



POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

DECEMBER
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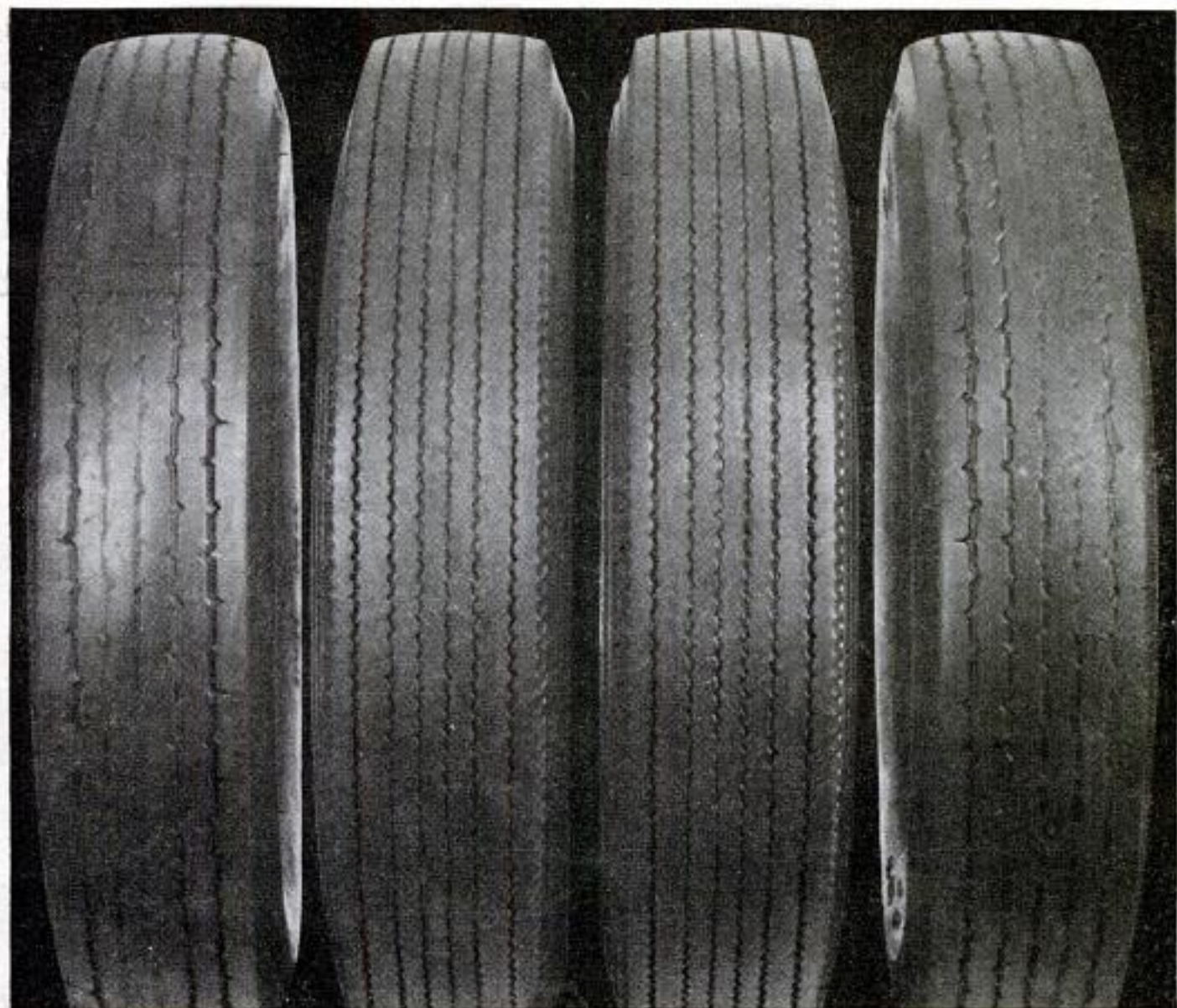
Will Your Flashlight **WORK**
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New synthetic tire will **OUTWEAR PREWAR TIRES**

B. F. Goodrich passenger car tire coming soon

BEFORE these tires had their pictures taken, they went thousands of miles on a test car. They were carefully rotated so all got equal wear. The unretouched picture shows exactly how they looked after the test.

The two outside tires were made of natural rubber with prewar treads—equal in every way to new prewar tires. Note that they were run until nearly smooth. Then observe the still effective tread on the middle tires... the new B. F. Goodrich synthetic-rubber Silvertowns. This was one of many tests that have proved the new tires give better-

than-prewar mileage.

These tires are newly designed for passenger cars. B. F. Goodrich builds them of a new, better synthetic rubber—different from the ordinary synthetic in general use by the tire industry. This rubber was also a B. F. Goodrich development. The tire body is stronger, too, with a new, stronger kind of cord reinforcement. The tread is slightly wider and flatter.

The tires have had more than 2,000 tests and nearly 17,000,000 miles of all-weather, all-road driving by taxicab fleets, state police departments, and the B. F. Good-

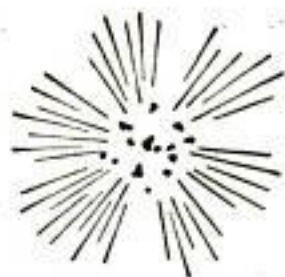
rich test fleet.

When can you get them? We hope to have them in the hands of nearly all dealers and ration-free by the end of the year. If you make your tires last as long as possible, you may be able to get these new, better tires by the time you have to buy. *The B. F. Goodrich Co., Akron, O.*

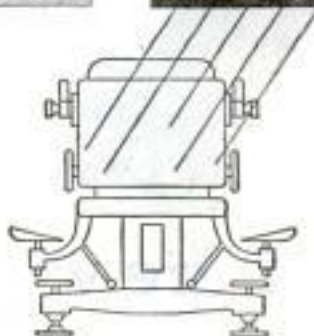
Coming soon...from

B.F. Goodrich

FIRST IN RUBBER



Target practice with Relays and Keys



(Left to right) The operator punches the problem data on tape, which is fed into the computer. The solution emerges in the teletype receiver. Relays which figure out the problem look like your dial telephone system.

In designing the gun-control systems which shot down enemy planes, Army ballistic experts were faced by long hours of mathematical calculations.

So Bell Laboratories developed an electrical relay computer. It solved complicated problems more accurately and swiftly than 40 calculators working in shifts around the clock.

Resembling your dial telephone system, which seeks out and calls a telephone number, this brain-like machine selects and energizes electric circuits to correspond with the numbers fed in. Then it juggles the circuits through scores of combinations. It will even solve triangles and consult mathematical tables. The operator hands

it a series of problems with the tips of her fingers—next morning the correct answers are neatly typed. Ballistic experts used this calculator to compute the performance of experimental gun directors.

In battle action, Electrical Gun Directors are instantaneous. Such a director helped to make Antwerp available to our advancing troops by directing the guns which shot down more than 90% of the thousands of buzz bombs.

Every day, your Bell System telephone calls are speeded by calculators which use electric currents to do sums. Lessons learned are being applied to the extension of dialing over toll lines.



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Popular Mechanics Magazine

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Next Month

PHOTOGRAPHY fans may soon get their films developed at the drugstore in the time it takes to eat a sundae. At least that's what the researchers in diazo (dry photography) predict. Other wonders in store include color movies from black and white film, a short-wave radio flash outfit, and lightweight optical plastics. If you're not a camera fan already you will be after reading "It's Time to Open the Shutters" in the January issue.

MUCH of the Old West can be made to live again in a skillfully crafted model of the horse-drawn stage coaches of gold-rush days. How to build a model of the famous Ben Holliday coach is fully told in the next issue.

FRESH tomatoes and electric stoves are sprouting wings. And if you accept the confident prophecies of air-minded shippers, everything from azaleas to zebras will be carried in the fast air freighters of a future that starts right now. "Flying Freight," a January feature, depicts the giant cargo planes being readied for the air freight age, and the "bull's-eye" parachutes for delivering parcels on the route of the flying boxcars.

THERE'S an old one about "using your head to save your back"—and no one knows the truth of it better than a farmer. That's why he likes to sit on the tractor seat and "let the engine do it." The tractor scoop described next month increases the working capacity of one man a hundredfold.

MONTHS of dangerous work are ahead for our Navy men clearing unexploded mines from Asiatic waters. An article next month, "Sweeping Up Sudden Death," is illustrated by graphic drawings showing the mechanics of clearing the mine fields.

Volume 84	DECEMBER 1945	Number 6
Managing Editor.....	Roderick M. Grant	
Assistant Managing Editor.....	Wayne Whittaker	
Shop Notes and Crafts Editor.....	James R. Ward	
Radio and Electronics Editor.....	Frank L. Brittin	
Art Director.....	Frank Beatty	
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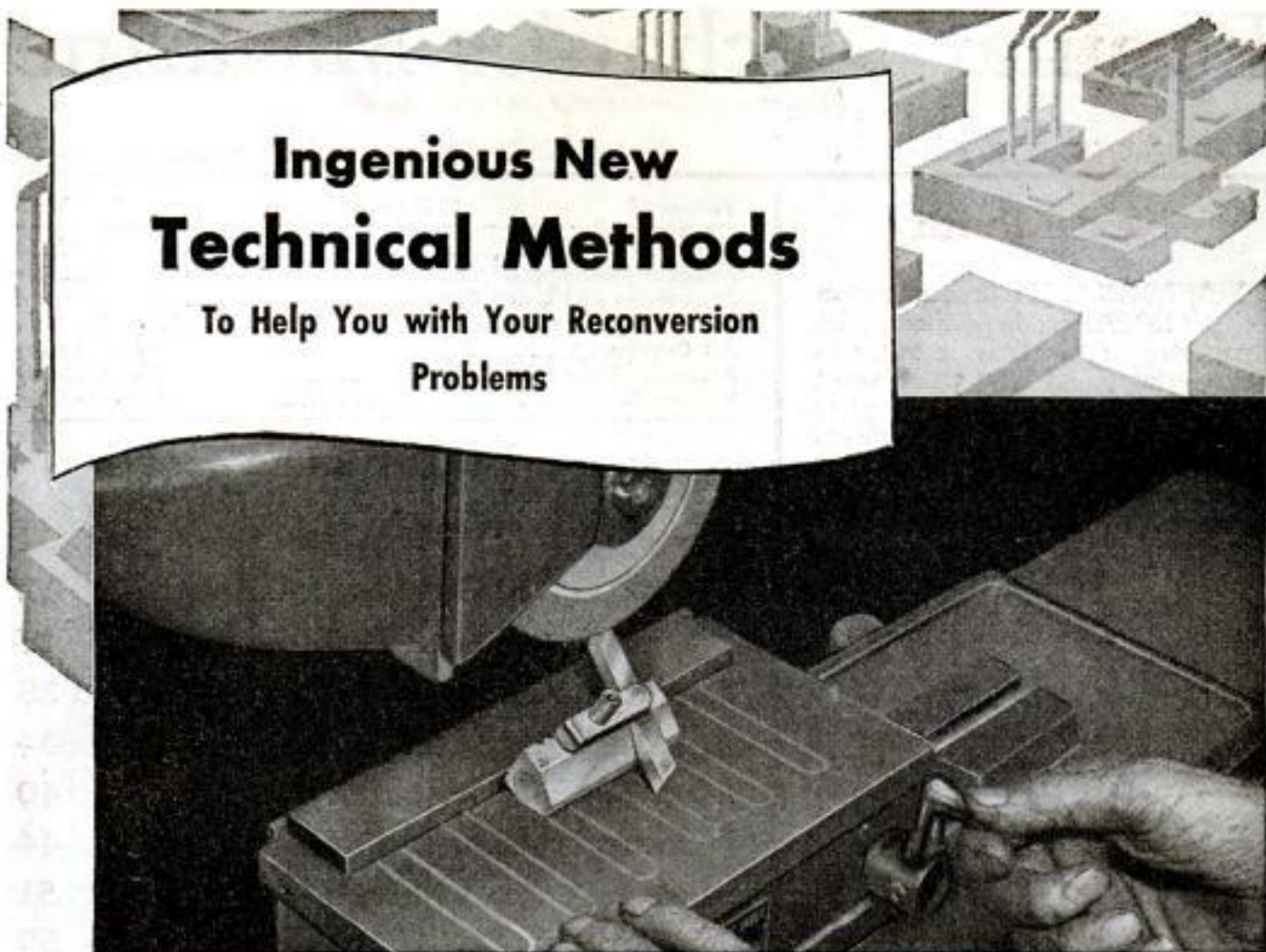
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Problems



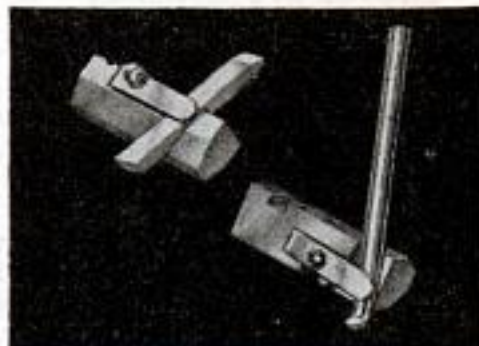
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The Magic of Mind

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It is time you realized that the rites, rituals and practices of the ancients were not superstitions, but subterfuges to conceal the marvelous workings of natural law from those who would have misused them. Telepathy, projection of thought, the materializing of ideas into helpful realities, are no longer thought by intelligent persons to be impossible practices, but instead, *demonstrable sciences*, by which a greater life of happiness may be had.

One of America's foremost psychologists and university instructors, says of his experiments with thought transference and the powers of mind—"The successes were much too numerous to be merely

lucky hits and one can see no way for guessing to have accounted for the results." *Have you that open-minded attitude of today which warrants a clear, positive revelation of the facts of mind which intolerance and bigotry have suppressed for years? Advance with the times; learn the truth about your inherited powers.*

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that are opening up more and more. Opportunities in private practice, as a cost consultant or C.P.A.

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Manufacturer's name and address appear in parentheses directly after items believed by us to be commercially available

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Sheet-Metal Worker
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Ship Fitting
Shop Practice
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Radio Operating
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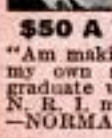
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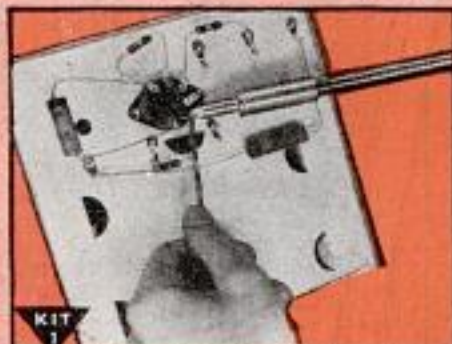
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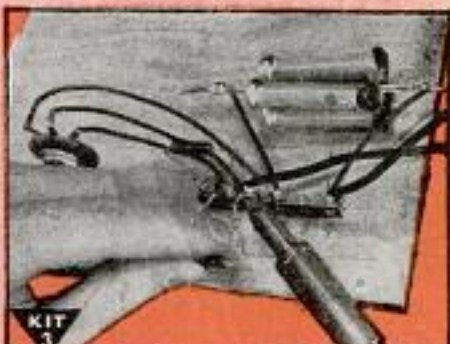
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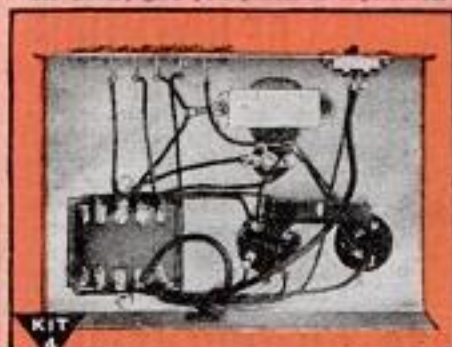
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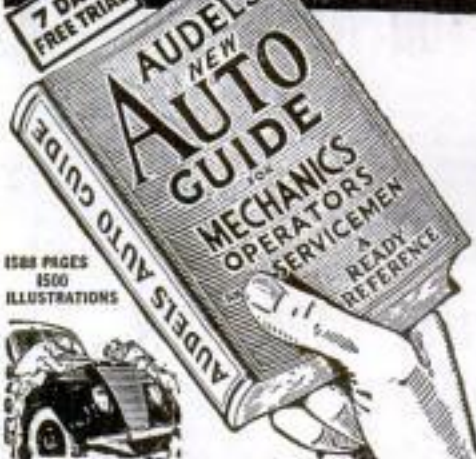
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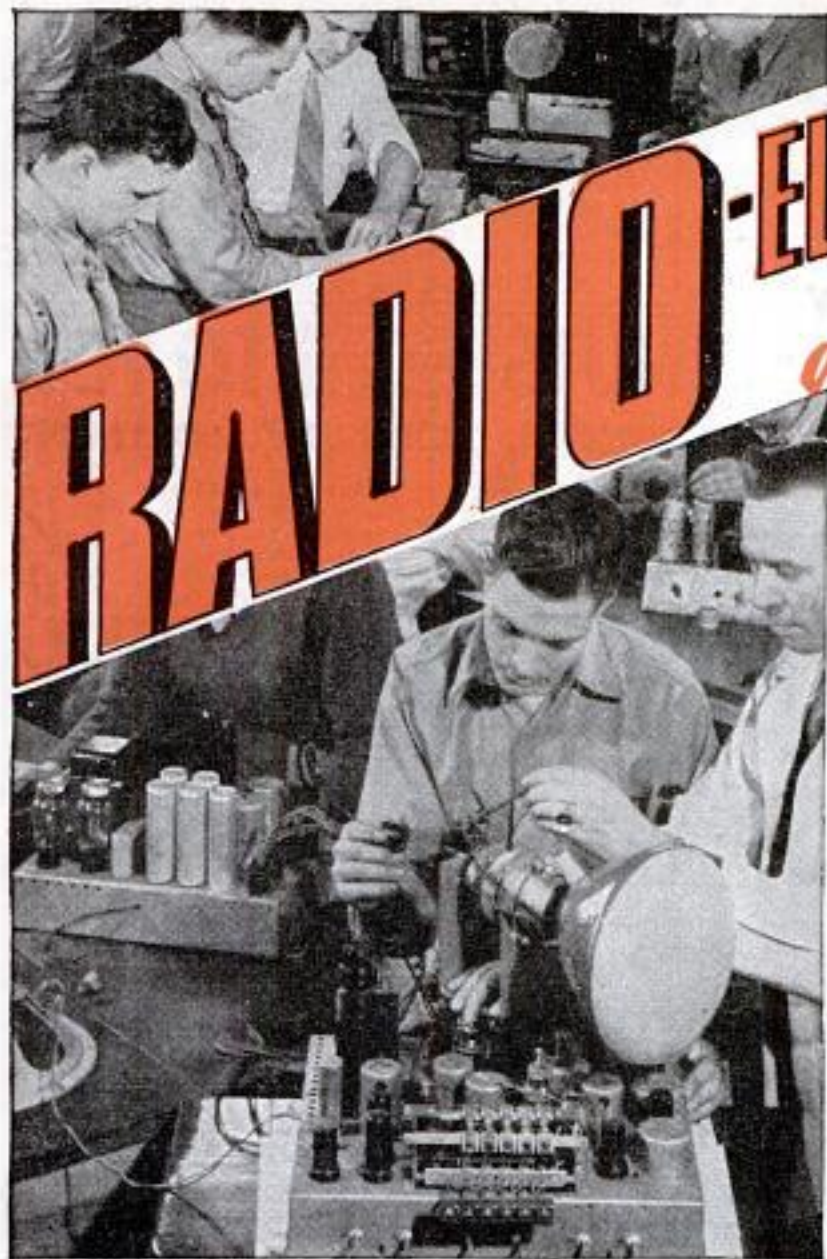
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By S. T. CHRISTENSEN
the "Fix-it Man"

WELL, I guess I'm the fellow to see, for I've repaired thousands of refrigerators (home and commercial both), vacuum cleaners, radios, washing machines, irons, fans, lamps, mangles, motors, etc. In fact, many of my customers call me their "electrical appliance doctor." And, "doctoring," I might add, has paid me a good substantial income for quite a few years. Funny, in a way, how I got started. Always liked to tinker and by experimenting around I found that most electrical appliances had many things in common. That, regardless of what the appliance was used for, or who the manufacturer was, the basic principles were much the same. From fixing my own appliances to fixing friends' and then for strangers at a fee, seems now to have been but a small step.

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At first, I let the owner decide the charge and, frankly, I was amazed at what I earned per hour. But then, when one figures what initial costs are involved in buying most electrical appliances, one can readily see that spending extra dollars for repairs is well worth while. Before long I was making more in my spare time repairing than from my regular job. The result . . . I went into business for myself. When war came, business boomed, for new appliances were not available.

For a while, repair parts (needed on some

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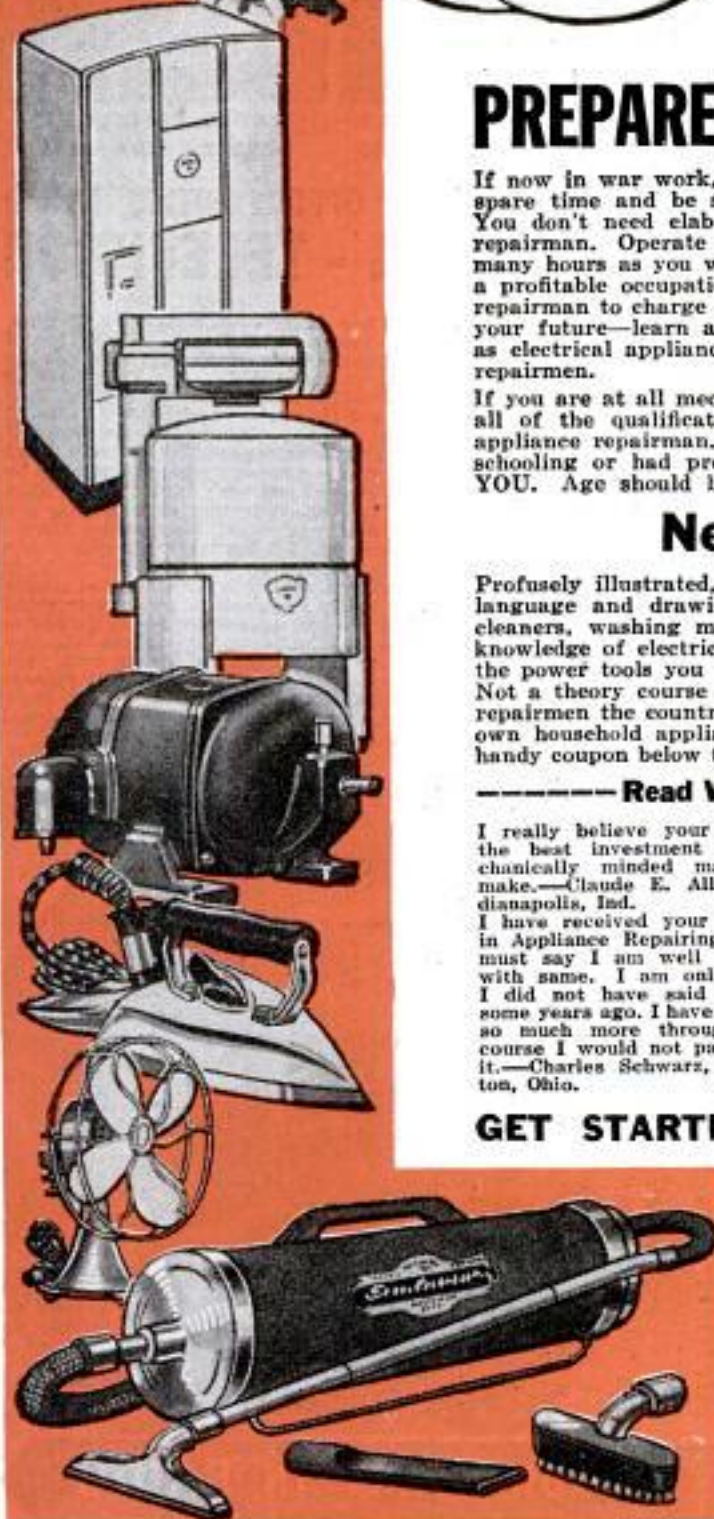
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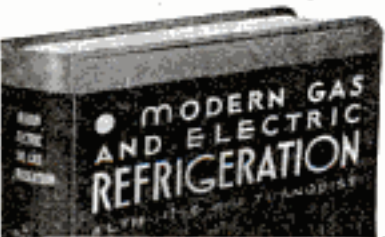
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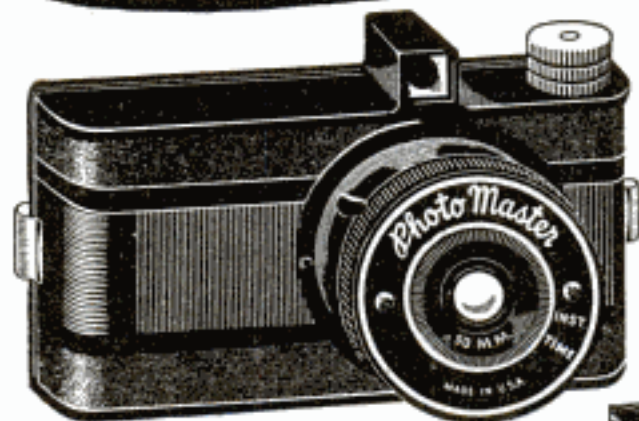
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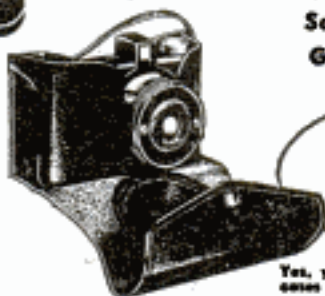
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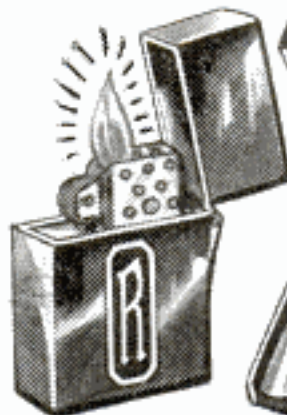
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LARGE Stock Indian parts. Expert motor rebuilding. Indian Motorcycle Sales, Kansas City 1, Mo.

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WHATEVER You need for welding, we have it. Gas or electric generator, 150 to 400 amp. transformer, 100-600 amp. gas torches, regulators, hose, wire, goggles, etc., cable. Welding Headquarters, 3425 Milwaukee Ave., Chicago, Ill. 47.

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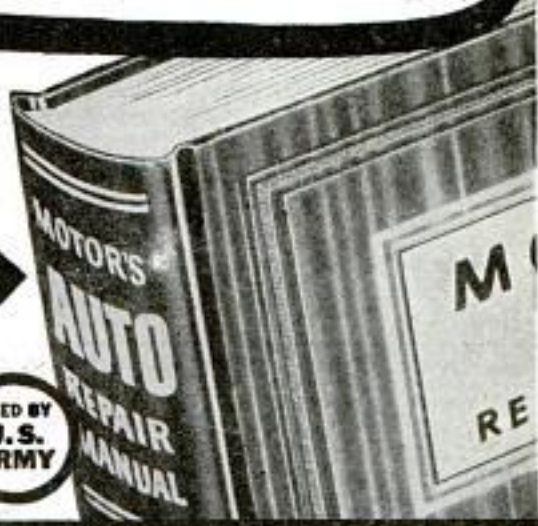
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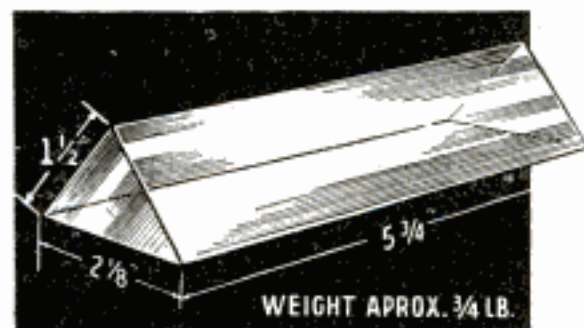
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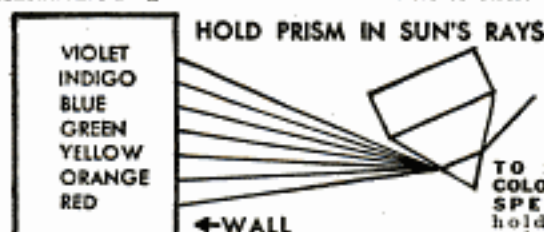
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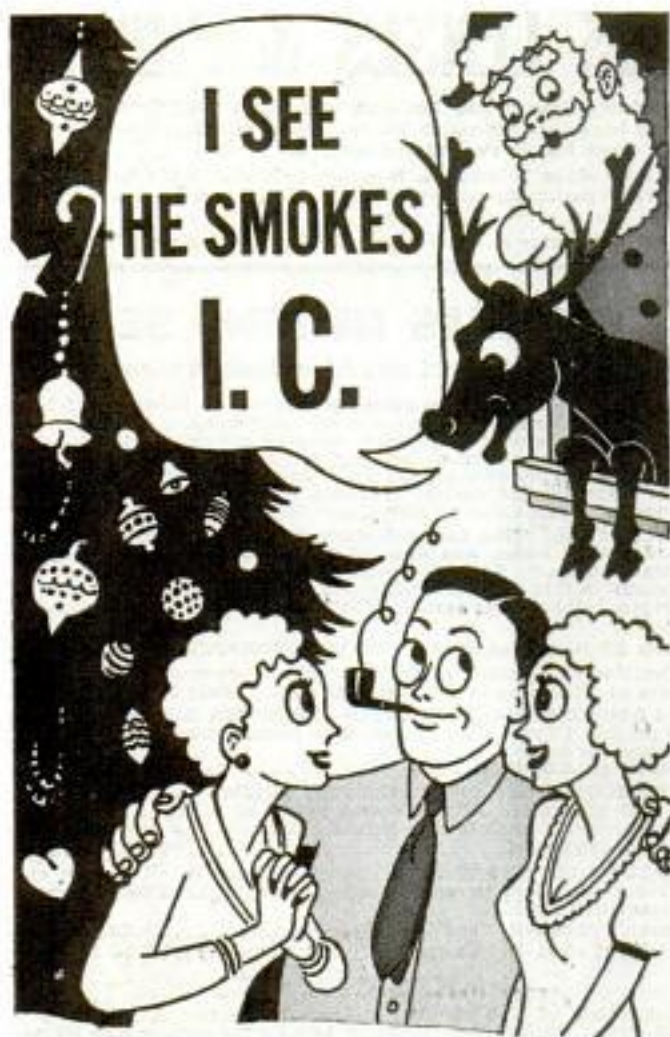
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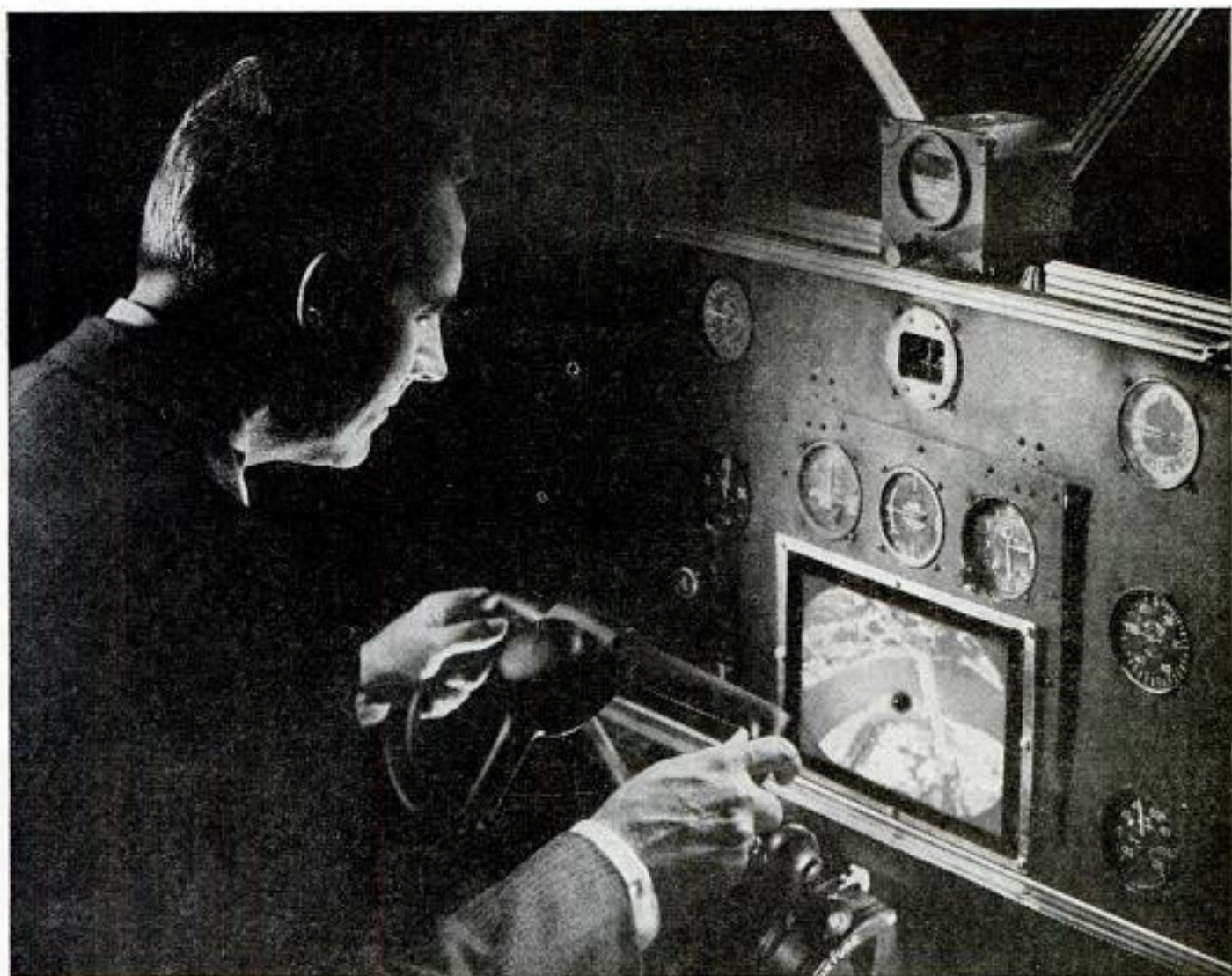
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Pilots can now have an accurate radar "roadmap" of the earth below—showing landmarks and major details of terrain. Radar will make it a whole lot safer to fly at night or in stormy weather—as well as in broad daylight.

This is only one of the many possible uses for radar. For example, radar will "see" icebergs or islands many miles away—day or night—and will thus enable ships to avoid them. It will provide men with an amazing new "sixth sense"—and will be used in a great many ways yet to be discovered.

RCA research and engineering played a leading role in developing radar . . . the same research that goes into *all* RCA products.

And when you buy an RCA Victor radio or television set or Victrola, made exclusively by RCA Victor, you enjoy a unique pride of ownership. For you know, if it's an RCA it is one of the finest instruments of its kind that science has achieved.

Radio Corporation of America, Radio City, New York 20. Listen to *The RCA Show, Sundays, at 4:30 P.M., E.T., over the NBC Network.*

HOW RADAR WAS BORN


During RCA experiments at Sandy Hook in the early 1930's, a radio beam was shot out to sea. Men listening with earphones discovered that this beam produced a tone upon hitting a ship that was coming into the New York harbor.

Later on the question arose, "If radar could 'hear' couldn't it be made to 'see'?" So the viewing screen—or scope—was incorporated into radar. This scope is an outgrowth of all-electronic television that was invented and perfected at RCA Laboratories.



RADIO CORPORATION of AMERICA

So You'll See Better

 Nature designed your eyes for seeing by daylight. But the average person spends most of his waking hours under artificial light.

To develop better artificial light—for all living and working conditions—has been a continuous project of G-E engineers and research scientists. They have even developed a whole new Science of Seeing.

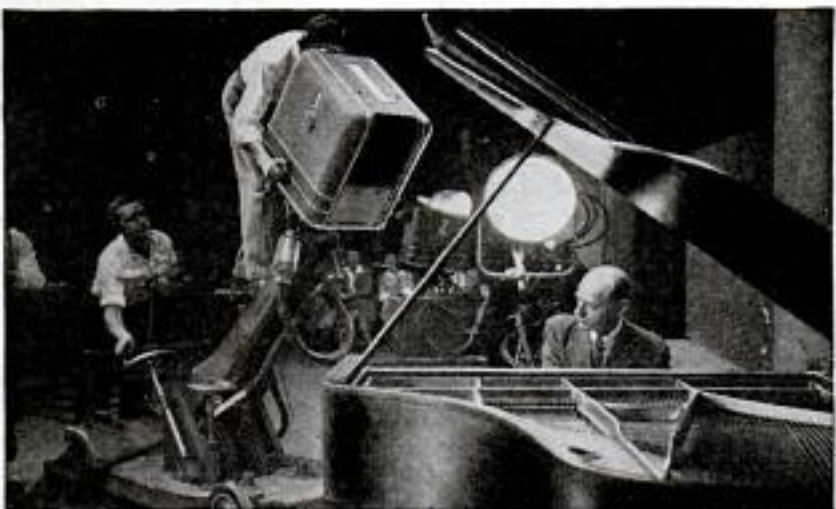
The pictures on this page illustrate a few ways in which G. E. is helping you see the day-by-day and night-to-night things more easily. *General Electric Company, Schenectady, N. Y.*



Powdered light. This luminous powder that you see is a phosphor. Coating the inside of every G-E fluorescent lamp, it transforms invisible rays into soft, cool light. Recently General Electric developed a remarkable new phosphor which will be used in a new fluorescent sun lamp to provide healthful summer sunshine all year round, economically and efficiently. And speaking of economy, G-E lamp research has reduced the cost of a 60-watt G-E bulb by 75% since 1923. Another way in which General Electric helps to bring More Goods to More People at Less Cost.



The tiny 7-watt G-E bulb in this night light makes darkened halls safely navigable for sleepy people. It's especially useful in homes with small children. And the cost of electric current has been brought so low that, at average residential rates, this little lamp will burn for four 8-hour nights for only a penny or so!



You'll soon see events as they happen—by improved television with a bigger screen and clearer reception. Back in 1928 a G-E engineer, Dr. E. F. W. Alexanderson, gave the first public television demonstration. And for more than five years now, G. E. has been telecasting regularly from its own station, WRGB, in Schenectady.

The best investment in the world is in your country's future

KEEP ALL THE BONDS YOU BUY

GENERAL  ELECTRIC



*Smoother than ever
- it's a new ride!*



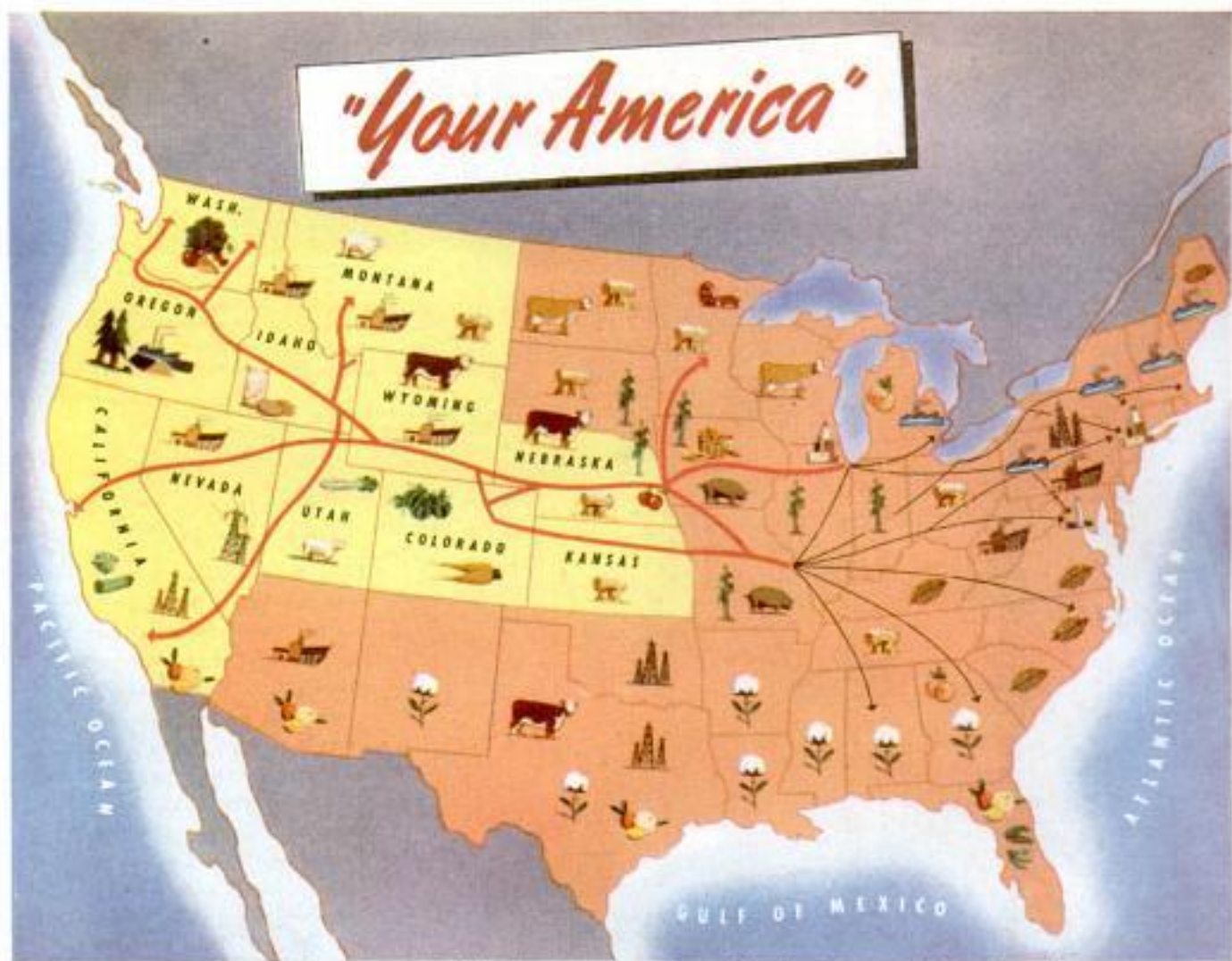
This new Ford car—so big and smartly styled—offers more new developments than most pre-war yearly models . . . New multi-leaf springs give you a ride that's smooth and level . . . Brakes, too, offer major new advancements. They're oversize, self-centering hydraulics for quick, quiet stops . . . There's stepped-up power—and new thrift in gas and oil . . . Inside, new luxury awaits you. Colorful fabrics and trim in pleasing two-tone combinations . . . Choose from two great engines. The V-8, now increased from 90 to 100 horsepower; the 90 horsepower Six . . . Ask your Dealer about the smartest Ford cars ever built.

FORD MOTOR COMPANY

TUNE IN... THE FORD SHOW... CBS, Tuesdays, 10-10:30 P. M., E. S. T. THE FORD SUNDAY EVENING HOUR. ABC, Sundays, 8-9 P. M., E. S. T.



THERE'S A
Ford IN
YOUR FUTURE



Map of "Your America" Showing Territory Served by the Union Pacific Railroad



For more than 75 years, Union Pacific has

served eleven western states... been a partner in their development... transported their people and products. This vast territory produces a great variety of agricultural products which not only feed and clothe the nation but are converted into a myriad of industrial uses.

The same eleven states also are a source of other industrial materials such as ores, minerals, lumber and petroleum. Rivers have been harnessed—providing irrigation and power. There is dependable rail transportation.

This vast western area has materials and facilities required for postwar expansion. There is plenty of space for such expansion and for homeseekers who desire a healthful contented life among friendly people in scenic surroundings.

★ ★ ★

Union Pacific... the Strategic Middle Route, uniting the East with the mid-West and Pacific coast... will, upon request, gladly furnish information regarding available industrial and mercantile sites or farm lands in the territory the railroad serves. Address Union Pacific Railroad, Omaha, Nebraska.

THE PROGRESSIVE
UNION PACIFIC RAILROAD
The Strategic Middle Route

Popular Mechanics Magazine

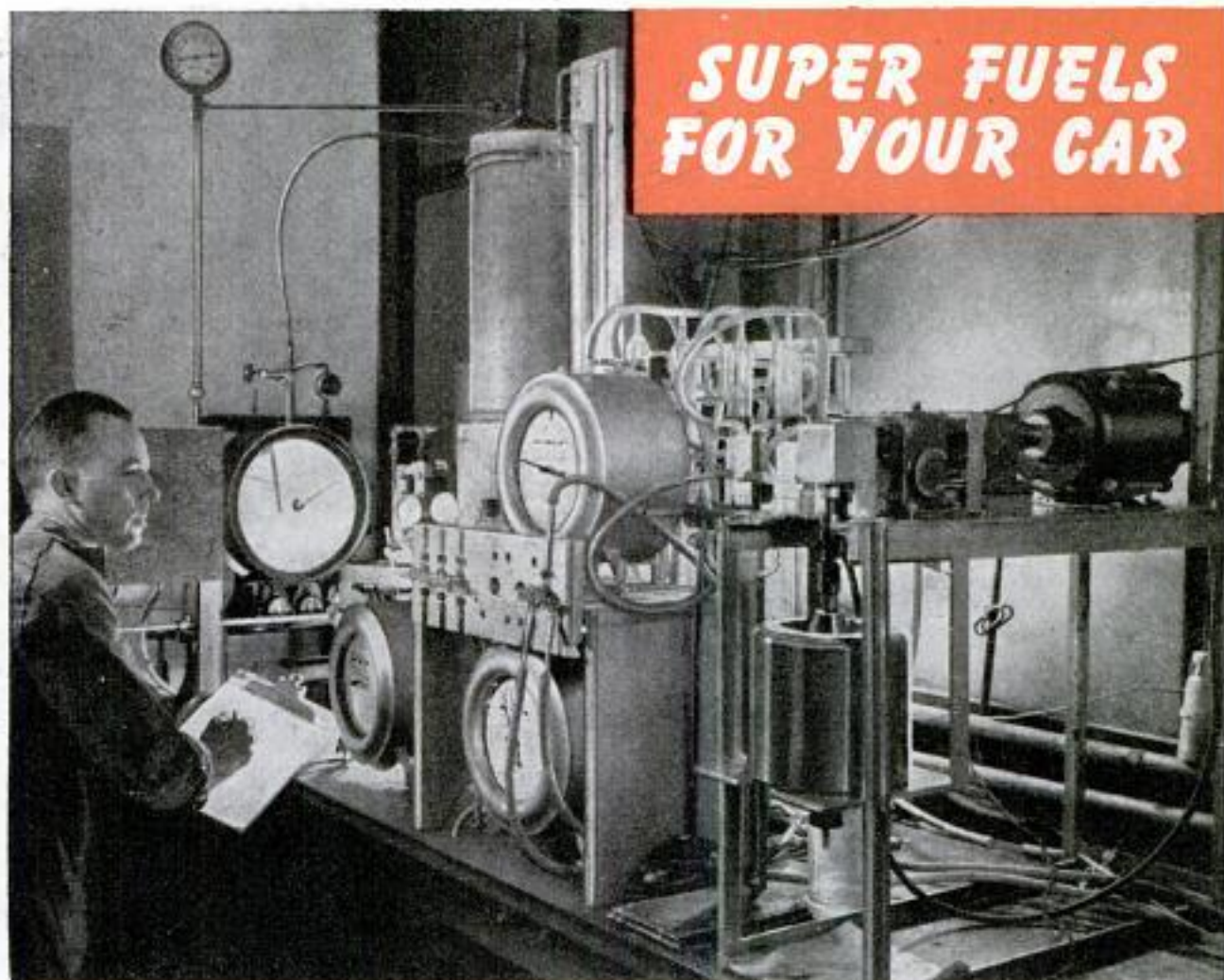
Registered in U. S. Patent Office and Canada

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 84

DECEMBER 1945

No. 6

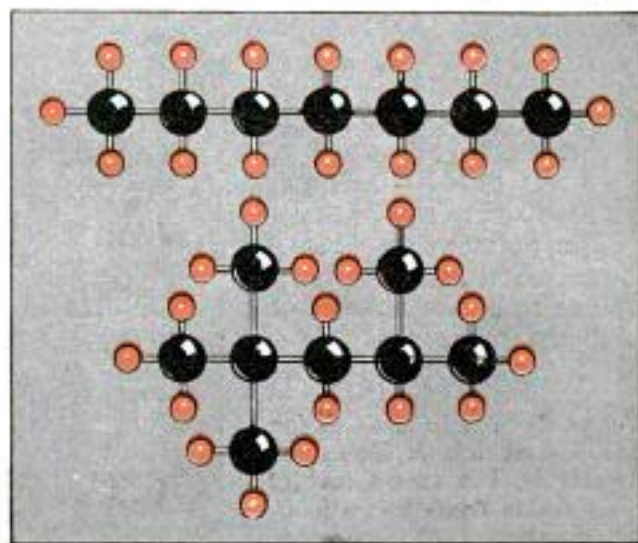


THE MOTORING PUBLIC is accepting as a matter of course the better gasoline which is pouring from pumps of rejuvenated service stations across the nation. However, the day is still far off when you'll be able to fill the jalopy's tank with 100-octane gasoline and sail right over the roof of the road hog ahead.

Even if you had been able to buy all the 100-octane aviation gasoline you wanted during the war, it wouldn't have done you much good; nor will it today. But you can buy higher-octane gasoline than the pre-war range, which means greater mileage and higher efficiency for cars with high compression engines. In 1940, the house brand or regular gasoline had a 75-76-

Right, arrangement of atoms in molecule of gasoline is secret of power. Black spheres are carbon atoms; red are hydrogen. Molecule of normal heptane at top produces knock. Below it is molecule of iso-octane

Experiment in catalytic dehydrogenation in laboratory of Universal Oil Products Co. is typical of research that boosted production of aviation gasoline from 42,000 barrels daily to a half million



DECEMBER 1945

oil

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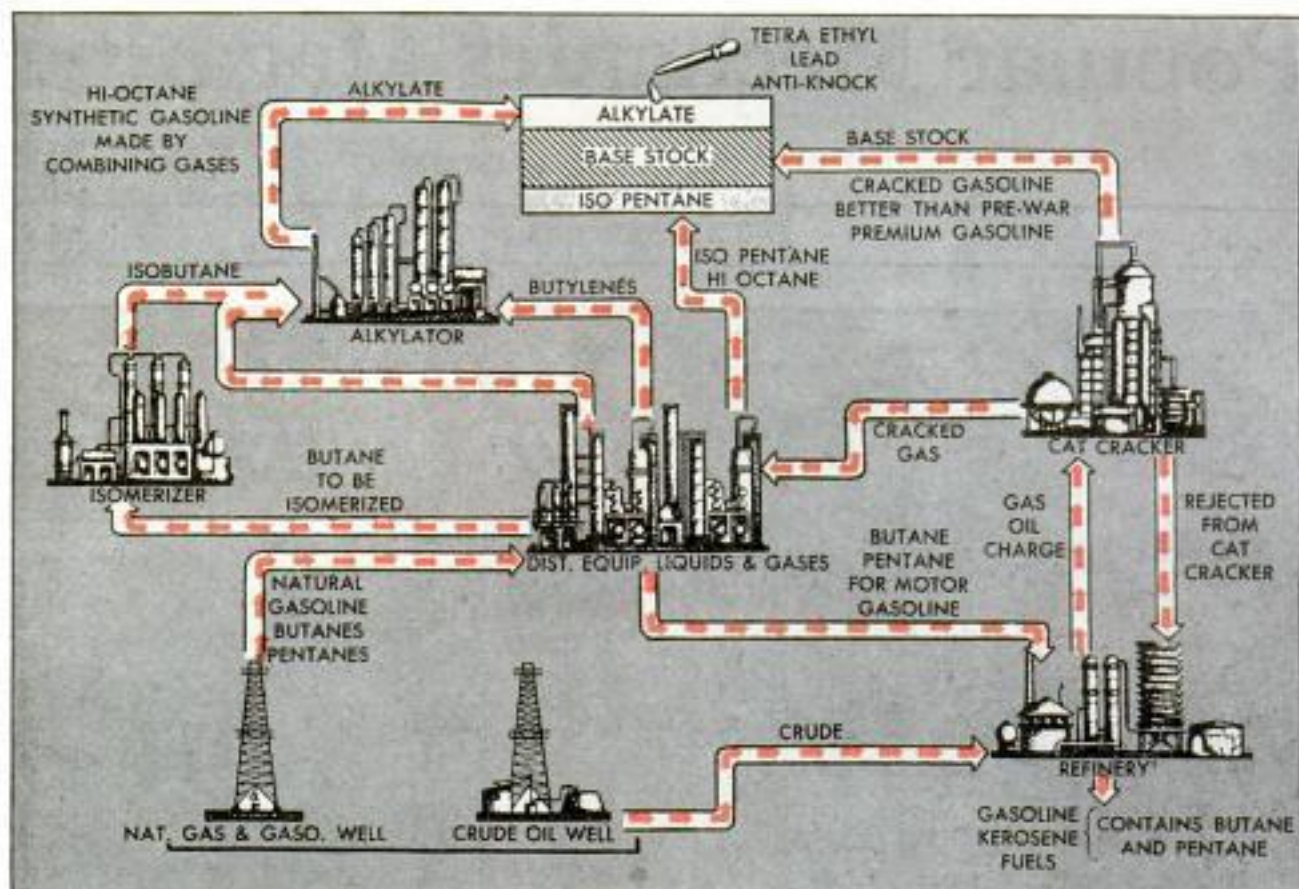


Chart from Petroleum Administration for War
 Here are principal steps involved in making 100-octane gasoline which is indicated in square marked alkylate, base stock and iso-pentane. Cat cracker produces base stock and returns the nonpotent fuel to the refinery

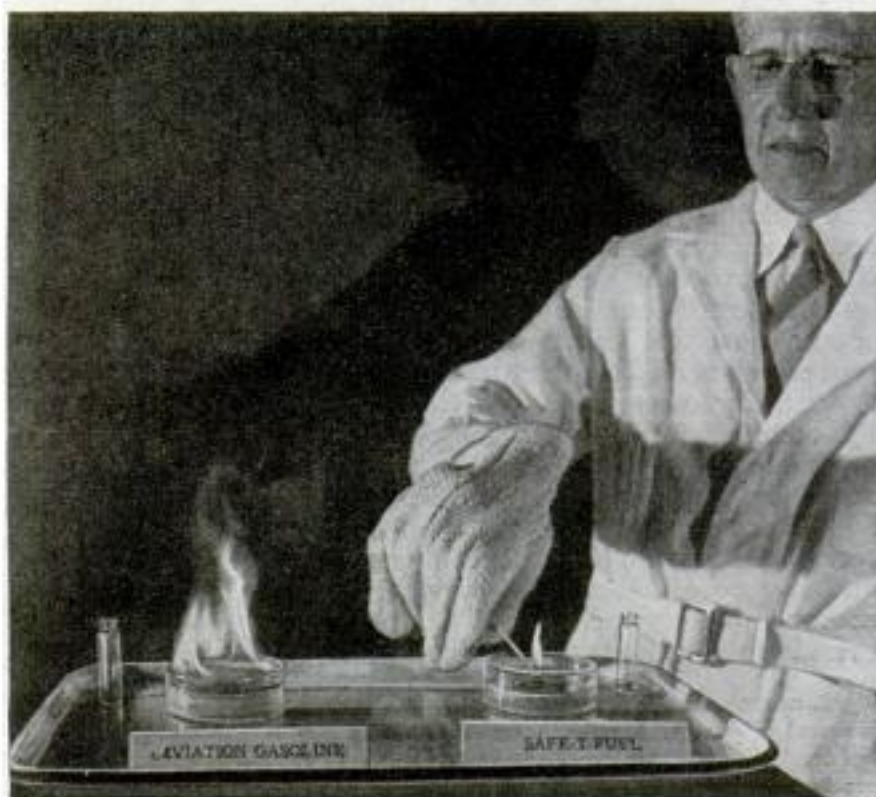
octane rating, and premium gas was 80-octane. Today the trend is to 80-octane for regular and 82 to 85 for premium gasoline. The 85 figure is aimed at getting the most out of postwar engines with higher compression ratios. Government regulations held regular gasoline to a maximum of 70-octane during the war, with premium at 76—when you could get it.

A significant trend in postwar gasoline purchases is evident in figures disclosed by a major oil company. Where regular gasoline outsold premium gasoline by 10 to one before the war, premium is outselling regular by approximately the same ratio today. Postwar motorists have become octane-conscious.

The octane scale itself is merely a measurement of the antiknock level of a given mixture of iso-octane, a gasoline hydro-

carbon having a knockless value of 100, and normal heptane, another gasoline hydrocarbon with a knockless value of zero. If a gasoline shows in these motor-method tests that its knockless value is equal to that of a blend of 70 percent iso-octane and 30 percent heptane, it is rated at 70-octane.

Vapor from regular aviation gasoline at left is highly inflammable, but safety fuel at right resists flame unless heated to above 100 degrees F. Standard Oil Co. (N.J.) photo



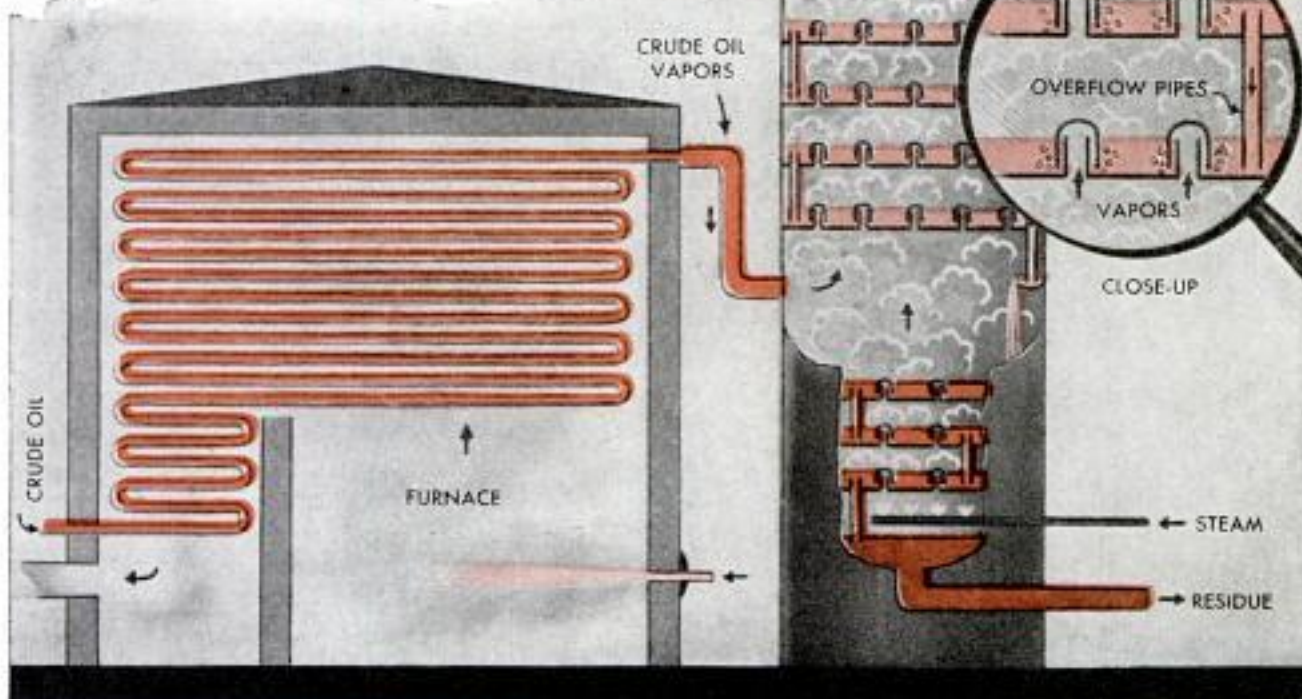
Spurred on by an insatiable demand for 100-octane gasoline for the thousands upon thousands of high compression, top efficiency aircraft engines of wartime, the petroleum industry literally lifted itself by its own bootstraps to reach a peak production of 500,000 barrels of aviation gas daily, compared with an average of 42,000 barrels a day by prewar processes. The net result is that the petroleum industry has become the largest mass production industry in the world, to quote Dr. J. F. Walter of the Universal Oil Products Company, a pioneer in petroleum research and processing development.

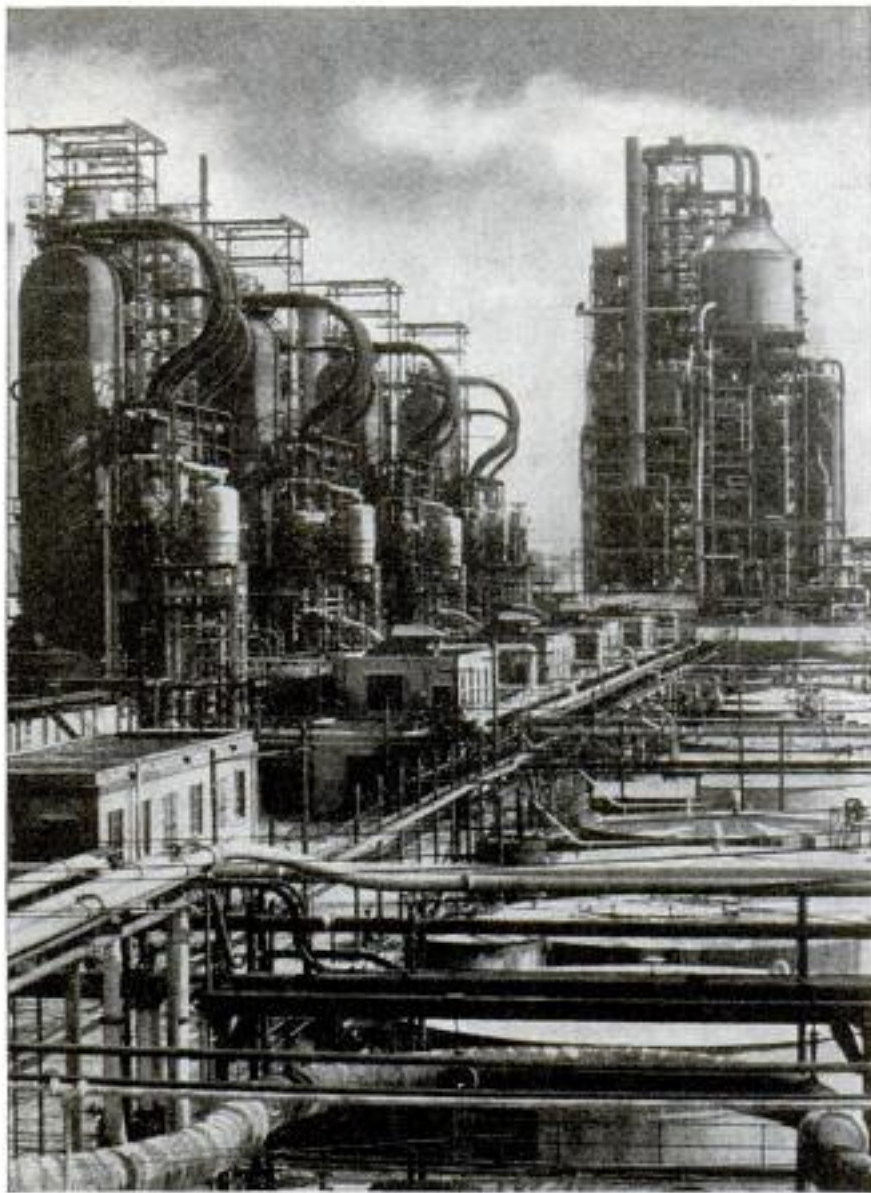
Although harnessing of atomic energy may some day present a real challenge to the petroleum industry, there is a strange kinship in the two fields. Originally, gasoline simply was distilled from crude petroleum, and operated the low compression engines of early motoring days quite successfully. But development of more efficient high compression engines created a need for better motor fuel, and it has been only in the last 25 years that such gasoline came into being. The secret of today's high-octane gasoline lies in rearrangement of the hydrocarbon atoms through new refining processes. The oil researchers were splitting molecules while the atom researchers were splitting atoms.

Returning from the realm of molecules and atoms, what do these petroleum developments mean to the average motorist?

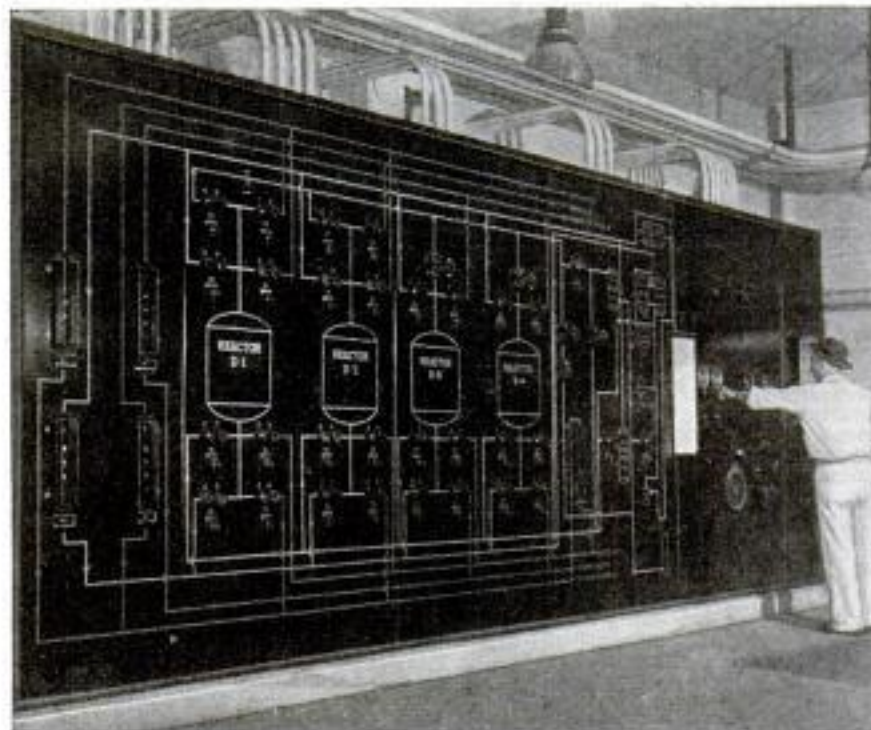
Key to petroleum refining is distillation of crude oil into various fractions. Oil is heated to 800 degrees F. and is completely vaporized in fractionating tower. Vapors with different boiling ranges condense on trays and are drawn off for processing

Courtesy of The Lamp, Standard Oil Co. (N.J.)





Above, cat crackers dominate scene at Standard Oil's Baton Rouge plant



Control board of hydroforming plant operated by the Pure Oil Company

To the aviation industry? Simply this: so far as present vision permits, automobile engine design when carried to the nth degree of attainable high compression, a ratio of about 9 to 1, still will not require 100-octane gasoline and the complicated processes required for its production.

Even in commercial aviation, 100-octane gasoline is not an essential requirement for ordinary transport purposes, and 91-octane fuel, which can be made by comparatively simple processes, will suffice. From an economy standpoint, 100-octane is justified only where long flight requirements and premium loads are involved. In wartime, of course, the economy factor is the last to be considered.

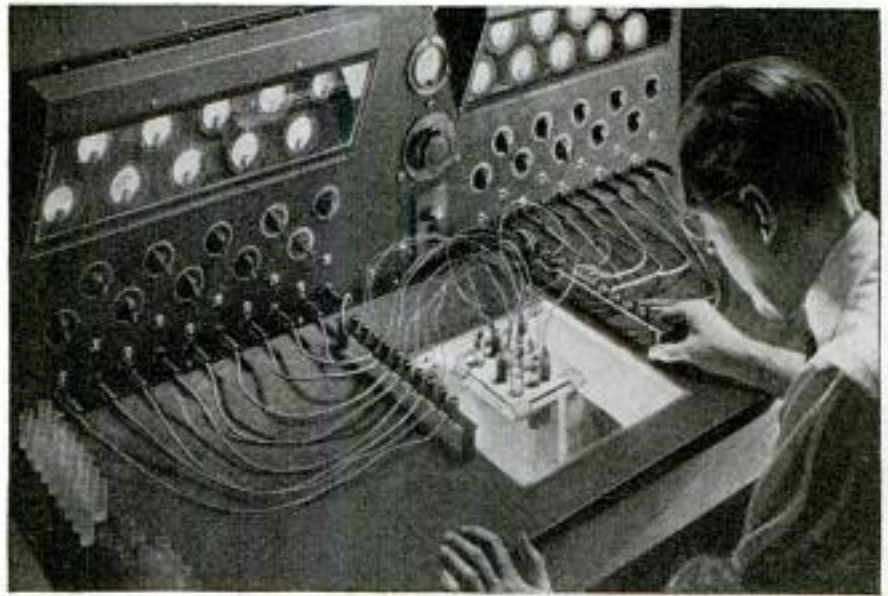
For greater safety in commercial aviation, the Standard Oil Company of New Jersey has developed a new safety high-octane aviation fuel which does not create an inflammable envelope of vapors when exposed to air at normal temperatures. Having all the power characteristics of 100-octane fuel, the safety gasoline still is as safe as kerosene to handle and has a flash point of 100 degrees F., as compared with a flash point of 40 below zero for ordinary 100-octane gasoline. The new gasoline must be injected directly into engine cylinders. First use of the gasoline will be confined to aviation, but its eventual extension to motor engines is quite probable.

Measuring of antiknock qualities of gasoline by octane number alone is being examined critically within the industry. The present methods of evaluating fuel are the motor method, described previously, and the research

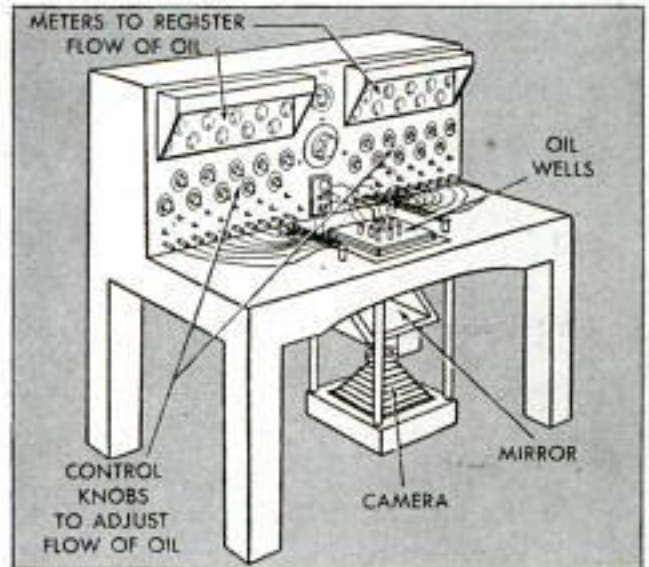
method. An 80-octane fuel measured by the motor method would be 92-93 by the research method. Neither is regarded as entirely satisfactory since other characteristics of the fuel such as chemical and physical factors are not taken into account. A third method of measuring fuel, called the Borderline method, relies on road tests for fuel evaluation and grades performance by a curve at varying speeds, instead of a number. This method was adopted by the Cooperative Fuel Research Committee in 1940. Pure Oil Company laboratories contributed greatly to this development. Its need is emphasized by Harry L. Moir, technical adviser to the Pure Oil retail marketing department, in a comparison of the requirements of L-head and valve-in-head engines at varying speeds. These follow:

L-Head Engine		
Speed, r.p.m.	Octane	Requirement
1000		71
1500		71
2000		73
2500		73
3000		76
Valve-in-Head Engine		
Speed, r.p.m.	Octane	Requirement
1000		82
1500		80
2000		79
2500		76
3000		74

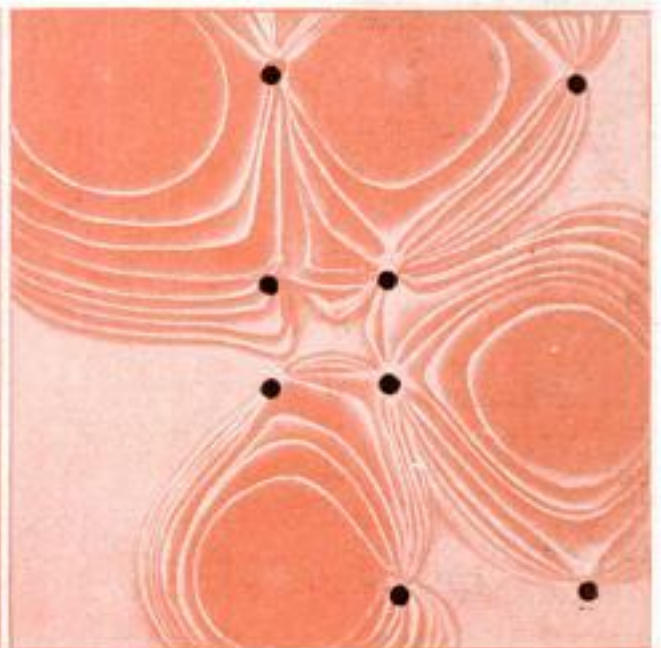
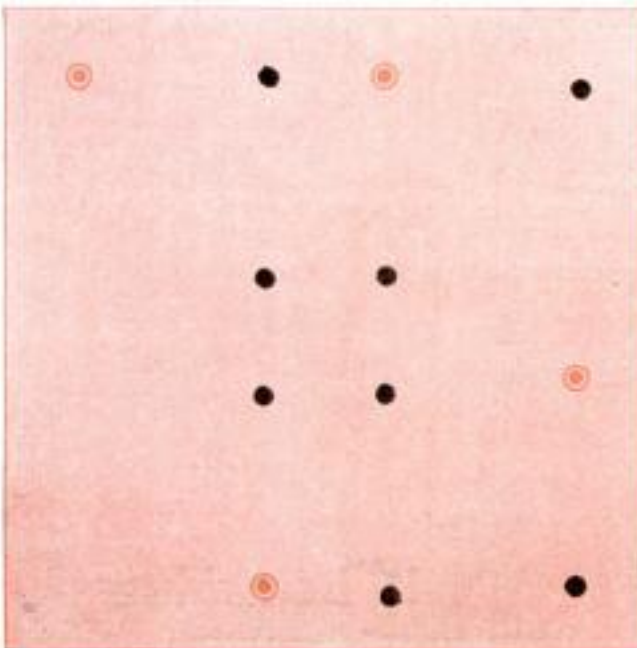
(Continued to page 164)



Gulf Oil Corp. photo and diagram
 Resembling a cross between telephone switchboard and radio, this electrolytic model takes guesswork out of water-flooding of wells to produce more oil



Flow of electric current in electrolytic model simulates flow of oil, gas or water in wells. Photo at left shows wells under study on model. Right, composite photo made on model showing various stages of flooding





LCI Dons "Civies" To Supply Camps

Navy war equipment is now being channeled into peacetime work. On Lake Temagami, in northern Ontario, an LCI ferries supplies to lumber camps and resort areas. Carrying 50 tons or more, the craft is especially useful in shallow lakes and rivers.

Streamline Jeep

Men of the 478th Air Service Squadron, in the Philippines, had some spare time on their hands, also a smashed-up jeep and a couple of wrecked airplanes, so they decided to streamline their jalopy. They made a racer type body from the cowling of a C-46 engine, fashioned fenders out of emergency gas tanks and wound up with a speedy little runabout.



Paddle-Wheel Boat

Got some old motors and junked parts around the house? Why not make a boat out of them? Lynn E. Troxel of Rittman, Ohio, did. For power he selected the motor from an old washing machine, to which he added, among other things, used parts from an ancient automobile, a clutch from a sewing machine and a Ford coil. A pair of home-made paddle wheels completed the job. It works—but Troxel brings a pair of oars along, just in case.

Speedboat Is Built From Fuel Tanks

Proving that American GIs are not unique in their inventive capacity, Flying Officer B. W. Bentley of Australia salvaged two Kittyhawk belly tanks and added an old motorcycle engine to build a speedy boat for whiling away his off-duty hours. A wooden platform mounted on planks connects the tanks and forms a support for the engine.

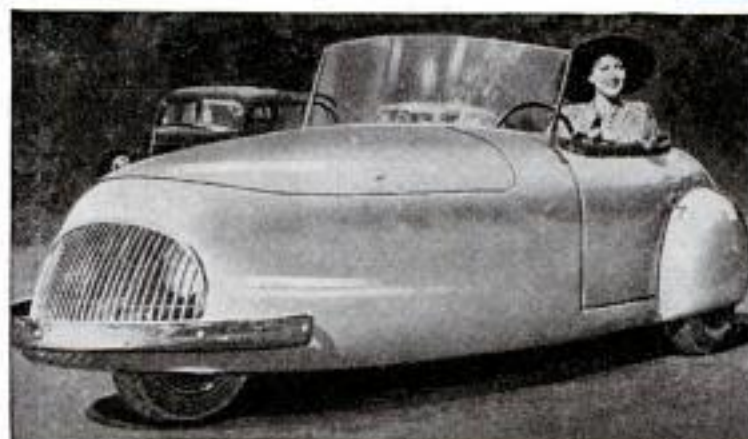
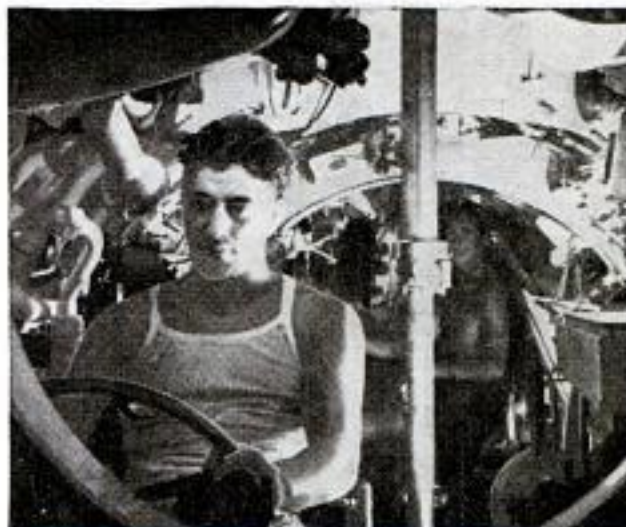




David vs. Goliath

Small in size but packing a powerful punch, British midget submarines varied in length from 30 to 50 feet and were operated by crews of three or four men. Moving silently about 12 feet below water surface, these undersized subs scored many hits on Nazi ships before moving into the Far Eastern war. Their biggest bull's-eye was the German battleship, Tirpitz, which was crippled by the midget subs in a Norwegian fiord and later sunk by RAF planes.

Above, British midget submarine entering the harbor at Sidney, Australia. Right, view inside the craft



Three-Wheel Midget Auto Goes 100 Miles Per Hour

Equipped with a 58-horsepower aircraft engine, a small three-wheeled automobile is planned by a West Coast manufacturer who says it will go 100 miles per hour and travel 40 miles on a gallon of gasoline. In case of a puncture, an installed jack automatically raises the car when a button is pushed. A special foot pedal serves as both accelerator and brake.

DECEMBER 1945

*Warner Mfg. Co.
666 Hawthorne St.
Glendale, Calif.*

COMING UP— THE ALL-HYDRAULIC

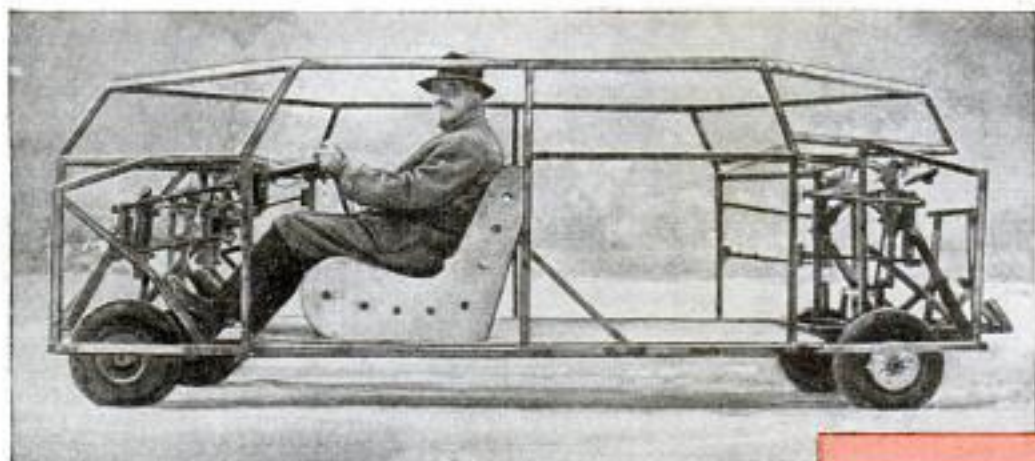
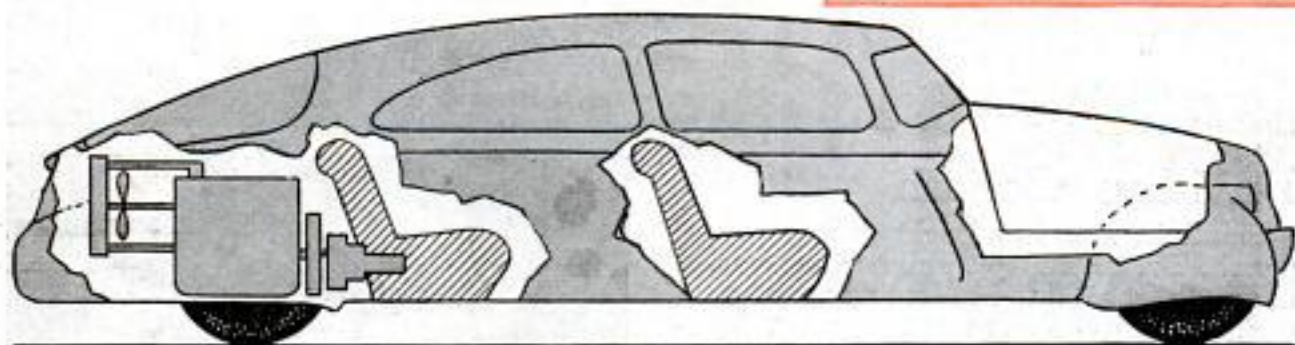
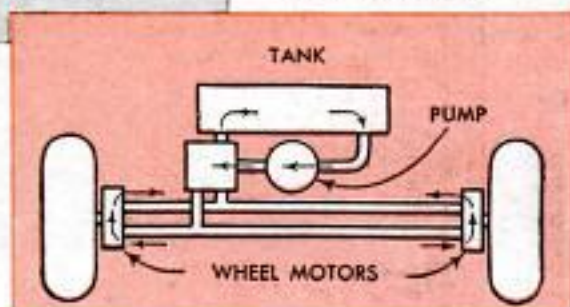
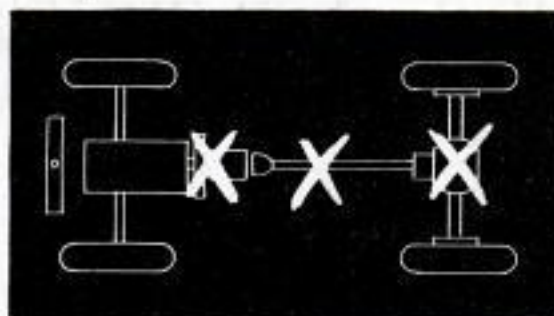


Diagram below illustrates the principle of the complete hydraulic drive. Note the flow of oil to both wheels under equal pressure, providing differential action without gears. A four-way valve (left of pump) reverses oil flow to replace reverse gear

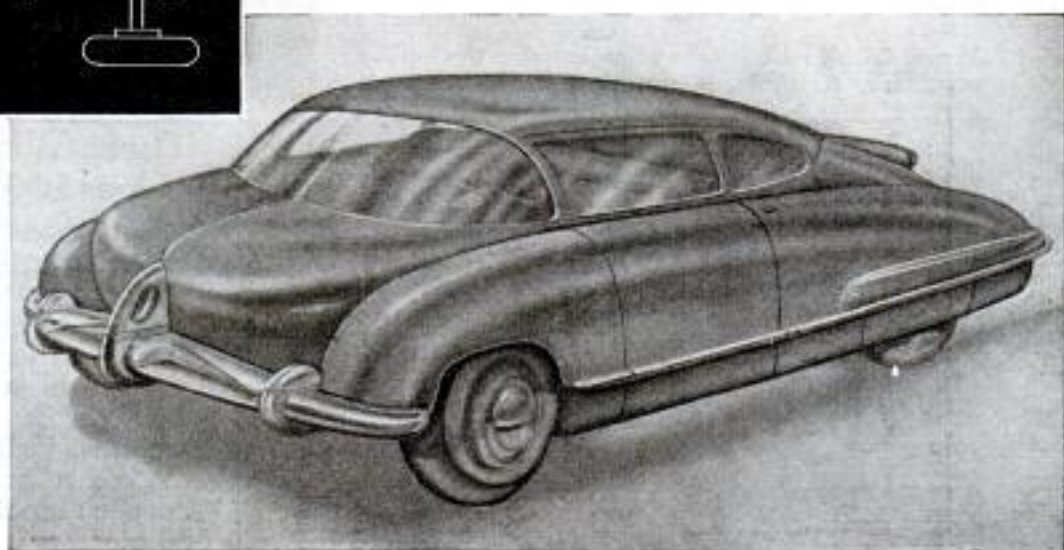
Welded steel tubing, above, replaces conventional frame in this experimental hydraulic drive automobile developed by Ray Russell, shown seated at the wheel. Mounts for installing the engine are between the rear wheels. This photograph, taken before a plywood test body was added, shows airplane wheels and tires used experimentally and later replaced by standard automobile wheels and tires. This type of frame permits freedom of interior design with floor space unobstructed by the drive shaft or transmission



Above, artist's conception of the Russell car with engine located at the rear and luggage compartment under the hood at the front. Left, this diagram shows the power transmission parts—transmission, drive shaft, differential, rear axle and universal joints—eliminated by the use of hydraulic drive equipment, with a saving in weight up to 800 pounds



Here is the designer's idea of a rear engine, hydraulic drive car with full vision through a curved safety-glass windshield. Each spacious seat will accommodate four persons, side by side. The rear engine design prevents noise, vibration and fumes from reaching passengers. Wheel suspension is independent, both front and rear



COMplete hydraulic drive is being tested in an experimental automobile whose "plumbing system," pumping oil from engine to drive wheels, eliminates some 800 pounds of conventional power transmission mechanism.

