Picker Has the Shakes

Harvesting five acres of raspberries in a day, a mechanical picker shakes the ripe berries loose and collects them as it rolls along between the rows. Built by a Washington berry farmer, the picker has two 1½-horsepower engines, one to move the machine forward, the other to operate a vertical shaker arm that has a series of horizontal fingers. The ripe fruit falls to a flat bed beneath the shaker arm and rolls on a conveyor belt that transports it to the rear.

Paint- Tube Caps

Artists save paint and, at the same time, keep their sketch boxes orderly with a set of molded lead caps that serve as a reservoir for the paints. Screwed on to the tube in place of the original cap, the lead caps permit the artist to work directly from the reservoir, making wasteful blobs on the palette unnecessary. The paint will not harden in the reservoirs during short periods. If the paints are to be stored for a long time, a layer of oil is put over them and the lead lips folded down. The square sides of the reservoirs hold the tubes in place when the box is carried.
There are right and wrong ways of falling. Take these tips from a man who taught the Navy how to tumble safely and . . .

LAND ALIVE!

TWO MEN are trapped by smoke and flames on the fourth floor of a burning building. Leaping from the window is their only possible escape.

One man, even though death is certain in the fire, is afraid to jump. His friend slugs him on the jaw and throws him out of the window and he lands flat on his back. The braver man then leaps out and lands on his feet.

Which of the two men will survive?

It will be the coward who lives, though badly injured, while the man who landed on his feet will be speared through his vital organs by his own thigh bones.

Countless cases of men falling from great heights were analyzed by the Navy and it was found that by far the best chance of survival occurred when the victim landed flat on his back.

Falling from a lesser height, on the other hand, the least injury will be suffered when the victim, for instance a man falling from the roof of a two-story building, takes the initial shock on his feet but distributes the force of his fall by letting his body roll.

When you trip, moving at slow speed, extending arms is easiest way to break the fall before landing flat

By Eugene M. Hanson

Photos by the Author
The Navy considered the problem of how to fall safely so important that a special training film was made during the war to teach such know-how. The man who demonstrated the various techniques for falling safely was a former professional tumbler, Bruce Connor, who is now a physiotherapist in Los Angeles and spends a good part of his time teaching paralyzed war veterans how to walk on crutches, and in case of accident how to fall off the crutches without being hurt.

Connor says many lives would be saved and countless injuries avoided if every school child were taught, as part of the physical-education curriculum, how to take a fall properly.

He sums up the findings with two bits of advice:

"First, always try to roll your body in the direction you are falling; second, always try to land as flat as possible."

This applies to ordinary falls, those which can happen to anyone at any time, just as much as to the more spectacular accidents, Connor makes it clear.

He who slips on ice, a rug on a smooth floor or a roller skate usually falls backward, and the point most susceptible to serious injury is the end of the spine. If you remember to try to land flat, you will arch your back and thus keep from landing on the vulnerable tailbone.

In falling forward, on the other hand, the exact technique depends on how fast you are moving. If you trip at ordinary walking speed, you can ordinarily save yourself by catching your weight on your hands in the push-up position. If you are carrying something, drop it. Don't try to catch your weight on one arm. You're likely to break it.

If you fall when running, try to go into a football roll. Twist sideways and land with a rolling motion, hip, side and shoulder taking the first shock, and with knees bent.

(Continued to page 242)
Raising the Roof

Engineers who erected a new building for Trinity University at San Antonio, Tex., literally raised the roof. They simply poured the big concrete roof on the ground in 46 by 73-foot sections, then raised the slabs into position with eight hydraulic jacks. One of the sections weighed 168 tons. A central control panel was used to regulate the movement of the jacks as the big slabs were eased up into position.

Ten-Mirror Fishing Lure

Ten tiny mirrors on a new angling lure reflect the sunlight to catch the attention of the fish. The highly polished mirror surfaces are cut into both the concave and convex sides of the lure. They reflect both infrared and ultraviolet light, which some scientists believe are the wavelengths seen by fish.

Live-Bait Lure

Live bait is kept alive and allowed to move naturally with a new lure clamp. Gentle spring pressure and serrations on the holding pads prevent escape without injury to such bait as minnows, crabs and frogs. As many as 15 to 21 casts can be made with the same live bait. The lure is made in three hook sizes.

Chemically Treated Fabrics Resist Mildew and Rot

Fabrics treated with a new chemical become highly resistant to mildew and rot. The treatment promises to gain back, for many fabrics, the fields that have been lost to the plastics, such as shower curtains and sunshades. Rot and mildew largely result from the growth of fungi and bacteria on textile fibers. The new chemical is poisonous to these organisms but does not affect higher forms of animal life.
YOU ARE RED LEADER and the three other pilots in your formation are right behind you, holding together in a tight group at 600 miles per hour.

In the cockpit of the F-86 Sabre you make another routine instrument check. Tail-pipe temperature: 600 degrees Centigrade. Percent of power: 95. Fuel: one third remains. Everything is satisfactory and you glance again at the aircraft altitude indicator. It's steady at 43,000 feet.

You have been at altitude for more than half an hour and are beginning to feel it. You've got a touch of the aerial bends in spite of your oxygen and in spite of the pressurized cockpit that puts you more than a mile below your actual altitude. Your knees and elbows have begun to ache, you are tired and your feet are freezing cold.

The cockpit is heated, but the heater doesn't entirely compensate for the outside temperature of minus 45 degrees Centigrade. Everything in the cockpit is icy cold and you are wearing gloves.

Your eyes seem to be affected by the altitude, too. There's nothing in the vast sky to focus on and if you were staring at infinity you might fail to see an aircraft only three or four miles away. Fortunately, radar can find your targets and guide you to them.

The clock tells you that the point of no return is approaching and that it's time to go home. Pressing the transmitter button, you get ready to talk. "Red Leader to

By Thomas E. Stimson, Jr.
Sabres swooping down on a low target. Smoke trails indicate engines are operating near their full power.

Red Flight,” you say, and pause. Talking is a real effort and you are forcing your voice up from your chest. “We are starting back to the base now. Making a 180 right.”

You make your turn as smoothly as you can, because in the thin air it’s easy to overcontrol. And you turn in a wide sweep, careful not to exceed three Gs of pull. In a tighter turn at this altitude, the plane might simply shudder along in a high-speed stall.

It doesn’t take long to get down to 30,000 feet. From here on in the jet is a delight to fly. The cockpit is so quiet that you could hear the thump of your machine guns if you fired them. The plane is as stable as an airliner, even though you are pushing 650 miles per hour, and it handles so smoothly that you can fly tight formations that would seem foolhardy in propellered aircraft.

The elevator and aileron controls are operated through hydraulic boosters and with this help the stick doesn’t tighten up exorbitantly even when transsonic speeds are reached.

Relaxing in the cockpit on a straight course, you have to remind yourself that with just a little pressure on the controls you can make a six-G turn. You won’t black out, with your antigravity suit, but your oxygen mask will try to pull loose from your face and your goggles are apt to slide down on your nose. Your head sags onto your chest in six-G maneuvers and your arms and legs grow as heavy as lead.

The swept-wing F-86 is the newest, hottest fighter plane in military service. It has been clocked, combat loaded at 670.981 miles per hour. Ceiling hasn’t been announced but the plane is designed to intercept jet bombers that reputedly are flying...
nearly nine miles or more above sea level. Brand new techniques and maneuvers are being invented to make fullest use of the plane’s superior qualities.

The first Sabres that came off the line at North American went direct to March Air Force Base in California, where the famous First Fighter Group was given the job of developing the tactics that would make best use of the plane’s speed and climbing ability. The 27th (Falcon), the 71st (Winged Mailed Fist), and the 94th (Hat in the Ring) squadrons of the group had their beginnings in the first World War, with Nieuports and Spads. The group has done the service testing of the F-80, the P-43, the P-38 and other well-known fighting aircraft.

Today the First Fighter pilots are flying their newest jets in the formations that were so successful in the last war. The basic combat “finger” formation of four aircraft still works extremely well. In this formation the planes are arranged like the finger tips of the right hand, with the leader in front, one wingman behind and to the left, and with the third and fourth planes trailing to the right. In simulated combat, the planes spread out but still maintain their relative positions. In spite of their extreme high speed, the new aircraft operate as teams and probably always will.

Overhead view of an F-86, emphasizing the 35-degree sweepback of its wings. Below, pilot’s hands held up while machine guns are being loaded assures ground crew that guns will not be accidentally discharged.
The Sabres carry six .50-caliber machine guns and clusters of air-to-air rockets. The tactics being evolved today are based on present weapons, with modifications to make best use of new weapons and new situations as they develop.

The prodigious rate at which a jet engine consumes its fuel has led to several revisions of ordinary flight routine. Instead of circling around leisurely after take-off, the jets head at once toward their destination, climbing for altitude and forming up as they go. A pilot who is a minute late in getting off the ground would have difficulty catching up with his companions; fuel is too precious for the other pilots to wait until he joins them.

There is no monkey business about landings, either. When you stand in the control tower at March and watch a group of the jets come in, virtually diving at the runway, you wonder if they are putting on a special show. Anyone in the tower will tell you that such approaches and landings are standard. For one thing, the swept-wings have to fly fast to maintain control. Too, the pilots have no time to waste once they have descended to low level because of the high fuel consumption.

Landing procedure actually begins while the planes are still out of sight. "Red Leader requests pancake for four chickens" is the way a leader may ask permission to land. The tower replies, telling the leader what runway to use, the altimeter setting at the field and the condition of the wind.

Now the planes are only five miles away and beginning their deceleration process. Over the radio the leader gives the command, "Speed brakes out, NOW!" At "Now!" each pilot pushes the button that extends his fuselage flaps. Simultaneously and almost instantaneously the four aircraft slow from an original 600 to 300 miles per hour. The pilots' heads are thrown forward abruptly by the fast braking.

On the base leg, still high above the field, each pilot chops his power, drops his landing flaps, and extends his wheels. Slots in the leading edge of the wing automatically extend themselves to provide better control.
at slow speed. One at a time the pilots make diving turns that line them up with the runway and then drop onto it. On the ground the nose is held up so that the wing creates a drag, helping to slow the plane. Not until the speed is down to 90 or 100 miles per hour does the pilot drop the nose wheel on the ground and begin to apply the brakes.

The aircraft land in a staggered formation in good weather, trailing each other at 1500-foot intervals. In poor visibility they are talked down by Ground Control Approach operators.

The jets can operate at low and medium altitudes. Now that they have speed brakes that allow them to fly at reduced speed they are a match for slower aircraft that previously could outmaneuver them. The jets actually are at their best at high altitude where they get more miles per gallon of fuel and where piston-engine aircraft are at a disadvantage.

About half of America's present jet pilots are excombat flyers who stayed with the Air Force after the war. They made the transition to jets without much extra training and immediately were "sold" on the new planes.

Augmenting these experienced pilots are the younger men graduating from the training bases. The first postwar students got instruction in a series of successively faster aircraft before they were allowed to try out the jets; now it has been found that some of these steps (Continued to page 226)
Hybrid Auto Is Mobile Welder

There's a little of everything and a lot of ingenuity in a hybrid automobile that started life as a Lincoln Zephyr and has become an efficient mobile welding outfit. Built by Manuel Farmer of Lancaster, Calif., the car contains assorted parts from a Chevrolet, Dodge, Pontiac, Oldsmobile, GMC, plus, of course, the original Zephyr. The Chevrolet engine is located in a box behind the front seat and it powers the vehicle and also a 200-ampere generator mounted under the hood where the original motor was located. The radiator is now just three inches in front of the fire wall and cool air is drawn back to the engine through two pipes under the front seat. The chassis was lengthened to allow space for extra gas cylinders. Farmer uses the hybrid machine as he travels in the desert doing on-the-spot welding for ranchers.

Silicone Automobile Polish Is Immune to Heat of Sun

Silicones — the synthetic substances which protected military equipment during the war—are stirred into the formula for a new car polish. The chemicals are water repellent and are not affected by high temperatures. They produce a glass-hard surface that prevents moisture and heat from penetrating paint and chrome surfaces. One application of the polish lasts six months, according to the manufacturer.

Ground-Hugging Motor Car Being Made in Sweden

Cruising the streets of Stockholm is a new Swedish car, built so low it seems to glide along the ground. The little car seats two and is designed to sell for about $386. When the plant is in full operation, about 50 of the cars will be turned out each week.

Information not listed on articles in the index, starting on page 12, frequently is listed in the WHERE-TO-FIND-IT LIST, available without charge from Bureau of Information, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11
Television Borrows Movie “Tricks”

“Telepencies” depicting such widely different scenes as a Paris street or an Arizona desert are being used as sets in television studios. They consist of a translucent screen as large as 12 by 18 feet on which a photograph of the desired locale is projected, blending in with stage properties in the foreground. Above, insert at upper right-hand corner shows how the live actors in the foreground blended in with the projected studio set on an actual TV screen.

For a poolroom scene, below, left, the actor is realistically “shooting” ball projected on screen. Below, right, a composite television scene, including actors, “props” and projected background. Adapted from motion-picture practices, the television technique requires pictures that are made in special perspective.
The sea is calm here, but there are days, lots of them, when closing the mouth of the trap is a battle with the waves. Note the pulleys on the larger dory. Below, sketch of the underwater trap.

Below, in the early morning light, a fishing boat, towing its dories, heads out to tend the nets.
ROMANCE and fishing villages go together. Anybody who has ever heard the put-put-put-put of the squat fishing boats as they slip out of the harbor in the quiet before the dawn or as they return in the sunset heavily laden with the day's catch will agree. The small-boat fisherman, and there are thousands of them along our coast lines, still does battle with the elements much as his ancestors have done for centuries. It is still man against the unpredictable sea.

Out of Newport, R. I., more than 100 fishermen haul in 75,000 pounds of fish weekly, nine months out of the year, with giant net traps. Like a mammoth underwater rat-trap, the net is anchored a mile or so offshore. Fish by the hundreds swim in through funnel-shaped openings to be entrapped. Early each morning, the fishing boats, trailing several dories, go out to the nets. Rugged fishermen, bronzed by the sun and wind, take to the dories to pull the heavily laden nets to the surface with a heave-ho.

As the trap nears the surface, the dories work closer and closer together until the fish can be scooped into the "mother" boat with a winch-operated basket net. Today's catch aboard, the crew resets the trap for tomorrow's catch. On the trip back to the unloading docks, the fishermen are kept busy sorting the catch, which is mostly scup.

For nine months each year, these fishermen tend their nets seven days a week. During the three mid-winter months, they stay ashore, mending their nets, working on their boats and swapping yarns.

It's a long, tough pull to haul in a trap with its load of fish, especially when you're standing in a dory. Below, the fishermen transfer the fish from the trap to the power boat. Most of the fish here are scup. Also caught are bass, mackerel and flounder.
Midget Motorcycle Built to Scale

Built to scale, a half-size motorcycle is the pride and joy of Yoji Ono, a Hawaiian, who spent almost a year on the project. Patterned after a standard Harley-Davidson cycle, the machine uses wheelbarrow wheels and a small concrete-mixer engine. Fenders, gasoline tank, handles, seat and most other parts were hand made by Ono. He travels more than 50 miles on a gallon of gasoline and the cycle has a top speed of over 55 miles an hour.

Plastic "Skin" Protects Paint

By covering the surface of the paint with a plastic sheet, you can prevent the formation of the thick skin that usually forms when you put a partially filled can away after use. The plastic is placed directly on the paint, sealing out the air. In effect, the plastic does exactly what the paint itself would do if left uncovered. It can be wiped off and reused any number of times and comes in sizes to fit both gallon and quart-size paint cans.

Child-Size Bulldozer Looks and Works Like the Real Thing

Scaled down to child-size, a pedal-operated bulldozer is a realistic model of a Caterpillar diesel tractor, complete with everything except the engine noise. The endless track rolls over four rubber-tired wheels and the tractor is steered by clutch levers just like the real thing. When one of the steering levers is pulled, the track on that side is raised, allowing the other track to swing the toy around. Another lever raises and lowers the blade. Energetic youngsters will use it to clear snow off sidewalks this winter.

If you'd like to take a long trip, travel one megaparsec, which is over 19 quintillion (19,000,000,000,000,000) miles and is the unit used by astronomers to describe the distances of remote galaxies.
Gas Pump Ends Pouring Spillage

Transferring gasoline from a large container to a smaller one, a dangerous operation when done by the pour method, is made safe by a hand pump that eliminates spillage and explosive fumes. The pump, which handles six quarts a minute, has interchangeable caps that screw on any standard fuel can. It also pumps gasoline from your car into the gas tank of power mowers, outboard motors and camp stoves, eliminating the need for keeping a separate gasoline supply around the house or summer cottage. Refueling outboard motors while out on the lake is done safely from a seated position when the pump is screwed into the fuel storage can.

Ride in Comfort With Car Headrest

With the addition of a comfortably padded headrest, the front seat of your car becomes as comfortable as an easy chair. The metal frame slips over the back of the seat and can be adjusted to any desired height. It enables the passenger to sleep comfortably on long trips and makes those long waits while your wife shops more enjoyable.

Mail Buggy

Plowing through the mud roads near Bartelso, Ill., is a weird vehicle that combines the traits of a tractor and a car. It was built for a rural mail carrier whose route carried him over wheel-deep mud roads in river-bottom land. Mounted on a Ford model-A truck chassis are four tractor wheels to give the vehicle additional road clearance and power in low speeds.
well with 21 years of experience and behold—one shipyard.

"My shipyard actually started in my old tool chest," he says, "and I still have some of my first tools in my box here at the plant today. One of the originals is an old iron smoothing plane."

Before he acquired his first real boat at the age of 10, Derecktork concentrated on building models. He built some dandies—schooners (two or more masted vessels with the mainmast aft instead of forward such as is found in the yawl or ketch) and some de luxe models of old-fashioned square riggers with two or three masts. He would work for months striving for perfection in a model. When it was finished he would take the model to the shore and let it go. This amazed his chums and Bob never bothered to explain that a man with a real feeling for ships knows that they have to be free.

The summer Derecktork was 10 he heard about a sailboat that had been sunk and practically abandoned off the shore at Rye,

By Wayne Whittaker

Along the old Boston Post Road where it swings out close to the shore on Long Island Sound at Mamaroneck, N.Y., stands a new shipyard that has the old-time shipbuilders talking all the way from the tip of Maine to Sandy Hook. Although this shipyard is only three years old, down its ways are sliding modern masterpieces in the form of sleek sailing yachts that make many a veteran craftsman catch his breath.

The man to whom the old salts are paying tribute is 28-year-old Robert E. Derecktork, who looks more like a husky blond sailor than a shipbuilder.

"Bob knows as much about boats as any man on the coast," said one admirer, "and he's hep on combining old-time hand craftsmanship with modern methods. He even makes most of his own tools. Where he ever learned so much at his age is a mystery. He sure didn't pick it up at Swarthmore College or driving a torpedo boat for the Navy."

"It ain't no mystery to me," said another old-timer as he tested a pinch of snuff. "I've seen that boy 200 miles out at sea when he was 11 years old in a sailboat he had rebuilt from an old wreck."

Here's Derecktork's own recipe for starting a shipyard: Take a few old tools such as a chisel, a brace, a hammer, a smoothing plane and add to these a seven-year-old boy with a "fever" for boats. Mix these

You could go 'round the world in this Megginia sloop which Derecktork says is his most interesting design
Once a seven-year-old boy with a toolbox and a "fever" for boats, Derecktork now builds his sleek yachts here a few miles from White Plains where his family was living. It was a 15-foot sloop with jib and mains'l. The rudder was off, the deck was rotten and the mast badly broken. Bob found the owner who said he would be glad to sell it for a small sum. His father, a nonseagoing attorney, was not enthused at the idea but finally weakened.

"I tell you I was in a sweat," Derecktork recalls. "Two of my friends helped me get that boat home. One of the fellows was about my age and the other 18. We fixed up a carting rig out of an old Buick chassis and finally got the wreck into our back yard. I worked all winter on that boat and by spring it was seaworthy. We launched it by running a cradle down into the water off the beach and christened it Spray."

Two years later Bob sold the Spray for $150. He needed the money to help buy materials to build a 26-foot sailboat he was designing himself. First, he had offered the design to his manual-training teacher and suggested it as a class project. The teacher told him he was too young and to go back to building his little models.

All that winter Bob worked in the family basement on the vital and preliminary loft work which is the first step in building a boat.

"I had never seen a boat built and had to depend on books and magazines for my information," he said. "First, I painted the basement floor white (you can imagine how I startled the family) and then laid down the lines from my plans for making the templates."

Determined young Bob bought mahogany planking (he says Philippine mahogany was cheap in those days), oak for the frame and fir for the decks. He even built a hollow mast for his boat. Today, all the masts on the Derecktork boats are of hollow construction. These masts are stronger and lighter weight than others, he says. However, his first mast was made of pine and today he uses only Sitka spruce from the

Blueprint in hand, the youthful shipbuilder checks over the details of a sailer new under construction
When spring came the templates were all made, materials were at hand and Bob started construction of the boat in the back yard on a floor he had made.

He laughed. “I didn’t make the old mistake of building that 26-footer in the basement. Instead I built a shop around the boat as I went along. When I got through I had a building 12 feet wide, 10 feet high and 30 feet long. I guess by this time the family realized they had a shipbuilder on their hands. I can’t say they were enthused—just resigned.”

The Spindrift, as he named the boat of his first design, was finally launched from the public beach at Rye when Derecktor was 15. The boat had three bunks and was designed for long trips. The designer and builder says he did not sleep a wink the night before the launching—but he really didn’t need to worry. The sturdy Spindrift is still operating off the New England coast. Derecktor
inspected it only recently and found it shipshape—including the original hollow mast which he had made with wedges and improvised oak frames because he didn’t have enough clamps.

The mast still bears a scar or two of one of Derecktors most harrowing experiences off the coast of Maine. He and another boy had sailed out of Cape Small at the mouth of the Kennebec River headed for Nova Scotia. Some sparks from the stovepipe set the sail on fire. It went up like a Roman candle and almost set the mast on fire. The boys worked like fury with wet mops and finally extinguished the blaze. They managed to limp back to shore, repaired the mast and got a new mains’l. Another time out in the Spindrift, Bob was caught in a storm 100 miles at sea out of Nantucket. Buffeted by 25-foot waves, the young sailor had to heave to for 36 hours. He kept just a little sail up and kept the Spindrift headed at an angle to the wind. As usual he returned home safely.

Experiences at sea and working summers in shipyards helped build up Derecktors knowledge of how a ship should be built. He learned that in finishing hulls there is no substitute for a trained eye and sensitive hand using wooden planes and hand sanding. The old-timers taught him about wood. Today, he can recognize a dozen kinds of mahogany at a glance. He selects his mahogany today—not by the load—but by the piece. His favorite wood for trim is Honduran or Guatemalan mahogany. However, he says, African or Philippine mahogany is best for hulls because of the long lengths available and the great strength of the wood due to its interlocking grain.

Honduras mahogany works easily and resists contracting and swelling from the water. He uses oak for frames and backbones and most structural members. The planking is usually either Virginia or Port Oxford (Ore.) cedar in the small boats and for the heavy ones he uses yellow pine or mahogany. For the de luxe yachts or any craft designed for use in tropical waters, Derektor uses teak for planking. The teredo worm does not attack teak.

When it comes to tools, he prefers rock maple for making planes and some of the bottom pieces are made of ebony. Derektor has a huge ebony log in his plant that he found in a friend’s basement over in Riverside. A seagoing ancestor found the log a hundred years ago along the coast of Africa and brought it home as a curio.

Specially made tools, redesigned and built by Derektor, include bevel squares, boring bars, scrapers, gouges and chisels, planes, slices and adzes for heavier work, various types of hammers and both wood and metal mallets. Derektor says commercial bevel squares are too large and improperly designed for measuring internal angles between small members. His assortment of special planes consists of smoothing planes, jack and joiner planes, molding and spar planes, as well as “scrub” planes for cleaning a big rough piece of wood. There are special low-angle planes for working cross-grain and riven-grain woods and high-angle tools for smoothing and joining soft and uniform-grain woods. The handles are carefully positioned so that the pressure is exerted behind the blade and downward.

One special mallet for calking is “alive”...
Shipbuilder at the Derektor yard is clamping down the timbers on a backbone preparatory to drilling and gives off a certain ring when calking is put in with just the right amount of force. Derektor says that when calking is put in with a wheel one cannot tell when the cotton is hard enough.

Derektor considers the adz an important and neglected tool—neglected in both use and design.

"The shape and size of the blade and handle, the angle between the blade and handle and the curvature of the head in both directions are subtle and important," he says. "The handle must be so shaped that the hand is leading the cutting edge rather than pushing it. Also, the bevel of the cutting edge must be such that the adz will neither bite too deeply (when the angle is too acute) nor must it be so blunt that the adz will bounce back."

Of the big machines in his plant the ship bevel bandsaw is the most versatile. It permits pieces to be cut with changing bevels and at the same time following a curved line. Another important machine is the spindle shaper with a 12-inch head which enables the operator to shape large timbers up to 12 inches thick.

Derektor prefers to train his own men and now has 16 employees. Just as the old-timers along the coast taught him, he teaches them about tools and woods and hand craftsmanship. Recently, he added a sideline to his yacht building—the production of solid—mahogany furniture of original and modern design.

Derektor personally follows every operation. In the loft he makes sure that each boat is laid down precisely according to his design. The finished templates include bevels, rabbets and fastening locations—every bolt and screw must be carefully designated. After the various structural members are cut out, the backbone is set up level and plumb and the molds erected in positions indicated in the loft layout. The molds are permanently braced and "ribbons" strung around at close intervals following the plank lines. These ribbons and molds are temporary and used to bend the oak frames to the proper curvature. Before working with the frames, they are softened in a steam box. Then come the planking, deck beams, the deck itself, joiner work, bulkheads, engine beds, tank foundations and finally the engine itself.

Derektor thinks the most interesting boat he has turned out so far is a 40-foot Mackinac cruising and open-racing sloop. It is powered with a 40-horsepower Universal engine and will sleep four to six persons. This sloop could easily make a round-the-world cruise.

Derektor's advice to anyone buying a boat—either new or used—is to make sure that it will fill your needs as to sleeping space, speed and performance. Its ability in rough water is a vital factor. The boat should be made of good materials and well fastened. For example, a good boat should be put together with bronze, copper or Monel fastenings of the proper type, diameter and spacing. The wood should be properly seasoned and if you are buying a new boat examine it for sap runs.

"Also, it is a good idea to find out if the boat was designed by a reputable man and built by a reputable builder. Remember that narrow planking usually indicates a boat that will hold its shape. It's a good idea to examine the seams for solid calking. Make sure they are tight inside."

"Still better advice," Derektor adds, "is to take a friend along who knows something about boats." He paused. "And another thing. Be mighty careful about giving toolboxes to small boys who have a fever for boats. First thing you know they may have a shipyard and no time to go sailing!"
Tires Galore Under Huge Dragline Floor

Enough tires to last a motorist a lifetime were used recently to move a 220-ton section of a huge dragline over 60 miles of unpaved roads, including 30 miles built especially for the job. The problem was to transport a 610-ton dragline from Tracy to Los Banos, Calif. The huge machine was divided into sections, the biggest chunk too large to travel the improved highways. It was mounted on 66 tires distributed beneath a truck trailer and two special dollies. When all was ready, the big section was hauled down the road, each tire under the heaviest part supporting 8333 pounds.

Midget Darner

With a tiny, English-made darner, housewives can do a professional weaving job to repair worn clothing. Actually the darner is a miniature loom with a mechanism which alternately raises and lowers the threads to produce an interwoven effect. The small loom repairs holes in silk, wool and linen.

Bathtub Hoist

Peter Wagner of Chicago once took a nasty spill while climbing into his bathtub. The result is his bath hoist, which lifts Wagner, youngsters, invalids or anyone else over the edge of the tub and lowers them gently into the water. The hoist, which is operated by the bather, works like an auto jack.
Traveling through all the rooms of the subterranean limestone "city" would require a 12-mile walk.

Deep in the Heart of Ohio—

half a mile deep, in fact, they’re mining limestone in a vast underground city where diesel trucks and giant shovels roam through labyrinths of rock.

By Walter E. Burton

IT TAKES four minutes on one of the world’s longest elevator runs to span some 300,000,000 years to the Devonian Age. After stepping from the elevator into a strange new world, you may look around for a Tyrannosaurus or other prehistoric reptile; but, instead, you will see an occasional scurrying dump-truck dieselsensis (diesel-engine dump truck) and other modern monsters, some of which create great noise. For you are nearly a half mile below the surface of Ohio, inside a 345-foot-thick deposit of Columbus limestone, where valuable industrial raw material is being dug in what is considered the world’s deepest limestone mining operation.

About the time of the first World War, the Columbia Chemical Division of the
Pittsburgh Plate Glass Company began to think about a limestone source near home. "Home" was Barberton, Ohio, where their big plant produces soda ash, chlorine, carbon dioxide and various other heavy chemicals essential to thousands of industrial plants.

Chief raw materials required are salt and limestone. Salt from deposits deep in the earth beneath the plant and near-by areas is brought to the surface through salt wells. The limestone came via Great Lakes boats to Lake Erie ports, thence to Barberton.

To get to the salt under Barberton, it was necessary to drill through considerable limestone; so the chemical makers knew that they were practically sitting on an inexhaustible supply. But it is nearly a half mile down, and to dig that far costs money. The problem therefore boiled down to one of cost and convenience of local deep-lime mining, compared with cost and inconvenience of hauling the stone long distances.

The company decided in 1940 to establish a mine that would give it access to the deep lime under the area, selecting a site about two miles from the plant. It took drilling and mining crews, aided by 100,000 pounds of dynamite, 400 days to sink twin shafts 550 feet apart, each measuring 7 by 16 feet, to the limestone. One shaft turned out to be 2258 feet deep, the other, 2323 feet. Because they extend through numerous layers of sandstone and shale, both are framed with steel and lined with concrete.

To sink the shafts and hollow out the beginning of an underground "city," rugged men of Finnish extraction, long experienced in digging iron ore and copper in the deep mines of Michigan and Tennessee, were brought to Barberton. More than 30,000 tons of rock had to be brought up the shafts to make room for such necessary...
mining equipment as a rock-crushing unit capable of reducing threeton chunks to six-inch size, belt conveyors, transformer stations, maintenance and repair shop, and one of the world's largest and deepest-buried septic tanks. By 1943 the 550 feet between the two shaft bottoms had been spanned by this network of underground chambers.

Into one of the shafts was built a conventional-looking service elevator or hoist, which transports men and supplies in a nonstop run at 10 miles per hour over a vertical distance almost twice the height of the Empire State Building. Each minute, 100,000 cubic feet of conditioned air for ventilating the underground workings is forced down this shaft; and to enter or leave the elevator house on the surface it is necessary to pass through an air lock. In the other shaft is a pair of rock-carrying skips—six-ton bucketlike affairs each carrying 10 tons of limestone to the surface at a trip, one skip going up while the other (empty) goes down. In two minutes a skip is loaded and whisked to the surface at a speed of 23 miles per hour, and unloaded before it stops.

The service hoist is handled by an elevator man whose run is four minutes and nearly a half mile between floors. The car is about six by eight feet and approximately the height of the average passenger elevator; yet on it and the production skips, all of the massive mine machinery was lowered into the underground chambers. Much of the equipment had to be specially designed so it could be lowered a piece at a time and then put back together by mechanics. To reduce time wasted by hauling damaged parts to the surface for repairs, a complete maintenance shop was established underground. In addition, there are roving repair crews which can rebuild a jumbo rock-drilling outfit or a loading machine on the spot.

The mine began to grow outward through the limestone strata, using a two-entry room-and-pillar method of mining. First, parallel entries were blasted through the rock; then rooms extended sidewise from them. Approximately half of the stone is left in place to
After the blasting is over, scaling crews with crowbars remove dangerous loose rock from walls and ceilings.

act as pillars for supporting the mine roof. Each room measures about 32 feet wide, 600 feet long and is generally 28 feet high. Eventually, stone will be blasted from ceilings to increase their height to 46 feet. A complete trip through all the rooms and entries would be about 12 miles long. Such a journey is not difficult, either on foot or in one of the dump trucks or other vehicles, for the floor of the mine is as smooth as the average city street. Calcium chloride and waste oil from engines is spread on the roadways to keep down the dust.

Suppose we select a sample chunk of limestone, follow it, and see what it has to go through to become a part of some useful chemical, a bit of aggregate to strengthen a highway or a building, or a quantity of fertilizer to help a farmer raise better crops.

To go back to the very beginning would require a trip of something like 300,000,000 years, for that is the time that has elapsed since the Columbus limestone was laid down, geologists estimate. Our bit of this lime deposit may have been formed from primitive marine shells which settled to the bottom of the body of water that covered the area. With billions of other lime particles, and intermixed with smaller quantities of magnesium, silicon and other materials, these particles in time became an integral part of a huge sheet of limestone. This sheet is made up of numerous laminations or strata, some harder than others, and each separated from the others—a fact useful in mining operations.

Eventually, glacial action and other geological influences covered the lime bed with shale, sandstone and other materials to a depth of nearly a half mile. There our chunk of stone slept undisturbed for millions of years.

The piece of dense, gray rock eventually found itself a part of the 26 by 32-foot working face of the mine. Like a battery of machine gunners, the drilling crew moves in. Their pneumatic drills, mounted on a mobile rig, are adjustable so that any part of the rock face can be drilled. A pattern of holes has been worked out for the Barberton mine, one designed to cause the rock to break into pieces that are the best size for subsequent handling and processing. Drillers are taught this pattern by projecting a slide image of it on the rock face, and marking the hole positions with daubs of red paint.

The holes are grouped closely, usually a foot or two apart, at the center, and arranged so the initial charge of dynamite...
Placing dynamite in hole drilled in rock face. It is set off remotely after last man leaves the mine.

will blow out a central plug. To help guide the breaking of the rock, a few of the holes are not filled with explosive. Farther out from the center, holes are positioned so that subsequent explosive charges will dislodge the rock progressively outward from the central cavity.

The rock drills are jointed tubular sections of steel, tipped with either a conventional hardened-steel bit or with one having tungsten-carbide cutting inserts. A steel bit will penetrate about nine feet of rock before requiring sharpening. A bit tipped with carbide, which ranks close to the diamond in hardness, may go 200 feet before becoming too dull. Water is forced through the drills while they are biting into the rock. The 2½-inch holes for explosives may go to a depth of nearly 50 feet.

After the drilling crew has completed the hole pattern, the blasting crew takes over. The charges are rammed into the drilled holes, as much as a ton of explosive being used a night. Electric blasting caps are arranged so that the central holes will fire first, followed successively by holes farther and farther from the center. When our sample chunk of rock comes tumbling down from its resting place, it is accompanied by some 800 tons of other pieces—representing the breaking-up of a block measuring, roughly, 28 by 32 by 50 feet.

No one knows exactly what happens when a blast is set off, because there is no one in the mine then. Not until the last man has left is the dynamite set off, by remote electrical control. Blasting takes place just before midnight. By the time the morning shift has gone to work, all dust and fumes from the blasts have been removed by the mine's ventilating system. Our sample piece is now lost in a huge pile of broken stone.

Before it can be disturbed, the scalers must do their stuff. Using crowbars and working singly or in pairs from a "man bucket" attached to a boom extending from a Caterpillar-tread tractor, they examine every inch of the walls and ceiling of the recently blasted area. They pry loose any dangling piece of rock that might fall on workmen during later loading operations. Because of the stratified nature of the limestone deposit, the ceiling is positioned at a seam, and is as smooth as the ceiling in many a living room.

When the scalers have finished, an electric shovel, specially designed to operate in the restricted rooms of the mine, moves in. Or instead of a shovel, a Joy loader, with mechanical arms, scoops up the loose stone like an excited gambler raking in the chips. Then the stone is loaded into stubby diesel-operated dump trucks. Diesel engines are used in all mobile machinery because the fumes from them are practically free of carbon-monoxide gas. The mine's ventilating system removes exhaust gases.

A truck bearing our sample piece of limestone starts its speedy trip from the working face back to the center of the mine. It is prevented from tangling with other trucks by traffic signals exactly like those used at city-street intersections. The final signal is triggered by a photoelectric cell.

(Continued on page 218)
Jaws on Tractor
Bend Pipe Line

Pipe lines that carry oil for the Sinclair Oil Co., over the mountains from Venezuela fields to the coast are bent to match the hilly terrain by a powerful device mounted on the pipe-laying tractors. At the base of the tractor crane is a jaw which grabs the pipe and tugs it against the girders of the crane. Power is supplied by the tractor engine. Short, powerful tugs make a series of tiny crimps to bend the pipe.

"Rubber Necked" Tripod

Photographers using a new "rubber necked" tripod can set their cameras at any angle regardless of the position of the legs. A flexible connector between each leg and the tripod head is the secret of the universal action. The legs of the tripod are not fixed and can even be opened out in spread-eagle fashion for close-to-the-ground shots. The head swivels 360 degrees independent of the flexing action. There is no need for lock screws as the head remains firmly in any position once it has been set.

Nearly half of the fish landed at U. S. ports is used in fish meal—to feed hogs and poultry—and in fish oil for industrial purposes, according to the U. S. Fish and Wildlife Service.
FAN BRACKET lets you aim the breeze where you like, even down into a tray of ice to cool the air. Its wide legs increase stability.

LIPSTICK "matches," at right, won't burn, but they will make milady sparkle. A tiny mirror inside the flap makes her retouching precise.

MAGNETS in door of a refrigerator, below, hold it shut without a latch. Foot pedal opens it. Handy ice-cube tray releases one at a time.

PANTS HANGER, right, relieves crowded closets, prevents wrinkles. It holds six pairs on the horizontal rods and it swings down for ready access, up for storage.

READERS-IN-BED can read for hours without back or neck kinks by reclining on a back rest that's hinged to the headboard. Sliding up and down like a window sash, it adjusts to any tilt. Between uses, it swings back into the headboard.
GUARD RACK lets you carry any glass coffee maker and its stave with one hand. It protects glass bowls from breakage, too.

STORM WINDOW, above right, has three separate units, two glass and one screen. Each moves independently in its track.

SAUCE PAN, right, has holes in lid and pan rim so water can be drained without scalding hands. Lid locks in place.

AUTOMATIC DISHWASHER, below right, requires no drain installation. It pumps the waste water directly into the sink.

HOSE RACK keeps hose coiled neatly for storage and holds the nozzle at any angle when you are spraying the lawn.
It’s Small But Smart, This “Suitcase Brain”

Not much larger than a suitcase, a new electronic “brain” can handle most of the intricate problems solved by the huge automatic computers, some of them almost the size of a basketball court. The small computer, called the Maddida for its initials (magnetic drum digital differential analyzer) was designed by 31-year-old Floyd G. Steele. It is only two feet wide, four feet long and three feet high, and weighs 750 pounds. When a difficult problem is fed into the Maddida it comes up with an answer accurate to within one part in a million.

Soil “Waffle Iron” Reduces Erosion

Pockmarking the soil with thousands of indentations that look like the grid of a waffle, a soil-preparation tool pulverizes the soil, tamps it around seeds and reduces erosion. The wheels of the implement, which are cut away at four evenly spaced intervals, leave tiny retaining walls over the surface of the field. Rain water collects inside these retaining walls, preventing wash-off. The implement has an over-all width of 10½ feet.

Loose-Leaf Photo Album Makes Its Own Binding

There’s no limit to the number of pages you can add to a loose-leaf photographic album because each page becomes part of the binding. The pages are transparent plastic pockets, the open sides of which interlock to form a hinge. A metal pin is threaded through the hingelike edges of the pockets, locking them together securely. No matter how many pages are added, the album always opens flat.

Sources of available products described in this issue are listed in the WHERE-TO-BUY-IT INDEX. Sources of further information on other articles are included in the WHERE-TO-FIND-IT LIST, available to readers without charge. For your copy of the list, just write Bureau of Information, Popular Mechanics, 200 E. Ontario St., Chicago 11.
CAMERAS IN DISGUISE

Climaxing the mystery yarn of 50 years ago was the instant the intrepid spy or detective clicked his concealed camera, capturing the evidence. Cameras were bulkier then, but designers disguised them ingeniously. These cameras are displayed at the George Eastman House in Rochester, N.Y. Opera glasses and pistols are sure-fire giveaways for spies, yet that didn’t deter the designers. Those in Photo 1 are cameras in disguise. That harmless-looking man surveying land near the Army base was really a spy and his theodolite, like the one in Photo 2, was a camera! The dapper detective was never without his cane because it had a camera in its handle, Photo 3. Back in 1890, the ascot tie, Photo 4, was the mark of a gentleman, but this one had a built-in camera, its lens forming the stickpin. Cruder but just as efficient is the circular camera that shoots through a buttonhole, Photo 5.
There's more to restoring an old city than just digging up its relics. The laborious and time-consuming excavation work would be utterly wasted if it were not followed by a "metal embalming" process, without which an iron hinge or lock, buried since the 18th century, would crumble into dust in a museum cabinet within 10 years.

At Williamsburg, Va., the famed village that is being reconstructed as it was 250 years ago, scientists have developed a remarkable iron-preserving process. Here's how M. W. Thomas, Jr., Director of the Archaeological Museum at Williamsburg and one of the experts who perfected the process, describes it:

Very rusty iron of the type found in the Williamsburg excavations is more like a sponge than a metal when it is removed from the earth. This is a result of the action of soil acids and other agents. The first step in preserving a piece of such iron is to clean it by hand to remove outside rust and dirt. Often a toothbrush is used on delicate parts. Next, the iron is placed in a container along with fragments of metallic zinc and a solution of sodium hydroxide (caustic soda and an ingredient of lye). This stew is boiled for 4 to 14 hours, while complicated chemical actions take place. Essentially, the combination of metals and an alkaline solution forms an electrolytic cell so that electrolysis plays a part in the cleaning. Hydrogen bubbles form on the iron and help to pry off particles of rust.
The hydrogen reduces some of the rust while the alkali dissolves more of it. The metallic iron is not affected by going through this treatment.

Next, a series of boiling and rinsing operations in water, plus the addition of some acid, clears the iron of the alkali and other chemicals. The piece is then dried. A slight coating of oxide is retained so that the iron will look its age instead of possessing a bright metallic luster. After thorough drying in an oven, the specimen is immersed in smoking-hot paraffin for 12 to 20 minutes and then is removed and cooled. The wax seals all pores against the further admission of rust-causing agents and gives the iron a pleasant sheen. The wax provides practically no resistance to wear, but is ideal for museum pieces that seldom are handled. When a wax-treated specimen becomes dirty, it is only necessary to dip it again in hot paraffin to clean it.

Thomas, a chemist by profession, is charged with assembling, study, classification and preservation of all artifacts left by the early inhabitants of Williamsburg. It may be significant that, of the 40 tons or so of such relics in his laboratory when this was written, 40 percent were fragments of wine bottles! Bottle glass made in the 18th century and buried in the earth ever since is corroded to a depth of $\frac{3}{8}$ inch or more. In some cases, there are holes "rustled" all the way through the glass. Flint glasses and other kinds harder than bottle glass show less corrosion. Fragments of very beautiful goblets having air-twist, cotton-twist and teardrop designs in their stems were unearthed. Modern replicas of such goblets are now being manufactured and sold.

Lying on a table in Thomas' office was a shallow tray containing some moldy looking chunks of metal. These were pieces of lead type found at the foundation of a print shop operated around 1736 by William Parks. This type, of the design made famous by William Caslon in the 18th century, is being cleaned and a press is to be constructed for using it. Type and other lead articles discovered in the restoration area are cleaned by alternate treatment with nitric and hydrochloric acids and sodium hydroxide.

One material that has just about stumped
the Williamsburg Archaeological Laboratory is pewter. This alloy of lead and tin was used widely in colonial times. Dishes, mugs, candlesticks and other items made of it are subject to a disease in which the tin of the alloy undergoes a change of form without experiencing a chemical change. There is no known way of stopping this disease once it starts and its progress cannot be reversed without melting the pewter. Any antique piece of pewter, Thomas explains, may develop a spot of the tin disease at any time and this spot may spread through the piece and eventually destroy it. Keeping the pewter surface clean and well polished seems to be a way of preventing or delaying the malady.

Usually, copper articles are corroded the least of all Williamsburg artifacts and in most cases require only a good scrubbing with water. If copper and brass are found to have an attractive greenish patina, no attempt is made to clean the metal other than simple washing. When the patina is unattractive, it is removed with brass polish, restoring the metal to its original lustrous condition. Visitors to the restored Virginia town see considerable brass, both old and new, and often marvel at the beautiful polish. Lacquer or other coating materials are not used to preserve such polish. Thomas says that any coating applied to retard tarnishing suppresses some of the beautiful sheen and some may eventually deteriorate and attack the brass.

Wood preservation is another of the archaeologist's problems. Most of the original wood rotted long ago, but occasionally a piece worth preserving is found. If termites have attacked it, they cease to be a threat as soon as the wood is placed on a museum shelf or otherwise stored where the insects cannot have access to ground moisture. But powder-post beetles are a bigger problem. These industrious bugs, which were named for their ability to reduce wood to a powder, continue to work in a piece of wood no matter where it is stored, unless they are killed by chemical treatment or other process.

Some fragments of wood discovered in old buildings have provided clues to the kinds and colors of paints used in the colonial town. When a painted board is found, architects and laboratory workers remove the paint layer by layer until the first coat is uncovered. Such painted boards sometimes are found under stairways and in other parts of 18th-century buildings that survived to the present. Old records describing shipments of pigments from England have helped in analyzing the paints and in formulating finishes that duplicate the originals.

Thomas also is concerned with the never-ending search for ancient muskets, pistols and other arms for the restored powder magazine, governor's palace and other buildings. Many of these now on display are true 18th-century pieces. Others are more recent, but are used because of the lack of older ones. Some of the guns used by original Williamsburg inhabitants never can be replaced, simply because no specimens have survived to this day.

Williamsburg gets most of its guns from dealers in antique firearms, from museums (Continued to page 234)
Laboratory In a Box
Handles "Hot" Isotopes

"On the outside looking in" is an accurate description of the way scientists work with certain low-energy radioactive isotopes in miniature laboratories. Only the gloved hands of the technician protrude into the plywood box, which is coated with Vinylite resin-base paint. A large window permits full visibility. Air pressure within the box is kept slightly below atmospheric pressure and exhaust air is filtered to remove contaminated material. These boxes are the low-cost solution to the handling of low-energy radio isotopes and provide virtually complete contamination control.

Hot Periscope

Engineers at General Electric can look directly up into the exhaust stack of a jet engine pouring out 2500-degree gases without noticing the heat. The explanation is a 12-foot periscope, steel jacketed and cooled by 45 gallons of water a minute, which extends into the test chamber through a wall. A quartz window, washed by a powerful stream of cold air, peers up into the business end of the engine. On the viewers' end of the periscope, through which engineers study the pattern of burning gases, are a 16-mm. motion-picture camera, an eyepiece for an observer and a screen several persons may watch.

Disabled Veteran
Still Mows Lawn

Drawn by a power mower, F. J. Baker, Jr., of Dunedin, Fla., a disabled veteran of World War II, mows his lawn from a wheelchair. The chair is attached to the mower by a piece of steel shaped like a slingshot which Baker had designed by the Rebco Company, Clearwater, Fla.

Grass that stays green the year around where there is little or no frost, a Bermuda type known as U-3, is one of the developments in an experimental turf culture program at the University of California at Los Angeles.
Operator selects a disk to match the kind of concrete ordered and places it on a turntable. Disk makes electrical contacts to release material and water into mixers in the proper ratio. Above, right, diagram shows the multilevel mixing tower.

Conveyor belt dips under road to bring materials from stock piles on other side. Four levels of tower from top down contain storage bins, control room, mixers and loading station.

Push-Button CONCRETE MIXER

THREE men can prepare over a thousand yards of concrete a day in a towering push-button mixer near Phoenix, Ariz. The big tower has six bins which are filled by conveyor belt from stock piles of material. Orders for concrete are sent to the control room by pneumatic tube. Depending upon the order, the operator selects a disk and places it on a turntable. As the disk revolves, buttons make electrical contact to release material into the mixers. Three minutes after a driver sends up his order, the concrete is dumped into his truck.
Cabinets need not be entirely painted. Doors and drawer fronts can be finished natural to give pleasing contrast. Note the smart “drop ceiling” cornice between cabinets.

The corner plant shelf over the sink, above, and the writing desk, below, are two window “built ins” that add a touch of distinction to the modern functional kitchen.

Your Modern Kitchen

By E. R. Haan

PART I - ESSENTIALS OF PLANNING
THAT MODERN KITCHEN you have dreamed about is well within a modest budget if you are willing to do most of the work yourself, even the planning. You can build the cabinets, or purchase and install them at a considerable saving. In either case, the arrangement should be well planned to save steps as well as to get a pleasing appearance. Every hour of planning will be time well spent. In fact, many homeowners, after they have the arrangement worked out to their satisfaction, make up a small scale model of their proposed kitchen. A model helps you to visualize the full-size kitchen and often shows up oversights in planning that were not apparent in sketches and plan drawings.
Four basic arrangements: Today’s kitchens are based on the four basic arrangements shown in Fig. 1. You can approximate one of these arrangements even if the fundamental design of your present kitchen cannot be altered. Keep in mind that in every kitchen there are three centers of activity, which are storage, preparation and cleaning, and cooking and serving. All of these centers include vital appliances and cabinets placed in a production-line sequence so that kitchen operations can proceed orderly from storage to the dining table. The line starts at the service door where food is delivered and ends at the nearest point to where it is served. A, B and C of Fig. 11 indicate the paths of back-and-forth walking. It is important that these be as short as possible over the usual minimum of 4 ft. to save steps, especially distance B between sink and range, where most walking is done.

By studying the typical kitchen layouts in Fig. 2, you’ll find one that is most adaptable to the shape of your present kitchen. The new arrangement
will depend largely on the location of the sink as extensive plumbing changes are expensive, although pipes can be shifted about 8 in. in either direction at small cost. A dead-end, U-shape kitchen generally is the most efficient. See Plan F of Fig. 2. Two alternate arrangements of one end are shown at A and B. If the room is less than 11 ft. wide, the two wall cabinets on the same wall as the window are eliminated and the width of base cabinets along this wall is reduced. Then the plan will fit an 8 or 9-ft. kitchen width but the alternate arrangements at A and B may not be possible. If your kitchen is 4 or 5 ft. shorter than the plan shown at F, the breakfast space may have to be sacrificed.

Storage center: Counter space of at least 18 x 24 in. should be provided next to the refrigerator on the side where the door opens. This is for deliveries as well as for food to be removed from or returned to the refrigerator. Cabinet storage space should be within arm's reach of this counter. If you have a home freezer cabinet, it should be placed next to the refrigerator if space permits. For vegetables and fruits, a near-by base cabinet should contain a tier of easy-sliding, ventilated drawers, Fig. 3. Flour, sugar, etc., can be kept in a drawer having metal containers as in Fig. 6. Or, you may prefer to keep flour in a sifter that slides into a wall cabinet as in Fig. 7. Some cereals and condiments may be kept in wall cabinets most convenient to points where food is prepared. Always keep in mind that supplies should be stored close at hand where they are first used.
Preparation and cleaning center: This includes counter space of not less than 24\times36 in. at one or both ends of the sink. For cutting, you can install a slide-out hardwood leaf, Fig. 4, or a slide-out lapboard, 26 to 28 in. above the floor, for working in a seated position as in Fig. 5. Processing equipment is stored in drawers or on shelves of base cabinets along the preparation counter. Counter space where dishes are stacked for washing should not be less than 24 \times 36 in. This may be the same counter used for food preparation. It will be on your right when facing the sink if you wash dishes, from stacking to storing, in a right-to-left sequence. Then the cabinets where dishes are stored should be at your left, so they can be dried and put into the cupboard. Cutlery goes into partitioned drawers nearby, and cooking utensils preferably on easy-sliding shelves or drawers in base cabinets. Dishwashing equipment is stored under the sink and this space may include one or more sliding towel racks as in Fig. 9. Convenient disposal cans may be fitted on the sink-cabinet doors as in Fig. 8—one provided with a waxed-paper bag to catch refuse, and the other for empty cans, jars and bottles. If you go beyond the manual dishwashing stage, you’ll install an electric dishwasher and perhaps also a motorized disposal unit.

Cooking center: The cooking range should be located conveniently near the dining-room door, breakfast nook or both. A counter not smaller than 24 \times 24 in. should be placed next to the range to facilitate transferring cooked food to serving dishes. Base cabinets near the range can hold some of the heavy cooking utensils. Bread and bakery goods are kept near the range in a special metal-lined drawer.

<table>
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<td>24, 27, 30</td>
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<td>36</td>
<td>24 to 24\frac{3}{4}</td>
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<td></td>
<td>24, 27, 30</td>
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<td>Utility</td>
<td>18, 21</td>
<td>36</td>
<td>24 to 24\frac{3}{4}</td>
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SIZES AVAILABLE IN READY-MADE WOOD AND STEEL CABINETS (dimensions in inches)
similar to the one in the drawing in Fig. 10.