Developed by Ray Russell, Detroit engineer and industrial designer recently retained by the Ford Motor Company, this rear engine car does away with the need for a clutch, transmission, drive shaft, torque tube, differential, differential housing, universal joints and rear axle.

While details of the hydraulic equipment have not been revealed, the design is known to use multiple pumps, connected directly to the crankshaft of the engine, which force oil through motors on the wheels. A new type of braking action, provided by slowing down or reversing the flow of oil through the motor wheels, may eventually eliminate use of conventional drum type brakes, according to Russell.

Experimental models now under construction feature a frame of welded steel tubing, individual wheel suspension, hydraulically operated windows, driver's seat and windshield wiper and an engine that can be removed by taking out four bolts.

Russell believes that since it is so easy to remove the engine, garages some day will stock spare engines to be installed in cars while repairs are made on the original engines—in the same manner that rental batteries serve car owners while their batteries are being recharged.

Engineers and writers who recently rode in one of Russell's experimental hydraulic-drive cars equipped with a plywood body reported smooth, silent operation without excessive heat in the hydraulic system, a problem previously considered almost insurmountable.

From seven to 15 speeds forward and reverse can be produced in the hydraulic-drive car, depending upon the number of oil pumps. Three pumps produce seven speeds, or ratios, and four pumps provide 15 speeds. Because of this factor, Russell says, performance is unbelievably smooth—comparable only to steam. More power is available in low gear than in any passenger car built, and a higher ratio is produced for fast level driving than in any known overdrive, the designer states.

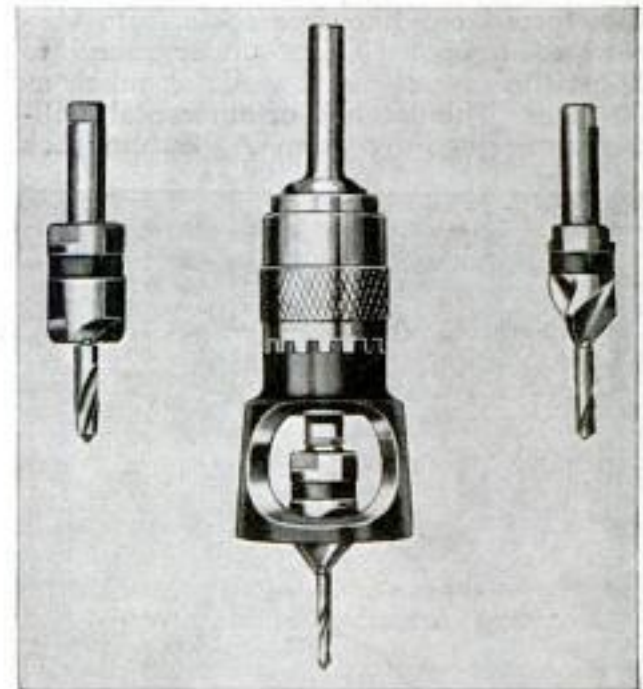
No public announcement has been made as to when the hydraulic car may go into production.

Electric "Long Tom" Toy Cannon



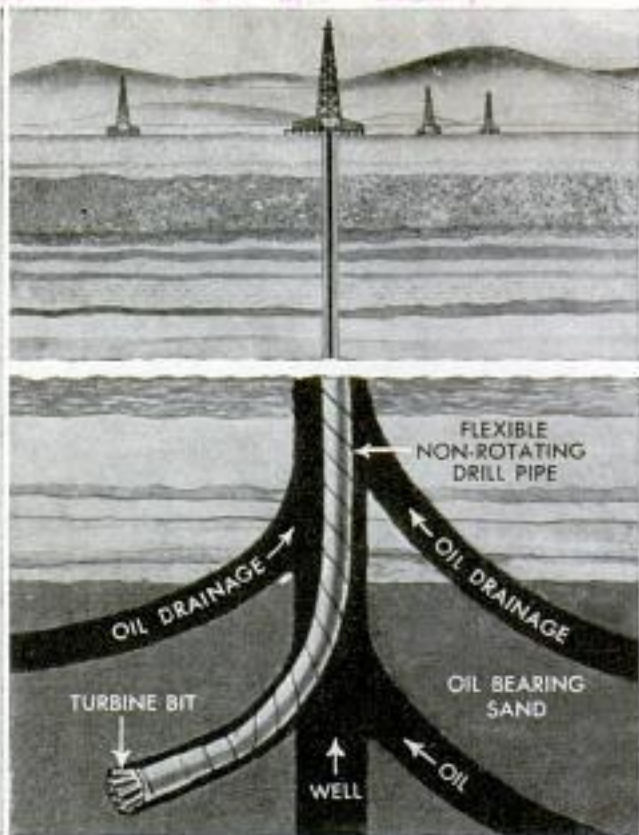
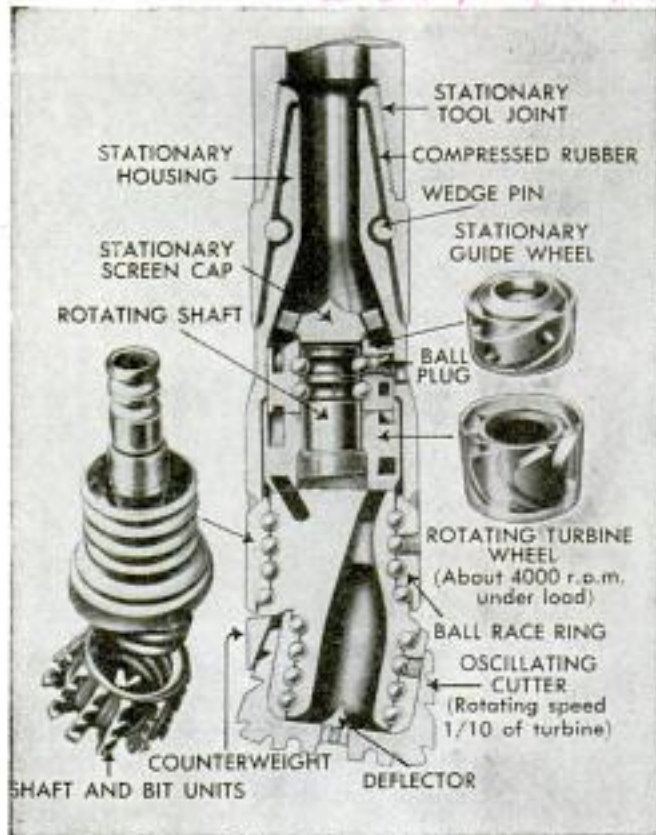
Operated electrically, a toy cannon patterned after the 155-millimeter "Long Tom" shoots a stream of wooden shells 30 feet but without enough force to break things. At the push of a button the gun makes a booming noise, shoots out the shells and even recoils like a real cannon.

Drilling Tool Does Several Jobs



Drilling and countersinking, spotfacing or counterboring can be performed in one operation with a new interchangeable tool made of high speed steel carefully ground for close tolerances. The tool can be changed easily from one job to the next and put through a wide range of operations. With standard angle drill adapters or attachments, drilling and countersinking or drilling and spotfacing can be done in places usually difficult to reach.

*John A. Zublin
 2369 8 1st St
 L. A. Cal.*



Rootlike Oil Drill

Spiral pipes tipped with turbine power bits sprout out like tree roots from vertical drill pipes 80 feet underground to boost the output of oil wells as much as 20 times. This method of horizontal drilling, conceived by John A. Zublin, Los

Angeles petroleum engineer, recently produced 25 barrels of oil per day from a California well abandoned 17 years ago when its yield fell to one barrel a day. Thousands of such abandoned wells exist in the United States. Power for the horizontal drills comes from fluid mud pumped down the drill pipe to the turbine.



Toolboxes Swing Out, Return Automatically

Sixteen toolboxes are kept in nine square feet of floor space on a welded rack designed by R. E. Qualkenbush of the Bell Bomber Plant's production handling equipment department at Marietta, Ga. Each section holding a toolbox swings out like a cabinet door. When the lid of a box is closed, the section swings back into place automatically. The rack was built from black pipe, angle and strap iron and plywood, and conserves both time and space.

Supercutting Alloy

Vanadium and titanium carbides bonded with a metallic nickel are essential constituents of a supercutting metal alloy developed in Germany for war uses. It required no tungsten, which was not produced in the Reich and had to be imported.

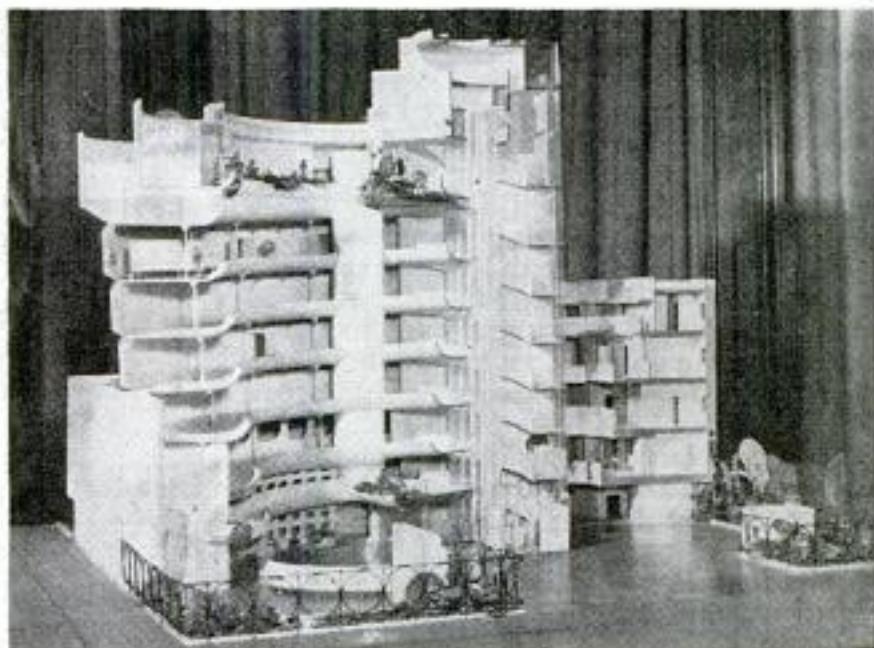


Aerial "Roadster" Has 500-Mile Range

Priced about the same as an expensive automobile, a two-seater monoplane is being manufactured by a West Coast builder for civilian flyers. The new plane—called the "Ensign"—has a cruising range of 500 miles, cruising speed of 112 miles per hour, and a service ceiling of 13,500 feet. A low-wing "flying roadster" of all metal construction, the ship made its debut recently at Long Beach, Calif.

Spiral Art Gallery Has 3/4-Mile Ramp

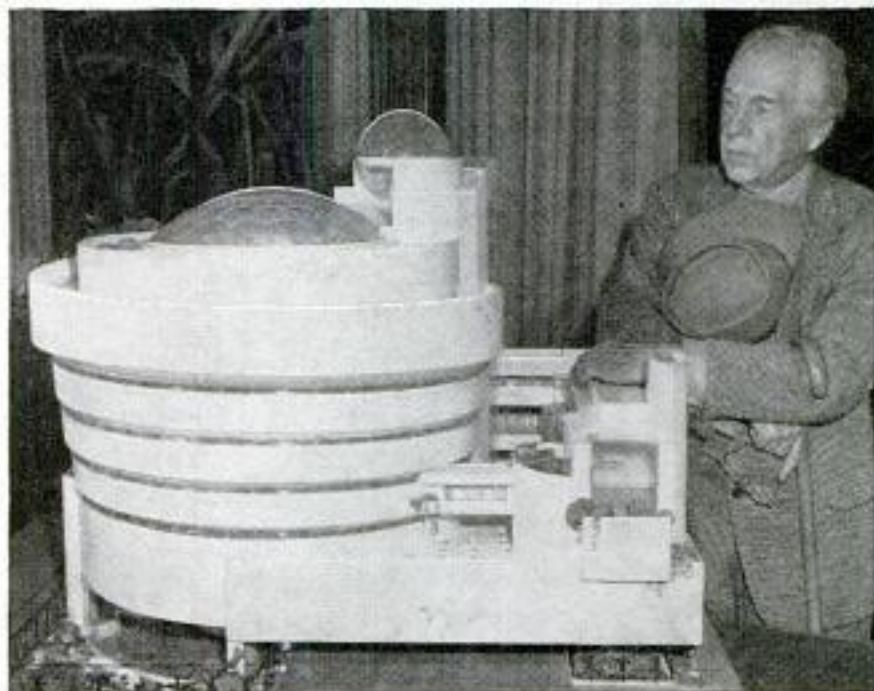
Equipped with a winding 3/4-mile ramp extending from the ground to the 10th floor, a \$1,000,-000 spiral-shaped building has been designed by Frank Lloyd Wright to house the Solomon R. Guggenheim collection of paintings in New York City. The paintings will be displayed—unframed and unglassed—along the ramp, protected against dust and moisture by an air conditioning and air cleaning system. Dust also will be removed from visitors' clothes by a vacuum-like device at the entrance. At the top of the building will be a large glass dome for projecting movies.



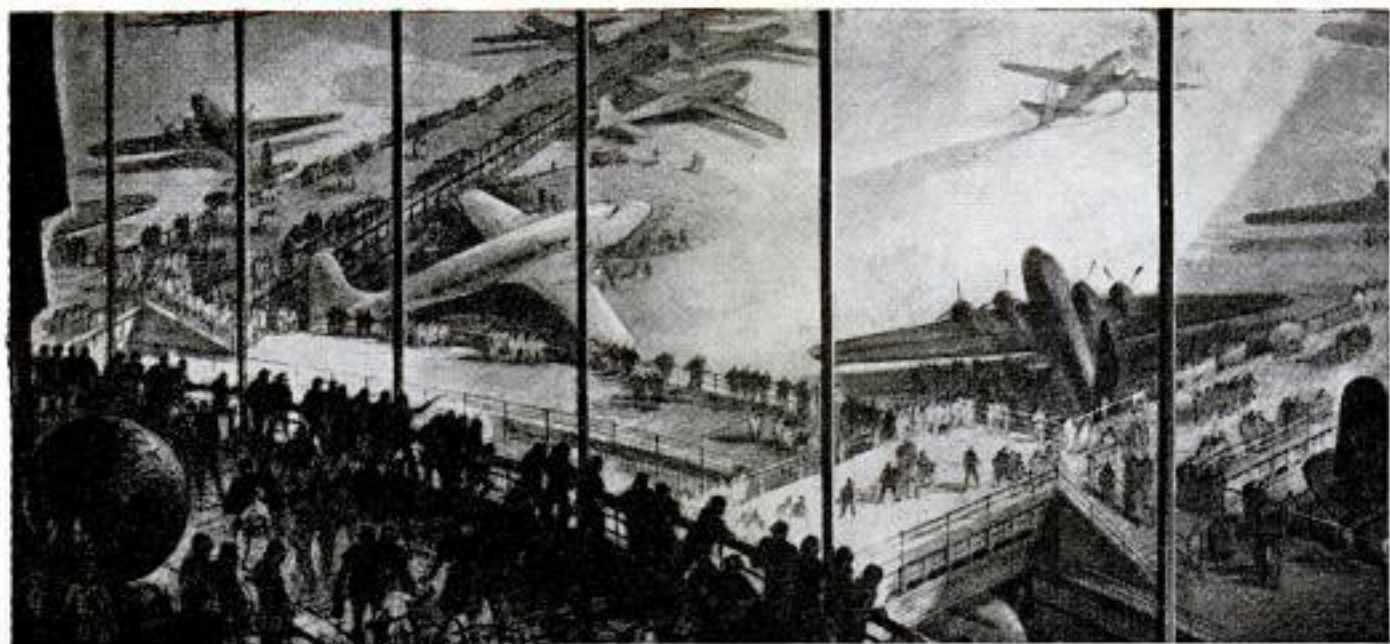
Mouse Electrician

With an electric light wire tied to its tiny harness, a pet mouse recently helped electricians by squeezing beneath a small building at Camp Holabird, Md., to pull the wire from one end of the structure to the other.

☐ Research indicates that quack grass, a lawn pest, compares favorably with hay as animal feed.



\$200,000,000 GATEWAY TO



NEVER one to do things by halves, the City of New York is completing the first stage of its airport of tomorrow while many other cities are still talking about picking sites and drawing plans.

As this article appears, the first three runways of 4976-acre Idlewild Airport should be finished and ready for use. No token runways built just for the honor of being first, these are Runway A, 10,000 feet long, Runway B, 7500 feet, and Runway C, 8200 feet. All are constructed of reinforced concrete 12 inches thick and 200 feet wide, designed to stand up under pounding of planes weighing up to 150 tons.

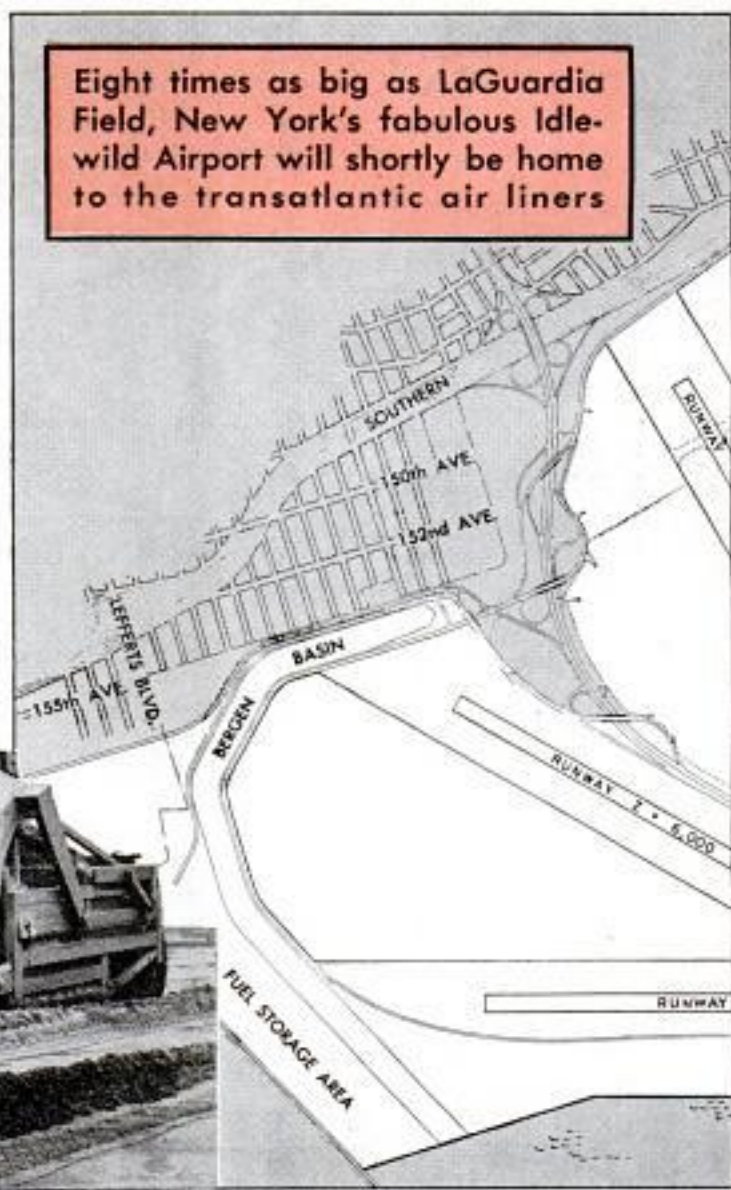
Although 12 airlines already have signed up to use the facilities at Idlewild, actual 24-hour commercial operation probably will not get under way until next spring because of inability to complete hangars

Earthmover levels sand fill on low parts of airport. Forty-one million cubic yards of sand have been used



Sketch by Hugh Ferriss for Delano & Aldrich, architects, shows view from observation room at Idlewild

Eight times as big as LaGuardia Field, New York's fabulous Idlewild Airport will shortly be home to the transatlantic air liners

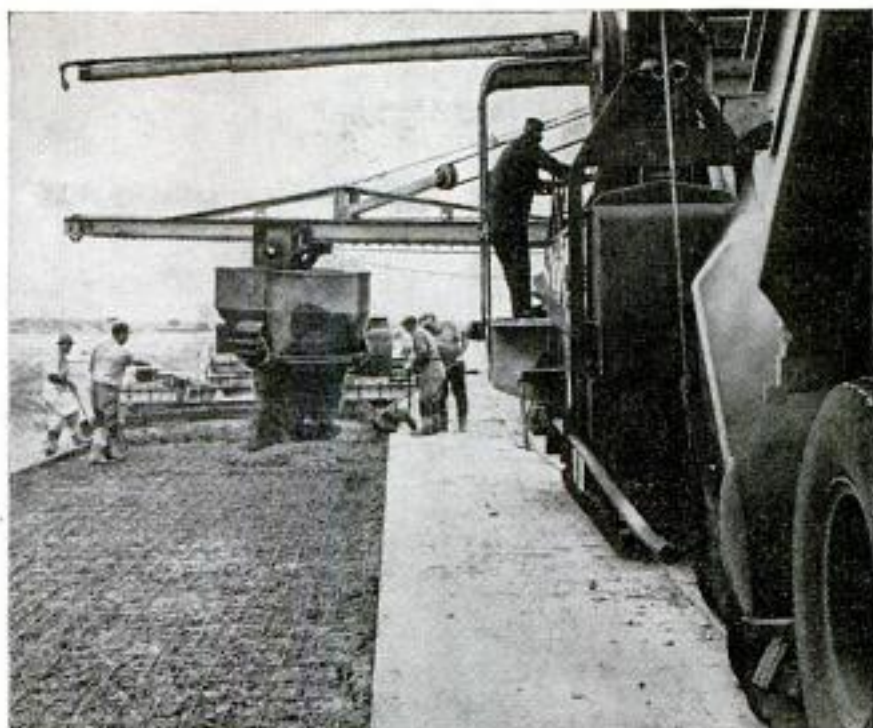


EUROPE

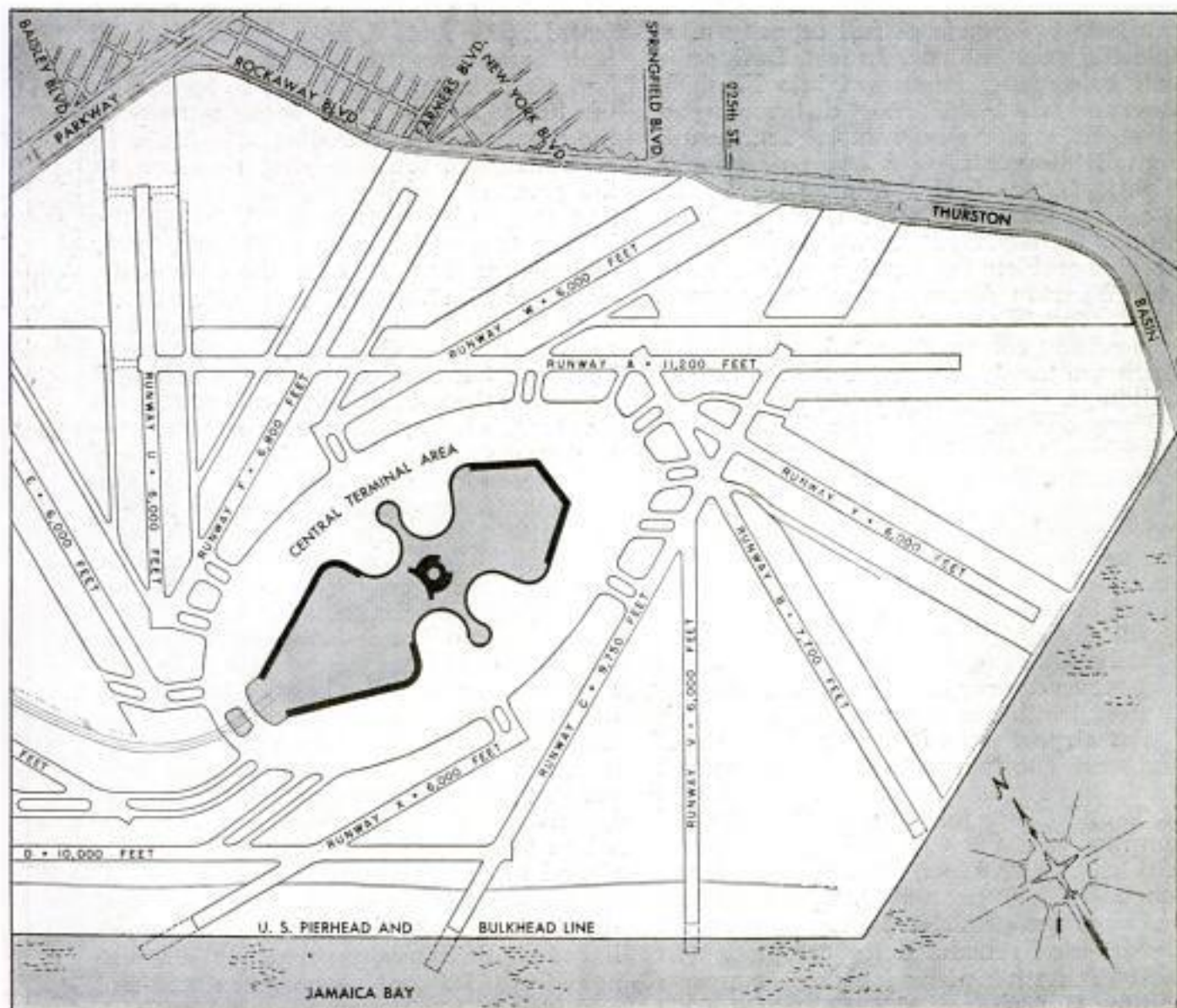
before then. The one-story temporary administration building and its control tower are scheduled for completion now, however, and planes undoubtedly are trying out runways at this moment.

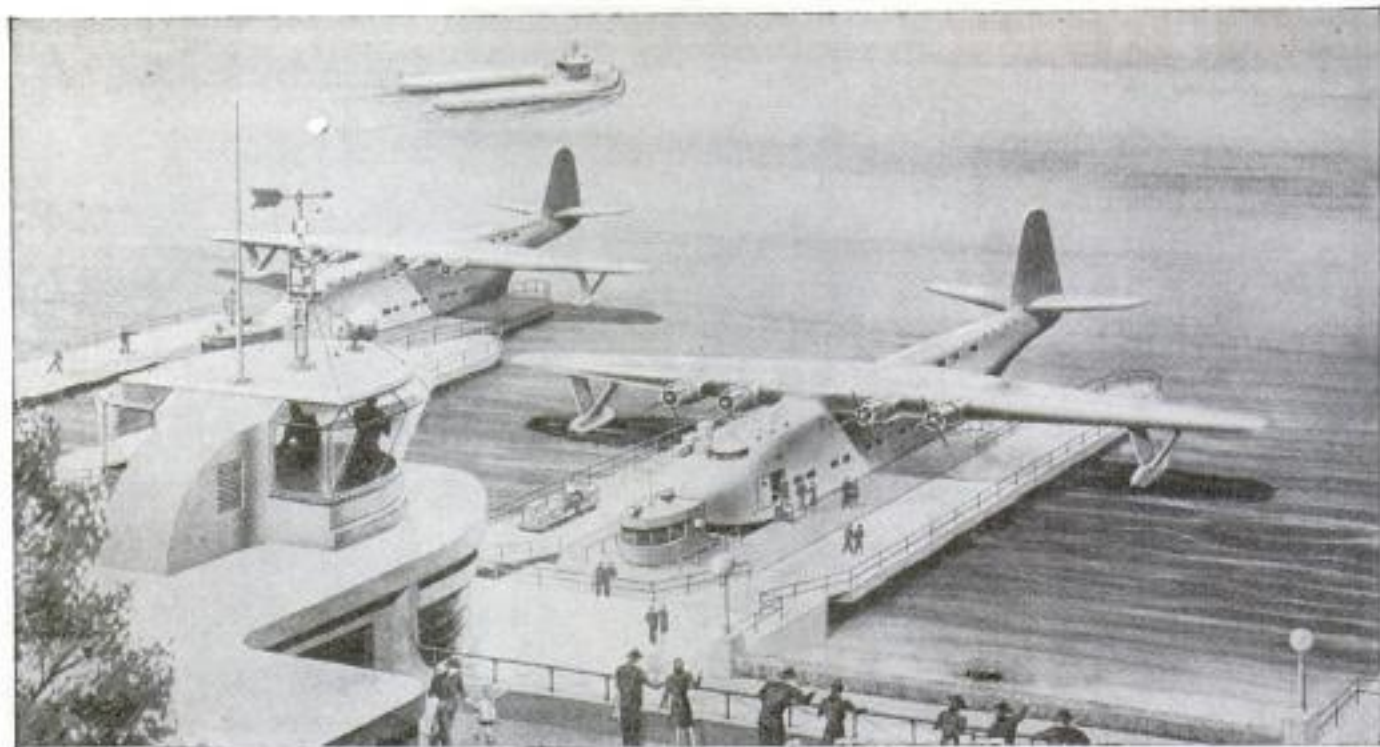
Construction of the \$200,000,000 airport at the head of Jamaica Bay in the southeastern corner of New York City began in April 1942. Idlewild is eight times larger than LaGuardia Field's 550 acres and four times as big as the Navy's 1100-acre Floyd Bennett Airport at the lower end of Jamaica Bay.

LaGuardia Field will



Mixing machine drops concrete on one of six major runways at Idlewild Airport. Below, plans for the 4000-acre landing field and buildings





This is Glenn L. Martin Company's conception of facilities for handling seaplane passengers and freight, featured by U-shaped boats to tow planes and U-shaped docks. Idlewild Airport will have a special seaplane base

continue to operate at full capacity after Idlewild goes into use. In fact, LaGuardia will be expanded outward into Flushing Bay, and will handle short distance flights of about a 1000-mile radius. Transcontinental, intercontinental and transatlantic flights will have their terminals at Idlewild.

Site of the new airport, on lowlands around the bay, created a stupendous engineering problem for Jay Downer, engineer, and Wharton Green, associate engineer, who prepared the general layout and are supervising construction. Delano and Aldrich are the architects for all the airport buildings.

Forty-one million cubic yards of sand fill have been placed on the site by hydraulic suction dredges in the bay. E. J. Carrillo, field engineer, declared that 12 million more cubic yards of fill will be placed under the next contract for the second phase of operations, and eight million more will be added in future operations. About 10 feet of fill covers the original marshland, Mr. Carrillo said, and a total subsidence of two feet occurred over the site. No further settlement trouble is expected.

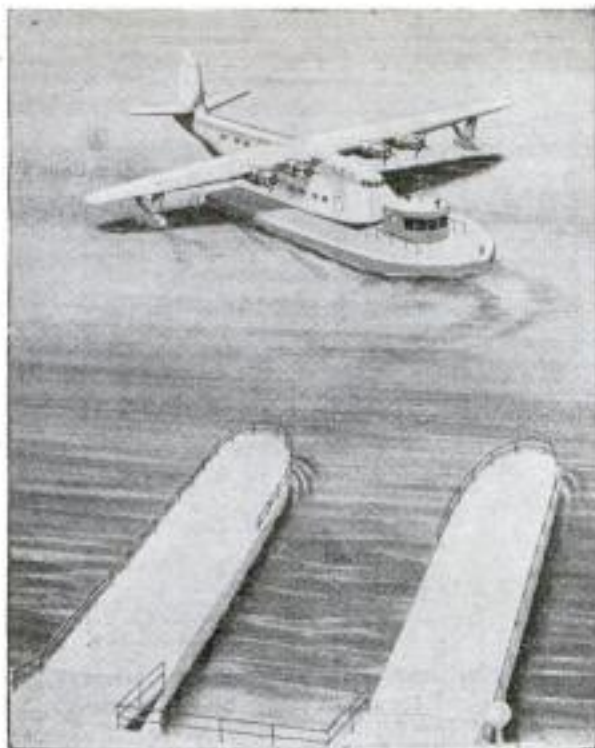
The airport runs five miles to the east and west, and two and three fourths miles north and south. The completed runways A, B and C are just half of the principal runways and the three others, D, 10,000 feet long, E, 6000 feet, and F, 7700 feet, are scheduled for use in 1947. Six additional runways are provided in the plans, with construction scheduled for completion in 1950. Tentative plans for these runways call for U, 6000 feet, V, 5650 feet, W, 6000

feet, X, 5200 feet, Y, 6000 feet and Z, 6000 feet. Experience gained in operation of the first six major runways will be applied to the future runways and specifications for the latter may be altered as a result.

Drainage of the low-lying area created the greatest problem encountered in the first stage of construction. Although the 10 feet of sand fill covers 3000 acres now and eventually will cover the entire site, contractors on foundation work have found it necessary to add more fill when they reached the muck beneath the first layer. Drainage trenches crisscross the field and a gigantic three-barreled storm sewer, 8400 feet long, is being laid to assure proper permanent drainage. Water from the storm sewer goes into Bergen Basin, a manufactured waterway at the edge of the airport that is 200 feet wide at the bottom, 6000 feet long and 30 feet deep. Two million cubic yards of earth were dredged from the bay to create Bergen Basin.

Choice of the site was made to provide both land and seaplanes with excellent landing facilities. The location on the bay assures a 15,000-foot basin and seaway for the largest flying boats envisioned for ocean travel. In addition, ocean-going tankers will unload their cargoes of fuel directly into airport storage tanks.

The three completed runways were designed to eliminate any waviness caused by taxiing heavily loaded airplanes, and the 12-inch-thick reinforced concrete is believed ample to assure permanent smoothness. Each 200-foot runway has a 50-foot shoulder of bituminous material on both



Hydraulic pipe bender that exerts 40-ton pressure twists steel pipe into desired shapes for electrical conduits at the airport

sides. This material can be ripped up easily and replaced by concrete should wider runways be desired in the future.

Newest types of giant earthmoving machinery, graders and concrete mixers, dredges and shovels are employed in construction of Idlewild. Specially designed for the operation are six planting machines which plant long bladed beach grass in the sand fill to anchor it and prevent erosion. The beach grass is brought in from the beaches farther out on Long Island, and completion of the planting is hampered only by a shortage of supply. Eight men ride on each tractor-drawn planter. Three are kept busy extracting stalks from

(Continued to page 160)



A surveyor lays out the line for 8400 feet of sewer pipe to drain low marshlands. Below, self-propelled subgrader moves ahead of concrete mixer to smooth surfaces for a long runway



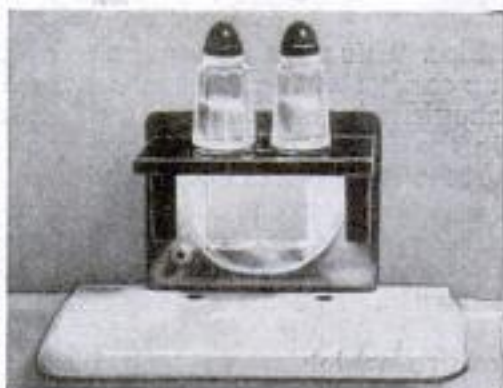
9th. FLOOR
FURNITURE
DISHES
HOUSEWARE
→



What's wrong with this picture? An alert housewife would spot the hot iron burning a hole in the ironing board cover—but this one is burn-proof. The material is Asbeston, used for firefighter suits on carriers



Among other postwar products is the coupling (left) for a garden hose; it was originally designed to speed refueling of battleships and prevents leaks. Special holding lugs and locking ring make it easy to attach. Right, clogged salt shakers are dried out in a few minutes when placed on drier which is heated by two six-watt light bulbs. Drier takes up little space in the kitchen



Below, one machine serves as a combination washing machine and dishwasher. Left, clothes washing unit is lifted out of cabinet to be replaced (right) with basket arrangement that holds service for six persons



"SHORE DUTY" ON A BATTLEWAGON



Like giant fingers, guns of USS Iowa point toward shore. Below, machine shop on ship

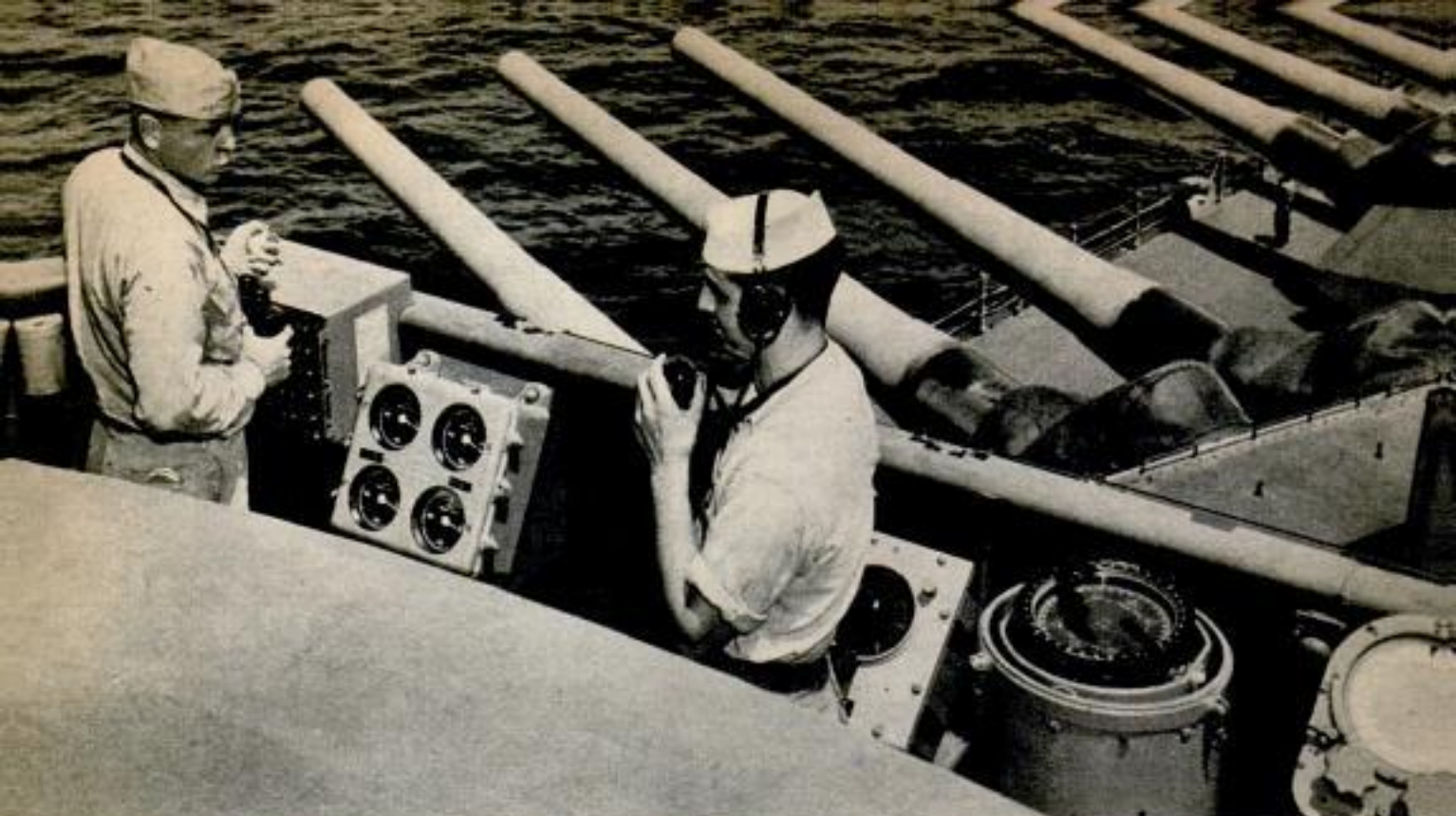
By Lieut. J. L. Williams, USNR

LIKE all things big—the Empire State Building, Primo Carnera and supercolossal Hollywood epics—battleships receive their share of friendly ribbing, particularly from other ships in the Navy. Sailors on destroyers that pull alongside to refuel call them “AOBB’s”—“AO” being the Navy’s designation for fleet oiler and “BB” for battleship.

Seamen aboard smaller vessels never tire of greeting their pals aboard the battlewagons with: “Say, how do you guys like shore duty?”

But the officers and men aboard the battleships can afford a sense of humor, knowing that the battleship is still the largest, most powerful vessel that fights on the seas. It’s a breath-taking sight to see one of these huge, steel-armored monsters, bris-





On bridge of Missouri, officer passes order to "talker" who phones it to stations



Sailors on Alabama "hit sack" when off watch with emergency gear at arm's reach. Below, "fish-eye" view of North Carolina

ting with guns, pulling at anchor. It's even more exciting to be aboard when a \$100,000,000 warship is plunging through the white caps on a mission of destruction.

The U. S. Navy now possesses more battleship strength than any other nation. On December 7, 1941, we boasted 16 battleships of which eight were blasted into the mud at Pearl Harbor. Since then we've raised, reconditioned and put back into service all but two. In addition we've added 12 modern 35,000 and 45,000-tonners—giving us a total of 26 battleships.

In this age of air warfare, battleships have naturally been overshadowed by the colorful exploits of aircraft carriers. But battleships have played two important, if not as spectacular, roles: (1) the slower pre-Pearl Harbor battleships have been used to soften up invasion beaches so that marines and soldiers could storm ashore, and (2) the speedier new battleships have been employed as essential elements of fast carrier task forces.

Slower though they may be, don't make the mistake of calling our pre-Pearl Harbor battleships "old." Any battlewise sailor will tell you that these so-called "old" battleships have done





One of Uncle Sam's new \$100,000,000 battleships is the USS Wisconsin, 45,000-ton giant of the Iowa class; its overall length is 860 feet. Armament includes nine 16-inch guns, 20 five-inchers and 128 others



Portside view of USS Washington, 35,000-ton battleship launched in 1940; it has complement of 2000 men

a lot of shooting in this war. They have new guns, turbines, fire control equipment, damage control apparatus and communications.

Nobody in the Navy, from admiral to apprentice seaman, seriously argues the question of battleships vs. carriers any more. The answer, as found in World War II, is battleships AND carriers—an unbeatable combination for raiding enemy strongholds or plastering beaches. Modern task force warfare is based on hit-and-run principles, not standing and slugging it out with the enemy. Task forces are made up of a combination of carriers, battle-

ships, cruisers, destroyers and submarines.

In spite of new battle tasks, traditional shipboard routine is maintained to a higher degree on battleships. Its very size lends a battlewagon a certain majesty and dignity—and this is reflected in the ordered life aboard.

Although the huge warships carry a complement of from 1500 to 2000 men, there is less crowding than on a carrier of approximately the same size. Battleships don't have to store planes, bombs, rockets, aviation gasoline, spare parts and flight gear. Nor do they have to provide quarters and messing facilities for the

30-year-old USS Pennsylvania helped pay off Pearl Harbor score with her 14-inch guns at Surigao Strait





Freshly baked bread is removed from ship's ovens through the hatch at right; at a single meal men on a battleship can polish off 1900 loaves

more of the peacetime "spit and polish" aboard battleships than other vessels of the fleet.

When radar instruments pick up contact with enemy ships and planes, a battleship gets ready for combat. A bugler blows the quick, brassy notes of "general quarters" over the loudspeakers and a bosun pipes a shrill tune and bawls "man your battle stations." There is less of the pell-mell rush that characterizes life on a carrier. The deliberation with which a battleship gets ready to fight is almost an insult to the enemy.

Even when a battleship is within range of enemy ships and planes, the daily routine proceeds much as usual.

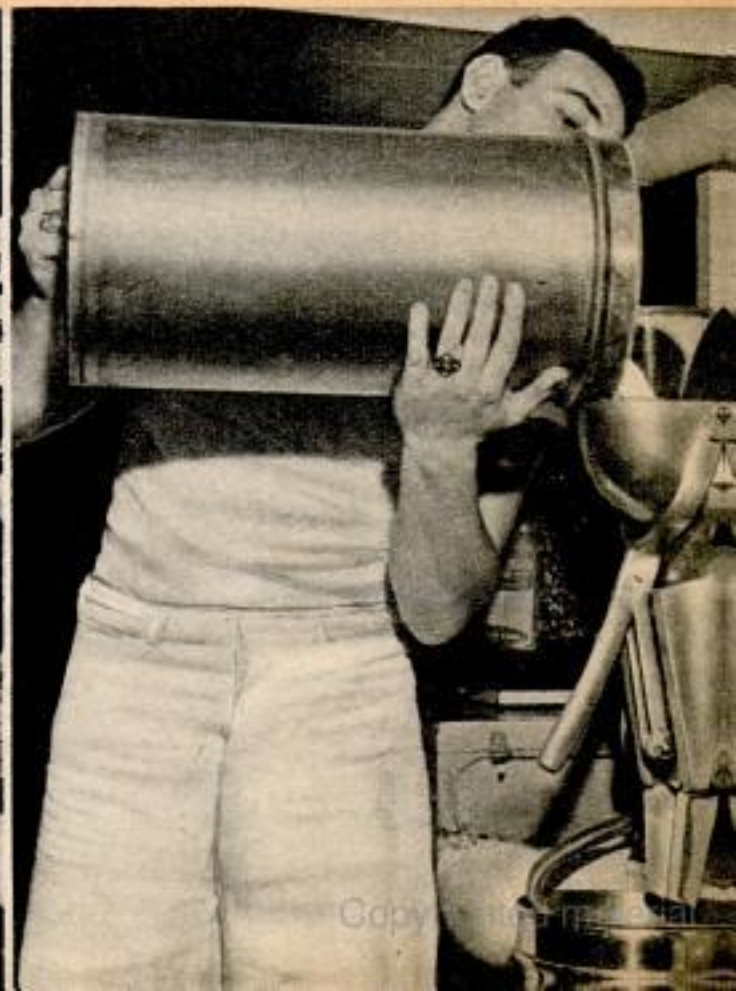
"passengers" — the pilots, air crewmen, plane handlers and mechanics.

In a war of rolled sleeves and dungarees, officers and men aboard battleships maintained a high degree of personal neatness. Efficient shipboard laundries kept clothes washed and ironed. There was

Meals are served piping hot and on time, the ship's daily newspaper goes to press and the latest movies are shown below decks at night. If you remain below, you can almost convince yourself that a peacetime cruise is in progress.

The Navy makes much of the fact that

Left, control panel of "city size" power plant on ship. Right, ice cream mixer turns out 200 gallons daily



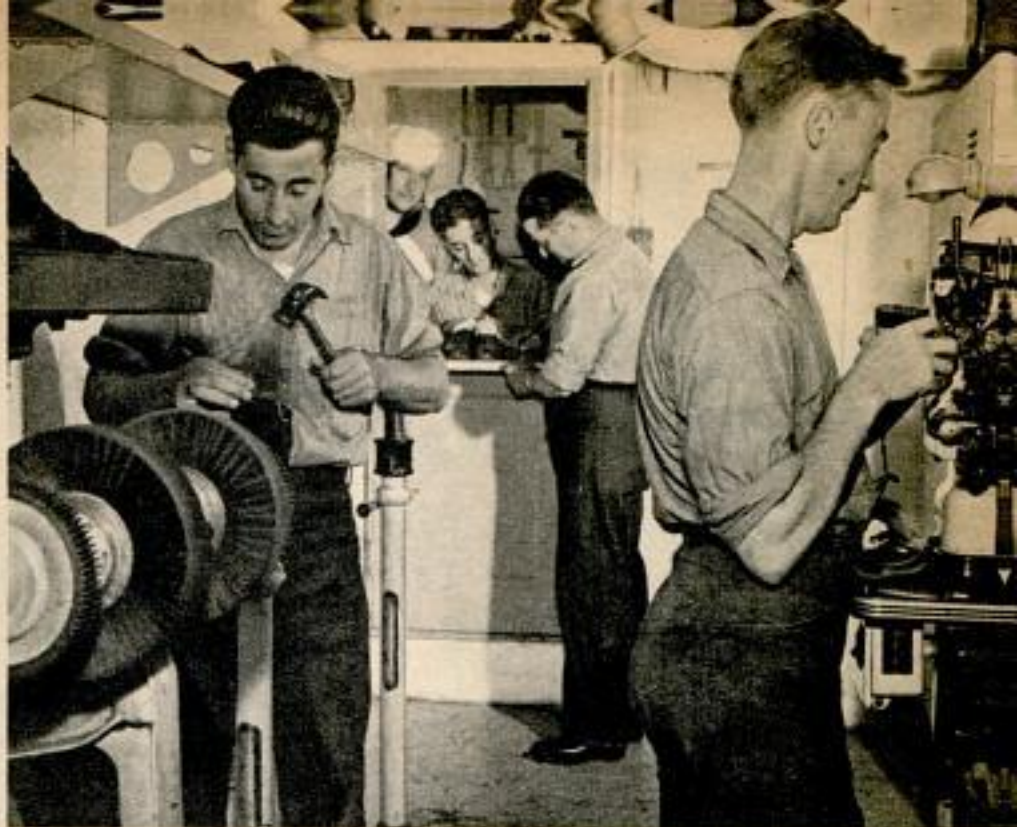
tasty chow is one of the best morale builders. Meals served on a battleship, cafeteria style, would do justice to the Waldorf-Astoria kitchens. Reefer space is large enough to store plenty of fresh food — steaks, chicken, turkey, fresh fruits and vegetables, milk, ice cream. There are no K rations on a battleship!

A battleship is a small, highly efficient city afloat, moved about the ocean by the 180,000 horsepower of its four geared turbines. Although its primary purpose is to throw steel and TNT at the enemy in large doses, its secondary purpose is to provide adequate sustenance and all the comfort possible for the men behind the guns.

A battleship's sick bay has complete medical and dental facilities and there is none of the "kitchen surgery" which emergencies sometimes make necessary on smaller ships. There are religious services for men of all major faiths—Protestant, Catholic and Jewish. A print shop produces a daily paper with regular press association news, photographs, columns, jokes and cartoons. A well-stocked library offers books and magazines for pleasure reading as well as technical books for advancement in rating. The "corner drug-store" is to be found in the ship's service store which carries a standard stock of cigarettes, candy, ice cream, toothpaste, shaving cream, writing materials and scores of other items.

The bluejacket who draws "shore duty" aboard a battleship considers himself lucky—despite the danger of death from a bomb, torpedo, shore gun or suicide plane.

It was once argued



Cobbler's shop on battleship receives average of 90 shoes every day

that battleships would be sitting ducks for enemy bombers. But World War II proved that battleships are less likely targets than carriers and smaller vessels. The big warships now bristle with antiaircraft guns, mounted on every available bit of deck space. It is estimated that today's battlewagon has 100 times as much antiaircraft protection as prewar battleships.

The Japs found this out when the South Dakota, then known as "Battleship X," was attacked while convoying a task group in the Solomons. The enemy hurled three waves of dive bombers and torpedo bomb-



This battleship soda fountain handled 345 customers in 45 minutes during rush hours. Prices are reasonable

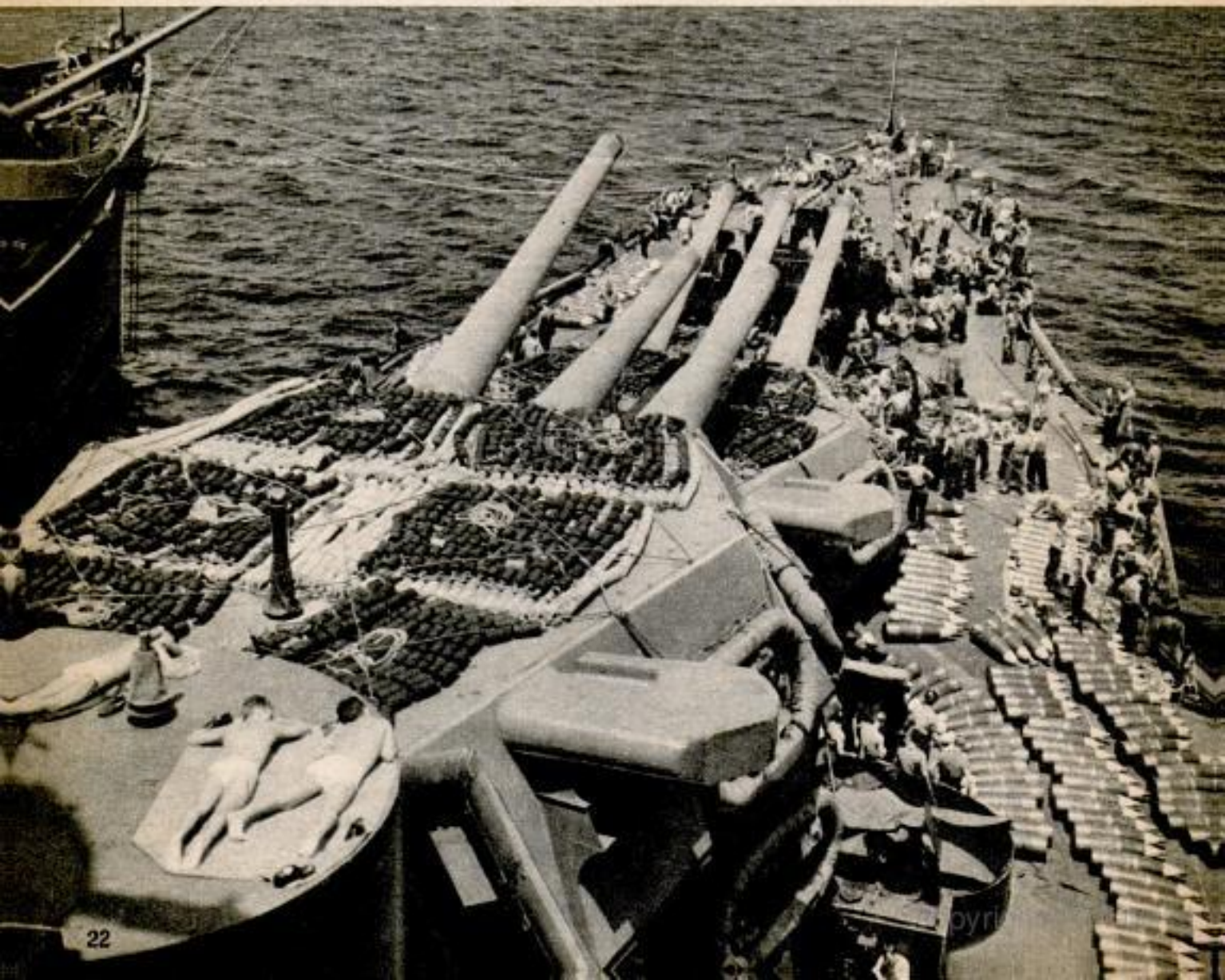


Officers and bluejackets man their stations on navigating bridge of USS North Carolina. Below, rows of big shells line decks. Note sun bather

ers, 84 planes in all, at the battleship and lost 33 of them. After that they were wary of attacking our battleships.

Jap Kamikaze suicide pilots found that a battleship was hardly a worthwhile target for their "sure-hit sure-kill" tactics. If a suicider managed to get through the hail of red-hot lead thrown at him, he smashed against steel decks and plating built to withstand 16-inch armor-piercing shells. The result was something like tossing an egg against a brick wall. Kamikazes scored some hits on our battleships but the damage was negligible.

Much to the disappointment of battleship admirals—and crews as well — the Pacific war





Aerial view of mighty USS Tennessee in the Pacific showing placement of her 12 long-range 14-inch guns

failed to produce any large-scale engagements between United States and Japanese battleships. The four major battles of the Pacific—the Battle of the Coral Sea, the Battle of Midway, the Battle of the Philippine Sea and the Battle of Leyte Gulf—were all carrier battles.

The nearest thing to a real battleship fight was the Battle of Surigao Strait when a group of pre-Pearl Harbor battleships took sweet revenge on a Jap task force.

In what has been called "a perfect tactical situation," the United States battleships waited in the darkness for the Jap force to come single file through the narrow channel. When the Jap ships were within range, the big guns of the American battlewagons opened fire, accomplishing the classical "crossing of the T" which every Annapolis student dreams about. The Jap force fled, every one of its ships having been sunk or crippled.

Reassuring sight from carrier deck are these powerful warships in the task force

One of the big tactical surprises of the war was naval gunfire support for landing operations and the advancement of ground troops. Battleship sailors puffed out their chests when Marshal von Rundstedt credited Allied naval guns in the Normandy invasion with making it impossible for him to bring up German reserves.

In the Pacific, gunfire from battleships had a demoralizing effect upon Japanese

(Continued to page 158)



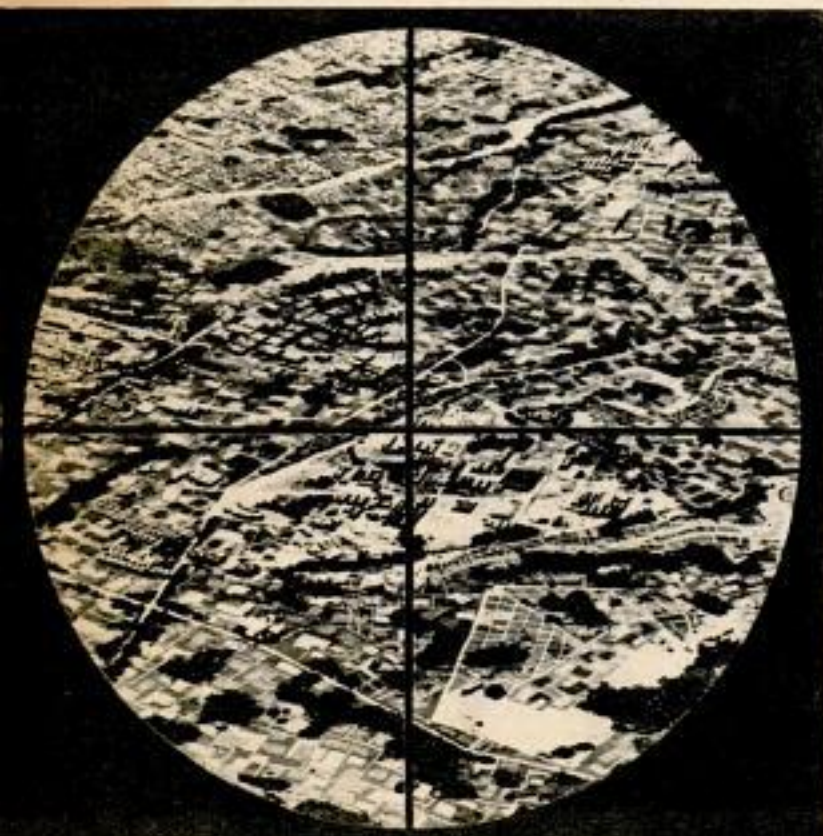
MAPPING



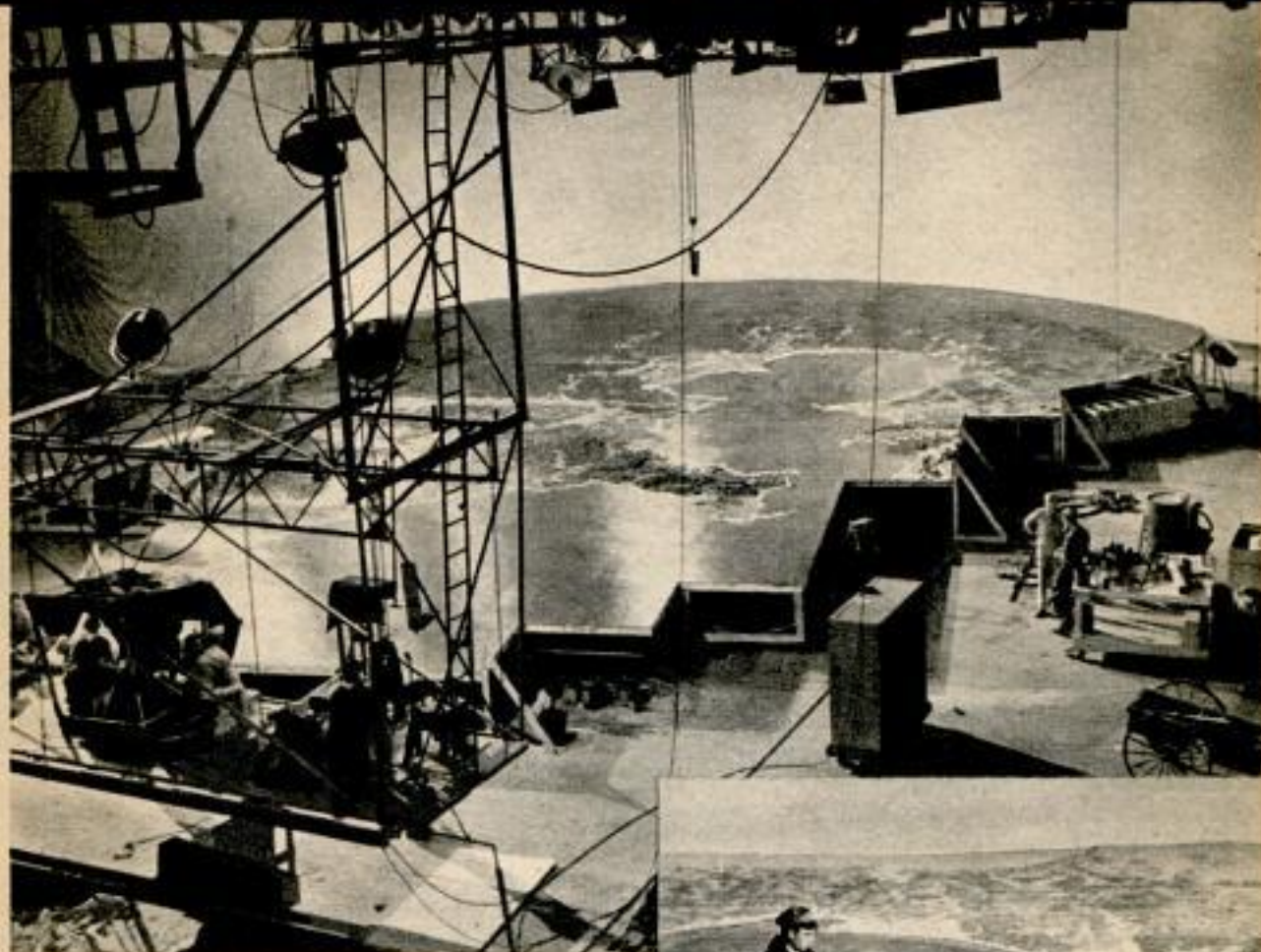
MINIATURE replicas of Japan, laid out on the floors of sound stages in Hollywood and Washington, D. C., helped B-29 crews in the Pacific to recognize almost every bump, stream and industrial bombing target in the Nipponese homeland. Not only did the "floor maps"—representing 2700 square miles in Japan—show mountains, rivers, lakes and cities, but they also provided an accurate way to time bombing flights and plan the necessary altitudes. Cameras that were mounted on moving cranes simulated the speed and altitude of B-29s so that Japan-bound and homeward flights could be charted in complete detail.

At the 949th Engineer Aviation Topographic Company headquarters on Guam, Army men fabricated additional target models to guide B-29 airmen. Using wood shavings, casein glue, cardboard and sand, the model makers constructed topo-

Dotted with scores of sliver-sized models of Japanese factories, section above is ready to be inserted in large scale map to chart bombing missions. Below, bombardier's sights lined on a target. Right, completed miniature is checked against a reconnaissance photograph



JAPAN FOR THE BOMBERS



Above, cameras moved by swinging cranes took motion pictures of floor maps of Japan to aid flights of B-29s. Right, Nagasaki reduced to two feet to mile

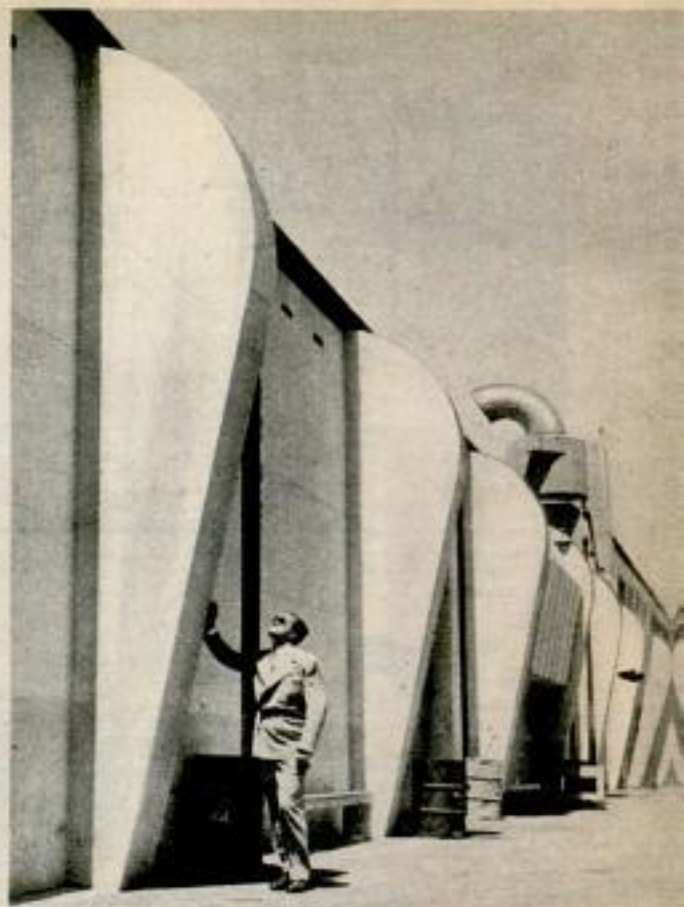
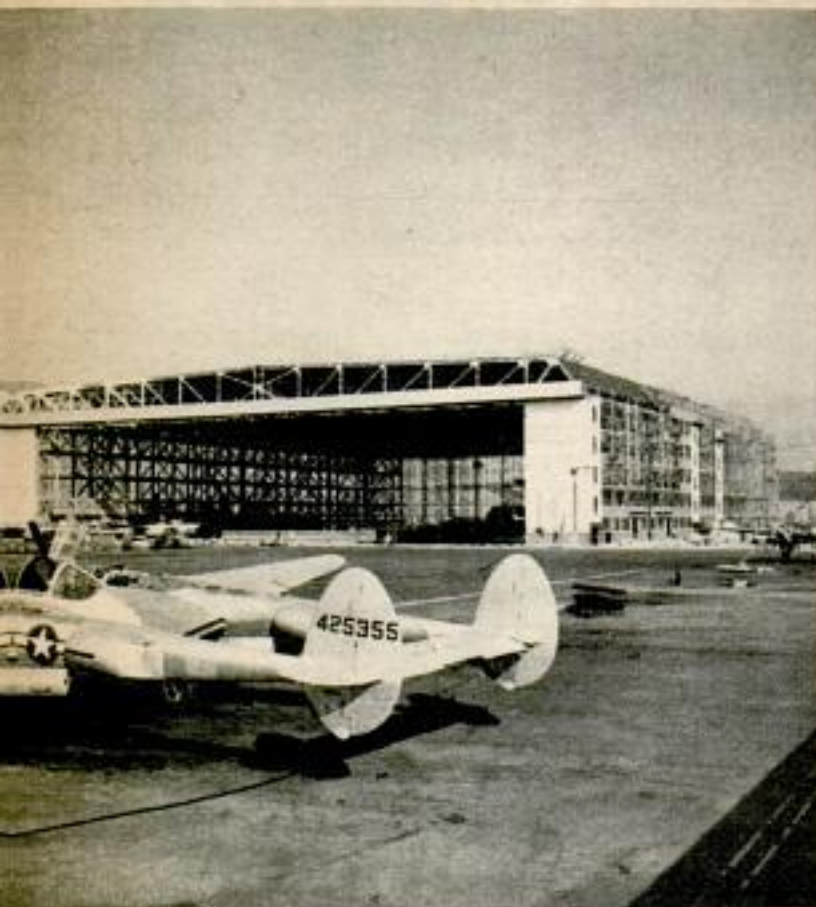
graphic maps on a scale of two feet to a mile. Workmen turned out thousands of tiny buildings on electric buzz saws and kept the pin-sized structures in tin cans—one can often holding as many as 8000.

Model makers had such precise assignments as reproducing, to scale, an entire Japanese aircraft manufacturing plant. A plane model had a wingspread of $\frac{3}{8}$ inch and its tail was $\frac{1}{8}$ inch wide. One target model was dotted with 600 tiny model planes whose creation required a soldier, using a razor blade, to cut out 1800 wooden parts, each about the size of a splinter. In simulated bombing practice, the target models were moved rather than the "plane." By means of specially designed lenses, the bombardier got the illusion of making a bombing run. As the target moved into range, he released a "bomb"—actually a plumb—and if it dropped within four inches of the target he was given credit for a hit. So sturdy were the models of Japanese cities that some of the Army engineers insisted the models would hold together longer than actual Jap industrial



centers. One model fell from a table in the Guam workshop and not a single thimble-sized tool shed toppled from its perch. Reconnaissance photographs were the first step in making the models. The problem of coloring from black and white photographs was solved later by color photography.

"Balancing" Sidewalls Hold Up Hangar Roof



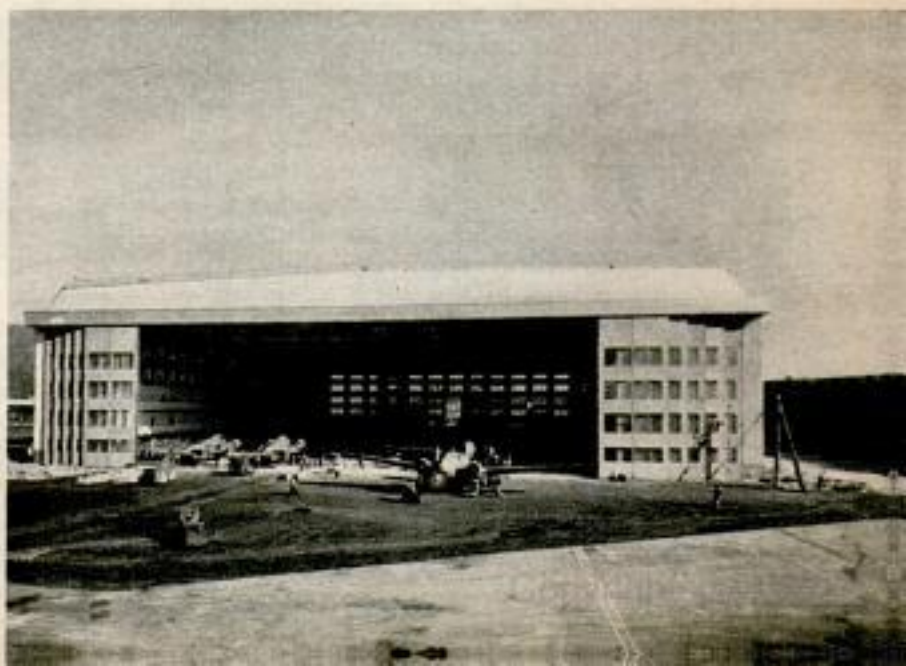
COUNTERBALANCED sidewalls bear the entire weight of the roof in a new type of building design, eliminating interior columns or other roof supports. Known as the three-hinge arch principle, the design is applied to factory and hangar buildings.

An outstanding example of the new design is a hangar 406 feet long, 302 feet wide and 60 feet high built by Lockheed Aircraft Corporation in Burbank, Calif. (Construction photo, top left; finished hangar, lower right.) The floor of the building is entirely free of columns. A crane attached to the roof can move two-ton loads.

In cross section, the building consists of

two vertical steel trusses that form the sidewalls (below at left) with their tops joined by the long roof truss. The inner chord of each vertical truss supports the weight, while the outer chord and the diagonal members counterbalance the weight of the roof truss. Several long balcony floors are built into the vertical trusses for use as offices and subassembly areas. A patent on the design has been applied for by its inventor, C. E. Noerenberg.

Construction is much lighter than for comparable buildings of other design, represents considerable saving in cost and is earthquake resistant. Additional floor



space can be provided inside the building at about half the usual cost. Cantilevered roofs extending outward from the sidewalls also may be added.

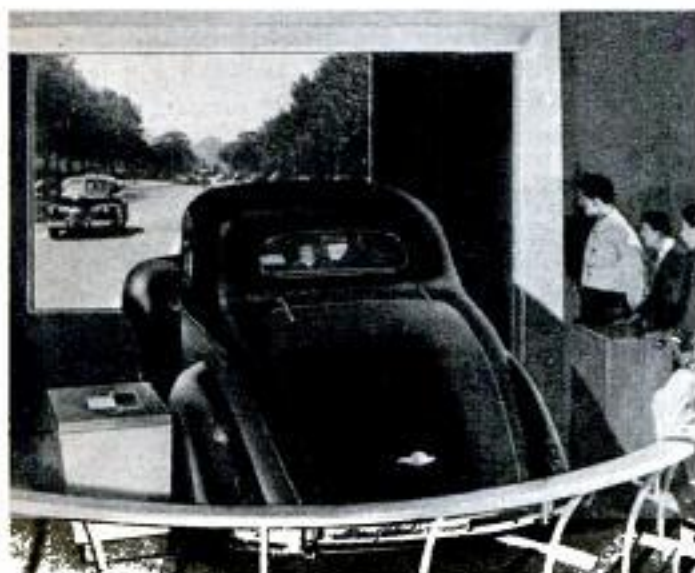
Hughes Aircraft Company, Culver City, Calif., uses a comparable principle in several of its factory buildings. In these the counterbalancing of the weight of the roof is obtained by means of exterior "upside-down" (see photo) reinforced concrete wall buttresses. The overhanging weight of these members balances the weight of the roof, eliminating interior roof supports.

Rocket Powder Tested by Sound

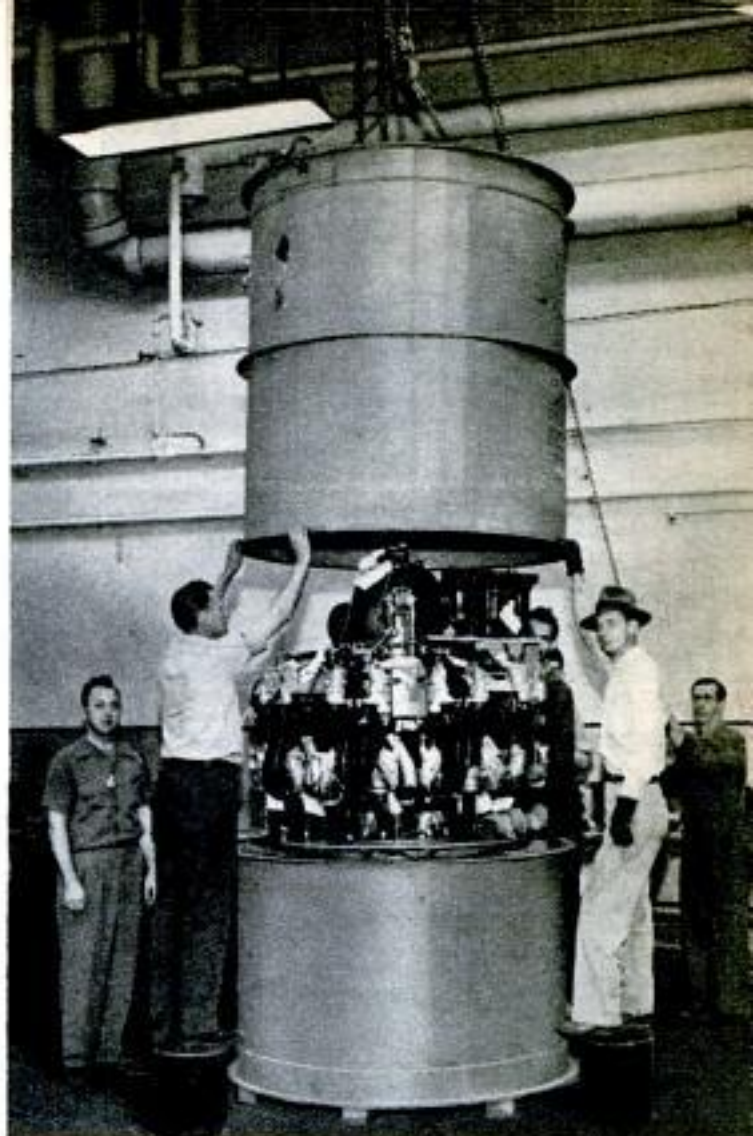
Supersonic waves of very high frequency have been harnessed by Hercules Powder Company engineers to detect rocket powder voids or air pockets. These might affect the rocket's accuracy or cause the motor to burst at time of firing. The waves are generated by a crystal connected to an electronic circuit. A minute flaw in a grain of powder deflects a percentage of the waves, which is recorded on a meter.

Driver's Test With Sound Movie Duplicates Traffic Problems

Driving skill is quickly and accurately revealed with a device which combines a Technicolor sound movie and the operation of a real automobile. The automobile is mounted in a testing slot which records the driver's reactions when faced with traffic problems shown on the screen. Re-



actions such as putting on the brakes or swerving to dodge a pedestrian or car are automatically recorded. Cheating is said to be impossible. Color perception, visual acuity, reaction time and attitude are all recorded on a card. The tester was developed by the Atlantic Refining Company.



Engines "Canned" for Shipment

Aircraft engines can be shipped safely to advanced bases with an experimental "canning" process. The engine is packed in an iron can or tank which protects it from breakage and climatic effects. This packing method was devised by the engine test branch at Warner Robins Air Technical Service Command, Robins Field, Ga.

Direct-Reading Radiator Gauge Shows Antifreeze Protection

Testing three types of antifreeze—alcohol, methanol and glycol—a handy antifreeze meter gives a direct reading without requiring reference to a chart. All information is shown on the barrel of the meter. The instrument tests cold engines without warming up, and indicates how much antifreeze is needed.



"INCUBATOR BABIES" of the Plant World

By Dorothy S. Towle

THE transplanted Southerner who would like to grow an orange tree in the White Mountains, or the Northerner who wants blueberries in Texas, can renew his hope. Perhaps the things he dreams of aren't too far off.

Dr. Richard Jones, a young scientist, working on embryo culture in the botany department at the University of New Hampshire, is perfecting a technique for obtaining new varieties of plants which may result in an entirely new phase of plant breeding. As a result of his experiments, scientists may be able to develop unusual hybrids with varying degrees of resistance to temperature, drought or disease. Plants which normally grow only in acid soil may be crossed with hitherto incompatible plants to yield new varieties which will flourish in basic soil. Shade-loving plants may be crossed with other plants to give varieties which will tolerate strong sunlight, and fruits normally borne on vines may be grown on bushes. Almost any combination of characteristics can be visualized through this process although the method is limited to those plants in which the flowers will fertilize each other.

Embryo culture is not particularly new, but the handful of scientists in the country who have been working with it have had indifferent success in transferring seedlings from the plant food, or nutrient media, in which they were started, to the soil in which they are to be grown. In many experiments, only a small percent of the seedlings survived, but with Dr. Jones' new technique, as high as 91 percent have lived, and this percentage may be increased.

Preparing the seeds for embryo culture is exacting work. In fact, it involves a very delicate surgical operation. To understand it, it is necessary to know something about the structure of the seed itself. A plant seed consists of the outer protective coats, the young embryo, and the endosperm, or food material upon which the embryo depends until it develops green leaves and manufactures its own food.