Planning center is optional: If space permits, you can have a planning center. A drop-leaf table 30 in. high and a stool or chair that slides under it are provided as in Fig. 12. An open wall shelf holds a small radio and cookbooks so that the table can be pulled out into the room and used for other purposes. A shallow drawer keeps pads, pencils and bills out of sight.

Figuring storage space: When planning a new kitchen, first determine the storage and counter space needed. This varies with the size of the house and the family (see Fig. 13). Compare your figures with the measurements of base and wall cabinets given in Figs. 14 and 15 so that you can work out cabinet and counter dimensions to suit. Ready-made wooden and steel cabinets are available in the sizes given in Fig. 15. If the kitchen is larger than needed, only part of it may be required, leaving space for a breakfast nook or snack bar as suggested in Fig. 2, plans A, B, D and F.

Corner space can be utilized to best advantage by using corner cabinets, available in both wall and base types. These have doors at a 45-deg. angle to the walls as in Fig. 18. Some types are available with rotating shelves, as in Fig. 16, which further increases their convenience. A utility cabinet for brooms, dust mops and vacuum cleaner, and a cabinet for clothes and rubbers, can be included in your kitchen plans. Also include a built-in ironing board if the kitchen is to be used for ironing.

Planning with scale models: An excellent method of crystallizing a plan is to draw the floor space of your present kitchen to scale, say ½ in. to 1 ft., including the exact position of the sink, doors and windows.
Then cut out, also to scale, cardboard strips representing the range and refrigerator, and two strips representing the total length of the wall and base cabinets required. After positioning the range and refrigerator at the right locations, cut up the cabinet strips to fit between and adjacent to them. Work clearance between counters and appliances facing each other should not be less than 4 ft.

Windows and doors: Sometimes, for best results, it may be advisable to have a carpenter change the location of a window or door—or just the direction the door swings. Windows in frame houses are easier and less expensive to change than those in brick houses. For adequate illumination, the window area of a kitchen should not be less than 20 percent of the floor area. One counter at least, preferably the preparation and cleaning counter, should be well lighted from a window. Most women prefer to have a sink at a window but this is not essential in a well-planned, efficient kitchen. Windows never should be “boxed in” by wall cabinets. A much better appearance results when cabinets are spaced about 9 in. from the window edges and rounded shelves are installed as shown in Fig. 17.

Changing the position of a door entails considerable mess. A door should not swing into a work area or interfere with the use of cabinets and appliances as in Fig. 19. Nor should a door swing against an open wall which should be used for a necessary cabinet. A door may swing against the end of a cabinet or appliance as in Fig. 20. Two doors are preferred to three, especially in small kitchens. If possible, they should be located so that household traffic will not cross kitchen work areas, as indicated by the arrow in Fig. 11 and also in the floor plans A, B and F in Fig. 2.

Cabinet heights, clearances, spacing: Base cabinets should have toe space 4 in. high and 3 in. deep to facilitate working at counters without leaning. Standard height of base cabinets is 36 in. although
the food-preparation counter, or part of it, may be lower to suit the user. A 32-in. height here suits the average woman. Glued-up hardwood tops are available as shown in Fig. 21. There should be a clearance of 15 to 18 in. between counters and wall cabinets.

Wall space over sinks and counters should be protected with a backsplash, Fig. 21, not less than 4 in. high and preferably extending from the counter to the wall cabinets. When planning cabinets, a space 36 in. wide generally is allowed for a refrigerator, with a 6-in. clearance above it, Fig. 22. Most kitchen ranges are of the 36 or 39-in. size. Normally, a 42-in. space is allowed to accommodate them but if the range is set between cabinets, or a cabinet and a wall, this allowance is not enough to permit cleaning the sides of the range. A 6-in. space at each end as shown in Fig. 23 is better. A 30-in. wall cabinet may be set over an electric range with the usual 18-in. clearance. Gas ranges, however, require at least a 30-in. clearance because of their greater fire hazard. This still permits the use of 18-in. wall cabinets over them, if necessary, but none at all is preferable.

**Kitchen ventilation:** An exhaust fan gives a complete change of air in a few minutes to eliminate cooking odors, excess heat and humidity. Air exhausted by the fan is automatically replaced by fresh air drawn in through an open window, or air coming from other rooms. Often an exhaust fan is located over a service door. However, if the range is against an outside wall, a better place for the fan is directly above the range as in Fig. 24. Two other arrangements are shown in Figs. 25 and 26.

**Lighting fixtures:** It's advisable to have a center ceiling light for general illumination of 10 foot-candles. A control switch should be located at each important entrance. Sink, range and breakfast table can be illuminated from the ceiling with flush-type fixtures which are easy to keep clean. Intensity of light at these spots should be 40 foot-candles. For work areas under wall cabinets, illumination can be provided by tubular lamps, either the fluorescent or filament type. These are installed on the undersides of the wall cabinets so that the lamps will be out of the line of vision. Counter lamps may be controlled individually or all by one wall switch. It's much better to have too many electrical outlets than too few, and at least two should be provided on each wall. Locate several along the counters, using multiple outlet strips. Others should be provided at the range, refrigerator, exhaust fan, radio, toaster and ironing board. A sunken outlet also may be installed for an electric clock.

(To be continued)

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**Handy Masking-Tape “Dispenser” Provided by Plastic Sheet**

For the artist-hobbyist as well as professional artists and photographers who use a considerable amount of masking tape to mount their work, selecting tabs of tape from a sheet-plastic dispenser is both convenient and economical. Completely cover the sheet on both sides with strips of tape laid edge to edge. Then, using a T-square and stencil knife, cut the tape into tabs of the desired size. The soft plastic will not dull the stencil knife as would glass, and with the tape stored in this manner it does not lose any of its adhesive quality.

Paul H. Will, Chicago.

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**Disposable Liner for Paint Tray Saves Cleaning Time**

When using a roller and shallow tray to apply paint to the interior walls of my house, I found that a considerable amount of time ordinarily spent in cleaning the tray could be saved by fitting the paint tray with a wax-paper or cellophane liner. The liner is cut and folded to cover the bottom and sides of the tray completely and is held in place with paper clips pressed over the edge of the tray. When the job is finished or a new color is to be applied, only a few minutes are required to remove the liner, discard it and replace it with a clean one.—Ted J. Kubit, Detroit, Mich.
FOR A SPARKLING FINISH on a toaster or other stainless-steel appliance, polish with baking soda. Sprinkle the soda on a clean, soft cloth and rub over the surface. Follow by rubbing with a second clean cloth to make the surface glisten like new.

NEXT TIME YOU PRESS A PLEATED SKIRT try placing a sheet of coarse sandpaper under the pleats to hold them in place. This will save pinning the pleats together. It also results in a neater job, as there will be no indentations in the fabric caused by the pins.

WRAPPING CRAYONS WITH CELLULOSE TAPE reinforces them to withstand the pressure when the youngsters really bear down to get the color on thick. The tape is wrapped spirally around the crayon and peeled off as necessary to expose more of the tip.

DON'T MAR THE HIGH POLISH of wooden candleholders by trying to scrape off the drippings. Instead, set the holder in the refrigerator until the wax becomes hard and brittle, after which drippings can be picked off without scratching the finish.
TO SHIELD SHARP POINTS OF SCISSORS which are carried in a handbag or knitting bag, press an eye-dropper cap over the points. This will hold the blades of the scissors closed as well as prevent the points from tearing fabric or injuring fingers.

STEEL WOOL IS EXCELLENT FOR SCOURING pots and pans except that it is hard on the fingers. To protect the hands when using steel wool, stuff a wad of the wool into a short section of garden hose and feed the wool through from the top as required.

A VACUUM-BOTTLE CORK SOMETIMES WORKS LOOSE because of pressure within the bottle. An easy way to avoid this is to fit the cork with a compression spring which presses against the cover. Turn the end of the spring into the top of the cork like a corkscrew.

ENVELOPE FLAPS THAT WON’T STICK are particularly irritating if the envelope has already been addressed and stamped. When this happens, you can seal the envelope by applying a thin coat of fingernail polish over the mucilage and pressing the flap closed.

SHOWER-CURTAIN HOOK

NIGHTLY WASHINGS OF HOSE AND UNDERTHINGS will not clutter up the bathroom if they are dried by hanging from a towel rack or shower-curtain rod. Use spring-type clothespins suspended from shower-curtain hooks, drilling the pins to slip over the hooks.
Horseshoe at Top of Hitching Post Permits Securing Reins Quickly

Nailing a horseshoe to a heavy post, so that it forms an eye at the top end, provides a hitching post to which the reins can be secured in a jiffy. There's no need to tie and untie the reins. Instead, just pass the reins through the opening formed by the horseshoe and then bring the end back, dropping it over the edges of the horseshoe as pictured in the drawing. To release the reins, just lift the loop from around the horseshoe and pull the reins loose.

G. E. Hendrickson, Argyle, Wis.

There's a Trick to Drying Windows

When drying windows after washing, it is a good idea to dry the outside of each pane with vertical strokes and the inside with horizontal strokes or vice versa. Then, you can tell at a glance whether any remaining streaks are on the inside or outside of the window pane.

Mrs. Mathilda Zweiberth, St. Louis, Mo.

Ignition Trouble Caused by Oil Vapor in Distributor

A worn distributor shaft will permit a small quantity of crankcase vapor to pass into the distributor where it will cause arcing and rapid burning of the points. Any time that ignition trouble is suspected and examination of the parts fails to turn up any of the more common causes, look for a black, sooty deposit on the breaker plate just below the points as indicated by the pencil point in the photo. The next thing is to make sure that the breather cap on the oil-filler tube is not clogged or damaged in any way that would restrict passage of air. If the breather cap is clear and in good condition, then the trouble probably is due to a badly worn distributor shaft. The only permanent repair is replacement of the defective shaft or worn bushings.

Ed Packer, Chicago.

Candy Turtle Party Favors Utilize Walnut Shells

For something unusual in the way of favors for a children's party, make these candy turtles from gumdrops, raisins and walnut shells. Press a gumdrop into half of a walnut shell and then stick a toothpick through the exposed portion of the gumdrop along the length of the shell. Allow the point of the toothpick to project slightly so it looks like a tail and impale a raisin on the blunt end of the toothpick to serve as a head. Then press four cloves into the gumdrop to simulate the feet. A number of the turtles can be made up in just a few minutes.—William Swallow, Brooklyn, N. Y.

Marigold bouquets can be deodorized by dissolving a teaspoonful of sugar in the water before arranging in the vase.
IF UNUSUAL APPEARANCE in magazine racks appeals to you and you like a project that tests your craftsmanship, tackle this two-section walnut rack with its distinctive loop facing. Each sidepiece is made in three parts which are grooved with a special cutter shaped from flat steel as in the lower right-hand detail. The ends of a piece of ¼-in. steel, 1 ¾ in. wide, are twisted at right angles to the shank and then ground to form a center point with a radius on each side. The center of the shank is drilled for mounting on the circular-saw arbor and the tool is held by hand for facing the center disk of each sidepiece in the lathe. After the disk has been grooved, a section is carefully cut out for the second grooved part, while the third part is cut to suit the radius of the disk. The three parts are assembled with dowels and glue. Turned feet are doweled and glued to a bottom board, and the sidepieces and a centerpiece are attached with screws and glue.

Below, note long ½-in. dowel used to join horizontal section to cutout portion of center disk.
That fine old chair relegated to the attic for want of a seat can be brought back into the good graces of your home by weaving a new seat of genuine rush

By L. M. A. Roy

Rush seats, characteristic of ladder-back, Hitchcock and other fine old period chairs, are not difficult to weave, and if you have stored away a cherished piece, planning to have it reseated, bring it out of retirement and do the job yourself. A ruler, shears and a hardwood hook are all the tools you'll need.

The average-size chair seat takes about 1½ lbs. of cattail rush, which can be purchased from a dealer in chair-seating materials, or you can gather and dry the rushes yourself. These are cut around the middle of August or early September, at which time they are fully grown and have passed the green and tender stage. It is important to cut them before they become hard and woody. When cut, separate the leaves and spread them out to dry. Drying requires about a week and it is important to have the rushes thoroughly dry as mildew may occur and make them unfit for use. Next, place the rushes in water and let them soak overnight to make the leaves soft and pliable. Then, before using, run the rushes through an ordinary clothes wringer to remove the excess water and air. During this process the leaves will make a crackling sound, indicating they are just right for twisting.

The beginning step in weaving is perhaps the most important one of the whole job and the steps illustrated in the diagrams should be studied beforehand to acquaint you with the weaving pattern. As most
ANTIQUE CHAIR

Chair seats are wider at the front than at the back, the weaving is started in the following manner: With the chair facing you, select two rushes, one tip and one butt length. The tip is the top growth and the butt is the stalk of the rush. Twist the middle section of the two strands and loop them over the back rung of the seat frame, temporarily fastening one half of the length to the chair back. Fig. 1 shows half of the strand being twisted and brought forward. This method is used to permit twisting the rush tightly. When necessary to splice in a new rush to the strands being worked, insert it between the others, using either the tip or butt to keep the strand of uniform diameter. Hitchcock chairs are generally reseated with fine strands about 1/8 in. in diameter, others with 3/16-in. strands. The working end of the strand is kept twisted tightly and brought over the front rung at

Above, the seat is built up "square" by adding to the sides and front twice as fast as the back. Below, when the distances along the back and front rungs are equal, a single strand is used to fill in the center.

Above, here the side areas are nearly filled and when this point is reached, the rest of the seat is completed by weaving from front to back. Below, this view shows front and back areas almost completed.
the left post, then down around and up through the frame and over the left side rung. Repeat the same wrapping step twice as indicated by the arrows in Fig. 2 and then continue the twisted strand across to the opposite side rung. Here it is wrapped around the rung, up through the frame, around the front rung twice, as before, and finally strung to the rear post where it is tied. Now, going back to the starting point, proceed with the other half of the strand and weave it around the left rear corner post as in Fig. 3 and then follow the same procedure as before, ending where you left off with the first half of the twisted strands. At this point the two halves are merged and continued as one strand, passing it over and around the rear rung, up through the frame, around the side rung and then back across to the starting point at the rear, left-hand post. In bringing the strand forward again, it is first divided into two halves as before and then one is brought to the front and wrapped around the rungs at the corner exactly as was done with the starting strand, except that the second and subsequent strands are wrapped around the rungs only once. At the right rear post, the strands are merged into one strand, Fig. 4, which is passed around the rungs and brought across the back to the starting point. Thus, each complete time around you add one strand across the back, two along the sides and two across the front. The reason for this is to build out the slanting sides of the seat twice as fast at the front rung as at the back. This step is repeated until the center opening in the seat takes on a square shape, Fig. 5, after which a single strand is used to go around and around the opening until it is filled. The sides, being shorter, generally close up first and when this point is reached, the weaving strands are merely run back and forth from front to back rungs in the form of a figure eight, passing them under at the center opening in the seat. Keep the strands pushed closely together as they are wrapped around the rungs and keep the top strands under slight tension and twisted tightly. As the center opening in the seat gradually closes up, Fig. 6, a wooden hook, such as the one shown in Fig. 10, will be found helpful in pulling the strands through the narrow opening. Fig. 7 shows the seat nearly finished, and after the weaving is completed, the loose ends protruding from the bottom of the seat are snipped off close as in Fig. 9.

Chairs with side rungs higher than the front rungs should have stuffing inserted in the side and front sections. This is added from the top surface when filling the sides and from underneath in stuffing the front. The rear section is not stuffed. The stuffing, which consists of scraps of rush, is forced in place with a flat wooden-shaped chisel as shown in Fig. 8. The seat should be varnished as soon as completed and before the rush has a chance to loosen in drying. Use a good grade of varnish and apply it to both top and bottom surfaces of the seat.
Bag Hung From Circular Frame Easily Filled With Leaves

There's nothing to filling a gunny sack with yard rakings if the bag is held open by means of this circular rack. The top of the sack is impaled on six hooks evenly spaced around the rack and, when filled, the sack is simply unhooked from the rack and carried away. Drapery hooks or short pieces of pointed rod are welded or brazed to the top ring of the rack to form the hooks. Three splayed legs, consisting of 3-ft. lengths of rod welded to the ring, hold the rack steady while the sack is being filled. The ring is a 16 or 17-in.-dia. circle bent from flat iron, rod or conduit. The unit is lightweight so that it is easy to set up wherever needed in the yard.

H. E. Chapman, Tulsa, Okla.

Faucet Handle Provides Key Rack

Key rings and chains are always at hand if they are kept on this novel key rack improvised from an old faucet handle. To make the key rack, press a short length of hardwood dowel into the handle and fasten with a setscrew. If the handle is not fitted with a setscrew, simply drive a slightly oversize dowel into the hole. Then fasten the other end of the dowel to the underside of a convenient shelf by using a wood screw driven through the shelf from above or by pressing the dowel in a hole drilled in the underside of the shelf and gluing it in place.—Frank Shore, New York City.

Gun Used to Ignite Campfire

When you start to build that all-important campfire and find that the supply of matches has been depleted, you can use a shotgun or rifle to start the fire. Remove the shot or bullet from the cartridge, tap out a little of the powder and rub it into a small piece of cloth which has been torn from a handkerchief or shirttail. Then wad the cloth, insert it in the shell and place the shell in the chamber of the gun. Gather a pile of dry grass or leaves and some small dry splinters. Step back a few feet and fire the gun into the pile of grass. The shot will ignite the powder in the cloth and will require only a little blowing and fanning to start a small blaze that is sufficient to ignite the dry splinters.

Insert for Pedestal-Type Ash Tray Facilitates Disposal of Waste

Food and other waste matter which ordinarily makes a pedestal-type ash tray difficult to clean is disposed of easily if it is caught by an ordinary tin can set below the removable top of the tray. Two aligning holes are punched in opposite sides of the can near the open end, and stove bolts fastened in the holes support the can on the top edge of the pedestal. If desired, a length of rod passed through the holes may be used instead of the bolts. The rod, of course, must be slightly longer than the diameter of the tin can and threaded at both ends so that nuts may be used to lock it in place. The funnel-shaped top of the ash tray will guide all the waste into the can, and the latter may be removed quickly for a thorough washing.

T. C. Jensen, Galesville, Wis.

©Porcelain enameled coffee pots can be kept fresh by boiling them once a week in a solution of baking soda and water.
REFRESHMENT NOVELTIES

By Roberta L. Fairall

Add a touch of easy informality to your entertaining by providing these colorful accessories to aid in serving the refreshments. With a jigsaw or small bandsaw you can complete any one of them in an evening and have them ready for decorating in gay, informal colors.

Tomahawk for crushing ice: This novel one-piece accessory is suitable for use either in the kitchen or rumpus-room. Outline it on a piece of hardwood, such as maple, and bandsaw the stock to the pattern lines. Drill a small hole near the end of the handle for hanging on a hook. Then enamel in bright red and paint an Indian design on the handle in black. Make a chopping bag of heavy canvas, with a full-length flap, for holding the ice cubes. The over-all size given is about right for holding a half-dozen cubes.

Beverage Stand: This unusual stand will get a big hand at any informal party. When assembled, the pygmy elephant stands chair-seat height and holds bottled refreshments and six tall tumblers on his back. The body, legs and ears are bandsawed from ½-in. plywood and the parts are notched as shown in the pattern details so that they fit together snugly without the use of nails, screws or glue. Sand the exposed edges and round them slightly. Then apply an undercoat and two coats of pink enamel. When the enamel is thoroughly dry, paint the eyes in black and white, add the red spots and the eyebrow and profile lines in black, and also outline the toes in black. The back of the elephant, which is a tray, is made from ¾-in. plywood, notched on one edge as indicated and fitted with a bottle rack made from ½ and ⅛-in. dowels. Recesses for the tumblers are made by cutting round holes in two pieces of thin stock and then gluing these to the base on each side of the bottle rack. Finish to match the other parts.

Napkin holder: One-dozen paper napkins folded into narrow triangles form the skirt of the doll figure, which is bandsawed or jigsawed from ¾-in. plywood to the shape and dimensions given in the squared detail. Two slotted wooden disks form the holder. The upper one is grooved to fit snugly onto the lower edge of the figure. Both disks are slotted by running spaced saw cuts in from the edge and each disk is center-drilled for a ¼-in. dowel. All parts are assembled with glue. Enamel the figure with the colors suggested in the detail.
Rock-Wool Insulating Batts Cut Quickly by Using Dull Handsaw

When insulating his house with rock-wool batts, one man found that they could be cut to size easily by using a dull handsaw to work through the fibers. To hold the batts for cutting, he nailed two boards to wooden cleats so that the boards were spaced about an inch apart, and then he supported the boards on sawhorses as shown in the illustration.

Built-Up Corner Posts for Cabin Eliminate Notching Logs

To save notching logs when building cabin walls, one carpenter uses a boxing of vertical boards to support the corners. Two boards are nailed together at right angles and guide strips are nailed along the inside corner. The logs are simply set against the boards and guide strips and spikes are driven through the boards into the ends of the logs. Boards nailed over the corners complete the boxing.

Albert H. Blackmon, Neeses, S. C.

Birds Kept From Eating Grass Seed

If you sow your lawn only to have the birds eat the grass seed, color the seed with bluing before spreading it. Soak the seeds in a solution of bluing and water until they are well colored, and then scatter the seed. The birds will not eat the seed and the coloring does not affect the fertility.

Bar Clamped to Sheet Metal Serves as Depth Stop

Craft projects in sheet metal sometimes require that a series of cuts having an identical depth be made along the edge of the work. This can be done quickly by using a metal bar to serve as a depth stop for the tin snips. The bar, which should be as long or longer than work, is clamped to the sheet metal. Locate the bar parallel with the edge to be cut and fasten it in place with C-clamps. Then open the jaws of the snips as wide as possible, press them against the edge of the sheet and cut the metal. The upper jaw of the snips will strike the metal bar and be prevented from cutting any deeper. If the same procedure is used with all the cuts, their depth will be identical. The distance of the bar from the edge of the sheet will determine the depth of the cut. However, the distance must not be greater than the length of the snip jaws.

Herbert E. Fey, New Braunfels, Tex.
CUT SCALE LUMBER
on your circular saw

IF YOUR HOBBY is modeling homes and you have the problem of getting the scale lumber needed, why not make it yourself? By using regular power tools, it's possible to produce exact scale lumber on a production basis. In fact, this type of production offers an ideal means of making your workshop pay. By contacting other home modelers you may be able to work up scale lumber and parts to their specifications. Framing lumber, siding, certain types of millwork and complete roof panels can be made on a circular saw. It's easy to make framing lumber almost any size, Figs. 2 and 3, but siding and roof panels take more time. First, determine the sectional scale size of the material and check the width of the saw cut. Then, lay out the end of the stock from which the scale sizes are to be cut, Fig. 3, marking parallel lines to indicate the width of each cut. Make the ripping cuts as in Figs. 1 and 3, noting that the first series of cuts does not go clear through the stock. Turn the piece to the adjacent working face and run the second series of cuts. Here the blade is set to cut clear through as in Fig. 3. In this second series each pass of the stock over the blade produces four to six pieces of the same sectional size. Using this method, it’s possible to produce a number of scale-size $2 \times 4$s, $2 \times 6$s or $2 \times 10$s from a single piece of stock.

Large models will require scale-sized

![Images of scale lumber cuts](image-url)
drop siding in individual boards. These can be made as in Fig. 5, details A and B. Tilt the saw table, or the arbor, to about 5 deg., adjust the ripping fence and make the first cut as at A. Then turn the piece end for end lengthwise without turning it over side- wise. Again adjust the ripping fence for a beveled board of the proper thickness at the top edge and run the second cut as in detail B. This cut gives you the first beveled board. By simply repeating the process any number of boards can be produced to a uniform size. Simulated siding and roofing shingles are produced easily on panels, either of plywood or of solid stock glued together edge to edge. The cuts are made with a dado head as in details C and D, Fig. 5, still keeping the table tilted. Here the cuts are made from one edge only; the piece is not turned. Each dado cut represents one strip of siding, which requires that the dado head be assembled to cut the correct width. The trick, of course, is in setting the dado to the right height and moving the ripping fence an equal distance each time. Shingles are simulated by scoring the panels with a sharp scriber as in Fig. 4. The effect will be more realistic if the scoring is made so that the shingles appear to be laid in random widths.

**Flashlight Cells Taped Together Form Low-Voltage Battery**

On occasion, it is necessary to connect two or more flashlight cells in series for running a toy motor or setting up an electrical experiment. The simplest way to do this is to place the cells end to end, hold them tightly together and wrap a few turns of masking tape around each joint. After wrapping, twist the cells slightly to assure a good connection. The leads are soldered to the end of the battery.

**V-Belts Serve as Boat-Dock Fender**

Several used V-belts cut into 10-in. strips and nailed vertically to the edge of a dock, provide an inexpensive fender for approaching or moored boats. The belts are nailed at approximately the same height as the rub rails of the boats likely to pull up at the dock. Use finishing nails so that their heads can be driven into the rubber.

Karl N. Greife, Pittsfield, Ill.

If you don't have a small garden trowel, a shoehorn will do the trick.
Solar Water-Heating Unit for Summer Cottage
Improvised by Draping Garden Hose Over Roof

If you've been putting up with uncomfortably cold showers at your summer cottage simply because installing a water heater does not seem worth the trouble or the expense, here's a way you can have hot water at the cost of 100 ft. of garden hose with no fuel or power bills to pay. However, running water and an outside faucet must be available. Connect one end of the hose to the faucet, drape the hose in loops over the ridge of the cottage roof and run the other end of the hose to an outdoor shower stall. That's all there is to it—you let the sun take care of heating the water in the hose. Be sure to use black hose as it will absorb heat readily, and locate the loops so that they are exposed to bright sunlight for the maximum amount of time each day. On sunny days, there will be sufficient hot water for two or three showers in succession, and the water will again become warm in about a half hour. On cloudy days, of course, the water will be lukewarm or cold. The hose should give four or five seasons of service before replacement is necessary.

Lawrence McCracken, Rye, N. Y.

Empty Talcum-Powder Can Forms Picnic Salt Shaker

Ideal for picnics or camping trips, a spillproof salt shaker can be improvised from an empty talcum-powder can. Pry off the top and then wash both the can and the top with hot water. Dry thoroughly, fill the can with salt and replace the top. Screw the cap tightly over the perforated mouth of the can or, if the cap is the type which remains on the can, simply turn it closed.

Fred Cornelius, El Paso, Tex.

Light Bulb Suspended in Bass Drum Keeps Head Dry Outdoors

Dance-band drummers who play many of their shows outdoors will find it profitable to install a 60-watt light bulb inside their bass drums. The heat from the bulb keeps the drumheads dry and also helps prevent warpage of the drum shell. To install the bulb, remove one of the drumheads and pass the extension cord through the air opening. When the drum is set up, the air opening should be at the top of the drum so the light bulb will hang at the center of the drum. The extension cord can be wrapped around one of the tension rods to keep it from pulling the light socket against the shell. Lengths of string or cord tied to the light socket and then to lugs inside the drum will keep the light from swinging against the heads when the drum is in use. Of course, colored bulbs can be used if subdued light is desired.

Clifford D. Coover, Minneapolis, Minn.

The flame of a candle or match will quickly loosen tight paint-jar caps.
Window Awning Has Bamboo Slats to Provide Better Circulation

Lengths of bamboo nailed to a wooden frame provide a window awning that not only allows sufficient air circulation to prevent the forming of a hot-air pocket under the awning, but also permits more light to filter through than the conventional fabric covering. In addition to these advantages, the bamboo awning is inexpensive and especially attractive on a summer cottage where an informal effect is desired. Nail a wooden frame to the outside window casing so that the bamboo is supported at a 45-deg. angle. Then paint the frame and allow it to dry before covering with the bamboo. To prevent splitting of the bamboo slats, nail holes should be drilled through them before fastening to the frame.

Hi Sibley, Nuevo, Calif.

Rubber-Ball Halves on Table Legs Protect Picnic Lunch From Ants

Keeping ants away from the picnic lunch is always a problem, especially on outings during the hot summer months. One effective way to protect the food is to set it on top of a card table, the legs of which have been fitted with guards made from rubber-ball halves. Just cut two hollow rubber balls in half so that you have a dish-shaped section for each of the four table legs. Then cut out a square from the bottom of each rubber dish, making the cutout slightly smaller than the cross section of the leg. To install the guards, press the dishes over the table legs, and partially fill each dish with powdered ant poison.

Lemon Juice Cleans Marble

If washing with soap and water does not remove stains from marble table tops and mantels, try rubbing the spots with lemon juice, using a wad of cotton. Rinse the surface thoroughly with clean water to prevent any possible damage to the marble.

Length of Rod Locks Gas-Range Controls in Off Position

Inquisitive children can be prevented from turning on the burners of kitchen ranges which have circular-type burner controls, if the control knobs are locked in the off position with a length of small-diameter rod. Aligning holes are drilled through the upper portions of the knobs and the rod is simply passed through the holes. If the position of the oven control does not permit locking all the burner controls with a single rod, a shorter length of rod can be used on each side of the oven control. A section of rod cut from an old refrigerator shelf will provide a lock that does not detract from the appearance of the range.
CARRYALL

By Evan Wright

IDEAL for wheeling a basket of wet laundry, garden rubbish, feed, fruit or other heavy loads, this handy two-wheel utility cart can be put to many uses around both the home and farm. It features a pivoted basket holder which is self-leveling to prevent spilling even over the roughest ground, and the low-slung design of the cart makes the heaviest load easy to wheel.

Although the diameter of the flat-iron basket holder is average for the standard wooden basket, it’s a good idea to check the size of any metal basket before making the holder. Make the frame and the wheel brackets first, using regular % in. rigid-type conduit and welding at all joints indicated. Drill the wheel brackets for the 1/2-in. axle. The lower left-hand detail shows how the basket holder is pivoted on stove bolts which pass through holes drilled in the frame and the rim of the holder. First, the bolt is inserted through the hole in the holder, then a nut is run down the length of the threads and the bolts are inserted in the holes drilled in the frame of the cart. Place a lock washer over the end of each bolt and turn on a nut. Then adjust the holder for free movement by loosening the inner nut and tightening the outer one as required.
Scraper Made From Garden Hoe Removes Old Plaster

One homeowner who likes to do his own remodeling found that an altered garden hoe was just the thing for removing old plaster down to the lath. He simply heated the curved shank of the hoe and straightened it to bring the cutting edge of the blade in line with the handle. This novel tool is especially effective on a ceiling, as it is easily forced under the edge of the plaster and the long handle permits working from a step-ladder at some distance from dust and falling fragments.

Cut-Down Glove Protects Thumb When Whittling With Jackknife

Especially handy for those who are just beginning to take up whittling as a hobby, an old leather glove can be used to shield the thumb from knife cuts and bruises. The fingers are cut from the glove, leaving only the thumb and enough of the wrist to hold the glove in place.—W. B. Eagan, Louisville, Ky.

Cone-Shaped Strawberry Patch Has Sheet-Metal Trays

Distinctive in appearance as well as a practical spacesaver, this cone-shaped strawberry patch holds a large number of plants in an extremely small area. The largest, or bottom, tray is only 36 in. in diameter and the entire bed is approximately 5 ft. high, thus allowing you to pick the berries without kneeling. Each cylindrical tray is made of galvanized sheet metal with the bottom perforated to permit drainage. The trays are supported by angle-iron brackets welded to a center post of 3-in. pipe which is embedded in concrete. The exposed portions of the bed are painted as desired.—Grover Brinkman, Okawville, Ill.

Croquet-Ball File Holder

Excellent holders for files, punches and nail sets can be made by mounting half of a discarded croquet ball on a wooden block. After sawing the ball in half, drill a number of holes in the rounded surface of one of the halves to take the tangs or tips of the tools. Then fasten the flat side of the drilled holder to the base block by using glue and a flat-headed screw which is driven flush with the underside of the base.

Plastic Cleans Sanding Disks

To increase the efficiency of my sanding disks, I clean them by holding a scrap of plastic against the abrasive disk while the disk is turning. Unless the disk is completely clogged, this does a quick cleaning job.—J. Jachimowicz, Washington, D. C.
Care and Repair of
BAMBOO RODS

By Claude M. Kreider

YOU WON'T have to tell about the big one that got away if you take time to recondition your bamboo fishing rod before going on that first all-important trip of the season. A careful fisherman assembles and checks his rod between trips and goes over it in every detail, from reel seat to top, at least twice a year. A sticking ferrule, for example, will immediately attract his closest inspection, as will a loose one. Either fault affects the life and spring of a good rod. Whipping the rod lightly will turn up a loose ferrule but one that is just slightly slack can be discovered only by bending the individual rod sections. Next on the inspection schedule are the line guides, the rod top, the cork grip and reel seat, after which comes the silk windings, one by one, and then the condition of the finish. Worn agate or metal guides may tear a line to shreds long before you can play a big one into the landing net, and a fighting trout gets a real break if you strike him hard with a loose rod top. Whipping white water with a worn reel seat or a worn grip that may suddenly loosen and twist in your hand is just asking for trouble which usually happens right at the critical moment.

Rod refitting: A complete refitting job on a worn rod is time well spent. The first step is to make a chart to show the spacing of the guides and windings on each section of the rod as in Fig. 2. Slit the windings with a razor blade and remove them and

Above, the three lower types of grips are supplied for fly rods. The upper one is a two-handed grip usually used in surf casting. Below, before removing wrappings make a chart showing their locations.
After applying cement, press the ferrules in place on the seats against a wooden block held in a vise.

When renewing the rod grip, spread cement on both meeting surfaces of disks before forcing together.

Above, the cork disks are forced together tightly on the filler stick. Below, the grip is rough-shaped with a wood rasp or a coarse, half-round file.

Also remove the rod top, or top guide, by applying heat to soften the cement. Scrape off all the old varnish—old varnish which has lost its elasticity can slow up the action of a good rod—and smooth the flat surfaces with fine sandpaper or No. 00 steel wool. Now's the time to reset that loose ferrule. On some rods the ferrules are pinned and cemented and often, after removing the pin, the sleeve will slip off when pulled and twisted lightly. If it resists a light pull, apply heat from a candle or alcohol burner and remove with pliers. Remove the old cement from the ferrule seat with a strip of sandpaper as in Fig. 3. Check the ferrule for fit, then recement it in place, using the special stick cement supplied for this purpose. Usually it is necessary to heat the ferrule slightly and press it quickly in place. If the ferrule has been damaged in any way, especially if it is of the double-shouldered welt type or the shoulderled-band type with closed ends, it may be necessary to renew both male and female parts. Reseat after cementing, using the method shown in Fig. 4.

**Repairing reel seats and grips:** If a close examination of the reel seat and grip shows that renewal of the parts is necessary, heat the seat moderately to soften the cement, and then pull it from the rod. Cut off the old cork grip with a sharp knife, sand off the cement and smooth the filler piece, or stick. One-piece cork grips, Fig. 1, are available as renewal parts for most rods, but many fishermen prefer to build up and shape the grip from cork disks as in Figs. 1, 5, 6 and 7. Apply glue, or stick cement, between the disks as in Fig. 5, force them tightly together as in Fig. 6 and, after the cement sets, rough-shape the grip as in Fig. 7. Finish the grip to the shape desired with fine sandpaper, Fig. 9. Then attach the reel seat. New cement over the projecting end of the filler stick usually will reset an old seat securely. A new one is generally installed in the same manner but it may be necessary to reduce the size of the filler slightly by sandpapering. After applying cement liberally, press the seat tightly into place as in Fig. 10.
Mounting guides: Many fishermen prefer steel snake guides for fly rods. On bait rods, the ring-type guide generally is considered best. Tops or tip tops for both bait and fly rods should be chrome plated and on fly rods the stripping guide should be of the ring type and chrome plated. Fig. 8, details A to D inclusive, shows the procedure in binding, or rewinding, guides to the rod. Refer to your chart for the exact position of the guide and then proceed as pictured. Some fishermen apply a thin coat of rod varnish over the area to be wrapped, then proceed with the wrapping before the varnish sets. The simplest way to apply the wrapping is to hold the rod under the left arm and rotate it with the left thumb and forefinger. The right hand guides the thread and maintains the correct tension. No. 00 silk is the size most commonly used, but many fishermen prefer a heavier thread for wrapping guides. It also is regular practice to rewrap the ends of the ferrules where the metal meets the bamboo. As a rule, the wrapping is started a few turns below the ferrule ends and is carried up to the edge of the metal. Ferrules that have serrated ends should be wrapped up to the shoulder or bead.

Repairing a fracture: Occasionally the separate strips of bamboo will open under severe strains and in some cases may splinter. Generally, such fractures can be repaired. Carefully pry open the parts at the joints and insert toothpicks in the openings as in Fig. 11. Then brush waterproof glue into the openings, pull out the toothpicks, press the parts tightly into place and bind with strong cord wound on the glued portion in a crisscross pattern as in Fig. 12. When dry, remove the wrapping and sand smooth on all the flat faces.

Finishing: It's regular practice to refinish an old rod with three coats of special rod varnish. Wipe the rod sections to remove all dust and lint. Thin the first coat with a small quantity of pure turpentine and in applying the varnish flow it on with as little brushing as possible. Hang the sections vertically to dry. Smooth the sections between coats with fine steel wool.
Chopping Board of Laminated Hardwood Fitted With Detachable Tray for Mixing

Combining a detachable mixing tray with a sturdy chopping block of laminated hardwood results in one of the handiest of kitchen utensils. Four removable pins of brass or aluminum anchor meat to the block for easy carving. The hardwood strips can be laminated by gluing them together or fastening with two tie rods. The mixing tray is cut from sheet aluminum according to the half pattern and the corners are crimped in three steps as shown. The tray hooks over a sheet-metal rail screwed to the edge of the chopping block. — Roland Cueva, Heyburn, Ohio.

Adjacent Paint Swatches on Glass Match Colors Professionally

The next time you run out of paint before finishing a job and must mix a new batch to match a given color, try comparing the color with a method often used by professional painters. Smear the color to be matched on a piece of glass and next to this place a swatch of the shade being mixed. Then turn the glass over to view the two colors. If there is the slightest difference in shade you will notice a definite line between the two smears. Continue to mix the color until no line is visible. — Jeff Sterns, New Bedford, Mass.

Firm Foundation Under Flagstones Keeps Them From Tilting

When laying a flagstone walk, remember that it is important to have a firm foundation under each stone to keep it from tilting or rocking under foot. To do this, cut the outline of the stone in the lawn, making it about an inch deeper than the thickness of the stone. Then fill the hole with sand or mud until the top of the stone rests flush with the sod. Add another 1/2 in. of sand or mud and tamp the sand or, if you use mud, press the stone into the hole to the desired level. Allow the stone to set for 24 hours before walking on it. — Robert C. Kendall, Oak Park, Ill.

Driving Screws in End Grain

Wood screws driven into end grain will not pull loose if they are driven into a length of dowel. Before driving the screws, drill a hole parallel to the end of the piece and in such a position that the screws will enter it when completely driven. Then press the dowel into the hole. In this way the screws will actually be driven into surface grain instead of end grain.

Wire Solder Binds Extension Cords

Extension cords of portable tools and electric appliances which must be wrapped and unwrapped frequently for storage can be bound in a neat bundle with a short length of wire solder. A turn or two of solder will keep the cord from unwinding, and the solder can be removed in a jiffy without untangling or untwisting when the cord is to be plugged into a receptacle. — Louis Hoekman, Sherman Oaks, Calif.
Inexpensive Trays and Coasters From Cardboard

Ideal for the little girl's party, or even the teenage hostess who wants something different and personal, these die-cast coasters and trays of cardboard can be made in many shapes and decorated in any color or combination of colors, including spatter and mottled finishes, as well as finishes in which colorful bronzing powders are used. The trays are so inexpensive to make that any youngster can do it, although dad may have to jigsaw the dies to shape. Use 1/2-in. stock for the coaster dies and 3/4-in. stock for the trays. Cut the cardboard blanks 1/2 in. oversize and to the shape of the die. Then soak them in water until pliable and soft. Clamp the dies together and leave them until the cardboard is dry, after which it is ready for finishing. If the trays or coasters become soiled, just make some new ones.

Electric Detector Locates Nonmetallic Sewer Line

Before starting excavation for a new building which is to be adjacent to an older one on your property, it will be necessary to locate the course of the sewer lines running from the present house. Even though the sewer pipe is of nonmetallic tile, an electric metal detector can be used to locate the position of the sewer accurately. To do this, just run a metal tapeline or auger into the sewer so that the detector will pick up the course of the tapeline. If there is sufficient water in the sewer, the end of the tapeline can be floated to facilitate moving it through the pipe. This is done merely by tying a cork float to the end of the tape.

Edgar Barnhart, Whittier, Calif.

Wallpaper Moistened for Removal By Using Vacuum-Cleaner Spray

Next time you are redecorating and have to soak the wallpaper in order to remove it, try using the spray equipment which is supplied with the vacuum cleaner. To do a quick job of loosening the paper, make sure that the spray-gun container is kept filled with warm water.
EXPERIENCED power boatmen who regularly work their boats offshore for hire or for pleasure keep at hand certain accessories that save time, comply with boating regulations and are always available to serve both normal and emergency uses. Most of these are made easily by the owners themselves at a considerable saving in initial cost.

Mooring buoy: If chain is used on the mooring anchor, a mooring buoy is needed to support the end of the chain at water level. The buoy pictured at the left and detailed in Fig. 2 is made from stock sizes of cork, brass studs with nuts for both ends, two square pieces of marine plywood, canvas (about 12 oz.) and a flanged tube of copper or galvanized iron having an inside diameter which will permit the chain to run freely. Any boater can make the buoy by following the assembly details given in Fig. 2.

Solar switch for anchor light: When it is necessary to moor a boat outside designated anchorage areas it is essential to show a riding light after sundown. The light detailed in Fig. 1 is controlled automatically by solar heat acting on a 3-in. thermostat of the double-wafer type which is hooked up to the 6-volt storage battery. The thermostat-and-contact assembly serves as one side of the electrical circuit of the switch, the other side being the bridge and one of the binding-post assemblies to which one of the lead wires is attached, as will be seen from the detail in Fig. 1.

In use, solar heat—sunlight—expands the thermostat which breaks contact between the washer-nut unit and the bridge, thus turning off the light.
mostat when the sun sets or is covered by
dark clouds, reverses the action and closes
the circuit, thus turning on the light.
Current drain is reduced to the minimum by
using a 6-volt radio-dial bulb in a mini-
ature screw-base adapter, which fits the
anchor-light socket. The regular anchor-
light stand and the thermostat are mounted
on a Bakelite base as detailed in Fig. 1.
The binding post on the top of the thermostat
is made up as shown in the pull-apart view,
using a piece of spring bronze for a washer
contact, and the bridge is supported on two
brass spacers, tapped at both ends. Bakelite
parts are used where insulation is required.
Note that the Bakelite base is recessed on
the bottom to house the wiring and the nut
which holds the thermostat assembly. With
this arrangement it is easy to unscrew the
thermostat from the base should it be nec-
essary to replace it. On cabin cruisers, the
light unit is placed on top of the cabin
where it is not likely to be damaged. Seal
the joint with calking compound. When
mounted on deck it may be necessary to
provide a glass cover to protect the switch.
However, it should be remembered that the
cover will tend to slow the action of the
thermostat by retaining solar heat. During
the winter months in the northern latitudes
this delayed timing would probably prove
satisfactory but in or near the tropics faster
action of the switch is desirable. Painting
the thermostat black also would tend to
have the same effect as the glass cover.
In hooking the switch to the battery just cut
one side of the power line and connect in
series at the switch as shown in the detail
in Fig. 1. When the switch is in continuous
operation, clean the contact points at reg-
ular intervals.

**Boat-hook bracket:** An indispensable
piece of loose equipment aboard a large
cruiser is a boat hook, but owing to its
length it can pose a storage problem on the
smaller boats. To be of any practical use
on a cruiser the hook and handle should be
at least 10 ft. long and the place for such
a piece of equipment usually is on top of the
deckhouse as in the photo above Fig. 3.
Located in this position the hook is always
at hand when you need it and when not in
use it is held firmly in place on a special bracket which prevents it from being knocked down or blown overboard. One feature of the boat-hook bracket detailed in Fig. 3 is unique: The handle is drilled transversely about 1 1/2 in. above the hook ferrule to take a 5/8-in.-i.d. copper tube with flanged or flared ends. The tube fits over a pin in the center of the front bracket member as indicated. The pin is formed by turning a brass wood screw into the bracket and then cutting off the head as suggested. Bandsaw the three members of the bracket from selected mahogany to match the boat woodwork and smooth with fine sandpaper. Center-bore the rear member to take the handle of the hook, then drill and counterbore all three members for screws and wooden plugs. Attach the bracket members to the top of the deckhouse on the center line with brass wood screws. Drive plugs cut from matching wood into the counterbores and file and sand flush. Finish the wood with at least two coats of spar varnish. To lash the boat hook in place, insert the end of the handle in the hole in the rear bracket member and slide it back until the copper tube in the handle near the hook will drop over the pin in the front member. Then tie in place with the leather lacing provided. The lacing holds the hook securely in place, and the pin engaging the sleeve in the handle prevents it from sliding either forward or backward.

Safety fender cleats: Any boatman who has ever “stubbed” a toe on a metal fender cleat while wearing canvas deck shoes can appreciate the streamlined safety cleats pictured and detailed in Fig. 4. One boatman who experienced a painful injury in such a manner designed these cleats to support the fenders along the narrow side decks of his cabin cruiser. They are made from selected white oak and can be finished in the natural color with spar varnish or painted in whatever color suits the boatman’s fancy. Note that each one is bandsawed to a 5 1/4-in. radius across the top and to a 5/8-in. radius at each end. This leaves a center height of only 1 3/4 in. As detailed, the cleats should be made in pairs from a block 2 1/4 in. wide and 5 1/2 in. long. Mark intersecting center lines from the edges of the block and bore a 1-in. hole at the intersection. Then bandsaw the radii on both edges and rip the block in half on the long center line. Round the top edges and also the inner edges of the half-round opening. Attach the finished cleats to the deck with flat-headed brass screws. In rigging a fender on this type of cleat, most boatmen would use a continuous loop through the eye of the fender and the half-round opening in the cleat and tie with a square or reef knot.
Pennant pickup buoy: This buoy is similar in construction to the mooring buoy already described. Its purpose is to carry the end of the Manila pennant when you leave the permanent mooring buoy. When you return to the mooring, the pennant buoy is picked up with the boat hook, thus bringing the eye of the pennant to hand with the minimum of effort. As in the detail, Fig. 5, the buoy is built up from cork to a 6 x 6-in. sectional size and a length of 12 in. and is covered with canvas. Holes are drilled through the built-up cork block near the ends to take $\frac{3}{8}$-in. hardwood dowels which are cut flush with the surface of the cork. After the canvas covering has been cut to size and sewed in place, wet it to shrink the fabric tightly over the block. Then attach a heavy canvas strap with brass screws and washers, the screws passing through holes punched in the strap and into the ends of the dowels on both sides of the cork block. The free ends of the strap are fitted with a bronze ring and snap as shown. At the opposite end of the buoy block the strap is left slack to form a loop which can be caught with the boat hook. To stiffen the loop so that it will stand clear of the buoy block, apply two or more coats of outdoor enamel or airplane wing dope to the strap. Paint the buoy block with orange or ivory-colored outdoor enamel and letter the boat number and name on both sides in black. Either of the body colors (some boatmen will prefer orange) shows up clearly on dark water in daylight and also at night when picking up the buoy with a searchlight. The enamel will take better if the canvas is first filled with a coating of white lead. Be sure the latter is thoroughly dry before applying enamel.

Improvised deck scupper: Here's another inboard accessory worked out by a boatman from a sink strainer and it's as neat and efficient as any of the conventional brightwork. In fair weather, deck scuppers seem the least essential of any of the deck fittings but when the wind makes up and sends spray spinning off the wave crests you'll be glad you installed them. Primarily, of course, they're installed for the purpose of draining away water used when washing down the deck on larger cabin boats. The installation shown in partial section in Fig. 6 is made in a plywood deck covered with linoleum. For a neat job simply bore a hole through the deck and scarf the edge of the linoleum around the hole so that the flange of the strainer fits flush when the locknut is tightened from underneath. Use the entire sink-strainer fitting as shown in the inset detail. Attach a hose to the lower end of the fitting with a clamp and lead it down to a bronze through-hull fitting of the type having a tailpiece.
Adjustable Brackets Extend Roller to Raise Lawn-Mower Cutter Bar

To assure that growth of a lawn continues throughout the dry, hot days of summer and also to prevent the soil from cracking and drying out, it is sometimes desirable to keep grass trimmed to a length of 2 1/2 or 3 in. during the late summer months. On mowers not equipped to permit adjustment of the cutter bar to the required height, this can be done by fitting the roller mounting brackets with flat-iron extensions. After sloting and drilling two pieces of flat iron as shown in the detail, ream the threads out of a small nut and weld it over the hole to serve as a bushing for the roller shaft. The offset in the bracket extensions is bent to suit the length of the roller. Bolting the slotted portions of the extensions to the original roller brackets permits varying the adjustment.

Gathering and Storing Cold-Weather Fish Baits

One of the best pan-fish baits for early fall is the small ear worm found in sweet corn. The worms should be gathered and stored in a deep box or barrel together with a few cornstalks with the ears left on. The grubs found in horseweed and goldenrod stems also are good fall and winter pan-fish bait. Just cut off the stems above and below the swelled portions (the worms are inside) and store them in a dry place until you need the grubs. Angle worms should be dug in late summer and stored where they will not freeze. Keep the worms in a wooden box packed with alternate layers of damp moss and well-rotted leaf mold. Do not keep the worms too damp. Many species of minnows can be kept in a fairly deep pond or in a galvanized water tank where fresh water is pumped in daily. Feed them a little raw oatmeal or small worms.

Pan of Water Forms Level For Checking Slope

Finding it necessary to determine the degree of slope when pouring a new driveway and not having a level to do the job, I checked the slope by using two rulers and a pan of water. I filled the pan about three-quarters full of water and set it in the driveway excavation, first being sure that the surface underneath the pan was uniform. Next I held two rulers on end in the water so that the distance C was exactly 1 ft. The depth of water in inches at B was subtracted from the depth at A, giving the slope per foot.

Leonti Thompson, New York City.

Ink Bottle in Paint Sprayer Saves Cleaning Cup

Time wasted and paint lost in cleaning a quart-size sprayer cup after painting small objects can be saved if an inner container such as an ink bottle or baby-food jar is used to hold the paint. Partially fill the ink bottle with enamel of the desired color and set it inside the cup of the sprayer. After painting the articles, clean the spray gun by replacing the ink bottle with a second bottle filled with gasoline. In this way, the regular container is kept clean and ready for use on a larger job. If you buy the paint in 1/4-pint cans, the can of paint usually may be placed right inside the sprayer cup.

(Furniture hardware can be cleaned by scouring it thoroughly with borax and water, and then polishing with a soft cloth.

Preventing Lawn-Roller Rust

If your lawn roller is the type which is filled with water, it can be kept from rusting on the inner surfaces by adding a rust inhibitor to the water.
That toddler of yours doesn’t need to be convinced that daddy’s wonderful, but if you want to give him a real thrill, spend an hour or two some evening and make him one of these exciting pull toys. Six colorful blocks which fit loosely over dowels ride on the top edges of the wheels and spin as the wheels turn. The faster the toy is pulled, the faster the blocks spin. The base of the toy is a block of wood drilled for the dowels, the wheels are turned and nails provide axles. After the parts are cut out and enameled, they should be allowed to dry overnight. However, once the parts are dry they can be assembled in five minutes.

I. M. Fenn, Chicago.

Proper Storing Keeps Bait Frogs and Crayfish Lively

Crayfish and frogs will be in lively condition when used for bait if they are kept in a clean, dampened gunny sack. Place some leaves and small branches in the sack and tie the top shut to keep the bait inside. The branches will hold the sides of the sack apart. The sack should be moistened with cold water as necessary to keep it wet, and it should be stored in a cool, dark place.

R. A. Jenkins, Los Angeles, Calif.

Streamlined Bicycle Lights Form Headlights for Youngster’s Auto

Mounting small bicycle lights on the sides of a child’s automobile will provide neat headlights which not only add to the appearance of the car but make it more realistic for the young driver. A light may be mounted on either side of the cowling or front grille, or a bicycle horn may be substituted for one of the lights.

To remove shellac from fabric, saturate the spot with grain or denatured alcohol. Then apply wet fuller’s earth over it and, when dry, brush off.
RECORD CABINET
serves as hassock

By Elma Waltner

AFTER A few years, a phonograph-record collection invariably overflows all available storage space which, in many cases, poses the problem of adding a record cabinet to a room already crowded with furniture. If this is the situation in your home, here is a combination hassock-record cabinet that not only will take care of the overflow of records but will double as a comfortable seat. The cabinet is partitioned into three sections, one for storing 10 or 12-in. record albums and two drawers for filing 7-in. records and miscellaneous items.