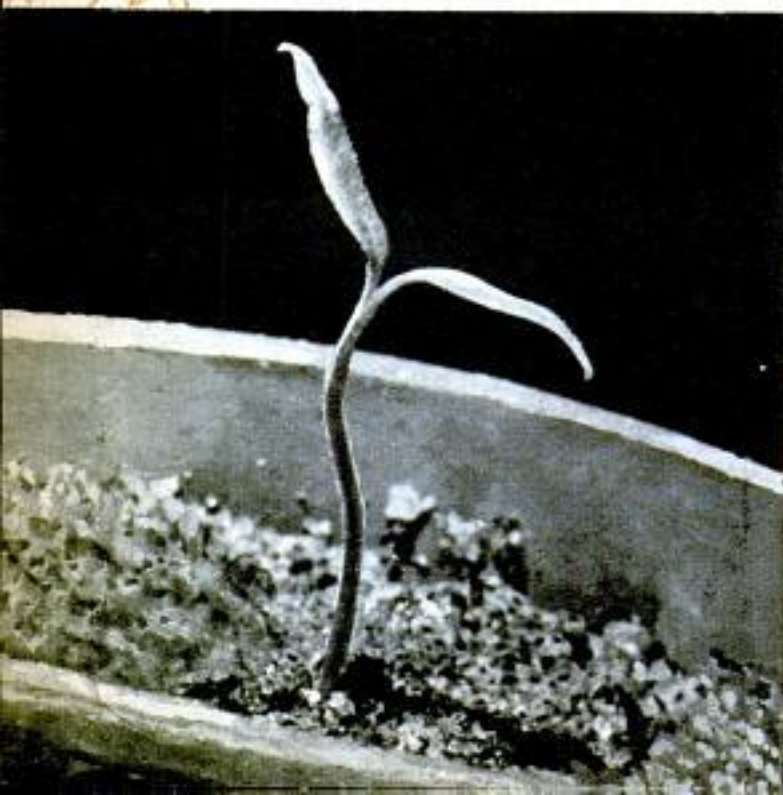
In trying to cross certain varieties or species, the hybrid will mature, but seeds from the fruit are "dead." Thus the second generation is lost, and with it the pos-



Magnified 31 times are fully developed seed, left, seed from green tomato, right, and embryo of latter



Artificially fed seedling looks like this when it is ready to be transferred to soil medium. Below, tomato plant two weeks after embryo is taken from the seed

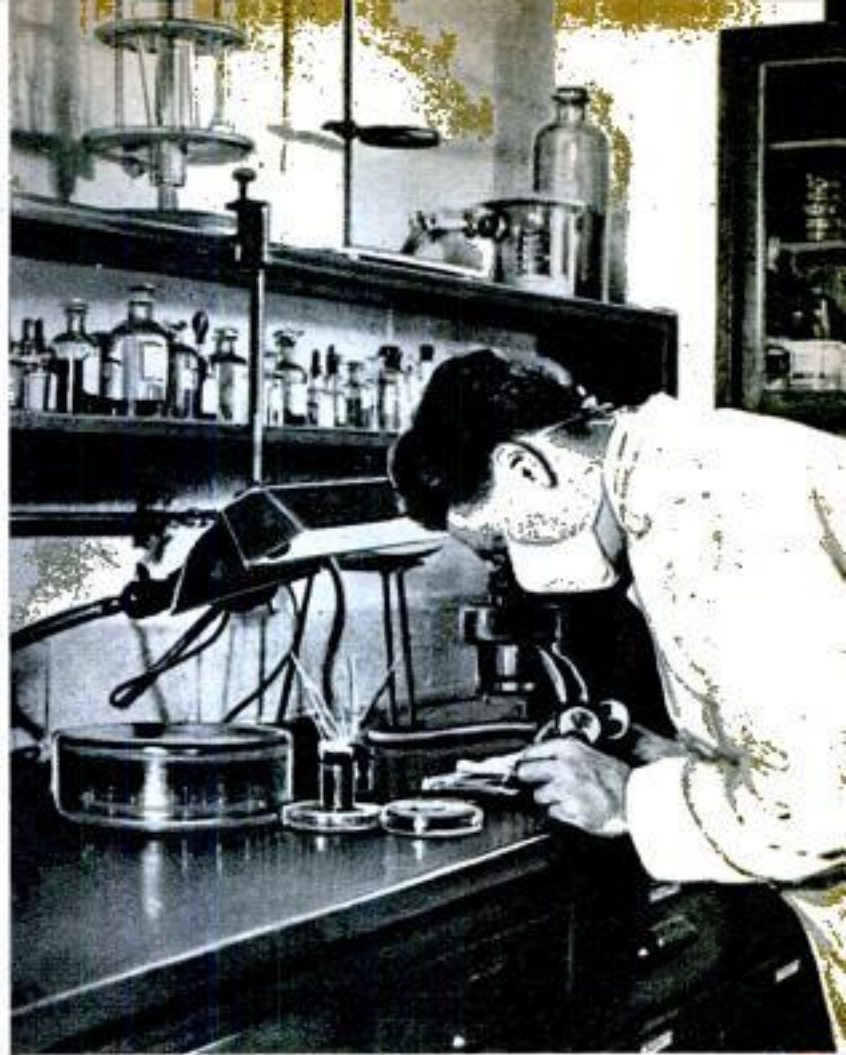


Grow oranges in New Hampshire? Blueberries in Texas? That's not so farfetched as it sounds, according to a modern Burbank who found a new technique for plant breeding

sibility of perpetuating or modifying the hybrid strain. There may be several reasons for this lack of vitality, depending upon the plant group, but one of the most common is the fact that the endosperm or food material does not develop properly and the embryo starves to death. In such cases, because the embryo dies in the seed, the seed will not germinate.

In embryo culture, the young seed is taken out of the green fruit and grown in a nutrient medium—taken out when the fruit is as small as one seventh of its mature weight, and before the embryo has a chance to starve. Suppose, for example, the scientist is interested in working with a particular variety of tomato whose seed consistently has failed to germinate. The green fruit is cut in half or quarters with a sterile knife, placed in a sterile petri dish and kept closely covered. The outer coat of one of the green immature seeds is taken off, the endosperm removed, leaving just the embryo. This is a precise operation, done aseptically under a microscope, with the operator wearing a gauze mask to avoid contaminating the embryo. Even in a fruit as large as the tomato, the embryo is little larger than the head of a pin. It is a pale translucent gray; in the seed it appears kidney-shaped, with a tiny bubblelike projection on the curved end containing the root, and with the leaves folded in toward the center.

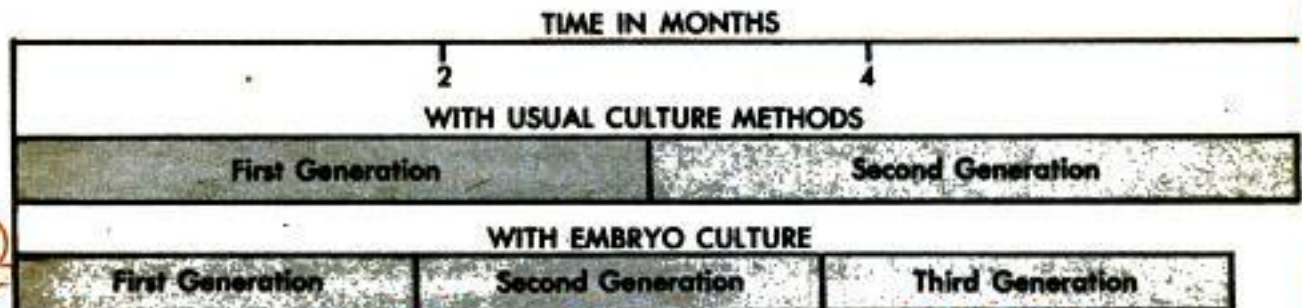
Some scientists use small steel knives to remove the seed coat, or attempt to force the embryo out of the seed coat by pressure between two glass plates, but Dr. Jones has found that glass knives with long, flexible, needlelike blades are excel-



Dr. Richard Jones dissects seed to remove embryo. He wears a mask and performs delicate operation with sterile instruments

lent tools for this work. The small seeds when removed from the fruit are moist and slippery. In cutting through the tender coat, great care has to be taken not to damage the embryo. When the outer coat gives, the glass knife blade is flexible enough to yield with the coat, and there is less danger of cutting into the embryo itself.

When the embryo is removed it is put into seven or eight cubic centimeters of nutrient agar to which standard nutrients have been added. Dr. Jones uses a modification of the nutrient medium developed by Dr. Philip White, one of the foremost workers on plant tissue culture and cancer research, adding sugar and yeast extract and using slightly different amounts of minerals.



Taking embryo from seed of green fruit speeds culture in addition to assuring fertility of hybrid seeds



Left, transferring seedling grown from embryo to glass beads in a plant food solution. Right, working under ultraviolet lamp to guard against bacteria, embryo is placed in solution for artificial feeding

Not only must the embryo be removed under aseptic conditions, but the experimenter works under ultraviolet light to minimize the danger of contamination from bacteria or other air-borne organisms. When bacteria or molds do get into the jars in which the embryo is placed, contaminating growths form on the agar and the whole jar must be thrown out. The embryo is incubated at about 78 degrees F. for several days, until its root system develops and the seed leaves become green. As soon as these leaves become green, the plant can manufacture its own food; until then it must depend upon the food provided in the nutrient medium.

A critical stage in the life of the young seedling comes when the germinated seed is transferred from the nutrient medium to the "soil" in which it is to continue growth. Sterile garden soil, beach sand, quartz sand and glass beads all have been used successfully. The transfer from the nutrient agar to the soil medium is made under ultraviolet light to prevent contamination. For two days the young plant is watered with a solution of the same food plant in which it was started so there will be less shock to the protoplasm. Then, if beach sand or garden soil is used, it is watered in the usual way. If glass beads or quartz sand are used, the plants are watered with a solution of mineral nutrients—the beads or sand particles simply serve as a support for the roots to work around. Whatever medium is used, the seedling is covered with a glass beaker for 10 days, or until it is well started, and kept at room temperature. Then the beaker is removed and the plant is allowed to grow normally.

What does all this mean in terms of the individual gardener? Plant scientists have been working for many years crossing one variety or species of plant with another, often getting hybrids whose seeds will not germinate. If the seeds that lack vitality could be brought by artificial means to the stage where their leaves would form and they would begin to manufacture their own food, then the breeding of these varieties could go on rapidly. Artificial nourishment of the seed embryo seems to offer a means of accomplishing this end.

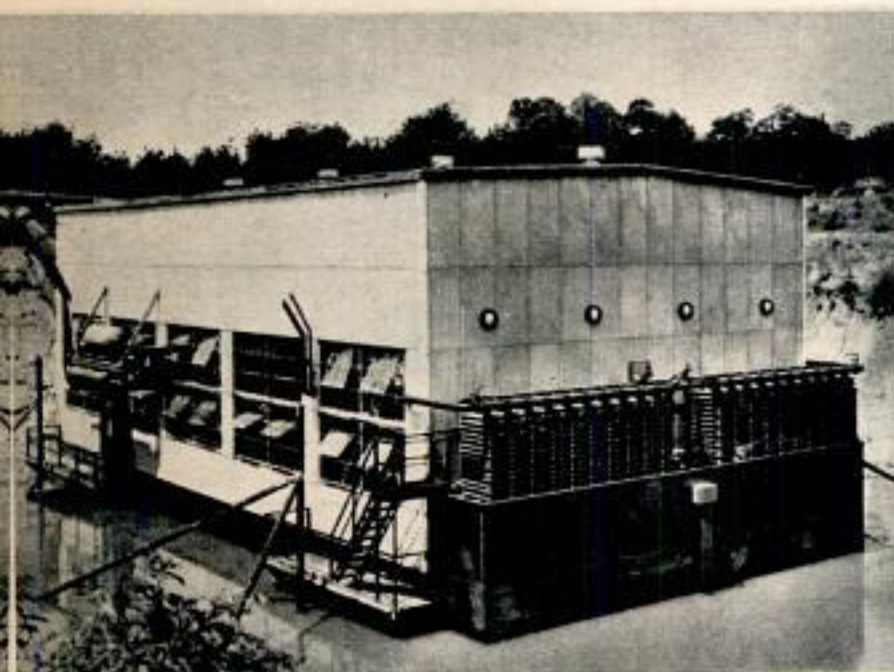
By using the Jones method, scientists may develop new varieties of fruits, vegetables and flowers which can be grown in all parts of the country under many conditions of environment. Furthermore, the plant breeder will not have to go through the whole life cycle, allowing the fruit to mature and giving the seed a rest period before planting it.

It means also that plant breeders will be able in a much shorter time to cross plants of one species with those of another, combining desirable features of each. They will be able to develop new varieties resistant to varying degrees of temperature, moisture, light, acidity and disease. They will be able to make hitherto impossible crosses between spreading vines and other plants, develop new plants of a bush variety which bear fruits but take less space in the garden, and make new crosses between wild and cultivated species.

What Dr. Jones and others in this field are doing will literally bear fruit in gardens from one end of the country to the other and the results of their work will be seen in gardens and on tables everywhere.

"Atom" Planes Used New Fuel System

Fuel-feeding systems shooting pressurized sprays of gasoline directly into B-29 engine cylinders supplied the getaway power needed by the two Superfortresses that dropped atomic bombs on Hiroshima and Nagasaki. Designed and built by Bendix Aviation Corporation, the "direct fuel injection" equipment is reported to cut down engine warm-up time and improve acceleration, cooling and engine operation. Two compact injection pumps—each synchronized with the main engine drive shafts—accurately divide fuel into equal parts and pump it at high pressure into the cylinders of the 18-cylinder, 2000-horsepower Wright engines via airtight stainless steel lines. Each pump contains nine plungers which spray the fuel in tiny shots—one spray from each plunger every twentieth of a second. Fuel precisely metered by a master control is injected directly into the cylinders at pressures ranging from 500 to 2500 pounds per square inch.



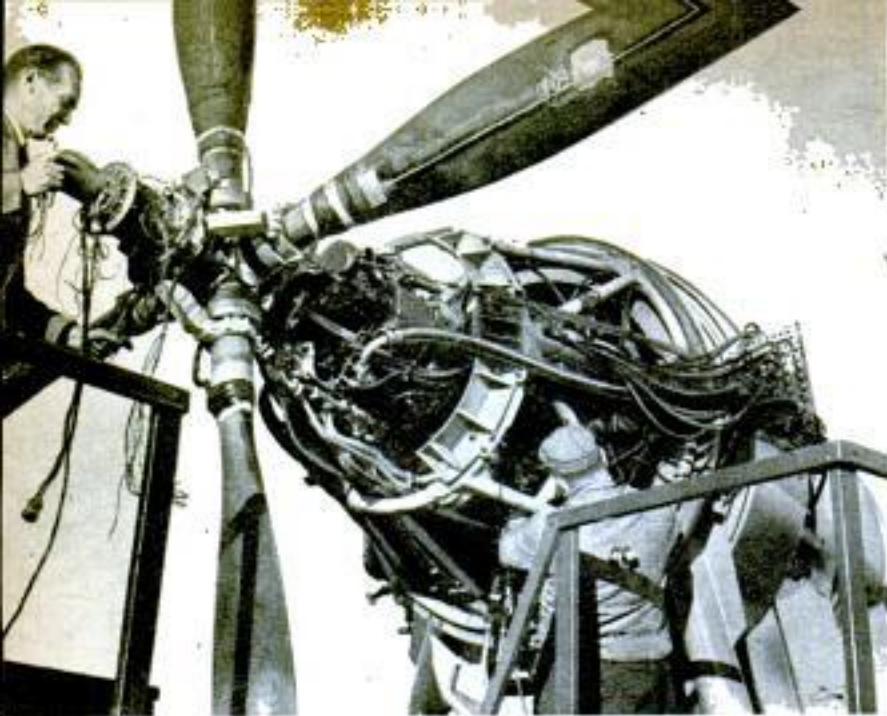
Pump Station on Barge

With a capacity of 100,000,000 gallons a day, a floating pumping station protects Oklahoma's second largest oil field against floods. When Pure Oil Company engineers found it impractical to locate a station on land at Cumberland Field, the pumping equipment was mounted on an 85-foot barge. Two Cooper-Bessemer Diesel engines are connected to 30 by 38-inch centrifugal pumps. Each engine also drives a generator to supply electric current for auxiliary units, such as the 30-horsepower motors in the cooling system. Flood protection is necessary due to the diversion of the Washita River around the field.

British Plane Has Main Wing Behind

With a small wing in front and a larger one behind, the British twin-engined Libellula appears to be flying backward when it takes to the air. The plane's peculiarity makes it especially suitable for aircraft carriers, since the pilot always has an unobstructed view. George Miles, of the firm which produced the British Miles Master, designed the new airplane.

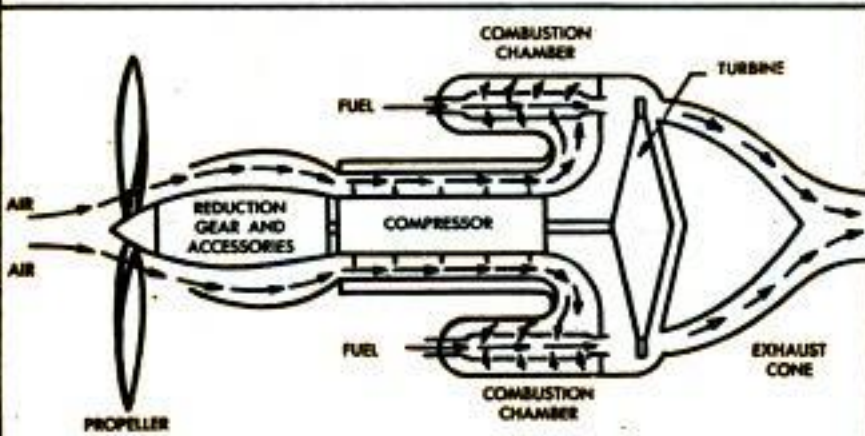
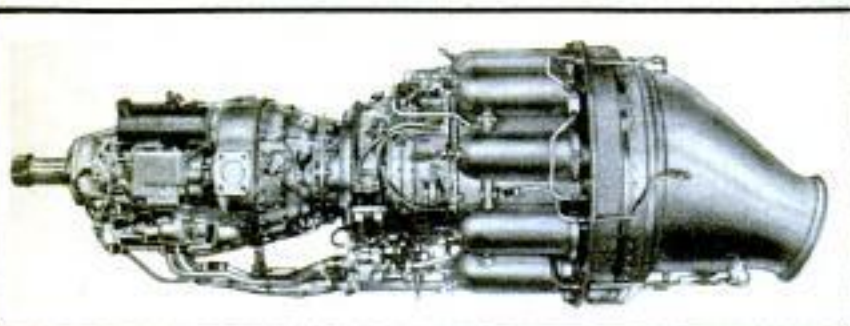




PROPJET ENGINE

COMBINING a propeller in front with jet propulsion in the rear, the Propjet, developed by General Electric for military purposes, may prove a long step toward the goal of efficient gas turbines for aircraft. Tested in an Army plane of advanced design,

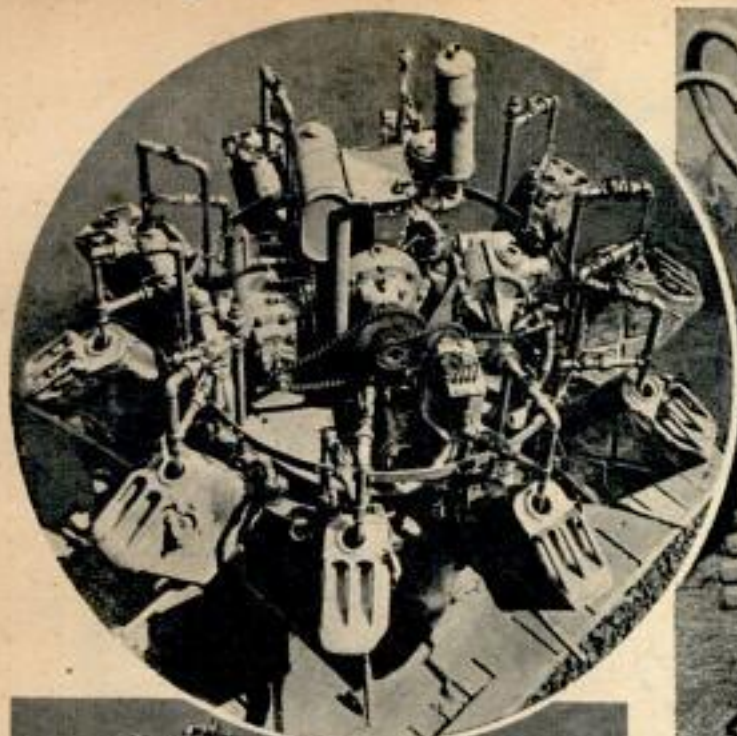
First gas turbine engine to drive an airplane propeller and generate jet propulsion. Below, drawing shows how the G-E Propjet fits into wings of a plane



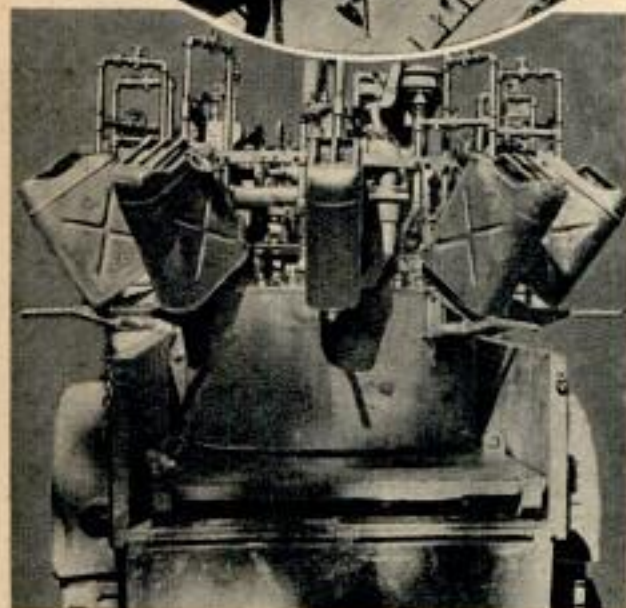
the engine performed well on kerosene in its first trial. The gas turbine gets its power from a whirling turbine wheel driven by hot gases supplied by burning liquid fuel. Air entering at the front of the engine is compressed and mixed with gases in a combustion chamber where the burning fuel greatly increases velocity and pressure. The gases then pass through the turbine which powers both compressor and propeller. The Propjet is light, creates little vibration and operates at full power for long periods on almost any liquid fuel.

Parallel photograph and diagram of the Propjet engine show its component parts

Revolving Cleaner Removes Rust, Sediment From Gasoline Cans



Gasoline drums and cans are cleaned of sand, mud, rust and sediment with a cleaner which looks like a bottling machine. Developed by the Quartermaster Corps, the machine is powered by a gasoline engine and cleans 10 five-gallon cans in 72 seconds. As the cans revolve, kerosene is sprayed under pressure into each one, after which the kerosene is removed by suction. An extension cleans 55-gallon drums.



Five-gallon cans are placed on rack and pipe nozzles are inserted. Above right, extension nozzle for drums

"Third Hand" for Phone Leaves Two Hands Free

Equivalent to a third hand, a new device holds a cradle-type telephone in speaking-and-listening position and keeps both hands free. It is equipped with two clamps, one which fastens to the edge of the desk and the other to the telephone. The one at the telephone end is mounted on a universal joint to permit adjustment to the best angle for the individual. The holder consists of a curved tubular arm that swings out of the way when not in use. A third clamp locks the holder and mouthpiece to the base.





These steel-plastic exercisers are designed to strengthen arm and shoulder muscles

PROVING GROUND FOR INVENTIONS

GOT any ideas for an invention to make you rich?

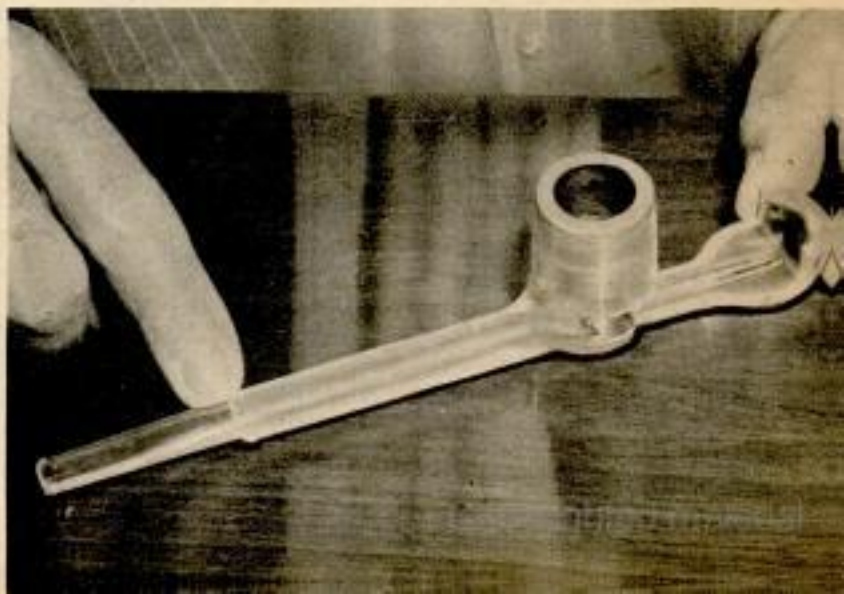
The truth is that for every "million dollar" invention that pays off, thousands of ideas that looked good to their originators never earned a cent.

Of the 50,000 ideas and patents submitted since 1940 to the Crosby Research Foundation of Hollywood for possible marketing, less than one half of one per cent had enough merit to warrant putting them on the market. Some were too visionary to be practical, some conflicted with patents already granted, others had too limited a potential market, still others would cost more to manufacture than the public would be willing to pay.

Organized as a business venture by Bing Crosby and his brother, Larry, the foundation provides research, manufacturing, and marketing facilities for inventors who devise



Above, pump automatically works when water supply gets low. Below, left, wastebasket with removable bottom. Right, plastic pipe for cooler smoking



7928 Sunset Blvd.
Los Angeles, Cal.

new appliances that stand a chance to become widely used. Inventions are not purchased by the foundation, but standard royalties are paid to inventors on the basis of sales volume.

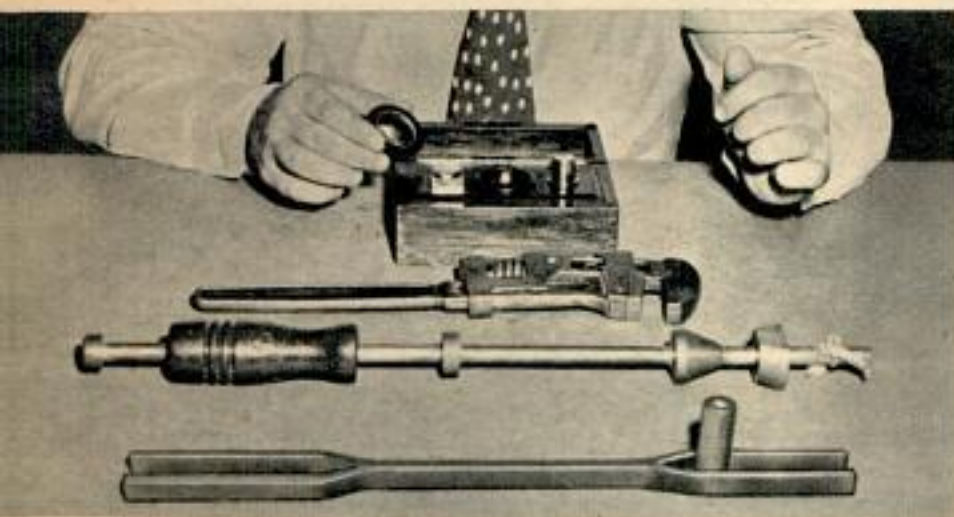
During the war, the Crosby Foundation helped develop the atomic bomb, a marine mine, an improved incendiary bomb and a device for detecting submarines.

The organization includes a staff of experts who consider the merits of ideas and inventions, conduct surveys to determine the potential markets and re-engineer and restyle devices that need such treatment. The "inventorprises" department then finances the manufacture of promising items and the "merchanteers" department arranges for national distribution through regular sales channels.

Right now the Crosby organization is readying patented articles for distribution



Above, horse race game sets odds for each horse. Left, a storage battery with visible liquid dial. In foreground, special wrenches



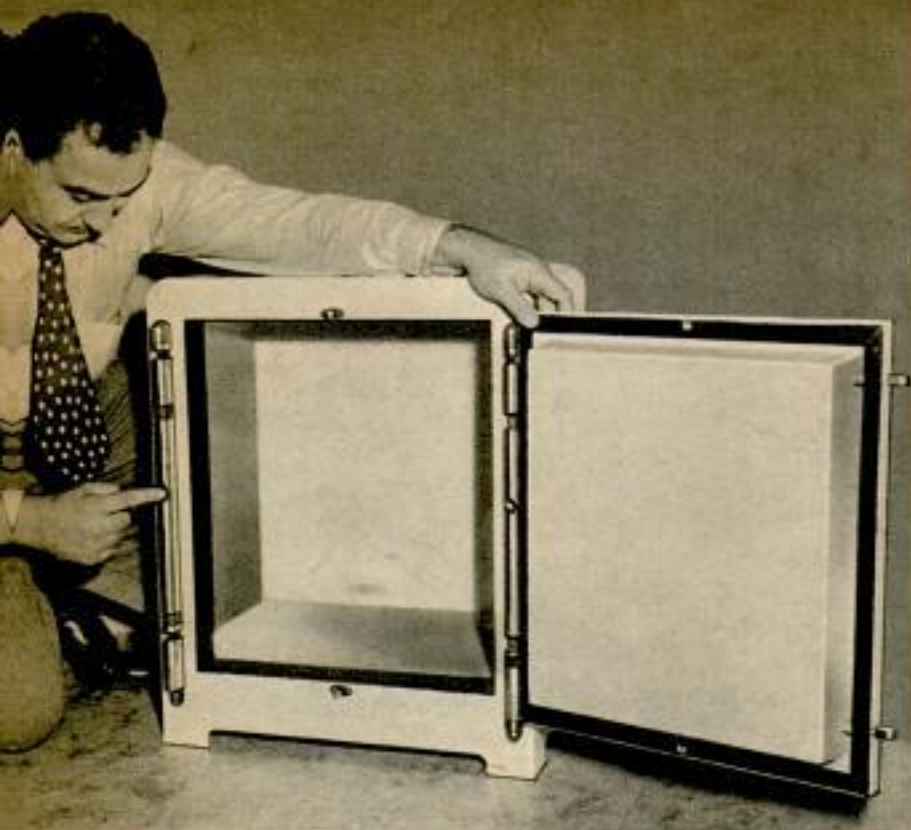
at the rate of one new item per week. Scheduled for sale this winter is an all-plastic, unbreakable smoking pipe with a replaceable briar bowl insert. The bowl is surrounded by a cooling chamber that provides a cool smoke. The stem may be taken apart for easy cleaning.

Another idea going on the market is a simple die-cast paint brush holder that clamps to the side of an open paint can. The holder keeps the brush handle away from wet paint on the can's rim and has a wiping bar, centered over the can, for removing excess paint from the brush. It will be on sale around Christmas time.

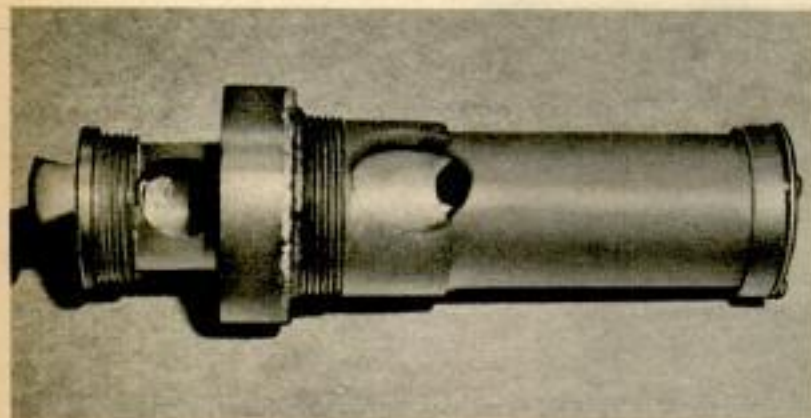
Other inventions the Crosby company is backing include: a built-in ceramic ash tray for bathrooms to prevent burn marks on window sills; a ceramic soap holder that lets the soap dry instead of becoming a soggy mess; a horse race game with its own totalizer that automatically changes odds for each horse at the start of a game; a streamlined plastic cigaret box that hands you a cigarette when you raise the lid; a hand-cranked metal paddle that mixes

Dual-purpose crutch, another of Crosby Foundation's sponsored inventions, has extra legs for sturdy seat





Refrigerator model has door that opens from either side at touch of a button. The door has hinges at both the left and the right



Above, self-breathing plastic spigot eliminates need of a second hole to facilitate pouring from barrels. Below, pants hanger with plastic teeth uses clamshell principle to grip the cloth securely



paint from the bottom up. Each idea was picked because it had wide appeal and could be sold at a price low enough to insure a large volume of sales.

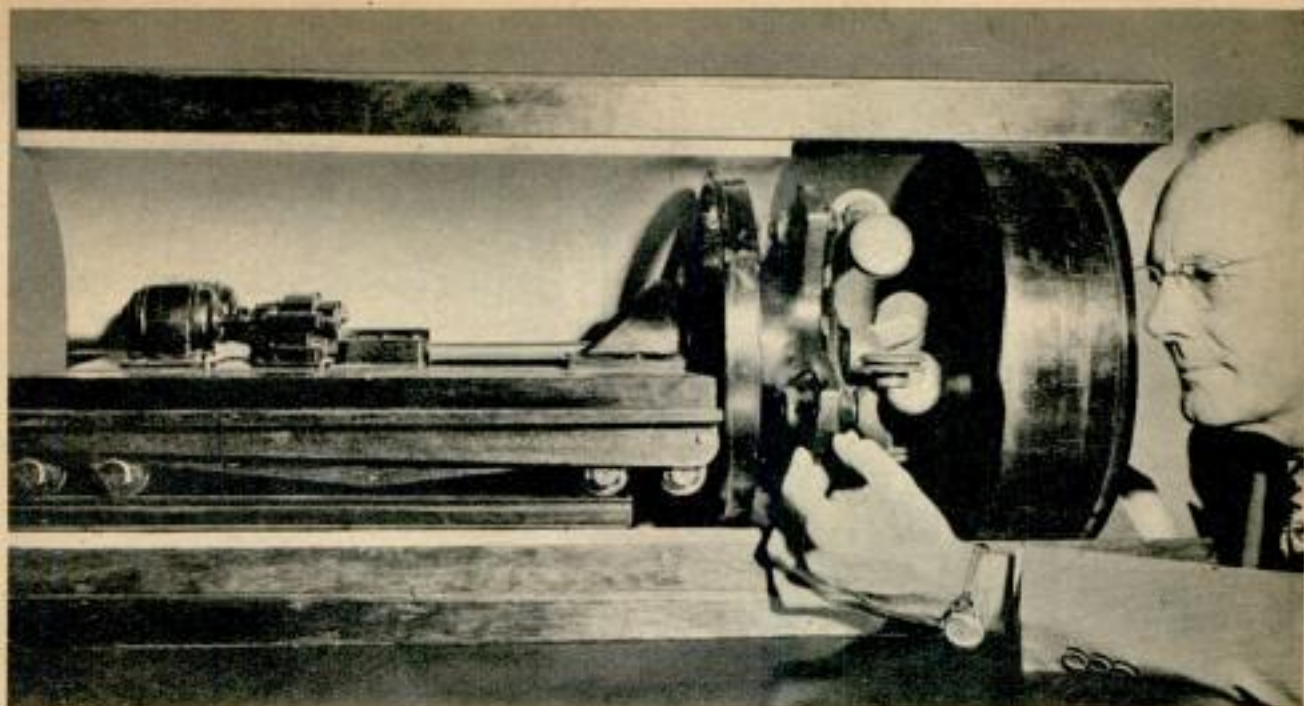
Turned down by the Crosby firm were: a battering ram mouse trap, the principle of which, the inventor said, could also be used by warships to fend off torpedoes aimed at them; a plastic mine equipped with an electric eye for picking up its target and a propeller for chasing it; a camouflaged and armored top for foxholes that would require a squad of men to carry and install; a toothbrush with a self-contained supply of dentifrice; a zippered handbag without any new patentable ideas in its construction.

Other articles, while entirely sound and practical, had to be dropped because they would appeal to relatively few prospective purchasers.

Many inventors don't know how to protect their ideas, they are overly optimistic as to what their inventions should earn, and they don't understand the manufacturing and marketing problems involved in putting a new device on the market. H. L. Praeger, manager of the Crosby industrial system, has some sound advice from which such inventors could profit.

First of all, he says, protect yourself. Prepare a description and drawings of your idea, dated and signed, and have your signature witnessed by a notary public or by two witnesses who sign their names below your signature. Mail this material to yourself by registered mail and file the letter away unopened when you receive it. The purpose of this is to prove that you had your idea on a certain date. In case of a law suit charging patent interference you can hand your unopened letter to the judge or patent office examiner as proof of the time when you had your idea. Such a letter affords protection for a year from its date.

Second, find out if your idea is original. Employ a reputable patent attorney to make a search of Patent Office records to learn whether your idea conflicts with patents already issued. After



A research man examines model of tunnel digging machine that uses electric motors to operate cutting heads

making this search your attorney can give his opinion as to whether your idea would be granted a patent. His services should cost you from \$15 to \$75.

Third, learn whether your device could be sold at a profit. The way to decide this is to make a manufacturing and market survey. Show a model or drawing of your invention to several manufacturers. Ask them whether its engineering is sound, whether you should redesign it for greater economy of manufacturing, and get a close estimate of production costs.

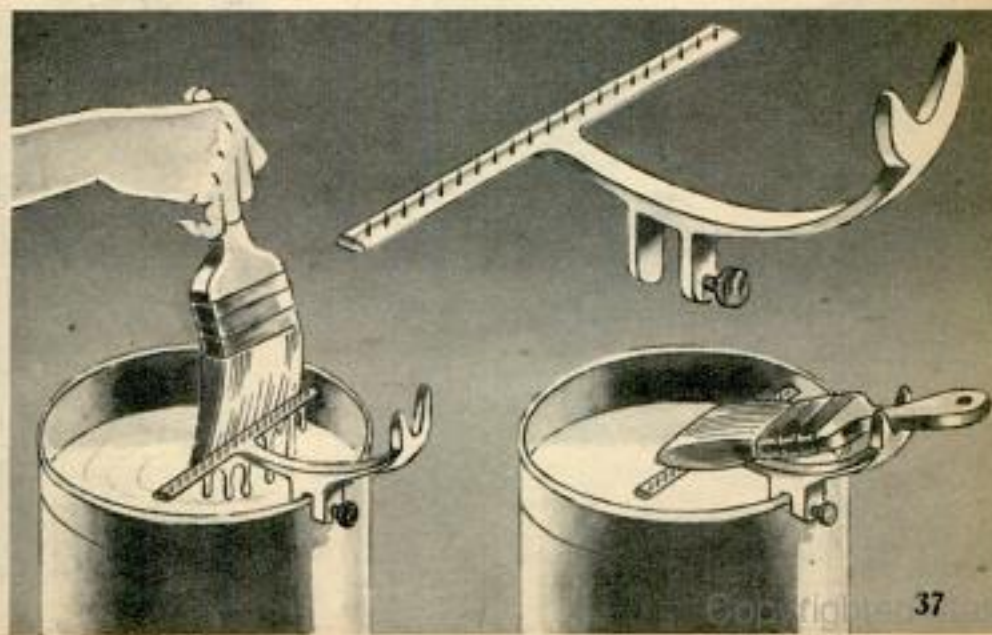
Next ask a buyer for a large store how well your gadget would sell, considering its utility to the purchaser, advantages over comparable articles and its price. Its retail price, roughly, will amount to five times its cost of manufacture. You can dis-

play your idea freely while making these surveys because you have already protected it by the unopened registered letter.

Finally, you should apply for your patent only if these surveys are favorable and it appears that your device can be manufactured and sold at a profit. Attorney's fees for preparing descriptions, making drawings and filing for your patent will cost from \$150 to \$2500, including some \$80 in filing fees.

After making your surveys and obtaining a patent, you are then in a good position to discuss its production by a manufacturer. If you offer your patent for sale on a royalty basis you should expect to receive royalties amounting to from one to five percent of the wholesale price. Larger royalty percentages are quite rare.

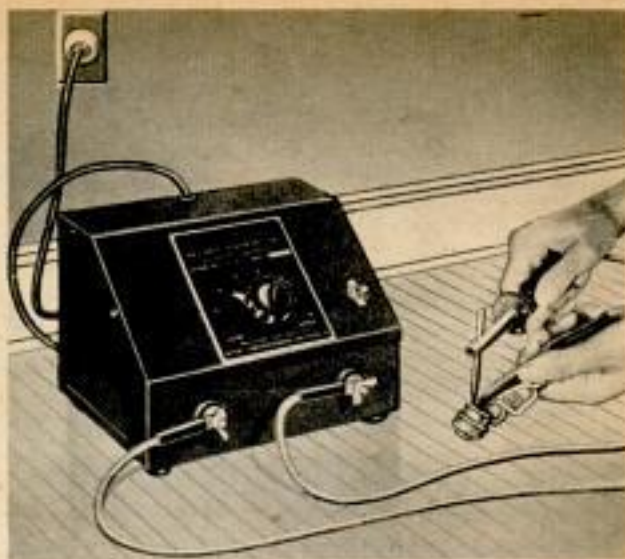
Below, left, an ash tray with slot to hold match book securely. Right, paint brush holder attached to can





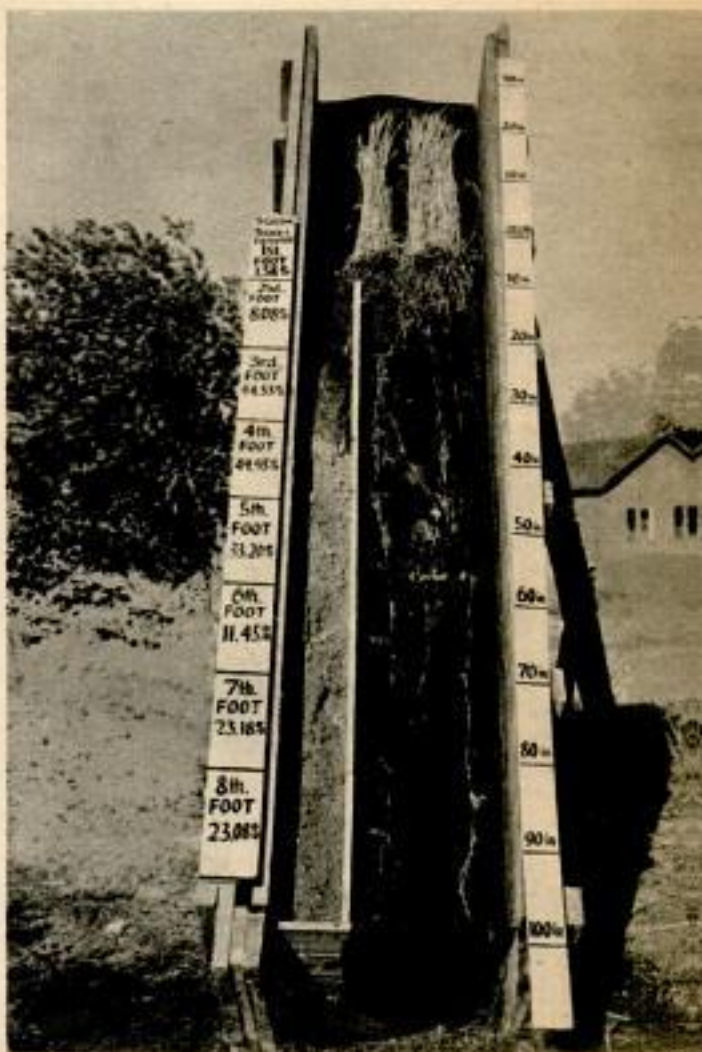
CABLE CAR built by Philip J. Kirst of Kenmore, N. Y., carries him across a gully to get firewood for his parents' weekend cabin. Car will support 500 pounds

LEFTOVER ALUMINUM TUBING designed for struts in B-29 Superfortresses is now being used by toy manufacturers to make nontipping bases for hobby horses Chicago Merchandise Mart photo



COMPACT SOLDERING UNIT designed for intricate electronic work reaches into spaces that an ordinary soldering iron can't touch. It develops an intense heat that is concentrated at the tip and can be regulated to eight different temperatures. The copper-plated carbon rod can be resharpened easily with a scraper or emery wheel. The unit may be used for etching on metal, and an adapter for wire stripping is available

WHEAT ROOTS that penetrated to a depth of nine feet in Deaf Smith County, Texas, are mounted on a chart that shows how rich soil is in calcium deposits





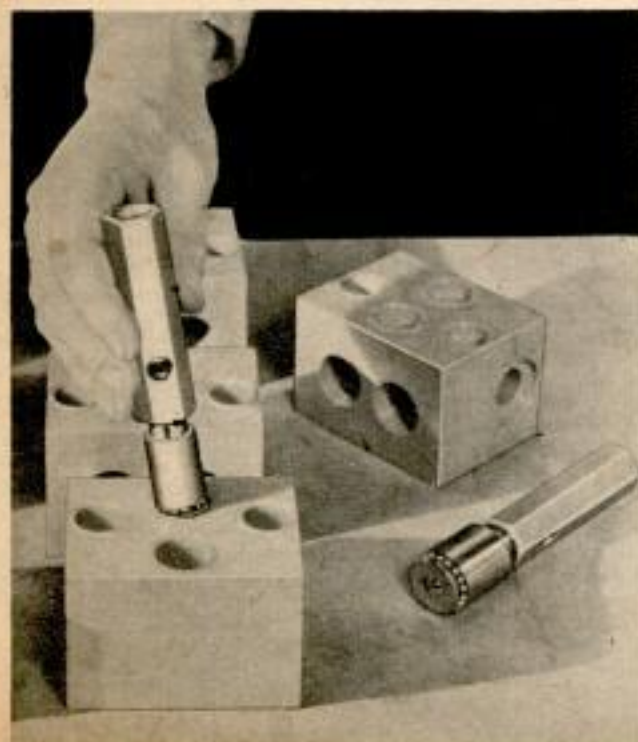
TOKENS are inserted in a meter dispensing unit to release gasoline to individual stations. This is a boon to both the service station operator and gasoline supplier. Instead of making daily deliveries of 100 to 200 gallons, the supplier fills the tank to the top. The operator does not pay for the full tank, but buys tokens which release 50 gallons at a time. This insures an ample supply of gasoline. The deposited tokens provide an accounting system

BALL BEARING ring on plug gauge (below) assures proper alignment and prevents jamming and wear. Free to turn in any direction, the gauge is automatically aligned regardless of the angle at which it enters. As the instrument enters the work of its own weight, it is impossible to jam even though the diameter of the gauge is the same as the opening. This prevents wear on bores in soft metals. The constant turning of the bearings adds to the life of the gauge



ELECTRONIC "mathematician" determines the proper location for new radio towers in a few minutes—a job that once required weeks of human figuring. The RCA machine, known as an Antennalyzer, adds, subtracts, squares and takes the square root of numbers and fractions. It contains 52 electron tubes. Electrical circuits are set up to simulate characteristics of a proposed transmission tower. A pattern of light on cathode ray tube shows right "blueprint"

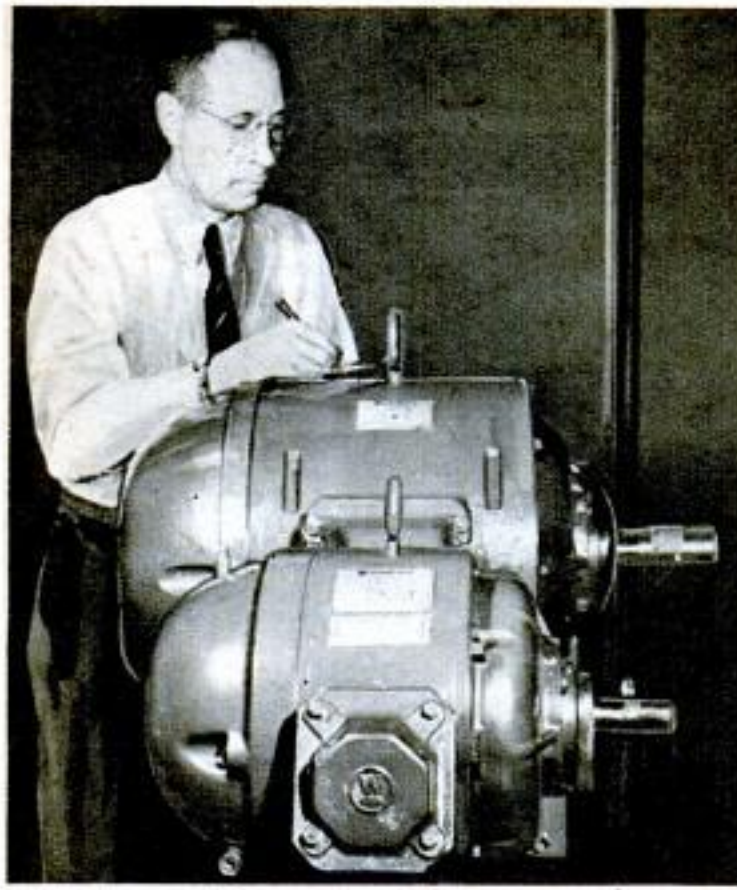
"BIRD BATH" for airplane parts (below) keeps hangar floors free from grease. The shallow pan in which parts are washed is seven by four feet and is mounted on an accordionlike frame. This frame can be wheeled about wherever needed and expands from 32 inches to seven feet in height. It holds 15 gallons of cleaning liquid. Small parts, such as nuts, are washed in a basin covered with screen at one end of the pan. American Airlines mechanics built it



P-6 11

*Dow Corning Corp.
Midland, Michigan*

MEET THE SILICONE FAMILY



Silicone varnish on insulation of the small motor gives it power output of big one

CAN you imagine a liquid that flows like water 70 degrees below zero, that doesn't melt at 400 above, or an insulating varnish that doubles the life of electric motors? These and other wonders are now within the realm of possibility through the development of a new line of chemicals called silicones.

These new compounds are made up of rings and chains of silicon and oxygen atoms instead of the carbon atoms of the older organic chemistry. It might be called a "silica sand" instead of a "coal tar" chemistry.

For years artisans have wished for something in the nature of a liquid asbestos or an artificial mica that could be poured and moulded. With this new development, industry soon may have available a host of new plastics, elastomers, oils and coatings, all extremely resistant to heat. The new compounds possible are numberless and the industrial possibilities are beyond the range of the imagination.

It all began with some research in polymerization in connection with glass and plastics. Polymerization is the joining together of molecules to form long strings or an interlocking network. When this reaction takes place a material usually thickens or solidifies and yet does not change its

actual chemical composition. Formerly this reaction had been of interest only in plastics, rubber, glass and adhesives.

The older organic chemistry was based on the ability of carbon atoms to combine with four other atoms. Silicon atoms also combine with four other atoms and although chemists have long realized the possibility of developing an entirely new line of compounds based on this element the only familiar materials have been the inorganic natural compounds of quartz, glass, asbestos and mica. Now a start has been made which may result in a hundred thousand new chemical compounds.

The basic raw materials for the production of these new compounds are sand, brine, coal and oil. The brine is electrolyzed to produce magnesium metal and chlorine gas. With the aid of this, chlorine and silica sand are converted into silicon tetrachloride.

Organic chlorides are prepared from chlorine, coal tar and petroleum and with the aid of metallic magnesium, in what is known as the Grignard reaction, these organic chlorides and the silicon tetrachloride are combined. The magnesium does not enter permanently into the compound but only assists the reaction.

The organic-silicon chlorides are then hydrolyzed or combined with water and the resulting molecules are capable of being condensed or polymerized into long chains.

The distinguishing characteristic of most of these compounds is their remarkable resistance to heat, acids and electricity.

Some of the compounds are water-white liquids, some appear oily, some are of greaselike consistency and some are hard resins. They are insoluble in water but dissolve in certain organic solvents.

The greaselike compounds are already being used for high temperature lubrication with good success. Some of the liquids can be heated to 800° F. without evaporating and can be cooled to -50° F. and still remain fluid. They are being proposed as a heat transfer medium for industrial uses. The resinous silicones are being tried out as electrical insulating material in connection with continuous glass filaments and



These pictures demonstrate that silicone lubricant withstands higher temperature than petroleum jelly. Left, silicone lubricant is in the left-hand vessel; petroleum jelly in the other. Right, flame melts the jelly

to make possible motors much smaller in size with the same horsepower.

The trend toward higher operating temperatures for motors was stimulated by the advent of fibrous glass insulation but full advantage could not be taken of this material because of the heat failure of the organic varnishes used to impregnate it. With the discovery of resins of the silicone type, varnishes can be prepared that stand operating temperatures of 125 to 200° C.

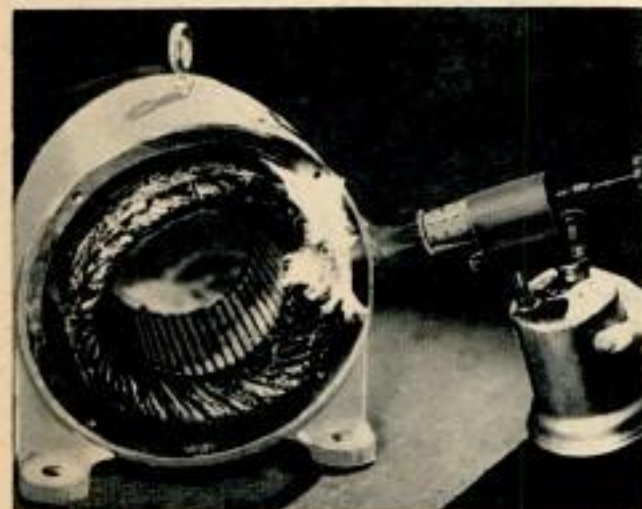
Silicone liquids have a very small change in viscosity over a wide temperature range. They will stand both high and low temperatures and are already being used to impregnate packings and gaskets, as gauge

glass and dash pot liquids and for lubricating molds in the hot molding of plastics.

Greaselike products are being used for lubricating plug cocks in high temperature chemical apparatus to withstand temperature changes from -40° F. to 400° F.

The latest development in this new chemical field is a rubberlike material that actually contains no natural or artificial rubber. Silicon forms the chemical framework and lends its property of high temperature resistance. It has a lower tensile strength than rubber and could not be used for tires but is already being used as gaskets in B-29 superchargers and as a cushion for Navy searchlights.

Left, torch ignites silicone-varnished insulation; right, flame goes out seven seconds after torch is turned off





Gunners Practice On Robot Planes

One of the reasons why U. S. fighting men scored so many bull's-eyes in shooting at enemy aircraft was that we had radio-controlled, pilotless planes for target practice. The Air Technical Service Command has revealed that robot planes were used extensively to train air force gunnery students and to instruct radar students in tracing flying objects such as rocket bombs and airplanes. The Army developed two models, one a monoplane



Left, robot plane is target for gunners' practice. Center, operating plane by remote control. Right, parachute lands it



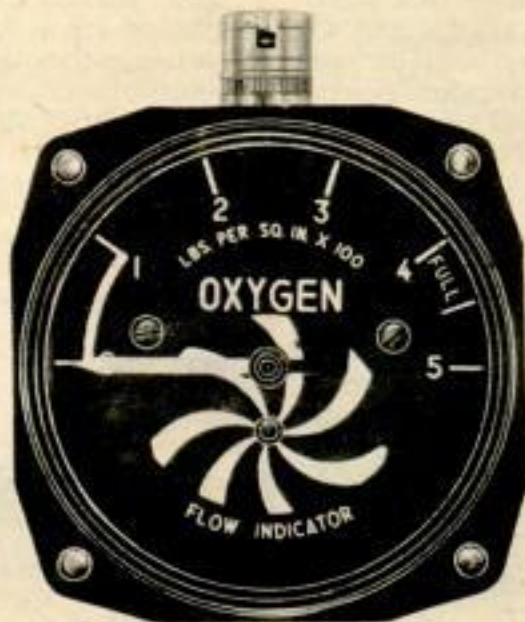
with a nine-foot wing span capable of flying 103 miles an hour, the other with a wing span of 11 feet 6 inches capable of 140 miles per hour. The plane is catapulted from the ground by either compressed coil springs or a

rubber shock cord. In air the flying robot can be made to perform intricate maneuvers—duplicating actual combat “squirmings”—by remote control. When the target plane's gasoline supply is exhausted, the ship is landed by a parachute opened by radio control.



AAP photos

Left, bomber panel has “buttons” which light up when oxygen supply to any crewman gets low. Above, dial indicates flow and pressure



Plane Dial Lights Up If Oxygen Runs Low

Insufficient oxygen for a bomber crew is disclosed by an oxygen warning system which keeps tab on each airman. An oxygen combination indicator incorporates a pressure gauge and flow indicator, with pressure shown in hundreds of pounds by a pointer, and flow indicated by a luminous whirler disk. The central warning panel contains a time delay mechanism and warning lights arranged in the same pattern as the plane's oxygen stations. If a crew member receives insufficient oxygen, his warning lamp lights up.



Self-Elevating Outboard Motors

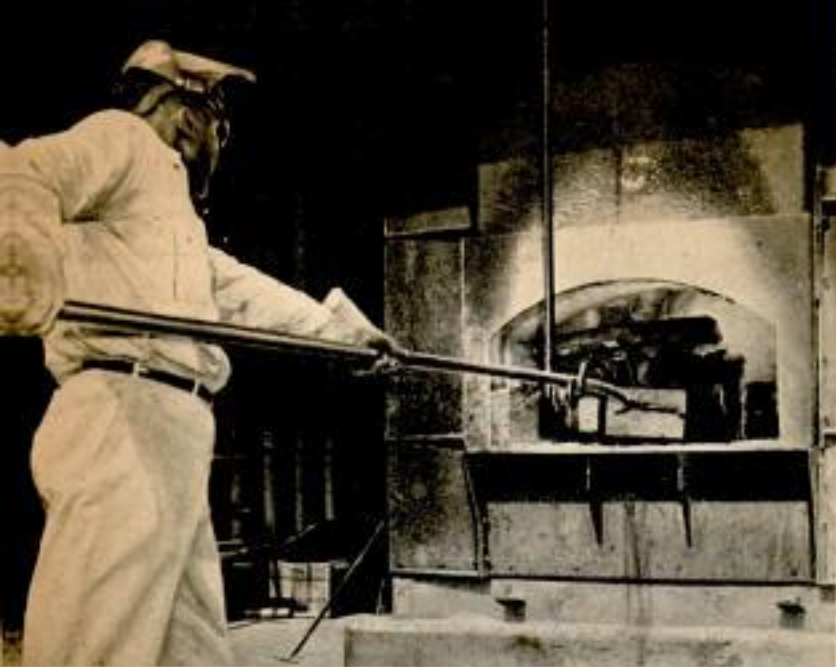
Giant war-developed outboard motors and propellers seem destined to be important cogs in postwar marine transportation. Available in gasoline or Diesel models from 45 to 330 horsepower, the so-called "Harbormasters" are suitable for use in towboats, tugs, police and fireboats, icebreakers, fishing craft, river ferries and such work boats as pile drivers and derricks. A feature of the unit is an elevation mechanism which permits the propeller to be raised outward and upward, either manually or by power. This flexibility enables heavily laden craft to be driven over submerged obstacles. In the war these big outboard motors propelled "Rhino Ferries" and "Rhino Tugs" to form mobile bridges over which invasion equipment rolled shoreward, and also took part in minesweeping operations, laying cable, maneuvering derricks and clearing port obstructions.

Featherweight Canoe

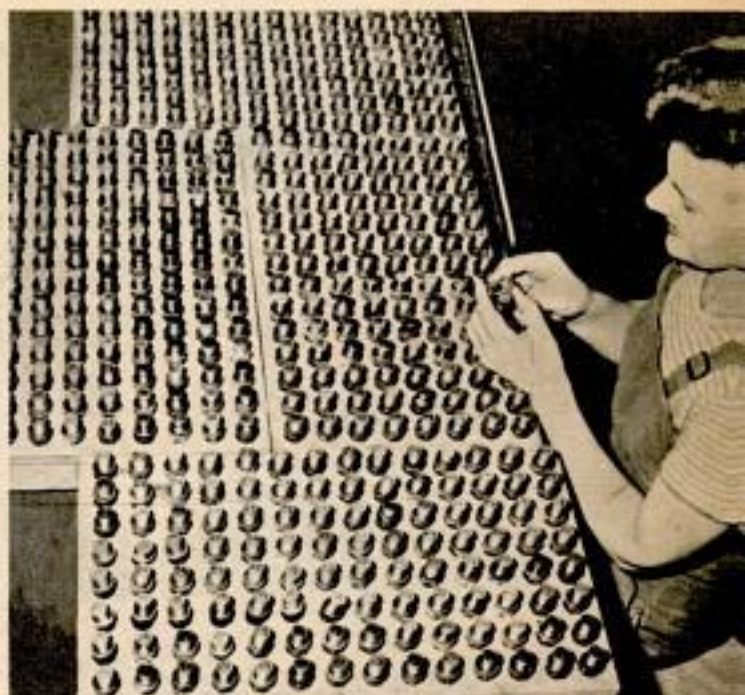
Aluminum canoes weighing only 38 pounds are being manufactured by the Grumman Aircraft Corporation at Bethpage, Long Island, wartime makers of Navy fighter planes. The canoes are so light that a girl can easily hoist one above her head and carry it.

Write to firms listed in the Where-to-Buy-It Index, page 8A, to learn more about products described in this magazine. Say you saw it in Popular Mechanics.





Above, left, parts from wrecked warplanes are pushed into a melting furnace to be reduced to molten aluminum. Right, after "cooking," the aluminum comes out in ingots. Below, left, ultraviolet lamp from a bomber is attached to a base for classroom work. Right, checking spark plugs from old Navy planes for possible reuse



HUNDRED BILLION DOLLAR SCRAP PILE

DON'T be surprised if your new aluminum stew pot starts 'revving up' and takes off from the kitchen stove on a flight around the house."

That's the way one Navy scrap and salvage expert jocularly describes the conversion of war's debris to the economy of peace. Your new kitchen aluminum may have been a part of an airplane that shot down its quota of Japs or had a hand in the subjugation of Germany.

Cleaning up after Mars is a vast job that will last for years. The armed forces themselves get first crack at wrecked vehicles and equipment. Parts that are still good are "cannibalized" so that other units can be

repaired and restored to service. Scrap materials that are left over, from paper and lumber to plastics and steel, are being returned to industry for reworking and reuse.

Huge stores of obsolete or surplus items no longer needed by the services are being offered for sale. Everything from brooms to bulldozers, from electric wiring to sea-going ships, will be put on the block. The sales tag on a Flying Fortress minus armament, for instance, is \$39,000.

Called the world's greatest merchandising task, the job of peddling an estimated \$100,000,000,000 worth of goods is currently handled by the Surplus Property Board, a government agency. Retail sales to the

public are not planned. Instead, various government groups are advertising bulk lots of materials and equipment, selling to the lowest bidders. The materials then move through regular merchandising channels to consumers. Sales are running at the rate of \$50,000,000 per month.

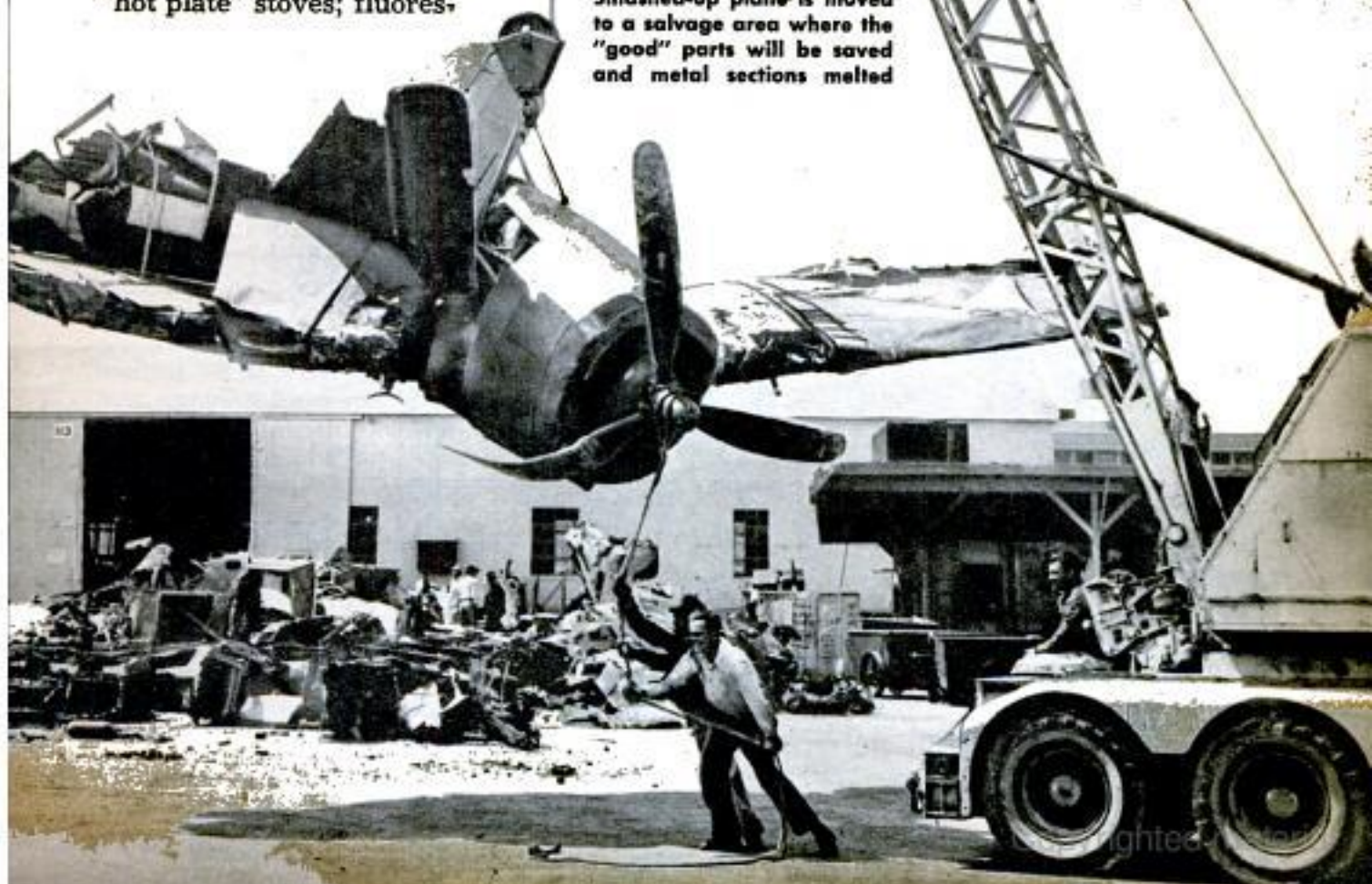
Air compressors and blankets, to name two surplus items, can find uses without conversion, but to what practical use could you put half a million gas masks or a thousand rubber floats used in bomber fuel tanks or 10,000 hydraulic cylinders of assorted sizes?

One conversion organization took a gas mask apart and produced bicycle handlebar grips from the mask's rubber tubing, workshop goggles from the glass lenses, a powder-puff holder from the canister, and a toy gas mask from what was left over.

Large surplus metal electrical junction boxes become bases for electrical "hot plate" stoves; fluores-

Keep a sharp eye on that supercolossal white elephant, last year's bomber. It may turn up in next year's kitchen stove, bobby pin or bicycle

Smashed-up plane is moved to a salvage area where the "good" parts will be saved and metal sections melted





Piece by piece, wrecked fighting planes are taken apart by workers who salvage the metal and various parts. Below, inventory is made of salvaged materials stored at a naval air base



cent black-out lamps for irradiating the instrument dials of aircraft are converted to 110-volt operation and are used for studying fluorescent minerals and paints; large pieces of stainless steel scrap are cut to size, shaped and riveted into photographic development tanks; surplus hollow mooring buoys used by ships become excellent water-storage tanks for farm use.

Lengths of rolled aluminum alloy sections left over from the building of aircraft have infinite uses. Lightweight newspaper racks for street sales stands and lightweight bakery racks that can hold 30 pans of cookies and biscuits are only two representative items being made from these alloy sections. A whole field in itself is the adaptation of lightweight metals plus plastics and surplus aircraft parts in the manufacture of automobile trailers for vacation use.

Tidying up the battlefields is no mere figure of speech. That's where the reconversion job really begins. In Europe, maintenance companies followed closely on the heels of the combat outfits. Theirs was the clean-up job. Wrecked tanks, worn-out guns, blasted trucks and all the lost and damaged debris of battle were classified, sorted and headed toward the repair shops or junk piles within a couple of weeks from the time fighting had ceased.

Tank, truck and jeep motors were rebuilt at shops in western Europe at the rate of 20,000 per month. Everything that "rolls, shoots or explodes" that needed repairs was reconditioned for battle. At first it was estimated that 50 percent of the material used in Europe would have to be junked, but the sharp-eyed salvage men have reduced that figure to 20 percent. Reconditioned, the rest of the equipment was rushed to Japan.

The salvage process is essentially the same in all branches of the service for all kinds of equipment. Damaged aircraft, for example, that are moved to a salvage depot are first inspected to determine whether they can be safely repaired either by rebuilding minor portions or by substituting parts that are on hand.

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The repair shops go to work if repairs are decided upon; otherwise salvage crews remove from the plane structure every assembly and item that could be put back in use. If an entire wing is in perfect shape it goes into storage against the day another plane of the same type needs a wing. Hydraulic cylinders are removed, inspected and put in stock, radios are removed, tested and put on the shelf. Armament, instruments, tail wheels and even spark plugs go through the same process. Control wires and cables, however, are never taken from an old or damaged aircraft for use in another.

The aluminum structure that remains, possibly consisting of the fuselage and a wing, is cut up by acetylene torches or giant shears and put into a melting furnace where it is reduced to molten aluminum. This is then poured into ingots and finally makes its way back to industry. Secondary aluminum such as this is not as strong as virgin aluminum but is entirely satisfactory for many purposes such as pots and pans.

It is estimated that the scrapping of old and damaged aircraft will provide one billion pounds of secondary aluminum. Virgin aluminum itself is now available without priority for manufacturing civilian items. All in all, including the tremendously in-



A wounded sailor and a WAVE admire a plastic cigarette holder made by convalescent seaman of parts from smashed planes

creased capacity for producing aluminum that the United States built up during the war, many times the amount of aluminum that was used before the war is available today.

Mare Island and other Navy yards that repair battle-damaged warships maintain vast scrap and salvage areas. Twisted deck

Below, left, clips from the wall of a bomber navigator's compartment serve as a handy spice rack for kitchen use. Center, bakery rack made from warplane aluminum scrap. Right, newsstand built from scrap aluminum





Soldier recuperating from war wounds learns how to design and fashion useful and decorative items from scrap aircraft copper and leather

plates, smashed funnels and even armored turrets that may have taken direct hits may all be removed from a ship that is in for repairs. These structural items are cut up for easy handling and returned to steel plants as scrap.

Salvaged parts that are removed from scrapped vessels or from ships that go through a modernization process go into the salvage "store." Here hundreds of electric motors, thousands of valves and pipe fit-

ting are left over in any manufacturing process. Douglas Aircraft Company produced 30 to 60 tons of scrap per month, ranging from stainless steel and aluminum alloy to leather and bits of plastic. Some of these materials can be used again but much of the scrap goes instead to Army and Navy hospitals and hospital ships. Convalescing servicemen, if provided with a few simple tools, turn out many handicraft articles from scrap materials while recuperating.

MOBILE PLANT EXTRACTS DRUGS TO TREAT MALARIA VICTIMS

Developed by the Cinchona Research Unit of the U. S. Army Engineer Board, a portable unit extracts antimalaria drugs from the bark of cinchona trees where they grow. This saves shipping tons of the dried bark to this country. The drug which is extracted is totaquina which contains quinine and other related chemicals. The extracting plant consists chiefly of three fabric bags about five feet high, watertight and resistant to acid and alkali, three tall metal cylinders, a small gasoline pump and a set of fabric drying trays. Mash made from the fresh bark is pumped through metal cylinders containing material re-

sembling charcoal. Several steps later a dark red liquid poured on the drying screens is collected as pink powder. This is totaquina, known as "poor man's quinine."

Paper Waste Improves Concrete

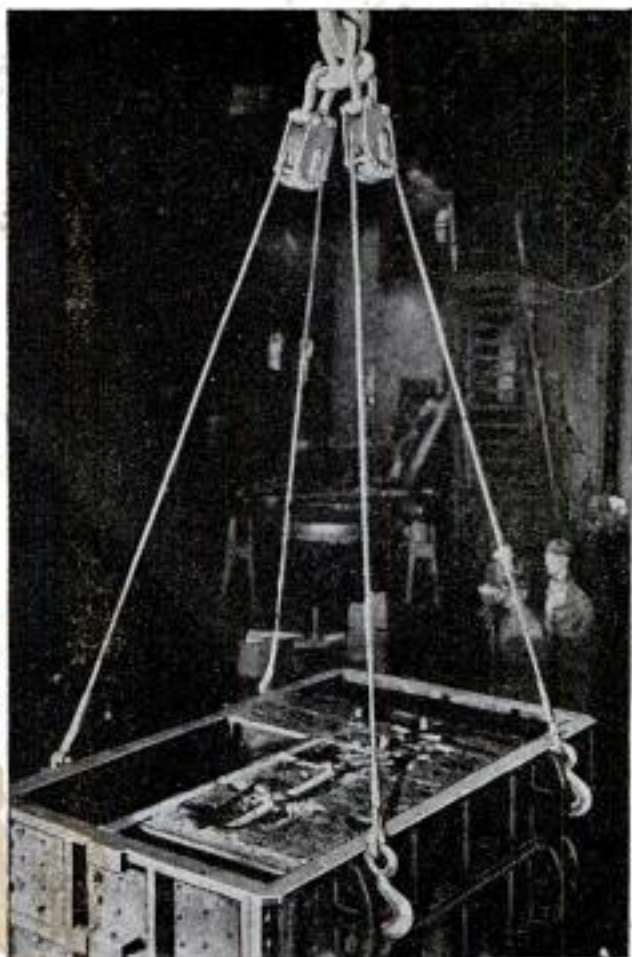
Tests conducted at Ohio State University show that cement produced with addition of calcium lignosulfonate, made from paper mill waste, lasts four to five times longer than ordinary concrete. The lignin product disperses cement particles by electrostatic action, preventing bunching which doesn't let all the particles get wet.

tings, scores of Diesel generator sets and other equipment are readied for service again.

At regular intervals the Mare Island salvage officer sent lists of the items he had on hand to the Navy's forward bases in the Pacific so that distant repair departments could draw on him for things they needed. Frequently, too, a ship that put in at Mare Island found that the salvage department could provide it with vitally needed gear that otherwise would have had to be shipped west from an eastern factory.

The salvaging of lumber alone is a major item with the Navy. During a five-month period 2,500,000 board feet of lumber were salvaged and reissued for new uses at Mare Island, not counting 11,000 boxes reclaimed and used again as shipping containers. Mare Island salvage activities put back into service some 222,000 items of equipment last year.

Salvage begins at the war plants, for scraps of material



SELF-ADJUSTING SLING now on the market can lift heavy loads in a level position. A lightweight block containing wire rope is attached to the crane hook and the hook is lowered to the approximate center of gravity of the load. The sling is then attached. As the crane lifts, the ropes automatically adjust to level the load. When level, an automatic brake locks the cables to prevent slippage. Slings are available for lifting loads ranging from 1500 to 12,000 pounds



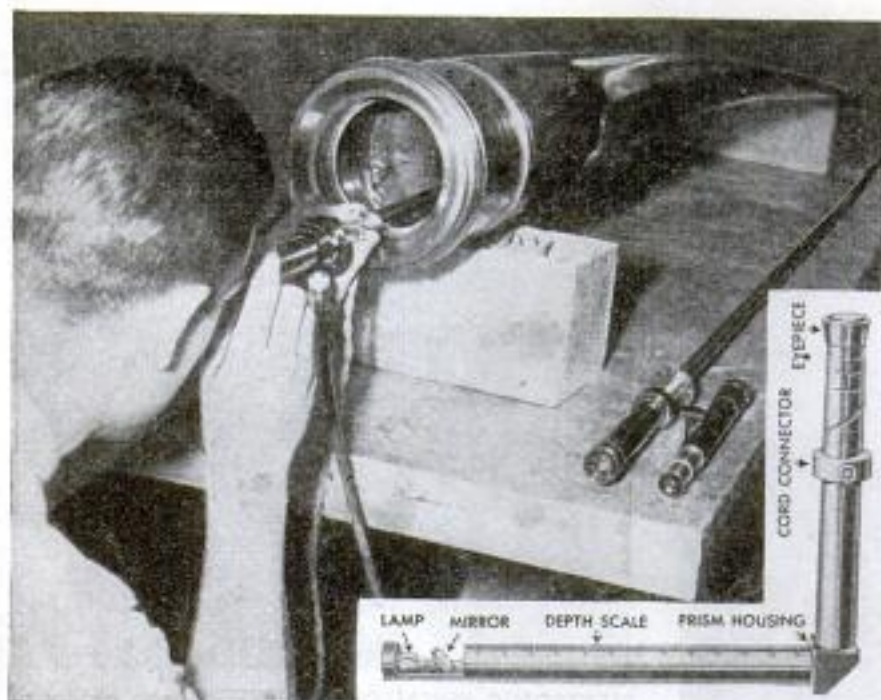
ORANGES BREATHE through 9000 pores per square inch into a specially designed respirometer that measures moisture and carbon dioxide content. Tests determine at what point an edible waxy solution stops the breathing when sprayed on the fruit. Breathing causes oranges to shrivel and lose flavor



ELECTRONIC "SWALLOW COUNTER" tests ability of airmen to withstand high altitudes. The tympanometer, developed by research engineers of Westinghouse Electric Corporation, has two oversize earphones into which are fitted two midget microwave transmitters that pick up and send out a record of eardrum movements or compensations, such as swallows, as the pilot adjusts himself to rarefied air. A receiver outside the test chamber records the data



SIREN ALARM guards locked doors of trailers used in supplying drugs and scarce commodities to a drugstore chain in California. The sirens, audible in a 800-1000-yard radius, are battery powered and can run continuously for hours. Time locks also make a record of each time a door is opened and closed



Borescope Looks Inside Gun Barrel

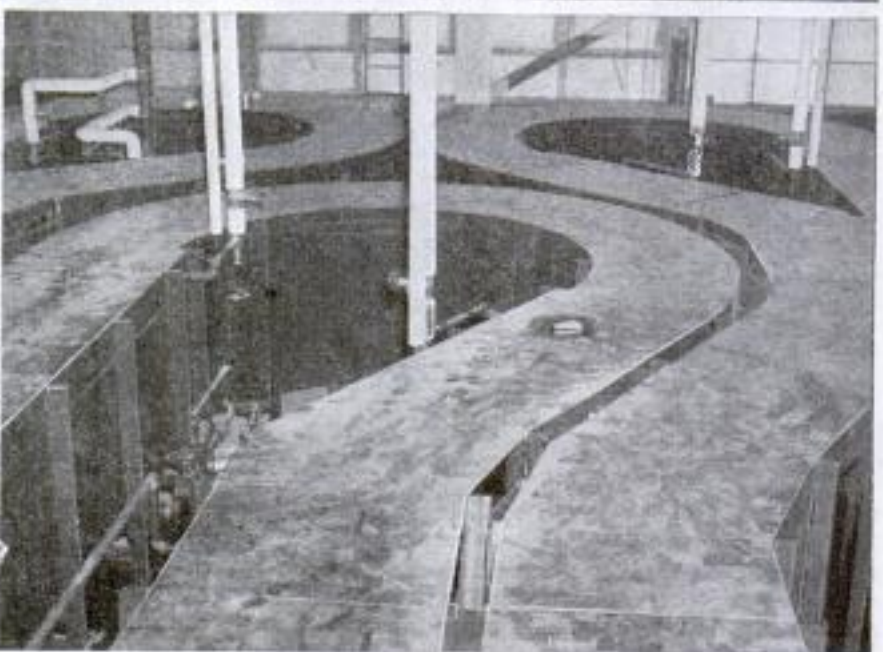
With an instrument operating somewhat on the principle of a periscope, the inner walls of gun barrels, engine cylinders or similar objects can be closely inspected. An adjustable mirror at one end of the instrument, which is known as a Borescope, picks up an image of the chamber wall. This wall is lighted by two small incandescent lamps behind the mirror. The image is transmitted to the eyepiece on the other end of the Borescope through a prism and lens system.

"Wash Line" Maze For Engine Parts

Hundreds of engine parts removed from wornout engines are hung on an automatic conveyor cleaning line at the Rome, N. Y., Air Technical Service Command for a three-hour washing trip. The conveyor moves slowly and a labyrinth arrangement of the line permits packing more than 400 feet of tanks and washers into a space only 46 by 86 feet. The system cleans parts twice as fast as old procedures.

ATSC photos

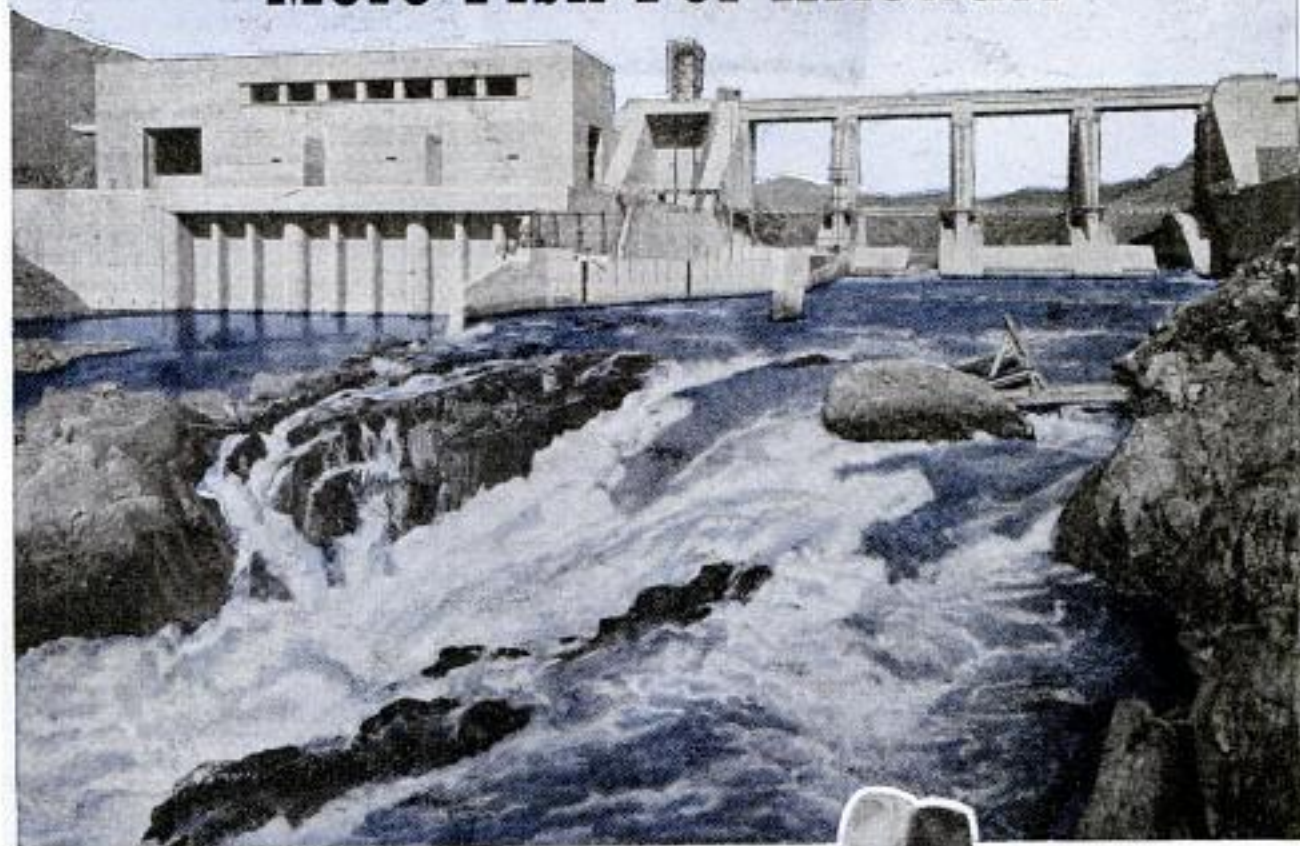
Baskets of engine parts, above right, emerge bright and clean after trip through labyrinth of tanks and washers shown below



Fluorescent Lights Don't Flicker

Flickerless fluorescent lights are now available for residents in the area of Niagara Falls, N. Y., and Toronto, Canada, where 25-cycle current is produced by water-driven turbines. Development of a special rectifier tube and voltage doubler circuit eliminates flickers in fluorescent lights operating on this current.