The sides, bottom and top of the cabinet are of %%-in. plywood and countersunk screws and glue are used to fasten all the joints. A recess must be routed or cut into the front edge of the right-hand side panel to permit mounting a friction catch for the cabinet door. A plywood partition then is set up between the top and bottom panels and a plywood shelf for the upper drawer is nailed to cleats attached to the side panel and partition. The shelf cleats are cut ¼ in. shorter than the shelf itself so the face of the lower drawer will fit flush with that of the top drawer.

The cabinet door is simply a %%-in. plywood panel that is hinged with invisible hinges. If the latter are not available, ordinary butt hinges can be used with satisfactory results. However, these also should be set in mortises so that the hinge leaves are flush with the wood surfaces.

Plastic or imitation leather is used to up-

Panel joints are glued and fastened in place with countersunk screws, below. Pilot holes drilled in end grain will prevent possible splitting of panel

Photo below shows router bit being used to cut mortise in cabinet door. Matching mortises in door and edge of side panel receive invisible-hinge plates
A plywood base slightly larger than over-all dimensions of cabinet top is fitted with foam-rubber pad to provide seat cushion. Note ventholes in plywood.

Cover for seat cushion is sewed together and placed over pad, above. Upholstery is brought around sides of cabinet and tacked to the top and bottom, below.

Seat-cushion cover is tacked to underside of plywood base and, after assembly, cushion is mounted on cabinet with countersunk screws driven from underside.

holster the cabinet, which is trimmed with a decorative welt seam of a contrasting color. The welt is sewed between the upholstery panels and corner strips when covering the sides, and between the top panel and boxing, or edge strips, when covering the cushion. The latter consists of a plywood base, a foam-rubber pad and the upholstery, which is brought around the edges of the base and tacked to the underside. A neater job of upholstering can be done around the door opening and on the door itself if the exposed edges of the material are glued to the wood between the tacks.

The drawers are made as in the detail, the drawer bottom being nailed in rabbets cut along the lower edges of the sides, front and back. Dimensions of both drawers are the same except that the face of the bottom one is made high enough to reach the lower edge of the top drawer. Furniture glides attached to the corners of the cabinet, raise it off the floor sufficiently to permit opening the door without binding.
Board Supported by Camera Tripod Forms Collapsible Utility Table

If, on occasion, you need extra work space in the darkroom, it can be attained quickly by improvising a utility table from a board and a camera tripod. Mount a standard tripod bushing in the underside of the board or simply drill a hole in the board to receive the tripod screw. Then support one end of the board on a table or bench top and use the tripod to provide a support for the other end, turning the tripod screw into the bushing or pressing it into the hole in the board. The board can be stored in an out-of-the-way place when not in use to keep it handy for emergencies.

Edward L. Fisher, Milwaukee, Wis.

Wetting-Agent Dispenser

Some photographers who add a wetting agent to their developer find that a hand-lotion dispenser of the type pictured is more convenient to use than a bottle and medicine dropper. After cleaning the lotion bottle and dispenser thoroughly, fill the bottle with a solution consisting of 1/2 oz. of concentrated wetting agent to 10 oz. of water. With the wetting agent diluted in this way, each depression of the dispenser plunger will adequately treat 8 oz. of developer.

Quartz or Carbon-Arc Sun Lamps Print Excellent Proofs

When making sunproofs at night on print-out studio proof paper, use a quartz or carbon-arc sun lamp to do the job. Proofs from negatives of ordinary density can be made in a few minutes, and the sun lamp is actually more desirable than daylight, as it allows positive timing control. Unlike daylight, the sun lamp is always the same intensity, allowing the proofs to be timed accurately to attain the desired shade or depth of tone.—Virginia Hanson, Santa Monica, Calif.

Spare Parts Carried in Match Book

Small spare parts for a camera can be carried in the pocket with little danger of loss if they are attached to the inside of an empty matchbook. Tightly fasten each part to the book cover with a strip of cellulose tape and, if desired, write any pertinent information regarding the parts on the inside of the cover or on a label glued to the outside.

John J. Rea, Urbana, Ill.

Miniature Spot for Close-Up Work Utilizes Coffeemaker Bowl

Wired to a photoflood reflector, the top bowl of a vacuum-type coffeemaker provides a miniature spot for extreme close-up work or microphotography. The metal bowl, mounted over the front of the reflector as shown in the photo, will throw a brilliant pin point of light at close range. Be careful when using the unit to prevent overheating, and handle the bowl cautiously after use to avoid burns.
PHOTOGRAPHER'S
PROP STAND

Photographing insects, plant specimens, etc., requires a special prop stand for close-up work, especially if magnification of the object is necessary. This stand supports a reading glass beneath the camera lens as in the upper photo at the right. It also doubles as a magnifier for spotting prints, as in the lower right-hand photo, or viewing negatives when making a critical analysis of detail. The design of the stand provides a universal adjustment of the glass, which can be locked firmly in any position by means of a screw eye and wing nut. The angle positions indicated are optional. All parts except the metal arm should be of hardwood smoothly sanded and shellacked.
E. Peter Smith, Los Angeles, Calif.

Paper Clip on Print Tongs
Hooks Over Tray Edge

To keep wooden print tongs from sliding into the developer when resting them on the edge of the tray, fasten a wire paper clip over one of the legs of the tongs, thus providing a stop which catches on the edge of the tray. If the arm of the tongs is too wide to permit slipping the inner loop of the paper clip over it, open the clip and bend the wire around the arm. Bend the wire so that it projects a slight distance from both edges of the arm.

A universal adjustment of the stand simplifies the placement of magnifier when photographing extremely small objects where critical focusing is necessary.

Simply readjusting the glass gives you a magnifying viewer for spotting prints or examining fine detail in choice negatives. Unit also can be made to serve as a magnifier for bench assembly of small parts.

Tape Across Top of Pan Head
Tightens Loose Camera

If the screw in the top of a pan head does not hold the camera securely enough to keep it from slipping when the head is turned quickly, cover the pan-head surface with black photo tape. The thickness of the tape together with its nonslip surface will keep the camera from turning after the screw has been tightened. Note that the screw projects through the tape and that the latter is trimmed around the edges to suit the shape of the pan-head top.
PARALLAX CORRECTION for a

NEGATIVE SHOWS EXACT AREA OF GRID BOARD RECORDED AT 15°

FRAME 1" OUTSIDE RECORDED AREA

TAPE 6" X 9"

SOLDERED 2" X 2"

1/4" X 10" X 42"

1/8" ROD

1/4" DOWEL

1/8" BRACKET

22"

26"

HOLE FOR VIEW FINDER

3/8" PLYWOOD

CORNER BRACES SOLDERED IN PLACE

EASEL SUPPORT

SHEET METAL

ANGLE BRACKET

HINGE

POPULAR MECHANICS
IN EXTREME close-up work where it is desired to make color transparencies of a single flower or other object with a 35-mm. camera, there is always the problem of parallax. At such close range the lens coverage and that of the view finder do not coincide. Thus, when the subject appears to be framed perfectly, it actually isn't and may even be partly out of the picture. To correct this, I made the simple device shown at the left which automatically centers the subject and brings it into sharp focus without adjusting the camera.

The wire frame forms a depth stop, and to shoot an object on the ground, I merely stand the device vertically over the subject and shoot. Likewise, in shooting a specimen or copy mounted on a wall, the device is simply held against the wall. The same is true in shooting a flower, and it's all done without an auxiliary close-up lens.

To determine the length of the wire framework, a wooden carrier is made according to the detail at the left. The dimensions given are not critical, and the 15-in. dimension is the distance I found necessary for my particular camera. The camera is mounted on a sheet-metal plate by means of a piece of angle iron. Note that a small peephole is made in the plate in line with the view finder. The camera and plate are supported by a post fastened to a movable base which is located at one end of a 3½-ft. board and an easel is provided at the opposite end to determine the area covered by the lens. This easel can also be used for copy work and may be hinged to fold flat. Rule the easel in 1-in. squares in ink and also rule heavy reference lines intersecting at the center of the board. Now, noting on the camera scale the closest distance the lens can be located from the easel, clamp or bolt the movable base to the carrier. If, for example, the scale reads 1¾, locate the lens 15 in. from the easel. With this done, take a test shot and make a print. Count the number of squares on the print and the same number on the easel, keeping the count in the same relation to the center lines both vertically and horizontally. Mark this area with a dotted line. It defines the exact area covered by the lens. Now, leaving the camera undisturbed, stand the setup on end and assemble the framework in the manner shown, painting all parts with flat-black lacquer. Note that the open end of the frame is made 1 in. larger over-all than the recorded or dotted area so that the frame will not register on the film.

Newspaper Flattens Curled Prints

When heat is used to dry glossy prints on ferrotype tins, the prints have a tendency to curl. While they are still warm from the drier, the prints can be flattened quickly by placing them face up on several thicknesses of newspaper which have been sprinkled with water. The prints will absorb enough moisture from the newspaper to relieve the excessive dryness which causes the curl.

Sandpaper on Flash-Gun Adapter Speeds Cleaning Bulb Terminals

To assure good contact, many photographers moisten the base terminal of each flash bulb before inserting it in the socket. A faster and, more important, a much safer way to assure firing is to rub the terminal across a strip of sandpaper or emery cloth which has been cemented to the flash-gun adapter or to a convenient spot on the camera case.—H. Leeper, Canton, Ohio.

Holder for Applicator Stick

Cotton and an applicator stick are always handy if they are kept right with the retouching medium. To provide a holder for these items, tape the top section of a lipstick container to the side of the bottle.
Basement Windows Sealed With Plywood Panels

Keeping light from entering through the windows of an improvised darkroom often entails enough trouble to dampen the enthusiasm of many an amateur photographer. One way to seal the windows of a basement laundry room or a utility room in a jiffy is to make lightproof panels which fit snugly between the edges of the window casings. Sheets of plywood, hardboard or cardboard are used for the panels. These are cut to size and framed with strips of wood. Then felt weather stripping or strips of cloth folded three or four times are tucked around the edges of the panels to form a light seal, and ordinary sash locks are used to clamp the panels in place.

Hugh Lineback, Stillwater, Okla.

Steel Ball Shims Reflector Swivel When Clamp Arm Is Removed

If a clamp-on photoflood reflector is mounted permanently on a stand, it is desirable to remove the clamp arm so that it does not interfere when adjusting the reflector. As the swivel ball is part of the clamp arm, it is necessary to substitute another metal ball which will serve as a spacer to hold the joint plates parallel. A ball from a bearing or a steel “marble” of the right size will shim the swivel fixture, allowing the reflector to be easily adjusted and holding it in position.

Cotton Dispenser for Darkroom

Instead of bothering to open the package of absorbent cotton and tear a wad of it from the roll as needed, one photographer saves time by rolling wads of cotton into balls and storing them in a cardboard candy or shoe box. The balls are of a size found to be most convenient for swabbing film, cleaning ferrotype plates and filtering solutions. Stored in the candy box, the cotton is available for quick selection and, if kept covered, is protected from dust and lint.

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All books are available from Popular Mechanics Book Dept., 200 E. Ontario St., Chicago 11, Ill.
HOME CRAFTSMEN, hobbyists and others who have only occasional need for a small circular saw can easily build a serviceable one from a few pieces of hardwood, assorted bolts, flat iron and a polishing head of the type having a straight spindle fitted with two machined collars. A light polishing head of this type makes a suitable arbor for a 6-in. saw blade. The top, or saw table, Fig. 1, is made from ¾-in. hardwood plywood, such as oak or birch. Have your lumber dealer cut the piece to size, run the ¾ x 7/8-in. groove and also cut the saw slot in the position indicated in the detail. The slot should be ¼ in. wide. Some polishing heads have larger pulleys than others, making it necessary to dado or recess the underside of the top as indicated by the dotted lines in Fig. 1 to provide clearance for the pulley and belt. If required, this cut can be made at the time the groove is cut. Cutting the belt slot in the table support, Fig. 5, is easy; just bore a 2½-in. hole with an expansive bit and make two saw cuts inward from one edge of the piece to remove the waste. Then reinforce the opening with two blocks attached to the back face with screws. Fasten
this support to a base of 3/4-in. plywood with screws driven through the plywood from the underside. Then cut another support of the same size and attach it near the opposite end of the base. Locate the polishing head on the base and fasten it in place with screws or bolts. Now, place the saw blade on the polishing head, and bring the top into position with the blade projecting through the slot. Shift the top until the blade is centered in the slot. Then mark the location of the hinges.

Parts which make up the elevating screw mechanism are detailed in Fig. 4 and shown in position in Fig. 5. This type of elevating screw gives a positive adjustment of the table height and will not loosen after being set. Figs. 2 and 3 detail the construction of the crosscut guide and ripping fence. The guide bar of the crosscut guide runs in a channel-type door track which is inserted in the table groove as in Fig. 1. The swinging metal guide pivots on a rivet, permitting it to be moved 45 deg. in either direction. The semicircular slot must be carefully laid out and filed to a uniform width. Details of the ripping fence will be clearly seen from Fig. 3. Fig. 1 shows scales made from hardwood rulers and set into the front and back edges of the table as an aid to accurate setting of the ripping fence. However, these are not essential as it is quite easy to set the ripping fence accurately with a rule. Finish the table with two coats of shellac and rub with steel wool.
Inexpensive Grain Blower Utilizes Scrap Parts

Operated by a 6-hp. motor or by a belt drive from a tractor, this homemade grain blower is just the thing for elevating grain into farm bins to be ground for feed during the winter season. Built inexpensively from scrap parts, the blower will handle as much as 10 bushels of small grain per minute. The blower shell is ½-in. sheet metal bent to a circular shape and held between two sheet-metal sides with 8-in. carriage bolts. The hopper is also of sheet metal fastened to an angle-iron frame, and a sliding door regulates the amount of grain being fed into the blower. The blower drive assembly consists of the front hub, bearing and axle of a 1936 truck. Four fan blades of ½-in. sheet metal are welded to a section of arbor bolt, or square axle, from a disk harrow. Then the arbor is mounted on the truck axle to complete the assembly.

Retruing Center Hole Without

When turning heavy stock between centers, machinists sometimes experience trouble caused by enlargement of the center hole at the tailstock end of the work. This happens quite frequently when a number of heavy cuts must be taken on the same piece. Ordinarily, it is necessary to remove the stock from the lathe in order to true the center hole, but this can be avoided by using a center-truing bit made as in the detail. Use a short piece of hex stock of a suitable sectional size and turn, center-drill and grind as indicated. Then temper the bit to hold a cutting edge. To use the bit, block up the stock to hold it in position, then run the tailstock center back until the bit can be placed in the center hole of the work. Run the tailstock quill in until the tail center enters the center hole in the bit. Seat the tailstock center fairly tight and turn the bit with a wrench. Usually one turn of the bit will clean and true the center hole accurately.

A. E. Kerswell, San Bernardino, Calif.

Removing Stock From Lathe

Easily Seen Warning Symbols Painted on Trailer Endgate

A tractor trailer is difficult to see on the highway at dusk or in a rainstorm unless it is painted in colors having high visibility properties or is otherwise clearly marked with a warning symbol which is visible at a distance. Ordinary red reflectors are often insufficient warning to approaching motorists. Some farmers who regularly use tractor trailers on the highway paint large “X” symbols on the trailer endgate, using a bright-yellow or orange paint. The symbols should be as large as possible so that they are readily seen under poor light conditions during the day or evening. Always use two symbols, one near each side of the wide endgate so that the full width of the trailer is clearly indicated.

(Loose piston rings and worn pistons or cylinders are indicated by oily conditions of the spark plugs.)
Two Oil Drums Welded Together Form Gasoline Storage Tank

Welding together two 55-gal. oil drums to form a single drum of 110-gal. capacity provides a handy gasoline storage tank for the farm. Drums having one damaged end can be used, as one end of each drum must be cut off before welding them together. After welding, paint the outside of the tank with aluminum paint to reflect heat, mount it on a wooden stand and fit one end with a spigot. Before welding, be sure to steam-clean the inside of each drum thoroughly to prevent the possibility of an explosion resulting from the ignition of oil fumes.

L. H. Houck, Jefferson City, Mo.

Interior Walls of Metal Tubes Cleaned With Abrasive Strips

Here's a way to mirror-polish the inside walls of metal tubes. Shoulder a length of ¼-in. drill rod ⅜ x ⅛ in. at one end and thread the projection. Then cut two 1 x 12-in. strips from abrasive cloth, punch a hole through each strip at the center and slip the two strips over the shouldered projection at the end of the rod. Run down a ¼-in. nut to hold the strips in place. Then tighten the free end of the rod in a hand-drill chuck as shown. Hold the tubing in a vise, insert the tool in one end of the tube and rotate the hand drill rapidly, moving it simultaneously back and forth. On long lengths of tubing, work from both ends.

Leroy J. Hebert, Lexington, Mass.

Wire Grip for Speeder Handle Prevents Blistered Hands

As the speeder handle for my set of socket wrenches had no rotating handgrip on the crank, I found that prolonged use of the wrench was hard on my hands. To facilitate using the wrench, I fashioned a suitable handgrip by wrapping 9-ga. wire around the crank. The starting end of the wire is clamped tightly to the crank with a pair of vise-type pliers and the wrench handle is turned to wind the wire. The ends of the coil can be squared by cutting off the ends of the wire diagonally, and they can be soldered in place if desired. However, the 9-ga. wire is stiff enough to hold its shape without soldering. In order to clamp the

end of the speeder handle in a vise to facilitate winding the wire, I sandwiched the handle between two pieces of board before tightening the vise jaws. These were drilled previously to form a matching half-round groove in each piece which keeps the handle from tilting but still permits it to be rotated while wrapping the wire.

Charles S. White, Vernon, Tex.

(Keeping tire valve caps in place is important. They help prevent air leakage and keep dirt out of the valve core.)
A deep tray built into the top of this unusual lathe bench catches 90 percent of the chips from the average wood-turning operations. Lathe bed is hinged at the headstock end so that it can be propped up and accumulated shavings swept into a chute from which they are deposited in a box located beneath the bench. There also is a drawer for lathe tools and the lower shelf provides a solid base for the motor. Actual dimensions of the bench are, of course, determined by the size of your lathe.
Keep Your Car Riding Like New

Straight-line steering and smooth riding qualities built into your car are retained by regular servicing of springs

By Murray Fahnestock

When you hit a hole in the pavement or a bump in a side road the shock absorbers snub out rebound of the car axle but the springs take the real punishment by preventing the shock from reaching the car frame and body. Even when you’re cruising on a smooth highway, the springs soften the ride by constantly flexing to equalize irregularities in the road surface. Lack of lubrication can cause rapid wear in leaf springs, and rust and metal fatigue combine to cause a slow loss of “life” in a coil-spring suspension of the type shown in Fig. 1. Under normal load conditions, spring suspensions of this type are designed to operate with the A-bars, or control arms, in approximately a level position. After years of service the springs may weaken and, in effect, shorten slightly under the body load which, of course, remains the same. This changes the normal position of the control arms and, in some cases, may even change the front-wheel camber as in the lower detail in Fig. 1. This condition can cause a serious loss in steering response and it also results in rapid wear on the tires.

Often the defect can be corrected by shimming the springs with spacing washers which fit into the retaining cups at the top and bottom ends. However, if body sag is excessive, or if one spring is lower than the other, then both springs should be replaced. On some older cars it will be necessary to check steering and possibly to realign the front wheels after shimming or installing springs. On certain newer cars, coil springs may be shimmed or replaced without changing the wheel alignment. Coil springs are simply torsion bars, upper detail in Fig. 2, and any surface flaws caused by rust will weaken them. To protect coil springs against rust, keep them well painted or coated with any of the rust preventives which are available.

Leaf springs and shackles on nearly all older-model cars and trucks require lubricating at regular intervals. The method of lubricating depends on the type of spring and the provisions made by the
manufacturer for applying lubricant. All leaf springs bend under tension as in the lower detail in Fig. 2 and on nearly all cars more than 10 years old the springs are of the type shown at A in Fig. 3, the ends of the spring leaves being cut square or diamond pointed as in Fig. 7. Some, however, were made with round, tapered ends on all the leaves except the top leaf, Fig. 7. On later-model cars, and on some light trucks, the leaf springs either are fitted with steel covers as at B in Fig. 3, or are of the nonlubricated type detailed at C. On the older-type springs, Fig. 3A, it may be necessary to loosen the rebound clips and pry the leaves apart in order to apply lubricant between the leaves. Whenever such springs are lubricated always make the checks detailed in Figs. 4, 5 and 6. If measurement from the top of the spring to the lower side of the frame varies more than \( \frac{3}{4} \) in., check the low spring carefully for a broken leaf or excessively worn shackles bolts. Renew faulty parts, as otherwise lubrication of the spring may increase leaf deflection and result in breakage of adjacent leaves. If possible, use the lubricant specified by the manufacturer of the car. Otherwise use chassis grease to which a small quantity of powdered graphite has been added, or use penetrating oil.

Lubrication of covered springs is easily done, without removing the metal cover, by the use of the special spring-lubricating fitting detailed in Fig. 8. On some of the late-model cars the need for lubrication of the leaf springs has been eliminated by the use of waxed fabric liners between the adjacent leaves, detail C in Fig. 3. On others, rubber "buttons" are placed under the tips of the spring leaves. The only service required on springs of this type is replacement of worn liners or buttons. This is done by jacking up the car body to take the weight off the springs. Then the leaves are pried apart with a screwdriver or a special spring spreading tool, and the worn liners or buttons are removed from the depressions in the leaf tips and replaced. On some liners, only the worn ends are renewed. This is done by wedging the leaves apart and cutting off the worn portion of the liner with a hacksaw blade. Replace with new end sections of liner fabric. When the rebound clips are removed for any reason, be especially careful when replacing them to see that they fit with the correct clearance, Figs. 5, 6 and 9. This clearance is important as it allows the main leaf to twist when the car or truck is driven diagonally across a low culvert or onto a ramp.
Burning Auto Tire Kills Weeds

One farmer found that burning a discarded auto tire made a fire hot enough to kill brush and patches of weeds. A length of wire tied to the tire permits pulling it over the ground without getting too close to the flames. To ignite the tire, stuff it with old rags and paper and pour some kerosene over them so that they will burn long enough to ignite the rubber. Using a tire in this way also provides a quick method of starting a backfire to bring a spreading brush fire under control.

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

Grease-Gun Nozzle Kept Dirt-Free

To keep the nozzle of a hand-type grease gun free from foreign matter, just slip an empty 12-ga. shotgun shell over the end of the nozzle. The shell fits snugly and is easy to remove from the nozzle.

Benj. Nielsen, Aurora, Neb.

Rubber Skirt Tacked to Type Brush Prevents Spattered Solution

When cleaning type forms with gasoline or caustic solutions there is a danger of spattering near-by equipment and damaging or soiling it. To remove this danger, fit the brush with a skirt cut from inner-tube or sheet rubber. Just tack the skirt to the wooden handle so its lower edge does not quite reach the ends of the bristles.

Check Locates Leaky Head Gasket

This quick check will spot a leaky head gasket every time. First braze a tire valve into the base, or shell, of a spark plug, being careful to produce an air-tight braze with no pinhole openings. Starting with the No. 1 piston, remove the spark plug and screw in the improvised air valve. Then turn the engine over until the piston is at the top dead center with both valves closed. Place the transmission in gear and, if necessary, block the rear wheels so that the car cannot roll. Apply air from the tire-inflating line to the test valve. If there is a leak in the head gasket, bubbles will immediately appear in the radiator tank. This procedure will turn up head-gasket leaks which cannot be detected by other methods. Auto mechanics will need three test valves made in this way, one each in the 10, 14 and 18-mm. sizes. — Henry G. Lutter, Libertyville, Ill.

Storage Space for Ground Feeds Included in Stock-Tank Shelter

Located on the fence line between farm feed lots, this neat structure provides dry storage for ground feeds and year-round shelter for a large concrete watering tank. The tank shelter is fitted with hinged doors which are kept closed during the night when the temperature is below freezing, thus making it unnecessary to operate a tank heater except during the most severe winter weather. The feed-storage section of the building is of conventional construction with a concrete floor. The sides of the water tank serve as sills for heavy posts and plates which support the roof structure of the tank shelter.

Don’t forget to apply just a touch of oil to the distributor cam each time the car is lubricated.
SHAVINGS BOX

By Paul A. Waugh

DISPOSAL of light, fluffy shavings from a jointer is aided by this neat shavings box. As pictured at the right, it works just like a tilting flour bin and is easily removed from the jointer stand for emptying, thus keeping the shop clean and reducing the fire hazard to the minimum. The back, bottom and sides are made from plywood and the front from solid stock. Note that the upper ends of both sides are cut part way across the width on a 10¾-in. radius, the curved cuts ending in \( \frac{1}{4} \times \frac{1}{2} \)-in. notches. The back sides of the notches form stops. The front piece is rabbeted on both sides and the lower corners are notched as shown. In assembling, the joints are fastened with glue and small nails or screws. After assembly, a cleat is nailed and glued to the bottom as in the underside view, below, and two small blocks are glued to the bottom in the position indicated. The box is supported by a \( \frac{1}{16} \)-in. metal rod as in the lower right-hand photo. To place the box in position in the stand, slide it inward on top of the supporting rod. Then tilt it outward until the stops strike the vertical sides of the top piece of the stand. Then raise the box slightly so that the blocks on the bottom will slip over the rod. To remove the box simply tilt it outward until the stops engage the stand. Then raise it slightly and pull outward at the bottom.
IN ORDER to use precision measuring instruments efficiently it is necessary to keep in mind that there never is a perfect measurement. There are always tolerances and limits. Generally speaking, the term tolerance refers to the allowable error, while limit, or limits, refers to the specification of the large and small dimensions. As an example, a hole is to be bored 1 in. in diameter. If the work is of such a nature that the diameter must be held within fairly close limits, large and small dimensions will
MEASURING
and Trammels

be specified as plus and minus, that is, the hole can be bored slightly over 1 in. or slightly under and still meet the requirements. But the measurements of the finished work cannot exceed the limits specified as otherwise the job will not serve its purpose.

As pointed out in Part I last month, the important thing is the ability to make measurements of consistent accuracy and to follow through with the production of work which checks within the specified limits with an equal consistency. Specified limits define the necessary degree of accuracy. For ordinary machine work in production shops, dimensions nearly always are specified in thousandths and in some cases in “tenths,” or ten thousandths, of an inch. Production shops usually work within thousandths while limits specified in ten thousandths are used by manufacturers of highly specialized products. Ten thousandths are used also in toolrooms and die shops and in experimental laboratories where mock-ups and scale models are made for reference or testing purposes and where, for various reasons, work must be produced within very close limits.