More Fish Per Kilowatt



By Joe Mears

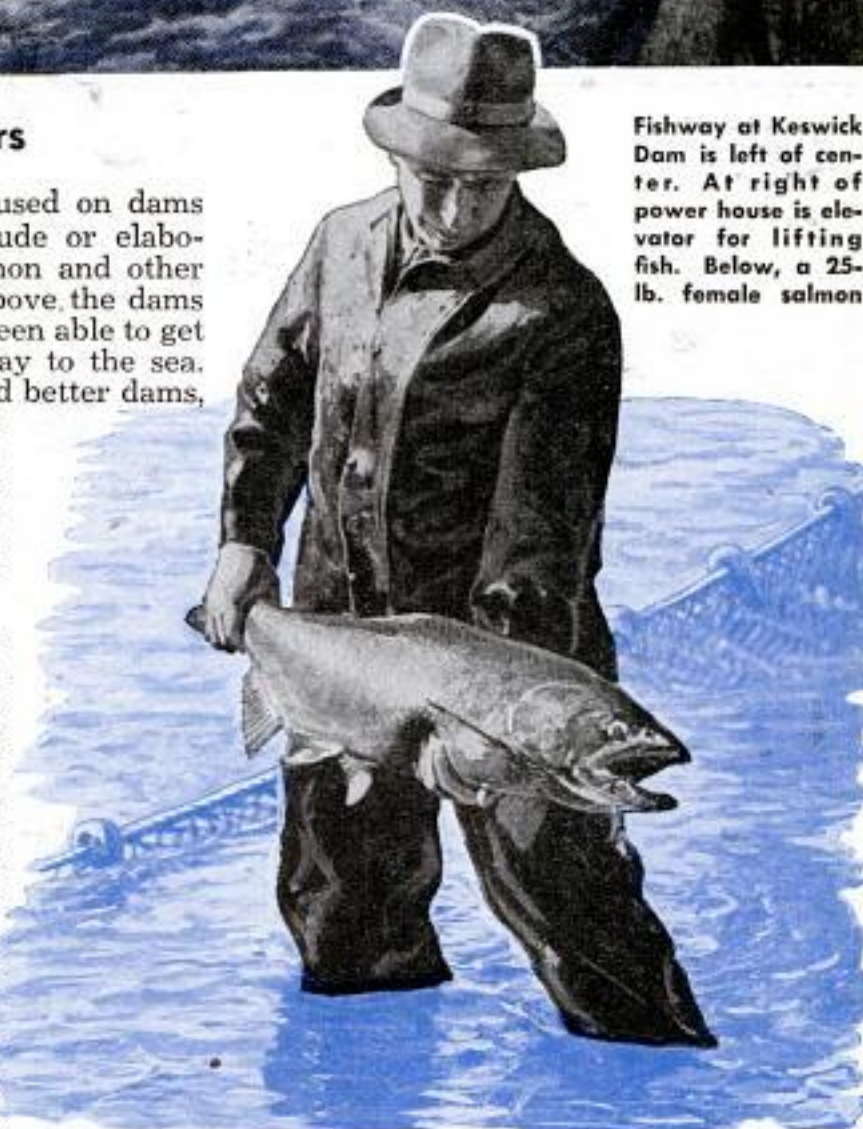
FISH ladders have been used on dams since colonial days. Crude or elaborate, they have helped salmon and other ocean fish fight their way above the dams to spawn. Young fish have been able to get past the ladders on their way to the sea.

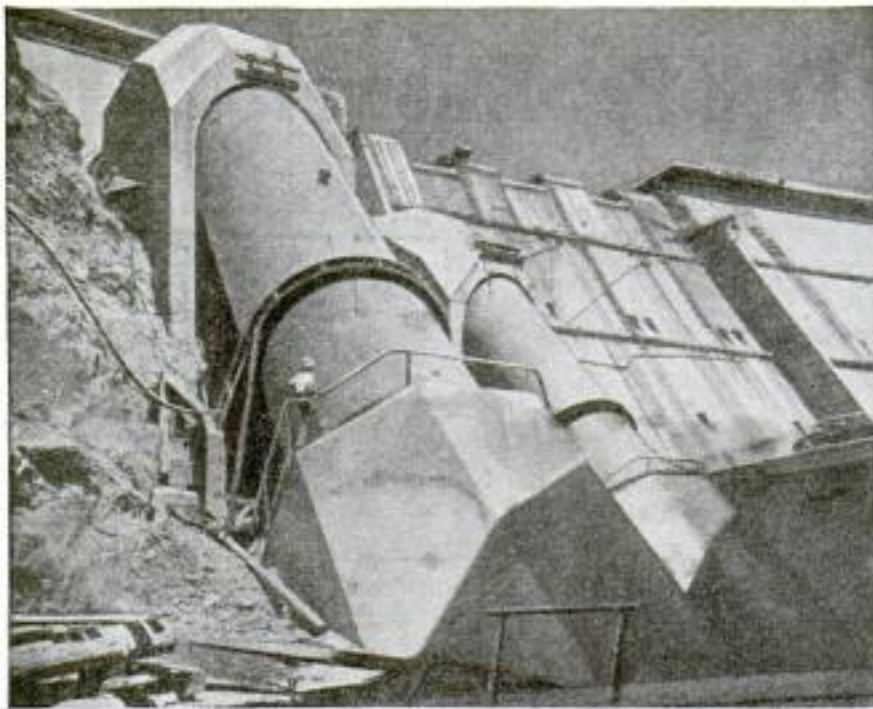
The demand for bigger and better dams, especially the higher types designed for producing electricity, has brought the plight of migratory fish to the attention of conservationists, sportsmen and commercial fishermen.

"It looks as if we've either got to cross the salmon with the flying fish," said a noted biologist, "or do something about this orgy of dam building!"

When the pressure of commercial and recreational interests became strong enough, protection of migratory fish from the bad effects of dams became big business. On the Columbia River in Oregon and Washington, \$10,000,000 was spent to protect part of the \$25,000,000 salmon fishery from the

Fishway at Keswick Dam is left of center. At right of power house is elevator for lifting fish. Below, a 25-lb. female salmon





Migrating fish have small chance for life in churning water within these giant penstocks of Shasta Dam

menace created by the Bonneville and Grand Coulee dams. On the Sacramento River in northern California, an initial sum of \$2,000,000 has been spent to salvage as much as possible out of the annual salmon run.

It's a far cry from primitive fish ladders on the Atlantic coast to the multimillion-dollar projects on the Columbia and Sacramento. The development has been gradual. Every large-scale experimental project has required tedious trial-and-error research with mechanical guinea pigs.

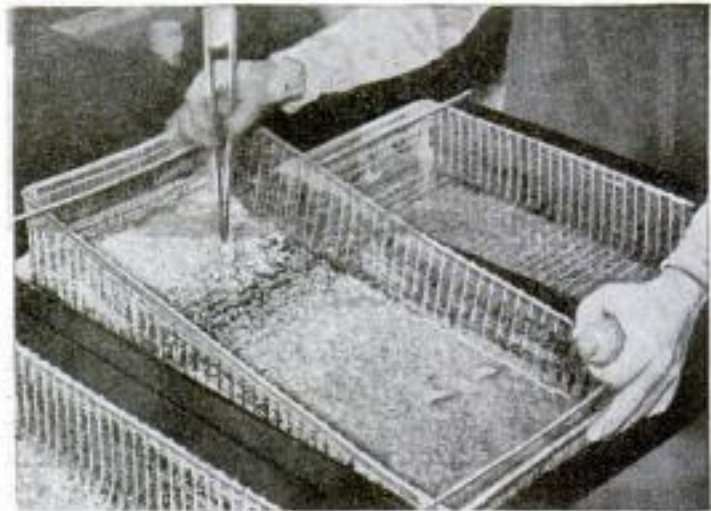
Guinea pig No. 1 was the Bonneville project. There more than \$7,000,000 was spent on ladders and other devices designed to give passage to salmon and steelhead runs. Bonneville, 146 miles from the mouth of the Columbia, formed a 75-foot high barrier to fish fighting upstream to spawn.

Due to the moderate height of the dam, fish ladders worked well at first. As results became apparent, hopes of scientists of the Bureau of Reclamation and the Fish and Wildlife Service appear to have been premature. The Department of the Interior recently announced that Chinook salmon passing over Bonneville Dam have decreased to the lowest number recorded. In 1938, when the first count was made, 272,158 salmon went over the dam. The number rose to 461,713 in 1941 but since has declined sharply. In 1944 checkers

at the dam counted only 241,718.

The Fish and Wildlife Service blames this decline on construction of dams on the Columbia River and its tributaries which blocked the fish from their traditional spawning grounds, drying up of streams by use of water for irrigation, death of young salmon in irrigation ditches, overfishing due to lack of controls, water pollution chiefly from sewage and industrial waste, and erosion which has damaged spawning beds.

Young migrating salmon and steelhead must



Bad eggs are sorted out in fish hatchery used to stock 151-mile reservoir behind Grand Coulee Dam. Below, fish ladder at Keswick Dam on the Sacramento River where migrating salmon are trapped



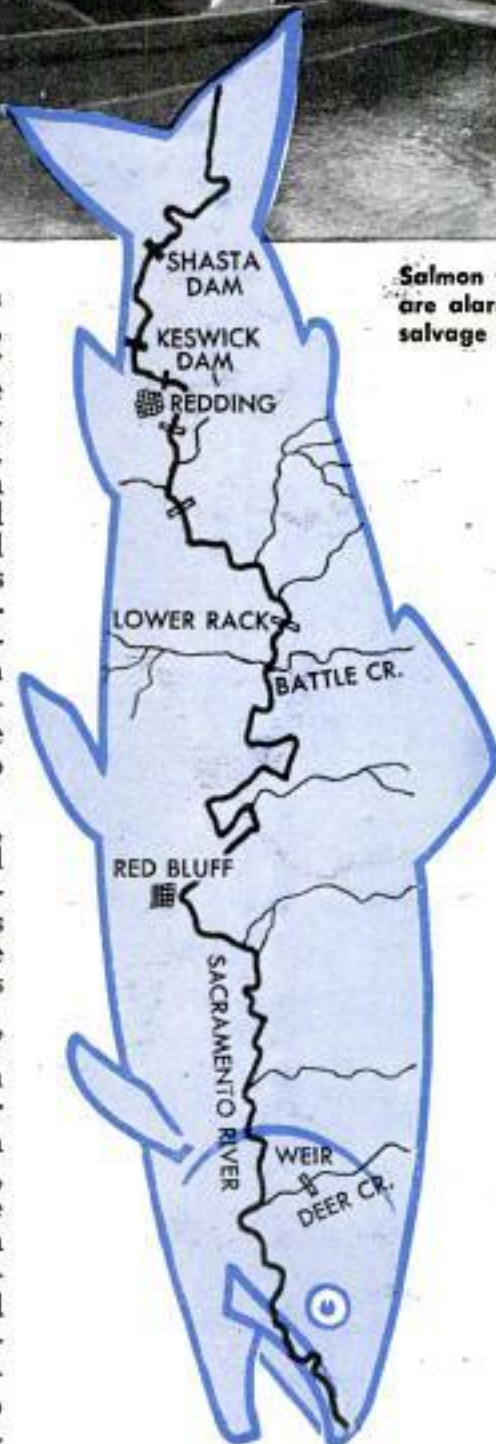


Salmon fishermen who enjoy catches like this are alarmed at threat of dams. Left, salmon salvage project on Sacramento cost \$2,000,000

pass through the dam on their way to the ocean, where they live for four years until they are ready to follow the age-old urge to multiply. Checkers have seen large chunks of wood pass undamaged through the penstocks of the huge hydroelectric plant, but they wonder if many salmon could survive the turbulence created by the vast outrush of pent-up water.

Dr. Ira W. Gabrielson, chief of the Fish and Wildlife Service, believes that engineers and the public may be oversold on the success of fish ladders.

"We are justified," says Dr. Gabrielson, "in being encouraged over the success attained in the upstream migration, but the success of the downstream migration is still an unknown factor. No successful means has been developed to guide downstream migrants into fishways and fish lad-



ders. Many fingerling fish probably are destroyed when passing through the turbines and over high dams."

The Fish and Wildlife Service's guinea pig No. 2 is at Grand Coulee Dam on the upper Columbia River, 450 miles above Bonneville, where \$3,500,000 has been spent for investigations, hatcheries, tank trucks and other devices. There is a growing belief that the entire project is more or less of a failure. It will take a couple of years more before scientists complete studies to determine how many salmon trapped below the dam and transported in tank trucks to side streams actually survived to spawn in the unfamiliar environment and how many small salmon were produced.

Regarding the survival of artificially spawned, hatchery reared salmon fingerlings, further studies will be required, but researchers don't think the results will justify the high cost.



Removing eggs from salmon in hatchery; they will be fertilized, hatched, and young fish placed in river

More hope is held out for success in the fight to get more fish per kilowatt-hour at guinea pig No. 3, the salmon salvage project at Shasta Dam on the upper Sacramento River. Many of the earlier mistakes of the Bonneville and Grand Coulee Dam experiments have been avoided.

The Sacramento is not nearly as important a salmon stream as the Columbia, but it is extremely valuable as an economic

and recreational factor in California. As a vital part of the vast Central Valleys project, in which more than 200,000 licensed sport anglers fished in 1941, the Sacramento's future welfare has aroused sportsmen and conservationists.

Chief consultant of the Shasta salvage project was Dr. Willis H. Rich, professor of biology at Stanford University. Dr. Paul R. Needham, for many years aquatic biologist of the Fish and Wildlife Service, renowned for his Pacific Coast trout investigations and now director of fisheries for the Oregon State Game Commission, directed the field work. Dr. James



Trap tank is loaded with salmon which are later put in tank truck for ride to hatchery. Below, 35-mile lake backed up by Shasta is fisherman's paradise



W. Moffett, aquatic biologist, is now in charge of the project.

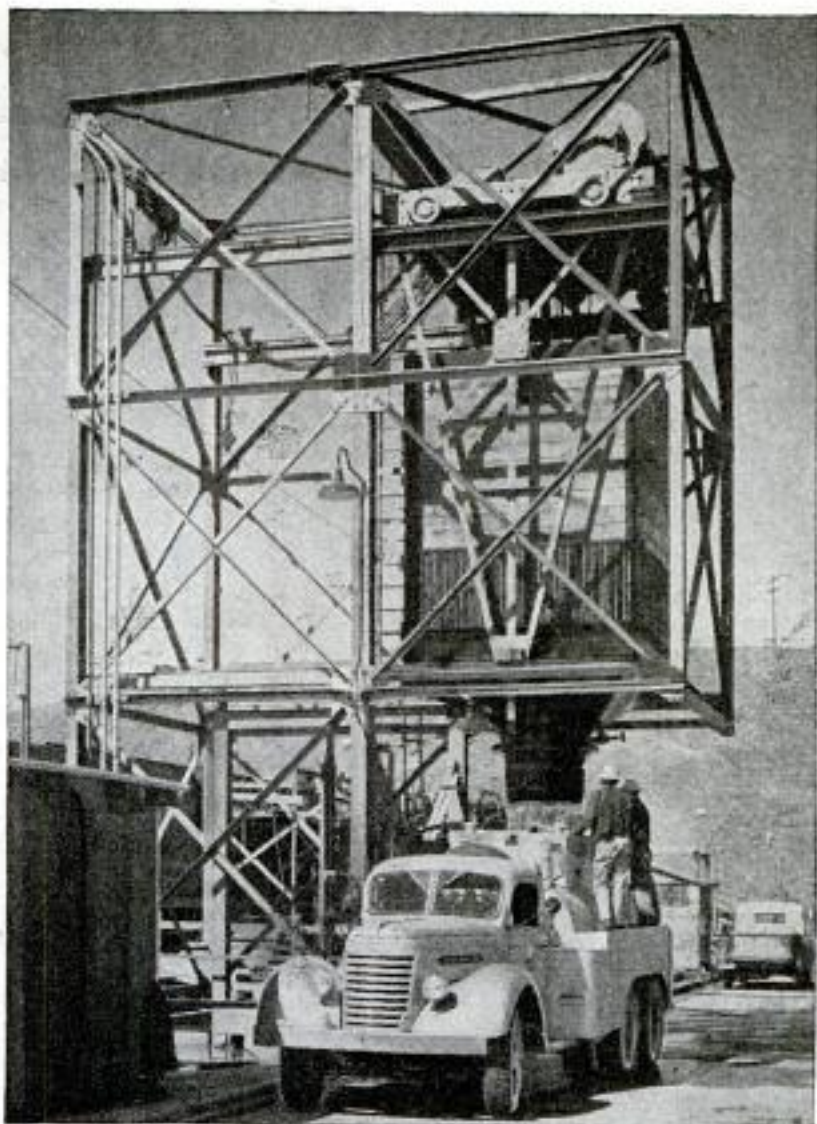
Shasta Dam, like Grand Coulee, formed an impassable barrier because of its height and nature of construction. Shasta is of the gravity type, 602 feet high, higher than the Washington Monument. It is two thirds of a mile long on top. Three rivers, the Sacramento, Pit and McCloud, eventually will be backed up in their deep canyons as far as 35 miles, forming a great mountain lake.

"Although it might be possible and practical," said Dr. Needham, "to transfer adult salmon over the dam on their spawning migrations, nothing is known as to how they would react when confronted with the slack waters of the reservoir. If the adult salmon migrated up through the reservoir and spawned successfully in the streams above, there would still be the problem of getting the young down past the dam on their way to the sea."

If the young salmon did get past Shasta Dam, they would meet similar dangers at Keswick Dam, nine miles below, which was built to regulate stream flow and generate added power. It was decided that the mortality of fish would be too great to make the transfer of adult salmon above Shasta Dam worth while.

The Shasta salvage plan adopted by the Bureau of Reclamation is essentially simple. It calls for three separate operations. From January 1 to June 15 of each year, 10,000 spring-run salmon are transferred to Deer Creek, a tributary of the Sacramento, in tank trucks, and 2000 spring-run fish are taken to the Fish and Wildlife Service hatchery at Battle Creek to be held until ready for artificial propagation. From June 16 to October 10, 18,000 summer and early fall-run salmon are transferred to the Battle Creek hatchery. From October 1 to December 31, a fall-spawning plan is inaugurated

(Continued to page 152)

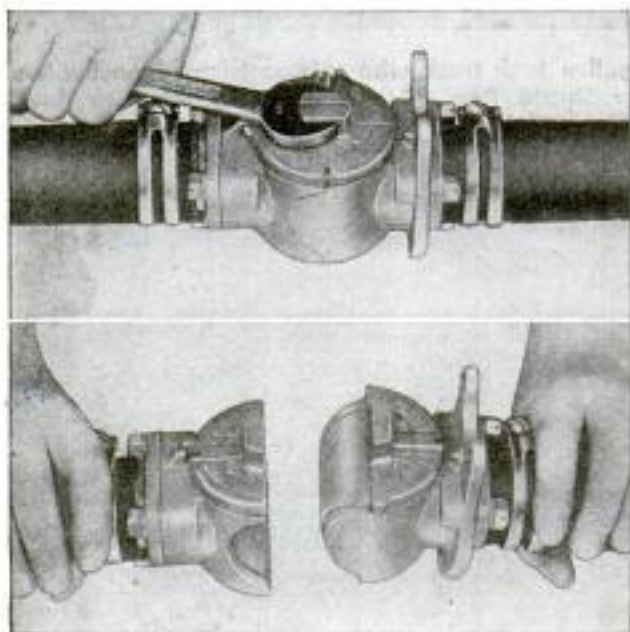


Loading 10,000-gallon tank truck with salmon trapped on ladders of barrier below Shasta Dam. Below, releasing fish into creek U. S. Fish and Wildlife Service photo





LIFE'S A GRIND to the Briton who coupled the rear wheel of his bicycle to a grindstone with a belt, and travels the countryside sharpening housewives' cutlery. The bicycle lets him cover a wide area and his own sturdy legs provide all the power he needs



QUICK SEALING is provided for fuel, oil and hydraulic lines by a coupling which can be disconnected with a quarter-turn. Leakage or formation of dangerous vapors are prevented by the quick action. Both ends of the lines are sealed despite the disconnection and either may be opened again for drainage. Reconnection is simply and easily made. Developed for fast servicing of war planes, the coupling is being adapted for use in factories, foundries, refineries and laboratories where lines carry liquid products

"SHOT TREATMENT"

LABORATORIES often are full of smocked technicians and scientific equipment, but Mishawaka, Ind., boasts one that is far different. Its job is to pepper parts of engines and other war equipment with shot for a few seconds, then return them to their maker with a report on the process, known as shot peening.

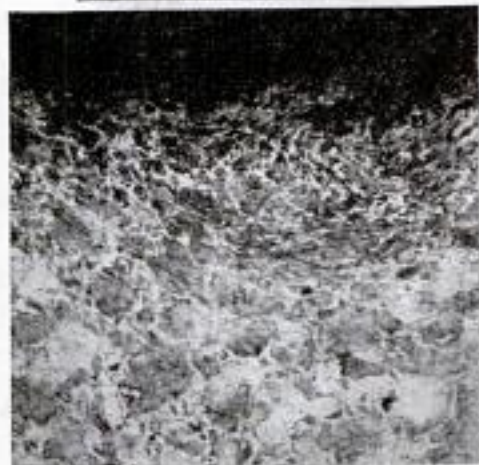
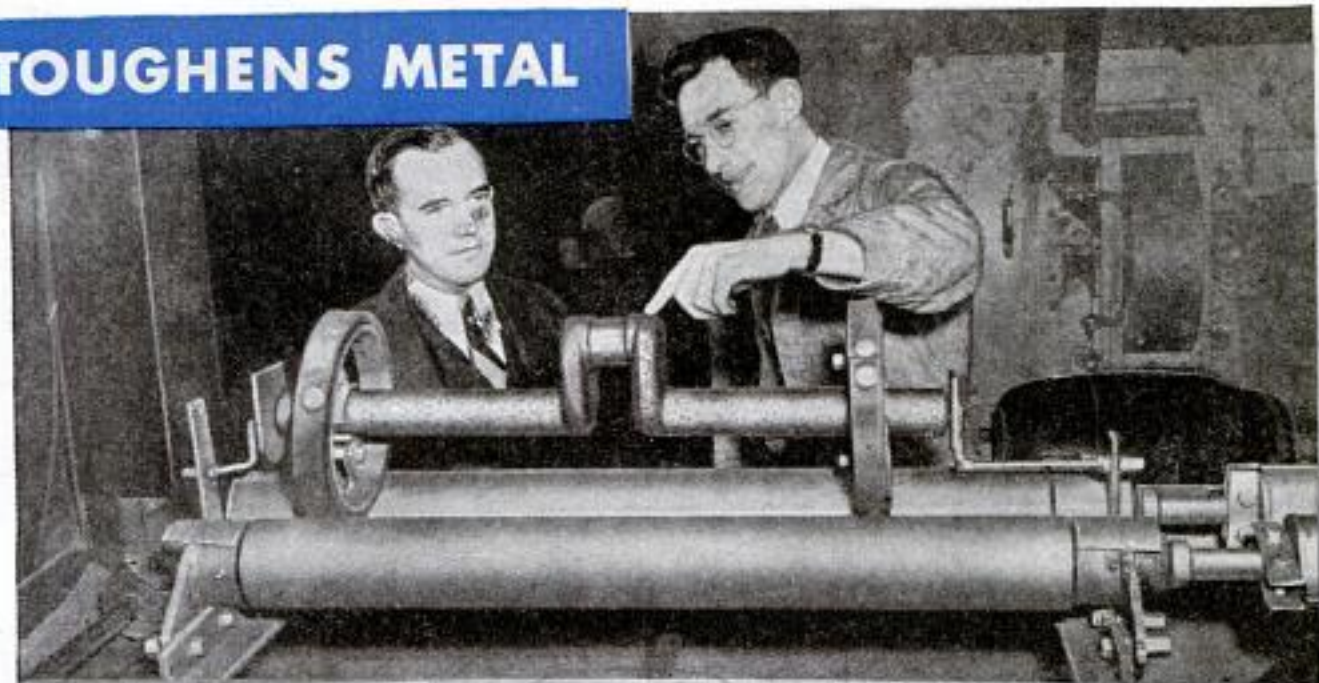
Centrifugal and tangential forces combine in modern peening machines to throw the shot with high velocity. Shot is fed to the center of a rapidly rotating wheel, called a Wheelabrator, and travels out along blades that throw the shot much as you would throw a ball. The shot are chilled iron drops produced by molten cupola iron falling from a height into water.

Results of the process are: Higher rating of aircraft engines with no weight increase; less weight of engine parts with no decrease in strength; normal life for parts that had been failing prematurely; use of less expensive steels without sacrificing strength; elimination of grinding and polishing. Springs peppered by the shot last up to 20 times longer than unpeened springs. A machine testing the life of peened gears ran so long that its own gears wore out and had to be replaced by peened gears.

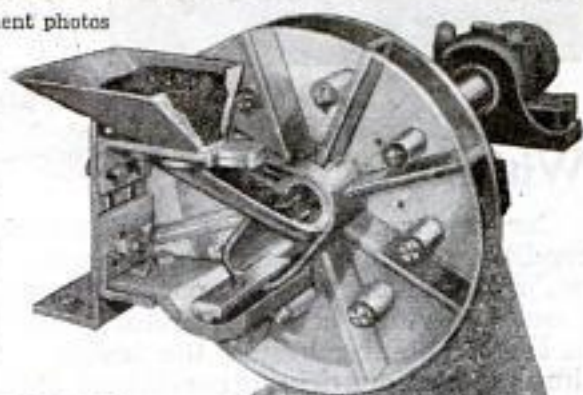
Shot peening produces a tougher outside layer on a metal part. The metal in this layer, only a few thousandths of an inch thick, is squeezed together by the rain of shot. Under alternate bending stresses, the compressed surface "gives" enough to forestall the tiny cracks which enlarge and cause failures.

Factories use shot peening machines in production of equipment. The laboratory's role is to establish standards that will maintain uniform results in manufacturing. A plant with its own peening machines may have breakage trouble with a crankshaft. It requires peening standards for time, size and direction of shot and other variables to maintain the best intensity of peening to a gauge height of .014-inch on sides and fillets of the shaft. Off to the laboratory goes the crankshaft. First the intensity is measured by gauge or arc height. When a strip of steel is peened on one flat side, squeezing of the surface layer causes the strip to become dished in shape. Amount of curvature represents intensity of peening, and is measured in thousandths of an inch. The operator uses a fixture and blocks holding test strips to determine the settings for the required intensity. Then the crankshaft itself is peened and returned to the manufacturer with the data.

TOUGHENS METAL



American Foundry Equipment photos
Crankshaft above has been shot peened in peening machine that hurled shot against it at high velocity. Process toughens part by squeezing metal in outside layer. Shot peened steel, left, magnified 200 times in microphoto, shows effect of shot barrage

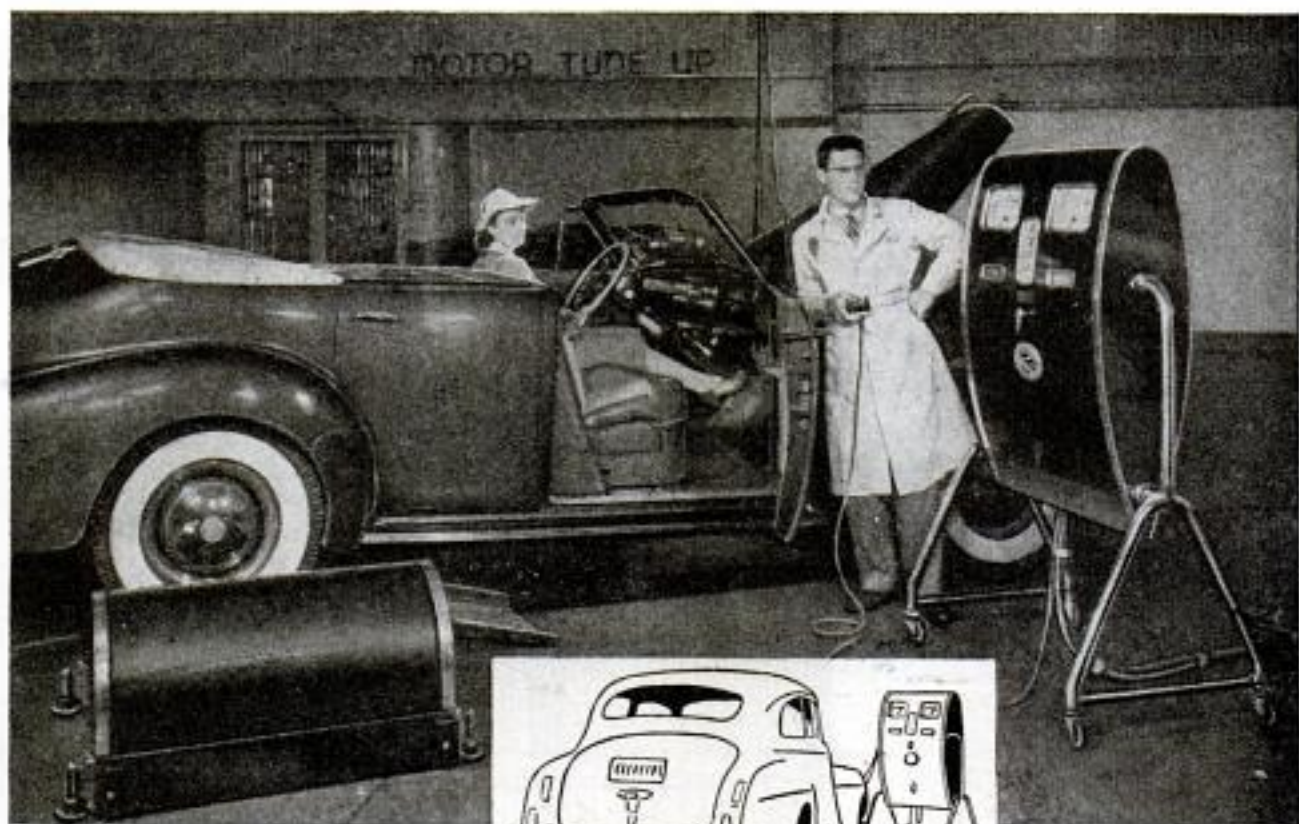


Shot in funnel of Wheelabrator above travels through opening in center to blades of rapidly rotating wheel and is hurled out against metal object



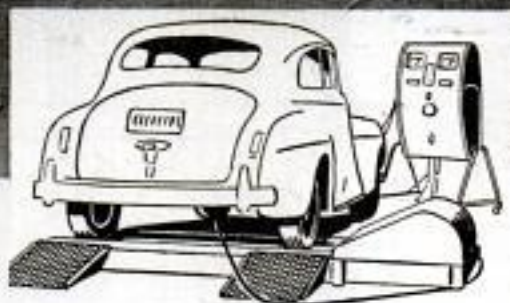
Above is the surface of shot peened steel, magnified seven times. Left, a Wheelabrator multi-table in action. Superimposed lines show the manner in which circular tables travel under blast of shot being applied to gears





Automobiles Tested Without Moving

Car performance under actual running conditions is shown without the car traveling an inch on a "vest-pocket" proving ground. Giving a complete motor diagnosis in five to eight minutes, the testing unit simulates various driving conditions. Press-



Testing unit requires only a small working area near automobile

ing a button subjects the car to conditions encountered in heavy traffic, on the open road, up a steep grade or under acceleration. The entire driving mechanism is checked and the performance of the individual parts is shown on an easily read dial.

Air-Boat Skims Over Mud Flats Covered With Only an Inch of Water

Employees of the Bear River Wildlife Refuge in Utah reach hitherto inaccessible regions with an air-propelled boat. Power unit and propeller are mounted several

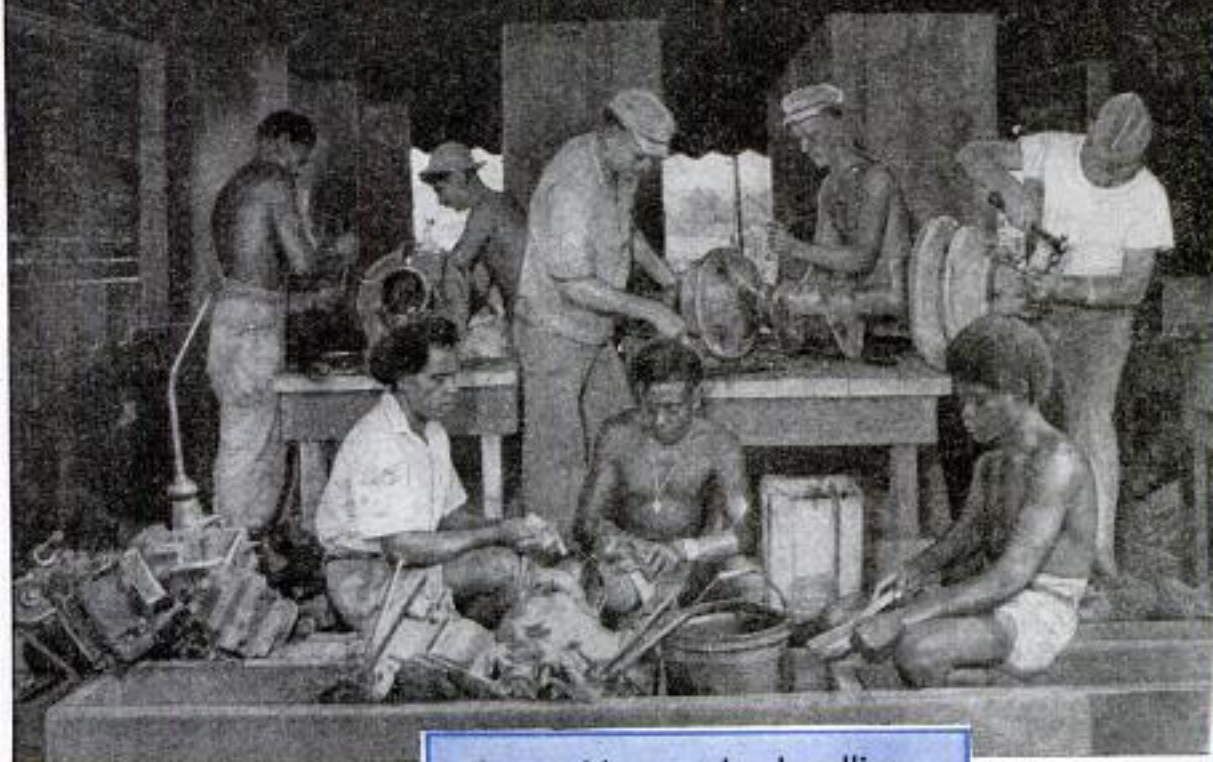
feet above the duralumin shell of the shallow craft. It will travel over mud flats covered with an inch or two of water and on a river or lake filled with aquatic plants. The air-boat is moved from one locality to another on a special trailer that can be backed into the water.



Nails Are "Shot" Into Steel Plates

Extensive postwar use is predicted for a "nail gun" used to patch holes in the hulls of sunken ships. A charge of explosive drives a steel nail an inch and a half into solid steel plates. The terrific impact has almost a welding effect and the joints are said to be as strong as if riveted.

Two Million Car Garage



**By Major
Theodore H. Erbe**

IF ORDNANCE shops had not been there to keep the trucks rolling and the guns firing, American troops still might be fighting the Germans and the Japs. These war garages helped vitally to end the war.

The army owns about two million vehicles; in 1944, it obtained five million tons of military equipment which the Ordnance Department maintains. Ordnance issues over 2500 different types of trucks, tanks, rifles, guns, mounts and instruments. It stocks better than half a million individual spare parts. To keep 100 Sherman tanks in the war during their first year alone, ordnance shops required 2800 different parts and assem-

They seldom make headlines, but the ordnance men who operated a worldwide garage and repair shop for 2,000,000 Army vehicles and more millions of weapons have performed a herculean task under orders from the boss: "Throw the red tape out the window!"

Malaita natives work with ordnance troops to repair wrecked Army vehicle parts and other smashed gear

What's a little thing like mud to a U. S. mechanic who knew jeeps had to keep going into Germany?





Soldiers with the 9th U. S. Army replace a tank track near front lines in Germany. Mobile repair crews kept equipment pushing on

Knowing that an army moves on its wheels, Lieutenant General Levin H. Campbell, chief of army ordnance, told his Department: "When red tape interferes with business, throw the red tape out the window. Accept this, please, as a personal order from me!" His troops around the world took this sage advice and won commendations from such generals as Eisenhower, Devers, Patton.

Ordnance field shops, manned by soldiers sometimes augmented by civilians, rendered vital service in China, Alaska, Egypt and Okinawa. They frequently went ashore on D-day, ducking bullets and repairing equipment at the same time. The Stilwell lifeline to China could not have been built without their help. With the largest fleet of trucks in the world to maintain, these globe-spread shops had less than four vehicles in

blies, including a total of 528,772 individual pieces packed in 5212 containers.

In performing this astronomical repair job, ordnance shops daily repaired tens of thousands of field failures, sometimes under enemy fire. Ordnance troops in the 1st Army alone numbered over 15,000, scattered about in an area from 75 to 150 miles wide and up to 300 miles deep; they handled 2500 tons of supplies each day.

each 100 held up for more than four days. Now much of their story can be told.

The army maintains its gargantuan fleet in good repair by organizing all repair work into five echelons (levels). Servicing work and minor repairs, the first two echelons, were accomplished by the units using the trucks or weapons. Ordnance troops in the field performed the remaining three echelons of work. These included

Below, left, GI uses metal spray gun to rebuild broken bulldozer track. Right, fixing faulty transmission

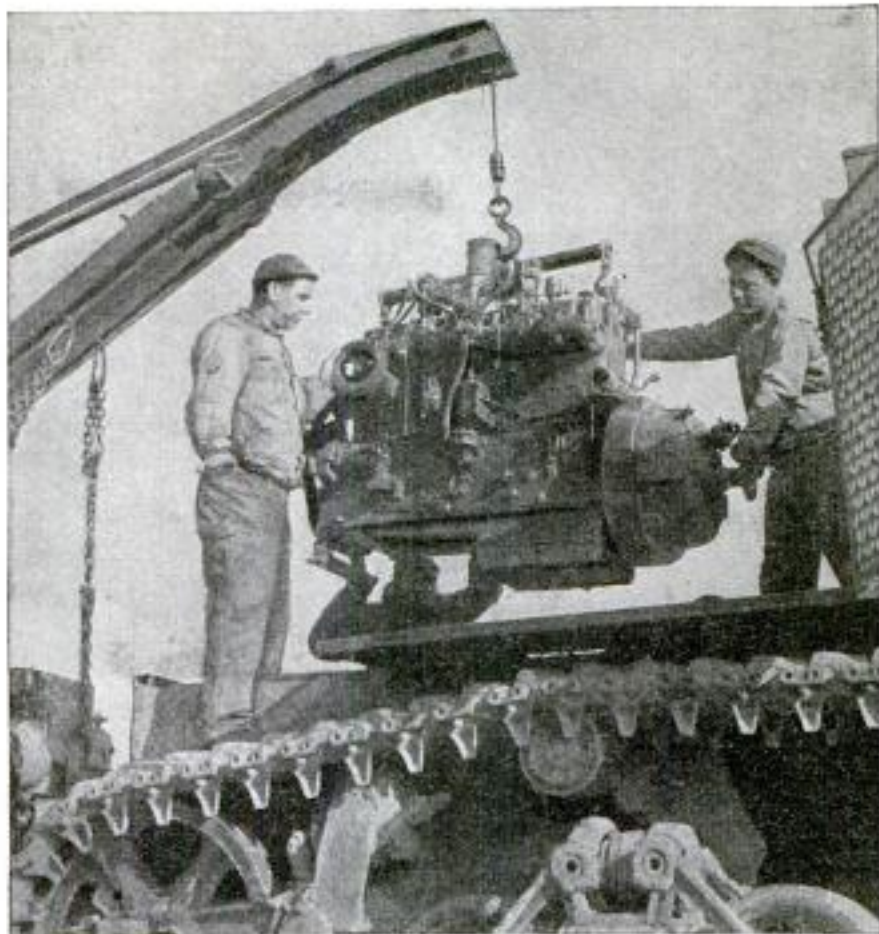


medium, heavy and base maintenance.

Mechanics from these shops invariably moved to the front to do much of their work. Contact parties, road patrols and inspection teams from field shops constantly worked in forward areas. Some ordnance men plied their trades at artillery gun positions and, when they couldn't repair a gun, called back to the shops for a new weapon. One outfit in the 3rd Infantry Division built a truck-borne miniature shop which always worked with front-line combat regiments to render immediate service. Mechanics in Burma once rode horses over pack trails to repair rifles at the front.

The operation of field shops is best understood by tracing a disabled truck or gun from front to rear until it is fully reconditioned. If a Jap gunner knocked out an American 2½-ton GMC truck, for example, what happened?

First, it was removed rapidly from danger and evacuated to the rear by four or 10-ton wrecking vehicles that towed it to a collection point behind the lines. Here all damaged or wrecked vehicles were assembled for processing through the army's giant maintenance system. Huge armored tractor-trailers called "dragon wagons"—able to carry 40 tons of tank without a murmur—hailed disabled tanks and armored

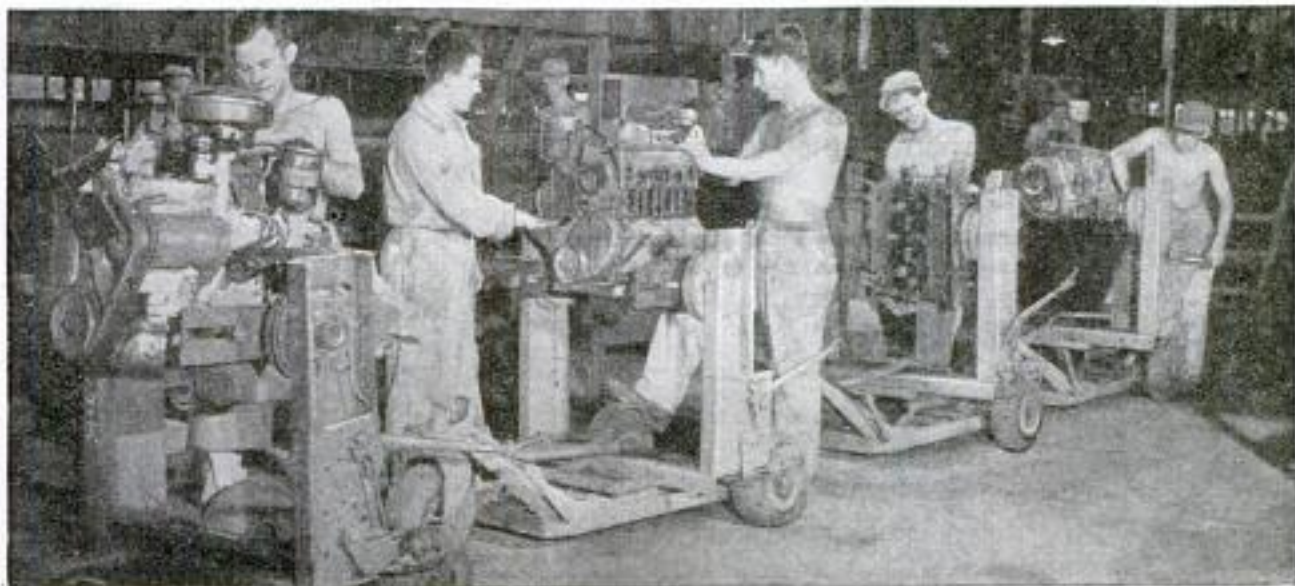


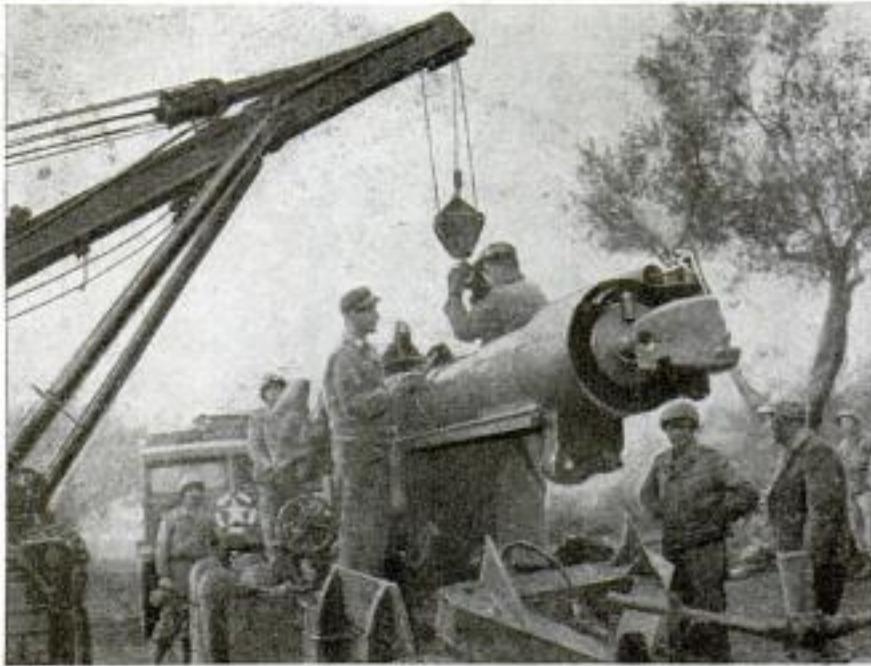
The job of repairing a tank is speeded up by installing a rebuilt engine

vehicles to this point. Ordnance contact parties inspected and repaired what units they could. Men from the division's light maintenance company worked here to the same end. But if these efforts failed to repair the damaged GMC, the truck was sent back to nondivisional ordnance shops.

It arrived at a well concealed medium maintenance company in bivouac from five to 25 miles behind the fighting lines. This fully mobile unit was staffed by six officers, one warrant officer and 169 enlisted men;

To keep 'em rolling, ordnance men operated an engine assembly line in their automotive shop on Guadalcanal





Jeeps or guns, Ordnance kept them fighting; changing a 155-mm. gun tube

its equipment was mounted on trucks for rapid movement, and its personnel frequently worked 20 or 24 hours a day. The unit in standard operation supported one infantry division of 15,000 men with medium or third echelon maintenance. Some medium companies served with the same divisions in both World Wars.

Inspectors checked the damage to the GMC truck, shop office clerks in the field headquarters wrote up a work order directing repairs, and wreckers towed the GMC to the automotive platoon. This group, one of three major parts in the shop, was prepared to change engines, radiators, assemblies such as starters and generators, and perform any type of medium work requiring a reasonable investment of time. The mechanics in this automotive platoon worked in the open, regardless of rain, mud and lack of shelter, often producing from 750 to 1000 completed repair jobs a month. They were forbidden to remove their tools and equipment from camouflaged trucks as this might slow up a sudden movement.

While the automotive mechanics were at work, men from the armament platoon re-

paired a broken machine gun on the damaged truck. Their tools and benches likewise were mounted in shop trucks. These specialists repaired all small arms, divisional artillery pieces up to 105 mm., instruments and fire control items. They even repaired watches.

When either the automotive or armament mechanics needed parts or supplies, they sent to the service and supply platoon which carried a full load of spare parts in specially designed trucks. These men calculated their stockages on the exact numbers of guns, weapons and other items

of equipment for which the shop was responsible. If the service and supply men didn't have the part required, they called upon their machine shop trucks. Crews in these vehicles manufactured vital parts, jigs, tools and fixtures.

If the medium shop mechanics reported that they could not repair the damaged GMC within 24 hours, the vehicle was towed back to a heavy maintenance field shop. Somewhat further behind the fighting, well out of any enemy artillery fire, this heavy shop was only semimobile and moved as infrequently as possible to avoid interrupting its highly technical work. While similar in organization and operation to the medium companies, this heavy company had far more time, tools and skill with which to work. It had a far larger responsibility, too, for it supported at least four infantry divisions and perhaps an entire field army.

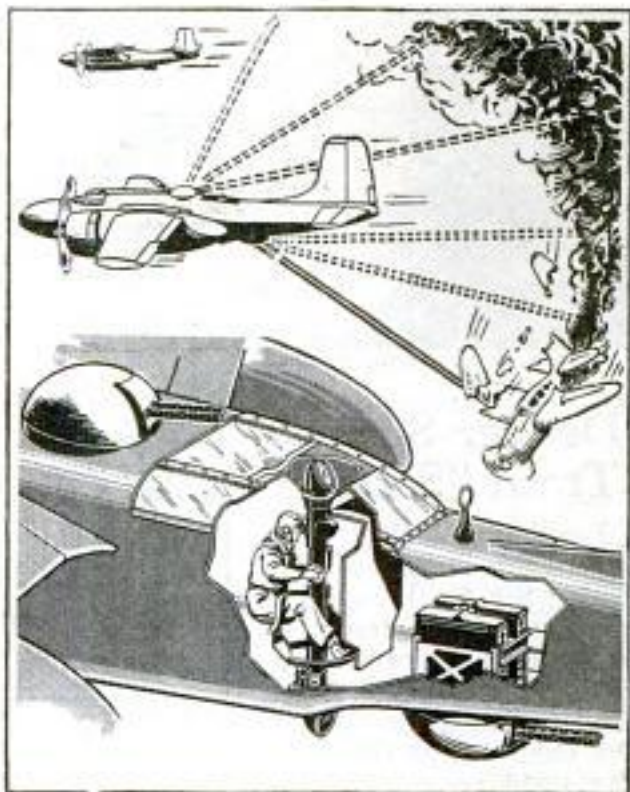
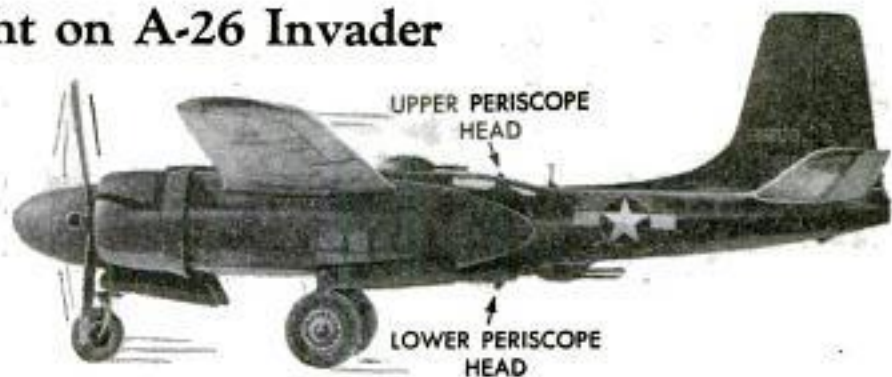
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U. S. "dragon wagon" using steel winch-powered cables picks up a disabled tank in three minutes for trip to GI garage



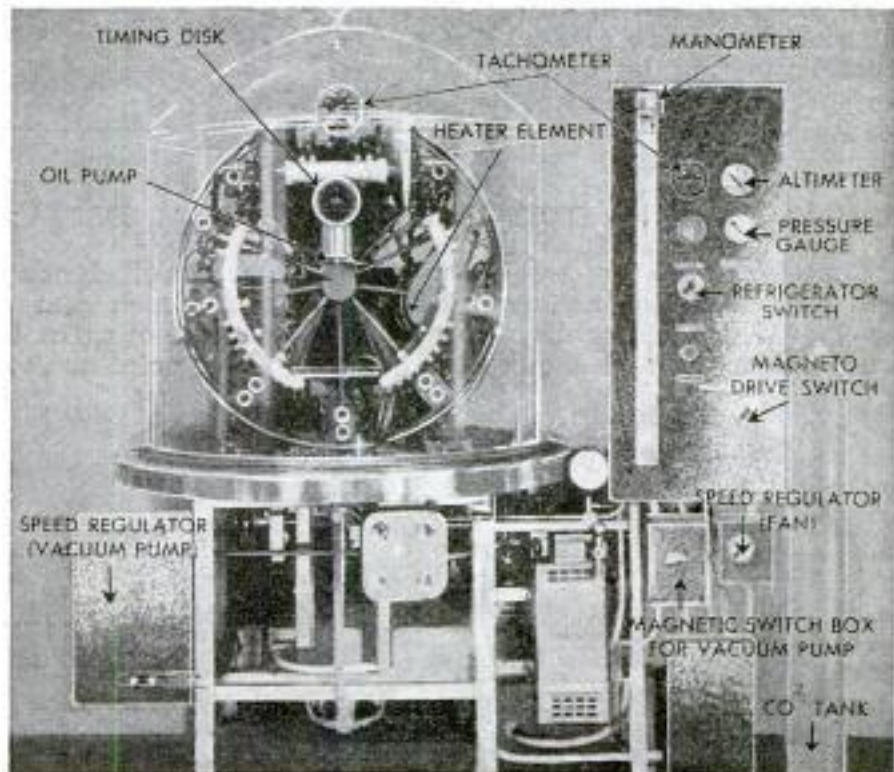
Periscope Gunsight on A-26 Invader

Developed in the final stage of the war, a periscope gunsight on the A-26 Invader enables a gunner to see in almost any direction. The periscope has a sight head on either end and passes completely through the fuselage. With a flip-over mirror the gunner's line of sight is transferred from one end of the periscope to the other. The sight is linked by remote control with two gun turrets which are operated by a single gunner on the medium bomber. As the gunner tracks an attacking plane on a dive which starts high above his own ship and passes far beneath, he can do so without once losing sight of the target. The gun turrets follow movements of the periscope sight and fire is switched automatically from one turret to another. This revolutionary gunnery system was designed and built by General Electric.

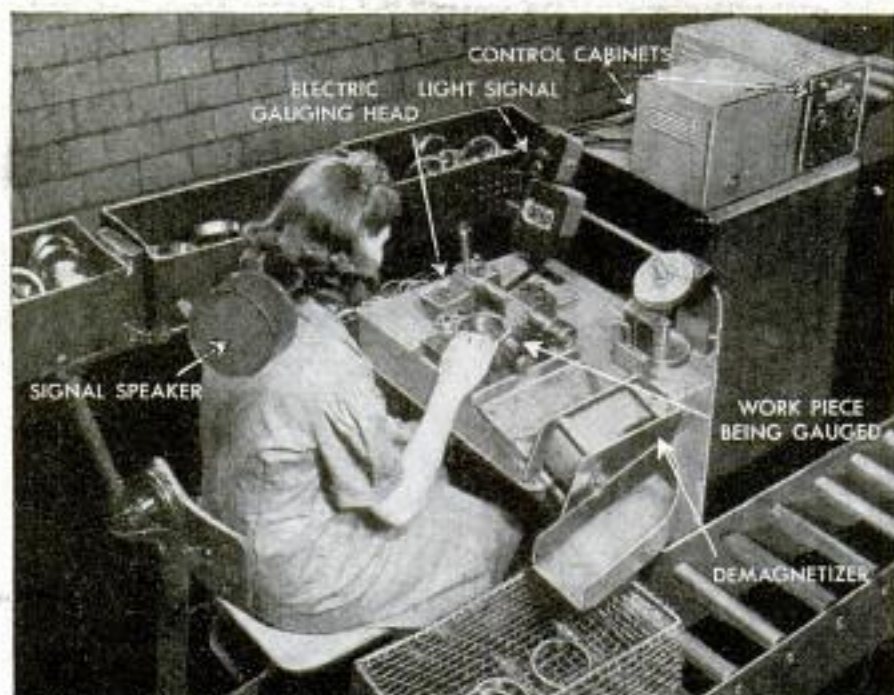


Stratosphere Brought to Earth In Bell Jar Test Chamber

Intense cold and extremely low pressure encountered at great heights are duplicated in a huge Plexiglas bell jar test chamber developed by Wright Aeronautical Corporation technicians. Reactions of ignition systems to the stratospheric air can be observed through the transparent sides of the jar. Besides the airtight dome chamber, equipment includes a refrigerating device that simulates sub-zero temperatures of five-mile heights or more. The dome weighs 350 pounds, furnishing a good air seal when resting on the rubber gasket which rims the edge of the platform. When necessary, a hoist lifts the dome from the platform. Parts of the ignition system being tested are powered by an electric motor. The refrigeration unit is specially built for the purpose. An instrument panel used in testing has a mercury manometer registering pressure within the dome, an altimeter and an electric tachometer.



Blind Inspect Roller Bearings by Electronic Sound Gauge

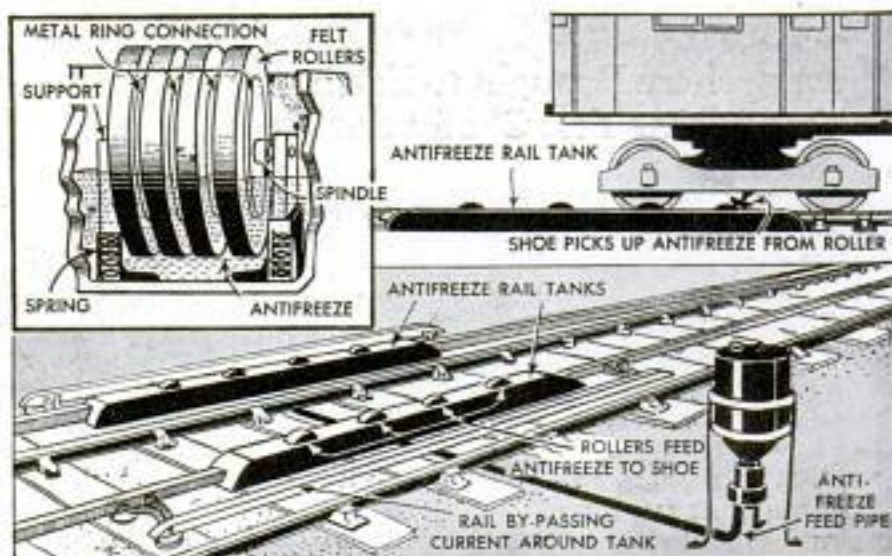


Timken Roller Bearing Co. photo

Fine tolerances in roller bearings are measured by a new electronic precision gauge which permits blind persons to inspect the work by sound. An electronic oscillator sounds a high note through a loudspeaker at the inspector's chair if the bearing is oversized, a low note if undersized, and a middle note if it is accurate. There are also three indicator lights on the system which enable a supervisor to make a quick visual check. The sensitive electronic gauge is accurate to within one five-millionth of an inch.

De-Icer Sprays Train "Shoes"

London's electric subway trains automatically de-ice the track as they go along. Four steel and felt rollers revolve in a bath of de-icing fluid next to the track. When the steel power shoes of the train pass over the rollers, the latter spin and smear each shoe with an antifreeze solution eliminating the need for special sleet trains or trackmen.

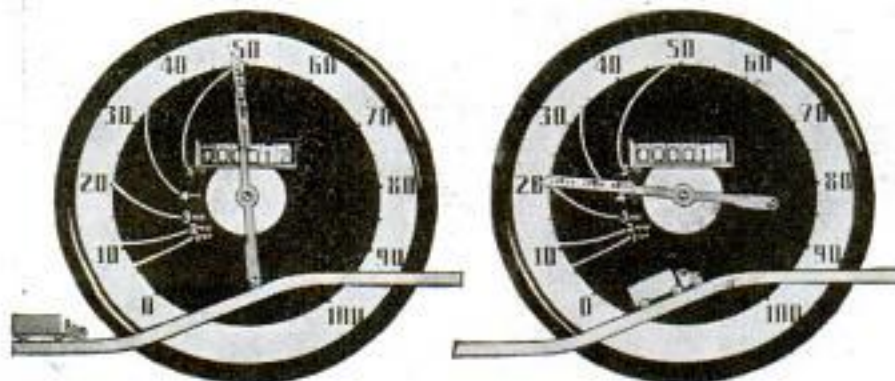


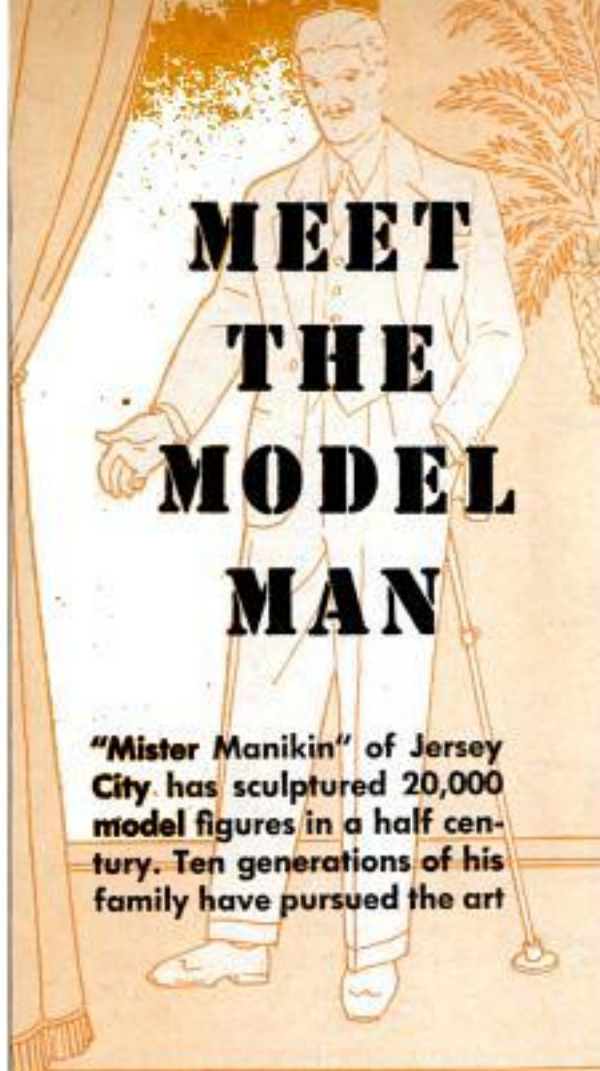
London News-Chronicle sketch

Dial Tells When to Shift Gears for Greatest Efficiency

Combining the features of speedometer and tachometer, an instrument developed by the White Motor Company tells the truck driver when he should shift gears for

most efficient operation. A spiral white line for each gear appears on the dial and a scale of r.p.m. is printed on the speedometer pointer. As the pointer moves around the dial, its edge crosses the spiral white line for each gear, showing the r.p.m. A white area on the pointer indicates the ideal range of 1700 to 2400 r.p.m. and a red area shows the engine is outside this range. When the end of the pointer touches the end of a gear line, a shift is indicated.





MEET THE MODEL MAN

"Mister Manikin" of Jersey City has sculptured 20,000 model figures in a half century. Ten generations of his family have pursued the art



Leopold S. Schmidt breaks mold and inspects face of wax manikin; cast marks will be scraped or melted off

IN and out of the fraternity of wax sculptors he is known as "Mister Manikin."

Leopold S. Schmidt of Jersey City, N. J., thinks more of that unofficial title than he would of a hundred Hollywood "Oscars." He is the 10th generation of a famous family of wax sculptors.

In the house that has been his home since 1900, Mr. Schmidt carves lifelike figures for show windows and museums. The house is living testimony to his tireless efforts. Clay dust covers everything, and magazine and newspaper cutouts are strewn about every room. His working studio, however, is in the back yard, a two-story wooden affair that was once a stable. Since "Mister Manikin" came to America in 1894, he has sculptured more than 20,000 individual wax figures, which is some kind of a record in this almost forgotten industry.

The Schmidt family's wax artistry has a 300-year history—on both sides of the family. Leopold was only 19 when he came to New York to visit his Uncle Gustav, who created the wax figures for the Eden Musee in 1884. The visit turned into a full-time job aiding his uncle in sculpturing museum figures and manikins. "I couldn't convince my uncle," said Leopold, "that the future for manikins lay in department stores, and

that we should promote them for window displays."

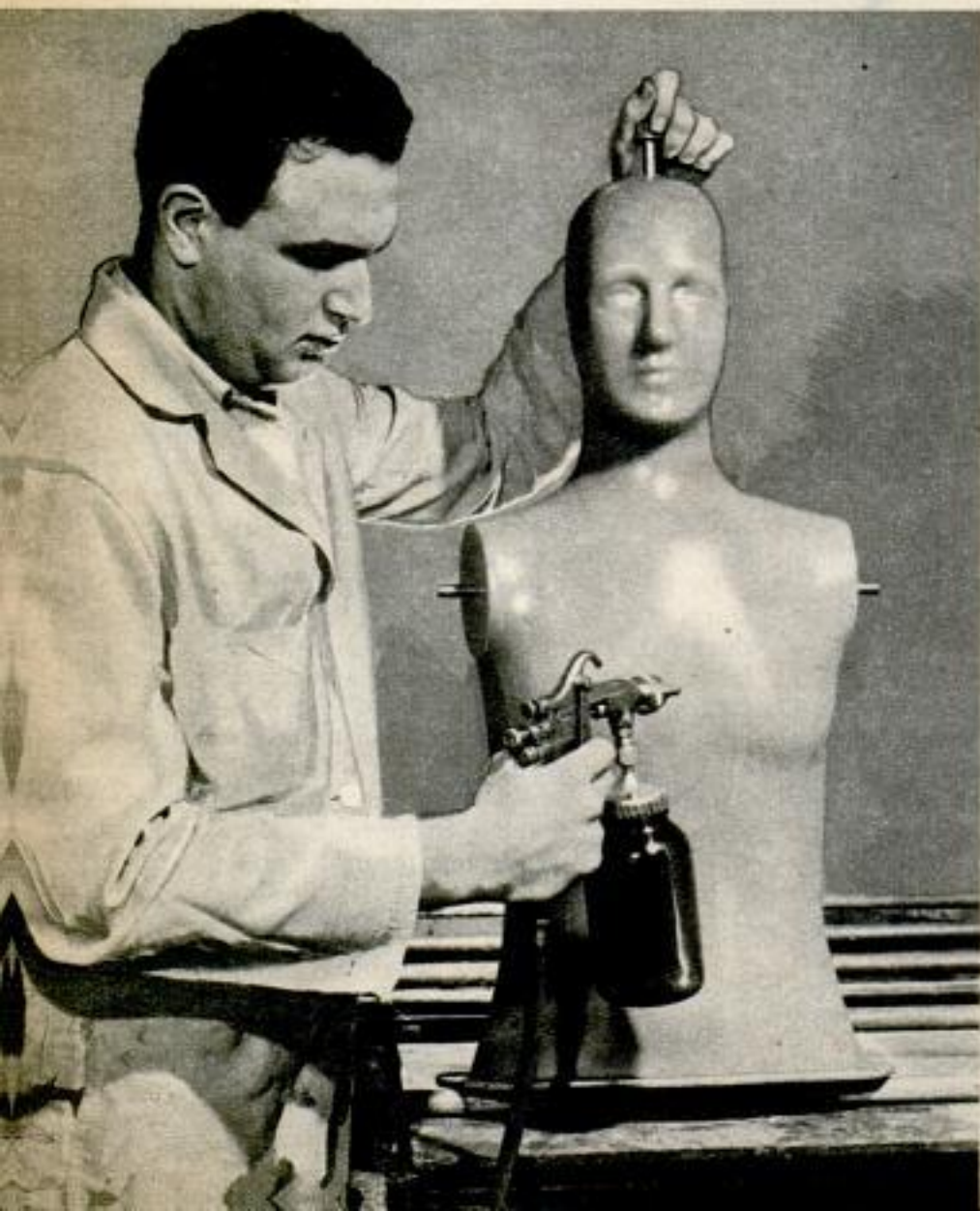
The first thing he did when he ventured out for himself was to tour the nation's key cities, talking to department store display managers. The idea was new and intriguing, but the road was difficult for Schmidt. Twenty years ago there were only about 150 firms in the United States using manikins. Today, there are thousands, exclusive of Hollywood's vast movie industry. A full-length Schmidt wax figure in 1900 cost \$150. In 1925 it brought \$350. Today Schmidt's price is about \$600.

In 1925 he began concentrating on museum pieces, principally because the orders for specialized pieces came in unsolicited. His authentic reproductions of famous people and historical episodes have been admired by millions of people at fairs and expositions and in wax museums. His life-size reproduction of the signing of the Declaration of Independence, displayed at the Philadelphia Tricentennial Exposition, is regarded by Schmidt as his finest work.

He is proud of his "breathing" mechanical figures in wax—probably the only breathing wax figures ever made—depicting a sleeping soldier, his wife and child, which he created in 1943. Experts, how-



Schmidt prepares figure of average AAF flier for mold; it was used to make copper model for testing heated suits. Below, torso of AAF figure



ever, maintain that his depiction of Leonardo da Vinci's painting, "The Last Supper," one of the high spots of the Atlantic City Steel Pier's permanent museum, rates among the best wax sculpturing of all time. Recently his "Spinners of All Nations," an attraction in the Museum of Science and Industry at New York's Rockefeller Center, is drawing favorable press acclaim. He has made many church figures, including wax reproductions of the Madonna and Child, and of Christ, as well as many of the Saints. Hollywood has also beckoned, and here lies, according to the artist, a tremendous new field.

Occasionally, Schmidt is called in for an unusual assignment by a captain of industry. George Matt-hem, the late vice-president of Standard Oil of New Jersey, once commissioned the wax sculptor to make a bronze bust of himself. Schmidt considers jobs like this a profitable sideline.

His most unusual contract came from the General Electric Company. Last year General Electric authorized him to build a "copper man," resembling both in size and features an average man. It was to be used for testing electrically warmed flying suits, casualty blankets and other equipment worn by bomber crews. It would, in other words, replace the human guinea pig. Each portion of this figure was so carefully worked out that the final job became a composite of the average Air Force man.

True to the Schmidt tradition, Leopold began to break his family into the business at an early date. His wife, son, two daughters, sons-in-law

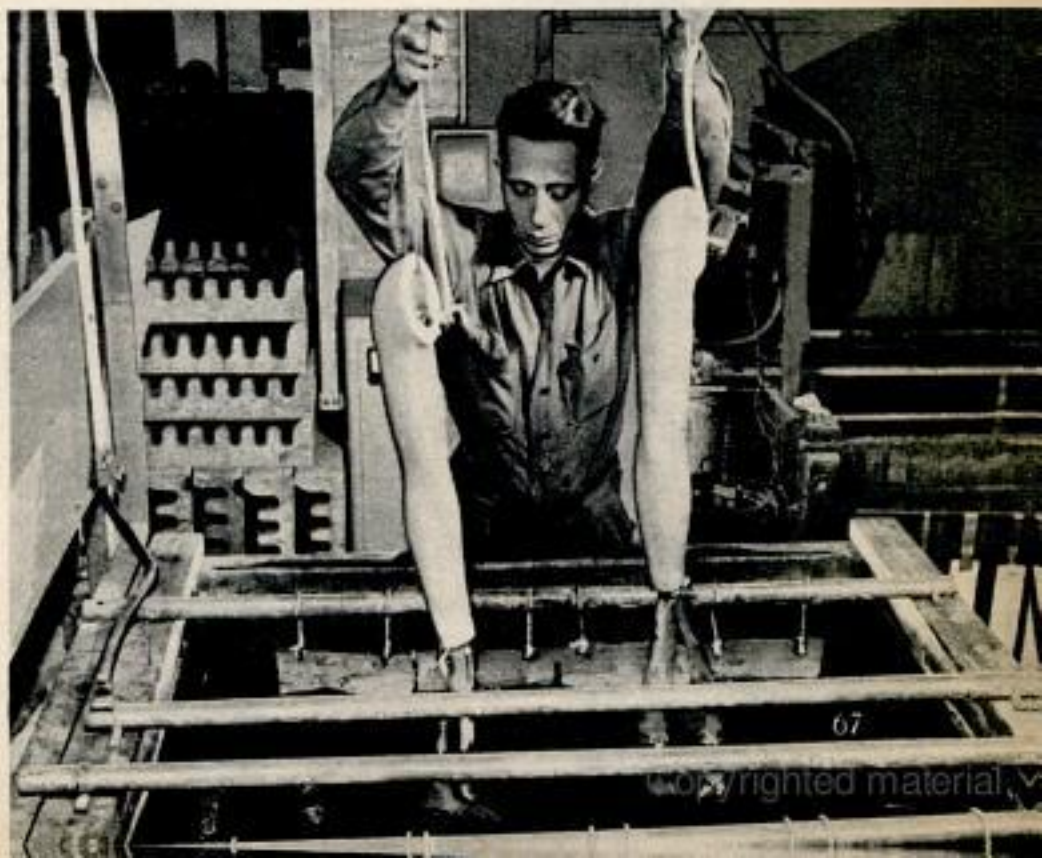


and five relatives of his wife all work for him. He trained each of them personally. His wife and one daughter have complete responsibility for selecting, buying and putting on the hair. This is quite an important item, since only human hair is used and a half pound is required for the figuré of a woman. Most of these hair-selling firms secure their merchandise from Europe where peasants sell their hair for cash. A small quantity comes from China. An average head of hair for a Schmidt female figure costs \$48!

His son Walter is now an all-around expert and is shop foreman. Walter is unquestionably the heir to the title "Mister Manikin." One daughter specializes in painting the completed figures, and in accumulating ideas from current magazines.

Schmidt's business, oddly enough, is seasonal—at least as far as the manikins are concerned. His models are begun in November and December, and must be ready for trade display by January 15. Orders secured on the basis of these models must be ready for store windows by June.

Lifelike wax figures made by "Mister Manikin" depict signing of the Declaration of Independence. Below, arms of dummy are dipped in electric bath to copper-coat wax





To form manikin body, Schmidt presses special clay onto skeleton made of lead pipe connected with wires; full-size figure takes 20 feet of lead. Below, applying an undercoat of paint



Schmidt employs the same method in making all his figures. He makes a skeleton from lead pipe connected with wires. For a full-size manikin this takes about 20 feet of lead and about four hours of concentrated work. Then he prepares his clay. He uses a special clay formula because ordinary clay dries out too quickly. The clay is pressed onto the skeleton by hand, forming the bulk of the body. After waiting one day for the clay to become workably dry, he takes his modeling tools, using the sling mainly for the contours. His fingers are still his most agile and adept tools. Satisfied that the human likeness has been achieved in body, Schmidt then cuts off the arms, making the arms and hands separately. The model, therefore, is only of the torso, looking very much like an Egyptian mummy. This model is cut in two—the upper torso and the lower torso. Then molds are made of plaster of paris and in three days they are ready for the wax treatment.

A specially prepared melted wax is drained into the molds and chilled at room temperature for three hours. The molds then are broken, and out comes the wax manikin, sans coloring, hair, eyes or arms. Schmidt inspects the figure, taking out all cast marks with scrapers and melting tools. The job of putting the body together now begins. Schmidt uses wooden joints in his creations.

The manikin is polished and washed with turpentine, and then hand-painted. This is most important, for the "personality" of the manikin is reflected in its own coloring. Schmidt selects the glass eyes that best match the personality he is striving for and inserts them. Then the hair is pressed in strand by strand by the expert Mrs. Schmidt. To accomplish this, she uses a needleholder with the eye cut in half. The hair is at-



tached to this and pressed three quarters of an inch into the wax scalp. It is so firmly held there that the hair can be combed, washed or shampooed without fear of coming out. Eyebrows and moustaches are inserted the same way. The wax manikin is now ready for delivery.

Sometimes, Schmidt makes manikins out of papier-mache, a composition of plaster, burlap and mache. This he does only on special orders. The steps are quite similar, differing only in that metal castings are used for joints instead of wood, and in "stuffing the mold." Layers of papier-mache and glue are spread in the mold (known in the trade as "pasting it out"), and, instead of being chilled as is the case with wax, it is placed in a drying cabinet at 125 degrees and baked for two days. Then the mold is broken, and the manikin is first smoothed, then subjected to special undercoats of casing paints, lacquered and finally hand-painted. The only other startling difference is that wigs are used and eyebrows painted onto the manikin.

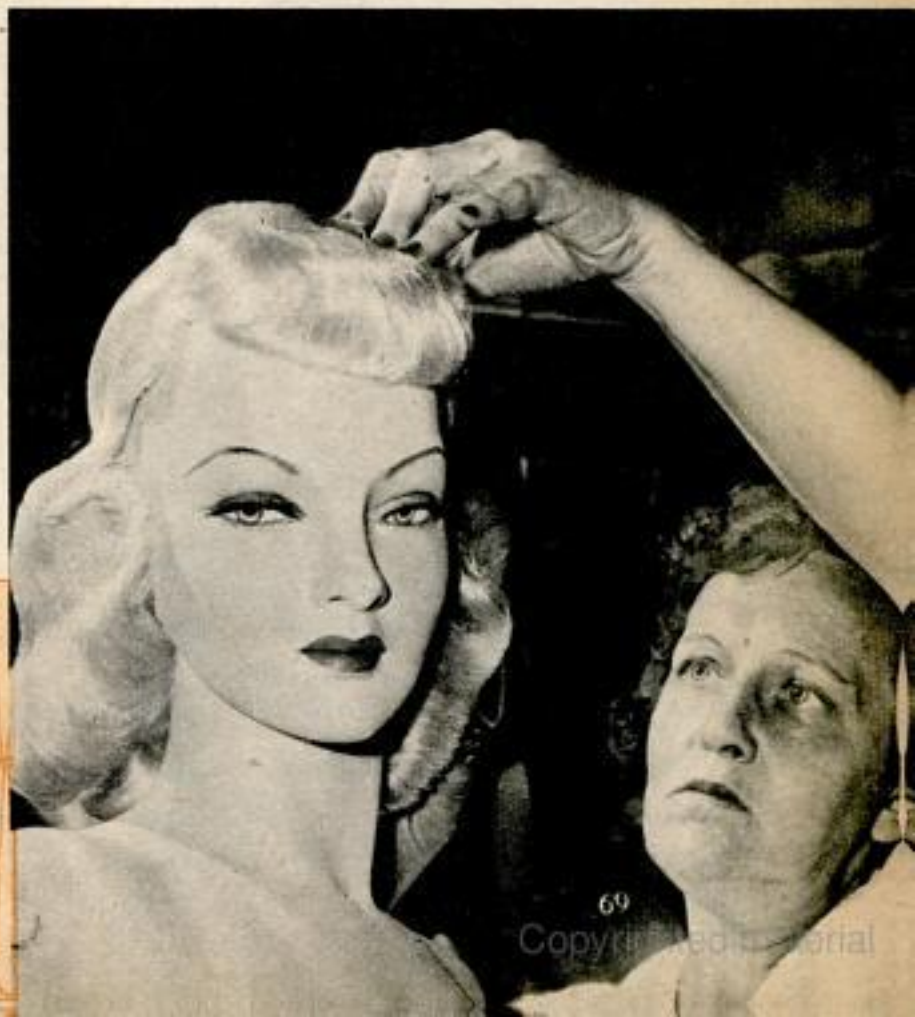
Like most artists, Schmidt has a hobby—flying. In fact, it's a family hobby. In 1936, at the age of 61, Schmidt, his son Walter and his two daughters made their initial visit to a nearby airfield and went up for the first time in a sightseeing plane. All four became student pilots, receiving licenses.

"It's a funny thing," the 71-year-old sculptor remarked, "what can happen to an industry when a few people change nationalities. Wax sculpturing was originally a European industry—you might say a German one, even though Vienna and Paris had great wax artists, too—but today America is the world center for such art. Europe will have to look to the United States from now on."

Mister Manikin ought to know.



While manikin "holds still," hairs are inserted one at a time three fourths inch into wax scalp; it can be shampooed and combed. Below, placing real hair wig on papier-mache manikin





SIPHON TUBES made of transparent Tenite plastic are used for irrigation purposes. They are easily bent to various shapes to carry water from ditches to plants



PUSH BUTTON bomb control panel was developed by the Army Air Forces' armament laboratory to improve the accuracy of dropping bombs by manual control



ELECTRIC EEL generates enough current to light up 48 small bulbs in a demonstration at the Bronx Aquarium



HYDRAULIC PUMP for straightening bent frames is demonstrated by Sgt. Joseph Ferrara, Montclair, N. J.

INGENIOUS Army Air Force mechanics used a section of metal landing strip as a ramp to load equipment—even war vehicles—aboard huge cargo planes



LIFTING 1000-pound drums—a back breaking job—is performed by an air lift. The equipment consists of a double-acting cylinder hoist and three-way valve
Compressed Air Institute photo





U. S. Navy photo

AMBULANCE SERVICE for crippled planes was one of the duties assigned to U. S. Navy propulsion barges shortly before the Japs surrendered. As demonstrated in the above photograph, one of the barges, originally built as a pontoon barge to form part of a causeway, was used to transport a damaged Martin patrol bomber to a repair base. Seabees utilized the barge for this type of rescue work during the Okinawa operations

Air Technical Service Command photos

Droppable Cover For Sighting Blister

Side windows used by waist gunners on Superfortresses are protected by jettisonable covers. They keep the sighting blisters free of mud on takeoffs from wet airstrips. The covers, developed by the Air Technical Service Command, are made of cotton duck with a section of transparent material which makes it possible for the gunners to give their customary takeoff reports to the pilot on landing gear, flaps and engine performance. The cover is fitted with button holes at the edges which slip over metal clips attached to the fuselage. It is jettisoned with a cable threaded through holes in the clips and passed into the fuselage at the top of the window. The cable hole is plugged to allow for pressurization of the cabin.

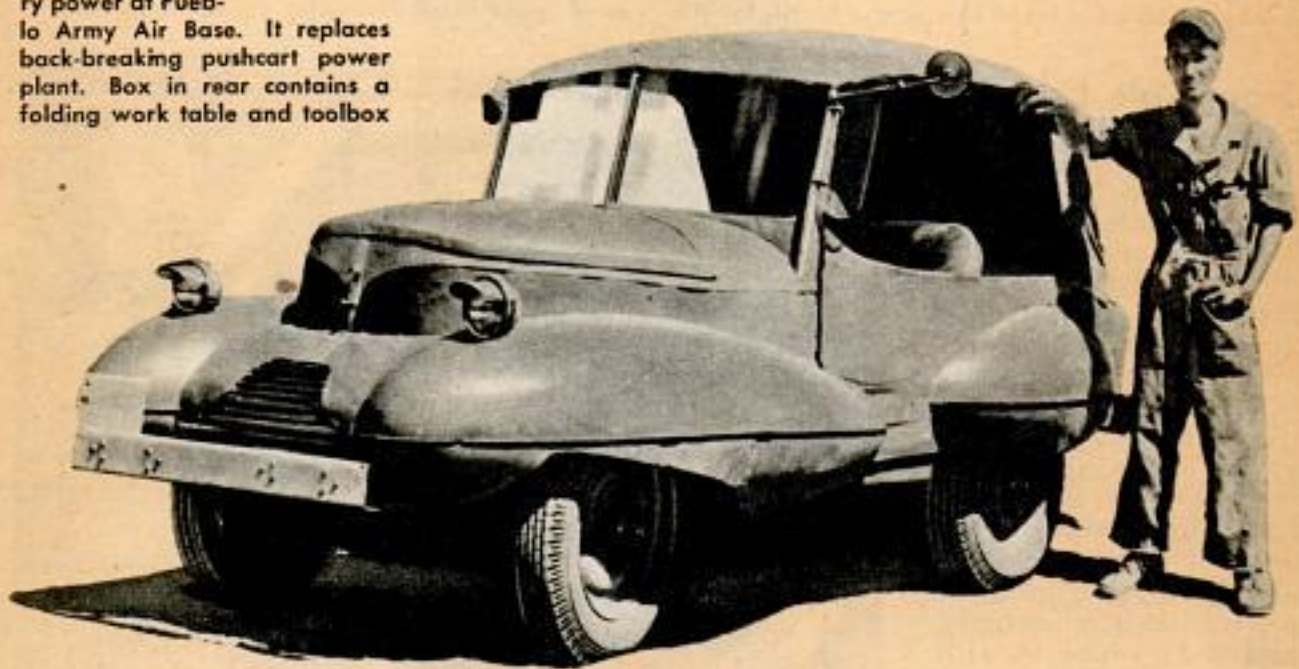
☐ See the index, page 8A, to find where to buy products described in this magazine. Say you saw it in Popular Mechanics.



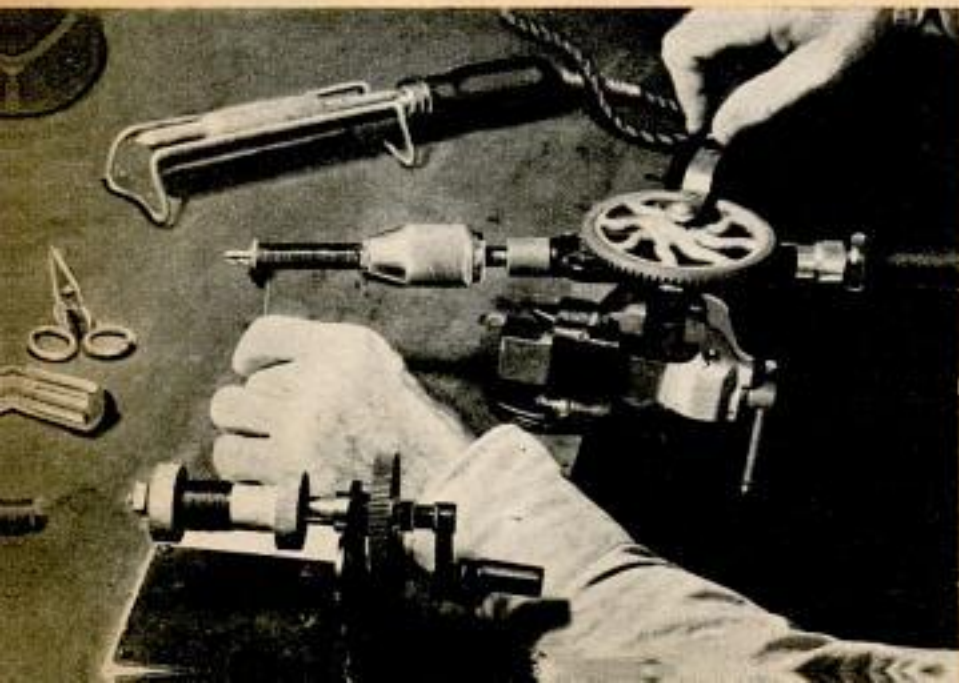


"Electric jeep" is plugged into B-24 to supply auxiliary power at Pueblo Army Air Base. It replaces back-breaking pushcart power plant. Box in rear contains a folding work table and toolbox

Clever These



Those teardrop fenders were made from belly tanks of a P-38 and the front grill was part of ammunition rack on a B-24. T/Sgt. Wayne K. Pike of Pittsburg, Kans., stands beside his transformed jeep at a 13th Army Air Force base



Left, rewinding coil on ingenious device built by men in radio repair section, 37th Division Signal Co. Wire is unwound from coil onto spool by turning crank and after break is found and soldered the wire is rewound

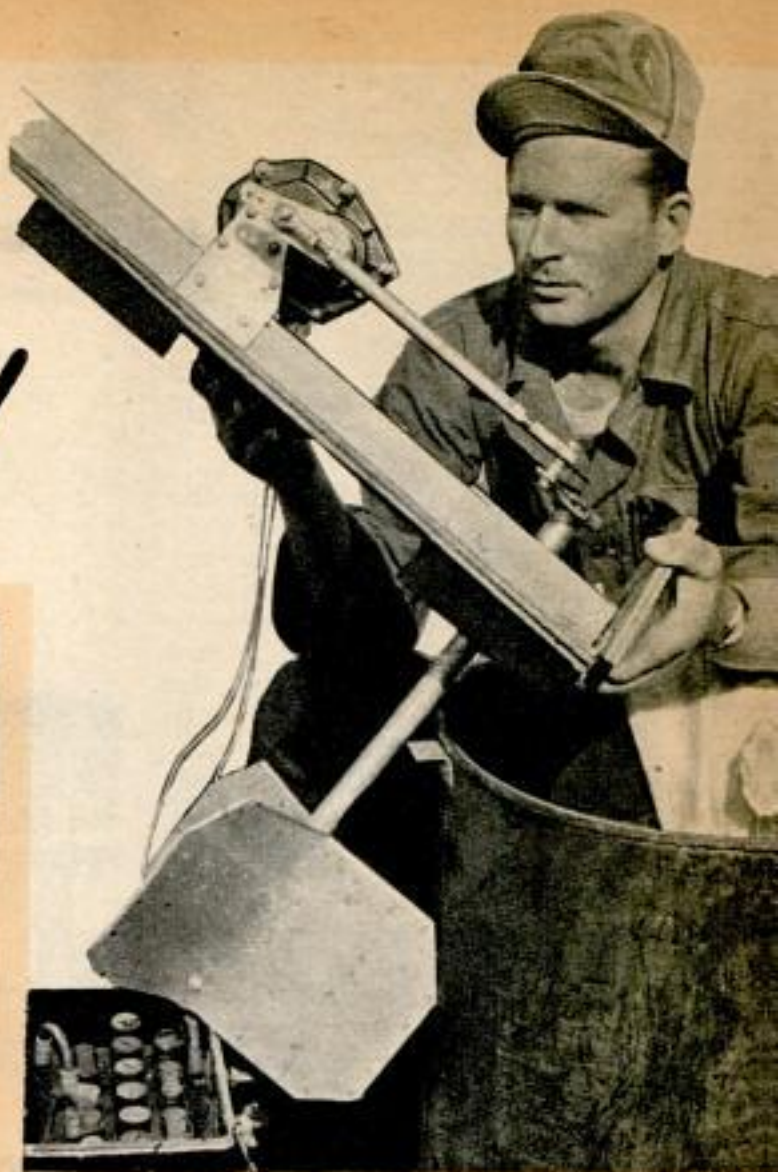




Yankees!



Curtiss-Wright Corporation reports an unorthodox method for straightening a bent propeller on a China airfield. With Japs advancing and no time to spare, the crew rammed jeep against tip to straighten blade



Building washing machines was a favorite pastime of inventive GIs. A Denver, Colo., private employed scrap from an airplane junk yard in England to put together his version of an electric washing machine

Below, transporting gasoline to advance air bases far beyond the reach of pipe lines was a major problem of the AAF. One outfit mounted tanks on trailers which rushed thousands of gallons to the front



Below, patching the thin skin of damaged bombers was a headache at the Pueblo Army Air Base until special maintenance car was built. It carries air compressor for riveting, generator and air storage tanks



"Picket Fences" on Wings Act as Brakes on P-61

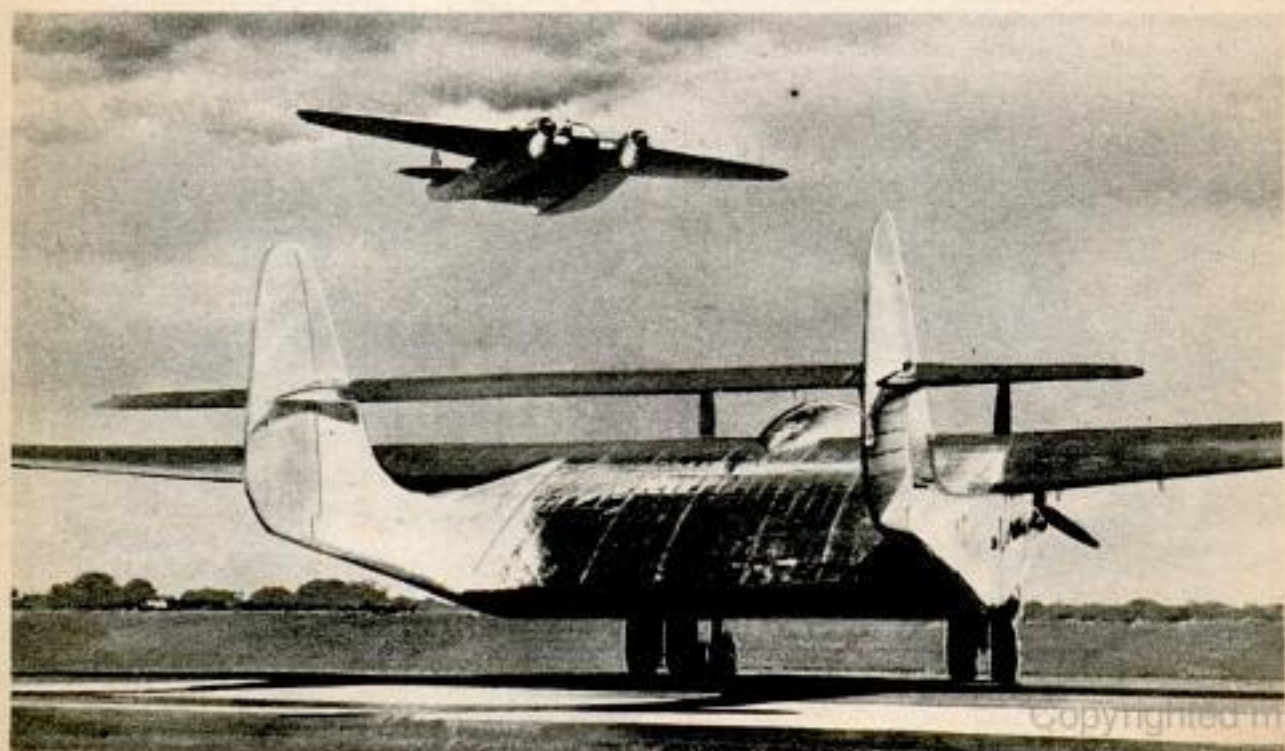
Brakes "sprouted" from the wings of the Black Widow P-61 night fighters shortly before the war ended to prevent the fast planes from over-running enemy aircraft. Resembling little picket fences, the brakes enabled the Northrop-manufactured planes to slow down more quickly. Aerodynamicists report that the new brakes exert a force of one "G" when applied full force, which means the plane slows down so quickly that fliers are pushed forward by inertia at pressure equal to their own weight. Another late improvement was a "high activity" propeller designed to absorb the increased thrust of the ship's two Pratt & Whitney engines.



Cargo "Wing" Carries 3½ Tons and Accommodates 24 Passengers

A new airplane built under Burnelli flying wing patents carries 700 cubic feet of cargo in a space 20 feet long, 6 feet high and 6 feet wide. In addition, the plane holds 24 passengers and a three-man crew and has a galley and coat room. Wide doors at both sides of the ship can be removed for loading

freight. Powered by two 1200-horsepower Pratt & Whitney engines, the plane has a maximum speed of 200 miles per hour, cruising speed of 185 m.p.h. and a range of 2000 miles while carrying 3 to 3½ tons of freight. It was developed, built and tested at Montreal, Canada.





SHOPPING FOR FURNITURE?

Here are some pieces for the compact, modern home which serve several purposes and leave you plenty of room to turn around. Wall cabinets (above) extend across an entire wall with compartments for phonograph records, books and hidden writing desk

Chairs were once just something to sit on, but the designer who created the quilted job (above) added a hollow arm which will serve either the lady or man of the house. She can use it for a sewing kit or he can cache his pipe, slippers or magazine in it

Below, glass-topped dining room table has a built-in steam compartment in the center. It is designed for the home without domestic help, and for the hostess who dislikes running back and forth between kitchen and table. The table serves an average family

Below, this one is called the V-table—for versatility and variety. It's a combination china cupboard-dining table. The table divides down center and spreads in V-shape to seat more guests, or it can be fully extended and shoved back against walls



Green Grow the Atolls

The GIs wanted corn on the cob, fresh milk and watermelons, so they turned the islands of the Pacific from Oahu to Okinawa into an immense victory garden



Natives unload watermelons grown on Guadalcanal for GI meals. Below, cattle arrive at Guam to give fresh milk to the wounded

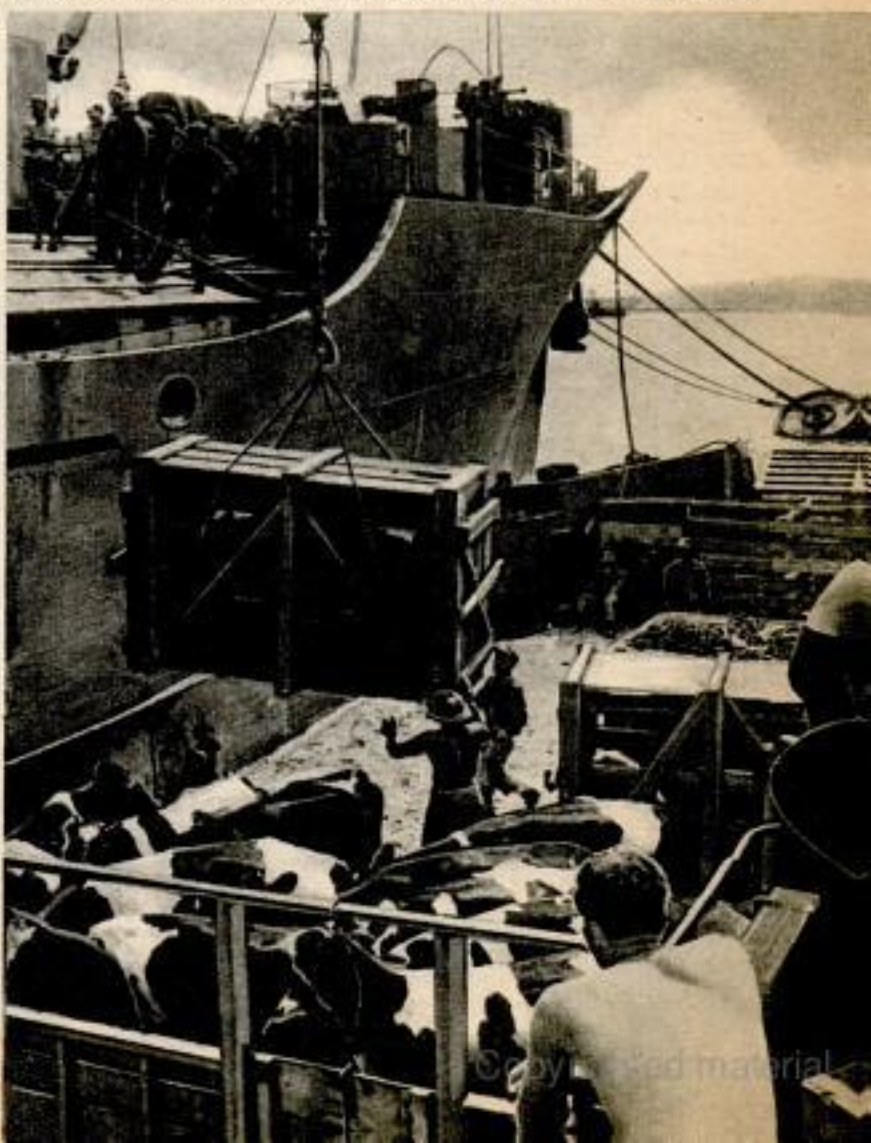
LETTER from a marine:

"Dear Mom:

"Believe it or not, we've had corn on the cob three times this month and cabbage and cucumbers every other day or so. It's a treat to dig into some fresh food after all these months of canned stuff . . ."

Multiply this sentiment by several million and you have the testimony of every U. S. soldier, sailor and marine in the Pacific—that crisp vegetables, cool fresh milk and other delectables, produced by American methods in the Japs' back yard, greatly aided our boys' health and spirits.

Quietly and without fanfare, a chain of victory gardens was planted from Oahu to Okinawa, from Guadalcanal to Guam. More than 5000 acres in the Solomons and 15,000 acres in the Marianas are supplying fresh corn, watermelons, cucumbers, tomatoes, cantaloupes, squash, cabbage, lettuce, radishes, peppers, eggplant and sweet pota-





U. S. Marine Corps photo

Aided by a jeep, marines remove weeds from a Pacific island cornfield and dream of corn on the cob—battered

toes to garrison troops on conquered islands and hospitalized personnel from the battlefronts.

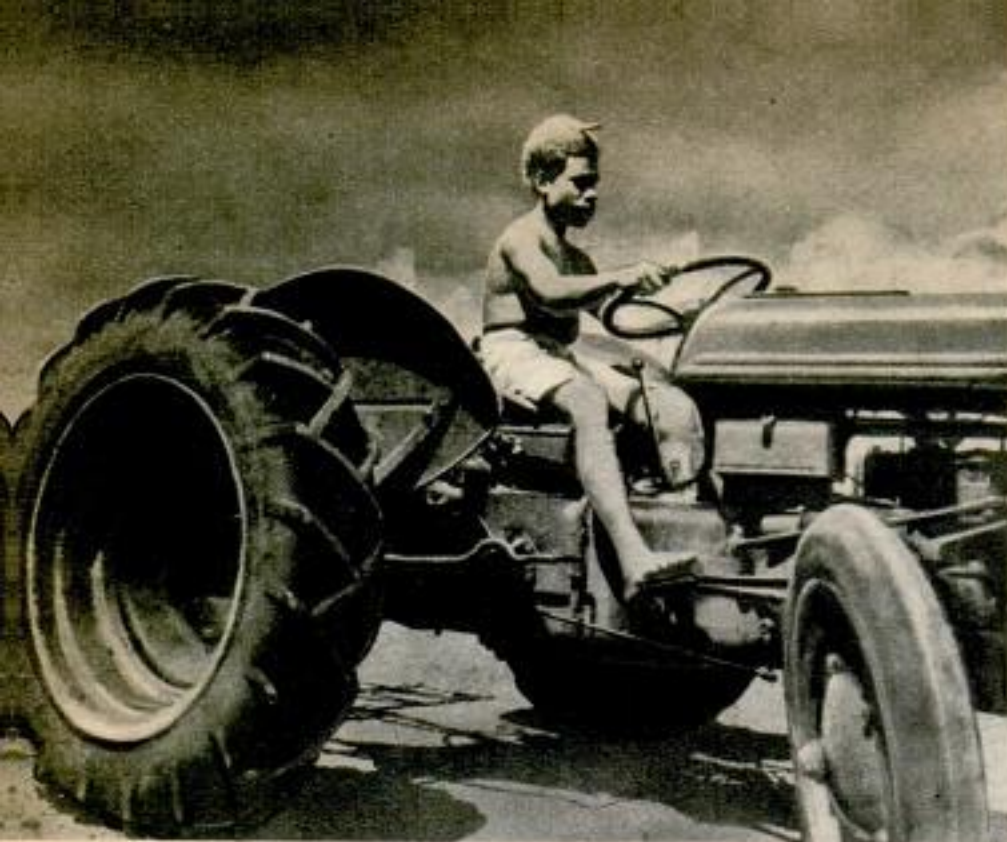
Approximately 3,000,000 pounds of fresh vegetables are being turned over to the Army and Navy in the Pacific each month, saving much valuable shipping space and providing troops with a varied menu. At an arbitrary value of 10 cents a pound,

the value of the crop is approximately \$300,000 per month. At this rate the \$1,500,000 spent for seeds, fertilizer and tools has already been paid off.

The Pacific victory gardens were planned, planted and picked under the supervision of "Cucumber Commandos"—agricultural experts of the Foreign Economic Administration—in cooperation

Left, tamed wild pigs caught in a Guadalcanal garden. Right, vegetables flown from Guam unloaded at two





"What's this?" asks a native of Guadalcanal as he climbs aboard a tractor

with Army and Navy officers. The FEA experts often went ashore soon after assault troops to prepare the acreage for cultivation.

The FEA's military farm projects in the Pacific stem from a survey made in 1942 by Rear Admiral Richard E. Byrd, USN, of Antarctic fame. The Navy realized then that its few supply ships ("beef boats"), running up from Australia and New Zealand with reverse Lend-Lease meat and agricultural products, would not be sufficient to provide large amounts of fresh food for Pacific troops. To divert other ships to this purpose would take valuable space needed for ammunition and the implements

Marines on Iwo Jima use captured Jap sword to divvy up cold watermelon



of warfare. The solution was a program to grow fresh food on islands captured by soldiers and marines. Valuable space would be saved, the troops would be given a more balanced diet and the agricultural economy of the natives on war-ravaged islands would be restored.

Until the war started, the principal agricultural products of the natives were coconuts, papaya, breadfruit, taro and sweet potatoes. The FEA aimed to vary this diet with food that appealed to the American male appetite: fresh corn on the cob, ice-cold watermelon, lettuce and tomato salad.

The first FEA farm got under way in 1943 at Guadalcanal and served as a laboratory for others that followed. The land, covered either with a thick growth of jungle or tough, razor-edged bamboo grass growing five feet high, had to be cleared with a bulldozer. Contrary to appearances, the volcanic or coral soil of hot jungle-lush lands is often far from rich, lacking especially nitrogen. Three times as much fertilizer as usual had to be applied. Insect and fungus growths were encountered and from seven to 10 sprayings a year were necessary to keep them in check.

But to make up for all the difficulties, Mother Nature is generous at the equator with sunshine and rain. Consequently, the growing season required only three fourths the time needed in the United States. In fact, four crops a year can be grown in the seasonless lands down around the equator.

Success of the FEA victory gardens at Guadalcanal and other islands in the Solomons prompted the Navy to repeat the experiment in the Marianas when Saipan, Tinian and Guam were captured in the summer of 1944. And instead of 5000 acres, it was decided to put 15,000 acres under the plow. Soil and weather conditions in the Marianas,

(Continued to page 156)



"Suntan" Prevention for Lamps

Germ-killing lamps of the future may function four times as long as today's models following discovery of why the lamps' glass picks up a "suntan" from ultraviolet radiation. Dr. Harvey C. Rentschler, director of the Westinghouse Lamp Research

Laboratories, has found that an alkali substance in glass cuts down the efficiency of lamps used to kill air-borne bacteria in hospital operating rooms, nurseries and laboratories. However, the scientist reported that this alkali does not exist in quartz or in a special glass developed in the Corning Glass Works.



Duck Tires Inflated in Motion

If postwar vehicles adopt the system used on Army Ducks for inflating tires, all a driver will have to do is move a control on the instrument board. The amphibious Duck is equipped with central tire pressure control. It consists of an air compressor pump located toward the front of the engine, compressed air storage tank, air lines and rotating pressure joints attached to each wheel hub. The most ingenious part

of the system, devised after extensive experiments by the Truck and Coach Division of General Motors, builders of the Duck, is the hub device. This rotating pressure joint is attached to the hub by means of special studs and setscrews. The inner member turns with the wheel and the outer stationary member is fastened to the body of the vehicle. The air hose is attached to the joint and the entire unit is sealed against sand and water. A gauge on the instrument board tells the pressure.

By the Way—



Parachute jumpers now speak back to their planes with a tiny transmitter



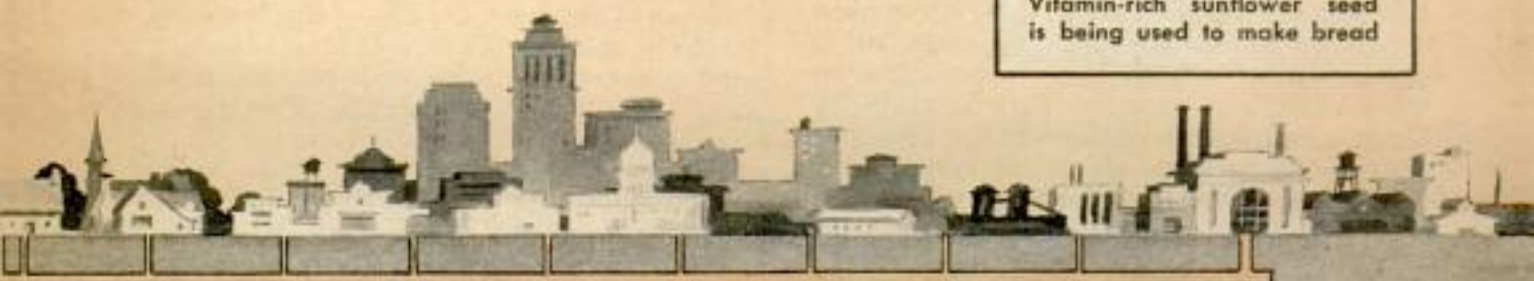
Coast Guard engineer stayed under water 14 hours to repair fouled propeller so his LST could join Okinawa-bound fleet. Below, heartbeats of a sailor stricken on a ship in the Pacific are broadcast to Navy doctor at Honolulu. Instructions by radio helped save his life

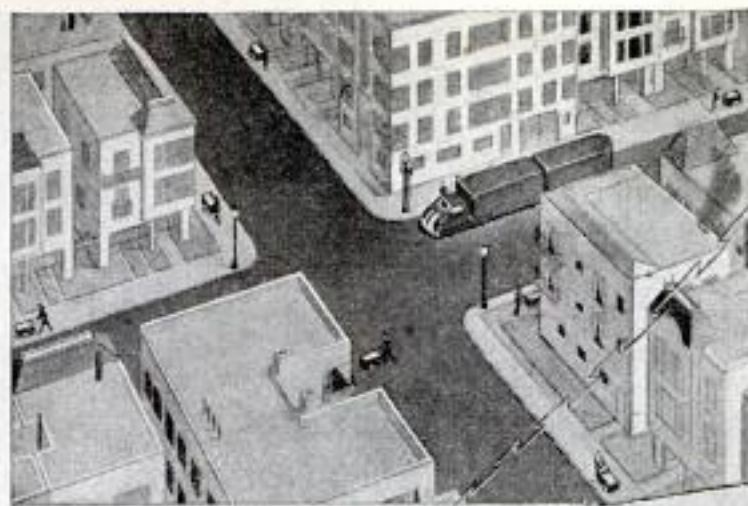


A postwar promise is self-whipping cream that changes from liquid to fluff as it strikes air when poured from a can. Below, plans are under way to pipe steam to homes in Chisholm, Minn., from a central plant

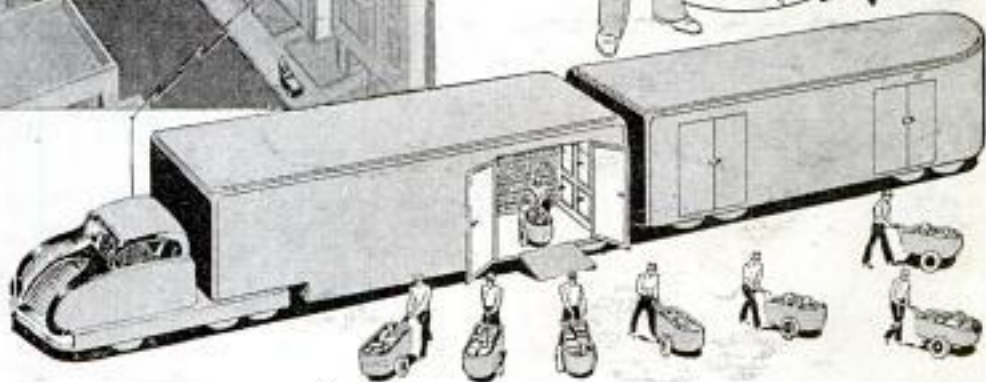


Vitamin-rich sunflower seed is being used to make bread





Big truck parks near residential intersection and eight salesmen, each with small rubber-tired conveyor, canvass neighborhood

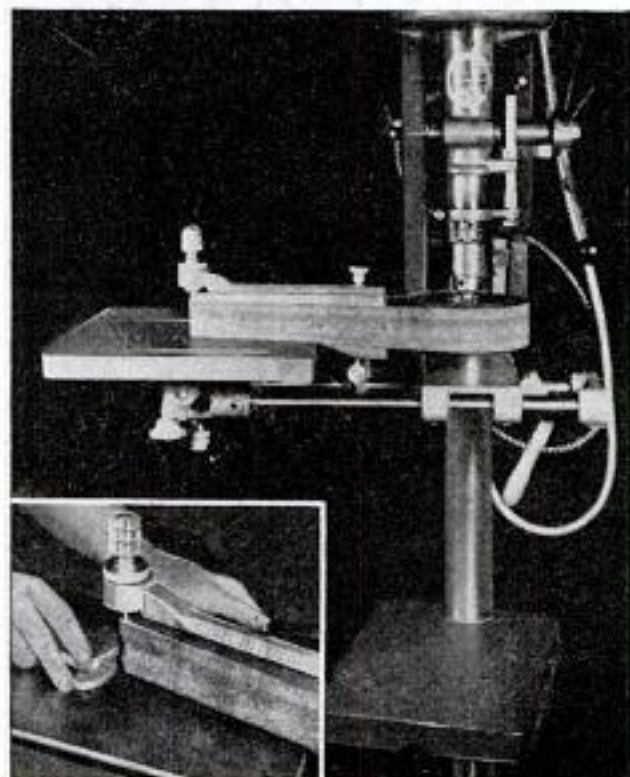


Future Store-on-Wheels Brings Food to Door

A streamlined, radio-equipped version of the old-fashioned country store-on-wheels has been designed to serve California housewives. Mobile stores 60 feet long and manned by eight smartly uniformed salesmen would cover residential areas three times a week, selling bread, butter, eggs and milk, taking orders for other foodstuffs and collecting clothes and other items to

be laundered or dry-cleaned. Each salesman would carry on his back a "walkie-talkie" radio to communicate with the driver of the huge truck in case a housewife decided to buy something not on his conveyor. A call to the parked "store" would bring the desired merchandise to the home by motorcycle. In addition to carrying fresh meats, poultry and frozen foods in refrigerated compartments, the food distribution concern plans to handle household appliances.

Attachment Converts Standard Drill Press Into Abrasive Belt Grinder



Making the drill press even more versatile, an abrasive belt grinder attachment fits all drill presses. It operates 11 times faster than the drill press spindle, providing speeds of 7,000 to 36,000 revolutions and from 700 to 4500 surface feet of abrasive a minute. Attached to the upright column, it can be swung out of way when not in use and does not interfere with normal operations. The grinder can be used for cutting, finishing, polishing and shaping of metal, wood, glass and plastics.

Fluorescent Yule Tree Lights

Fluorescent Christmas tree lights are available this year for the first time. The round bulbs are eight to a string and come in pastel shades of blue, green, coral and maize. They have a screw-type base which requires no auxiliary equipment to operate. Using about five watts of current, each bulb has a life of approximately 1000 hours, according to the manufacturer.



Signal men tie insulated wire to trees well above ground to delay relentless jungle rot

By Staff Sgt. John L. Kent

NATURE seemed to have conspired with the Japs in inventing special hazards for the communications men of our Army's Signal Corps in tropical regions of the Pacific and in Burma.

Some of the more obvious difficulties were recounted by a sergeant of a signal battalion who was stationed in the China-Burma-India Theater for 26 months. According to him, "getting the message through" involved problems never touched by "the books"—it was "snafu" (situation normal—all fouled up) all the time.

"When you are fighting in a part of the world where everything that doesn't rust quickly will rot away even faster, where batteries have less than half the normal life expectancy and insects do everything but march away with your telephone poles, you have to revise your thinking about signal supply," he said.

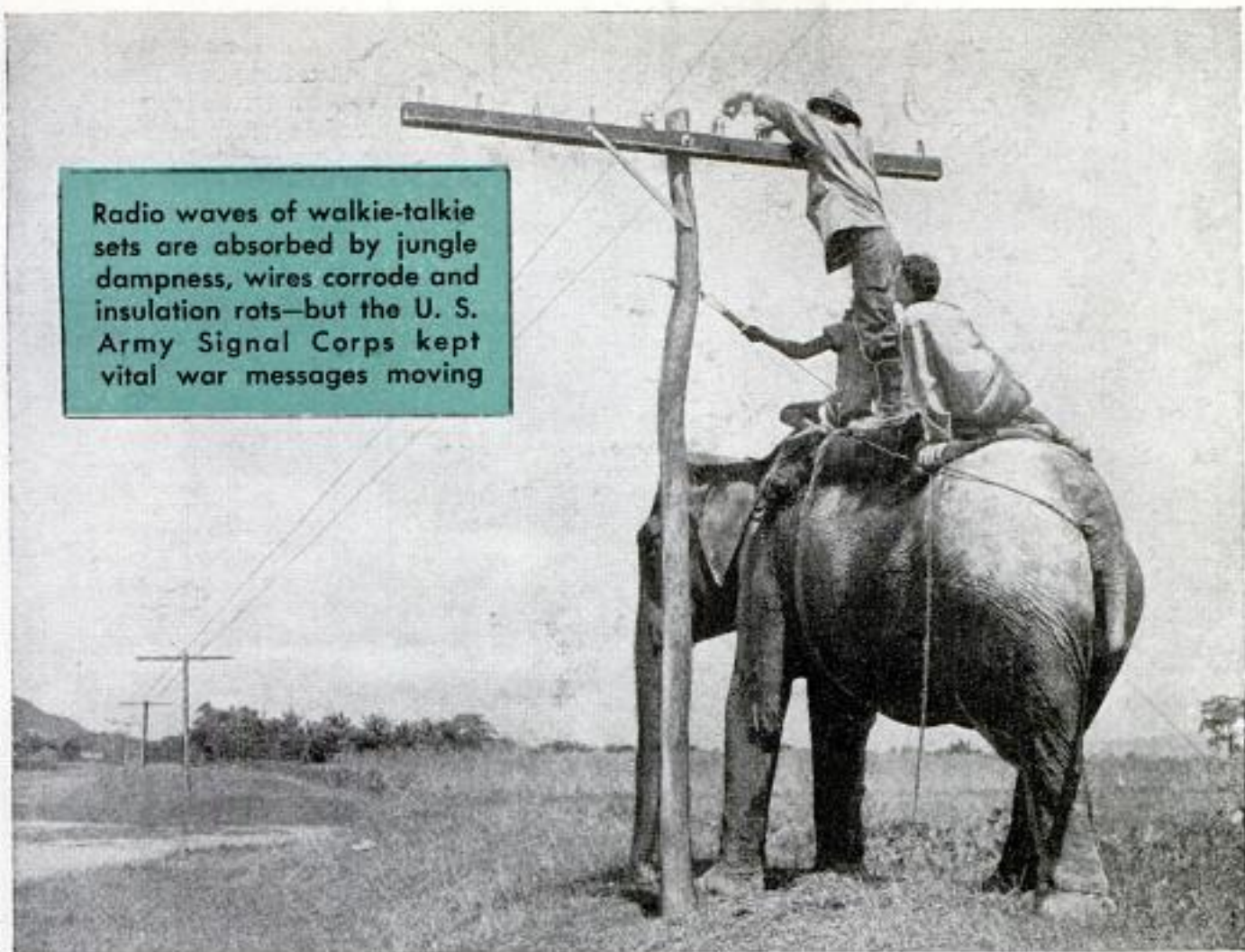
In the early Pacific campaigns, the Signal Corps encountered numerous difficulties in the operation of their equipment. Many of the early models of radios and telephones were not designed to function properly for any length of time in the excessive

MESSAGE FROM THE JUNGLE: SNAFU

heat and humidity, and failures occurred frequently.

The hot and moist climate found in the jungle promotes the rapid growth of fungus that corrodes wire, switch contacts and other metal parts. Various types of materials used in the construction of radios and telephones act as a sponge, soaking up small quantities of water. The water that fills the pores of the material destroys its insulating qualities and causes electrical failure. Condensation of moisture on metal surfaces causes rust and corrosion. The Signal Corps had to design special equipment which would be resistant to fungus growth and moisture. To make existing older models moistureproof, a special moistureproofing and fungiproofing kit, containing infrared lamps, brushes, spray guns and varnishes, was issued to Signal Corps units in the field.

Radio waves of walkie-talkie sets are absorbed by jungle dampness, wires corrode and insulation rots—but the U. S. Army Signal Corps kept vital war messages moving



To treat the radios and telephones, parts of the equipment were taken out and dried under the infrared lamps to remove all moisture. Then they were sprayed with the moisture-resistant varnish and allowed to dry. This provided a reasonable degree of protection against fungus growth, salt spray and moisture. But with all these extra precautions failure of signal equipment was still higher than in temperate zones.

There are certain special compensations to offset some of the trouble encountered. One of them is the physique and temperament of the jungle elephant, whose "spirit of cooperation" with the pole-line construction men is remarkable.

"Consider this," says the sergeant. "The ele-

Elephant provided steady platform for pole-line construction men, saving bother with safety belt. Below, fire control switchboard in jungle





Signal Corps photos

When monsoon threatened work stoppage, signal men in India hired a native canoe and kept moving ahead. Below, captured Jap walkie-talkie, and at right, a Jap radio set and generator for vehicles

phant hauls the poles where you want them. He sets them in the ground for you. When they're up, he kneels, you climb onto his head, he rises and there you are on a high, steady platform from which you can string the wire without bothering about spurs or safety belts."

A Signal Corps officer, however, reports numerous hazards on South Pacific islands, without the relieving element of elephants. His unit worked in a jungle area where, to use his words, "the bamboo trees grow as high as 100 feet, crowding together in order to reach the light. They form an impenetrable wall." Drainage problems were terrific, as the terrain was all swamps, the highest place being only about 15 feet above sea level.

Bamboo poles about 80 feet high were used for stringing radio antennas, three of them, bound together, making a satisfactory substitute for a regular antenna pole, but it was not as easy as it sounds. An 80-foot bamboo is about five inches in base diameter; it takes three men to get one of these out of the swamps. Bamboo is very sharp and it is possible for troops to get badly cut when handling these large poles.

In the swampy country abounding in some of the is-



lands, swarms of mosquitoes as savage as flying tigers sink stingers into the sweating signal men, especially when they have to work at night. This was a terrible scourge in the early days of the war before aerosol bombs, as fumigants, served to mitigate this form of torture. Malaria and dengue fever took their toll of the men.

The Japs, cooperating with nature in her most destructive moods, provided all the expected hazards and a few more for good measure. When driven out of any given area they left mines and undetonated bombs.

An enemy hazard, not fully foreseen, was that Japanese bombers often aimed for radio installations in preference to air strips, even when the latter had fighter planes parked on them as tempting targets. This was noted repeatedly by Signal Corps officers.

It would appear that our Army should have had no difficulty with portable radio sets, such as the walkie-talkie and handie-talkie, since they do not require pole-line construction, the stringing of wire or the erection of radio towers. But this was not the case. Radio communication is generally poor in jungle areas. The jungle that engulfs all also absorbs the radio waves going through it to such an extent that the transmission path along the ground, which is normally used for short-distance military communication, is practically useless for ranges of over one mile. The Army's signal engineers made a study in the jungles of Panama to find the reason and possible solution. They found that to increase the power on the transmitters was useless; even with the power increased two hundredfold, the range would only double — increasing from one to two miles. But they found that they could get better signals by elevating the antennas and by locating the transmitters and receivers on high ground.

(Continued to page 150)



From stern of an amphibious Duck, soldiers lay communication wires between islands in the Admiralty group and to warships at anchor



Trouble shooter on field wire is trying to locate cause of snafu. Below, transmitter building at 6th Army headquarters on Luzon; in thick of fighting these men handled thousands of messages





COACH AND SLEIGH on the "Pioneer," a snow train of two "coaches" drawn by a track-type tractor, enable visitors to Blaney Park in the Upper Peninsula of Michigan to see the winter wonders of the park in comfort. One coach is enclosed and heated, the other is an old-fashioned open sleigh. Both are mounted on runners. In case of a blizzard, the tractor powers its own snowplow which opens the way ahead of the snow train



Wheatblast Cleans Plane Engines

Wheat in place of sand in conventional sandblasting equipment is reported to remove carbon and oxides more thoroughly from airplane pistons and cylinders, with less abrasion. Precision parts and openings formerly had to be masked to protect them from the sand. This is unnecessary with wheat and cuts the time for the operation in half. Wheat cleans so thoroughly it eliminates a 24-hour pre-soaking of the parts to help loosen carbon.

American Airlines photos

Above, wheatblasting with regular sandblasting equipment. Left, loading wheat into bin

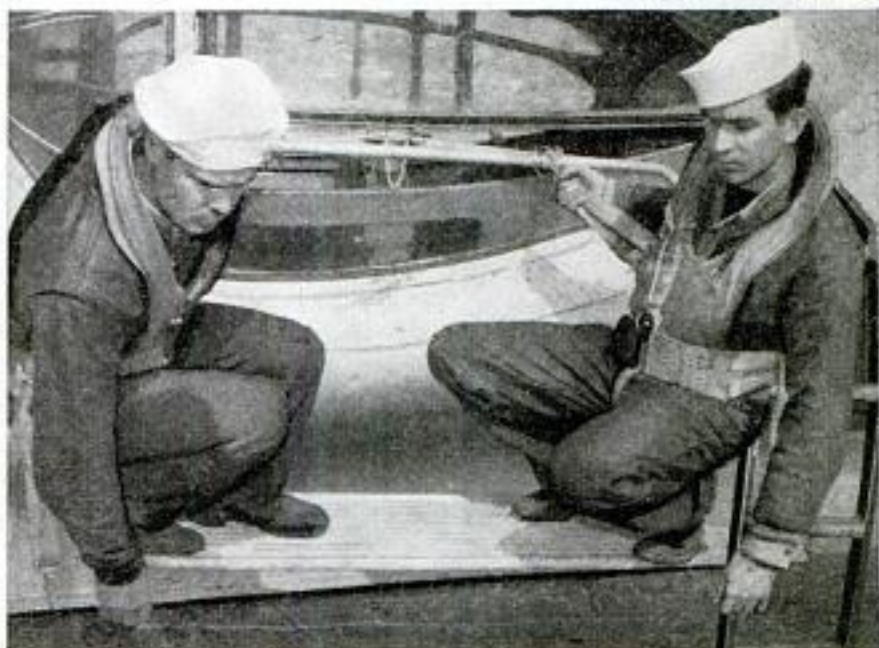
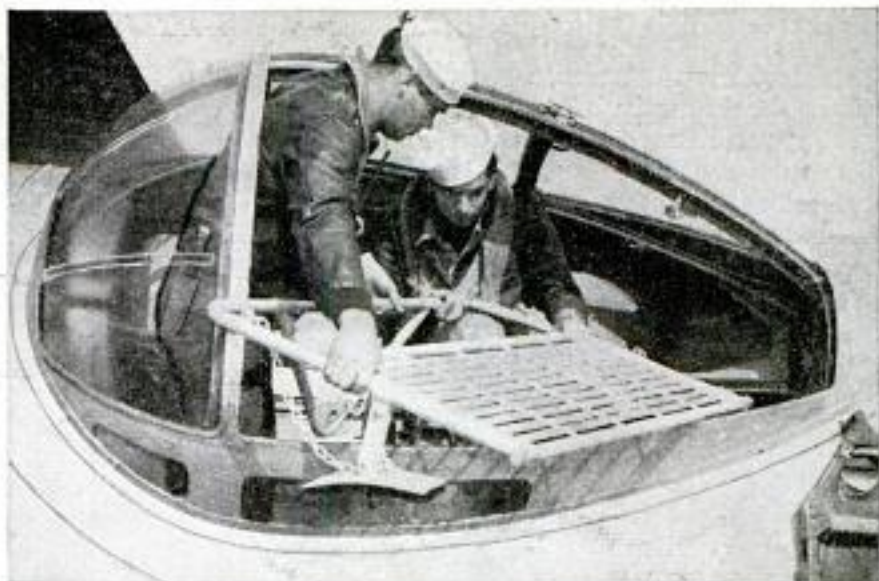
Mold From Hair Fights Germs

Red pigment produced from a mold on human hair may prove an effective remedy for typhoid fever and some kinds of dysentery. Penicillin, also produced from mold, does not affect typhoid or dysentery germs. The red mold pigment is being tested at Israel Zion Hospital, Brooklyn, N. Y.

Flying Boat Carries Rescue Platform

When a Catalina flying boat alights on the water for a rescue operation, a collapsible platform is attached to a side blister gun mount. It takes only a few seconds to drop a pin into the gun mount, anchoring the platform, which then is thrust out the window blister. Padded supports on the platform protect the hull of the "Dumbo" rescue plane. Rescue workers snap their safety belts to rings on the frame. This frees both hands for lifting a man aboard.

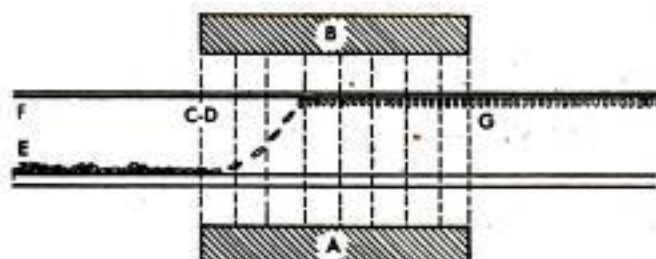
Consolidated-Vultee photos
Top, attaching rescue platform to gun mount. Right, rescuers snap safety belts to the frame



Electrocoat Fibers To Create Fabrics

Creation of new fabrics and unusual designs for material is made possible by an electrocoating process in which cloth fibers pass through an electrostatic field, become charged and stand on end. Then the fibers are hurled perpendicularly against an adhesive-coated backing which is dry-cured to hold them fast. As many as 300,000 electrocoated fibers, more than ten times those in woven goods, are in one square inch of fabric. Each electrocoated fiber is exactly perpendicular to its base, affording greater resiliency and uniformity in appearance. A few of the materials produced by electrocoating re-

semble delicate embroidery, "velvet" linings, dress fabrics and designs, chair upholstery and even the nap of a rug. The process is based on the old principle of rubbing a glass rod with a piece of silk to attract bits of paper to the rod, and is carried out by General Electric high voltage equipment.



- A. Negative electrode
- B. Positive electrode
- C-D. Lines of electrical force
- E. Conveyor belt carrying fibers
- F. Fabric backing; adhesive side down
- G. Flock fibers anchored

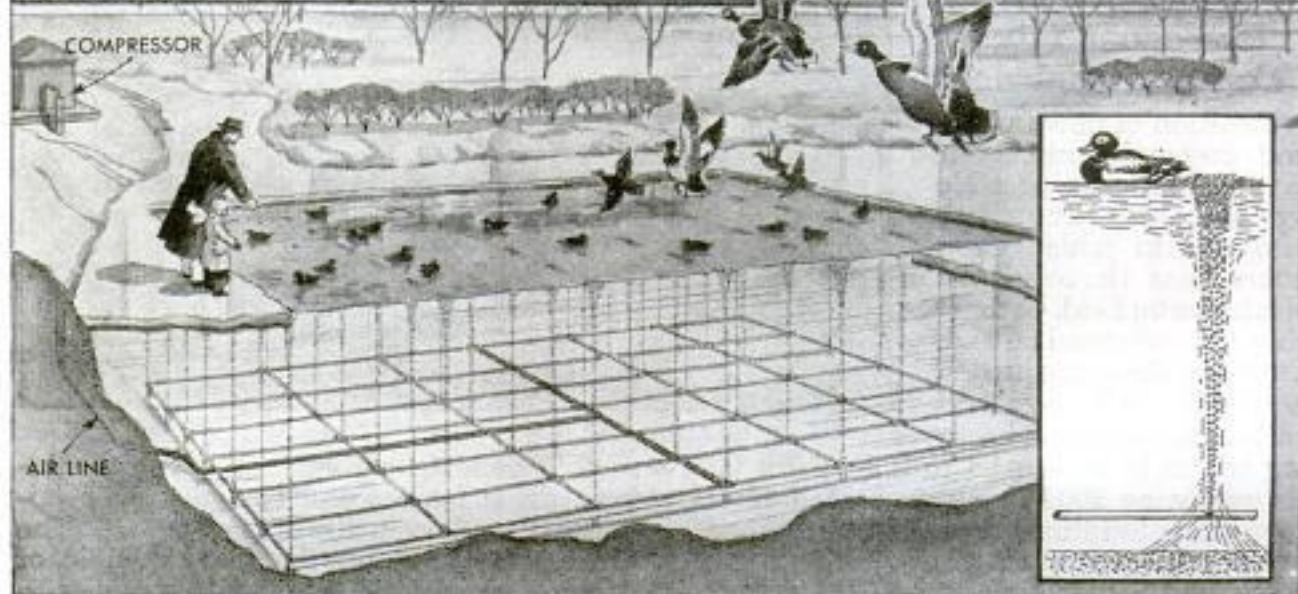


Loose fibers, or flock, enter electrostatic field, receive electric charge and are repelled upward to backing

'Bubble Bath' Keeps Ice Away From Ducks' Winter Home

An ingenious "bubble bath" provides a colony of ducks in Wisconsin with an ice-free lagoon in zero temperatures. Utilizing a simple fact of physics—that water is densest at 39 degrees above zero, and expands instead of continuing to contract as the temperature drops from there, thus freezing from the top—Charles Martin, an

Allis-Chalmers Manufacturing Company engineer, built a grid of seven $\frac{3}{4}$ -inch pipes 84 feet long and spaced five feet apart. He drilled 588 $\frac{1}{32}$ -inch holes in the top side. On the shore, a motor drives a little air compressor to produce 15 cubic feet of air a minute. When the temperature reaches freezing, a thermostat starts the motor and the lagoon erupts into ripples. The bubbles force the warmer bottom air up and the lighter, colder surface water to the bottom, where it is warmed. Operation of the grid also creates a low pressure area near the bottom, sucking in seepage at a 50-degree temperature from nearby Lake Michigan. Operating expenses for four months, December through March, are about \$30. And the ducks love it.



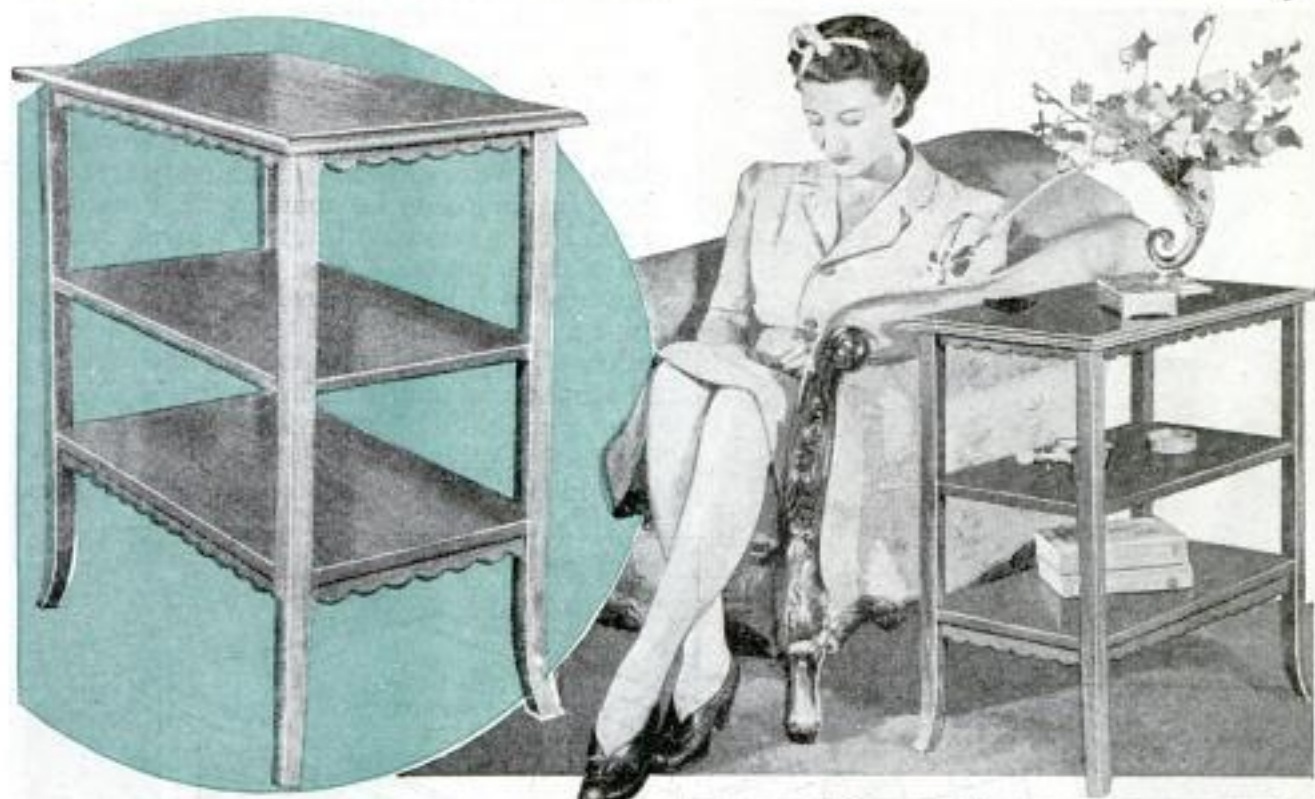
Blimps Spot Tuna for Fishermen

Now that no Jap submarines lurk off the West Coast, spotters in Navy blimps have developed a new way to keep their eyes sharp—they look for schools of tuna fish. When a blimp crew spots tuna racing along at about 30 miles an hour, the location is radioed to fishing boats which set out for the catch. Boats in sight of the blimp change their course briefly as a signal they have received the message. If a boat gives no such signal, the blimp crew assumes the boat has no radio. In this case, the blimp drops a smoke flare near the boat with the tuna location attached.

Film Filter Coated With Steel

Thin films of stainless steel on optical glass in vignetting filters have eliminated pictures bright in the middle but dark at the edges, previously encountered in aerial photography with wide angle lenses. The stainless steel film is deposited on the optical disk by an electro-vacuum precipitation process. Placed in front of the lens, the film is thickest and transmits least light at the center of the disk, growing gradually thinner and more transparent at the edge. By complementing the lens with which it is used, the filter permits photographs of even density.

Would you like to know more about commercial products described in this magazine? Many are now available. Addresses of the manufacturers or distributors of such items are in the Where-to-Buy-It Index, page 8A



END TABLE

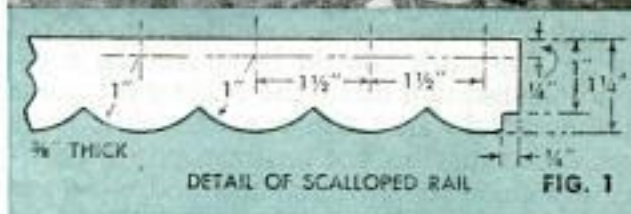
Matches Most Furniture

By Charles E. Troutt

DESIGNED to blend with almost any style of living-room furniture, this end table is constructed without the use of nails or screws and requires less than eight board feet of lumber. The wood selected should harmonize with that of the chair or sofa beside which it is to be placed.

The legs are cut as shown in detail B of Fig. 2, and a cardboard template of the dimensions indicated in detail A is used to shape the lower ends which serve as feet. Each foot should be laid out on adjacent sides of the leg, which is made of 1½-in. stock, and all saw cuts should be stopped about ¼ in. short of completion to give better support to the work. When all cuts have been partially made, the legs can be finished and sanded. Since the legs cannot be dressed on a jointer because of the curved feet, care should be exercised to cut exactly on the line.

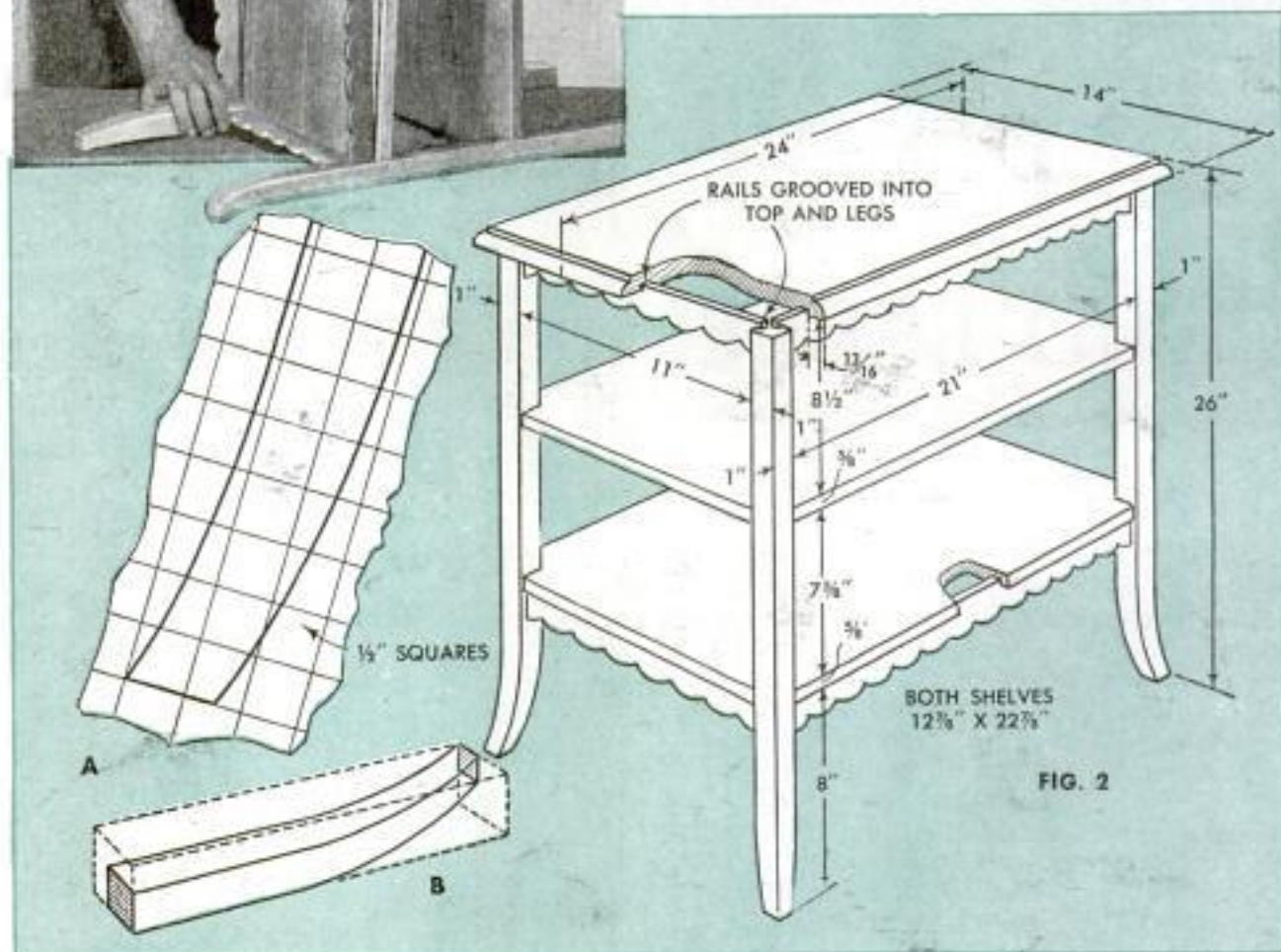
The grooves for the scalloped top and bottom rails can be cut in the legs with a hand router. If this method is used, the router should be moved so that the cut-





the leg grooves must be made short enough to allow the lower edges of the rails to be notched at the ends as in Figs. 1 and 3.

Dimensions for the table top and shelves are shown in Fig. 2. If these are glued up, using three or four narrow pieces for each and reversing the direction of the grain in alternate pieces, the tendency to warp will be minimized. The shape of the molded edge for the top of the table is given in the circular detail of Fig. 3. Grooves in the undersides of both the table top and the bottom shelf can be made with a router, as in Fig. 3, or again the work can be done on a drill press. If the dimensions given have been followed closely, it will be $\frac{13}{16}$ in. from the outside of the groove to the edge of the table top, and on the bottom shelf the distance will be $\frac{1}{4}$ in. If the dimensions have been varied slightly, an alternate method of locating the grooves would be to slip the rails into all four legs

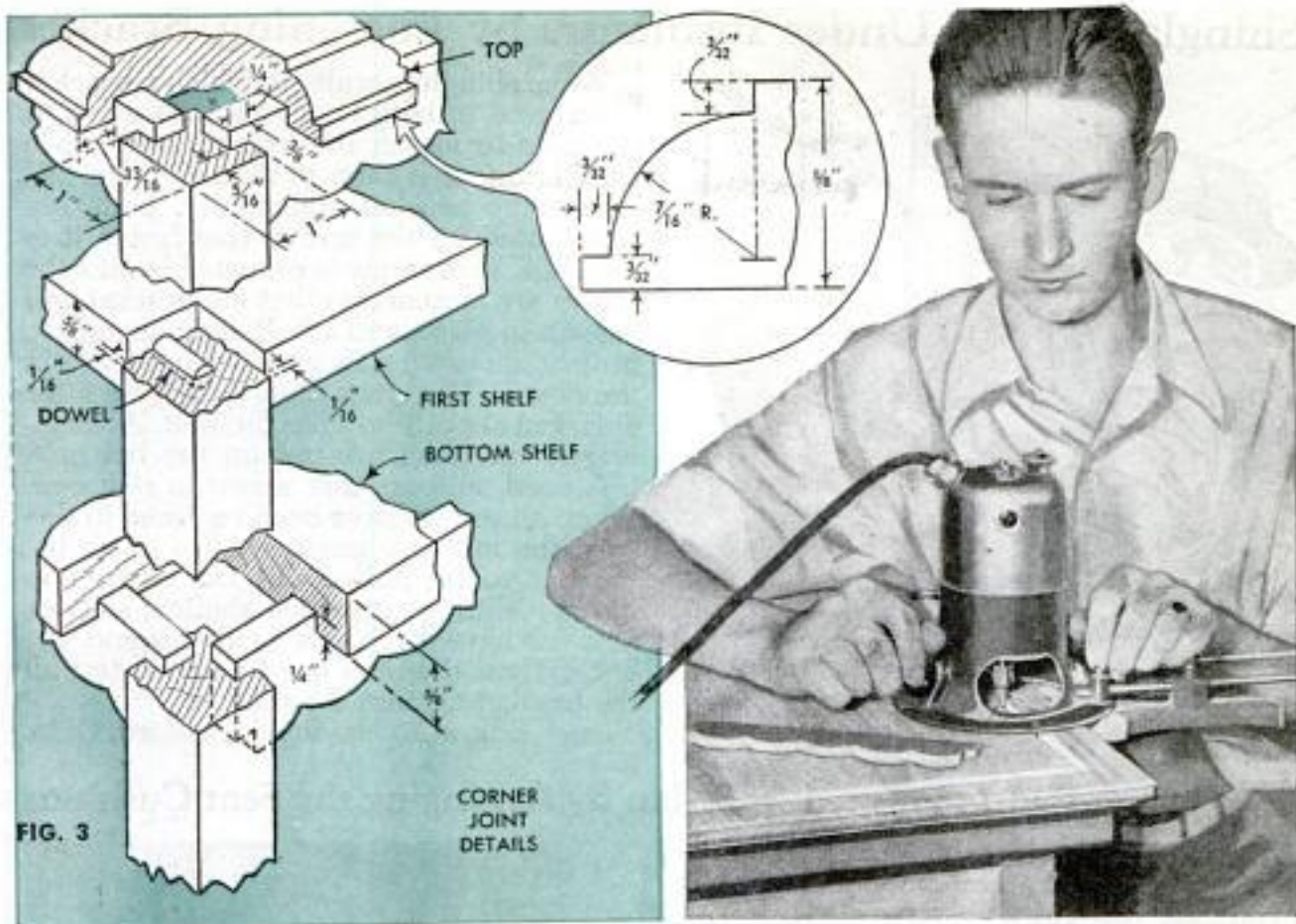


ting bit tends to make the router guide hug the work. Also, the grooves can be cut on a drill press by using either a router bit or a hollow chisel. When routing on a drill press the work should be moved in a direction that will make the cutting bit cause the work to hug the router guide. The grooves must be cut uniformly and accurately since the bottom shelf and table top are grooved to fit over the rails. Note that

of the table and then mark the grooves.

The rails should be a snug fit in the grooves, and are cut to the dimensions given in Figs. 1 and 2. It is possible to cut two rails at the same time on a jigsaw by tacking them together. If a fine blade is used this will eliminate sanding the scalloped edges.

Fig. 3 shows the method of fastening the center shelf to the legs by using dowels.



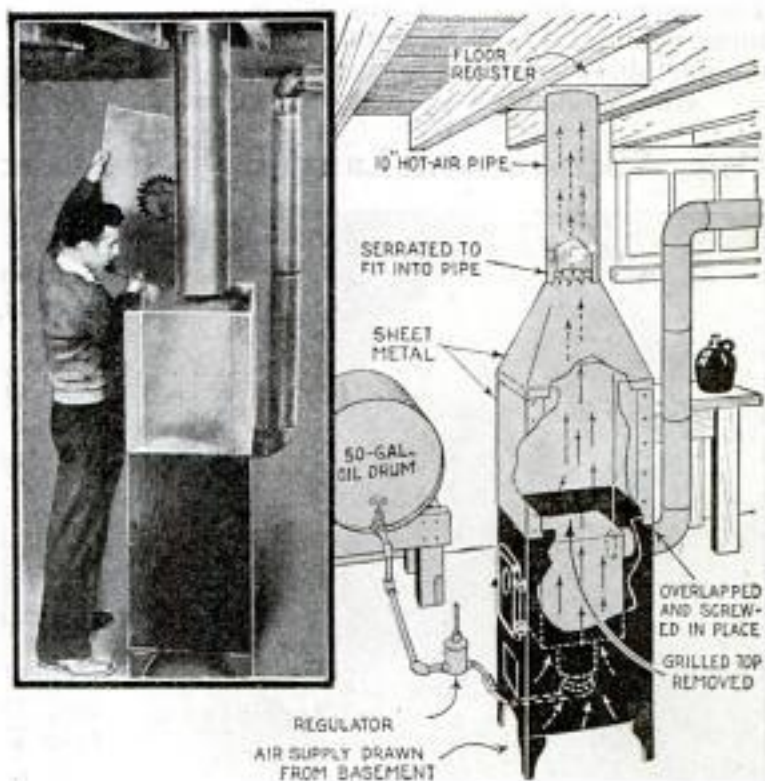
To complete the assembly, glue the short rails between the legs to form the two ends. As one operation, glue in the bottom side rails and the doweled center shelf. Following this, the bottom shelf can be slipped over the rails and glued. Then the upper

rails are glued into the grooves of the table top and the unit assembled to the legs. Using a sufficient number of clamps will assure good joints. Before finishing, the sharp corners of the legs and shelves, as well as the entire table, should be sanded.

Hot-Air Heater in Small Home Adapted From Oil Stove

Located in the basement of a cottage, cabin or other small building, a heating plant like the one shown will take the place of a more expensive furnace. The plant consists of an oil stove of the circulating type and a sheet-metal enclosure connected by a length of pipe to the register in the floor above. The enclosure is made in two parts; a jacket, which is open at top and bottom, and a tapering canopy. The grilled top of the stove is removed and the jacket is bolted in place. The canopy is placed on the jacket, and a length of hot-air pipe is fitted as shown. To avoid constant refilling, the reservoir in the stove is disconnected and a large oil drum, located at a safe distance, is connected by a feed pipe, a constant-level regulator being used to maintain the feed.

J. Modroch, Danbury, Conn.



Shingle Slipped Under Insulators by Loosening Bracket



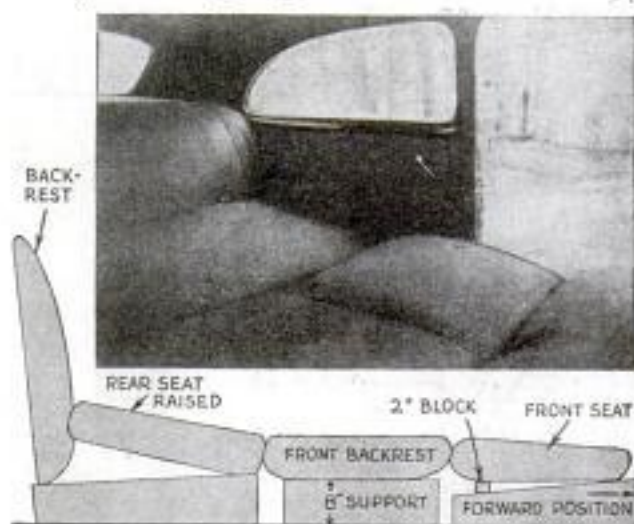
When shingling walls on which a bracket is screwed to hold heavy electric wires, it is easier to loosen the bracket and slip a shingle under it than to take it down. To loosen the bracket sufficiently, bolts are substituted for the screws that fasten it to the wall. One screw is removed before the others are loosened so that the bracket will remain in place, and a bolt, long enough to project about 2 in., is inserted from within the house. The screw hole may have to be enlarged slightly to take the bolt. A washer and nut then are put on the bolt and tightened, and another screw is removed. When all screws have been replaced in this way, the nuts are unscrewed to allow the bracket to be pulled out far enough to insert a shingle, in which shallow slots or notches have been cut to fit around the bolts. Then the nuts are tightened to pull the bracket against the shingle.

Edison R. Haviland, Bedford, Ohio.

Emergency Bed Is Formed in Sedan by Arranging the Seat Cushions

On week-end fishing trips or in an emergency when hotel accommodations are not available, the cushions of a 1941 model Chevrolet two-door town sedan can be arranged to form a bed. The front seat is moved as far forward as possible and the cushion is leveled by blocks of wood as indicated in the detail. The rear-seat cushion is raised against the backrest to form a "pillow." A support about 8 in. high, which can be formed from baggage or pieces of wood, is placed between the front and back seats, and the front backrest is laid on it. The space made available by this arrangement is about 4 by 6 ft., enough to provide comfortable sleeping quarters.

Charles A. Walhof, Rock Valley, Iowa.



Pair of Scissors and Lamp Bulb Are Used for Testing Flashlight Cells



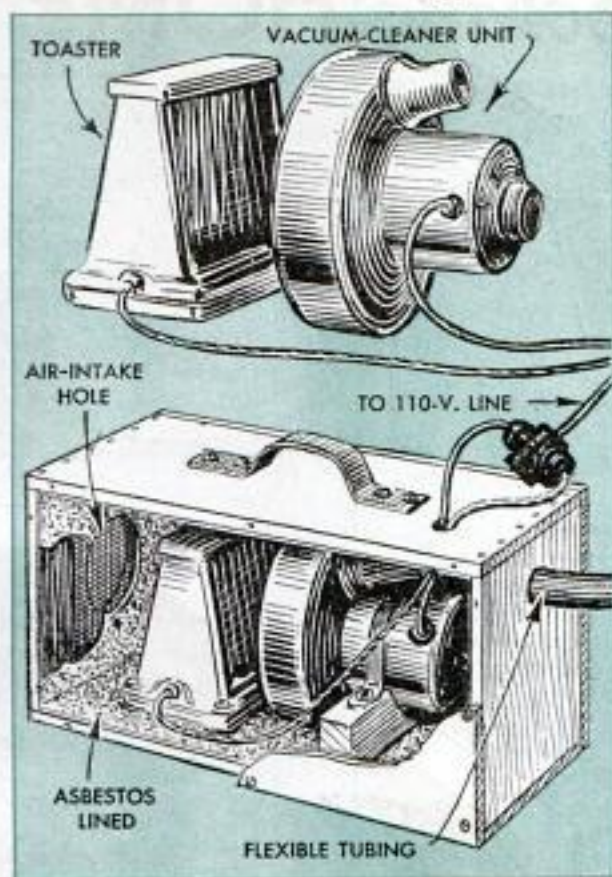
By using a pair of scissors and a lamp bulb you can determine whether a flashlight cell is exhausted. The bulb is set on the center contact of the cell, and the scissors are held so that one blade touches the base of the cell and the other blade contacts the threaded portion of the bulb base. If the cell is in good condition the bulb will light.—Wm. Swallow, Brooklyn, N. Y.

Rough Plastics Used as Lenses

If Lucite or Plexiglas rods are to be used in transmitting light, the ends through which the light enters and leaves the rod should be roughened by sawing or sanding. Polished surfaces of this material reflect light and prevent its transmission.

Robert A. Ridout, New Castle, Ind.

Frozen Water Pipe in Wall Thawed by Hot Air



Frozen water pipes located between outer walls of a house ordinarily cannot be reached so that they may be thawed. However, by using this simple heating unit, hot air can be directed between the walls to thaw the pipes. The unit consists of an electric toaster, a vacuum-cleaner blower and a length of flexible tubing. The toaster is fastened on the floor of an asbestos-lined wooden box and

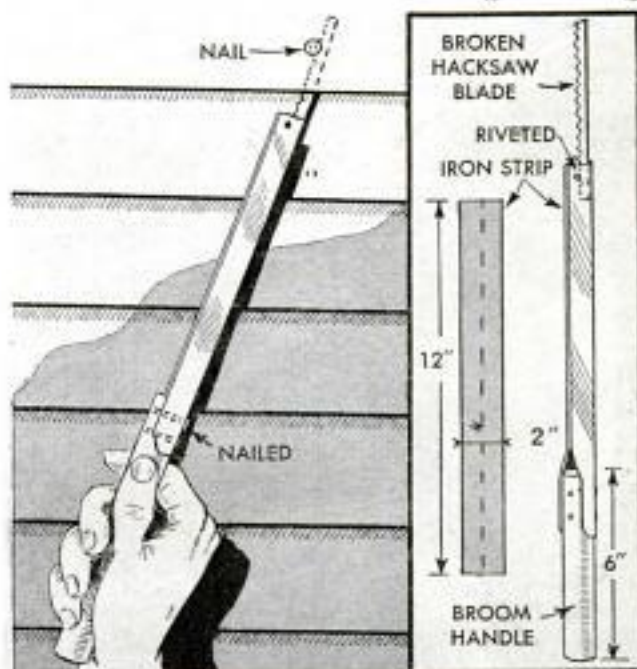
just behind an air-intake hole cut in the end of the box. Behind the toaster the blower is set in position to force air heated by the toaster out through the tubing. The method of attaching the tubing to the blower will be determined by the type of blower used.—David B. Clapp, Livingston, N. J.

Nails Sawed Under Siding to Remove It Without Splitting

When it is necessary to remove a few siding boards, they can be taken off without splitting by sawing off the nails with a piece of hacksaw blade. An extension for the blade is made by bending a 12-in. length of sheet metal along its center to form a channel in which the blade is held by a rivet set between the saw teeth as indicated in the detail. For a handle, a short length of broomstick will do. In use, the saw blade is slipped under the work and the nail is sawed through, after which the board can be lifted off.

C. H. Kinnard, Franklin, Tenn.

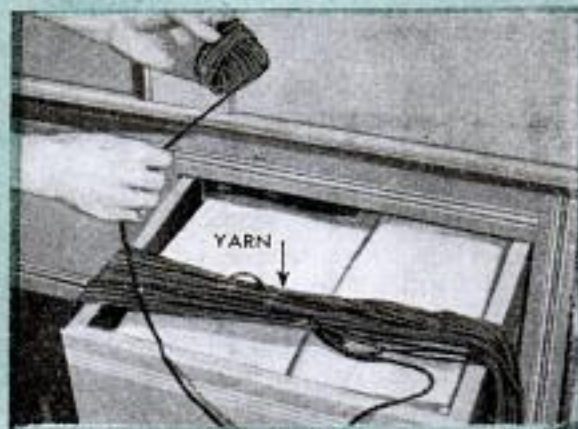
☞ In extremely cold weather add denatured alcohol, $\frac{1}{2}$ pt., to a tank of gasoline. The alcohol will mix with condensed moisture that may be present in the gasoline and thus keep it from freezing in the fuel line or carburetor.



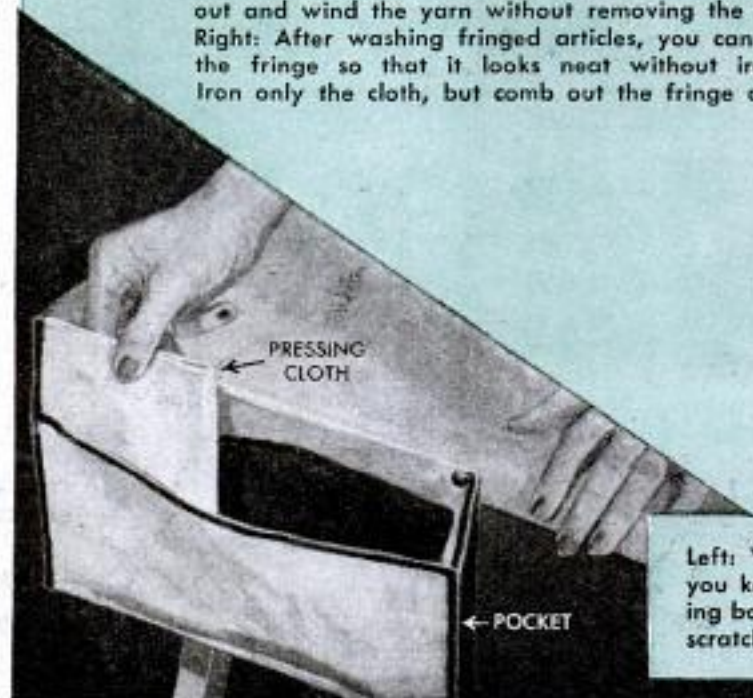
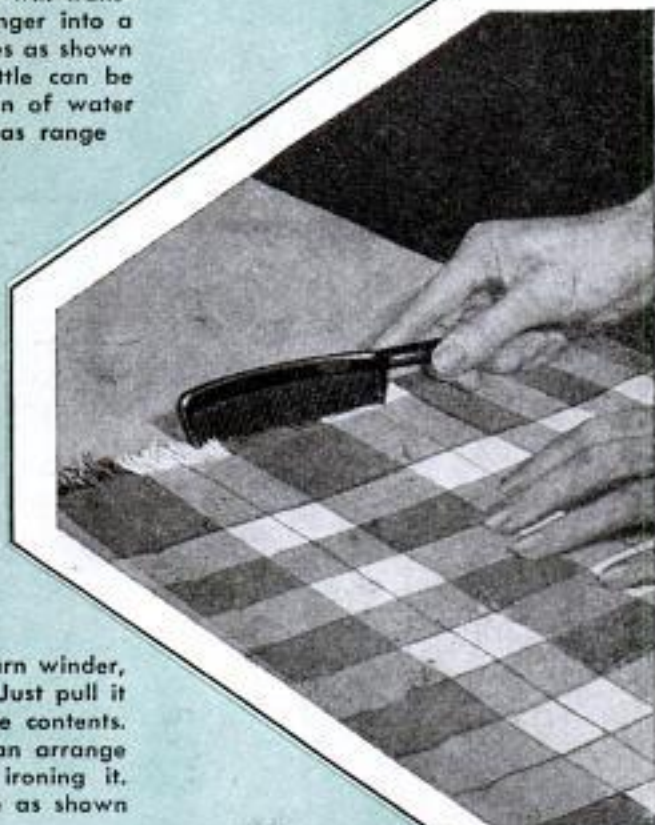
Solving HOME



Spring paper clips sewed to tape will transform a cloth-wrapped clothes hanger into a handy drying rack for small articles as shown above, left. Right: A baby's bottle can be kept warm by placing it in a pan of water set over the pilot light of a gas range

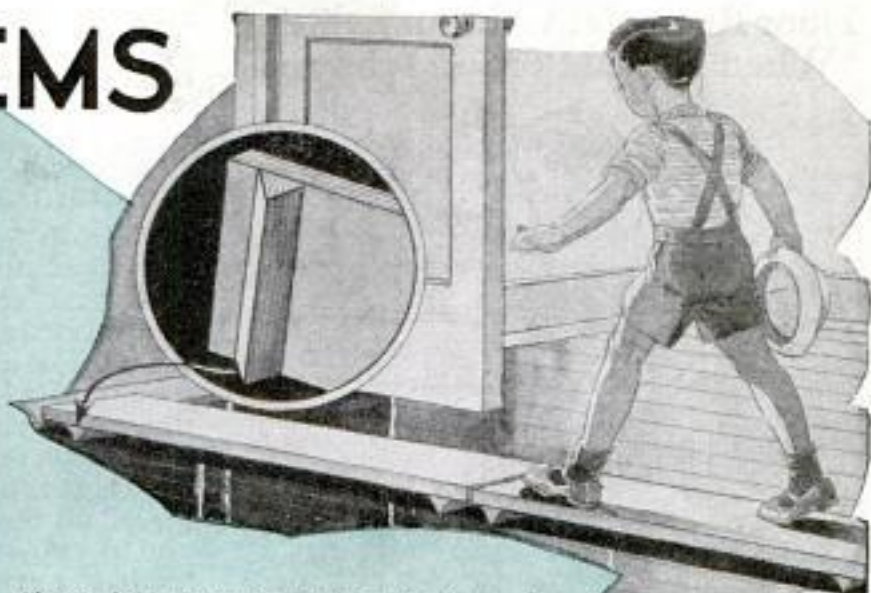
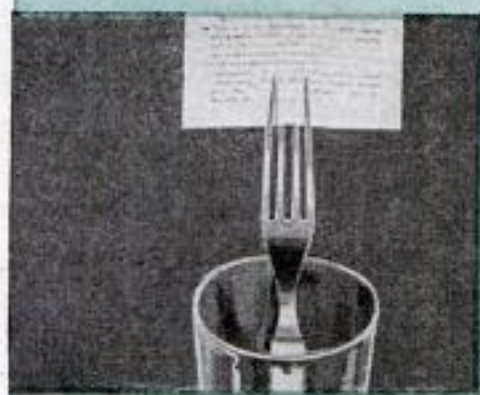


Above, left: If you do not have a regular yarn winder, a cabinet drawer makes a good substitute. Just pull it out and wind the yarn without removing the contents. Right: After washing fringed articles, you can arrange the fringe so that it looks neat without ironing it. Iron only the cloth, but comb out the fringe as shown

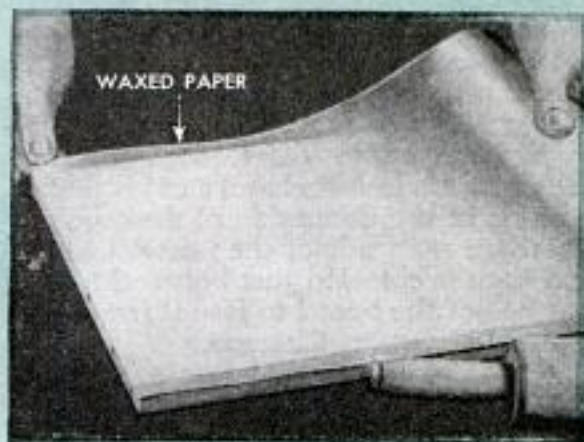
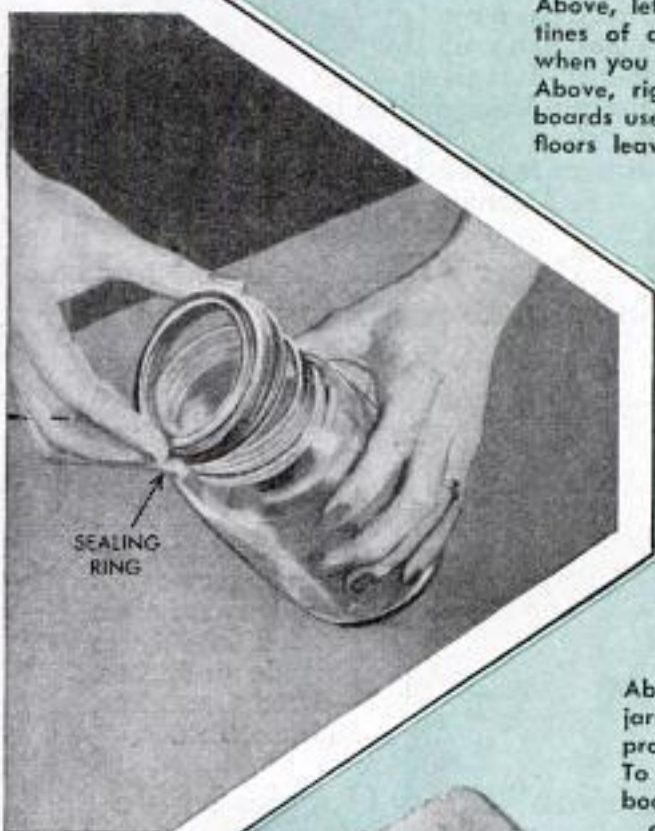


Left: You won't need to hunt for pressing cloths if you keep them in a cloth pocket tacked to the ironing board. Above: Colorless nail polish will smooth a scratched wooden crochet hook that snags the yarn

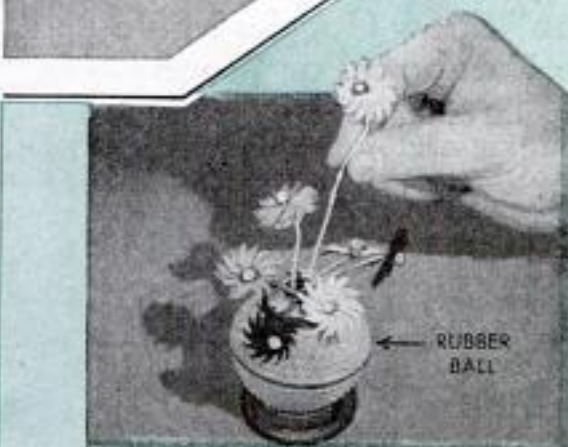
PROBLEMS



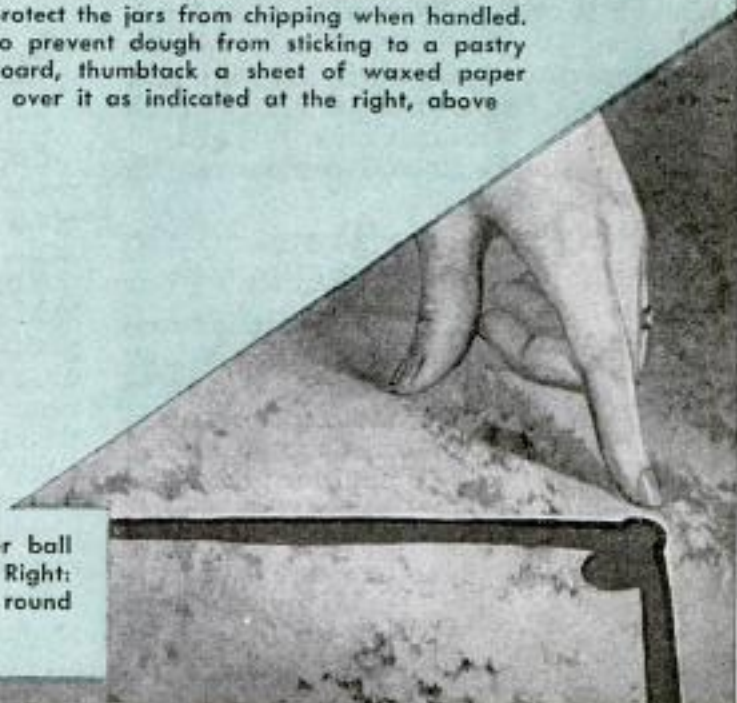
Above, left: A recipe card set between the tines of a fork placed in a drinking glass when you bake is easily read and stays clean. Above, right: Triangular cleats nailed to boards used as a walk over newly varnished floors leave only slight marks in the finish



Above, left: Sealing rings kept on canning jars will be at hand when needed and will protect the jars from chipping when handled. To prevent dough from sticking to a pastry board, thumbtack a sheet of waxed paper over it as indicated at the right, above



Above: Set on a caster cup, a hollow rubber ball slit to hold flowers can be used for a vase. Right: When making right-angle cuts in linoleum, round the corners to help avoid tearing it



Floor Removed Without Splitting When Nailed Portion Is Sawed



By using a keyhole saw as shown, old flooring can be taken up without splitting, thereby saving it for reuse. After one board is removed to allow room for the saw, the latter is inverted and a cut is made at an angle in the underside of the adjoining board on each side of the joist. The cut portion then is chiseled just below the upper surface of the board to free it from the nail.—Axel E. Ogren, Chicago.