A graduation line on the average rule is several thousandths of an inch in width thus making fine measurements impracticable. The double contact of the ordinary caliper makes consistently accurate measurements within close limits dependent to a considerable extent upon the skill and experience of the individual. Although very accurate work still is done with these simple measuring tools, shops that must work to close limits, with a consistent accuracy not attainable with ordinary rules and calipers, require more precise measuring instruments, such as the micrometer caliper.

The micrometer caliper, or “mike,” as it is commonly called, is simply a slide caliper with a fixed contact, or anvil, and a movable contact, or spindle, actuated by a precision screw adjustment provided with graduations which can be read in thousandths of an inch. The common types of outside and inside mikes shown in Fig. 15 have many uses in the shop and are made in a wide range of sizes. Inside mikes are supplied with extensions, A, B and C in Fig. 15, to increase their capacity. Many other types are available for special purposes. Reading an ordinary mike in thousandths is quite simple to do. The screw, Fig. 15, is accurately made with a pitch of
40 threads to the inch and advances onefortieth (.025) of an inch with each complete turn. On a mike of 1-in. capacity, Fig. 14, the sleeve is graduated longitudinally with 40 lines to the inch. Every fourth line is longer and is numbered 1, 2, 3 and so on, to indicate divisions in tenths of an inch. The beveled end of the thimble, Fig. 15, is graduated into 25 divisions numbered from 0 to 25. As one turn of the thimble, from 0 to 0, advances or retracts the spindle onefortieth (.025) of an inch, rotation of the thimble from 0 to the first graduation will move the spindle one twenty-fifth of onefortieth, or one twenty-fifth of twenty-five thousandths, which is .001 in.

On certain types of mikes, such as the micrometer depth gauge, the sleeve usually is numbered from 10 to 0 and it should be kept in mind that in this case, the total reading will be a value less than the lowest graduation visible on the sleeve. The inside mike is shown in use in Fig. 22. Ordinary outside mikes are available with a ratchet stop built into the end of the thimble, as in Fig. 15, or into the thimble itself. This feature is helpful when a number of measurements must be made quickly and accurately or when the same instrument is used by more than one person. The ratchet stop reduces the possibility of error to the minimum as it is so designed that it will slip and thus prevent the spindle from turning after a given amount of pressure is applied when taking the measurement. Nearly all mikes are provided with an adjustment to compensate for wear in the threads. This adjustment is made with a spanner wrench as in the inset, Fig. 15.

When it is necessary to scribe, lay out, or transfer dimensions of greater lengths than can be spanned with dividers, machinists often use a trammel, Fig. 17. The instrument consists of a polished bar, or beam, on which the points are adjustable by means of special clamps, or carriers. One
clamp is provided with a slow-motion screw to permit fine adjustments. Various types of points, or legs, are furnished to adapt the unit for scribing, Fig. 16, measuring from holes, Fig. 18, and for measuring distances across or inside which are too great for ordinary calipers or mikes. For the latter use, the trammel is fitted with caliper legs, Fig. 17. Trammel beams and couplings are available for increasing the span of the trammel to 36 in. or more.

Telescoping gauges, Fig. 20, are often used when it is necessary to obtain precise measurements of internal diameters, Fig. 26. The head of the telescoping gauge is made with one fixed and one telescoping member, and in ordinary use the head is telescoped by pressing on the ends of the members as in Fig. 24. When the distance across the head is slightly less than the diameter of the work to be measured, the head is locked by turning the knurled screw at the end of the handle. The gauge is inserted in the work and the head is released by slackening the screw. The telescoping head then expands across the opening, the spring tension keeping it in contact with the walls until the binding screw is tightened to hold the adjustment. Then the distance across the head is miked, as in Fig. 21, to determine the precise diameter of the hole. Before taking a measurement with a telescoping gauge, be sure there are no metal chips or other small particles on the contacts. When taking internal measurements with the telescoping gauge it should be held with the handle in line with the axis of the opening and the handle should be rocked slightly to make sure the contacts are seated firmly against the walls. Small-hole gauges, Figs. 19 and 20, serve much the same purpose as the telescoping gauges for measuring holes ranging from \( \frac{1}{8} \) to \( \frac{1}{2} \) in. in diameter. Hole gauges are made with a split ball at the contact end which is expanded by means of a tapered sleeve, Fig. 20. The sleeve is actuated by
and, therefore, it is necessary that they be pushed into the opening far enough to assure that the contacts touch the walls at the highest point of the radius. Before taking a measurement with any of these units, clean the work thoroughly to remove chips and grime which might cause inaccuracies of several thousandths of an inch.

Two other gauges widely used in the shops are the radius, or ball, gauge and the thread gauge, Fig. 23. The former is especially made for diesinker’s use but it also is used in some shops for making a quick check of the diameters of rod stock. As will be seen from the detail, the gauge is simply a length of polished steel with 180-deg. radii milled into each edge. Sizes are stamped on the body of the gauge and generally range from \( \frac{1}{6} \) to 1 in. in 32nds. Similar types of gauges are made for measuring wire, drills and screws. Likewise, the thread gauge, Fig. 23, is one variation of many similar types of gauges made for checking fillets and angles. Although commonly called a thread gauge, it is perhaps more properly referred to as a screw-pitch gauge. It consists of a number of thin leaves of polished steel pivoted in each end of a short frame. When not in use all the separate leaves fold inside the frame to prevent damage. On one edge of each leaf there are teeth corresponding to standard thread sections. When the pitch of a thread is not known, the leaves of similar size are opened and placed successively over the thread until one is found which meshes with that particular thread. The pitch of the thread is then read from the stamping on that individual leaf. The free end of each leaf is made narrow so that it can be inserted in a nut as in Fig. 25.

The depth mike, Fig. 27, or micrometer depth gauge, is simply an ordinary depth gauge fitted with a micrometer head instead of a graduated bar, or spindle. It is especially designed for accurate measurement of holes, grooves, recesses, projections and offsets in work of an irregular shape. The base is ground flat and the sides are finished perpendicular to the bottom so that the unit can be placed either on top of a finished surface or against a machined shoulder to obtain accurate readings. The micrometer head usually is furnished with a ratchet stop, and extra rods, or plungers, can be obtained in various lengths up to 6 in. or more for measurement of deep holes. Also the bases are furnished in different widths, or spans, up to 6 in. The rods are available in the round or flat type with flat ends, or ends turned and lapped convex. These features extend the instrument’s usefulness to include a greater variety of work.

[Certain technical information courtesy L. S. Starrett Co.]

(Top to be continued)
Portable Garage Light Utilizes Gooseneck Desk Lamp and Brake Drum

If you do much work on the car in your home garage or if you have an auto-repair shop and need an extra light, you'll find this special floor lamp a big help in concentrating the light just where you want it. The lamp base consists of a discarded brake drum with a 3/4-in. pipe flange welded to the outside face of the drum and directly over one of the bolt holes. A length of 3/4-in. pipe is screwed into the flange to form the lamp column. Then a 3/8-in. hole is drilled through the top of a pipe cap and the cap is screwed onto the top end of the column. If an old gooseneck desk lamp is available, it can be used for the upper portion of the shop lamp. However, this part of the lamp can be improvised from an 18-in. length of flexible metal tubing. Solder a 1/8-in. brass pipe nipple into one end of the tubing and solder the other end of the tubing to the pipe cap. Pull a length of ordinary lamp cord through the tubing and the column and lead one end out through one of the holes in the brake drum. Screw a switch-type lamp socket onto the brass nipple and add a reflector of the type designed to screw onto the socket. Complete the lamp by attaching a cord and plug.

Concrete Watering Pit Built Around Broken Drain tile

A continuous supply of cool, clear water for stock can be had by breaking through a drain tile and building a concrete watering pit around it. If possible, this should be done near a fence so that the watering pit does not interfere with plowing the field. A long ramp on one side of the pit permits the cattle to reach the water at the bottom, and this should be located so that surface water will not contaminate the drinking water. The pit can be dug out and the walls poured in wooden forms, or trenches can be dug for the walls and the earth used as a form, the center portion of the pit being dug out after the walls have hardened. Note that parallel ridges in the ramp provide a better foothold for the cattle. These can be made by pressing strips of wood into the freshly poured concrete and removing the strips after the concrete sets.

Temporary Farrowing House Made From Bales of Straw

Farmers and hog raisers, faced with the necessity of providing temporary or emergency shelter for brood sows at farrowing time, often use bales of straw or discolored hay for this purpose. The ends and back of the house are formed by two tiers of bales held in place by steel fence posts driven into the ground on each side. A 2 x 6-in. plank laid across the ends supports the bales which are laid side by side on top of the plank to form the roof.

An old soft-bristled toothbrush comes in handy for cleaning and oiling firearms.
A PORTABLE PIPE-THREADING UNIT that can be driven by any 1/2-in. heavy-duty electric drill is pictured above. It is designed to take any standard pipe die. In use, the selected die is started on the end of the pipe and the unit is attached to it. Power from the electric drill is applied through a 20-to-1 gear-reduction drive. After threading, the drive spindle, which is held in the drill chuck, is inserted in a reverse socket and the die is backed off.

HAND PIECES ON FLEXIBLE SHAFTS, below, left, can be changed quickly when this new snap-on-and-off coupling is used. It allows the operator to change from one tool to another without having to unscrew the hand piece from the shaft. A new-type locking sleeve on both the straight and angle spindles permits the hand piece to swivel freely, but prevents it from becoming accidentally disconnected and thereby endangering the operator.
ASBESTOS SHINGLES AND SIDING are easily cut, notched or punched with this hand-operated three-in-one tool. It's a complete self-contained unit designed for use right on the job. Using a cutting blade that works something like a metal shear, the operator can trim shingles or siding to any angle or length. In the views above, left, the operator is punching holes for nails and, at right, a notch is being cut.

PORTABLE POWER-FEED ATTACHMENT, right, simplifies and speeds up tedious, time-consuming job of "walking" long stock through a radial saw. When properly set up it will power-feed stock for straight and bevel ripping, molding, shaping, grooving and rabbeting. The unit is so designed that material being fed to the saw automatically is held tightly against the ripping fence to assure maximum accuracy. The power drive is fitted with both infeed and outfeed rollers having speed adjustments permitting a feed range from 10 to 120 feet per minute. The unit is portable and motor-driven, and can be easily attached to the machine.

CLEANING COPPER TUBES preparatory to soldering them end to end is done in a jiffy with this new tool. It consists of four holders, each fitted with special-type circular wire brushes, the inside diameters of which range from 3/8 to 1 in. Each brush is slightly smaller than the outside diameter of tubing it is intended to fit. To clean the end of the tube, simply insert it into the proper opening and turn it several revolutions, then twist it slightly as it is withdrawn. It comes out clean and bright for soldering.

A MAGNETIC LEVEL that sticks tightly to pipe or machines takes the place of that "extra arm" so often needed by plumbers and electricians when plumbing vertical lines of pipe or conduit. The reason this level sticks to metal is that it's fitted with two powerful permanent magnets. The level has a wooden body and is short, about 10 in. long, which makes it handy to store in an ordinary carryall tool kit. Ends of wooden frame are tapered, torpedo-type, and there are three glasses in standard positions. Picture at right shows how easy it is to plumb pipe. Note that hands are left free for holding the pipe in place.
Low-Cost Shop Heating System

When it is necessary to have heat in the farm workshop, basement or small garage, you can install an efficient hot-water system by using ordinary pipe fittings and a coal-burning water heater. The heater, preferably one of the larger sizes, can be placed in any convenient location in the building. The radiators, or coils, are assembled from pipe and fittings as pictured. Provide an expansion tank located at some point higher than the highest radiator. All horizontal pipes must be carefully leveled when installed, as otherwise the system may become air-locked.

Charles L. Stratton, Hollis, N.H.

Desk Slide Arm Has Glass Insert To Provide Handy Tracing Frame

If a desk in the home or office is equipped with a slide arm, a convenient tracing frame can be had by fitting the arm with a sheet of plate glass. Cut out the center portion of the arm and nail cleats to the four inside edges of the opening. The cleats should form a rabbet to hold the plate glass flush with the top surface of the arm. To use the tracing frame, just pull out the slide arm and the bottom desk drawer. Then, set a lamp in the drawer directly under the tracing frame.

W. H. McClay, Pasadena, Calif.

Oil Pump Primed for Starting By Releasing Air Pressure

Very often auto mechanics experience trouble in starting an oil pump after dropping the oil pan or flushing the crankcase. This usually is due to air-lock in the oil passages. One mechanic found that he could vent entrapped air from the oil lines by partly unscrewing the compression nut on the line leading to the dash gauge. After slackening off the nut, the oil line is loosened slightly in the seat to allow the air to escape. As soon as the air pressure is vented, the pump will prime itself and resume operation.

P. R. Wilson, Brooklin, Ont., Can.

Screened Window in Door Ventilates Storage Cave

An opening cut in the door of a farm storage cave provides ventilation for the cave during the summer months and helps to reduce danger from the deadly toxic gases known as blackdamp. Screen wire is tacked over the opening and, during wet weather, a tarpaulin can be thrown over the door. For the winter months, tar paper or a glass substitute fastened over the opening will protect the cave from extreme cold.

Vegetable Grater Shells Corn

Shelling popcorn or ears of corn for chicken feed is done quickly by rubbing each ear back and forth across an ordinary vegetable grater. This is much faster as well as considerably easier on the fingers than shelling the corn by hand.

Blanche Campbell, Phoenix, Ariz.
FULL-COLOR TUBES FOR TV

TWO TRULY remarkable new color-television tubes recently demonstrated by RCA are claimed to provide the key to all-electronic fully compatible color television for the home. Two color TV receivers were used in the demonstrations as the new tubes are of different types. One employs a single electron gun to "paint" the pictures. The other uses three electron guns each of which has an electron beam geared magnetically to actuate each of the three primary colors—red, green and blue—on the face of the tube and blend them true to the original scene being telecast, as illustrated in the simplified sketch, Fig. 1.

Television in natural colors has been possible for some time. The reason that it was not authorized for commercial broadcasting was due to the fact that none of the nine proposed systems met the Federal Communications Commission's compatibility requirements that were necessary to prevent obsolescence of equipment and several millions of television receivers now in the homes. The compatibility requirement states that the system used to produce TV color pictures must operate in harmony with existing black-and-white television to receive the color TV programs on present TV sets in black and white. Receiver circuit principles of both types of the tricolor Kinescope tubes are detailed in block diagrams, Figs. 2 and 3. These include the conventional black-and-white TV chassis.

The face of each color tube is coated on the inside with dots of color phosphors arranged in triangular groups of three—one red, one green and one blue as indicated in Fig. 1. There are 117,000 dots of each color, making a total of 351,000. Behind the tube face there is a metal masking screen containing 117,000 holes approximately the same size as the dots of color phosphor. The holes are so placed that they overlap equally each red, green and blue dot of a triangular group. The angle of the electron beam determines the color. The amount of light in color given off by each dot varies in exact accordance with the information supplied from the picture signals taken from the air. This action occurs so rapidly that the light from the activated color dots blends into the natural colors of the original scene.
FIVE-TUBE CIRCUS-WAGON

This five-tube radio in its attractive circus-wagon cabinet will provide joy and decoration for the child's room. It will fit into practically any modern playroom decorative scheme, and it gives dad or big brother an ideal workbench project.

Conventional in design, the set is not difficult to build. All parts are standard and easily available from radio parts houses. The coils are the reliable Meissner type, and the loop antenna is a standard broadcast-band replacement type. The one used in the model is an Allied No. 55-506. It may be mounted in the top of the cabinet as indicated in photo E, but a better method would be to mount it on the inside of the cardboard, or fiber, rear cover of the cabinet. The loudspeaker is a 3½-in. PM type with a 4-ohm voice coil. The output transformer is mounted directly on the speaker. The slide-rule tuning dial is the well-known "Croname" No. 231.

Drill the chassis base as detailed in Fig. 1; the large holes are made with a ⅝-in. Greenlee socket punch. Instructions for mounting the slide-rule tuner come with the tuning dial specified. The holes necessary for mounting the dial on the chassis are detailed in Fig. 4. The locations of the various parts on the base are clearly shown in photo D; the underside view of the base appears in photo F.

Mount the two-gang variable tuning condenser on ¼-in. steel-tubing spacers so that the variable condenser frame is ¼ in. above the chassis. This extra space is necessary to permit proper placement of the drum for the slide-rule tuning dial. A complete schematic circuit diagram is given in Fig. 2. Wire the filament circuit first, and make sure that the tube sockets are placed in the positions indicated by the socket key locations in Fig. 1. Leave the wires for the speaker and loop antenna long enough to...
permit their removal from the cabinet for checking and alignment.

When installing the chassis base in the wooden cabinet, cover the heads of the mounting screws under the cabinet so as to avoid any possibility of shock. The simple cabinet construction is detailed in Fig. 3. The top and bottom of the front and right-side openings are drilled with a \(1/4\)-in. drill to a depth of about \(1/2\) in., and are spaced 1 in. apart. This provides for \(3/16\)-in. birch dowel bars 5\(1/2\) in. long. Eight are at the front, and two at the right end. The receiver panel is \(1/4\) x 6\(1/2\) x 11\(1/2\)-in. plywood. The cutout for the dial is \(7/8\) x 4\(1/2\) in. The decorative front, with the curved top and bottom, is made of \(3/8\)-in. pine. The end panels are made from \(1/8\) x 5 x 6\(1/2\)-in. fiberboard. A number of \(1/8\)-in. holes are drilled in the left end panel for the speaker grille. The panels are painted with white enamel, and the cabinet and bars with red enamel, after which animal decals are applied as desired. Alignment of the set is quite simple if a strong signal can be tuned in at each end of the broadcast band. Try to tune in
a station at about 670 kc. or one that comes in with the variable tuning condenser nearly closed. The i.f. transformers are peaked at the factory and require very little adjusting. With the set still tuned to this station, adjust the trimmer on C2 (the oscillator cut-plate front section) to bring in the station at the proper dial reading. Now tune in a station at about 1400 kc. and adjust the trimmer on C1 (the r.f. rear section of the tuning condenser) until the station is received with maximum volume. Should you have any difficulty in aligning the set, most radio shops will do it for you with a signal generator and an output meter. Detailed student material list R-392 is available from Popular Mechanics Radio and Electronics department upon receipt of ordinary letter postage.

**NEW RADIO-TV HANDBOOK IS ANNOUNCED**

Popular Mechanics Press announces publication of "Radio-TV and Electronics Handbook" on September 15. The author, Frank L. Brittin, W9DCX, is Radio-Television, Electronics Editor of Popular Mechanics Magazine and a Senior Member of the Institute of Radio Engineers.

The book is a nontechnical guide for the student, experimenter and every owner of a radio or TV set. Providing practical how-to-do-it information with photographs, sketches and simple diagrams, the book will help you eliminate unnecessary service calls, aid you in the installation of TV antennas and tells you how to build inexpensive student sets, amplifiers, phonocell relays, record players, test sets and other electronic devices. It covers the installation of remote speakers and interroom phones and the building of code-practice sets and amateur transmitters. Glossaries of commonly used radio parts, television terms and schematic symbols are included. "Radio-TV and Electronics Handbook" may be purchased from your bookstore or Popular Mechanics Press, price $2.50.
Folded Exponential Horn

By Dr. R. C. Hitchcock

THE FIDELITY and volume of an exponential horn is much higher than for practically any other speaker enclosure or baffle. If you have heard one you probably want one for yourself. An exponential horn permits a small speaker cone to get a "grip" on a large volume of air. It doubles its area at certain successive distances along the horn. This horn is 10 ft. long.

Starting with an 8-in. speaker, the small cone radiates treble notes from the top grille. But the bass notes travel in and out three times in two parallel paths, finally emerging with excellent fidelity from the "mouth" of the horn, which is 13 by 33 in. The preliminary model, photo A, was made of clear plastic. Smoke blown through the model traces the direction of the horn. All construction details are given in Figs. 1 and 2. Photos B, C and D show front and rear views of the completed horn. Half-inch birch plywood is used for the large horizontal partitions, and 3/4-in. balsa or pine for smaller sections. All joints should be made airtight with airplane cement.
ELECTRONICS TODAY

A—Simplified table-model RCA permanent-magnet type electron microscope provides useful magnifications up to 50,000 diameters by photographic enlargement, with direct magnification in the instrument ranging up to 6000 diameters. "Little Giant" electron microscope opens new windows on the unknown. One third the price of the large universal model, it is hailed as a means of broadening the applications of electron microscopy in medicine and in industry.

B—Amplifier designed to provide high-gain preselection for any television or FM receiver. This "Super Sonic" TV/FM preselector is also claimed to reject unwanted off-carrier signals and extraneous noises.

C—Not a radio—this cabinet houses an electronic light alarm. An extension wire connects to any lamp in other rooms. Turned on, the device picks up sound, changes it to electrical energy and causes the light bulb to flash. Mothers use it as an electronic nurse; the deaf to translate doorbell sound.

D—Hearing aid features "Moveable Ear" detached microphone. It is easily covered by a necklace, as illustrated in photo, or women can wear it under a brooch.

E—Television industry's first printed-circuit TV-tuner unit, recently announced by RCA tube department, eliminates mechanical winding of separate coils.

F—Magnetic switch, set in gravel, dirt or cement garage driveways, becomes energized when a car passes over it, sounding a bell or chime. It warns persons in the home of approaching cars, permitting them to turn on light; it also triggers garage-door openers.
Better pictures come easier with KODAK equipment

A. Kodak Tourist "800" Camera—World’s fastest between-the-lens shutter—the action-freezing Synchro-Rapid 800. Fast f/4.5 Lumenized lens; built-in exposure guide;新型 shutter release. Takes full-color pictures as well as black-and-white. Flash shots, too. Negatives, 2¼ x 3¼. Perfect companion for a holiday or hunting trip...for any picture-taking occasion. $95. Other de luxe models—with f/4.5 lens, 1/200 shutter, $71; with f/6.3 lens, 1/100 shutter, $47.50.

B. Kodak Auto-Release—Snaps your picture for you about 10 seconds after setting, so you can "get in the act." Fits any camera with a cable release socket. Double spring insures shutter tripping. $4.25.

C. De luxe Field Case—"Tourist" looks better, carries better, handles better...and it’s safer in this handsome leather case. Reinforced with steel frame. Opening in back shows exposure guide and window. Front flap removable. $10.50.

D. Kodak Tourist Adapter Kit—Use it with your "Tourist" f/4.5 or f/6.3 and get pictures in 4 sizes! Accessory back and masks let you make miniature color slides, 28 x 40mm; half 620, 1⅜ x 2⅛; square 620, 2¼ x 2¼; or full 620, 2⅛ x 3⅛. $14.50.

E. Kodak Metal Cable Release—Take shot after shot without jarring camera. Excellent for "T" and "B" exposures. Non-stretching braided metal won't kink. 7-inch size, $.99. 12-inch size, $1.17.

F. Kodapod—Slips in a pocket—gives rock-steady support when it's needed. Toothed jaws take a bulldog grip on tree, fence, or any wooden object. Other end threads into camera tripod socket. Ball-and-socket joint locks in any desired position. $3.50.

Prices include Federal Tax where applicable.

EASTMAN KODAK COMPANY
Rochester 4, N.Y.
Deep in the Heart of Ohio
(Continued from page 138)

It controls movements of trucks into and out of the corridor leading to the crusher bin. When a truck enters the corridor, it cuts a light beam and the signal flashes "stop" in the direction of other approaching trucks.

Arriving at the crusher, the truck dumps its load into the big, funnel-like bin. When the truck leaves the corridor, the traffic signal automatically indicates clear; or if one-way traffic is maintained past the crusher, and the truck leaves by a different corridor, the truck driver operates the signal by hand after his load has been dropped.

Our representative piece of limestone is now in for a rugged time. Sliding from the bin, its movement being regulated by lengths of massive steel chain, it finally goes through the crusher, where it loses any excess weight and size it may have had. Then it is carried on rubber conveyor belts to a vibrating screen. If small enough, it passes through one of the screen holes and is transported to a 400-ton-capacity storage bin. If it measures more than 6½ inches in diameter and won't go through the screen, it is sidetracked to another conveyor belt and carried back to the crusher feed bin for another trip through.

In the storage bin, our chunk of rock gets only a brief rest. It soon finds itself sliding, along with numerous other pieces, into a 250-cubic-foot measuring pocket. There are two such pockets, each feeding one of the skip buckets which travel practically continuously up and down the production shaft. One of the skips comes to a halt at the bottom of its shaft, the other skip being at that instant at the top of the shaft.

A man on the platform above the loading chute touches a control, and 10 tons of limestone, containing our sample piece, pours into the skip. Precisely two minutes later and somewhat better than 2300 feet higher, our limestone chunk sees its first daylight in 300,000,000 years.

Its fate from then on may take any of several turns, but first it travels on a rubber conveyor belt to the screening mill. If it measures 1 to 6½ inches in diameter, it is loaded on an electric train and hauled to the Columbia Chemical plant. There it is taken apart chemically and its various portions made into such products as washing soda, carbon-dioxide gas and pigments for rubber. If smaller than one inch, the piece may become agricultural lime, which is in great demand in this part of Ohio. Or it may find itself eventually in an asphalt road or a concrete building foundation.

(Continued to page 224)
Once Again Dependable

CHAMPIONS

Win In Indianapolis “500” Mile Race

BE A CHAMPION DRIVER . . . Follow The Experts in Their Choice of Spark Plugs

Once again the checkered flag brought a Champion-equipped car into the winner’s circle in the 1950 Indianapolis Speedway Classic, for the 19th time. 7 out of the first 10 cars used dependable Champions.

Johnny Parsons, winner, and 1949 AAA Champion, set a new record with an average speed of 124.002 miles per hour for the 345 miles of the race—cut short by rain. Johnny always uses Champions.

If you tested spark plugs as exhaustively as the race driver, you would know that Champions insure the utmost in performance and dependability. The majority of these experts use Champions.

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Listen to the CHAMPION ROLL CALL . . . Harry Winter’s fast sportscast every Friday night, over the ABC network.
For Longer Life
Portable Radio Batteries

BURGESS BATTERIES have longer life because Chromo Protection curbs internal action when your radio is idle. Be sure you have BURGESS Portable Radio Batteries and you'll have full power for more hours of static-free listening pleasure!

BURGESS ENGINEERING assures long, dependable battery service.

BURGESS GUARANTEE, backed by the foremost name in radio batteries, means complete satisfaction.

BURGESS Portable Radio BATTERIES
BURGESS BATTERY COMPANY
FREEPORT, ILLINOIS

Clinic
for Homemakers

As a service to our readers in solving the hundreds of problems pertaining to a home—inside or out—the editors of Popular Mechanics invite you to present your problems to the Clinic Editor for help and advice. Address your questions to the Clinic Editor, Popular Mechanics Magazine, 200 East Ontario Street, Chicago 11.