Bottle Warmer Heats Gluepot

When you want to keep a pot of glue warm for long periods, try an electric heater of the type used for a nursing bottle. Although it cannot be used to melt hardened glue, the heater will maintain an even temperature which will keep the glue workable. Of course, a small gluepot such as a glass jar or tin can must be used.

D. E. Horn, River Forest, Ill.

Key Ring Held on Trouser Belt By Spring-Steel Clip



Keys that are carried on a ring attached to the trouser belt cannot be dislodged accidentally and lost if the ring is held by a clip like the one illustrated. It is made from a 7-in. length of $\frac{1}{2}$ -in. spring steel bent so the key

ring can be removed only by being pulled up and then outward and downward to open it.—Earl C. Black, Westville, Ohio.

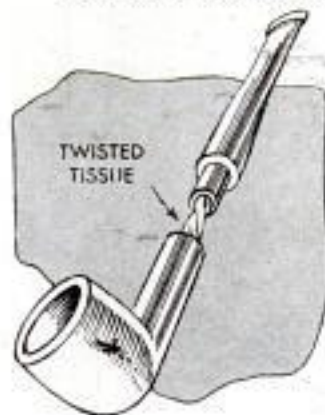
Stops Prevent Opening of Drawer To Expose Hidden Compartment

Valuables can be stored temporarily in a "secret" compartment at the back of a desk drawer if the drawer is fitted with stops to prevent its being pulled all the way out to expose the hidden articles. The stops are short lengths of iron rod fitted loosely into holes drilled in the edge of the drawer sides so they can be removed when the drawer is opened part way.

L. Meehan, Toronto, Ont., Canada.



Tissue Paper Twisted in Pipestem Substitutes for Smoke Filter



Tissue paper that has been twisted will absorb tobacco tar and nicotine in the stem of a pipe made to take a filter. The paper first is rolled and then twisted loosely to provide air spaces.—Fred Cornelius, El Paso, Tex.

"Eskimo" Snow Goggles Made From Cardboard or Wood

Snow goggles of the Eskimo type can be made by cutting narrow slits in a strip of oiled cardboard about 6 in. long and 1 in. wide. A V-shaped opening accommodates the bridge of the nose, and the goggles are held in the proper position by string or rubber-band temples run through holes at each end. More permanent goggles of this type can be made by whittling a piece of wood to the same size and curving it to fit the face.

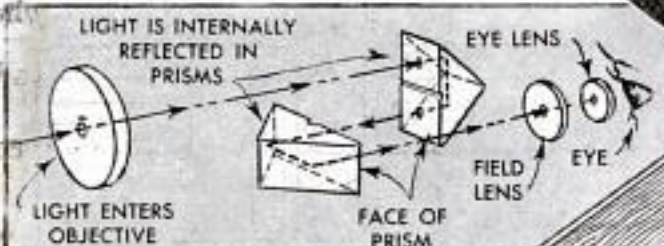
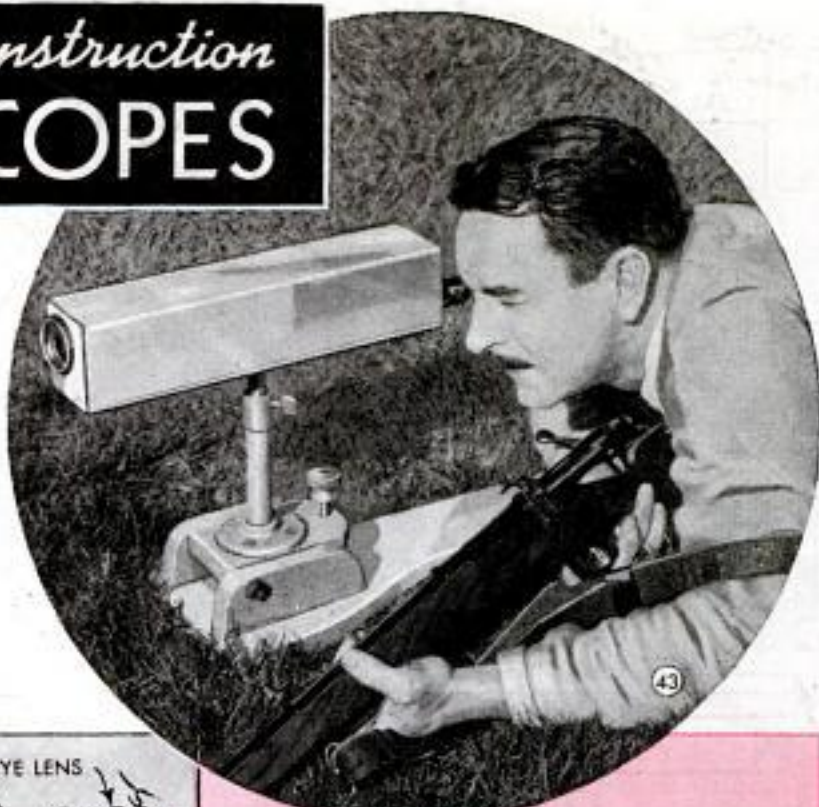


Design and Construction of TELESCOPES

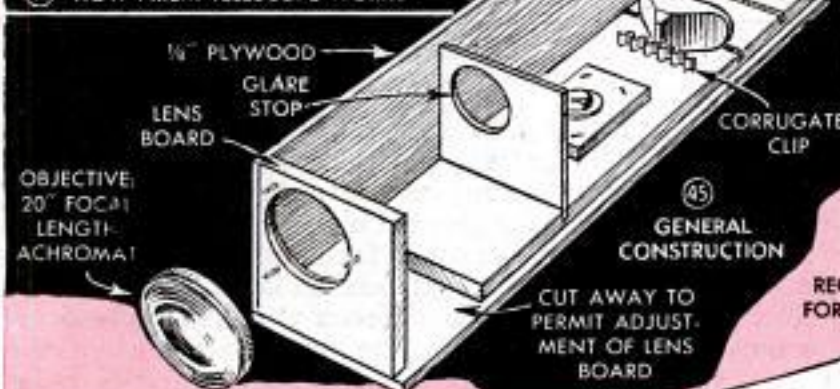
By Sam Brown

PART III

THE prismatic telescope is an astronomical telescope plus a pair of prisms for erecting the image. The most common example of this type of construction is the binocular instrument. One half of a binocular is a monocular. Some telescopes are used for a specific purpose and are named accordingly, a typical exam-



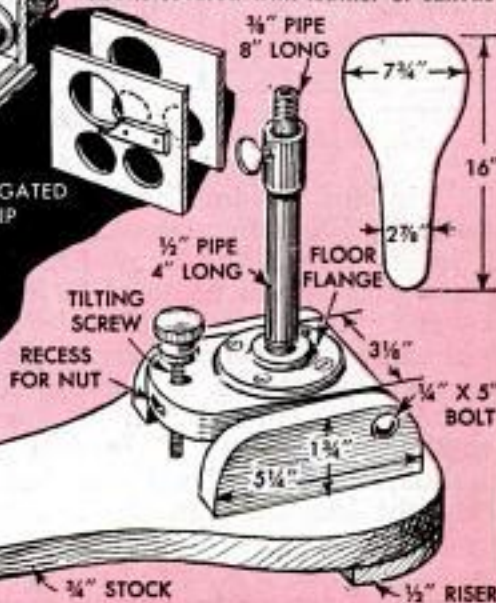
(44) HOW PRISM TELESCOPE WORKS



(45) GENERAL CONSTRUCTION

23X Spotting scope

uses 20-in. focal length objective and has prismatic erecting system. Main tube is covered with leather or canvas



(46) MOUNT HAS HEIGHT AND ANGLE ADJUSTMENTS

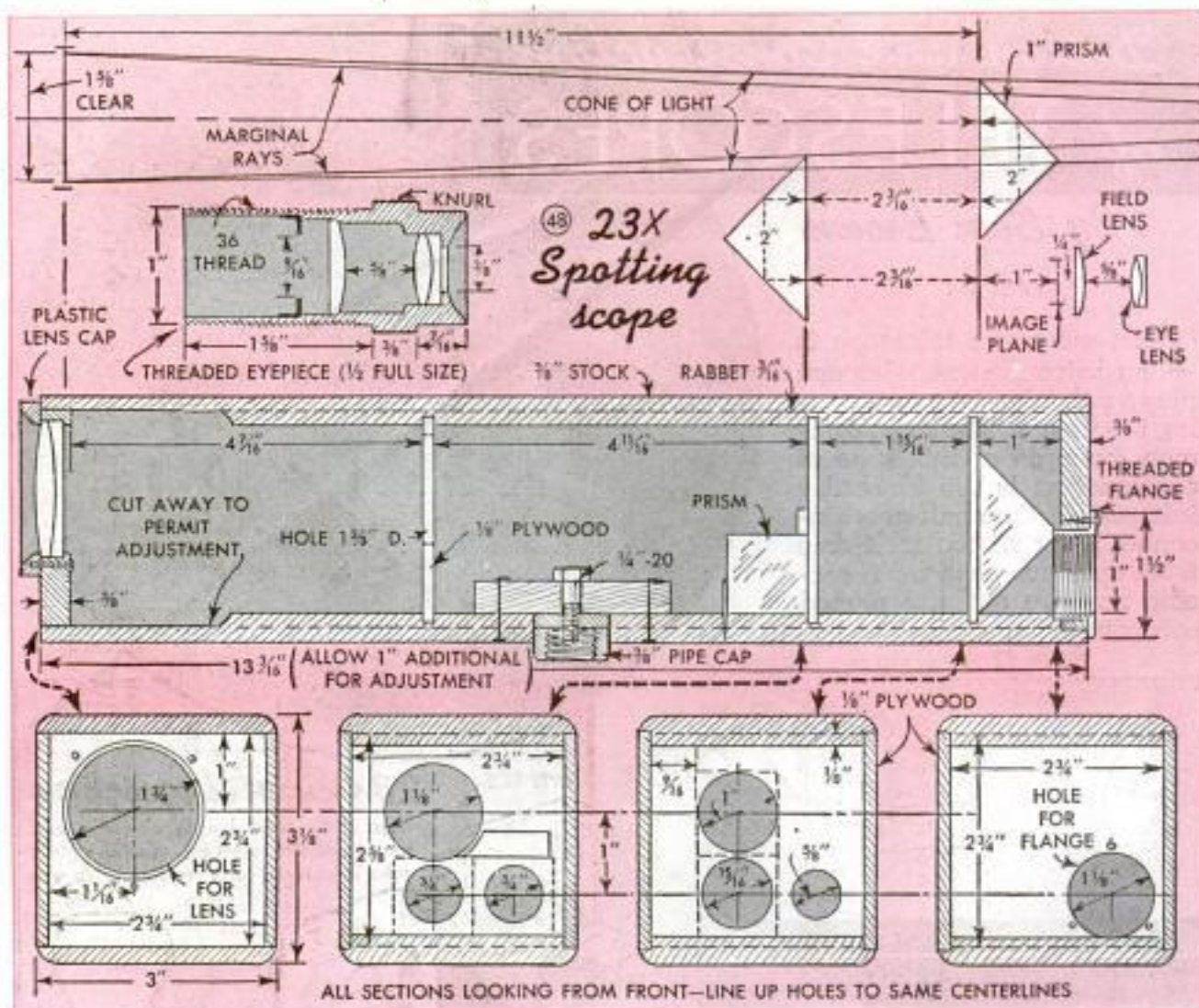
Lenses	Inches		Millimeters	
	Dia.	F.L.	Dia.	F.L.
OBJECTIVE	1 3/4	20	44	508
FIELD	7/8	2	23	50
EYE	1/2	1 1/2	16	28

Data

EQUIV. FOCUS OF EYEPIECE = $\frac{28 \times 50}{28 + 50 - 15} = 22$ MM.
 MAGNIFICATION = $508 \div 22 = 23X$
 EXIT PUPIL = $\frac{1}{8}$ " = 2 MM.
 EYE RELIEF = $\frac{7}{16}$ IN.
 LUMINOSITY = 13%
 PRISMS—1-IN. FACE
 IMAGE SIZE = $20" \times .030 = .60" = \frac{3}{16}"$
 FIELD OF VIEW AT 1000 YDS. = 24 YDS. (APPROX.)

ple being a spotting scope, which is used to view the target in rifle shooting.

Prisms: Prisms are polished, angular pieces of glass, the kind commonly used in telescopes being 45-45-90-deg. prisms. The long side is the face, while the two short sides are the reflecting surfaces. The size of the prism is the width of the face. Fig. 44 shows how the prisms are used in a telescope. Made specifically for telescopes, the prisms are grooved across the face in order to make a definite dividing line and avoid ghost images which would be caused by overlapping rays at this point. The ends are usually rounded to conserve space. The two sizes that you will probably work with



are 1 in. and $1\frac{3}{16}$ in. The 1-in. size is from the Navy 7X binocular while the smaller prism is from the Army 6X binocular. These prisms can be used in almost any power or type of prismatic telescope. The prime advantage of the prism erecting system is compactness. It adds somewhat to the bulk of the instrument but shortens the length considerably. The prism glass has an illusive quality of brilliance but actually the light loss through the two prisms is somewhat greater than through the two erecting lenses of a lens erecting system.

The 23X prismatic spotting scope: This design calls for a 20-in. focal length objective, which, with a 22-mm. focal length eyepiece (from Army 6X), gives 23-diameter magnification. Prisms are 1-in. face. Fig. 45 shows the general construction and Fig. 47 gives lens data, while Fig. 48 gives complete dimensions. The scope body is of wood construction in simple box form. The first prism, the one the light strikes first, is located in an upright position at the back of the box; the second prism is mounted flat on the box bottom. Plywood spacers hold the prisms in place and also provide for the passage of the cone of light admitted by the objective. The eyepiece is fitted in

a threaded mount. This type of focusing is satisfactory at set distances but is much too slow for general use. If you want this scope for general observation, it should be fitted with spiral focusing like the 10X monocular to be described later. It would also be practical to focus with a simple draw tube system. The principal point of the construction is to get the various holes lined up square. Use prism center lines as a guide and locate all holes from one master pattern drawn on cardboard.

A mount for the spotting scope is shown in Figs. 43 and 46. The $\frac{3}{8}$ -in. pipe fits into a pipe cap recessed and bolted to the bottom of the telescope as can be seen in Fig. 48. The pipe slides inside the 4-in. length of $\frac{1}{2}$ -in. pipe to provide height adjustment from 11 to 17 in. to objective centerline. Base on which the floor flange is mounted pivots on a carriage bolt and is tilted by means of a tilting screw.

Designing prismatic telescopes: Designing your own prismatic telescopes follows much the same procedure as used for astronomicals and terrestrials. Primary consideration should be given the objective and eyepiece. The prisms contribute nothing to the magnification; therefore, the power

you want must be obtained entirely by the ratio of FO to FE. Prisms should be of such a size or so located as to receive the full cone of light from the objective, although it is practical to sacrifice extreme edge rays.

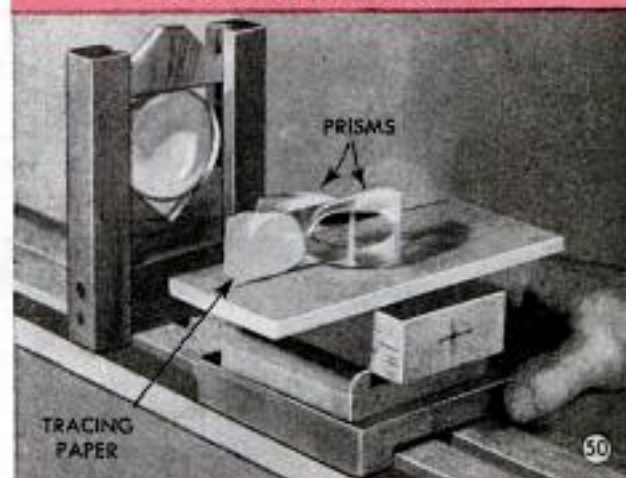
Fig. 52 shows the complete layout and construction of a 10X monocular. The layout (at top of drawing) is what you make to determine size and location of prisms and also the general overall dimensions. In this example, the objective has a 52-mm. diameter by 193-mm. focal length (from Navy 7X binocular) and the prisms are 1-in. face (from Navy 7X). As used by the Navy, this glass has a 27-mm. eyepiece, which gives a magnification of 7 diameters. If you want higher magnification, you have to use a shorter focus eyepiece. The Army 6X binocular eyepiece, 22 mm., could be used and would give you 9X. The eyepiece shown uses an Army binocular eye lens, but a shorter focus field lens, the combination giving 20-mm. focus, hence, about 10X magnification.

The preliminary calculation should determine the exit pupil and luminosity. This glass has excellent illumination at 92 percent. However, don't get the idea that the 13 percent rating of the 23X spotting scope is hopeless—13 percent is a good value for anything over 20X magnification. It is worth mentioning here that prism instruments are often rated for illumination on the basis of the exit pupil squared. Thus, if the scope has a 5-mm. exit pupil, it would be rated 25. Using this calculation, the 100 percent standard would be the normal size of the eye pupil, squared: 25 for daylight and 49 for night.

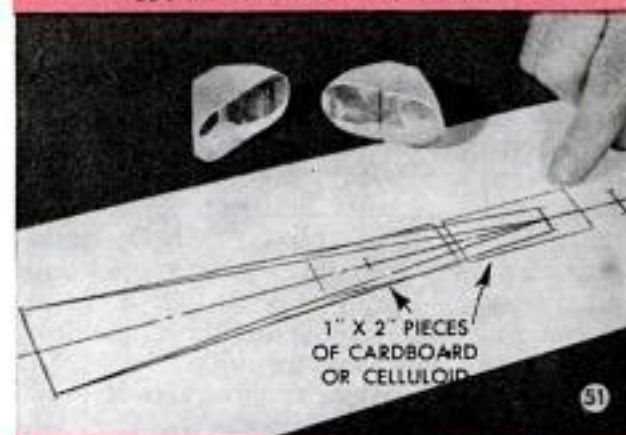
Bench setup: Set up the objective and focus on well-lighted copy or a bare light bulb, not less than 20 ft. from lens. Use tracing or waxed paper as a ground glass to pick up the image as in Fig. 49. Measure the distance from the rear side of the objective to the image plane. Start your layout and transfer this dimension to the layout, as indicated by A, Fig. 52. Next, put the two prisms face to face as in Fig. 50 and move the assembly back and forth until you pick up a sharp image of the copy or light bulb. Measure the distance to the face of the first prism and set off this distance on your layout, indicated by B, Fig. 52. Now, referring to the Fig. 48 layout, you will note that the distance the light travels through a 1-in. prism is 2 in., a total of 4 in. for both prisms. Set off this distance, C, on your layout to establish the back image plane. Determine the image size. In this instance, the multiplying factor is .070, and this figure multiplied by the focal length of the lens ($7\frac{3}{8}$ in.) gives .53 in. for the image size. Call this $\frac{9}{16}$ in. for an even figure and mark the image size at



PICK UP IMAGE ON TRACING PAPER

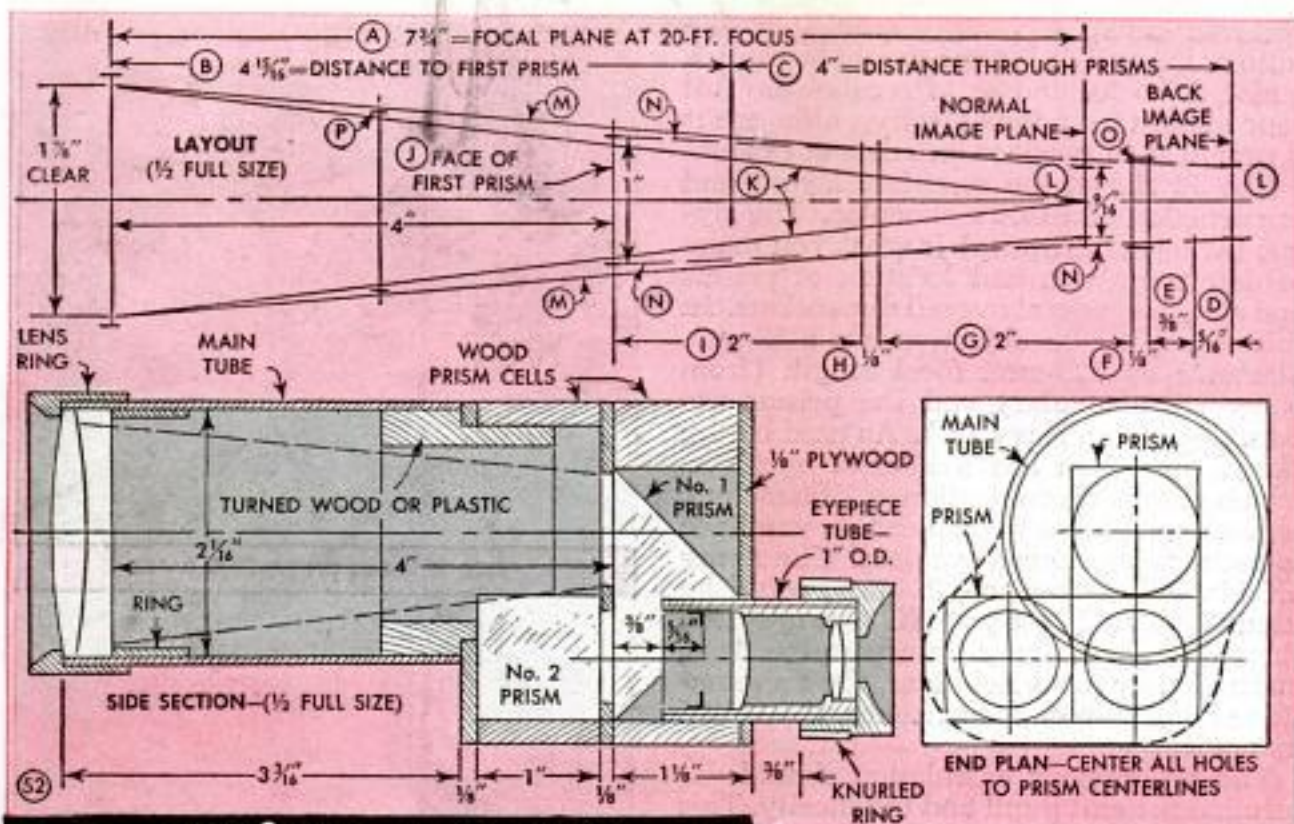


LOCATE IMAGE PLANE WITH PRISMS



MAKE LAYOUT AND MANIPULATE PRISMS TO SUIT

the normal image plane and again at the back image plane, as indicated by L, Fig. 52. Draw lines K and M representing the marginal rays and the full cone of light. Your prisms must catch the marginal rays K and also as much of the weaker edge rays as possible. The best way to determine prism placement is to make two 1 by 2-in. oblongs of cardboard or celluloid. Manipulate these over your layout as in Fig. 51. The forward edge of the first oblong represents the face of the first prism. You can tell at a glance how far forward you can push it and still pick up the marginal rays.



10x Prism monocular

OBJECTIVE: 52X193 MM.

PRISMS: 1"

FIELD LENS: 21X32 MM.

EYE LENS: 16X25 MM.

COMBINED FOCUS OF $\frac{25 \times 32}{25 + 32 - 16} = 20$ MM.

EYEPIECE

$M = 193 \div 20 = 10X$

$EP = \frac{3}{16}$ " STRONG = 5 MM.

EYE RELIEF: $\frac{7}{16}$ "

LUMINOSITY: 92%

FIELD (From Fig. 24): 70 YDS.

FIELD (Actual): 62 YDS.

WEIGHT: 1 LB.

The distance between the two oblongs is the spacing between the prisms. The distance between the back edge of the second oblong and the back image plane must be sufficient to permit focusing. What you finally arrive at in this case is D, $\frac{5}{16}$ -in. allowance for the distance the image plane will set inside the eyepiece tube; E, $\frac{3}{8}$ in. for focusing travel; F, $\frac{1}{8}$ -in. prism spacing; G, 2 in., the distance through the second prism; H, $\frac{1}{8}$ -in. prism spacing again, coming back; I, 2 in. for the first prism, arriving at J, the face of the first prism. This may sound complicated, but it is really very simple if you are actually on the job. If desired, you can now draw an outline of the prisms like Fig. 48. This shows both prisms flat, the same way you test them in the bench setup.

At this point J, it will be noted that the face of the prism catches all of the marginal rays and about halfway out to the lines representing the full cone of light. As mentioned before, it is practical to sacrifice some or all of the weak edge rays, so that this placement of the first prism face is quite satisfactory. What next? Well, you know that the maximum cone of light you

can catch on the first prism is 1 in. in diameter at J, so lines drawn from here to image size at the back image plane will establish guide lines for hole diameters needed to pass this same cone of light back to the image plane. These lines are marked N in the drawing, and O, for example, shows the diameter

of the hole at the back face of the second prism. If you want to use one or more glare stops ahead of the prisms, the hole diameters are determined in the same way, as at P.

Monocular construction: You will need two wood blocks exactly 1 in. thick to house the prisms, Fig. 54. The $\frac{1}{8}$ -in. spacing between prisms is taken up by a spacer of $\frac{1}{8}$ -in. plywood, and similar plywood pieces are used at the back and front of the housing. The whole thing is glued up like a triple decker sandwich, the prisms being held securely in the cutouts and between the various layers. Work carefully to prism center lines. Be sure that prisms are exactly at right angles since any rotation here will rotate your image twice as much. Prisms must be spotlessly clean and polished. The eyepiece tube is 1 in. in diameter, this size permitting it to work alongside No. 1 prism. Focusing is by means of a spiral groove cut half way across the eyepiece tube as in Fig. 55. Fig. 56 shows the monocular partly assembled and also shows how the turning which joins the main tube to the prism housing is cut away to fit over the second prism. Fig. 53 pic-

tures the finished job covered with a gray pebble-grain oilcloth.

General notes: Cut the main tube long when making any prism telescope. Check the final position of the objective by actually using the instrument; run the eyepiece in as far as it will go and then place the objective so that distant objects are in focus. Then the full focusing range is available for picking up nearer objects. The 23X spotting scope will focus down to about 40 ft.; the 10X monocular to about 30 ft. or even 20 if you want to make it that way. If you use spiral focusing, it is necessary to know in advance how much you will need for focusing. This travel will be very short with a short focus lens, but much longer with a long focus objective. Allow $\frac{3}{8}$ in. for lenses less than 10-in. focus; $\frac{3}{4}$ in., up to 14-in. focus; $1\frac{1}{8}$ in. at 18 and $1\frac{1}{2}$ in. at 20. These allowances will let you focus down to 30 or 40 ft. in all cases, possibly closer. When you make a bench setup at close range, remember that this represents the maximum extension of your telescope. If you make a bench setup by focusing on a distant object (this is advisable if you are using an objective of over 20-in. focal length) the setup will represent the telescope at its shortest draw.

The Kellner type of eyepiece gives best results with all prismatic instruments. The objective should always be a cemented achromat. If the lens is not cemented when you get it, you can dummy test it by cementing with glycerine. Final cementing should be done with Canadian balsam; in a pinch you can use a good grade of water white (clear) lacquer. The diameter of the objective controls the

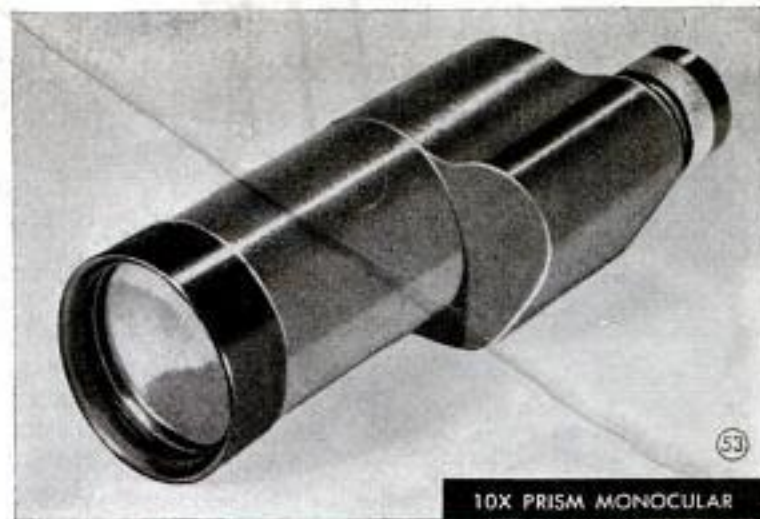
luminosity of the telescope. The diameter of the objective does not control the field of view; except in the Galileian instrument, you can see just as much through a small objective as a large one.

(CONCLUSION)

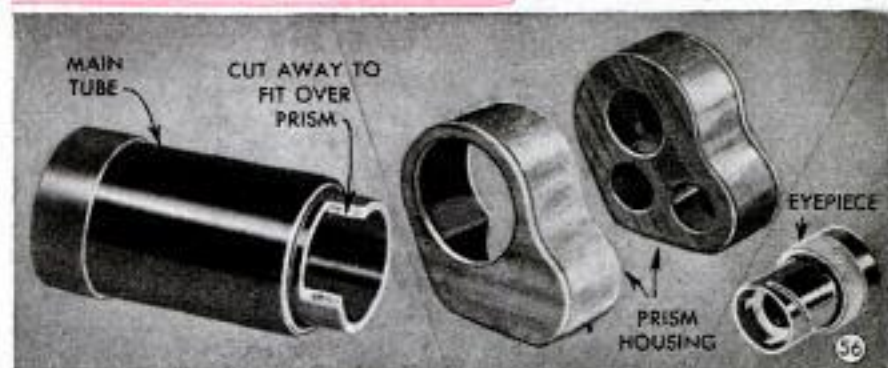
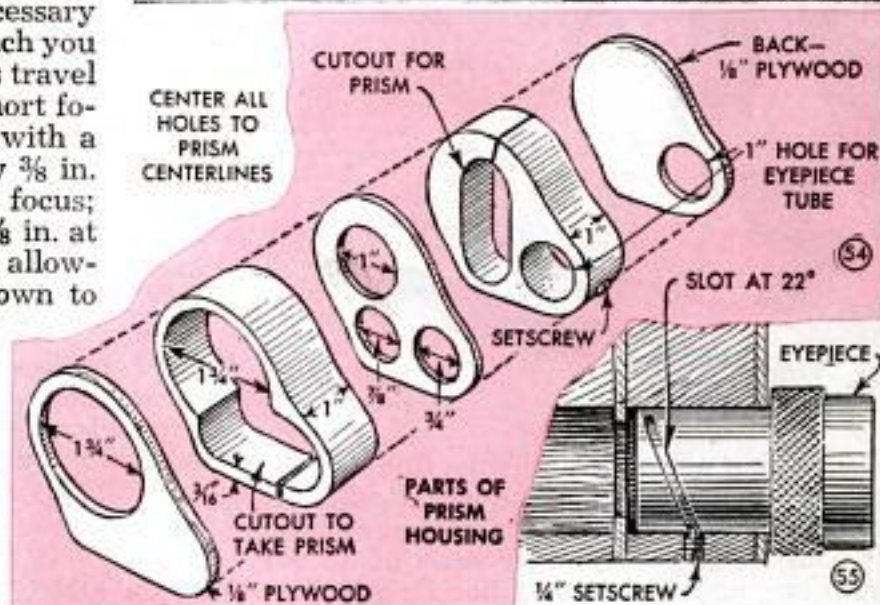
Water Glass Strengthens Asbestos Used to Hold Resistance Wire

Asbestos that is to be used instead of fiber or plastic for attaching the wires of a resistance heating element will be strengthened so that it does not tear easily if it is treated with water glass. The asbestos is soaked in a solution consisting of equal proportions of sodium silicate or potassium sil-

icate and water; then the asbestos is allowed to dry thoroughly. After this treatment it can be more easily drilled and sawed. If desired, a piece of the desired thickness can be built up from several thin sheets by using water glass as an adhesive and clamping them between boards to dry.



10X PRISM MONOCULAR



Engine Head Makes "Ice Plane" To Clean Skating Pond



Cleaning off snow and smoothing rough places on the ice of a skating pond is an easy job when this plane or scraper is used. It consists of the cylinder head of an old auto engine fitted with a handle which is made by assembling pipe and fittings to screw into the spark plug holes of the cylinder head as indicated. The scraper is pushed along by a skater and, as it is heavy and has sharp edges, it will remove snow and shave off rough places in the ice with little effort on the part of the skater.

Linens Arranged Neatly in Closet

Neat arrangement of linen need not be disturbed when one article is taken from a shelf if cardboard the size of the article is inserted between the pieces. This method prevents corners from being displaced when a piece is pulled out and only the item desired slides out.

Mrs. F. J. Tuccillo, Lime Springs, Iowa.

Bucket-Bail Grip Is Slit Spirally



If you place a short piece of hose over the bail of a bucket as a protection to your hand when carrying a heavy load, slit the hose spirally rather than straight in or-

der to slip it over the bail. When cut in this way, the hose will remain in place instead of pulling off when the slit is in line with the bail.

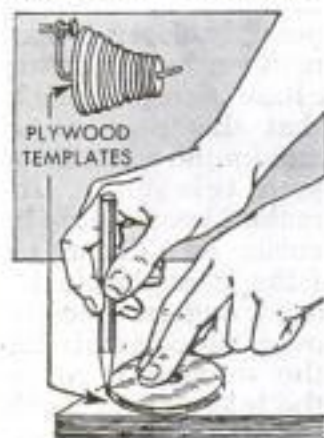
Magazine Binding Is Reinforced By Tape Stuck Under Staples

Pieces of transparent tape applied under the ends of staples used to bind the pages of magazines will prevent the pages from tearing at these places so that they fall out. The ends of the staples are pried up and the tape is placed between them, adhesive side down, after which the ends are bent down over the tape.—J. N. Parker, Bedford, Va.



Templates to Lay Out Corners

Used as templates to lay out rounded corners on panels, shelves and similar work, disks of plywood will serve in place of a standard fillet gauge. The disks are scribed to required diameters then sawed out carefully and smoothed, and a hole is drilled in each disk so that it may be held on a wire hook or nail when not in use.



A. H. Alexander, Philadelphia, Pa.

Sheepskin Buckled on Wrist Aids in Washing Ceilings

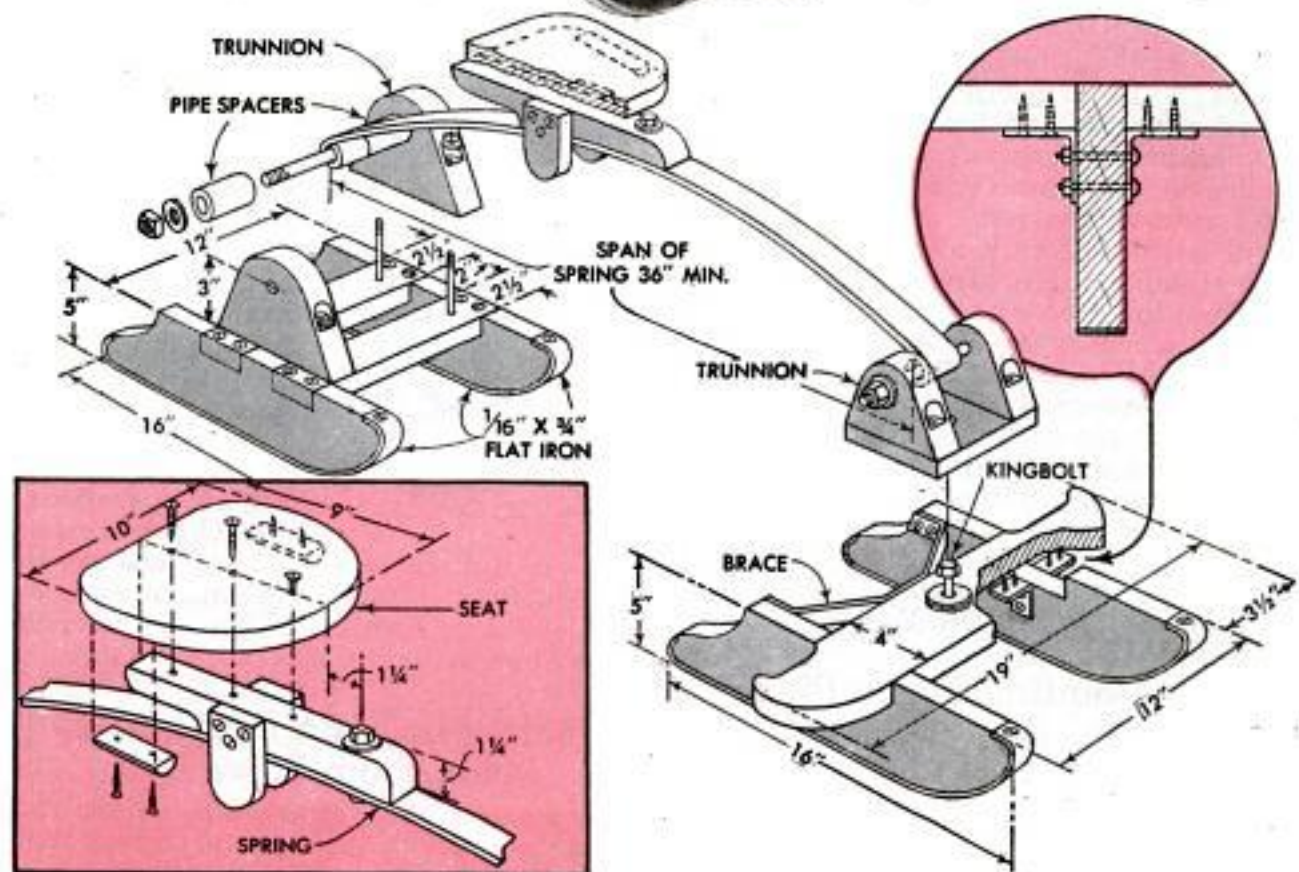
To keep water from running down his arm when washing walls and ceilings, a decorator wears a strip of sheepskin on his wrist, with the wool side in. The sheepskin is cut just long enough to fit tightly in place without overlapping, and is held by a buckle and a short length of leather strap such as is used on roller skates.



John Krill, Youngstown, Ohio.

Bouncing Bobsled

HAS AUTO-SPRING BODY



THE bumper the slide the better with this spring-bodied bobsled, which is steered with the feet so that the rider can hold on to the seat. The main leaf of an auto spring is held by lengths of iron rod set through wooden trunnions, which are bolted to cross members screwed to sled runners shod with strips of flat iron. Since the rear trunnions are widely spaced to prevent the sled from upsetting, the spring is centered on the rear rod by pieces of pipe. On the more closely spaced front

trunnions these are not needed, although washers may be used between the spring and trunnion sides. Corner irons reinforce the foot rest. The seat is screwed to a support that is attached by a kingbolt through the hole in the spring. Wooden guides screwed to the support prevent side sway of the seat, and narrow cleats are attached to the underside of the seat for finger grips. Spring and runner irons are painted to prevent rusting, and the wooden parts are shellacked and varnished.

Water-Heating Coil in Furnace Flushed to Keep It Clean

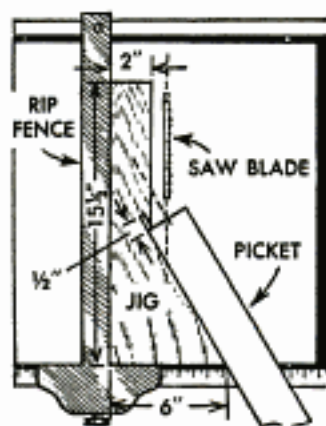


Frequent back-flushing of a water-heating coil in a furnace will keep it reasonably free of sediment and lime deposits. With the valve arrangement shown, flushing will require only a minute or two. In the cold-water side of the water line to the coil, install a shut-off cock and a sill cock or other suitable valve. Then run a hose or pipe from the sill cock to a basement drain. To flush the coil, close the shut-off cock and open the sill cock. This will cause the water to reverse its normal direction of flow through the coil and wash out the sediment. It's best not to flush the coil when there is a hot fire in the furnace as the coil then may act as a flash boiler and blow off steam. However, if handled carefully, the steam aids in the cleaning.

Robert A. Wilkinson, Van Wert, Ohio.

Jig for Pointing Fence Pickets

Faced with the job of pointing a number of fence pickets, one man used a jig for positioning them on his saw table. The jig consisted of a piece of $\frac{3}{4}$ -in. hardwood



shaped as shown. When cutting the diagonal side of the jig the saw is run into the straight side for a distance of about $\frac{1}{2}$ in. This cut will form a point at the junction of the angle to help hold the work in position. To use the jig, the saw fence

is set so that when the jig is advanced with the work, the blade will enter the picket at the centerline. After one corner has been cut off, the jig is returned to starting position, the picket is turned over and run through for the second cut.

Aime E. Tetrault, Fairhaven, Mass.

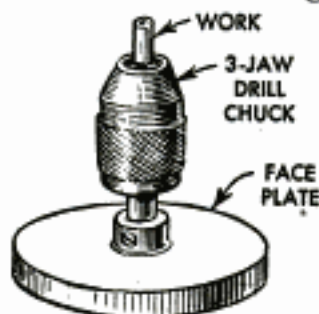
Nails Driven at an Angle Hold Warped Boards

If you experience difficulty in keeping boards and planks nailed down when used around a dock or swimming pool because they warp and loosen the nails, drive the nails at an angle. By doing this you will enable the nails to withstand better the continuous pull exerted against them by the warped boards.—George Barr, Brooklyn, N. Y.



By doing this you will enable the nails to withstand better the continuous pull exerted against them by the warped boards.—George Barr, Brooklyn, N. Y.

Small Work Held in Drill Chuck When Drilling or Machining



A $\frac{1}{2}$ -in. drill chuck mounted on a short shank and attached to the rear surface of a faceplate provides a handy tool for holding small work for light machine operations.

The chuck is especially useful when the ends of rods are to be drilled or ground as the machined surface of the faceplate provides a precision base when placed on a drill-press table.

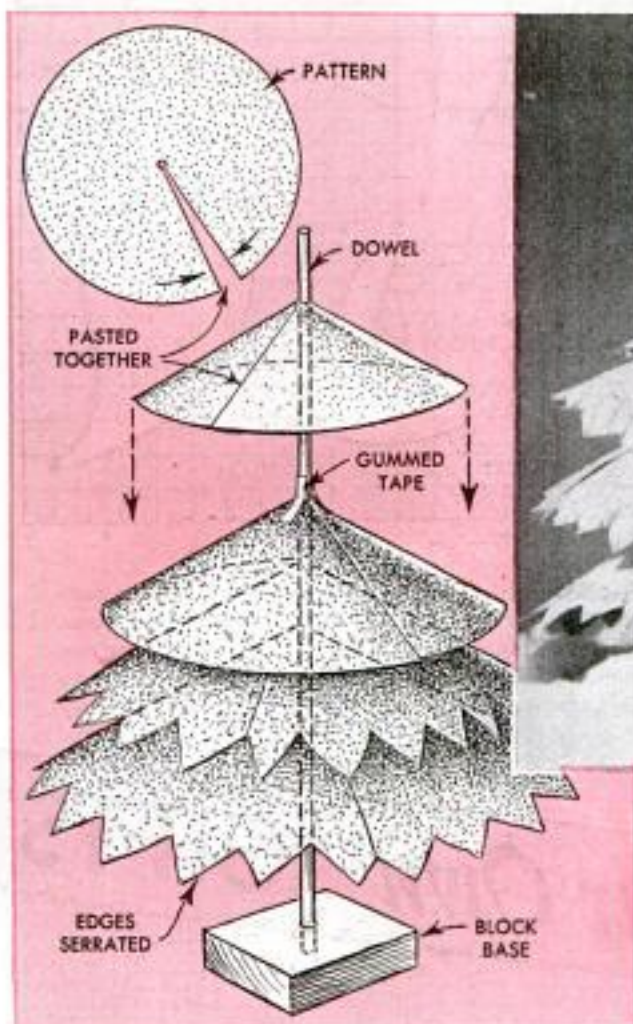
Safety Lock on Dog Leash Made From Stove Bolt

A restless dog sometimes twists the spring snap on his leash in such a way that it becomes unfastened. On a recent trip when my dog was checked in the baggage car, I prevented this by putting a stove bolt through the snap and screwing the nut tight after snapping the leash on the dog's collar. A nick in the threads kept the nut from loosening.

B. B. Brues, Newtonville, Mass.

Painted handles on knives and other kitchen gadgets should never be allowed to stand in water. The wood will absorb water and cause the paint to chip off.

Table Christmas Tree Has Paper-Disk "Foliage"



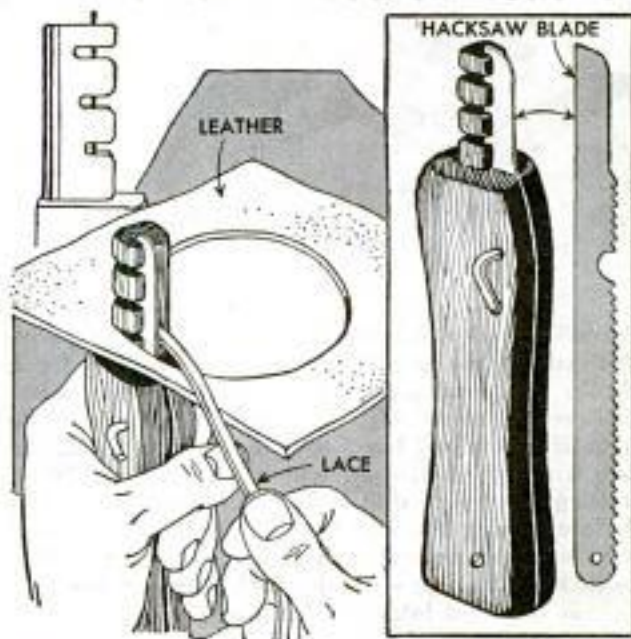
succeeding disk is cut to a smaller diameter so that the tree tapers naturally. From each disk a wedge-shaped piece is cut to its center, as shown in the upper detail. The cut edges are brought together and glued to form a cone and a hole is cut at the apex to fit the dowel "trunk." This may be tapered slightly and is set in a hardwood block which serves as a base. The cones are held by strips of gummed tape, and the edges are serrated. For trimming, mucilage is dropped on the cones and bits of colored paper are sprinkled over it.

Allan Carpenter, Chicago.

Built up of green-paper disks taped to a length of dowel, this "Christmas tree" is just the thing to decorate a table or sideboard. Any number of disks may be used. The diameter of the bottom disk determines the spread of the "foliage," and each

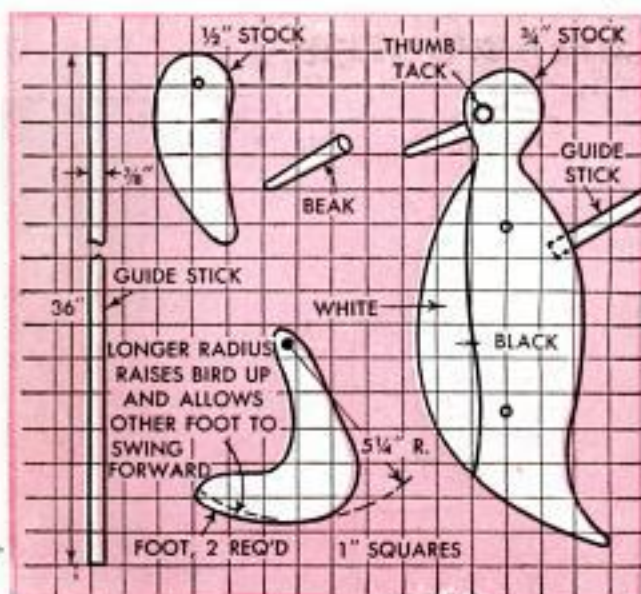
This Tool Cuts Long Laces From Small Piece of Leather

By making a tool like the one shown, you can cut thongs or laces of the desired widths from a piece of leather whenever an occasional need for them arises. The tool is a hardwood block shaped into a body or grip which is formed to fit the hand, and a narrower upper part in which notches of varying depths are cut, depth of each notch determining the width of lace. The body is slotted at a right angle to the notches to take a hacksaw blade that has been sharpened along the back edge. The body is drilled for a pin that fits into a notch ground in the toothed edge of the blade. In using the tool, a narrow tab is cut in the center of a piece of leather with a knife, and the tab is inserted in the notch of the correct depth and pulled through it, a lace being cut as the leather is drawn across the blade.—A. R. Wallis, Vancouver, Wash.





Walking penguin



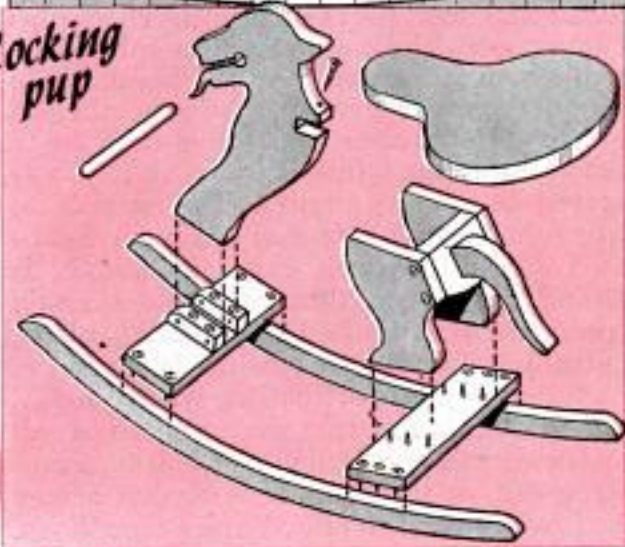
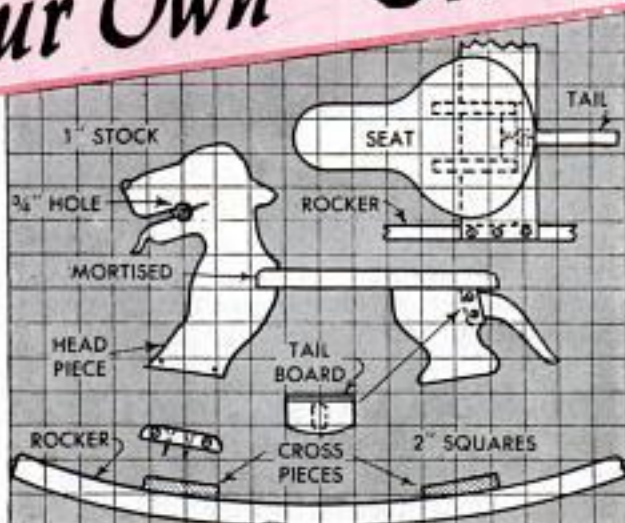
Realistic action of this toy as it waddles across the floor will please any small child. Body and head are one piece to which wings and feet are pivoted loosely. Curve of the feet is important as this allows the penguin to walk in a lifelike way



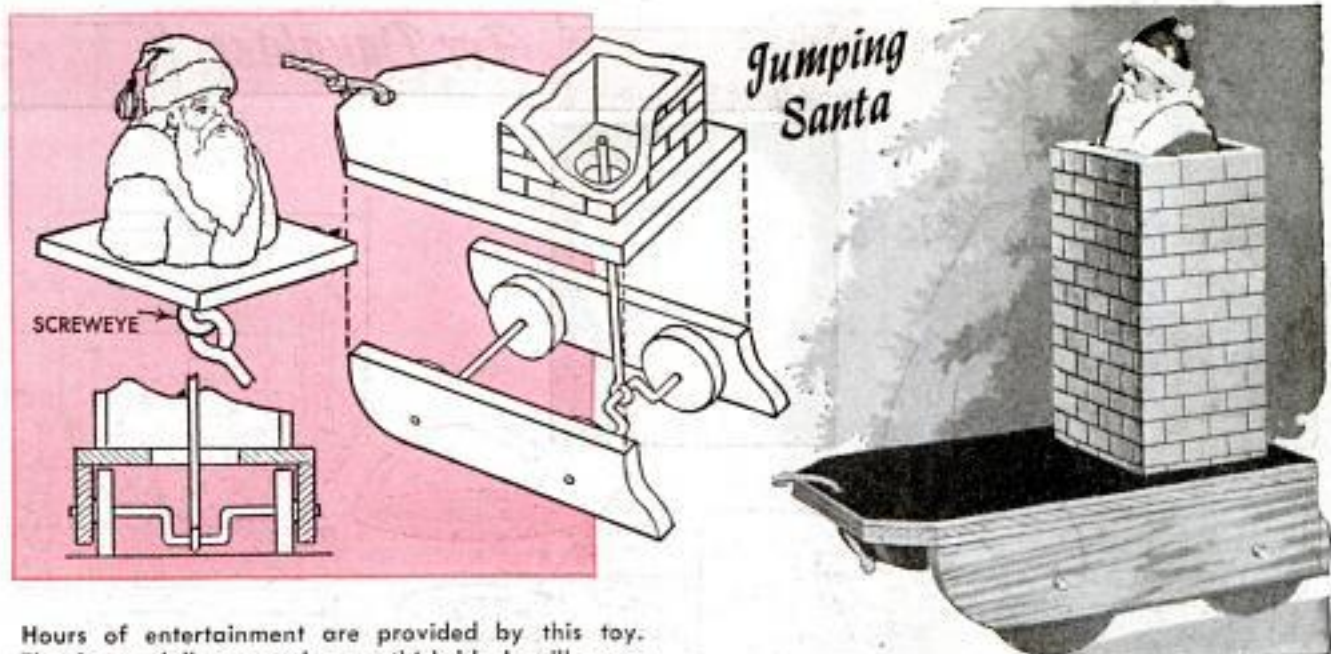
Make Your Own GIFTS



Rocking pup



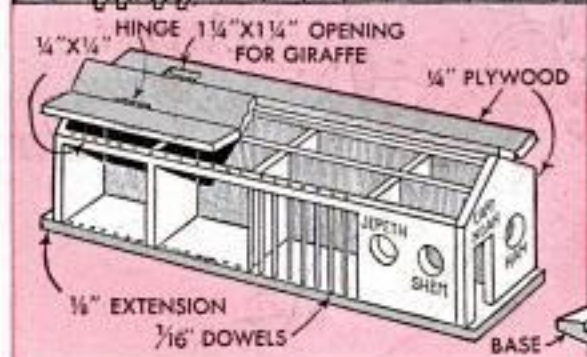
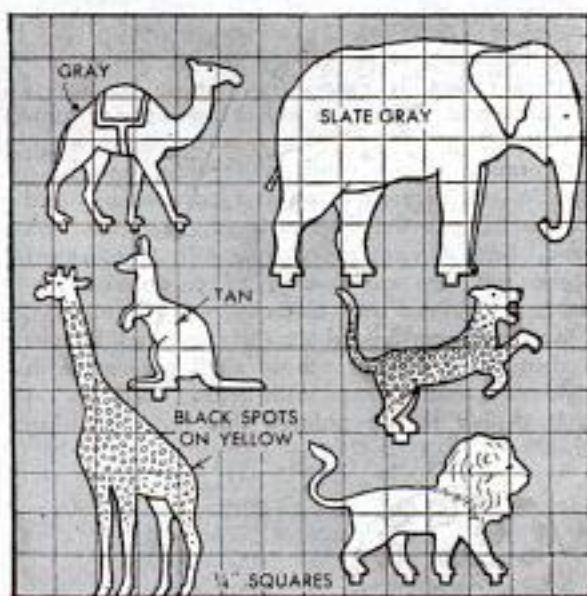
Standing under the tree on Christmas morning with his red tongue hanging out as though ready for a frolic, this rocking pup will make any youngster believe in Santa Claus. Construction takes little time if a scroll or band saw is available. And the job is not difficult, even with a coping saw. When cutting the head, drill a hole for a dowel handle before sawing the slot for the mouth. Then round all the edges, smooth with sandpaper and assemble with screws. Note that the front edge of the seat is mortised into the shoulders for rigidity



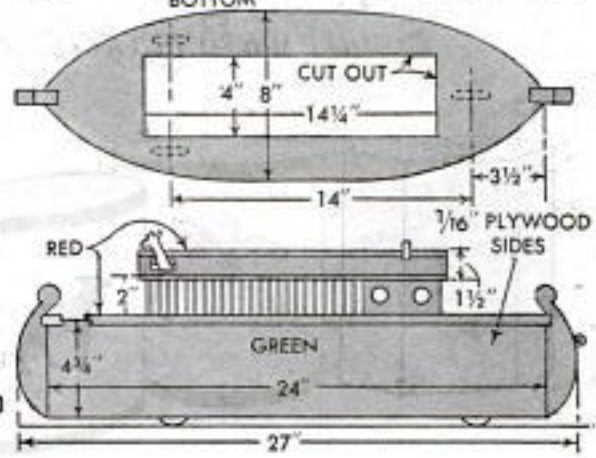
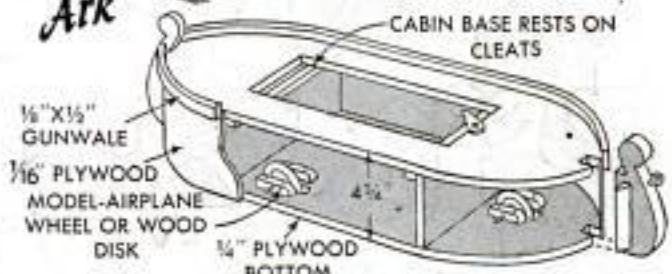
Hours of entertainment are provided by this toy. The Santa doll mounted on a thick block will move up and down due to the crankshaft action of the axle

for CHRISTMAS

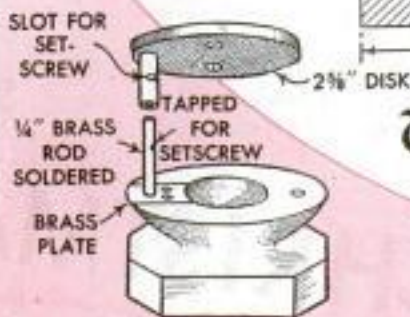
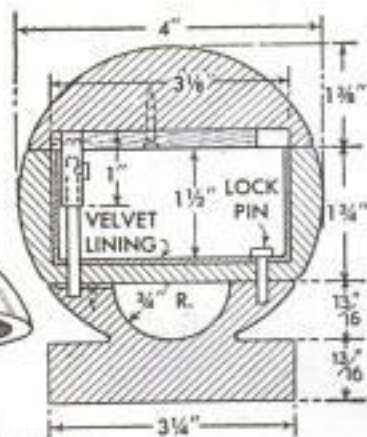
Noah's Ark is a traditional gift for young children. In addition to the animals shown, zebras and monkeys can be sawed out to expand the menagerie



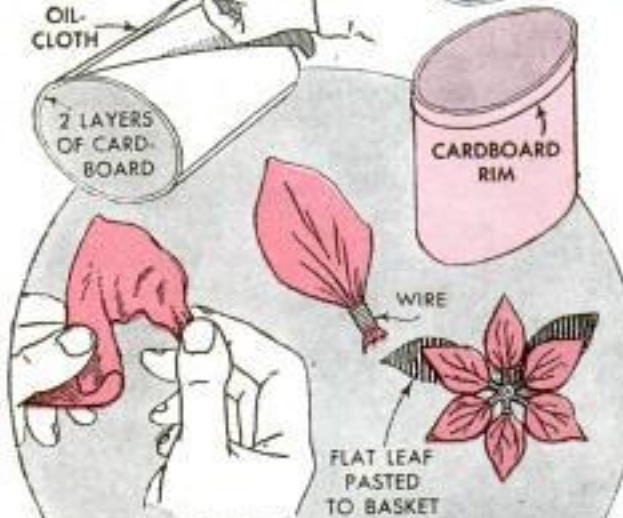
Noah's Ark



For Daughter

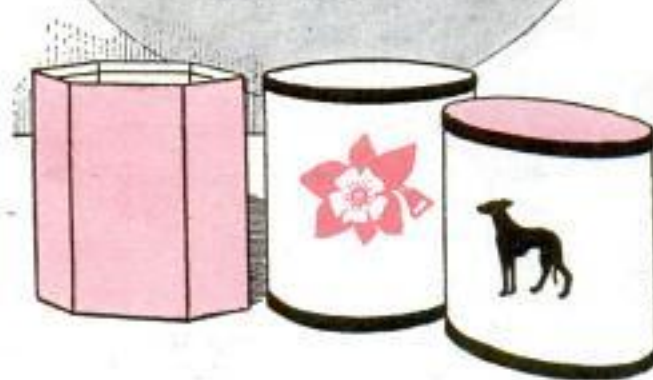


Trinket box



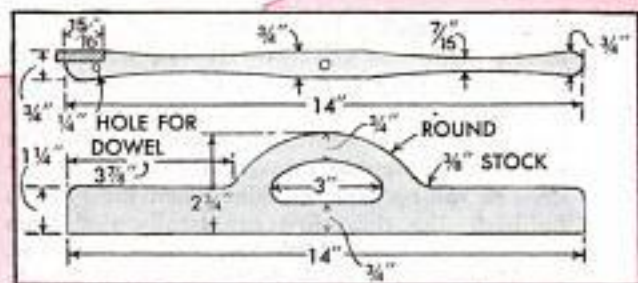
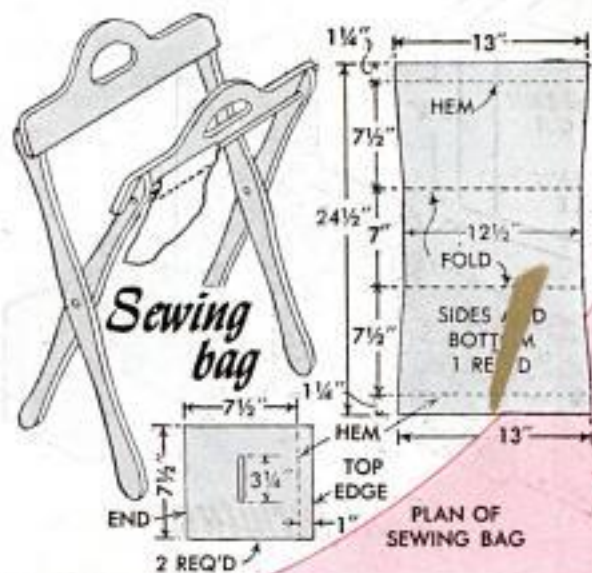
Smart wastebaskets

Above: Featuring a secret ring cavity, this attractive trinket box is made from three pieces of 2-in. hardwood. These are glued together for turning, paper being inserted to separate them later. After forming a 4-in. ball, turn center and base compartments, recess the top and fasten sleeve and rod assemblies to the lid and base. Then finish as desired. Left: Always a welcome gift, these smart wastebaskets are constructed of cardboard fastened to a plywood base and covered with oilcloth. The top also is cardboard similarly covered. Below: This string holder is a coconut shell covered with a bandanna and adorned with brass "earrings." A hole is drilled in the painted lips for the string



Coconut string holder

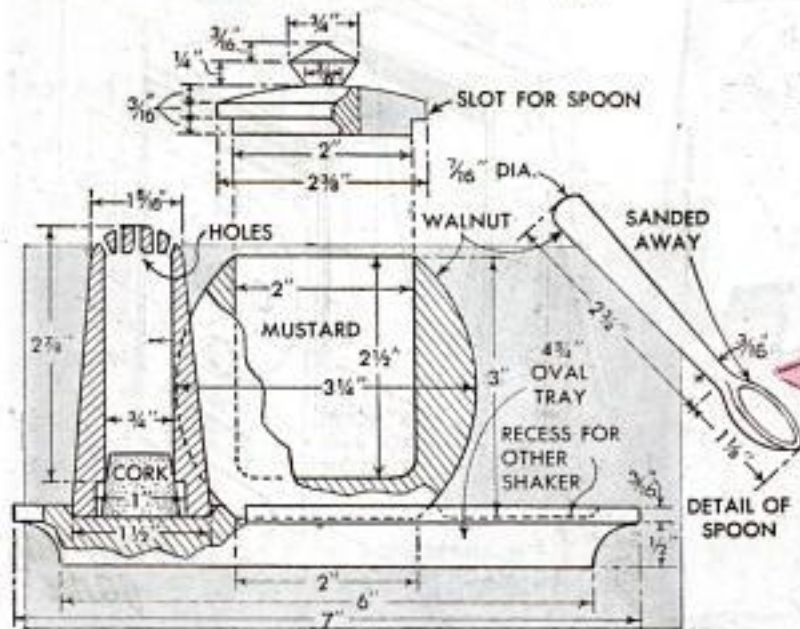
For Mother



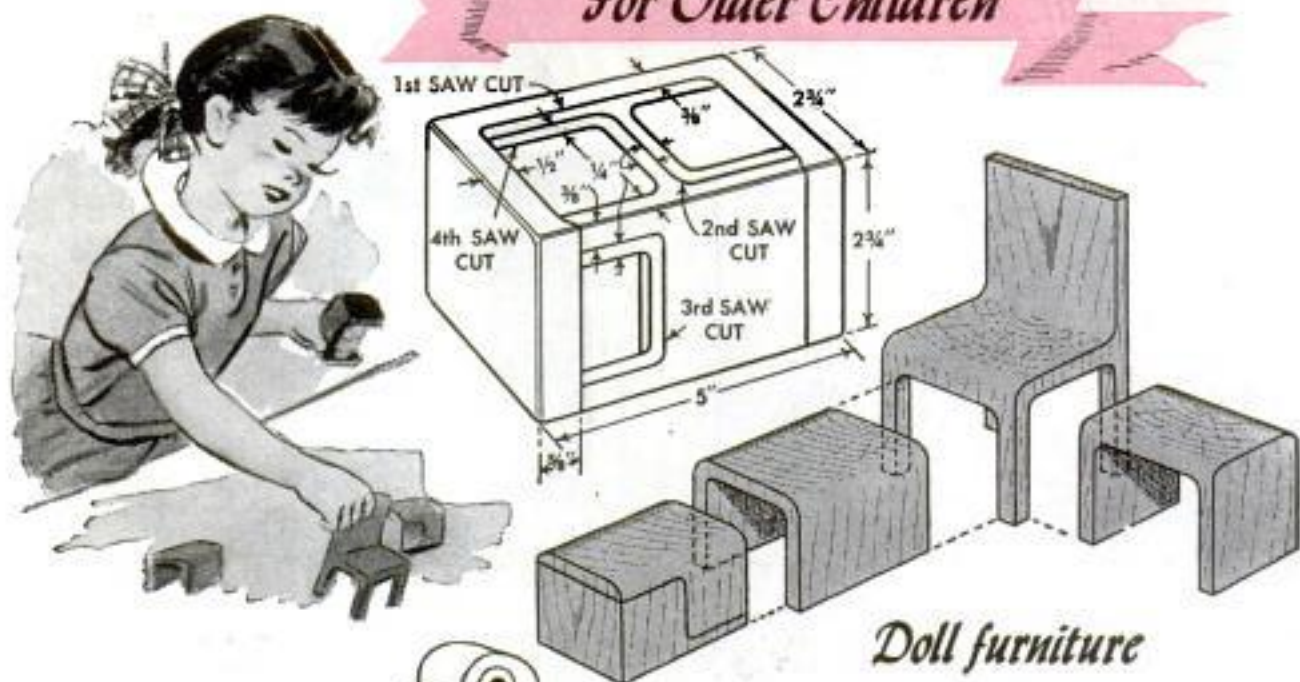
Above: Attractively colored oilcloth will make this sewing bag a gay and welcome gift. The cloth is cut as shown and all edges are sewed together, using bias tape of a contrasting color to bind the edges. Note that two $\frac{1}{4}$ -in. dowel rods hold the bag to the frame. Right and below: Ebony or rosewood, as well as walnut, can be used for this novel condiment set. The spoon is shaped by hand, and the other items are sawed and turned. Drill $\frac{1}{16}$ -in. holes for pepper and $\frac{3}{32}$ -in. holes in salt shaker



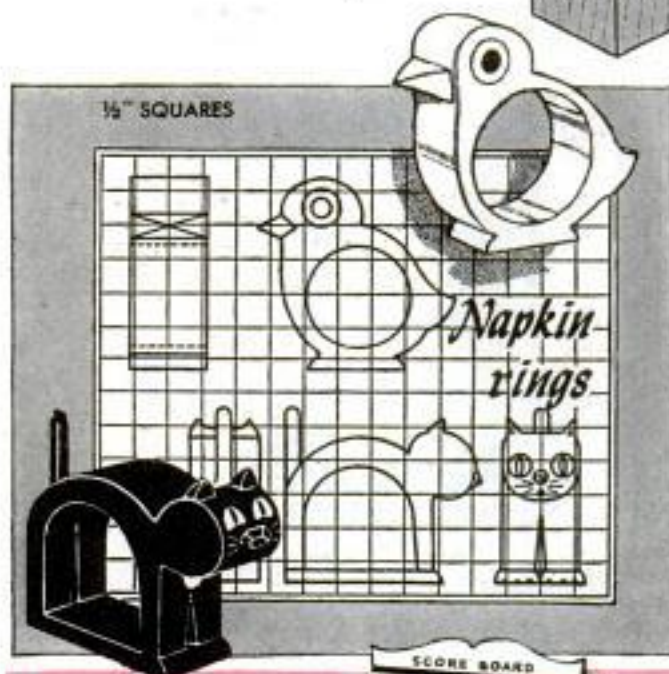
Wooden condiment set



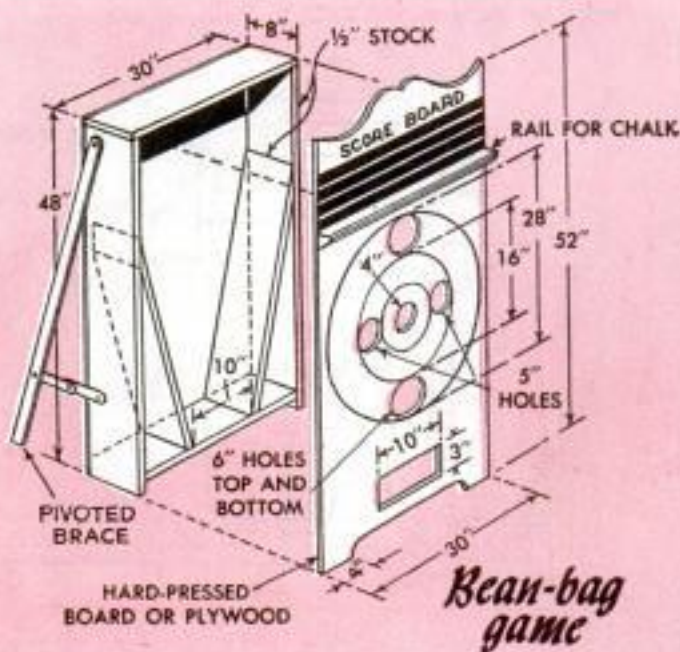
For Older Children



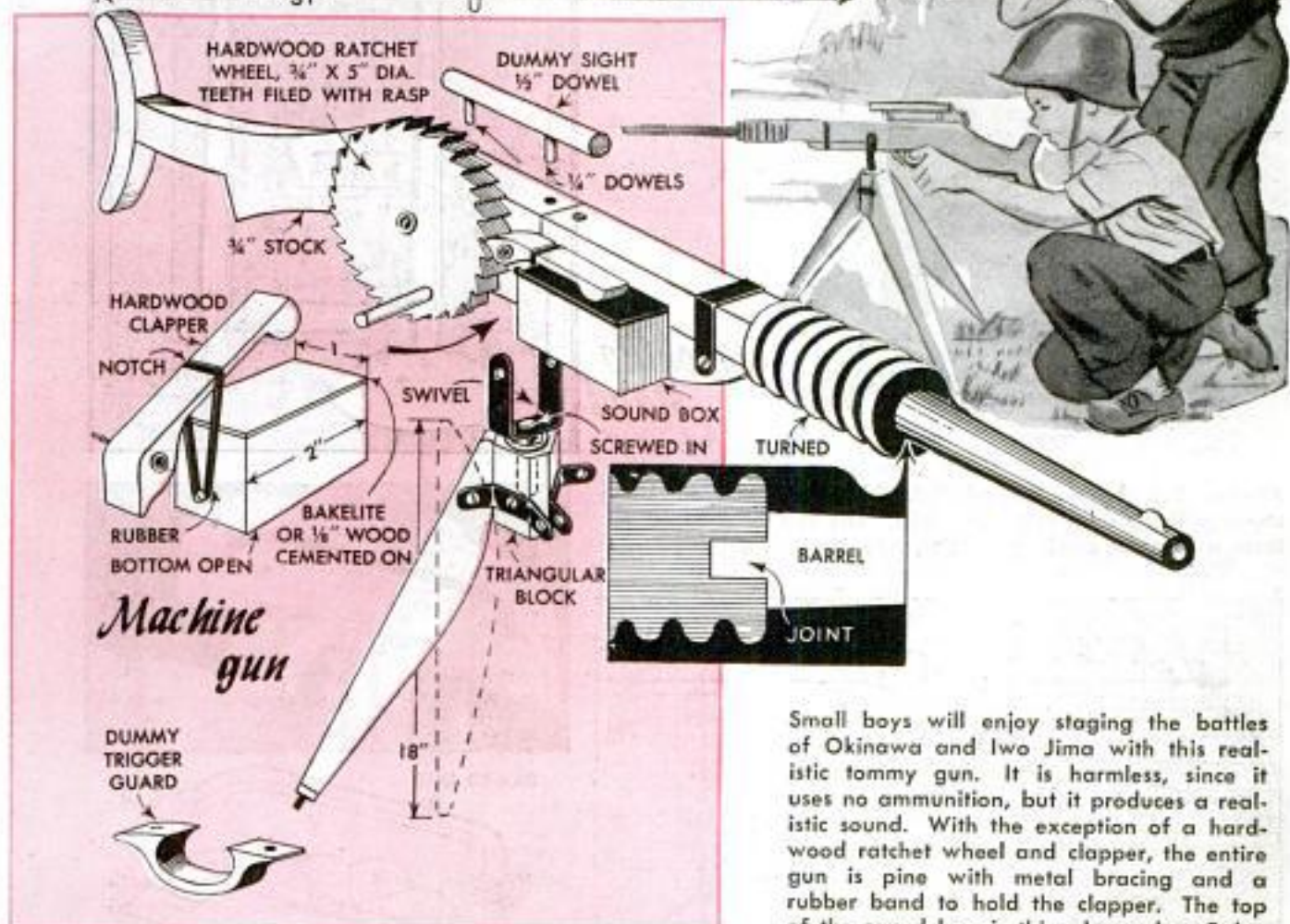
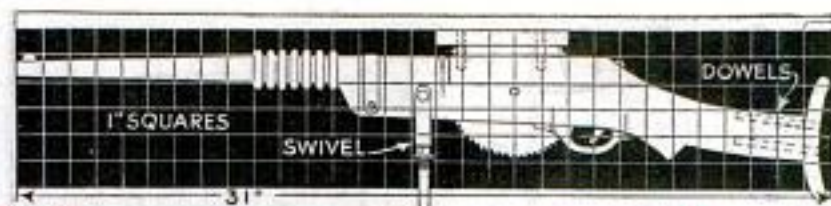
Doll furniture



Above: Durability is a feature of this doll furniture, which includes end tables, chairs and footstools. They are all sawed from one piece of hardwood as shown in the diagram, and then stained and varnished or waxed. Left: Cat and chicken napkin rings will encourage children to roll up their napkins when the meal is finished. The rings first are scrollsawed from 1 1/2-in. stock, then whittled to shape. However, the kitten ring is made in two parts, the body and the base, with small V-grooves cut in the body for the legs. For the finish, apply a priming coat of shellac and then several coats of enamel. Below: Just for fun, try throwing bean bags. After the bags are thrown through the holes, they slide down and collect behind an opening from which they are readily removed. Note that when set up, the stand rests on the braces and on the feet cut in the front panel.

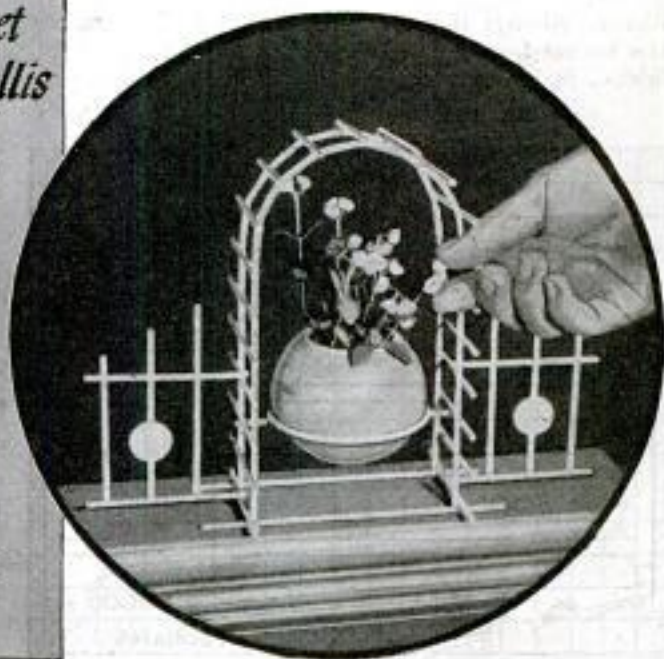
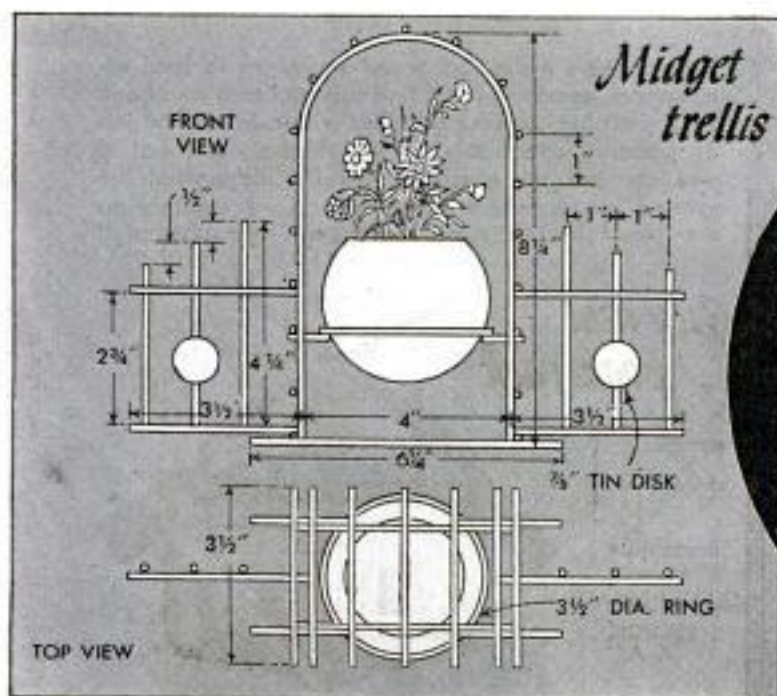


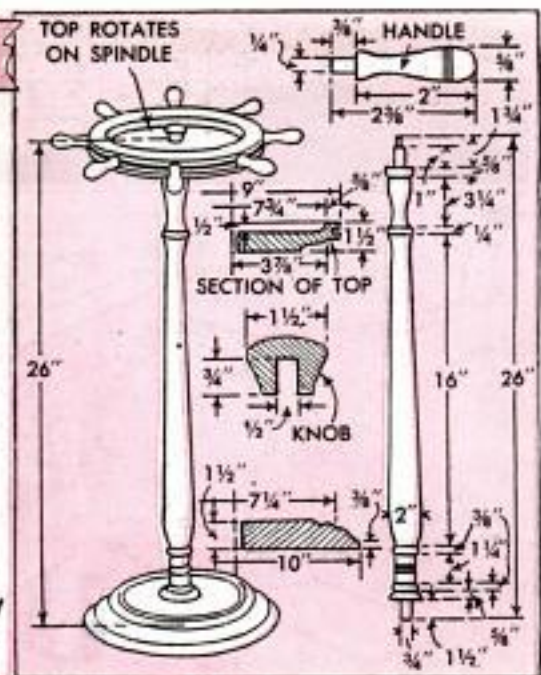
Bean-bag game



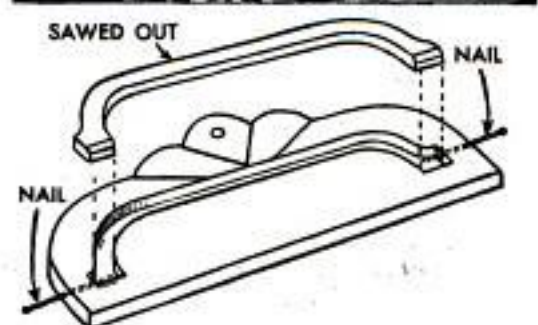
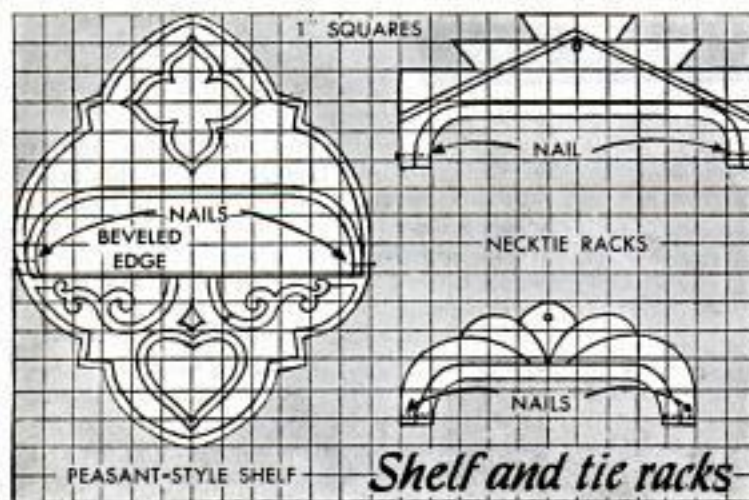
Small boys will enjoy staging the battles of Okinawa and Iwo Jima with this realistic tommy gun. It is harmless, since it uses no ammunition, but it produces a realistic sound. With the exception of a hardwood ratchet wheel and clapper, the entire gun is pine with metal bracing and a rubber band to hold the clapper. The top of the sound box is thin plywood or Bakelite secured with model-airplane cement. To add to the fighting effectiveness, a tripod can be made as shown. The gun is readily dismantled and carried from fox-hole to foxhole as the battle advances

Below: This eye-catching midget trellis will bring the outdoors inside during the winter months. It is built of $\frac{1}{8}$ -in. rod welded or soldered together



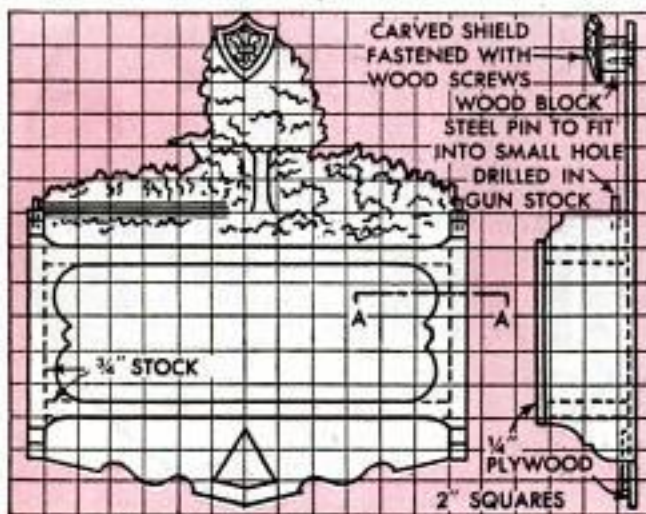


Above: For the nautical-minded, this ship's-helm smoking stand will be an appropriate gift. The top is recessed to form a tray for smoking articles, and is secured by a knob



Above: Always a useful gift, shelves and tie racks can be cut from a single piece of wood and, when folded, fit into the space from which they were cut

Below: With a painted woodland scene to lend atmosphere, sportsmen will find this gun rack and book shelf pleasing. If you are adept with a brush, the job of painting a suitable scene will be easy, but if you are not an artist, a favorite photograph or printed scene, which should be glued securely to the wood before scrollsawing, can be substituted



Gun and book rack



Painted Air Vents Cool Food Storage Cellar



Without any moving parts to wear out or require attention, a practical ventilating system for an underground food storage compartment can be made of a few lengths of tile drainpipe and some pieces of downspout. The drainpipe leads from ground level to open into the storage compartment at the floor to conduct cold air into the room. A 135-deg. downspout ell is inserted in the drainpipe opening for an air-intake vent. The ell is painted white to reflect heat, unless the vent is located in the shade, in which case painting may not be necessary. Another ell, painted black to absorb heat, is inserted through the ground to open into the room at ceiling level for the escape of warm air. Thus the ventilator operates solely by physical, rather than mechanical, laws, maintaining a cool temperature within the compartment by the reflection and absorption of heat.

Charles S. White, Vernon, Tex.

Paper Bags Line Wastebaskets

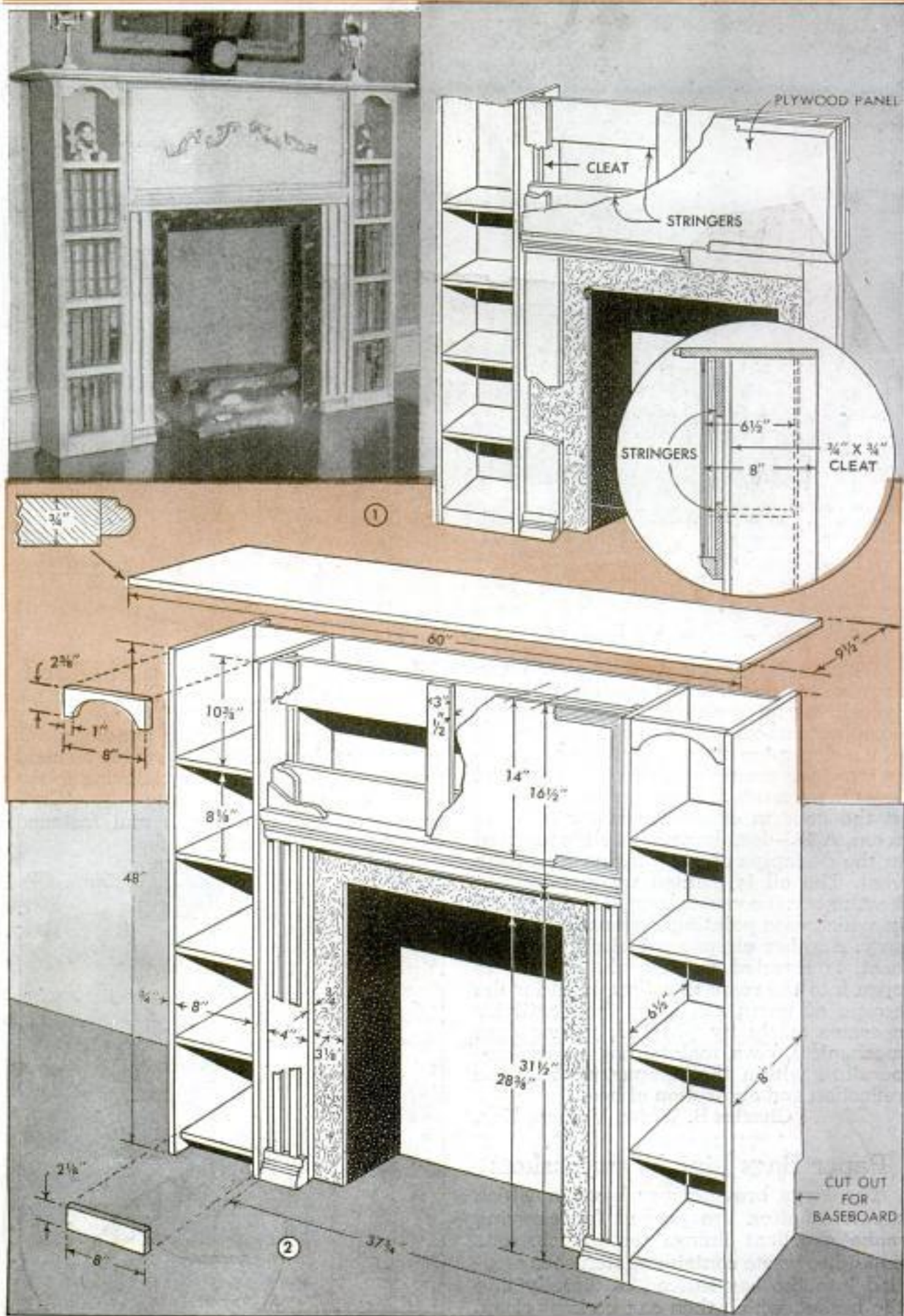
The large brown-paper bags in which groceries often are packed for carrying make excellent linings for wastebaskets and other waste containers. Refuse is emptied into the bag instead of directly into the basket, which then can be kept clean.

Handle of Well Pump Shielded To Protect Hands

Wrapped around a pump handle, strips of tape or thin rubber will provide a shield to prevent your hands from sticking to the metal on cold, frosty mornings. Cord wound around the handle and fastened with tape could also be used.



ALL-WOOD FIREPLACE, BOOKCASE



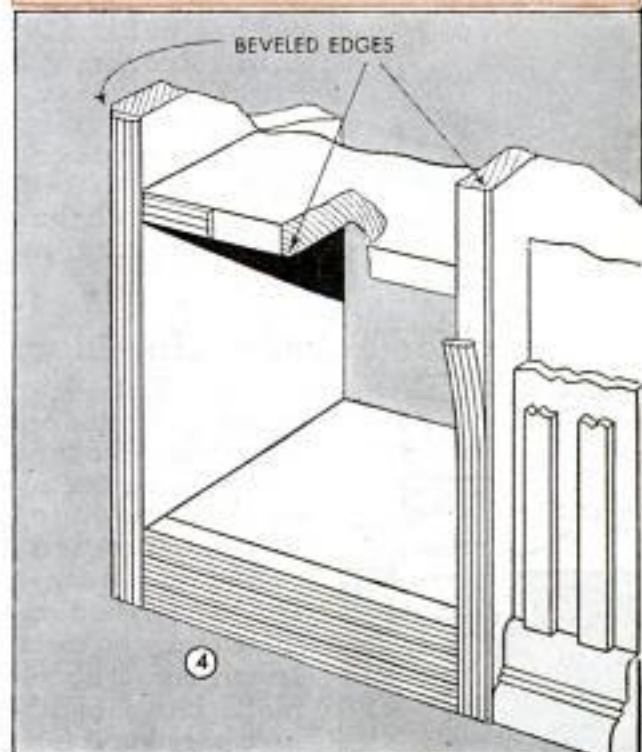
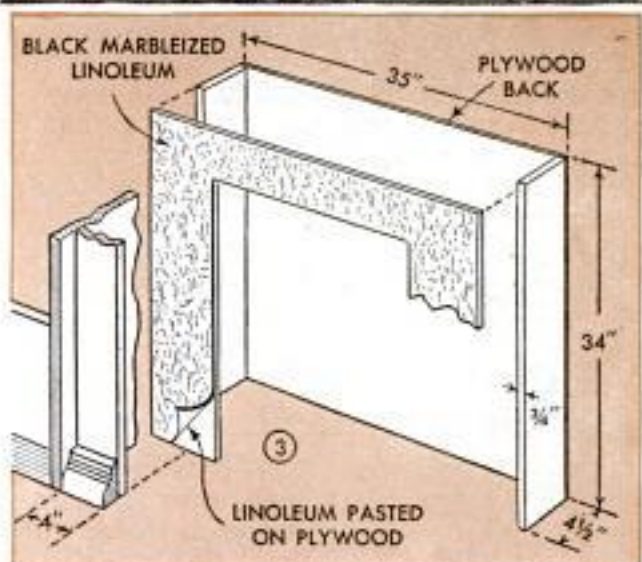
AND MANTEL

By Carl F. Baries

BLACK marbled linoleum contrasting with a white or ivory finish gives this unit a pleasing appearance in almost any surroundings. Construction is simple as the unit is nothing more than two pier cabinets or bookcases joined by stringers faced with plywood in which an opening is cut. If the unit is to be painted, almost any wood will do, but hardwood is better if you intend to use a stain-and-varnish finish. In this case, plywood to match the cabinets should be used for the mantel and front panels.

The cabinets are made as shown in Fig. 2, the rear edges of the side pieces being cut to fit over the baseboard. To accommodate books of varying heights, the top shelf is 10½ in. and the others 8½ in. Strips of wood are placed across the bottoms of the cabinets for aprons; and arched lintels are used across the tops. These serve not only as trim, but as a support to which the top may be nailed. Cleats are attached along the inside surfaces of the sides for stringers that hold the cases together, Fig. 1. Over the stringers three lengths of wood are nailed to support the panel and space it so that it extends flush with the edge of the molding as shown in the circular detail of Fig. 1. The mantel is a plywood panel that extends over the front and sides of the cabinets, and a strip of molding is bradded along the edges, as diagrammed in the upper left-hand detail of Fig. 2.

For the fireplace, a three-sided back is made of plywood, Fig. 3. This is placed loose between the cabinets or it can be nailed to the sides, in which case the dimensions shown will have to be increased. Sides of the back are hidden by an inverted U-shaped frame on which marbled linoleum is pasted. The frame is held in place by two wood strips attached to the cabinet sides, and molding is added to the strips for trim. The back should be painted brick red so that when a light is placed behind a stack of logs in the "fireplace," the reflection will suggest the glow of a real fire. Molding is applied to the edge of the sides and shelves of the cabinets, Fig. 4, and an ornament is glued on the front panel.

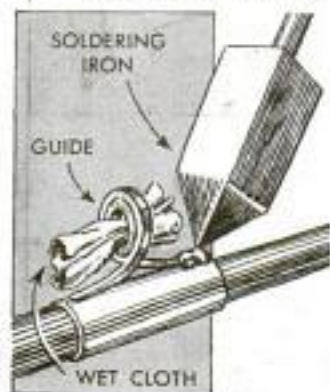


Spring Clothespin on Door Casing Holds Memos for Callers



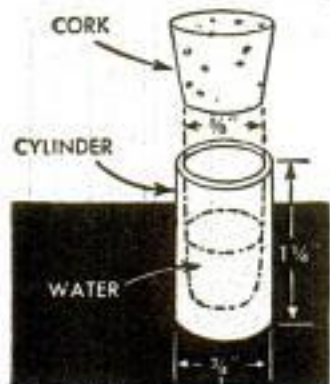
Attached to the door casing, a spring-type clothespin can be used to hold memos for deliverymen and notes from callers. To attach the clothespin, one of the jaws is slipped out of the retaining spring and drilled and countersunk for a screw. After screwing this piece to the door casing, the clothespin is reassembled and ready for use.—Chas. Kimball, Los Angeles, Calif.

Wet Cloth Cools Fishline Guide While Soldering It to Rod



When a new agate or glass guide is soldered to a fishing rod, the heat of the soldering iron may crack the glass. This can be prevented by a piece of wet cloth inserted through the guide to keep it cool.

Moistener for Tobacco Humidor



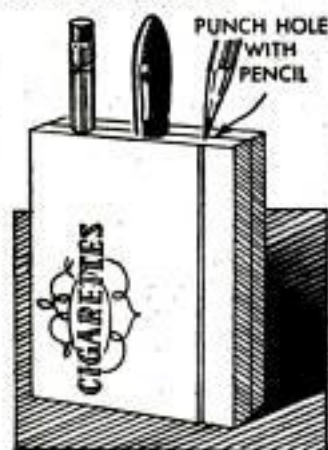
A small plaster-of-paris cylinder containing water will serve as a source of moisture when suspended in a tobacco humidor. The cylinder, which may be cast in any suitable mold, has a blind hole bored in it for

a water chamber. When the hole is plugged with a cork, water will seep through the cylinder walls to keep tobacco moist.

J. J. Paszkiet, Chicago.

Pencils Held in Cigarette Box Carried in Shirt Pocket

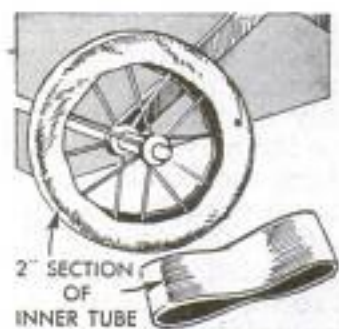
Pencils and pens, which ordinarily cannot be clipped to a shirt pocket, will not fall out if they are held in a cardboard box of the type used to package some brands of cigarettes. A container of this kind usually will fit a shirt pocket. The point of a pencil is pushed through one edge of the box to make holes in which pencils and pens may be wedged snugly. Also, the pencil lead will not soil the pocket.



F. T. James, Hespeler, Ont., Can.

Baby-Buggy Wheels Kept Clean By Inner-Tube "Galoshes"

When taking a baby carriage outdoors in wet weather, the wheels can be kept clean by covering them with strips of inner tube, which are removed before taking the carriage indoors. The strips should be cut about 3 in. wide so that when stretched over the wheels they will fold over the rims.

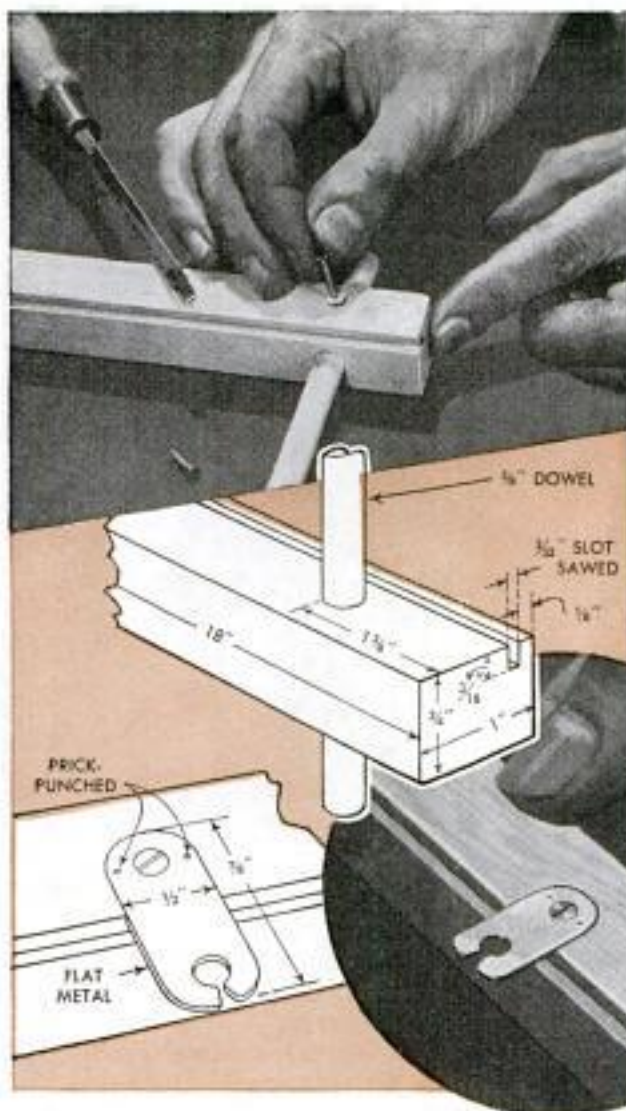


Wire Guide Located at Keyhole Is Useful in Dark Vestibule

Attached over an escutcheon, a length of wire bent as shown is useful for guiding a key at night or when the door is located in a dark vestibule. The ends of the guide are inserted in holes drilled in the door at the edge of the escutcheon, or the ends of the guide may be flattened and slipped under the escutcheon after loosening it.



Neat Frame Displays Photomounts Attractively



for the mount are sawed in the strips as indicated in the center detail, and holes are drilled near the edges for dowels, each of which is 23 $\frac{3}{4}$ in. long. To assure proper alignment of the holes, the strips are clamped together and each pair of holes is drilled at the same time. When in place, the dowels should project about 1 $\frac{1}{4}$ in., and are held by screws driven into countersunk holes

Photographs and other pictures will be set off to advantage in a simple frame like this one, which is made of dowels and two strips of wood. Dimensions shown are for a frame that will take a 16 by 20-in. photomount, although the size may be varied for any picture. To make the frame, slots

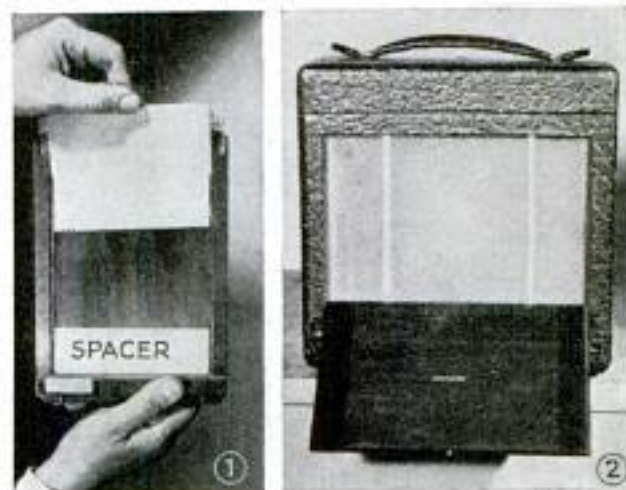
at the rear of the strips, as in the upper left-hand photo. For a hanger, a piece of flat metal, drilled and slotted as shown in the lower details, is attached by a screw to the rear surface of the upper strip, which is notched to receive the hanger.

Walter E. Burton, Akron, Ohio.

Spacer Adapts Large Plate Holder to Take Smaller Films

By slipping a spacer into the plate or cut-film holder of a 5 by 7-in. camera, 4 by 5-in. film may be used when the proper size is not available, or any size camera can be adapted to take smaller size film. For a 5 by 7-in. camera, a strip 1 $\frac{1}{2}$ by 5 in. is cut from a discarded negative for the spacer, or a piece of cardboard will serve the purpose equally well. The spacer is loaded into the holder as in Fig. 1, then the film is loaded on top of the spacer. After the film is inserted, another spacer of the same size is placed above it to keep it centered. The ground-glass back then is taped off as in Fig. 2 to show the position of the film.

Harry F. Leeper, Canton, Ohio.



STOP IT



By Fred G. Korth

WHEN photographing any subject in action, the amount of illumination required is determined by the duration of the action as well as by the general light values in the picture. Any action, whether it is as fleeting as a child's smile or as continuous as the chewing of a large drill through a steel plate, requires a shutter speed rapid enough to "stop" the movement, or the action—which may have been the only reason for taking the picture—will vanish or smear into a blur on the film. Or, what is worse, the smile may freeze into



a grimace, and a glint of surprise may become a leer. For this reason it is generally necessary to use flash, especially indoors, where illumination usually is sufficient only for time exposures.

Any good synchronizer attached to the camera will do, since extension cords may be plugged in for additional lamps set away from the camera position. If the synchronizer cannot be detached from the camera so that it may be held off to one side to operate the shutter while directing light where it is needed, a plug may be screwed into the synchronizer socket instead of a lamp, with the cord extended to hold the lamp where it is needed. A three-cell flash unit is strong enough to be used with a 25-ft. cord, and a 5-cell unit for a cord of 50 ft. or more, using wire of 16 gauge or heavier. When long extension cords or many lamps are used, however, the cells must be fresh.

Although sometimes it may be preferable to use two or more small lamps instead of one large lamp, this cannot always be done. Scenes like that



with **FLASH**



shown in Fig. 7, in which there are many persons moving at various distances from the camera, require a medium or large lamp in order to use a speed of $\frac{1}{200}$ sec., which is necessary to catch the action and stop down the lens aperture sufficiently to get depth of focus throughout the picture.

Many photographs of children are effective solely because of their expressions. Such expressions as those shown in Figs. 1 and 6 call for fast shutter speeds rather than a small lens stop. A speed of less than $\frac{1}{50}$ sec. generally is too slow. But children lose interest quickly. The best way of keeping them in any pose is to use weak light for focusing and flash for exposing. Two flash lamps, one at each side of the subject, are used for balanced lighting, and the model is framed on the ground glass to allow plenty of room on the film for slight movement of arms and legs. In taking photographs like those in Figs. 2 and 3, speed is of the greatest importance. For these pictures, two small lamps in reflectors were used; one overhead,

slightly to one side and close to the subject, the other a little lower on the opposite side and about twice as far from the child.

Most animals are especially uncooperative as models. They insist on scampering away just as the photographer has set his tripod in position, or they drop their ears and look wistful and accusing at the very moment when their good qualities are about to be advertised. Moreover, they resist costuming, particularly when goggles are included in the wardrobe. For this reason it is best to have an assistant who can hold the animal while the camera is focused. All preparations to take the picture should be made before the animal is set in





a different kind of photography in which flash also is important. Scenes of machinery in action are, perhaps, more difficult to take than pictures of people for the reason that not only is there motion—often much more rapid than any movement made by a person—but machines usually are grimy and dark in tone and therefore they have poor light-reflecting qualities. Furthermore, as in the case of the rolling-mill scene, Fig. 10, the material being processed may have extraordinary reflecting values. White-hot steel, for instance, will be recorded on film as a brilliant flat-white blotch in a fraction of the time necessary to show even a faint image of the dull, dark machine on which it is rolled into sheets.

the required pose: one medium-size flash lamp is supported about a foot above and at the side of the lens, and shutter speed and aperture are adjusted. Then a paw is draped over the back of a chair to suggest diagonal lines, Fig. 4, goggles are eased in place, Fig. 5, the assistant removes his hands and the photographer presses the button for the exposure.

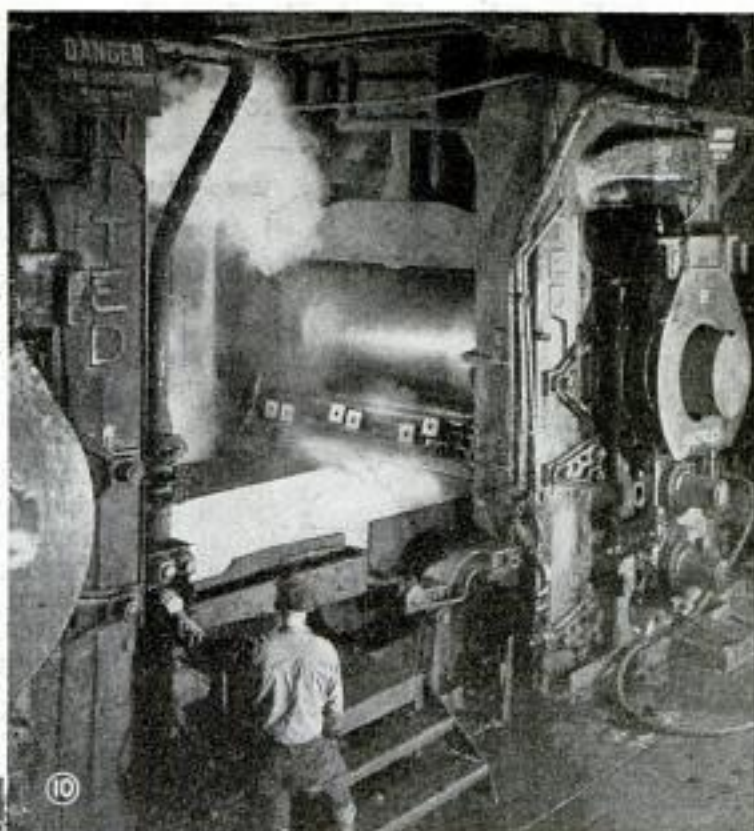
Scenes of a group at cards or people gathered around a fireplace, Figs. 8 and 9, unlike the dancers in Fig. 7, can be photographed without a synchronizer if the subjects are "briefed"—instructed to gaze into the fireplace, study their cards or look at one another rather than into the camera lens. To get a natural light for Fig. 8, a large lamp was placed deep in the fireplace without a reflector and a small lamp in a reflector was set 2 ft. above the camera to soften the hard side-shadows. For Fig. 9, two lamps were used. One was placed above the camera and 4 ft. to one side, the other 6 ft. to the other side at the same height.

Figs. 10 and 11 represent



The photographer, therefore, has to give an exposure short enough to prevent the steel from blurring the film, yet long enough to capture as much detail in it as possible, rendering in true tones the machine and the workman near it.

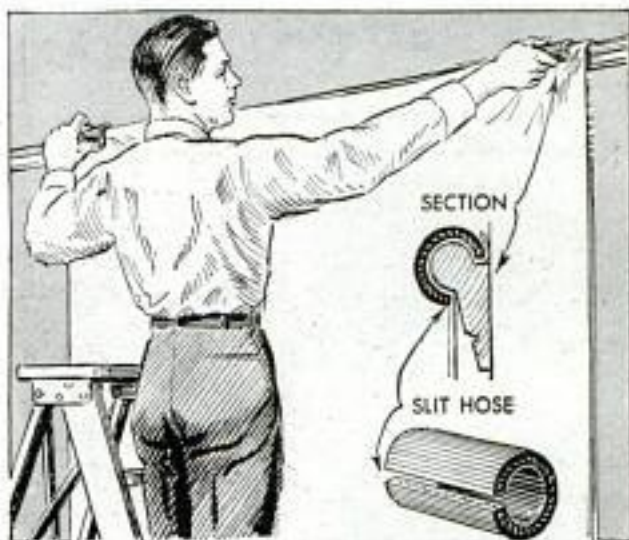
In taking this picture with a $\frac{1}{100}$ -sec. exposure, a long extension cord was strung over the left side of the machine to light the work and a second lamp was placed far to the right to illuminate the man and machine. In a scene such as that in Fig. 11, the workman becomes an integral part of the picture rather than a mere detail like the watcher in Fig. 10. The operator of the big drill, then, must seem to be actually performing the appropriate action, but must at the same time put on his best "look pleasant, please" ap-



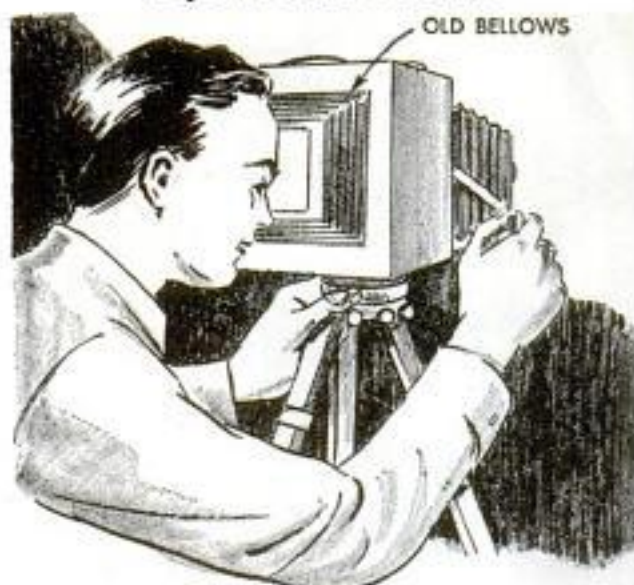
pearance. Since the big drill rotates at slow speed, its movement can be "stopped" easily with a shutter speed of $\frac{1}{100}$ sec. To take this photograph, three medium-size flash lamps were used. Two of these were placed at the right of the camera and one was held at the left. All three were directed so as to dissipate heavy shadows on the work and the operator, although no lamp was placed so that it illuminated the man's face from below.

Hose Holds Light-Reflecting Sheet on Picture Molding

To provide a light-reflecting surface in home portrait photography, many amateurs fasten a bed sheet, tablecloth or white drape against a wall with tacks or pins. However, these will mar the woodwork, and it is difficult to press pins into the plaster or trim. Also, wrinkles are likely to appear in a drape used as a background if it is suspended in this manner. A simple way of hanging a sheet or drape to avoid using pins and to eliminate wrinkles is to use pieces of rubber hose that are slit to fit over the picture molding, as shown in the details. These will not mar the wall or molding and, in addition, will occupy little space when stored away with other camera equipment.



Camera Focusing Cloth Replaced By an Old Bellows



Instead of using a focusing cloth or hood to exclude light from a camera ground glass, you will find that the bellows from an old camera is just as practical and packs into a very small space for carrying. Also, the bellows is easier to handle in a wind than a cloth, and saves time because it is always ready for use and does not have to be thrown over the head and held in place each time you look into the glass. The bellows can be cemented to the ground-glass back, or may be held in place by other means as required. A stiff wire will serve to prop the bellows open while in use.—Ken Murray, Baltimore, Md.

Flood Lamp Can Be Clamped Directly to Movie Camera

To keep the floodlight focused directly on a moving subject while filming movies, a unit such as the one shown can be clamped directly to the camera. This type of lighting is satisfactory for close-ups and especially suitable for photographing chil-



dren because the photographer can follow the child about the home without stopping to move a separate lighting unit. Built-in reflector-type lamps can be used if the camera is loaded with extra fast film.

R. Swedlund, Buffalo, N. Y.

Your Signature Printed on Photos

It's an easy matter to print your name on a photo by means of a separate negative. First prepare a negative of your signature. This is done by writing your name with black ink on a white card, photographing it and processing the film.



After exposing a print, lay the name negative over the desired location in contact with the undeveloped print and cover the sensitized paper with a cardboard or black-paper mask from which a corner has been cut for the name negative. Then expose the signature with a flashlight as shown, holding the mask tightly against the print to prevent light from leaking in under the edges and fogging the photo. The name will appear in black on the finished print.

White-Light Switch in Darkroom Inverted for Identification

If all the electric-light switches in your darkroom are grouped together or controlled from the same panel, there's always a chance of fogging paper or film through accidentally throwing the switch for the white light instead of the one for the safelight. To prevent this, remove the switch operating the white light and replace it in an inverted position so that the toggle operates in reverse order to the others. Then when you intend to turn on the safelight you can tell the white-light switch from the others by the position of the toggle.

H. A. Kharas, Bombay, India.

Marking Darkroom Trays

White enamel trays used in processing photo films may be marked with grease pencil or black crayon to be easily identified in the dim light of a darkroom. On hard-rubber or plastic trays, which are usually of a dark color, yellow or red crayon will be more easily seen.

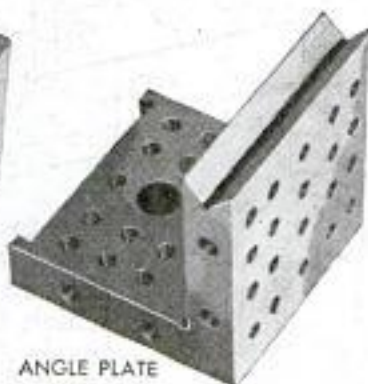




SINE BAR



V-BLOCK



ANGLE PLATE

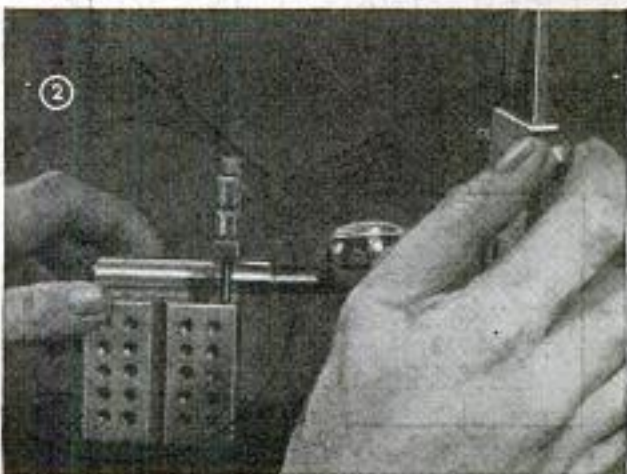
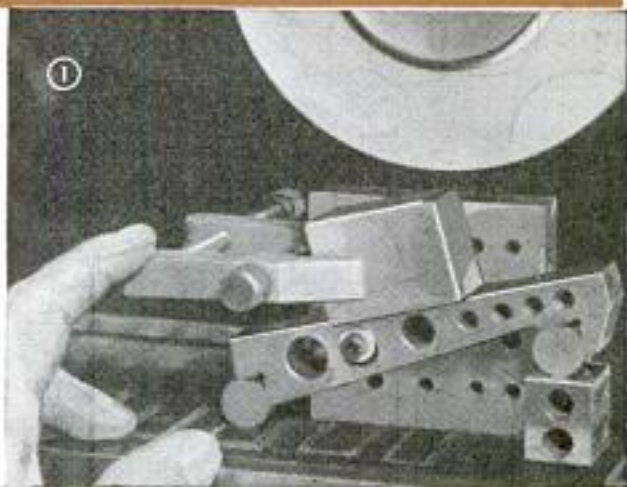


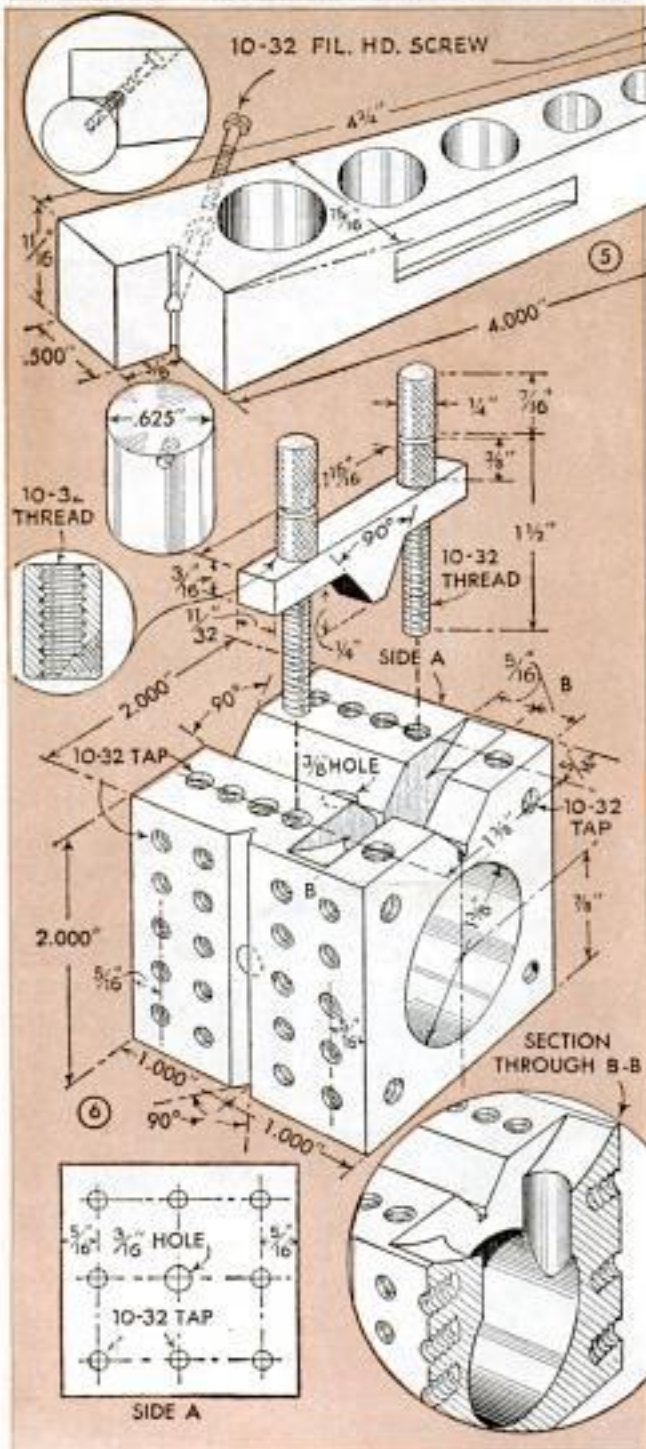
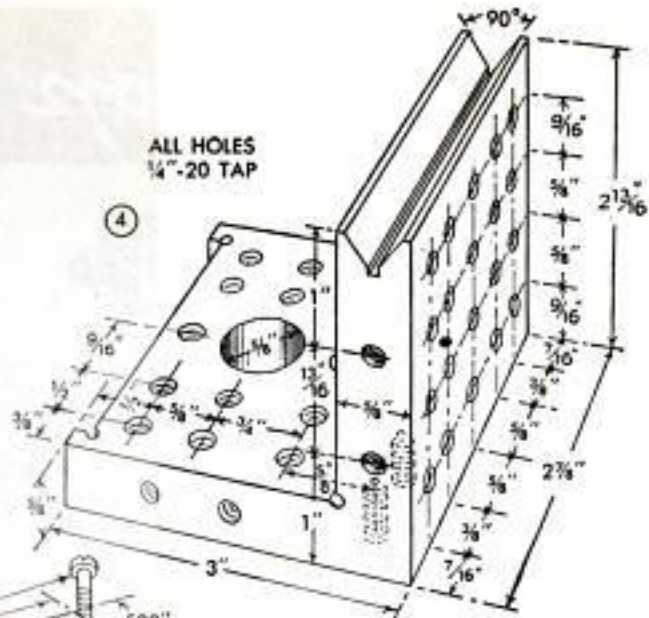
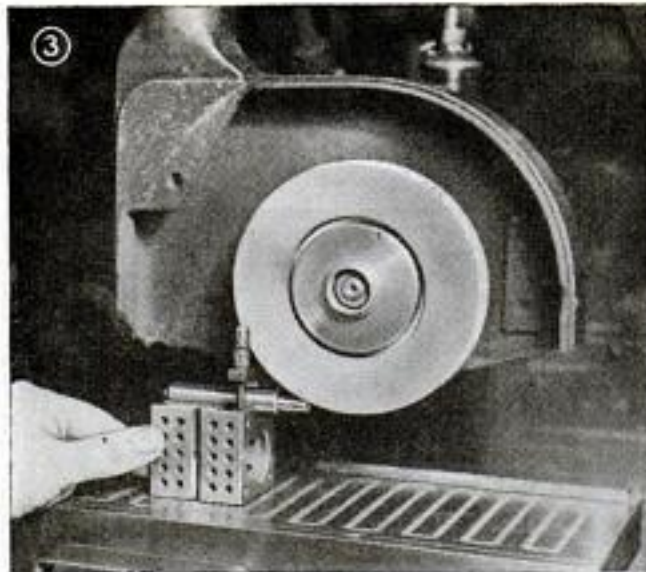
SMALL FIXTURES FOR THE TOOLMAKER

By Walter F. Debold

ALTHOUGH standard tools for precision machining operations can be purchased, toolmakers will find the sine bar, V-block and angle plate shown here especially useful, as these fixtures provide additional control over the work and can be made to any size. For instance, the angle plate may be used not only as a V-block, since one edge is grooved, but as a stop against which work may be held on a grinder bed, Fig. 1. Likewise, the V-block, besides serving as a fixture for laying out or grinding, Figs. 2 and 3, will hold work having collars or projecting heads as it is slotted across the V-groove to accommodate these projections. The block also has a small V-groove on one side at a right angle to the large groove across the top. All fixtures are made from tool steel or from machine steel that is then case hardened.

The angle plate is made as illustrated in Fig. 4. In a block of steel measuring $3\frac{1}{4}$ in. square by $3\frac{1}{4}$ in. long, a series of closely spaced holes is drilled for removing a segment. The angle thus formed is roughed out, leaving about $\frac{3}{16}$ in. for grinding. Holes are drilled for bolts to hold work, spacing of the holes being optional, although it is





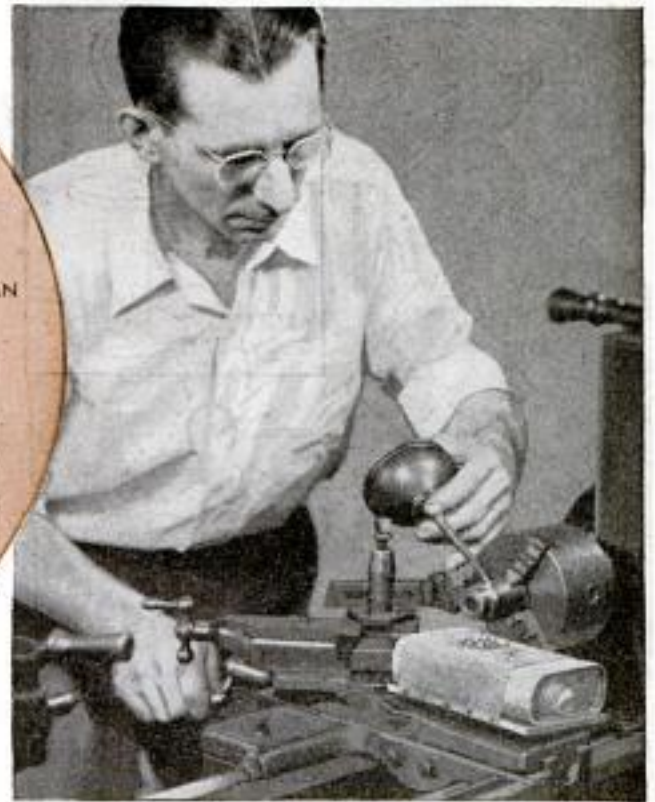
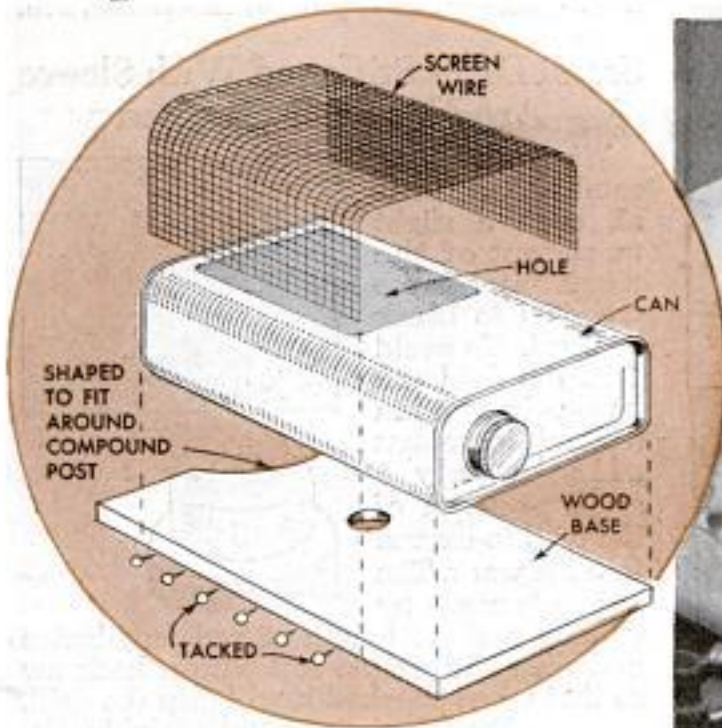
best to space them to coincide with the T-slots on the bed of the machine on which the plate is to be used. A V-groove is cut in the top edge of the vertical member and the plate is hardened and ground.

The sine bar, Fig. 5, is 4 in. long at the bearing

surfaces rather than 5 or 10 in., as are most standard bars, and will fit easily in a toolbox drawer. The bar is made from a piece of $\frac{3}{4}$ by 2 by 5-in. stock, rough-shaped to within $\frac{3}{64}$ in. of finish size, and holes are drilled to lighten it. One advantage of this type of sine-bar construction is that the bearing surfaces face in the same direction so that if too much is ground from one surface, more can be taken off the other to compensate. Plugs then are turned to exact dimensions, and holes are drilled and tapped in these and in the bar for fillister-head screws. In turning the plugs, the centers should be left projecting to form hubs by which they may be held for grinding. The projections can be ground off when the ends are trued after hardening.

The V-block and clamp are shown in Fig. 6. The block is roughed to shape and a large hole is drilled in the center to lighten it as well as to aid in clamping it to the work surface. The tapped holes are spaced as desired. They need not penetrate the block, as indicated in the circular detail, and the holes on one side can be spaced differently from those on the opposite side, as suggested in the lower left-hand detail. Then grooves are cut in the block and the clamp and screws are made. Each screw is provided with a threaded clamp-adjustment nut which can be unscrewed to loosen the clamp so that work may be placed in the V-groove without removing the screws from the block.

Drip Pan on Lathe Carriage Saves Cutting Oil



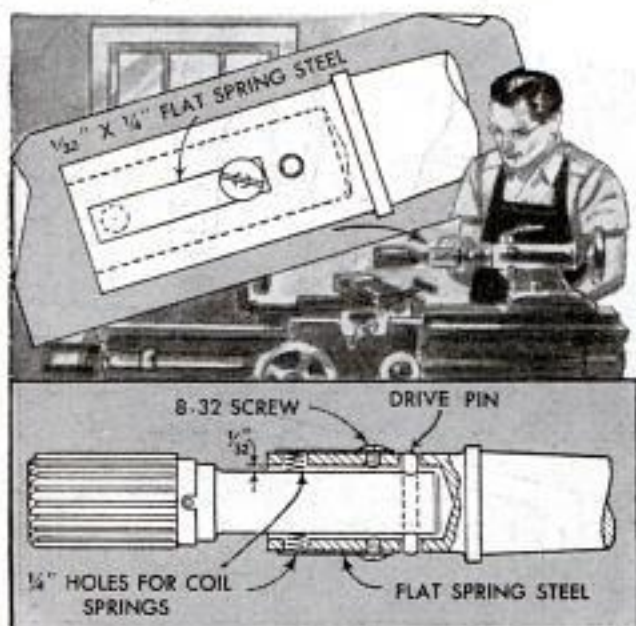
Set on a lathe carriage, a small rectangular can of the type in which salad oil or turpentine is sold will catch and save oil drippings for reuse and also will keep the lathe clean. An opening is cut in one side of the can, which is screwed to a wooden base. The base is shaped at one end to fit around the curve of the compound post and drilled for the stud or boss on the

lathe carriage as indicated in the left-hand detail. Then a piece of screen wire is tacked to the base and over the opening in the can to strain out chips. In use, the can may be worked close to the chuck and is instantly positioned or removed.

Reamer Is Floated in Holder if Lathe Centers Are Sprung

If your lathe centers are sprung slightly, a reamer held in the tailstock can be made to cut true by floating it in a special holder. The shank of the holder is turned to fit the tailstock taper, after which the body is drilled lengthwise to take the reamer. To

allow side play, this hole should be $\frac{1}{16}$ in. larger than the reamer shank. Two $\frac{1}{4}$ -in. holes are drilled to take coil springs, which center the reamer. They are held in place by two lengths of flat spring steel, attached to the holder by screws. The reamer is driven by a pin which fits tightly in the shank and loosely in holes drilled in the holder.—H. D. Chapman, Mt. Rainier, Md.



Plumbers' Soil Aids in Saw Filing

To reduce eyestrain when jointing or sharpening saw teeth, they can be coated with plumbers' soil, a water-soluble substance containing glue and lampblack. In filing, the soil will be removed, leaving the other teeth coated. The soil is brushed on and allowed to dry before filing is begun. When jointing, two coats are required, one before jointing and the other before sharpening. The same method can be used on band and circular saws.

☐ A tool for burning in shellac can be made from a piece of spring steel or a hacksaw blade fastened to a soldering iron.

Extension Cord Wound on Reel To Hold It Off the Floor



If an extension cord is wound on a reel it can be set directly on your work, and the cord will be kept off the floor where it might be walked on or otherwise damaged. A reel can be made from a metal spool of the type used for holding lamp cord and water-pump packing. A hole is cut in the reel as shown to take the cord, which is protected from abrasion by a rubber grommet. After the cord has been pulled through the hole so that the lamp socket seats tightly in the spool core, the core is filled with tar to hold the cord, which then is wound on the reel and fed out as required. The cord can be kept from unwinding by a notch filed in the lower flange and smoothed to keep the insulation of the cord from being cut. If desired, a wire cage may be attached to the reel to protect the lamp.

Padding Microscope Eyepiece Will Protect Spectacles

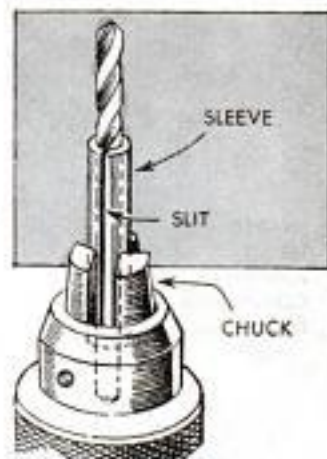


Laboratory workers who wear glasses sometimes have difficulty in using a microscope because their spectacles contact the metal edge of the eyepiece and become scratched. One way of avoiding this is to use a corn pad on the eyepiece. The adhesive on the pad

will hold it securely in place, and the felt ring will protect the glasses from touching the metal.—G. B. Taylor, Jacksonville, Fla.

Small Drills Stiffened With Sleeve Are Not Easily Broken

When drilling small holes in metal, even a slight movement of the work will cause the drill to break or bend. To avoid this, the drill can be chucked within a metal sleeve that allows only a small portion of the drill to extend into the work. The sleeve is made by drilling a short length of rod lengthwise and then slitting the rod with a hacksaw so that when chucked it will grip the drill.

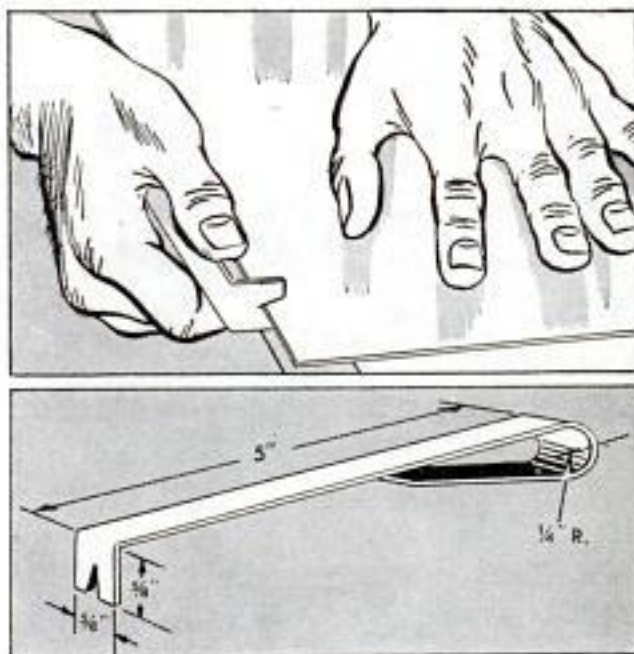


Emil Wittmann, Philadelphia, Pa.

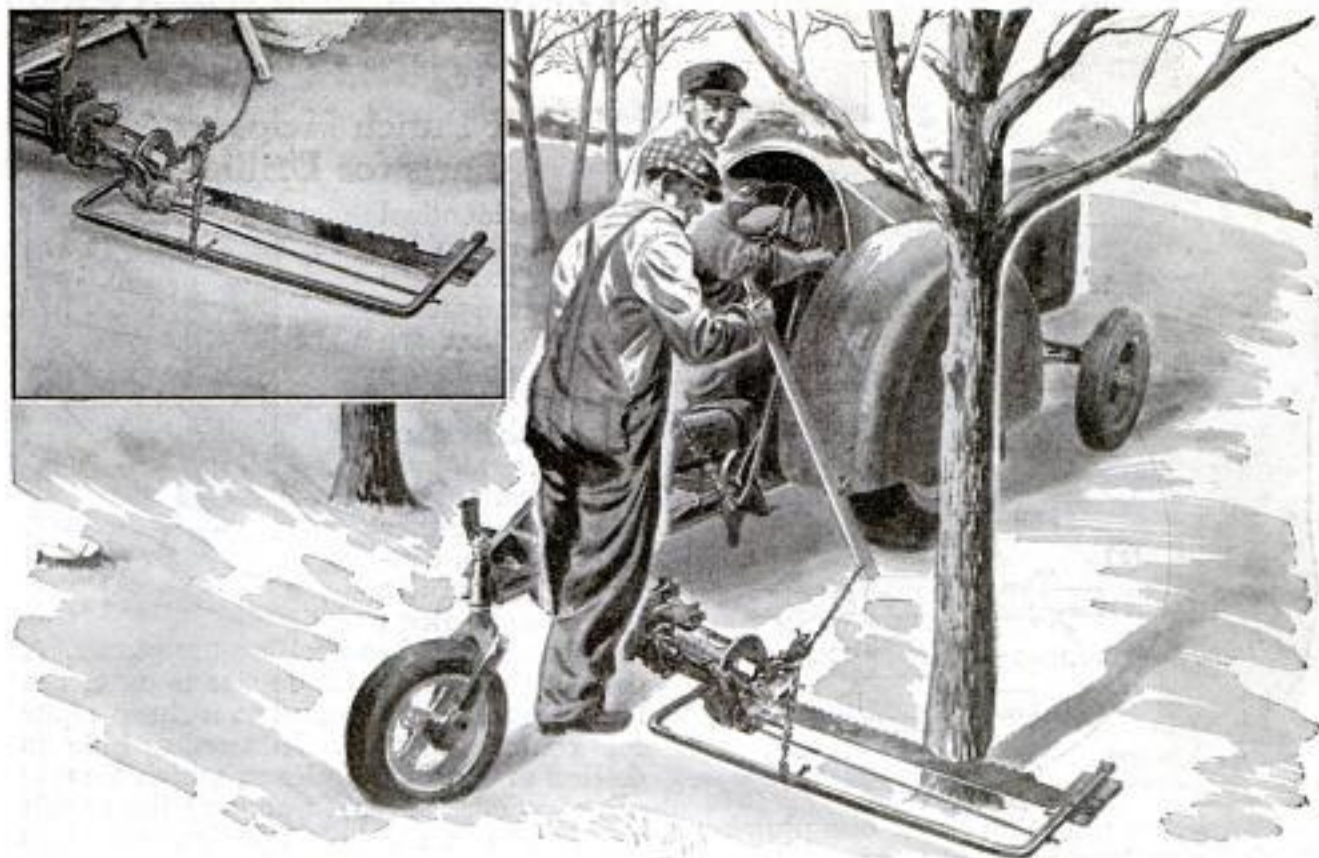
Hooked Scraper Removes Burrs From Sheared Aluminum

When a large number of aluminum sheets are to be burred after shearing, a hook scraper like the one shown will do the work rapidly as it will burr both sides of an edge in one operation. The scraper is made by cutting a V-notch in one end of a strip of steel and beveling the sides of the notch to form cutting or scraping edges. The notched end is bent at a right angle and a grip is formed at the other end, after which the scraper is hardened to retain its cutting edge.

Wallace H. McClay, Pasadena, Calif.



Power Tree Saw Is Made From Tractor Mower



By substituting a saw blade for the cutter bar of a tractor mower, one orchard owner, who needed to remove 1500 trees to make room for adequate growth of others, was able to cut down as many as 150 trees a day. Ordinarily, not more than 25 trees can be chopped down in that length of time

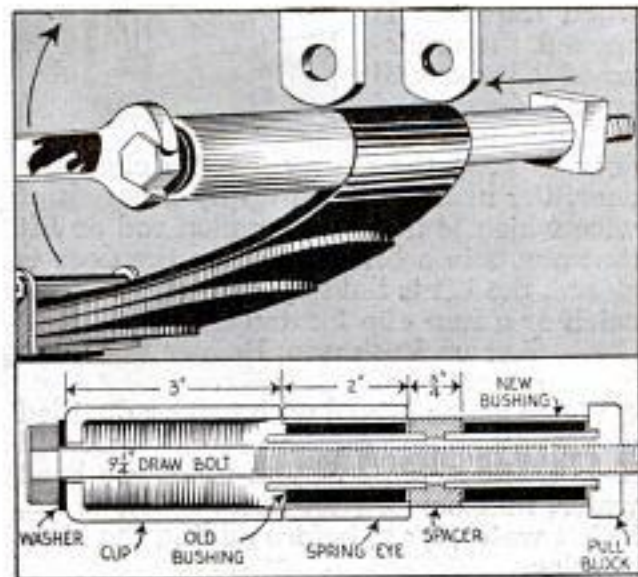
by two men with axes. Moreover, the saw cuts the trees close to the ground, leaving only a short stump. The blade operates like a mower sickle and is fed into a tree by a wooden lever which is pivoted to a fender of the tractor and attached to the mower cutting bar with a short chain.

Rubber Bushing Forced Into Spring Eye by Draw Bolt

The job of replacing rubber bushings in auto springs will be simplified considerably by using a tool like the one illustrated. It consists of a $9\frac{1}{4}$ -in. draw bolt of a diameter slightly smaller than that of the shackle

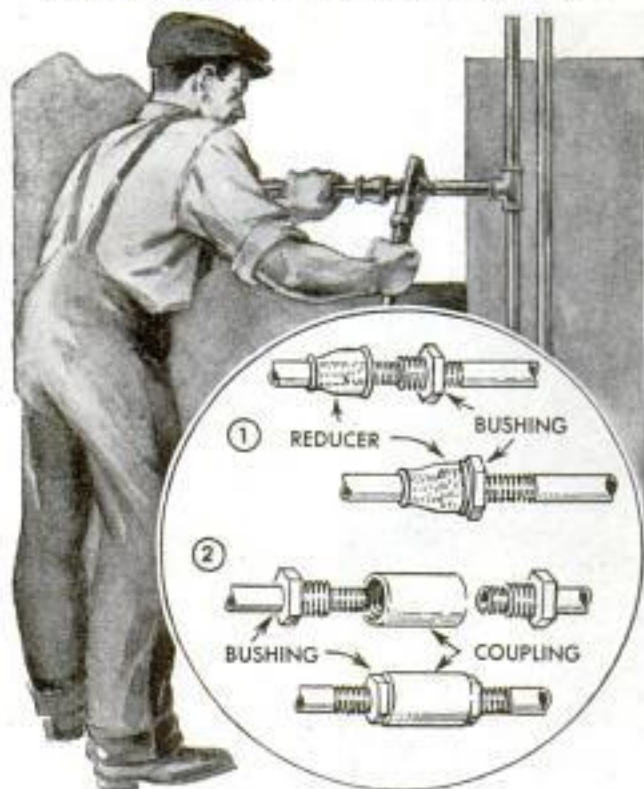
bolt, a nut to be used as a pull block, a tube closed at one end to form a cup, and a hardwood spacer, which must be of a diameter to slide through the spring eye. The spacer and pull block are shaped as shown in the detail, so that they contact the outer and inner metal sleeves enclosing the rubber insert of the bushing. To replace a worn bushing, the shackle bolt is forced out of the spring eye and the draw bolt, with the cup in place, is inserted. Then the spacer is slipped on the bolt, the new bushing is put in position and the pull block is screwed on. When the draw bolt is tightened, the pull block draws the new bushing into the spring eye and forces out the worn bushing, which drops into the cup.

A. E. Kennedy, Englewood, N. J.



☐ If the air pressure in automobile tires is allowed to drop even as little as 5 lbs. below the recommended pressure, the life of the tires will be reduced 32 percent, while a drop of 9 lbs. decreases tire life 52 percent.

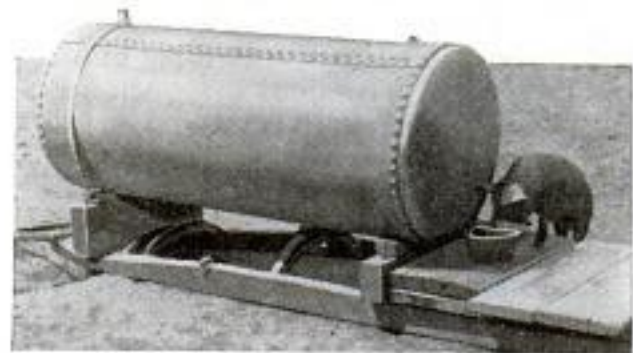
Reducer and Bushing Join Pipe When Union Is Not Available



Having no union on hand, one plumber joined two lengths of pipe by a reducer and a bushing as in Fig. 1. The reducer is screwed on one pipe and the bushing on the other, the threads on this pipe being extended for twice their original length so that the bushing can be screwed on far enough to allow the ends of the pipe to meet inside the reducer. Then the bushing is backed up into the reducer and tightened. Another method of joining pipe is shown in Fig. 2. In this case two bushings are screwed into a coupling, the threads on one or both of the pipes having been extended so that the ends will meet.

Hog Waterer Is Made from Boiler And Auto Frame

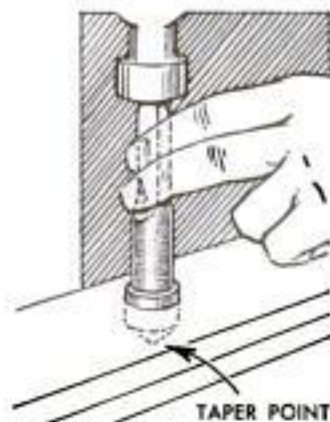
Large capacity is a feature of this portable hog waterer, which is made from a boiler and an auto frame. The boiler is mounted on blocks that rest on the frame and is fitted to take a watering cup. After filling the boiler, care must be taken to



make all openings airtight so that water will not rise above the cup inlet. Planks are laid across the frame to make it easy for small pigs to drink.—A. M. Wettach, Mt. Pleasant, Iowa.

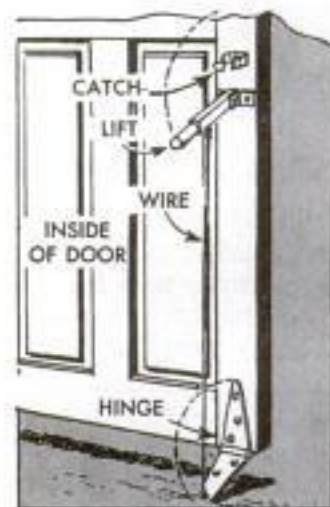
Center Punch Helps to Align Parts for Drilling

Where identical holes are to be drilled through two or more pieces of metal that are too thick to be drilled together, or are shaped so that one already drilled cannot be laid over another as a guide, a center punch made from a broken drill can be used to position the pieces. A drill of the required hole size is used, the broken end being ground to a sharp taper for center-punching. In use, a hole is drilled in one of the pieces, which then is aligned over the next one, and the punch is inserted in the hole and hammered to mark the center for drilling the second piece.—W. F. Johnson, Downers Grove, Ill.



Hinge Holds Barn Door Open

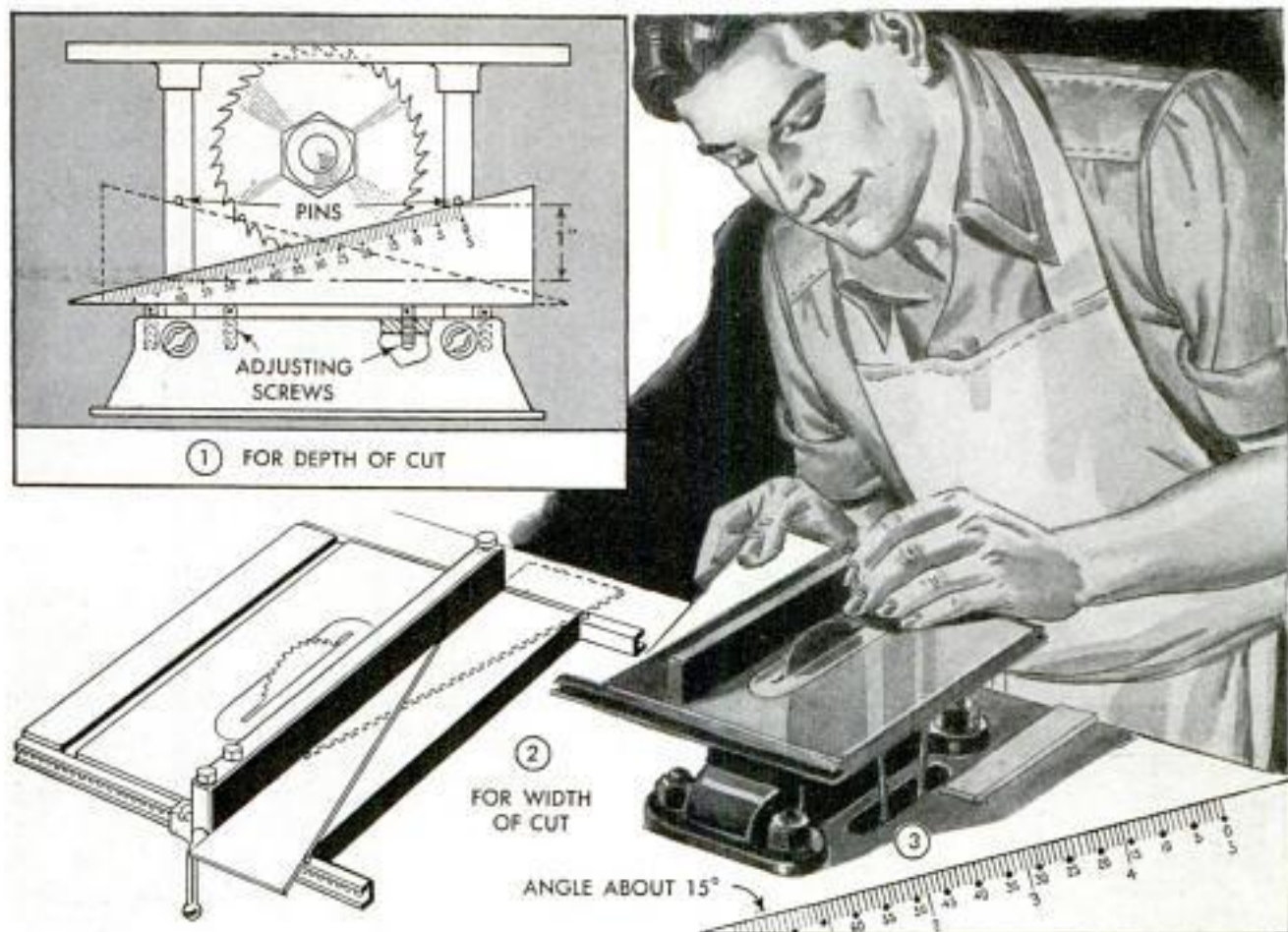
To hold open the door of a barn, garage or other outbuilding that has an earth floor, a strap or T-hinge will be found useful. One blade of the hinge is screwed to the door near the lower edge so that when the door is opened, the unfastened blade will swing downward and dig into the floor to keep the door open. To close the door, the blade is lifted up by a length of wire which is tied to a wooden rod or lift that pivots in a bracket. When the door is closed, the lift is held up by a sheet-metal catch or a fuse clip located above it.



Avrum Froimson, Beaver Falls, Pa.

Water stains mixed with soft or distilled water will go into solution readily and will have a clear color. If you must use hard water, mix borax (not boric acid), $\frac{1}{8}$ oz., in hot water, 1 qt., before adding the stain powder.

Measuring Gauge Gives Fine Adjustment on Saw



Modelmakers and others whose work requires cutting and grooving in fractions of an inch on small power saws not provided with finely graduated adjustments can obtain accurate results by using this measuring wedge. Briefly, the idea is to provide a wedge-shaped piece of metal with one side cut at an angle of about 15 degrees. The oblique side is marked off in an equal number of divisions, for example, a total of 64 divisions per inch of vertical drop as illustrated in Figs. 1 and 3. By having a level surface on which to slide the wedge, and by providing pins on the vertical sliding posts of the saw table, it is obvious that one of the pins resting on the wedge will be raised or lowered $\frac{1}{64}$ in. when the wedge is moved a distance of one division toward the wide or narrow end. The spaces on the wedge are actually much wider than $\frac{1}{64}$ in. If the scale is 4 in. for 1 in. of vertical drop, the spacing of the divisions will be $\frac{1}{16}$ in. although they represent $\frac{1}{64}$ in. of vertical measurement. Consequently it is much easier to make height adjustment on the saw with the wedge than it would be by measuring directly with a rule.

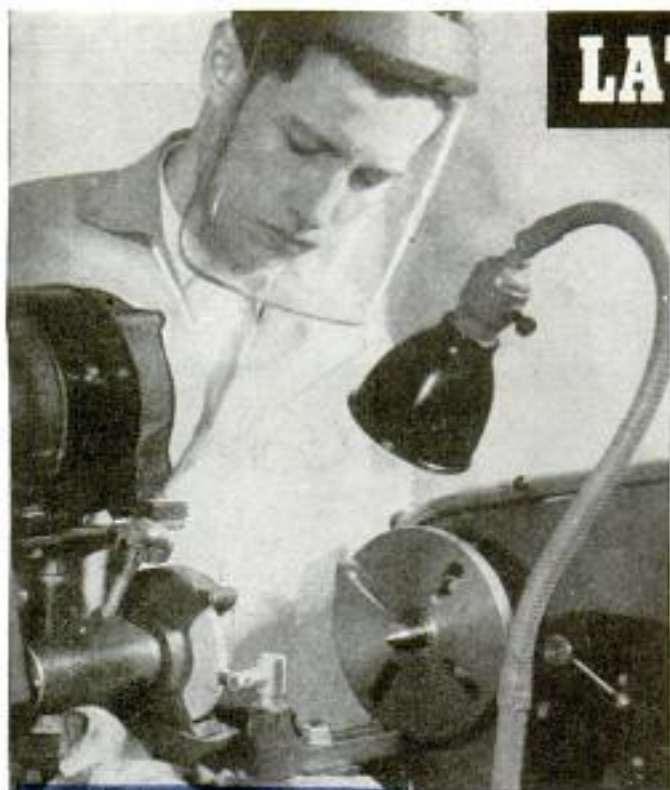
On a saw having two vertical posts supporting the table, a small hardened pin is set into a hole drilled in each post, holes in both posts being exactly the same distance from the surface of the table, and at a point

where the wedge reading is maximum. To adjust the table for depth of cut, the measuring wedge is placed first in the position shown in Fig. 1, contacting the pin on one leg, after which the wedge is reversed as indicated by the dotted lines, and the same adjustment is made on the other leg. To provide a perfectly true surface on which the wedge is set, two adjusting screws with the heads ground flat are fitted into tapped holes in the base. When making adjustment for depth it's a good idea to start out with the table surface flush with the saw teeth. Then the table is lowered for desired depth of cut by using the measuring wedge. When the saw teeth are sharpened, which slightly decreases the saw diameter, the adjusting screws on the base can be reset to compensate for the difference so that you will obtain the same reading on the wedge.

Besides making fine height adjustments, the same idea can be used to set the saw fence for widths of cutting. In this case the pins are fitted to the fence guides as in Fig. 2. They must both be located exactly the same distance from the saw. In this setup the fence is movable instead of the pins. However, the same method of adjustment is applied to get both ends of the fence exactly the same distance from the saw.

Ray Rusher, Chicago.

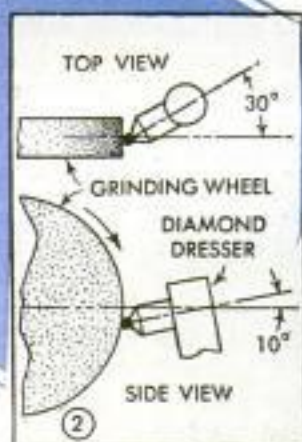
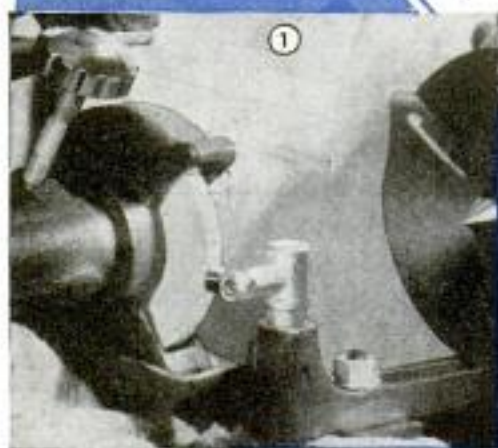
LATHE ATTACHMENTS



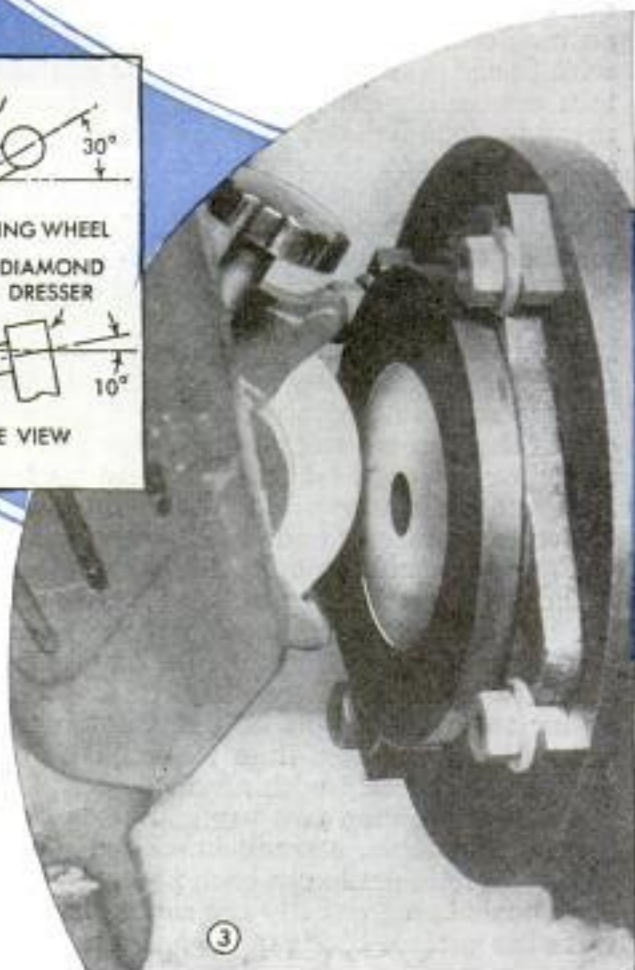
regular threading tool. To do this, the grinding-wheel face must be dressed to a 60-deg. angle.

To be most efficient, a grinder should be of correct size for the lathe on which it is used. A small grinder lacks rigidity and a heavy one may be unnecessarily expensive as well as bulky and inconvenient in use. The grinder should be either bolted securely to the lathe compound or held in the tool post. For bench lathes, a grinder designed for wheels of 3 or 3½-in. dia. and ¾ to 1½-in. width is most useful for external grinding. Grade and grain size of the wheels will, of course, depend on the type of work to be done. For mild steel, a vitrified aluminum oxide wheel of No. 46 grain and N grade, and for hardened steel, one of grade K of the same grain size, usually are best. A vitrified silicon carbide wheel of 36 grain, L grade, should be used for cast iron as well as for brass and other nonferrous metals. When the wheel is mounted on the spindle the nut should not be forced tight. It will tighten itself when the wheel contacts the work.

Most wheels of 3 or 3½-in. dia. can be



BY THE efficient use of a few accessories such as a tool-post grinder, a turret attachment, and a milling fixture and cutters, a metal-cutting lathe may be employed to do the work of several other machine tools. Thus its capacity will be increased while the cost of work done with it is reduced. For instance, with a tool-post grinder, a lathe will substitute, within limits, for an external, internal and surface grinder for small work, as shown in Figs. 3, 4, 6 and 8. Fig. 7 shows a machine spindle being ground internally while supported by a steady rest, and in Fig. 10 a screw thread is being precision ground to correct any errors that may have been made by the

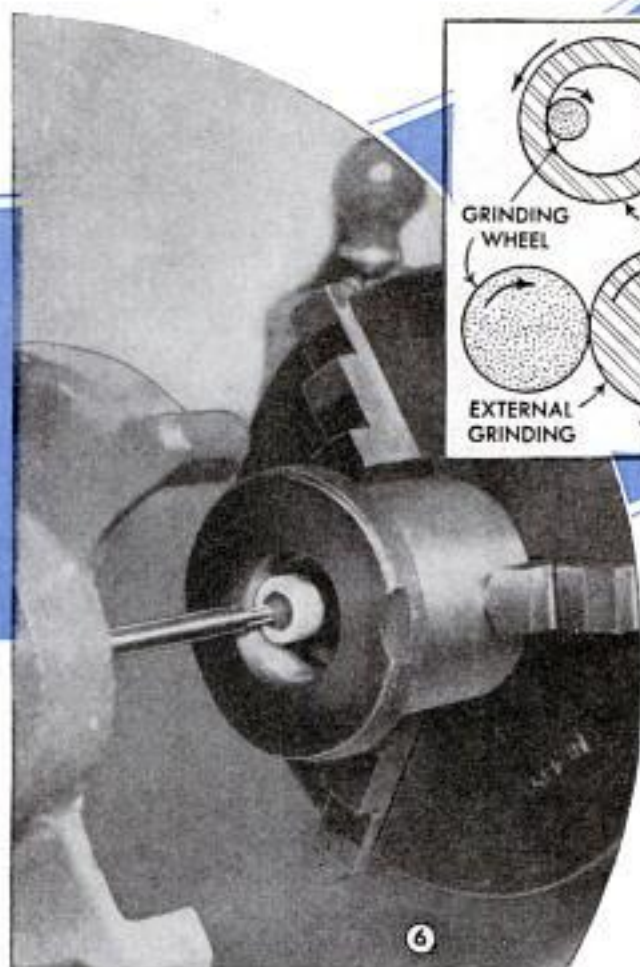


USED EFFICIENTLY

By H. J. Chamberland

operated safely at about 6000 surface ft. per min. However, since the wheel's cutting efficiency decreases as the diameter is reduced by wear, as large a wheel as possible should be used, the maximum diameter being determined by the wheel guard, which should be used whenever possible. Tool-post grinders usually have only two speeds, one for external use and the other for internal grinding, although some grinders have interchangeable pulleys by which the speed can be regulated to suit the wheel diameter.

For internal grinding, a slightly higher work speed and faster traverse feed may be used than for external grinding, and for rough-grinding a hole the infeed may be twice that used for external grinding because less heat usually is generated. The wheel



usually is of a diameter not less than one half that of the hole to be ground. Also, any vibration of the grinder will destroy the precision of the work. For external grinding, the wheel should rotate in the same direction as that of the work, but for internal grinding the wheel rotates in the opposite direction, Fig. 5. The same principle applies to surface-grinding work held on a faceplate, as indicated in Fig. 3.

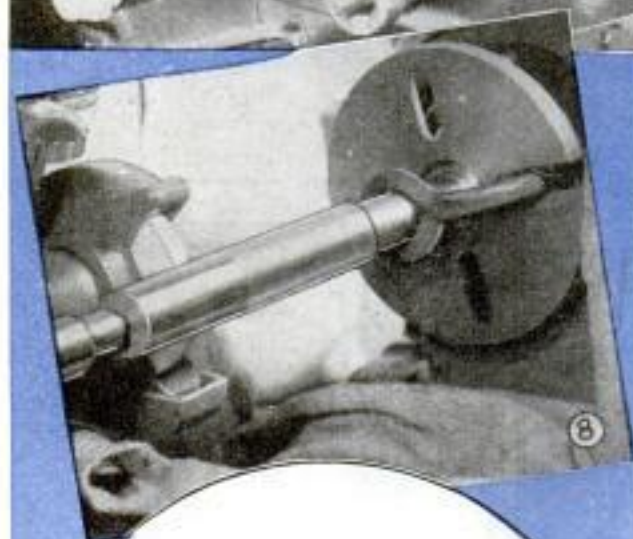
Since no coolant is used for grinding in a lathe the infeed or depth of cut should not exceed .002 in. at one pass across the work. A safe procedure is to rough-grind to within .001 in. by removing .0005 in. at



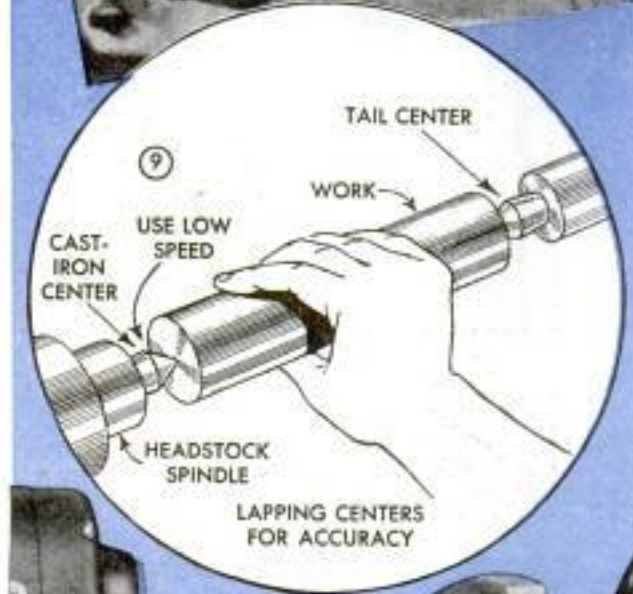
Work held in Steady Rest for Grinding

each pass with a roughly dressed wheel, then dress the wheel fine and take about four light cuts to bring the work to exact size. By passing the wheel over the work a few times with no in-feed, a high finish will result.