Locating Studs
Q—How does one locate the studs in a plastered wall when it is necessary to drive screws into them to support a large wall cabinet? Due to the weight of the cabinet it is necessary to reach the studs with screws. Isn't there a method of locating the studs accurately without drilling trial holes? F.M., Utica, N.Y.

A—Studs usually can be located quite easily simply by tapping the plaster lightly with a hammer. The method is well-known among builders. Move the hammer slowly to the right or left, tapping the surface of the plaster continuously. You will detect a progressive change in the tone, or reverberration, produced by the individual taping as the hammer nears a spot directly over a stud. The taps produce a hollow sound over the space between the studs but when the plaster is tapped directly over a stud the tone is much sharper and of a more metallic quality.

Cleaning Asbestos Siding
Q—The walls of my two-story home are covered with asbestos siding, which seems to be rather badly weather-stained especially below the windows. Is it practical to wash this siding and if so, how do I do the job and what cleaning preparations should be used? Or, should the siding be painted?—E.R., Carbondale, Ill.

A—Manufacturers of asbestos siding supply a special cleaner for this type of siding. Inquire of your local building-materials dealer. He can supply you with the cleaning compound direct, or, if he does not have it in stock, he can obtain it for you. Complete directions for its use will be included with this product. Of course, you can use other common cleaning solutions, probably with fair success, provided the siding is not badly stained with embedded grime. Carbon tetrachloride can be used to remove the stains under the windows. Caution: Carbon tetrachloride should be handled with care. Avoid inhaling the fumes, as they are toxic. Some instructions for cleaning asbestos siding will direct you to begin at the bottom of the wall and work upward toward the cornice. As a rule this is considered a good practice, although in some cases it may be best to work from the top

(Continued on page 222)
Ideas out of this World

...yours with these Wizards with Wood

Ideas for bonding wood! Ideas for finishing effects! Want 'em? Then send postcard for leaflets on Firzite, Satinlac, Weldwood Glue — used by professionals and offered by United States Plywood Corporation...

Strongest Wood Glue Ever Made

To make things or fix things, use Weldwood Glue for all wood-to-wood bonds. Makes joints stronger than the wood itself. Mixes easily with water. Stain-free, rot-proof...highly water resistant! 15¢, 35¢, 65¢, 95¢ and larger sizes.

WELDWOOD PLASTIC RESIN GLUE

A MUST for Finishing Fir Plywood

Tame that wild grain with FIRZITE. It tight-seals the pores...virtually prevents grain raise, checking...readies the surface satin-smooth for paint, stain or enamel. (For blond, pickled, wiped or tinted effects use White Firzite).

FIRZITE

Newer than Shellac or Varnish

For "natural wood" finishes on furniture or woodwork, there's nothing like Satinlac. Brings out the natural grain and color beauty of any plywood or solid wood. Avoids that "built-up" look, and will never turn yellow or darken with age. "Water-white", easy to brush or spray, dries ready for next coat in 2 or 3 hours.

SATINLAC

Ask for Weldwood Glue, Eirzite and Satinlac at hardware, paint or lumber dealers.

Send post card for interesting glue and finishing leaflets.

UNITED STATES PLYWOOD CORPORATION
Dept. 88, 55 West 44th St., New York 18, N.Y.

(Continued from page 220)
of the wall down. Ordinarily we do not recommend painting either asbestos siding or shingles, although it can be done. We would suggest that you try renewing the siding with the special cleaner before attempting the application of paint.

Painting Brick

Q — I have a new house with walls of common brick. The walls seem to absorb considerable moisture during winter storms and I've wondered if it might not be wise to paint them. It seems to me that this would form a coating which would prevent absorption of moisture. Would n't this be wood?

J.J., Dallas, Tex.

A — The mere fact that the bricks absorb moisture is not ordinarily considered sufficient reason for painting them. If the walls are of sound construction with tight mortar joints, it is not likely that moisture from ordinary rains is finding its way to the inner surface of the bricks in any appreciable quantity even though the wall is of single-course thickness, as in brick-veneer construction. Unless you wish to change the color of the wall, we would suggest that you consider application of a masonry sealer. This sealer seals and waterproofs the surface and dries transparent, that is, it does not change the color or texture of the wall. The sealer is applied with a brush and ordinarily only one coat is required. On the other hand, if you wish to change the color and, to some extent, the texture of the wall, then an application of oil-based paint or a masonry sealer is the thing. Apply either of the products in accordance with the manufacturer's instructions for application to masonry walls.

Rolling Lawn

Q — What is the best time to roll a lawn? I've been told that rolling in early fall, rather than in early spring, is recommended for best results, as spring rolling packs the soil and causes it to dry out and crack open, thus damaging the sod. Is the information correct?

J.S., Des Moines, Iowa.

A — The time to roll a lawn is determined by its general condition and not so much by season or custom. Among the more variable factors which govern to some extent are: age of the sod, condition and type of the soil, relative dryness or severity of the preceding winter, moisture content of the soil, and the thickness, or density, of the turf. Ordinarily, old, established lawns do not require rolling from season to season. Many landscape gardeners do not recommend rolling older lawns at any time, especially if the general condition of the turf is good. Where leveling is required on such lawns, top dressings of black soil or peat moss are more often used. Rolling alone cannot be depended upon to level a lawn. The only practical purpose served by rolling the lawn in early spring is to press down individual places that have been heaved by frost action during the warmer weather of late winter when there is alternate freezing and thawing. Even then, rolling should be light to avoid packing the soil unduly. Rolling is permissible when a lawn has been spotted seeded or when the soil over comparatively large areas has been reseeded and reseeded. Rolling the new seeding level, the first week or so, helps loosen soil and presses the seed into contact with the top soil without covering it too deeply. Many homeowners roll lawns in the early fall. This can be considered a good practice on soils which are loose and sandy and do not tend to pack under the weight of the roller.
DREMEL'S STRAIGHT-LINE ACTION GUARANTEES SCRATCH-FREE SURFACES

Here's fast cutting, finish sanding at its best. Dremel introduces a new electric sanding unit built to withstand hours of continued use. It is light in weight, well and shows speed. The straight line, no-waviness action leaves no scratches, no rotatory marks—just silky-smooth surfaces only a Dremel can have, for the first time, an electric sander built for years of faithful service—all at the remarkably low price of only $24.50.

A POWERFUL, FAST CUTTING TOOL FOR CRAFTSMEN, HOME and INDUSTRIAL USERS

Craftsmen find this new Dremel model has the extra stroke and power needed for wood-working projects such as cabinet-making, boat building and refinishing, garden furniture, etc. Homeowners find it's just the tool for preparing surfaces for painting and varnishing—removing rust or discoloration, removing old finishes. Dremel Model 2000 also does a professional job of polishing waxed surfaces—eliminating the back-breaking laborers, furniture, floors, stairways, etc. Industrial users likewise find this new Dremel Sander a faithful performer in factory, cabinet, building and body shop operations.

RUGGED DESIGN and PERFORMANCE FEATURES

- Only two moving parts—requires no oiling.
- Reciprocating action leaves no marks.
- Cannot burn surface.
- Saccharin sanding surface speeds production.

DREMEL Model "A" SANDER-POLISHER
Over 200,000 Now In Use!

A lighter-capacity Sander that takes all the work out of home or hobby projects. Popular with women for polishing furniture, etc. Same design and construction features as larger model. Furnished in attractive cardboard box. All our dealer's can't supply, order direct from factory.

DREMEL Electric COPING SAW
Cuts Scrolls Like Magic—Sands as it Saws

DREMEL Electric COPING SAW

MOTO-TOOL — THE POCKET-SIZE MACHINE SHOP

PRICE INCLUDES STURDY CARRYING CASE
Perfect portability of Sander, cored, abrasives, and polishing pads is provided in this sturdy, 3-shelf metal storage case. Price also includes 24 assorted sheets paper and a high-grade sheesham polishing pad.

MOTO-TOOL KIT NO. 2

MOTO-TOOL KIT NO. 2

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KINKADE GARDEN TRACTOR

A Practical Power Farm and Garden Tractor for Suburbanites, Gardeners, Florists, Estates, Fruit, Nursery & Poultrymen.

AMERICAN FARM MACHINE CO.
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M-SCOPE TREASURE-MINERAL LOCATORS

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SWISS PATTERN
FILES of the BETTER KIND
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Whenever fits and tolerances resolve themselves into denominators of thousandths, the files used on the work must be right for precise filing. Nicholson X.F. (Extra Fine) Swiss Pattern Files are widely regarded as the finest you can buy. They cover practically every need of the tool, die, pattern, model, watch, clock, jewelry and fine-instrument maker.*

Their accuracy and general high quality are outstanding in these primary essentials:

- SPECIFIED HIGH CARBON STEEL that is carefully inspected for proper grain size, and maximum hardenability and uniform performance.
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- UNIFORM HARDNESS AND STRAIGHTNESS to aid long life and accurate filing.

*Illustrated above is the famous Nicholson kit of twelve assorted X.F. Swiss Pattern Round Handle Needle Files—pride of the hobbyist and precision craftsman. Plastic box, with bottom stand, is in beautiful orange-and-blue design. At good hardware stores everywhere.

FREE BOOK, "FILE FILOSOPHY"—48 interesting illustrated pages on kinds, use and care of files. Write to—

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However, its ultimate fate, our pet piece of limestone, dug from a sleep that far outranks Rip Van Winkle's, has had its rebirth in one of the world's most fascinating mines in one of the world's most fascinating mines; and in its new life it is contributing its tiny bit toward a civilization that will go to almost any length to procure and utilize such a commonplace material as stone.

The Barberton mine can produce limestone at the rate of 300 tons an hour indefinitely. It probably will not go much deeper than it is, for the stone in the lower portions of the deposit is not quite as suitable for chemical uses as that now being taken from the upper layers. The mine, which now extends over about 70 acres, will continue to expand in working area as rock between the entries and existing rooms is worked out.

Visitors like to speculate about the fate of the mine if it should become obsolete as a source of limestone. It would make an excellent underground factory, some think. It is intriguing to imagine it as a place of refuge in case the neighborhood should become the target of a bombing attack—until someone asks how ventilation and elevator service could be assured.

Home-Owned Big Top
(Continued from page 84)

dimensions and a diagram for a shifting crate for seals.

Members conduct an exchange of ideas and a barter system of their own through the association's official bulletin "The Little Circus Wagon." Ads such as this appear: "Wanted: Is there any member who would have a picture of Ringling Bros.' cookhouse ranges with the smokestacks sticking out the sides of the tent being held with iron supports? Would like to get one or borrow one." This member was stuck on a detail which might seem slight to the average onlooker, but was of great significance to the builder.

Some members have become more adept at certain phases than others. Young Dyer Reynolds of Pawtucket, R. I., is known for his miniature clowns—true studies of such famous funnymen as Felix Adler, Lew Jacobs and Paul Jerome. Clowns, members will tell you, often change costume but never their make-up. Reynolds is also known for his lifelike clay animals.

Paul Caster of Des Moines, Iowa, was offered $600 for his Columbia bandwagon before its completion. Scaled at one inch to the foot, it glows with intricate gold carving. The tiny wheel brake up front actually works. He's well under way with his

(Continued to page 226)
THE lure of motorcycling is like nothing else in this world! Once it's in your blood...brother, you'll never be the same again! From then on, nothing can ever equal the fascination of cruising down a scenic country road with a Harley-Davidson purring quietly under you...the he-man thrill of soaring up a steep hill like a climbing jet...the breathless feeling of levelling off for the straight-aways...the sense of power and freedom you get whenever you settle back in the saddle and "give 'er the gun!" In no other sport are friends so loyal, gals so glamorous. Nowhere is fun so easy to find as at exciting race meets, hillclimbs, gypsy tours and other club events. A Harley-Davidson is your ticket to endless good times, to happy, healthful outdoor enjoyment. You can own one on easy terms. So why not get started now? See your dealer today.

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AUGUST 1950
side show—Freddie, the fat man, a knife-throwing act, and a magician with his lady stooge are completed.

When a circus arrives in town, local association members meet it at dawn with their cameras, notebooks and tape measures—and possibly request to check or photograph some phase for a fellow member hundreds of miles away. These avid fans want to know exactly how the circus unloads, which wagon arrives on the lot first, how it sets up and what new animals and acts have been added. The camera is used to record paraphernalia for future reference, and out comes the tape measure to get dimensions of the equipment so the miniature scale will be perfect.

The association is not without its crusades. It wants the circus to remain the colorful extravaganza of long ago. Members are upset over the discarding of sunburst wheels from the wagons (wooden wheels painted in a sunburst of color) and the substitution of dull rubber wheels, which delight city officials.

The year 1918 ended the elaborate, heavy, circus parades. The association wants them back, but they carry no false hopes. Many reasons have been given for their discontinuance: traffic, expensive licenses and the damaging of city streets.

But such thoughts don’t bother the miniature circus owners when they bring their shows to town. The circuses unload just as their big brothers, the wagons enter the lot in proper order, the tents go up and the side-show acts take their places. Quickly, then, the ticket seller enters his booth—the hawk raises his megaphone to his lips—and, behold, “The Greatest Show on Earth” is again open to the public.

---

School for Jet Pilots

(Continued from page 121)

are unnecessary. Student pilots go direct to two-place F-80 trainers almost as soon as they have learned how to fly. The transition from slow to fast aircraft and from piston engines to jets is helped by new ground training devices, including a brand new jet type of synthetic trainer.

All the controls, instruments and reactions of a fast aircraft are included in the new training machine and the operations are precisely as they would be in actual flight. Rates of roll, climb and acceleration are faithfully duplicated and the controls are loaded so that pressures vary with the air speed.

The student who sits under the hood in the new device is under the control of a check pilot, or instructor, who sits at an

(Continued to page 228)
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NEW ELECTRICAL TOOL removes 1 to 10 or more coats of paint from any wood surface as easily as cutting butter with a hot knife. No scraping, cutting, burning, sanding, or chemical stains. The new Lectro Paint Peeler instantly softens paint electrically and peels it off the surface clean to the bare wood with one easy stroke. It's faster than a blowtorch—there's no danger of fire—and it will not scorch or impair delicate wood surfaces. Makes no mess—no smell. It's even constructed to last for years. Some compete with extra high-quality electrical cord. Simply plug into any A.C. outlet. No harm to wood or house. Several minutes and remove paint to the bare wood on exterior or interior painted surfaces, fences, woodwork, cupboards, furniture, antiques, boats, window-sills, screens, doors—a hundred other uses. For $4.95 postpaid—nothing else to buy. Full money back guarantee. For immediate shipment—send check, cash or money order to:

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outside console and plagues the student with many of the emergency situations that are apt to occur in real flight. By pressing buttons the instructor can introduce the effects of rough air, wing and pitot icing, fuel pump or hydraulic-system failure, or can stir up a thunderstorm, complete with lightning flashes.

During a training period a student may find that he has a burned out tail pipe, his engine is disabled, he is headed for the runway with his wheels up and is too slow for a bail-out. He can still land safely. By turning one master switch, the "angelic switch," the instructor wipes out all the student errors and simulated mechanical failures and the student makes a fresh start.

A radar sight now being tested automatically solves all fire-control problems for machine guns, rocket firing and dive bombing, either in daylight or dark. It can be switched to manual control for targets that do not reflect a radar beam. With the sight, designated the A-IC and made by Sperry, the pilot centers his target inside a circular pattern of light, then presses a button that fires the guns or rockets and releases the bombs at the proper time.

Navigation must be exact because the margin of reserve fuel is extremely small. A detailed flight plan has to be worked out ahead of time then adhered to precisely. In a slow aircraft, with plenty of reserve fuel, a pilot can hold on one leg of a radio range in poor visibility and work out his approach problem; in a jet he can't fool around. He must hit the range on the nose and go through the approach and landing procedure on the first time around. Fuel is too critical for too many tries.

Pilots age more rapidly than do other military personnel and the suspicion is that jet pilots grow old faster than do those who fly slower aircraft. The question is, what can the jet pilots do to husband their energy? Do they need more frequent vacations, is rest or exercise best, should they have hot and cold showers, massages or what?

To find out, the Air Force has the University of Southern California making special tests of 100 men in its fatigue laboratory. For six weeks the men are taking special exercises, for six weeks they take no exercise at all, for six-week periods they receive various conditioning treatments. They regularly undergo complete physical and mental check-ups, including tests of their ability to withstand severe accelerations while riding on a human centrifuge.

Aircraft are overhauled and maintained at regular intervals. Now the Air Force is going to find out what is necessary to keep its pilots in the best possible condition, too.
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Please send me a free copy of the SHOPSMITH booklet.

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Address
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Zone
State
A Super-Tanker Feeds Oil-Thirsty America
(Continued from page 78)

squirts its stream in all directions with such force that oil, wax, rust, and scale are torn from the tank sides in a few minutes, and gas is forced out. The tank is then tested for fumes with a gasometer, which samples the vapor and indicates its explosiveness.

When the indicator says the tanks are gas-free, men climb in. Buckets, hung from special Amtank cranes, are lowered to them, filled with junk from the tank bottom, hauled up and dumped overside.

Occasionally, men must go into gassy tanks to make emergency repairs on jammed valves. Looking like a man from Mars, the repairman descends wearing a fresh-air mask. On deck, another crewman pumps fresh air to him through a long hose. Nobody cares for this job, since the mask is uncomfortable in the hot tanks.

The Amtank's second mate took a chance one day and went down without the mask to free a stuck valve. He was on the bottom only a couple of minutes. On the way back up the ladder he felt sleepy. At the top, he collapsed and fell over the rim of the hatch. "If I'd gone the other way," he recalls with a shudder, "I'd have dropped 40 feet to the hard steel bottom."

The explosive gas on any tanker is a constant concern. Smoking is strictly forbidden anywhere except in the after house and bridge. Fire rules are rigid, and for that reason tankers have fewer fires than other ships despite the hazard.

Crews must continually scrape the steel decks for painting, but the tools they use—wire brushes, whirling metal star scrapers, mechanical chisels and hammers—are made of nonferrous metals and are driven pneumatically instead of electrically so there will be no sparks. The Amtank boys, incidentally, have a unique way of painting. They smear it on the broad decks with mops instead of brushes, using a petroleum-base paint. "We can do a whole deck in half a day," Mathis boasts.

Despite precautions, freak accidents do happen occasionally. Between tank 9 and the pump room on the Amtank is a cofferdam space. Due to unusual stresses, a steel cofferdam plate fractured and cargo leaked into the space. Somehow gases seeped into the after officers' washroom, and an engineer going in to attend his morning ablutions lit a prebreakfast cigarette. Kaboom! The explosion blew out bulkheads and hatches, overturned chairs and tables and started fires in the messroom. Luckily the fire was quickly doused. The engineer

(Continued to page 232)

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THE IRON CEMENT OF 1000 USES

escaped with everything but his hair and eyebrows—a badge of distinction which he could add to the mark of every tanker man: barked shins from slamming into cargo hatches.

The most hazardous place on a tanker is deep in the pump room, where a little gas always seeps from the glands. "Can't be helped," says Mathis. "On one tanker they tried tightening the glands, and the pump friction made them so hot the oil in the pipes went up and blew off the whole after end of the ship."

So serious is pump-room gas that on the Amtank no one goes down unless someone above is watching through the grating. Over in England during the war, a pumpman on a Mathis ship went down to oil his centrifugal and passed out. The watcher went down to rescue him and he passed out. So did a third—would be rescuer. The U. S. Army, wearing masks, finally had to come aboard and rescue all three.

Lighting a cigarette in the pump room is pure suicide, and only one man ever tried it on one of Mathis' ships. He was an assistant pumpman and drunk. The pumpman saw him just as he was about to light the match on pump-room floorplates. It was never lit. The pumpman's wrench connected with his skull. At the trial, the pumpman was cleared immediately.

Since that time, no crewman feeling jubilant from a night ashore has ever come aboard a Mathis ship.

"These gases are too tricky to fool with," says the Amtank's skipper. "I've watched St. Elmo's fire play across open hatches, and I've seen lightning strike right into the tanks and nothing happened. On the other hand, not long ago off Virginia a tanker exploded for no apparent reason at all. Her whole forecast went flying into space."

Along with all other precautions on the empty trip to the tropics, the Amtank stages deadly serious fire drills. Every man wears a life jacket, or else. Hoses are broken out and checked, lifeboats swung from the davits. So far the lifeboats have never really had to hit water.

As she headed north, hull down, on her 111th trip from Sinclair's southern oil fields last March, the Amtank's distinctive unsupported flying bridge, looking like some airborne flying monster, was all you could see. She could boast a record average haul of 5,000,000 barrels of cargo a year. And up in the dusk-dimmed wheelhouse the self-satisfaction was evident in the contented cluck, cluck, cluck of the automatic Gyro Pilot as it quietly nudged her plunging bow back on course whenever a big wave shoved it off.
Minute Man... 1950

Some things have changed since 1776, but not this. We here in America still need “Minute Men” to protect our liberties—just as much as we needed “Minute Men” to win them.

Charles H. Boyd, farmer, veteran and student, exemplifies our modern version of those men who stood and fought at Lexington and Concord.

He is the 1st Sgt. of Headquarters Company, 816th Field Artillery Bn., an Organized Reserve Corps unit, located in Columbia, Missouri. He, and thousands of Army Reservists like him, keep themselves and their units trained and ready to defend our country and our freedom by being active in the Organized Reserve Corps.

Find out more about this vital component of our defense establishment by visiting your nearest U. S. Army and U. S. Air Force Recruiting Station or your nearest ORC Unit Instructor.
Restoring Old Williamsburg’s Relics

(Continued from page 146)

and occasionally from a private collector. Thomas tries to obtain specimens requiring little or no reconditioning. One of his happiest moments was when he unpacked a shipment of 18th-century muskets sent over by an English dealer and found them to be as perfect as the day they were made. “The owners of those guns certainly knew how to take care of them,” he says.

Bones and bone objects found at the restored Virginia town are preserved by careful cleaning and, when necessary, re-inforcing with shellac or other binder. However, when bone and iron are found in combination, as a bone-handled knife, the problem is difficult because the treatment that preserves the iron will damage or destroy the bone.

Chemist-archaeologist Thomas seems to have an endless job at Williamsburg. In the restoration of a building (an activity that still goes on), his part of the project starts almost before the historical research has been completed. He watches carefully all excavating activities carried on by archaeologist James Knight and takes to his laboratory any articles that might provide information helpful in making the new building and its furnishings duplicates of the originals. In the restoration work, one objective is to re-create residences, shops and other buildings that existed in the original Williamsburg. This is not easy, for a lot of information can become lost over two centuries and more. So, every fact that is unearthed, no matter how small, may be of great value.

Thomas is asked many questions. One of them is: “Why is concrete used for building steps and some floors and walks?” The answer is that concrete is not used for these items of the restoration, but that they are made of Portland stone from England, the same kind of material originally used. This stone looks very much like concrete, and is the material from which Portland cement got its name. Incidentally, Portland stone, being relatively soft, is not proving highly resistant to the wear of thousands of visitors’ feet that pass over it each year.

If you visit Williamsburg to see how our colonial predecessors lived, remember that there is a lot more in the restored town than casually meets the eye. One of the behind-the-scenes activities is the archaeological research which is responsible for the authenticity of the buildings, furnishings and other things that combine to make the one-time capital of colonial America live again.
"SURE, ALL MUFFLERS LOOK ALIKE...

BUT WHAT A DIFFERENCE
WHEN YOU GET A GENUINE
FORD MUFFLER!"

"THEY'RE BEST FOR FORDS," MY MECHANIC
TOLD ME, "AND THEY'RE THE LOWEST
PRICED QUALITY MUFFLERS WITH ALL
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"FORD MUFFLERS ARE DOUBLE-
WRAPPED...THEY ACTUALLY HAVE TWO
SKINS, FOR EXTRA SILENCE AND
LONGER LIFE."

"THIS FREE-FLOW DESIGN GIVES YOU
BETTER GAS MILEAGE, AND SAFETY-
SEAMS AT BOTH ENDS ELIMINATE
GAS SEEPAGE."

"AND I'VE LEARNED IT'S THE SAME
WITH ALL GENUINE FORD PARTS. THEY'RE
BUILT TO SAVE ME TIME, MONEY, AND
THEY MEAN REAL
SATISFACTION"

"IN SHORT, THEY'RE MADE RIGHT TO
FIT RIGHT AND LAST LONGER IN FORDS."
"MISTER," I SAID, "YOU'VE CERTAINLY
CONVINCED ME."

AVAILABLE WHEREVER YOU SEE
THIS SIGN AT ALL FORD DEALERS AND
SELECTED INDEPENDENT GARAGES

KEEP YOUR FORD
ALL FORD!
The "Big Blow" Takes the Diesel's Challenge

(Continued from page 110)

soon as full speed is reached. The diesel generator is disconnected as soon as idling speed is reached.

The locomotive has a different noise from an ordinary diesel. The high-pitched whistle and the exhaust blast that are characteristic of gas turbines can be heard but they are like the noise from a jet aircraft that is some distance away. An exhaust deflector was installed and has helped reduce the sound. Inside the engine compartment, however, it is a different story. There it is impossible to shout loudly enough to be heard even a few inches away. The operating cabs at each end of the locomotive are insulated and quiet.

Surprisingly, the inside of the engine compartment is always cool, even on a hot day. This is because there is a steady wind blowing through the compartment at all times. The overhead filtered intake of the turbine draws its huge quantities of air from the engine compartment and the compartment in turn sucks its air supply from the outside through 86 large filter panels contained in the side walls. There is always a draft in the engine room.

With the exception of its power plant the X-50 is composed mostly of standard diesel-electric locomotive components. It uses standard two-axle swivel trucks, standard generators and traction motors, the usual G.E. amplidyne excitation control system, and dynamic braking in addition to locomotive and train air-brake systems.

The engineer's station is similar to that on a diesel-electric locomotive and the engineer has his throttle pedestal at his left and the air-brake valve controls in front of him. An instrument panel contains a speedometer, an ammeter that shows motoring and braking amperages, a notching guide that indicates how fast the engineer may apply power by means of the throttle, and air-pressure gauges. Above these dials is a row of lights that indicate such conditions as turbine top speed, maximum dynamic braking and wheel slip.

The engineer's throttle handle controls the power plant in much the same manner as the accelerator pedal on an automobile, thus providing a means of securing any desired output, from minimum to maximum power. A power-plant regulator automatically controls the fuel supply to the turbine to maintain any desired speed and also limits the amount of fuel to prevent excessive temperatures in the turbine.

(Continued to page 238)
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NO 282 PINCER

6" - $1.35  8" - $1.55  10" - $1.90

NEW IN PERFORMANCE. New in quality. While known as a Carpenter's Pincer, No. 282 is a very versatile tool for any amateur or professional mechanic. Cutting edges are keen and leverage is ample for easy cutting. In addition to the uses illustrated opposite, No. 282 has a screwdriver point on one handle. Traditional Crescent quality. Polished jaws, parkerized handles. Three sizes... 6, 8 and 10 inch. Sold by Hardware Dealers and Industrial Distributors.

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Jamestown, N. Y.

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normal operation there’s no occasion for anyone to enter the engine compartment.

The X-50 has an operating cab at each end. It was designed for double-end operation although present conditions make this unnecessary. There are seats for three crew members in each cab and the cabs are equipped with heaters, defrosters and windshield wipers.

You can’t get a railroad official or a power-plant expert to commit himself on the future of the gas-turbine electric locomotive yet. He’ll tell you that the unit is being tested and that no final conclusions can be drawn without many more months of testing. Usually, though, there’s a twinkle in the speaker’s eye while he’s talking. There isn’t much doubt that he’s already convinced that the gas-turbine electric has great possibilities.

Hot-Rod Derby on the Salt Flats

(Continued from page 68)

two sizes smaller to pull against the wind on the return. Every little bit helps, the drivers figure, and in some cases heavy cardboard and yards of masking tape are used to fill hollows in a body, to smooth its contours and increase its streamlining.

Classes of cars that will run at Bonneville are: roadsters equipped with stock bodies, radiators and shells, and with clutch and full transmission; modified roadsters: lakesters that may have specially built bodies not exceeding 36 inches maximum width; competition coupes, and streamliners with special bodies of any dimensions.

These classes are subdivided according to engine displacement into five engine groups ranging from less than 91 cubic inches to 350 cubic inches and over. Engines must be of American manufacture and of the internal-combustion reciprocating type.

All drivers must wear approved safety belts and goggles and cars must be equipped with fire extinguishers. No windshields of glass are permitted but glass head lamps need not be removed if they are suitably taped. Cars that are not designed to start under their own power must be equipped with a rear push-plate or bumper for push starting. There are various other equipment and safety rules and all cars that compete at Bonneville are subject to inspection.

The Bonneville time trials will be conducted by the Southern California Timing Association in cooperation with the Salt Lake City Chamber of Commerce. The trials are open to all fast cars that can meet

(Continued to page 240)
NEW STATIONARY OR PORTABLE D.C. ARC WELDER
250 AMPS. MODEL 252
FOR ANY WELDING JOB, LIGHT OR HEAVY
Stop Costly Repair Bills, Weld It Yourself and Save
Order Now and You Will Get
Pay for Entire Welder
Designed for many years of trouble-free service. Handles anything from the finest to the heaviest work. • Complete with D.C. Arc Welder, yoke, leads, electrode, ground equipment, etc. • Low cost 250 Amps. electric motor rated 10.5 H.P. • Complete with 2 new 300 lb. 80% Rods (4050.00 Value)
Only $10.50

ACCESSORY KIT including welding helmet, electrode holder, two 5 lb. cans with clamps and 5 lbs. of abrasive • Free equipment • Model 252 • $10.50 Only

DIRECT CURRENT GENERATORS
For welding, lighting, truck and marine use, D.C. appliances, lights, etc. Aircraft quality under license. • Rebuilt in accordance with original specifications. • Complete with 2 new 300 lb. 80% Rods (4050.00 Value) • Only $10.50

HYDRAULIC CONTROL VALVES
ITEM #24 Four-way control valve with built-in relief valve. Use with one double acting hydraulic cylinder. • Can be used with two single acting cylinders. • Ideal for farm equipment. • New $29.50 • Only $10.95

VICKERS HYDRAULIC TRANSMISSION
Ideal for lathe drive, miniature cars, power ma- chines, etc. • Electric motor 1/2 H.P. • RPM 3500. • Output speed continuously variable made by changing speed ratio. • Complete with motor. (2450.00 Value) • Only $10.95

Hydraulic Cylinders-Air or Oil
Large supply of new labor-saving, economical hydraulic equipment for many types and sizes. Many types and sizes. Use 1/4" pipe fittings. • Mounts on any type of machine. • New $29.50 • Only $25.00

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750 WATTS • 115 VOLT • 60 CYCLE
A.C. LIGHT PLANT
USE FOR: Home lighting, trailers, tour- buses, small buildings, lighting, emergency standby units. Plenty of power for radios, fans, refrigerators, etc. • No 24 volt. • Use 120 volt. • Built-in motor 1/3 H.P. • Complete with wiring harness, mounting lugs, etc. • New $29.50 • Only $139.00

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Perfect For Water, Oil or Insecticides
Sprays DDT, 2,4-D, sulphur compounds, etc. • Pressure to 1250 lbs. • 1750 RPM. • Air driven, 2 HP. • 4 in. outlet. • New $29.50 • Only $16.50

PURIFIER OIL FILTER
PERMANENT TYPE
The perfect oil filter to keep your motor oil or hydraulic fluid clean at all times. Protect your pump and other parts of your engine with this unit. Just turn the handle and the element is clean. Suitable for 1 1/2" inlet and outlet ports to accommodate 12 gallons per minute. Shipping wt. 4 lbs. • Only $4.95

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AUGUST 1950
the required safety rules. There is no limit to the number of changes that a participant may make to his car or engine nor is there a limit to the number of times that he may run the course. As soon as he finishes one run he may drive back to the starting end and get in line once more. Each run will be timed.

The course is a straightaway and is five miles long to allow plenty of room for accelerating to top speed and for slowing down again. Photoelectric timing devices that are accurate to one thousandth of a second will clock the cars over a ¼-mile distance and a one-mile distance laid out along the middle of the course. The ¼-mile trap will be used for timing all cars until the latter part of the afternoon of each day, after which the day's fastest car in each class will have a chance to make a run both ways over the one-mile distance for an official record.

It's hard to say how many cars will be tested this year but a guess is that some 200 cars from all parts of the United States will participate. Spectators may approach within ½ mile of the course during the trials. Bonneville is six miles from the small town of Wendover on the Nevada border where meals and some hotel accommodations are available. Many of the spectators and participants will camp out on the salt during the week.

Niagara Falls Goes on Night Shift To Generate Power

Niagara Falls now is working 'round the clock—during the day it puts on its centuries-old show for honeymooners but at night it generates electrical power. Niagara consists of twin cataracts. Of the estimated 200,000 cubic feet of water which normally passes over these two falls each second, 100,000 cubic feet will be reserved for the daytime tourists' show during the spring and summer months. At nights and in the off-season for tourists, all but 50,000 cubic feet will be diverted above the falls for hydroelectric use.

High Altitude Plays Tricks on Eyes

Persons living at high altitudes are likely to become wall-eyed. Strangely, the opposite is also true, for many high-altitude residents are cross-eyed. Dr. Jorge Valdeadellano of Lima, Peru, has discovered that 60 percent of all Peruvians who have lived for more than six months at an altitude of at least 10,000 feet have a wall-eyed condition and can't make their eyes converge on a near object. Another 12 percent have crossed eyes which turn inward too much.
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THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

AUGUST 1950
Land Alive!
(Continued from page 115)

arms close to the body. If you do this properly, you'll roll right to your feet again in one smooth motion.

Falling at high speed, as from a running horse, an automobile or train, your best bet is the log roll. Keep the body straight for this, with legs stiff, chin against the chest, elbows over the stomach and hands over the face. The roll must be perfectly sideways, spin with no end-over-end action that would thump the head against the ground. Pulling in the elbows will help to make the roll less bumpy.

When falling headlong, as when tripping on a stairway or off some elevation, the forward roll is called for. The hands touch first in this roll, and take some of the shock. The chin is tucked against the chest and the shoulders take the main shock as the body rolls forward.

Like all other rules, those on how to fall have their exceptions. If you should slip and fall on a steep mountain slope, you might do well to spread out arms and legs to prevent rolling with the fall, because in this case the rolling might be hard to stop—the exception to the rule about rolling in the direction of the fall.

The other rule—try to land as flat as possible—has its exception when the victim is falling from a great height into deep water. In this case, try to land feet first, with toes pointed, elbows hugging the stomach and hands over the face.

As for his advice against the wrong way to fall—don't ever put out one arm or one leg to break a fall—he couldn't think of a single exception.
Snap-on ARMATURE RECONDITIONING TOOL

does both

● 1 turns down armature
● 2 undercuts the mica

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C & B CO., P.O. Box 506, Yuba City, California
Spinning a Span to Foil the Wind
(Continued from page 106)

for the carriage to make 24 trips a day operating at full speed, but darned if the graveyard shift didn’t turn in 25 trips the other day!”

Cole explained it was a bookkeeping record, since the previous shift had almost completed a trip before it went off.

After spinning was completed, the cable strands were compacted to a perfect circle with a hydraulic press. Cable bands then were attached and suspension cables were dropped at 30-foot intervals on the horizontal. The final operation of winding the cable tightly with a protective wire could not be done until after the roadbed was in because the cable was stretched by the additional weight.

The Bethlehem Pacific Coast Steel Corp., which built the towers, also built the roadway. The steel frames for the roadway of the first bridge were prefabricated on barges, then towed into position beneath the bridge cables and hoisted into place.

The new bridge is much heavier than the old one, however, and engineers do not trust the 10-knot tides that race through the Narrows. For this reason, the roadbed was built directly from each tower.

The first 60 feet was cantilevered out from each side. At the end of these cantilevered sections traveling derricks placed the next section, piece by piece. As each section was completed, the derricks moved out to erect the next section. A railroad along the completed deck transported the steel beams.

It was necessary for engineers to maintain a nicely balanced construction so undue stresses would not be placed on the main cables and towers. To aid in determining the construction schedule, the University of Washington Engineering School built an erection model of the bridge, scaled with one foot equaling 100. However, weights used to load the model were scaled so one pound represented 92,475.

As construction of the roadway proceeded, engineers at the bridge telephoned their next day’s schedule to the university. Corresponding weights were hung from the proper suspenders and workers peering through a Filar microscope focused on the model’s “main cable” could determine the deflection. When bending exceeded accepted tolerances, the actual erection schedule was altered.

In a number of ways this bridge differs from any other ever constructed by man. Its design is the result of years of study to minimize the effect of wind on suspension

(Continued to page 246)
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for any elec. drill, press, or flexible shaft. When ordering specify standard or Phil. lip heads.
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Cuts through wood, plastic, nails, sheet metal, plastic. Gets into "tight spots" with power — ideal for floor or wall repair. Small, light, sturdy, will last all working parts of hardened steel. Roller bearings.
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Polish and sand the easy, right-angle way. Exclusive design gives extra-swivel action. More than 100,000 now in use. Complete with sheepskin bonnet, rubber pad, 2 sanding discs.
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1/2" JACOBS HEX KEY CHUCK converts Bull Buffer into angle-head drill attachment for drilling at right angles in wood or metal from 1/16" to 1/2".
$5.00

2 1/2" CUP WIRE BRUSH. Easily attached to Bull Buffer head. Removes paint, rust, scale, etc., in a jiffy. $1.75.

ADAPTER B SET. For high-speed sanding. Doubles drill speed by running Bull Buffer backward. $2.00.

RUBBER PADS. Oil resistant, finest quality. Specify 3", 4" or 6" diameter. $1.85 ea.

SHEEPSKIN BONNET. 5 3/4" top-quality, thick black tan bonnet for buffing. $1.25.

WOOL PAD. 5 1/2" diameter, half-inch pile wool pad with rubberized back. For cleaning — won’t mat down. $1.35.

SATIN DISCS. 5" Garnet discs for wood (0000-0000-00-0-1-2-1/2-3), 10c ea. 4 open grit, each 15c.

BULL MANDREL KIT
includes mandrel, 2 1/2" grindstone, 3" wire brush, 1/2" universal feeding wheel. only $2.19

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Complete kit for mortising and routing-on-the-job with new Bull drill or drill press. Includes Bull Mortising Adapter and 1/4", 1/2" and 1/2" chisels with corresponding bits.
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spans. The original bridge was destroyed by a 47-mile-an-hour wind. Prior to its
failure it swayed up and down in light
winds, making motorists seasick.

During the war engineers spent more
than three years developing a design based
on aerodynamic principles. A model was
built and tested in a wind tunnel at the
University of Washington, and the new
design is stable in winds of 120 miles an hour.

To achieve this, the new bridge has a
number of interesting features. The eight-
foot solid roadbed girder of the old bridge
has been replaced with a 33-foot-deep gir-
der of open construction. The bridge has
been widened in relation to its length from
39 to 60 feet.

The four-lane highway has three-foot
ribbons of steel grille between each lane
and sidewalk so air pressure on either side
of the deck will be dissipated.

The bridge also has huge shock absorbers
at critical points to take up any motion
that might develop. In other respects it is a
far heavier bridge. For instance, 23,000 tons
of structural steel and wire will go into it,
compared to 12,000 tons in the old bridge.

When the bridge is opened to traffic next
month, the engineers vow that motorists
will be able to travel across without taking
a seasick remedy along.

“Bowling” Down Forests
For a Super Dam

(Continued from page 94)

the same operation and the ground is left
bare. The stacked timber dries out for a
few weeks and then is burned.

An operation like this requires big equip-
ment and the contractors have it, yet
neither thinks that the ultimate in equip-
ment has been designed so far. Trisdale,
for instance, recently put two D-8s side
by side and welded them together into one
unit, then fastened a 21-foot blade with 13
teeth across the front. One man operates
this “D-16.” With 270 horsepower behind
the blade there is virtually nothing that
this powerful rake can’t move. It does
the work of three separate units.

During the time that the reservoir-clear-
ing operation is progressing the dam itself
is growing higher and higher. Hungry
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a few miles south of Glacier National Park.
The river originates on the west slope of
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into the Clark Fork, a branch of the Co-

(Continued to page 248)
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Horse Creek that flows into the Flathead and the creek was named in token of two freight horses, Tex and Jerry, that wandered away from their sleigh back in the winter of 1907. For a month the two horses struggled through snowdrifts in search of food and they were in a starved condition when accidentally found. Fed up on oats, the hungry horses gained back enough strength to be led back to camp.

The dam is to be of the arch-gravity type and the structure will depend both on its own weight and the support of its abutments to hold back the water in its reservoir. When complete, the dam will be 2115 feet long at the crest, 564 feet high and will contain about 2,900,000 cubic yards of concrete. It will be the third tallest concrete dam in the world and its bulk will be exceeded only by Grand Coulee, Shasta and Hoover Dams.

Twelve contracting firms that banded together under the name of General-Shear-Morrison Company are building the dam and powerhouse at a cost of $43,431,000. Construction techniques in general follow the practices that were developed for building America's other huge dams. An 1180-foot diversion tunnel that was blasted through one wall of the canyon is now used to carry the river around the dam site. When the dam is completed, this tunnel will be sealed with a concrete plug and water will begin to back up in the reservoir. When the reservoir is full it will contain 31/2 billion acre-feet of water and its maximum depth will be 500 feet. Instead of cascading down the face of the dam in an open spillway, excess water will flow into an open "glory hole" type of spillway and will fall the height of a 47-story building on its way to the outlet portal. The odd spillway is being built back of the dam as part of the general contract.

The dam is to be a key project in the Bureau of Reclamation's program for taking full advantage of the water resources of the whole Columbia River drainage area. It will help control floods, will assist in balancing the downstream irrigation program and will contribute its share of electric power to the area.

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One tenth as heavy as sand, a new material processed from volcanic glass found in the Southwest may serve as a substitute in plaster and concrete. It saves about four tons in plastering a normal five-room house. Both plaster and concrete made with the new aggregate have superior insulating properties.
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AUGUST 1950

249
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Start Planning Now!
It's Easier Than You Think to Own Your Home

IDEAL FOR FAMILY OF FOUR
Popular Mechanics Build-It-Yourself Concrete Block House is 20'-8" deep by 32'-4" wide with 973 square feet of comfortable living space—living room, two bed rooms, cabinet kitchen, utility room, bath and three closets. Built in a Chicago suburb, a relatively high priced city, in a high price year, its total cost was less than $1610.00 including all material, heating, plumbing and electrical equipment and outside labor for installing the equipment and plastering all rooms. In many localities it can be built for even less and additional savings can be made by using less expensive bath and kitchen equipment.

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Construction is concrete throughout—poured concrete floors and concrete block walls—both vapor sealed for insulation—construction that requires no special skill. Walls are turred-out and plastered inside, stuccoed outside. Ceiling is insulated. Only a very minimum of carpentry is required—

simple shingled hip roof, door frames and trim, which almost anyone can do. Interior doors are now flush type. Hot air heating plant may be gas, oil or coal-fired. Hot air ducts terminate in ceiling; cold air ducts are tile laid under the floor.

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Every part of the construction is simplified and thoroughly explained in the BUILD-IT-YOURSELF Book from the turning of the first shovel full of earth to the last dip of the paint brush. It is written in plain, understandable terms and packed with pictures and diagrams that make every construction detail simple as A.B.C. The book also tells how to make your own concrete blocks, how to select and buy a lot and how to build a house of bricks. Book and set of ten working blueprint plans are all you need to get started and enjoy the thrills of home owning, doing the job yourself and saving money too. Book, $2.00. Set of plans, $12.00. See coupon for special money-saving offer when both are ordered together.

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Toy Pistol Puffs Smoke

Every time a “small fry” cowboy fires a new toy revolver it ejects a realistic puff of “smoke.” A tiny bellows in the gun forces out a miniature cloud of harmless powder when the trigger is pulled. The gun fires 5000 puffs of smoke on its initial load, and additional powder is available.

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See story in June issue of Popular Mechanics
Page 114
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After more than 2000 years as the spoken
language of the Indians of Peru, the lan-
guage, Quechua, has been given an official
alphabet. Never written or spelled out be-
fore, the tongue was one of the official lan-
guages of the Incas over 2000 years ago. Recently,
various authors have tried to put the lan-
guage into writing, but each writer used his
own system of symbols. Now, writers and
language experts have devised an official
alphabet and the Indians are busy learn-
ing the “ABCs” of Quechua for the first
time in history.

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PLANNING YOUR HOME WORKSHOP

Edited by SAM BROWN

Only Sam Brown and Popular Mechanics could give you such a book as "Planning Your Home Workshop," for these are magic names in the world of craftsmanship. Brown is a recognized authority and author of many articles and books on home workshops, advisor to power tool manufacturers and a man who has worked with every type of power tool, with all kinds of materials, and has a world-wide reputation for excellence in fine craftsmanship.

Planning Your Home Workshop is a "must" for the beginner and the experienced home shop worker, for no other book gives such complete information on shop layout and maintenance.

Your Shop — Layout — Equipment and Practical Shop Maintenance

This book shows how to set up a shop on a limited budget, how to avoid costly mistakes by buying the right tools, where to get the tools you need and want, what size and type to select, the basic "big-six" power tools, what hand tools to buy, floor plans and layouts to suit available space and facilities, the best use of electric motors, shop furniture you can build, hobbies for the home workshop, a selection of projects, and many other subjects. It contains 128 pages with more than 250 photos and 100 detailed scale drawings, many in colored line.

Telephone Amplifier For Hard-of-Hearing

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Searching for persons or objects in total darkness poses no problems for soldiers wearing sniperscopes. Clamped to a helmet, the equipment combines an infrared light source and an electronic telescope. Its energy comes from a power pack and battery which can be carried in a knapsack on the operator's back.
Swinging Reflector For Flash Photos

Flash bulbs can be fired from directly above the camera lens to eliminate unwanted side shadows when a curved flash-gun mount is used. The mount is a steel track that attaches to the side of a press camera, allowing the photographer to swing his flash gun in a 90-degree arc. For horizontal shots, the reflector is swung upward and locked directly over the camera lens. For vertical shots, it is swung downward to the other end of the track.

Underground Oil Reservoirs

With some assistance from engineers, Mother Earth is solving a storage problem that has long vexed the oil industry. Vast man-made underground caverns are replacing steel tanks as reservoirs for butane and propane. Both are fire hazards and have to be stored under pressure to be kept in liquid form. After ordinary drilling equipment opens a vertical shaft to the desired strata, the reservoir is formed by washing out or dissolving the earth structure around the shaft. A dissolving liquid, water or an acid, is shot down the shaft through a rotating pipe with a flexible rubber hose at its lower end until the required space is washed out. Drilling mud forced down under pressure seals off the walls of the underground chamber and prevents pollution of the stored liquids.

With 77 percent of their area covered by forests, the New England states have a larger proportion of woodlands than any other region in the United States.
Now you can get Shopmaster quality in power tools specially designed for the smaller home workshop, operating on a limited budget. Efficiently designed, they contain features found only on the highest priced tools.

Two-Wheel Stroller

Two small wheels, a tubular-metal frame and a harness-type seat are all it takes to make a baby stroller developed in Germany. It can be taken almost anywhere because it occupies little space. The child sits in the seat and hangs onto the rectangular frame.

Automatic Car-Door Lock System

Children can't open a door while the car is moving if the doors are protected by an ignition-controlled lock system. Whenever the ignition switch is turned on, the doors lock automatically. A switch on the dashboard allows the driver to unlock the doors whenever he wishes. Should the car over-turn, a mercury switch releases the locks.

Squeezed Hay Dries Faster

Farmers can put freshly cut hay in the barn on the same day it is mowed when the hay is crushed during the mowing operation. Tests carried out by engineers of Canada's Experimental Farms Service show that crushed hay, cut at 8:30 in the morning, is ready for storage by evening. A special farm implement was designed to pick up the new-mown hay, crush it between two power-driven steel rollers and strew it back on the ground to dry. No significant change in feeding value of the hay was detected.
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261
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Multi-purposed watch that measures distance, speed, time, moving objects. Used at Stop Time/Tape. Has sweep-second hands for full 12 hour timepiece. Second Dial records up to 15 minutes. Third Dial then starts up to 15 hours. Seconds—Minutes—Hours, all recorded automatically.

INDEPENDENT MOVEMENTS
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August 1950
Scaffold Works Like a Jack

Workmen using adjustable scaffold brackets can raise the platform to any desired level simply by jacking it up with two foot levers. Safety locks keep the platform secure at any position. It can't slip even under a one-ton load. The scaffold is attached to the building by a pair of horizontal braces at the top of the uprights. There is no other connection with the building, the platform being supported away from the wall. The double guard rail can be used as a workbench simply by nailing a wide plank to it.

Aureomycin Speeds Animal Growth

Aureomycin, the wonder drug so effective against pneumonia, whooping cough and other diseases, speeds the growth of animals up to 50 percent. Drs. E. L. R. Stokstad and T. H. Jukes of Lederle Laboratories recently discovered that the drug is a powerful growth accelerator. Extremely small amounts of the drug, mixed with animal feeds, have produced startling jumps in the weight of pigs, turkeys and chickens. Although aureomycin is expensive in pure form, the scientists discovered that it was just as effective in an unpurified state, and that only .0004 of an ounce added to a pound of feed rapidly added flesh to test animals. Use of the drug with animal feed may decrease meat production costs. Why aureomycin accelerates growth is not yet known, but the scientists suspect that it attacks germs within the body which rob the animal of valuable vitamins. It has been suggested that the drug may stimulate the growth of undernourished and undersized children.
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AUGUST 1950
Mechanical "Beanstalk"

Work at a height of 22 feet is easily reached by a mobile hydraulic platform. The user operates a manual hydraulic pump that boosts the tubular-steel platform to its maximum altitude in two minutes. It is lowered by pulling a pressure release. Four screw jacks lift the equipment off its rubber-tired casters and hold it in position during use. The complete unit can be folded to permit passage through a doorway six feet six inches high and less than 2½ feet wide.

Radioactivity Detector

Going the famed Geiger counter one better, an extremely sensitive radioactivity detector not only shows the presence of a radioactive material, but also identifies the material. Called a gamma-ray spectrometer, it has already uncovered previously unknown deposits of uranium in northern Saskatchewan. It uses a crystal of sodium iodide activated by a tiny amount of a radioactive iodine salt. The use of tiny electronic parts, such as those in hearing aids, keeps the weight of the device down to eight pounds. With it, substantial deposits of uranium ore have been detected at distances of several hundred feet.
...speaking of the really hot days in JUNE, JULY and AUGUST, my home workshop seems the coolest part of the house

When the temperature is in the 90's, there's nothing like leisure moments spent in a home workshop to take one's mind off the heat—a relaxing hobby is the "key" to hot weather comfort.

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However, a word to the wise: If you install a workshop, complete with power tools, now—there will be less broiling on the beach, less idle sitting, sweltering, this summer. It will prove difficult to lure you from what seems the coolest place in the house—your home workshop!

P.S. I would be pleased to hear from you as to your experiences with summertime home workshop activity—why not write! Simply mark the envelope: Room 512.

JIM

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OFFICIAL, AUTHORITATIVE, PRACTICAL INFORMATION

Written by C. E. Packer, formerly service school instructor and auto show lecturer for automobile manufacturers, Member Society of Automotive Engineers, Editor of Automobile Digest, contributor to leading magazines, author of some of the biggest selling books on Automotive subjects. Prepared with the full authority and active cooperation of the Plymouth Division of the Chrysler Corporation.

Plastic Storm Windows

Storm windows made of transparent plastic can be installed by the homeowner with a minimum of time and expense. They are sold in a kit which includes a large sheet of plastic, eight framing strips and nails for tacking the material in place. The plastic can be nailed to the front or, for a neater job, to the inside edges of the window casing. By attaching a sheet of it to a screen door, you can quickly convert it into an effective storm door.

Scrap-Iron Concrete

Atomic radiation, a hazard near atomic installations, is stopped more effectively by a mixture of cement, scrap iron and limonite, an iron ore, than by regular concrete mixes. Two scientists at Princeton University have discovered that a three-foot wall of iron and limonite concrete is 280 times as effective as ordinary concrete in stopping neutrons. It also is 20 times as effective against gamma radiation.

Giant-Size Patent

One of the longest patents ever issued in this country consists of 136 sheets of drawings and 188 columns of printed specifications describing a telephone-bill computer. Invented by three Bell Telephone engineers, the computer translates a series of punched holes into a monthly bill.
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Last-year's apple pollen, stored like a frozen vegetable in a home freezer, was used to "father" California apples this spring. Specialists of the U.S. Department of Agriculture conducted the experiment after tests convinced them that long-term storage of frozen apple pollen may be possible. Apple-tree pollen, unlike many other pollens, loses its power to germinate when dried and kept in ordinary cold storage. Storage by freezing, if proved successful this year, will be of great value to apple growers, permitting them to cross late-season apples with varieties which bloom early in the spring.

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