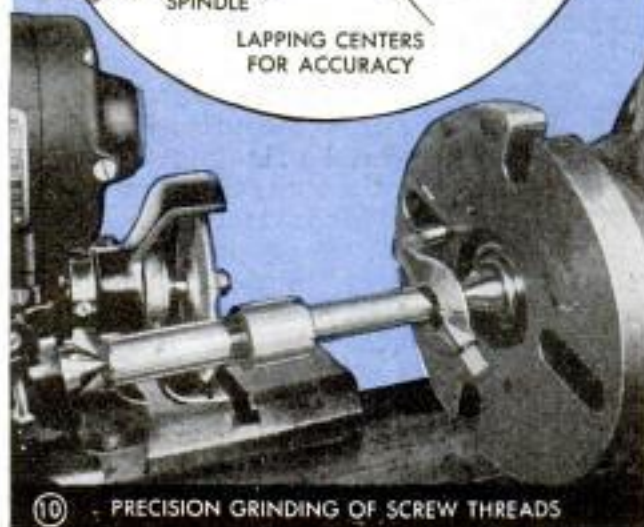
In dressing or truing a wheel, a "wheel dresser" consisting of a diamond set in a holder is commonly used as in Fig. 1. Each time the diamond is used, the holder should be given a quarter turn to maintain a sharp cutting point on the diamond. A

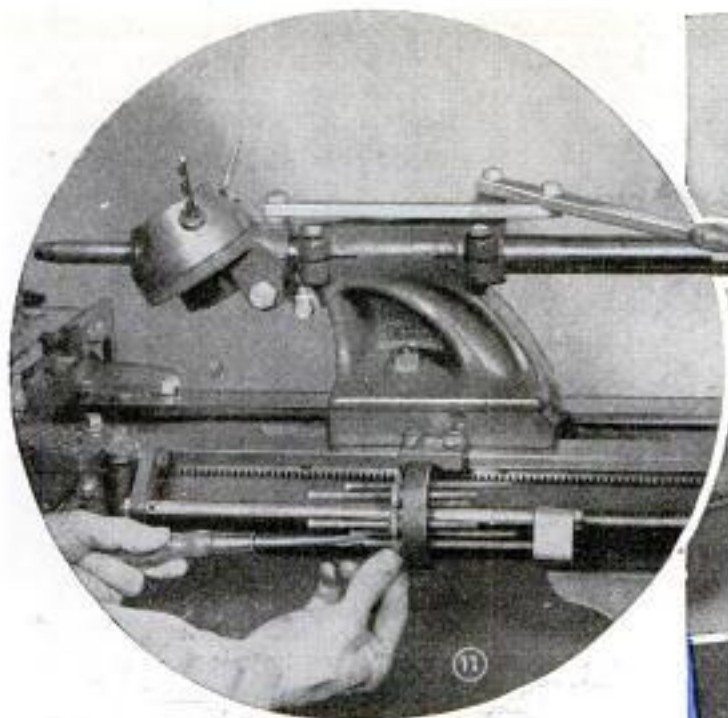


shop apron or other piece of heavy cloth should be spread on the lathe bed before dressing the wheel so that the abrasive will not fall onto the bed ways. To open the wheel face for rough-grinding operations, the dresser is positioned as shown in Fig. 2, and the wheel is passed over it rapidly at a depth of about .003 in. For a finish grind, the dresser must be passed slowly over the wheel several times, each cut being not more than .002 in. in depth. After the wheel is dressed, the lathe bed ways and other parts that may have been exposed should be cleaned carefully with kerosene to remove any particles of abrasive that may have fallen on them. When grinding shafts or spindles, center holes should be lapped with a compound of 400-grain aluminum oxide and sperm oil on a headstock center of cast iron or brass, as indicated in Fig. 9. This is particularly necessary if the center holes are rough or the work has been hardened.



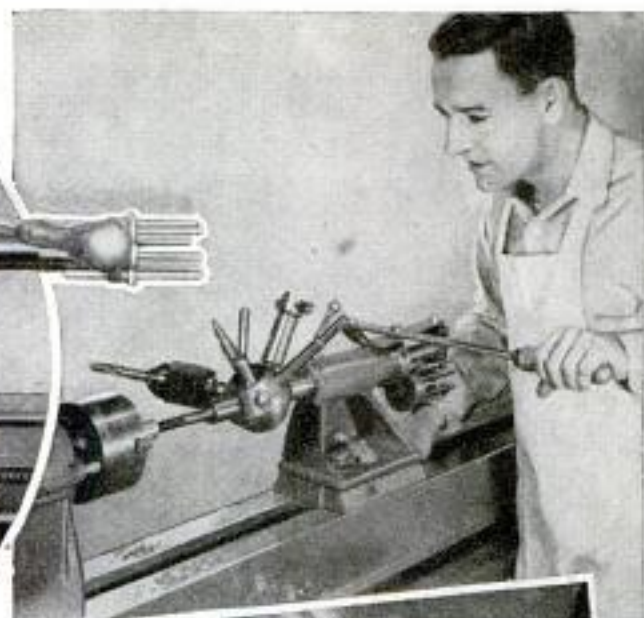
With a turret attachment, Figs. 11 to 14, a lathe will be equipped to perform certain operations ordinarily done on a screw machine and can turn out work on a production basis, as very little time is spent in changing from one cutting tool to another. A turret attachment can be held either on the cross carriage as in Fig. 12, or in the tailstock, Figs. 11 and 13, the style of each attachment being different. For use on the cross carriage, a square holder for tools generally is used. A tool post can be set back of the work as in Fig. 14, with the cutoff tool inverted and fed forward. Turret attachments held in the tailstock support the tools at an angle so that when the attachment is rotated the tools will be at the correct working position. Sometimes both types of turret attachment are used together, the tailstock turret holding tools for internal opera-





tions while the cross-carriage turret holds tools used for external operations. Cutting tools used in the cross-carriage type of turret ordinarily are larger than standard sizes because the tools may have to project farther from the holder for efficiency and therefore are subject to greater strain. The length and depth of cuts by any tool held in a turret are controlled by multiple stops attached to the front bed way or to the tailstock ram, Fig. 11. The stops are regulated by adjustable screws, each of which is marked to identify the operation it controls.

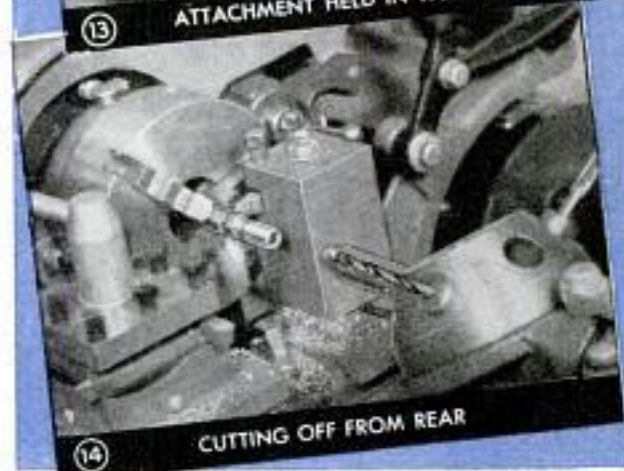
Another method of increasing the versatility of the lathe is to use a milling attachment and cutters of different kinds for a variety of milling operations. A few of the many cutters that are used for milling in a lathe are shown in Fig. 18. They are known by names that describe their uses. Cutter A is a plain milling cutter; it is provided with a key seat by which it can be held on an arbor and it may be reversed to cut in either direction; that is, for left-hand or right-hand milling. In right-hand milling on a lathe, the cutter rotates in the same direction as the chuck or faceplate rotates when ordinary turning is done, and the work held in the fixture gradually advances toward the operator from behind. In left-hand milling, the lathe spindle and cutter rotate in the opposite direction and the work is fed against the cutter in the same direction as the tool bit is fed in for regular turning. Detail B of Fig. 18 shows a keyseating cutter. Unlike the cutter shown at A, it cannot be reversed but is solid on its arbor, which must be mounted in a lathe so that the cutter rotates toward the operator, the



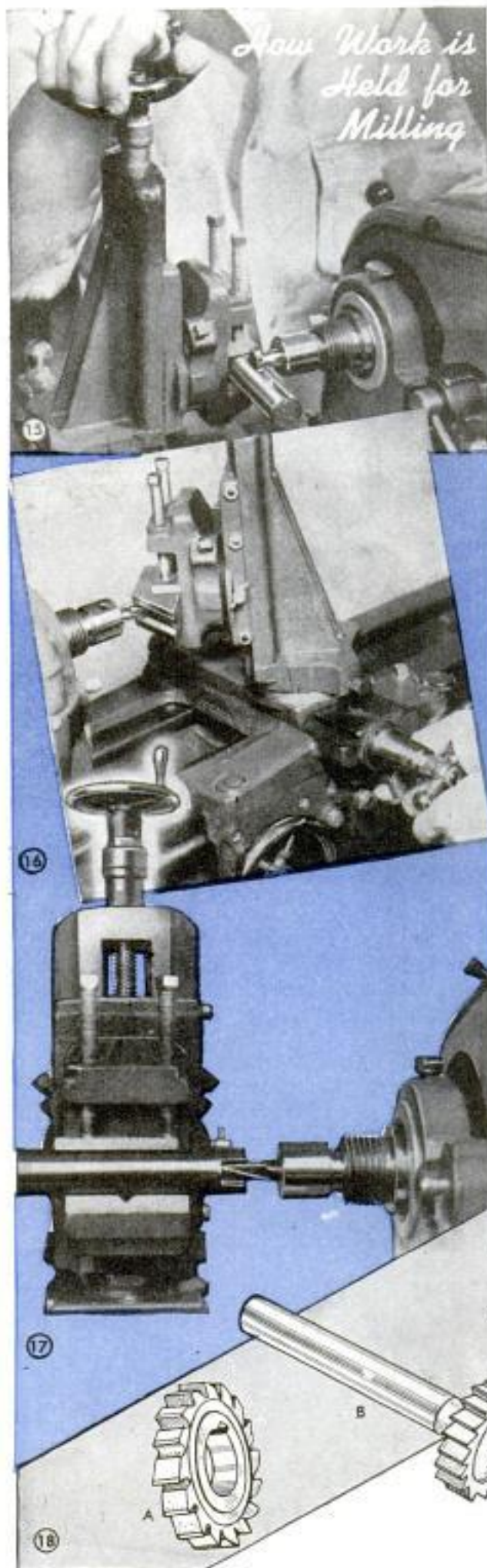
ATTACHMENT HELD ON CROSS CARRIAGE



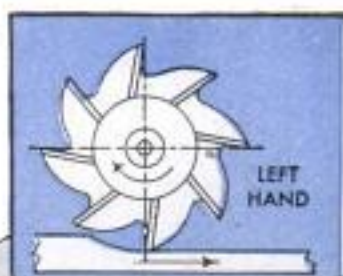
ATTACHMENT HELD IN TAILSTOCK



CUTTING OFF FROM REAR



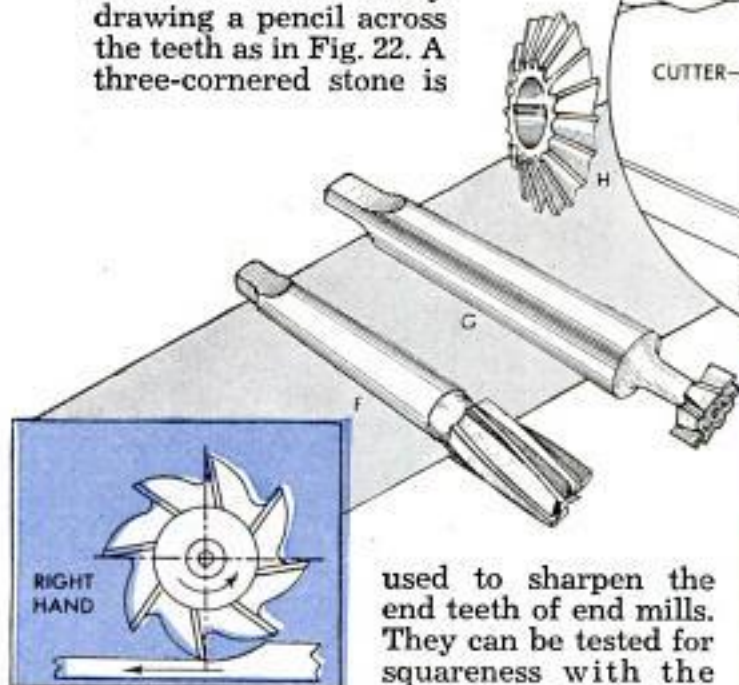
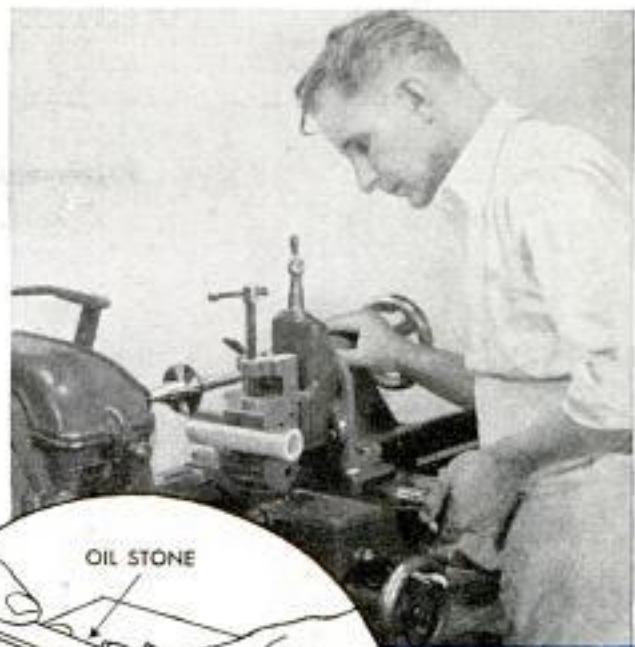
work being fed in from behind. In Fig. 15 a keyseating cutter is shown milling a slot in a shaft, the work being held in a milling attachment. Cutter C is a side mill, so called because the sides as well as the lips of the teeth are ground to a cutting edge. E is an angular cutter for left-hand milling of dovetails. In cutting dovetails, the female part may be cut in a single operation by using a 60-deg. angle cutter of required diameter, or an end mill may be used to cut a straight slot and the angles of the sides may be finished with a small angular cutter. The male part is then milled to fit. However, milling the angles separately means reversing the work unless a right and a left-hand end mill are used. In this case, care must be taken to keep the two cuts in perfect alignment. Arbor D, for the angular cutter E, has a left-hand thread so that when the cutter rotates against the work it will be tightened automatically. F is an end mill for right-hand milling, shown in use in Fig. 17 to mill a slot at the end of a shaft. By means of the swivel and vertical adjustments and the cross-slide feed of the milling attachment an end mill will produce cuts of various types without requiring the removal and resetting of the work in the attachment. For example, a shaft can be squared on the ends or opposite flats can be milled on it. In Fig. 16 the same cutter is shown milling a channel that can be made into a T-slot by replacing the end mill with cutter G, called a T-slot cutter. Detail H, Fig. 18, shows a double angular cutter, so called because the cutting edges ex-



tend on both sides of each tooth to mill a V-shaped slot. Double angular cutters are made with an included angle of 45, 60 or 90 deg., but V-shaped cutters of any desired angle may be made up to special order.

For use in a lathe, fine cutters—those having many teeth—are best as the milling

attachment is not as rigid as a fixture bolted to the bed of a milling machine. Coarse cutters are used to best advantage only for heavy work on regular milling machines. Lard oil should be applied freely to the cutters during milling operations to help reduce heat and wear of the edges. When the cutters become dull they should not be ground unless a special grinding fixture is available; it is safer to extend the efficiency of the original grinds to the limit by careful honing of the cutting edges. When being honed, the cutter is placed on a suitable rest, Fig. 19, and the stone is held at an angle corresponding to the amount of clearance on the tooth. The angle of clearance is usually about 5 deg. To determine whether the side or end teeth have sufficient clearance, a shave test can be made by drawing a pencil across the teeth as in Fig. 22. A three-cornered stone is

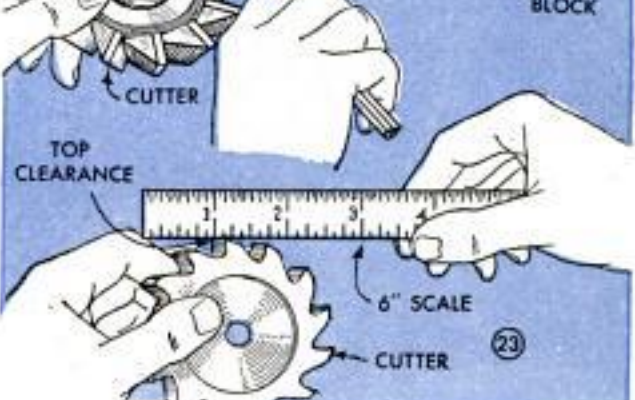
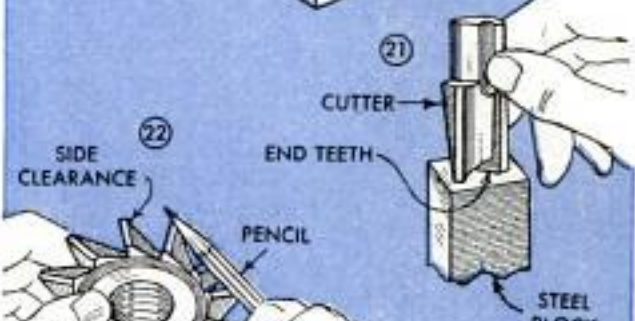
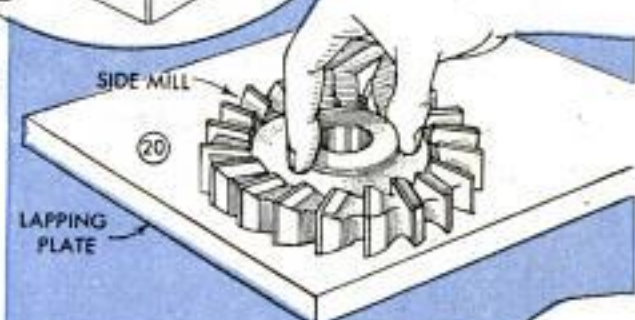
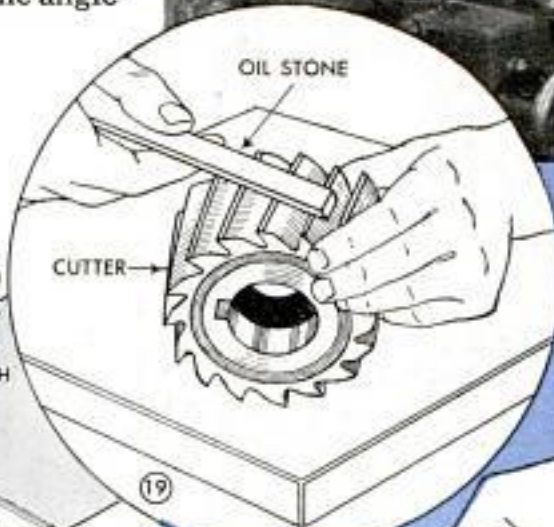


used to sharpen the end teeth of end mills. They can be tested for squareness with the peripheral teeth by

rocking the cutter on a small steel block as in Fig. 21. Peripheral teeth require no less than 4 deg. of clearance. This can be determined with fair accuracy by the aid of a 6-in. scale held on a tooth and parallel with the adjoining teeth as in Fig. 23.

Care must be taken in honing cutters to hold the stone so that it contacts the cutting edge of each tooth evenly, as a good stone will cut away the metal quickly and the edge may be ruined by a few incorrectly placed strokes. Side milling or angular cutters can be honed by lapping them on a cast-iron plate or a marble slab, Fig. 20. Lapping compound is used, and the cutter is rotated back and forth on the plate.

Crushing of wood when mounting it in a three-jaw chuck for turning can be avoided by wrapping it with light sheet metal.



Hairdressers Use Magnetized Rod To Locate Hidden Pins



After setting a finger wave or dressing a permanent, beauty operators often move a magnetized bar over a patron's head to locate hidden hairpins used to hold the wave while drying. The bar is a short length of steel rod and is magnetized by being stroked over a magnet, or it can be held in the center of a coil connected to two dry cells wired in series. The magnetized rod is inserted in a container of the type used to hold lipstick, and plastic wood or other substance is used to hold it securely. A similar rod drawn by a length of string across the floor gathers hairpins that have been dropped.—I. M. Fenn, Chicago.

Flashlight Held on Screw Driver Illuminates Work



By attaching a pen-type flashlight to a screw driver you will have light in close quarters when your hands shade the work. The light is attached by two strips of tin looped over the screwdriver close to the bit end, where they are held by bolts and wingnuts. Herman Klein, Pittsburgh, Pa.

Numbering Welding Cables Simplifies Tracing Them

When a number of welding units are used in a small area, delays caused by tracing a welding cable to the machine can be avoided by numbering the cables and machines. A convenient method is to paint a number on a metal band and clamp it on

the end of the cable. The machine then is painted with a corresponding number so the worker can look at the number on his cable and go directly to the proper machine.—E. W. P. Downing, Norfolk, Va.

Draftsman Applies Banana Oil To Mend Torn Tracings

Instead of mending torn tracings with gummed tape, which may be noticeable on blueprints, one draftsman uses banana oil that has been allowed to evaporate until it is thick. The torn edges of the tracing are carefully mated and pressed together, and the oil is applied over them with a small brush. When dry, the repair is permanent.



W. Fraser Hughes, Nova Scotia, Can.

Clogged Sanding Belts Renewed By Cleaning on Buffer

Sanding belts that have become dull from clogging with wood dust often can be restored to effective use by going over them with a cloth buffer. The belt is removed from the sander and held lightly against the buffer, which removes the dust without damaging the grit.



Sanding disks and drums may be similarly serviced.—C. Nott, Jr., Elbridge, N. Y.

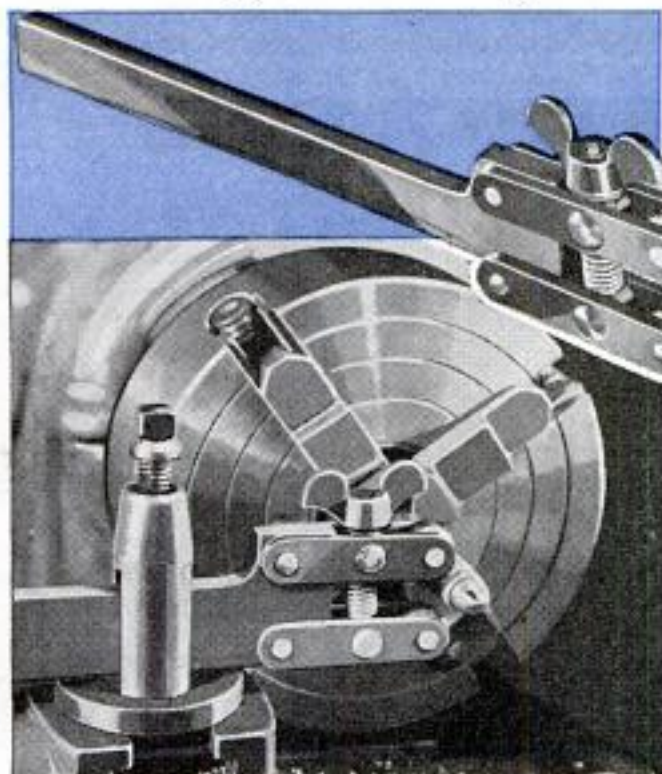
Slotted Nut Gripped in Lathe Dog Holds Threaded Work

When using a lathe dog in turning threaded work between centers, a slotted hex nut can be screwed on the work to be gripped in the dog. The cap screw of the dog is tightened on the nut which will clamp down on the work and hold it without damaging the threads.

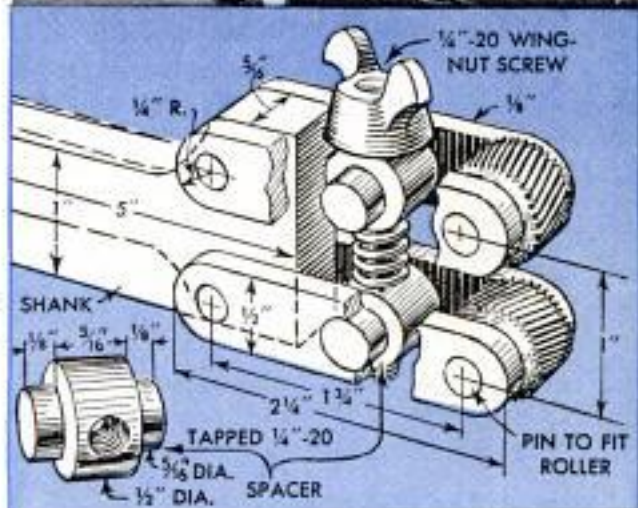


Wm. E. Hesel, Grand Rapids, Mich.

Knurling Tool Adjusts to Light or Heavy Work



For light, small-diameter work, this adjustable knurling tool can be used as a hand tool to produce a clean-cut hand knurl. If there is heavier work of larger diameter, a short shank will adapt it for use in the tool post of a lathe. The shank was cut from $\frac{5}{16}$ -in. stock, the same thickness as the knurls which were used, and shaped as indicated by the solid lines for the lathe tool and by dotted lines for the hand tool. A shank 5 in. long is used for the lathe tool and the shank for the hand tool can be 7 in. long. The four arms holding the knurls were made from $\frac{1}{8}$ -in. stock, cut and drilled as shown. Two spacers, which adjust the knurls to the work, were turned to the dimensions given and cross-drilled, one being tapped $\frac{1}{4}$ -in.-20 and the other drilled clearance size to receive the adjusting screw. This screw was made from a short piece of $\frac{1}{4}$ -in. rod, threaded for a distance of about $\frac{3}{16}$ in. on the head end, screwed into a wing nut and riveted over to hold it in place. The other end of the rod was threaded to screw into the bottom spacer. In assembling the parts, the



arms should be allowed to rock on the pins to give a self-centering action to the knurls when applied to the work. The compression spring shown between the spacers will add to the convenience of the tool.

Gary Moore, East Aurora, N. Y.

Shaft May Be Used as a Mandrel to Babbitt Bearings

When rebabbitting bearings, a mandrel is not always necessary because the shaft which runs in the bearing may be used as a mandrel itself. This is especially true if the shaft is undersize and a matching mandrel would be difficult to secure. The mold should be fashioned so that the babbitt can be poured quickly. If poured too slow-

ly, the shaft may heat unevenly and warp. In preparing the shaft for the mold, the journal can be coated with an oily soot and then covered with one layer of thin, tough paper. This will have an insulating effect and provide clearance between the shaft and the bearing. Some scraping may be required.—W. F. Schaphorst, Newark, N. J.

Half an Oil Drum Holds Sand For Checking Fires in Garages



An ideal container for holding sand used in extinguishing fires in garages, machine shops and other places where oil accumulates can be made by using one half of an oil drum that has been cut in two lengthwise. Legs, which are pieces of tire rim, are welded on the ends. Because of the container's shape, sand can be scooped out quickly.—Opie Read, Jr., Chicago.

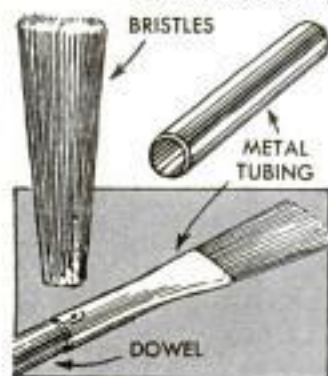
Screen-Wire Roller in Paint Pan Coats Brush for Stippling



A better way of coating a stippling brush than dipping it in paint is to run it lightly over a roller placed in a shallow paint pan. The roller is a length of screen wire wrapped around and tacked to two wooden disks.

Only enough paint adheres to the screen to coat the brush so that excess paint will not drip off to spoil the appearance of the wall.

Striping Brushes Improvised From Scrap Material



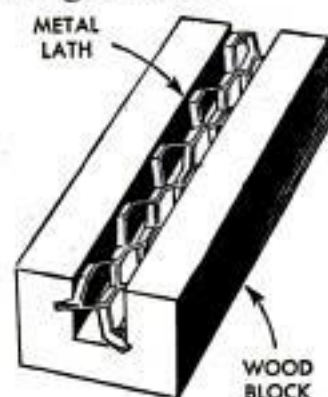
When a paint brush becomes clogged or worn out, it need not be discarded. The part of the bristles covered by the ferrule will serve to make a number of small brushes suitable for striping or edging. The

bristles are cut to the desired lengths and set into the end of a metal tube which is clamped together in a vise to form a ferrule. This is slipped over a length of dowel, which serves as a handle, and is prick-punched to keep it in place.

James McKeon, Collins, N. Y.

"Sanding Block" Shapes Edges Of Insulating Board

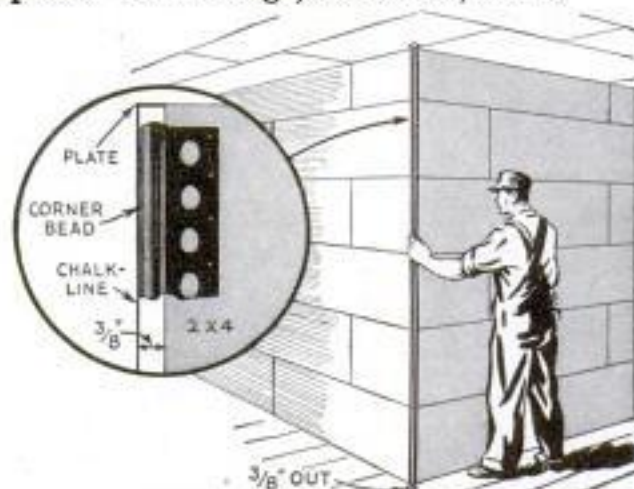
A strip of metal lath set into a grooved block at a slant provides a handy tool that can be used like a sanding block for quickly beveling or rounding the edges of insulating board and similar materials. A 2 by 3-in. block about 7 in. long with a groove $\frac{3}{4}$ in. wide and 1 in. deep is the most convenient size, and the lath is forced into the groove so that its sharp edges dig into the wood to hold it in place.



Claude N. Butts, San Francisco, Calif.

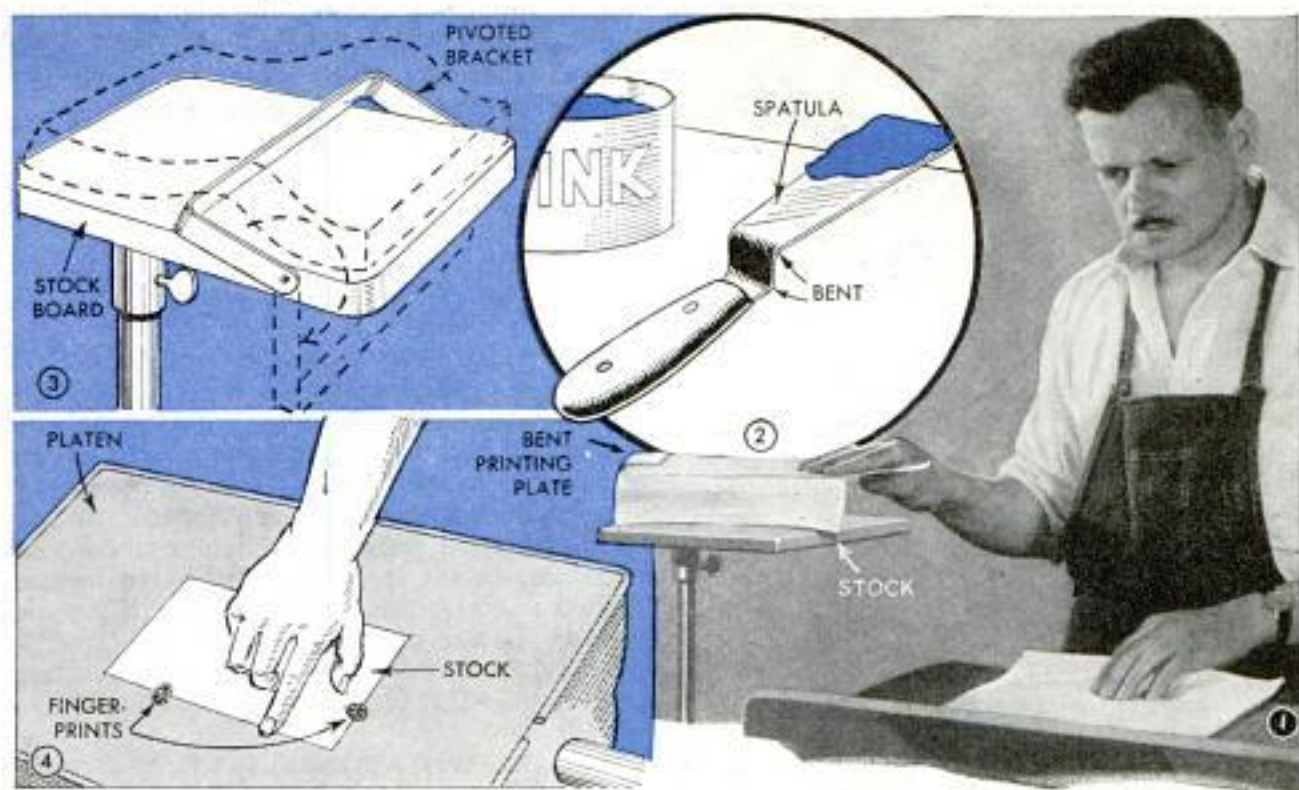
Chalk Line Used Instead of Level When Locating Corner Bead

By using a chalk line, you can position a metal corner bead vertically on a stud more quickly than when using a level, and the plastered wall will be equally true. The chalk line is suspended between nails at the top and bottom of the wall and spaced $\frac{3}{8}$ in. away from the stud, this distance being the thickness of the plaster. Then the bead is set over the edge of the stud, moved out to touch the line and nailed in place.—M. B. Birge, Rochester, Minn.



Shallow surface scratches in glass can be removed by rubbing them with a mixture of glycerine, water and red rouge, using a felt pad as an applicator.

Four Simple Kinks That Printers Find Useful



Printers have found these ideas time and labor savers in operating job presses. Fig. 1 shows how an old electrotype was bent at a right angle and used to weight a stack of paper on a stock board so that one sheet at a time could be removed and fed into a press. The bent end keeps the plate from sliding forward as a sheet of paper is removed. Bending the blade of a spatula as in Fig. 2 will not interfere with its use, but will prevent the blade from smearing ink over the workbench when it is laid aside. A metal bracket pivoted to a stock board as indicated in Fig. 3 will replace the stick that feeders of job presses sometimes use

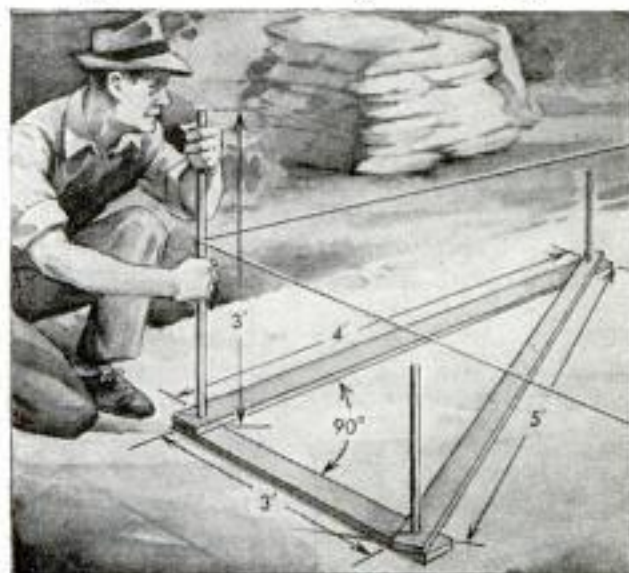
under the center of a stack of paper on the stock board to prevent the paper from sliding when vibrated by the press. The bracket also aids in removing one sheet of paper at a time, and can be swung up in position or dropped down under the board when not needed. Fig. 4 shows a quick way of spotting locations for gauge pins by pressing the tip of a finger on one of the ink rollers, then transferring the ink smudge to both the stock and tympan sheet. When the stock is removed, the line of separation in the smudges will show plainly where the pins are to be inserted.

G. E. Hendrickson, Argyle, Wis.

Foundation Lines Marked Off by Aid of Layout Square

In laying out foundation lines, often it is difficult to set stakes so that lines strung from them will mark off an exact 90-degree angle. An accurate way of doing this is to drive the stakes through holes drilled near the ends of three boards assembled as indicated, the holes being spaced so that the stakes are exactly 3, 4 and 5 ft. apart. With the stakes in this position, the angle formed at the juncture of the 3 and 4-ft. lengths measures 90 deg. By stringing a cord around the stakes, straight lines can be laid out for a considerable distance by sighting along the cord and over the tops of the stakes.—Wm. T. Gooley, Chicago.

☐ An old spectacle case provides a handy container for carrying small drills.



Glove Is Attached to Coat Sleeve To Free Hands for Writing



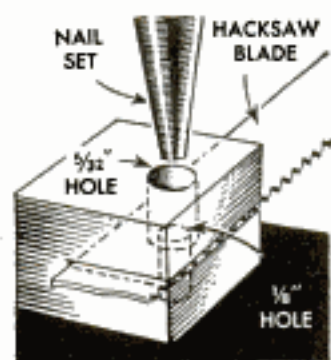
Deliverymen, messengers and others who have occasion to use a pencil outdoors in cold weather usually remove a glove while doing it. If it is inconvenient to put the glove in a pocket, it may be held out of the way by attaching it to a coat sleeve with an overshoe buckle as indicated, leaving the hands free for writing.

P. B. Horsley, Pembroke, Ont., Can.

Blueprints Stored in Glass Tubes

By removing the contact points at the ends of burned-out fluorescent tubes, the tubes may be used for storing blueprints, charts, maps and similar reference papers. The tubes may be stoppered with corks on which the contents of the tubes are recorded.—L. H. Houck, Jefferson City, Mo.

Holes Punched in Hacksaw Blade By Nail Set and Guide



A nail set and a guide made from the head of a machine bolt can be used to punch new holes in broken hacksaw blades. First cut the head from a $\frac{3}{4}$ -in. square-head machine bolt and slot

it to take a hacksaw blade. Then drill a $\frac{1}{8}$ -in. hole through the bolt head to center on the hacksaw blade. Ream the hole in the top half with a $\frac{5}{32}$ -in. drill to allow for the taper on a nail set. To operate, rest the guide on a solid surface such as a bar of solder or a piece of sheet lead and punch the hole with a $\frac{1}{8}$ -in. nail set.

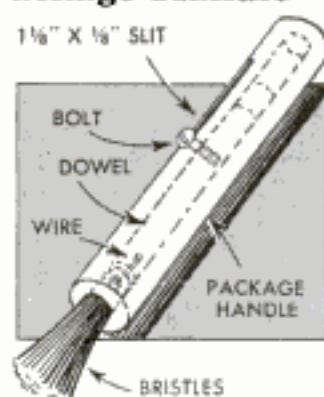
Leonard B. Ryan, Portland, Ore.

Heating Paint in Cold Weather Keeps It Fluid for Use

Paint that is to be used outdoors in cold weather should be stored, when not in use, in a room with an even temperature of about 70 deg. to prevent thickening of the paint due to cold. This will save much time that otherwise will be spent in thinning or stirring it to proper consistency. Also, if the can is set in a basin of warm water when used outdoors, the paint will remain fluid. More hot water should be added to the basin from time to time to maintain the heat.—Hal Geihm, Aurora, Ill.

Brush With Retractable Bristles Made From Package Handle

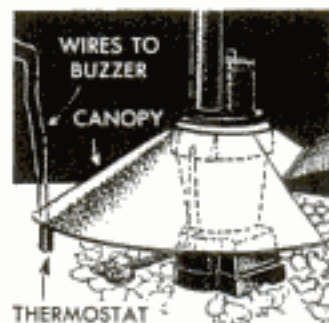
A pocket brush with retractable bristles suitable for typists can be made from a package handle and a tuft from a dusting brush. The bristles are wired to the end of a dowel of a size to slide freely in the bore of the handle, in which a $1\frac{1}{8}$ by $\frac{1}{8}$ -in. slit is cut to take a small bolt driven into the dowel for moving the bristles.



Frank Shore, New York.

Thermostatic Alarm on Brooder Warns of Low Temperatures

To warn of low brooder temperatures which might kill young chicks, an alarm can be wired to a thermostat to furnish audible indication that the brooder stove needs attention. The thermostat is installed beneath the canopy of the stove and connects to a buzzer located where it is sure to be heard.—Roger Huntington, Wrightstown, Wis.





Suggestions for 1946

W"OW"-FREE performance is claimed by the manufacturer of the portable recording and play-back equipment shown in photo A. It will produce recordings on disks up to 16 in. in diameter, at either 33.3 or 78 revolutions per minute. Designed for the speech, language and music departments of schools and colleges, and other users of high-quality sound recording apparatus, it employs a simple "gear shift" arrangement by means of which four pitches can be instantly selected to cut 98, 118, 141 and 161 lines to the inch. The center-driven turntable assures accurate timing of recordings.

Although to be installed on fleet units and at shore stations, the new National ultra-high-frequency receiver, photo B, employs a mechanical construction feature that may be adapted easily to commercial models, including wall-flush home sets. When the handles at the sides are released, the interior assembly can be pulled out on a drawer slide and tilted to three different positions for inspection or repairs. Photo C shows a magnetic wire recorder that features an automatic timing device capable of turning the machine off after the proper time has elapsed for recording. Recordings may be played through either the speaker or headphones. Photo D: Some new receivers will be equipped with a built-in automatic timer; programs are selected for any 15-minute period by flipping out one of the 48 keys around the large electric clock dial. An electronic stethoscope is illustrated in photo E; this is capable not only of transmitting body sounds for the physician but of intensifying the sounds that the operator particularly wishes to hear. Photo F shows a portable record changer attachment which converts your a. c. table or console model home radio into an automatic phonograph.



HOW TO CONVERT A SILENT 16-MM.

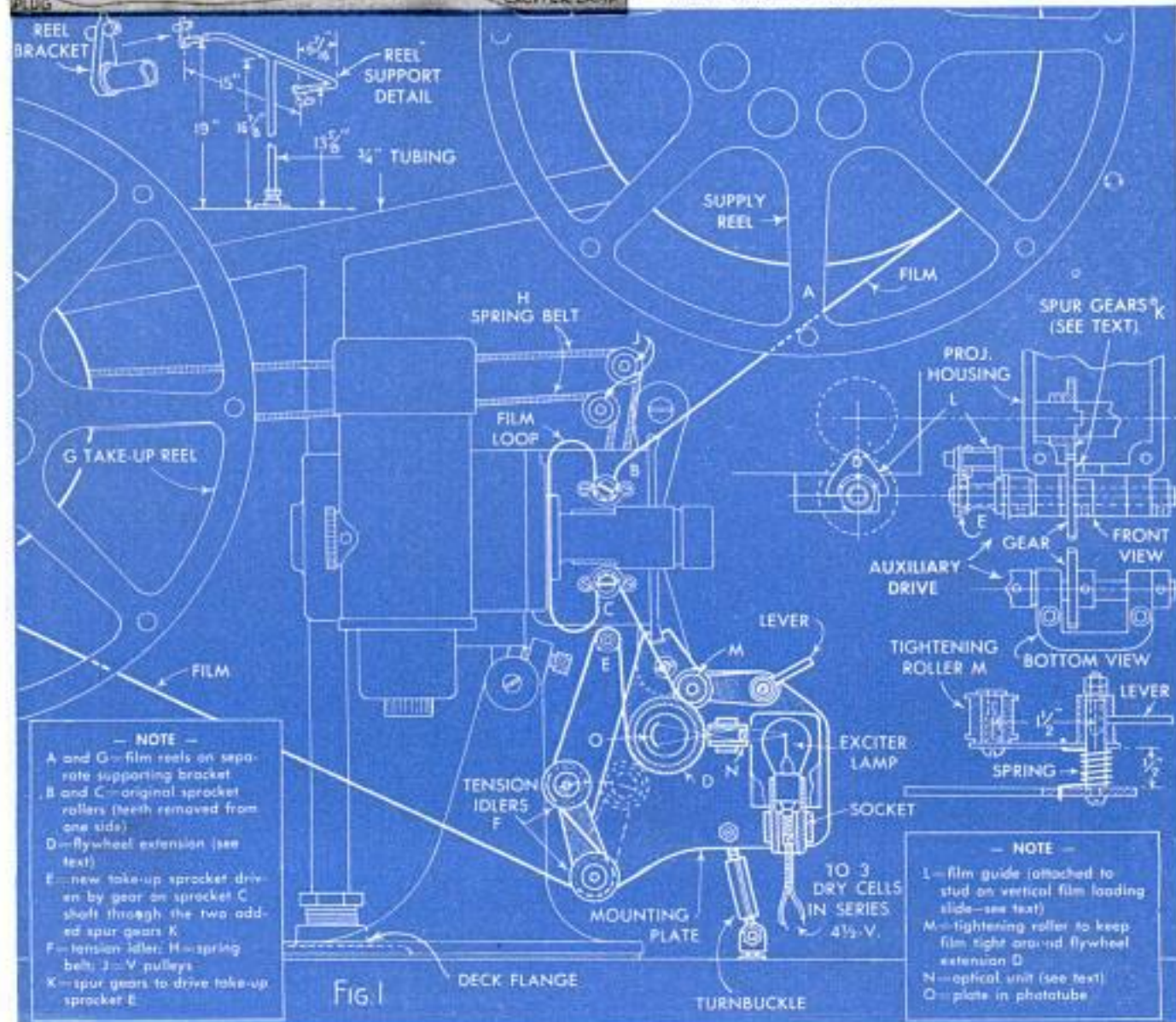
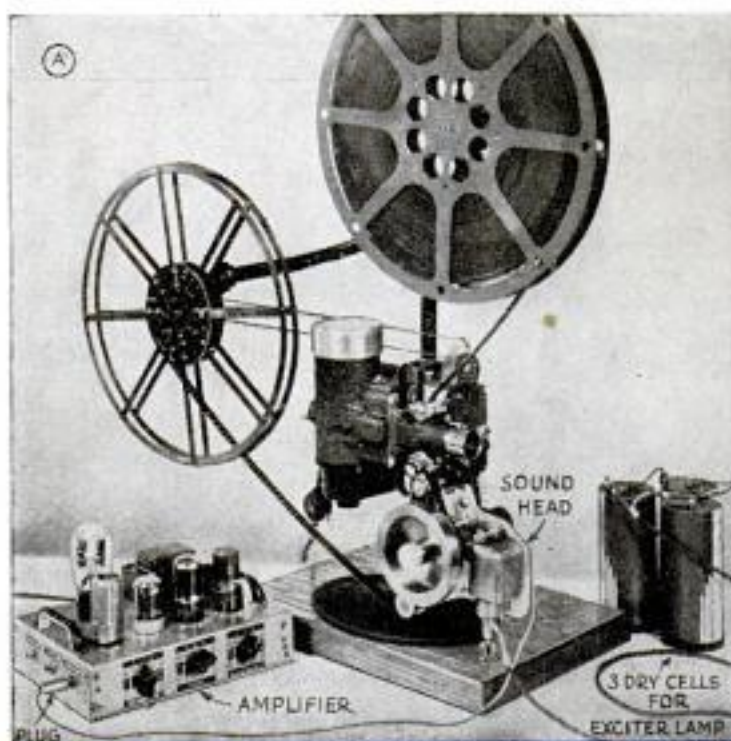
By A. H. Ketzler

PART I

CONVERTING an old 16-mm. silent home movie projector into a sound machine for using 16-mm. film with a sound track was an interesting project for this experimenter in radio and electronics. Actually the homemade conversion to be described was not difficult and the results were highly satisfactory.

The writer was equipped to do the necessary semiprecision machine work on the sound head on a metal turning lathe in his home workshop.

The 10-watt audio amplifier, which will be described for construction next month in Part II of this article, is a compact and highly efficient general-purpose unit that was easy to build.

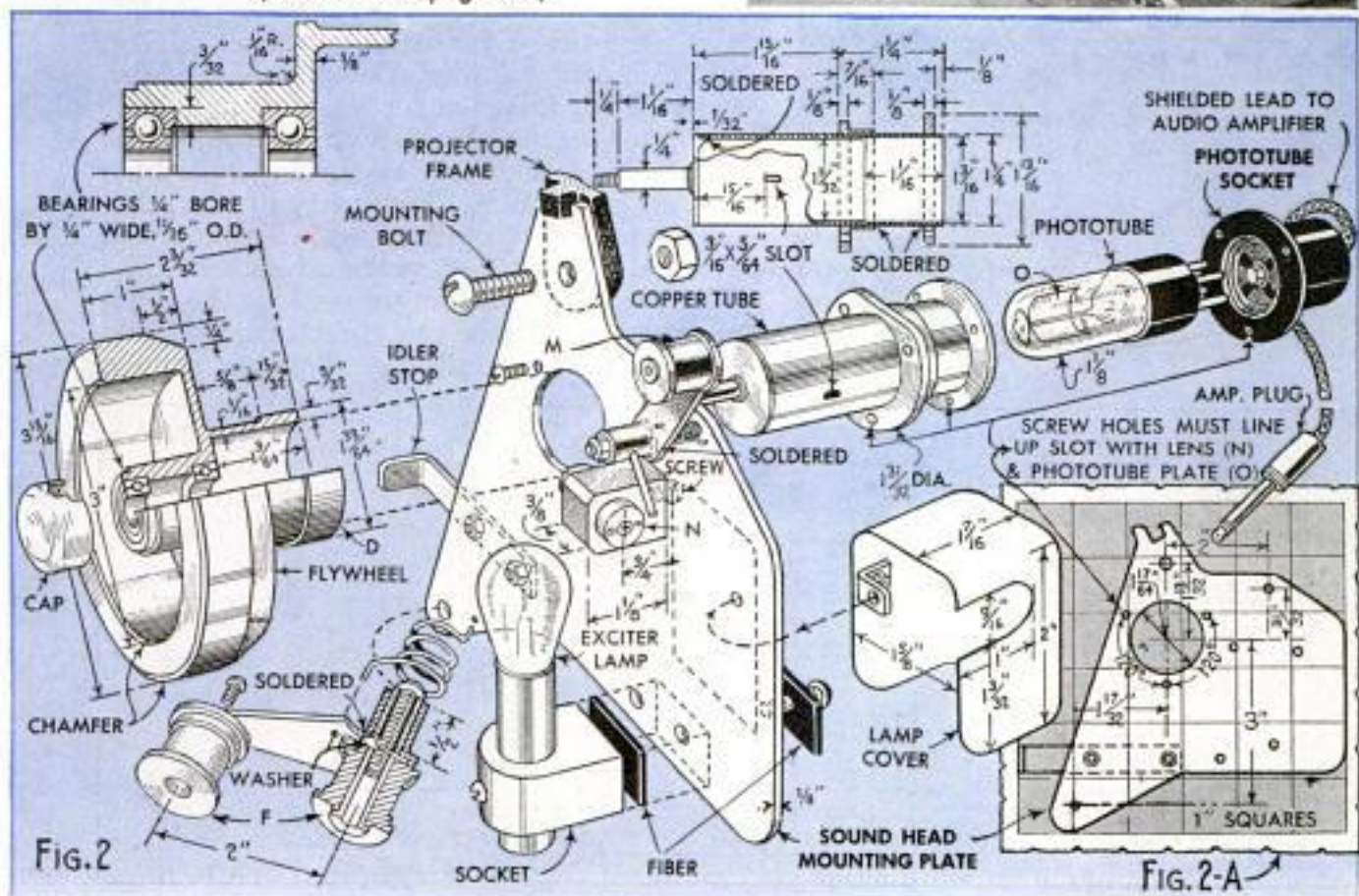
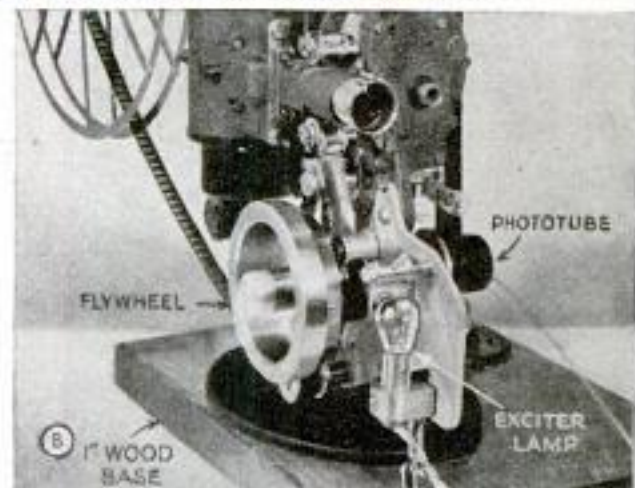


MOVIE PROJECTOR FOR SOUND . . .

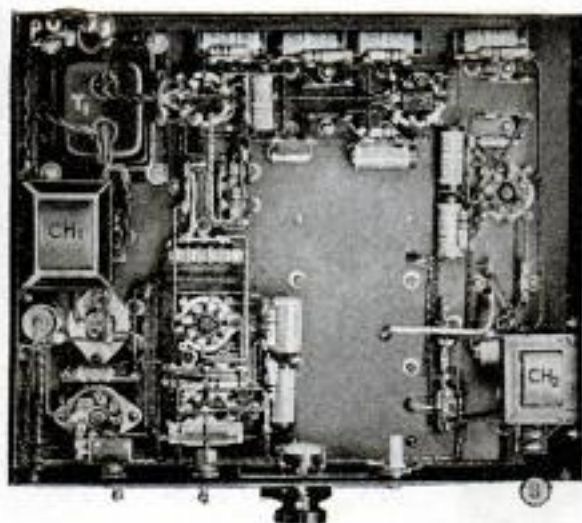
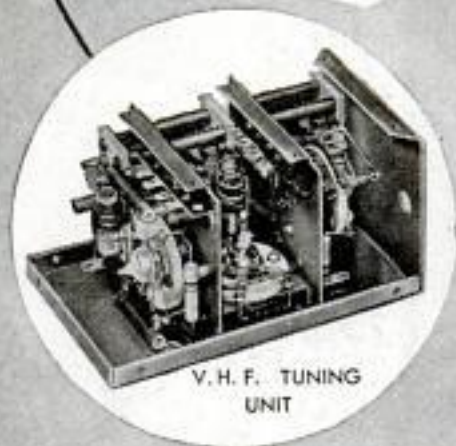
Photo A shows the completed units ready for sound projection. Some old projectors of different construction would have made it necessary to change the sound head mounting and assembly to meet requirements. However, the layout arrangement would remain the same in practically all cases. This projector was mounted on a 1-in. wood base supported on four rubber feet, the base being large enough to provide room for mounting the large reel-supporting bracket detailed at upper left in Fig. 1. This was necessary because the projector was not designed to use 1600-ft. reels. The original reel brackets merely were removed and mounted on the $\frac{3}{4}$ -in. supporting bracket tubing; the bracket assembly then was mounted on the baseboard by means of a deck flange in the proper position to feed the film through the projector. The take-up reel (G) is driven by extending the spring belt (H) around V-pulleys (J) as indicated in Fig. 1. All parts of the sound head are supported on the mounting plate attached to the projector, and are carefully detailed in Figs. 2 and 2-A, and in the assembly section view 2-B on page 168.

In Fig. 1 it will be noted that the film comes from supply reel (A) around sprocket (B), then forms the loop through the gate and goes around sprocket (C). Sprocket rollers (B) and (C) have the teeth

(Continued to page 168)



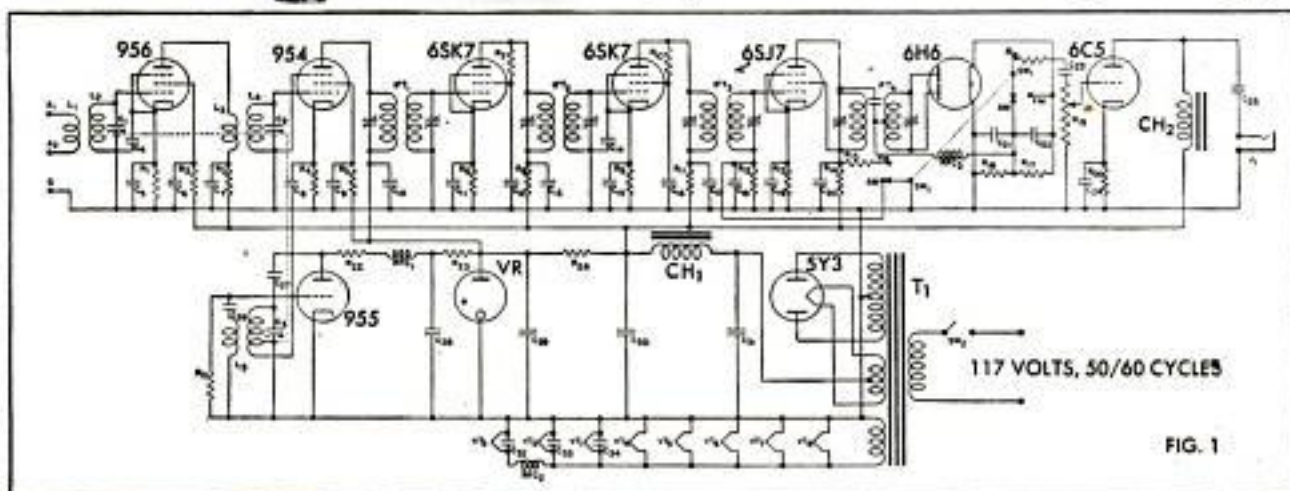
VHF Kit Receiver Includes the New FM Band



PRIMARILY designed for instruction and training purposes, this VHF (very-high-frequency) 10-tube FM-AM receiver kit is now available to civilian students and experimenters. It employs a straightforward and simple circuit with no frills or unnecessary components and offers the advancing amateur and experimenter an excellent opportunity to get started on the assembly of ultra-high-frequency receiving apparatus.

The receiver illustrated tunes from 88.6 to 107.6 megacycles and this range, of course, includes the new 92 to 106-megacycle FM broadcasting band so that you will be all set when FM moves "upstairs" to the new band. Very compact, sturdy and easily assembled, the kit comes complete with tubes and all necessary parts including a punched chassis and detailed instructions for assembly. The front panel is 6¼ by 12 in. wide and the chassis base is 3 by 10 by 12 in.

Photo A shows the completed receiver; the VHF tuning unit, shown with its cover removed in the inset photo, is the high-frequency heart of the receiver. This unit is mounted on the top of the chassis in the position indicated. It is constructed in two sections, out in the open, where every part is accessible for soldering and wiring. Emphasis is placed on simplicity and the use of extremely short leads. A type 956 acorn tube is employed as the r.f. amplifier, and a type 954 acorn tube is used for the first detector stage. The oscillator consists of a type 955 acorn tube in a plate-tuned inductive feedback circuit with excellent stability. Completely shielded, this unit is connected for filament and plate supply to the main chassis with only four wires. An underside view of the main chassis base appears in photo B. The conventional schematic circuit diagram is given in Fig. 1; it will be noted that a 150-30 voltage-regulator tube (VR) provides constant voltage for the high-frequency oscillator and first detector, and operates from a well-filtered power supply.



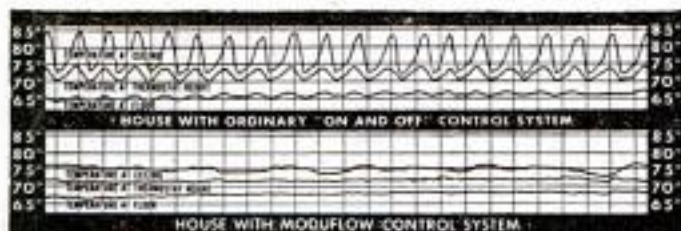
Give your living room The THERMOMETER TEST



One of these days when weather gets down below freezing, just try this thermometer test in your living room. You'll probably be amazed to find that there is as much as twenty degrees difference between the temperature at your ceiling and on your floor. (See chart below.)

That's because, in the average home, equipped with an ordinary on-and-off control system, the warm air rises to the ceiling, and the cold air forms in layers along the floor. But with Honeywell's new MODUFLOW control system, that's all different. By an ingenious method of control and supply, Moduflow nearly equalizes ceiling and floor temperatures. Much of the heat formerly wasted at the ceiling is used to heat the lower levels; result, blissful comfort from head to foot with greater efficiency of operation.

And here's the best news of all! Moduflow can be installed in your present automatic heating system. A limited number of Moduflow systems are now available. The sooner you order from your heating dealer, the sooner you will be able to enjoy the comfort of Moduflow. Mail the coupon today for an interesting booklet that tells how Moduflow will "evolutionize" house heating.



See how Moduflow smooths out the up-and-down temperatures caused by ordinary control systems. Shown above are actual temperature recordings taken in two identical houses — one with and one without Moduflow. Without Moduflow, temperature varies as much as 20 degrees from floor to ceiling. With Moduflow there is comfort temperature from ceiling to floor.

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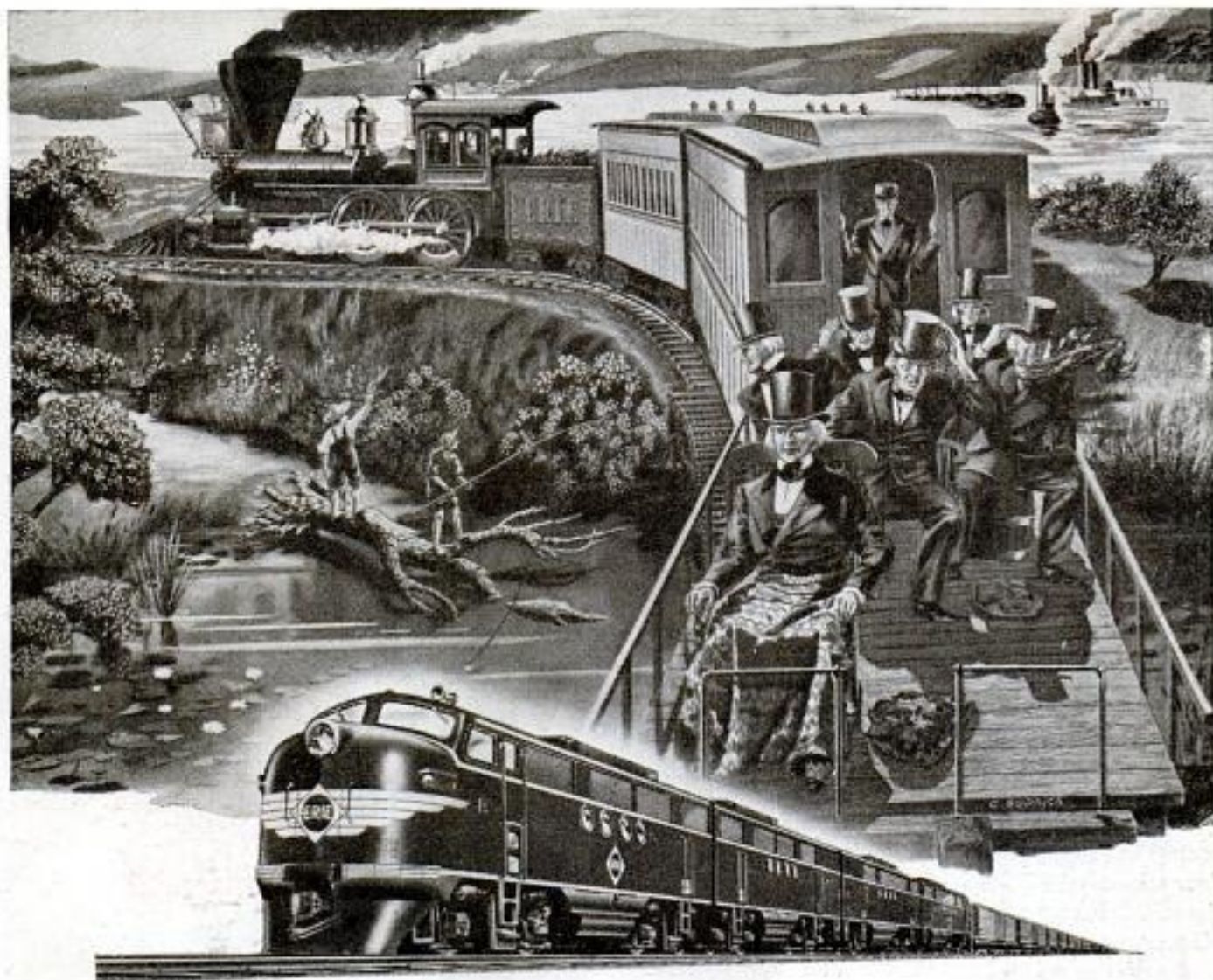
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To celebrate the opening of the then longest rail line in America, the Erie Railroad arranged a now famous junket for May 14, 1851. Included among the guests who made the 427-mile trip were President Millard Fillmore, several members of his cabinet and Daniel Webster, who is pictured here as he elected to travel.

SAMPLE OF THE NEW AND BETTER

In his hair was the snow of 69 active years—but in the heart and mind of Daniel Webster was ever-youthful eagerness to sample new and better things.

So when the Erie Railroad celebrated the opening of the first "long" rail line, he prescribed his own accommodations. Other distinguished guests could ride in coaches if they preferred—Mr. Webster would take a rocking chair on an open flatcar, so as not to miss anything new and exciting.

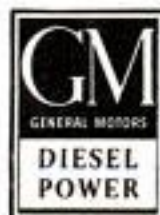
Were he with us today, Daniel Webster would still find new and better things along the lines of the Erie. Heavy grades that "bottlenecked" freight movements

for a long time, have bowed down before General Motors Diesel locomotives—and long strings of freight cars now move with dependable on-time regularity without split-up between Chicago and Jersey City.

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For their great power, their speed, their unmatched smoothness make one thing clear: *When whole lines become completely GM Dieselized, schedules can be clipped, costs still more reduced—and all your travels blessed with fresh new comfort and ease.*

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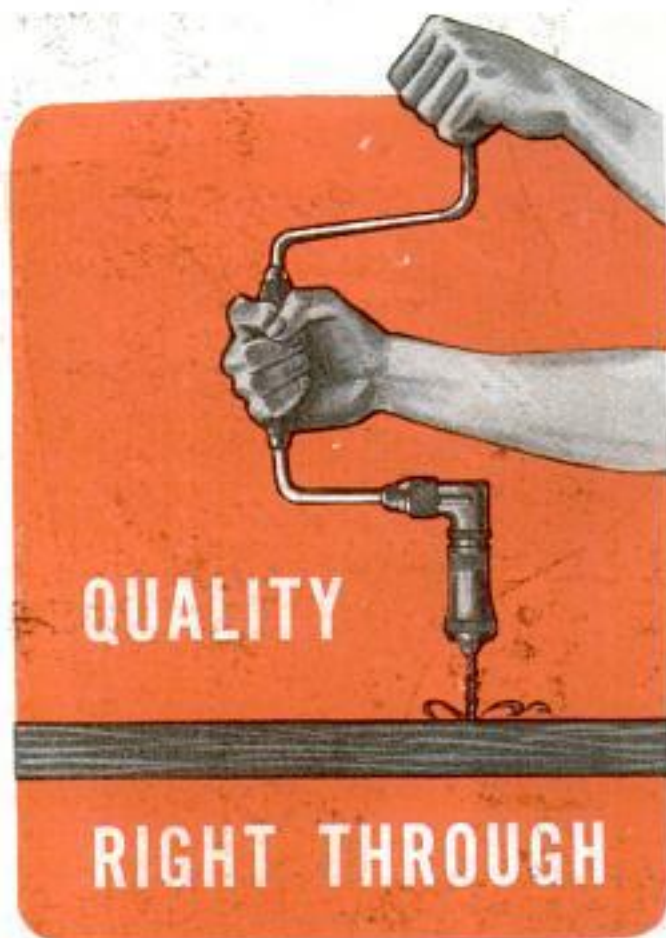
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Two Million Car Garage

(Continued from page 62)

The disabled truck, when processed, arrived in the automotive area, where skilled mechanics began repairs. They repaired the truck by replacing the engine, installing a new axle and running gear, rebuilding an assembly, or two, and reshaping the body and fenders.

The armament mechanics could either perform a major overhaul on the truck machine gun or replace it entirely. They, like the automotive men, were better equipped and more talented than their partners in the medium company. Heavy shop armament technicians repaired up to 155-mm. artillery as well as anti-aircraft weapons, electrical gun directors and complicated fire control systems.

The service and supply men carried their large stock of parts in six-ton vans rather than trucks. A vital link in the entire ordnance supply chain, they furnished parts, equipment and battle replacements to an entire army. If their services were needed for the truck, blacksmiths, electricians and combination welders helped complete the job. These men were noted for inventiveness—one shop in India-Burma found a way to manufacture critical bearings from old gasoline drums.

While the heavy maintenance shop was able to repair the damaged GMC and return it directly to the front, the old engine and other units removed from it during the process—valuable for salvage and reclamation—were sent further back to base shops for rebuilding and eventual reuse.

These base shops were entirely out of the fighting area so their work would not be disturbed, yet their job was important in keeping combat trucks rolling. Load after load of battlefield wreckage was dumped into these shops to be reconditioned and made ready for reuse.

These base shops usually were located in large towns or cities, where cheap labor, suitable buildings and quantities of heavy machinery were available. The base shops for the Stilwell Road, in Calcutta, India, were set up in old jute mills and the export branch of an American motor company. Naga head-hunters were among the 10,000 native workers employed by the Ordnance Department in the former CBI theater; some native mechanics worked in turn for British, Jap and American bosses.

Ordnance men often had unusual duties. Robert A. Walters was detailed to teach King Farouk of Egypt to fire an American army rifle. Another ordnance man learned

(Continued to page 150)



You, too, can enjoy "smooth going" with more efficient, economical and dependable engine performance by insisting on Champion Spark Plugs. Wartime driving emphasized enormously the primary importance of spark plugs as a means to these ends. It has also

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DROP FORGINGS AND DROP-FORGED TOOLS

to be a safe-cracker—he was to open captured safes which had been booby-trapped. A medium shop at Anzio during the Italian fight improvised tankdozers and built portable 40-foot artillery observation towers on trucks. An outfit in Corsica reconditioned a railroad locomotive. Ordnance men converted tanks into ambulances so American casualties could be moved during active fighting.

Ordnance field shops throughout the world simplified overseas transport, conserved critical material and saved valuable time by on-the-spot repairs. But, more important, they reduced American casualties by maintaining the mobility and firepower that brought our enemies to their knees.

Message From the Jungle: Snafu

(Continued from page 85)

In hilly country, this would answer the problem, but most jungle is fairly flat, and this remedy could not be used. Besides, the soldier who would try to find a hill from which to send his message would present an easy target for Jap snipers.

The signal experts also found that they could obtain an increase in range by an alternate method, that of using sky-wave transmission, technically known as transmission via ionosphere. In this method, antennas radiating energy almost vertically are used, and the waves are sent up to the ionosphere layers that exist in the region about 60 to 200 miles above the earth. The radio waves hit this layer and are reflected back to earth where they can be picked up by the receiver. In spite of the fact that this alternate path may be as much as 400 miles longer, it does not absorb the radio signal as much as one mile of jungle growth.

Although our signal men are ready to swear that it was only our equipment that was being "loused up" by the jungle heat and humidity, the jungle is impartial. The Japs had the same problems with their equipment. We found this out from captured equipment. The Japanese signal equipment which fell into our hands hastened the defeat of the "jungle experts" in more ways than one. Carefully studied and analyzed by the Army Signal Corps, it played an important role in their eventual destruction. Four uses were made of this captured signal equipment:

It gave a direct aid in developing counter tactics to make enemy signal devices less effective. Any valuable ideas, devices or methods of moistureproofing were incorporated into American equipment. Ameri-

(Continued to page 152)



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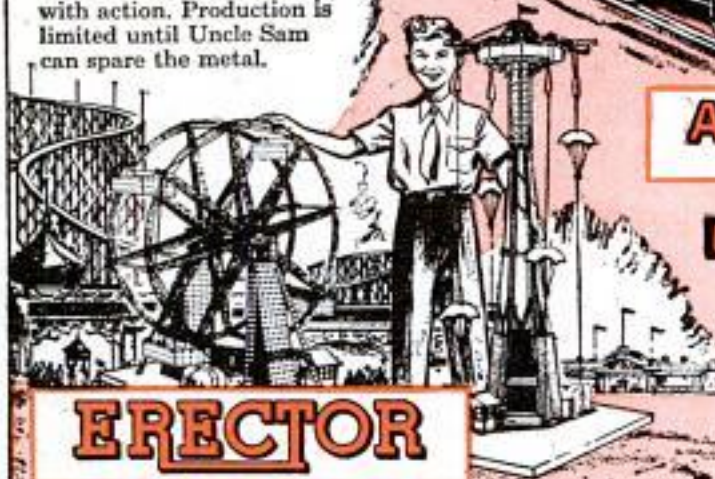
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Do you know

that the new Erector Jr. builds big bridges, cranes, airplane ride and other thrilling action models? It's made of wood—like famous mosquito bomber. You just "pin-peg" parts together.

Do you know

that the latest Erectors are super-mechanized and all-electric? Build army training parachute jump, giant Ferris wheel and other engineering marvels that whistle and buzz with action. Production is limited until Uncle Sam can spare the metal.



ERECTOR

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Do you know that Mr. Gilbert will award prizes totalling \$200.00 to boys doing the most important scientific research in 1946? Write for details. Gilbert Hall of Science, 41 Erector Square, New Haven, Conn.

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Yes, tight rope walking means perfection in balance—perfection achieved by years of practice. In Plumb tools, too, balance—or “hang”—is a perfected quality, an accomplishment resulting from Plumb's century-old experience in making fine hand tools.

The forged steel head on every Plumb tool is weighed against the polished red tested hickory handle—shaped comfortably to fit the hand. Plumb's properly balanced tools make the job easier, do the work faster. That is why men who know good tools have, for five generations, chosen Plumb. Fayette R. Plumb Inc., Philadelphia 37, Pa.



PLUMB

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can signal men were trained in the use of enemy radios which were put to our use. Finally, intelligence officers were able to assess the economic state of the Japs by checking for inferior materials and substitutes found in the equipment.

These things were not left to chance or to the varying technical capacity of different men. Not only captured signal equipment but all possible information relating to it was forwarded to the Camp Coles Captured Equipment Section of the Signal Corps Ground Signal Agency at Bradley Beach, N. J., and to the branches at Camp Evans and Fort Monmouth. Here it was minutely studied, analyzed and results made known to our signal men in the field.

Often there was no signal equipment, either our own or captured, and then the jungle commander had to depend upon the foot messenger to “deliver the message to Garcia.” Also, since the many jungle conditions make radio and telephone communication uncertain, it was the foot messenger who constituted the primary and most reliable means of signal communication in jungle warfare.

More Fish Per Kilowatt

(Continued from page 35)

by closing the off-river racks and distributing 30,000 fall-run salmon to the river for natural reproduction.

Facilities for transfer of salmon from the river consist of a fish ladder, traps and lifts at Keswick Dam, below Shasta, and racks at Ball's Ferry. Keswick is used when river discharges exceed 15,000 cubic feet a second and the Ball's Ferry racks when it is less.

Seven automobile tank trucks are used to transfer salmon from Keswick and Ball's Ferry to the hatcheries. The Battle Creek hatchery has a capacity of about 58,000,000 eggs, approximately 29,000,000 fingerlings averaging 1½ inches and larger fingerlings. It has 28 outdoor ponds for use as holding and rearing reservoirs, a cold storage and ice-making plant.

Mortality of salmon trapped at Keswick and taken by fast trucks to Deer Creek and Battle Creek was high at first. This was due to delays caused by war conditions. However, as the salvage work progressed, the losses dropped. In 1943, out of 5245 salmon transferred from Keswick to Deer Creek only 1273 died, while in 1944 losses were even less although 8000 were moved to Deer Creek.

Last year, the second of the plan, saw a much heavier run of fish, almost 70,000

(Continued to page 154)

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adult salmon, 10,000 more than had been estimated.

The results of the salvage program will not be known until the size of future returning cycles is determined. The 70,000 counted in 1944 are due to return from the ocean to spawn in 1948. If the count should drop to 35,000 the 1944 salvage would be considered only half successful.

Studies conducted at Shasta Dam are concerned with the size and distribution of the natural run, reaction of fish transferred from the river, the mortality of natural and transferred fish during the time they are in the creek preparatory to spawning, the manner and extent of utilization of gravel spawning beds in the streams, the beginning and end of the seaward migrations of salmon fry and the peaks of these migrations.

Chief among conclusions reached by researchers at Deer Creek is that natural spawning of spring-run salmon was more efficient and productive than placing them in the hatchery for artificial propagation. This bears out aquatic biologists' old contention that Mother Nature knows best.

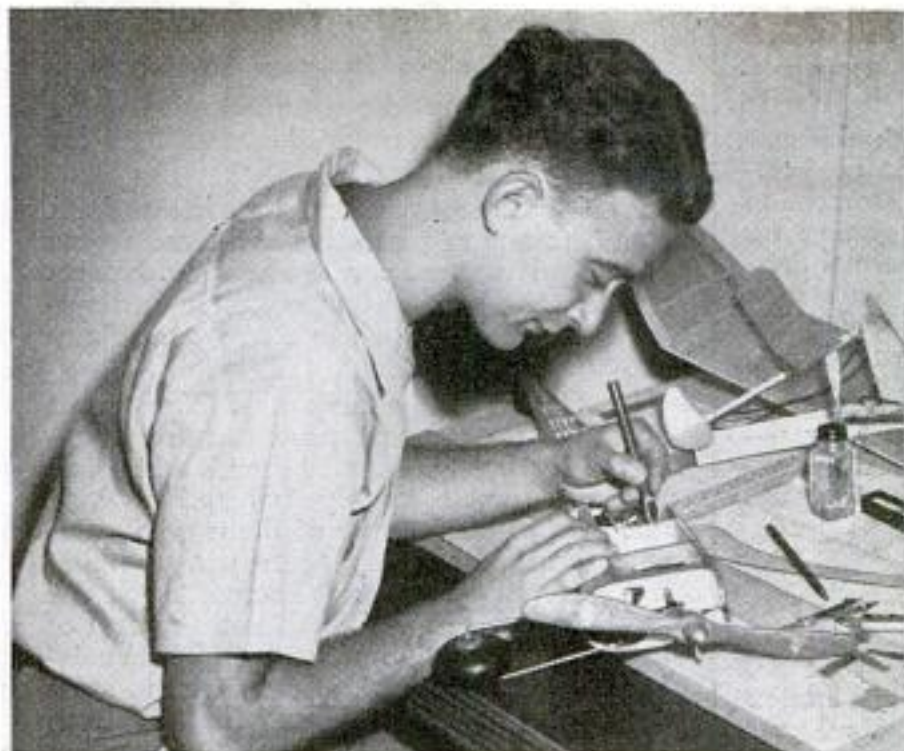
On the other hand, hatchery propagation of fall-run fish was quite successful and now the Battle Creek hatchery will be used principally for such work. Results at Deer Creek have about convinced the experts that thousands of dollars and fish can be saved if emphasis is placed in the future on natural spawning.

Another important benefit derived from experiments in salvage work on the Columbia and Sacramento Rivers has been to focus interest of sportsmen and conservationists on the peril to wildlife inherent in unregulated dam building on a nationwide scale.

There are about 14,000,000 men and women in the United States who buy fishing licenses every year. They know recreational facilities must be vastly expanded after the war for thousands of servicemen and servicewomen who will be interested in fish as well as cheap kilowatt-hours.

Patients Without Lens in Eye Can See by Black Light

Patients whose eye lenses had been removed in cataract operations were able to read an eye testing chart from top to bottom under ultraviolet lighting in experiments at Harvard University. Professor George Wald, conducting the tests, was unable to see the chart in the "black light." Dr. Wald reports the eye lens in man is yellow in color and acts as a yellow filter at the ultraviolet end of the spectrum.



HIS PLANES WIN PRIZES— HE MAKES THEM WITH X-ACTO!

"Most Useful Tool in Model-maker's Workshop," Says Brilliant Young Designer

Model plane fans know Martin Powell. His original designs have been written up in the leading magazines. His models have been used for display and instruction purposes by Air Youth of America. He's won prizes with everything from elementary "R. O. G.'s" to complex gas models.

Here you see him, working on his newest design. And you notice he's using an X-acto Knife. He says he doesn't see how any modelmaker can get along without an X-acto. He likes its scalpel-keen edge, the variety of interchangeable blade shapes. With X-acto, you can get true accuracy in even the smallest detail. "Most useful tool in a modelmaker's workshop." That's what this young expert calls X-acto Knives.



PARENTS PLEASE NOTE! As a teacher of craft classes for young children (aged 8 to 12), Mr. Powell found the razor blades they'd been using meant cut fingers and too much

spoilage. "X-acto Knives were the answer to that," he says. "The firm-grip handles permitted the children to carve safely, and turn out better work. That means a lot more fun!"

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X-acto Knife Chest. 3 X-acto Knives with complete assortment of extra blades, each neatly assigned to its special slot in a handy wooden chest. \$3.50 complete. No. 83 De Luxe All-Metal Knife Chest with 20 extra blades, \$5.

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GIVE DAD HIS OWN . . . Or else he'll be borrowing yours. Doesn't a swell guy like him deserve an X-acto set of his own?



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HOW TO GET THE MOST OUT OF BETTER FUEL

Don't expect to fill your tank with the new, higher-octane gas and get top-grade performance from spark plugs you may have switched to during the war. Now that you're getting far better fuel—and have returned to normal driving, you need to consult your service station about changing to AC plugs that run *cooler* than those you may have used with wartime fuels.

The correct type of plug is *necessary* to avoid hard starting—loss of power—waste of gas—cracked insulators—rapid electrode wear—excessive oxide coating—misfiring under heavy loads.

The AC Heat Range, and today's wider heat range per plug, enable you to fit spark plugs exactly to engine operating conditions. That's why AC's were standard equipment on 2 of every 4 new cars and trucks—why your AC service station can help you to get the *utmost reliability* in spark plug performance. Have your plugs checked today. Be sure you have the type that will give you the best in performance.

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION



CLEAN PLUGS SAVE UP TO ONE GALLON OF GAS IN TEN



LET'S FINISH THE JOB — BUY VICTORY BONDS

Green Grow the Atolls

(Continued from page 78)

which lie in about the same latitudes as the Hawaiian Islands, made the area ideal for growing vegetables.

Pacific victory gardens range in size from small, one-man plots to good-sized farms of several hundred acres. The FEA experts provide the seed, fertilizer, tools and scientific advice while the Army and Navy provide the manpower.

In Guam, for example, a Navy unit staked out a 400-acre tract to grow vegetables for hospitals and other land installations. Approximately 100 sailors with farm experience, some of them off battleships and submarines, were put to work. They loved it because it brought back the familiar smell of the earth and the feel of growing things. On Guam and other islands, natives also are encouraged to start farms and become self-sufficient. Natives are fed by the military government when the battles have destroyed their homes and crops, but they are urged to re-establish themselves on farms as soon as possible.

Power-driven equipment is used on all FEA farms—tractors, plows, harrows, seeders, cultivators, fertilizer spreaders, etc. Many natives saw such equipment for the first time. Some of the farms are planted on the sites of Jap airfields, some are carved out of the virgin jungle. In such cases bulldozers fill bomb craters and uproot tree stumps. Jeeps also have done yeoman work on FEA farms in the Pacific pulling plows and sprayers.

Victory gardening on islands taken from the Japs was fraught with many hazards never encountered in the cornfields of Iowa or the truck gardens of southern California.

On Bougainville, for instance, a patch of corn was planted so close to the front lines that it was later destroyed in a tank battle between American and Jap forces. At Guadalcanal, wild pigs got into the vegetable gardens and did considerable damage until machine guns were set up and the marauders shot. A few were caught and fattened up for slaughter.

On Guam, approximately 24 Japs were shot when they came down from the hills to forage for food or to raid seed supplies from the FEA farms. On Tinian, Japs stole into the fields at night and tied hand grenades to the tools. FEA farms there were planted on the site of some of the heaviest fighting in Marpo Valley and sappers had to clear the area of booby traps, land mines and unexploded ammunition.

(Continued to page 158)



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before the plows could turn up the soil. At Saipan there was a standing order that tractor drivers must carry carbines at all times and at least one driver painted a little Jap flag on his machine to account for a Nip he killed while farming.

The first large-scale experiment in livestock raising in the Pacific was begun at Guam when 75 cows, 8 bulls, 6 heifers, 1043 hogs, 600 chickens, 100 ducks and 50 turkeys arrived aboard two specially fitted Victory ships. Upon arrival at Apra harbor, the animals were lowered in crates over the sides of the ships to the decks of LSTs which carried them to trucks on shore.

So great is the demand for fresh food in the forward areas of the Pacific that most vegetables are consumed where they are grown. The one exception is the air shipment of fresh vegetables from gardens on Guam, Tinian and Saipan to the barren, volcanic island of Iwo Jima, whose lava soil is not suitable for truck gardens.

Records are being kept on the larger farms developed by the FEA and the Army and Navy in the Pacific. Facts and figures on suitability of crops, annual yield, methods of combating insects and pests, harvesting methods and storage procedures are being carefully compiled.

Such information and experience as the FEA is gaining from its Pacific victory gardens now will help the natives to maintain a full bread basket in the future and may also set a pattern for helping hungry areas of the world—such as China and India—to reduce or wipe out starvation.

"Shore Duty" on a Battlewagon

(Continued from page 23)

troops. It is questionable whether or not we could have seized as many islands as quickly and at such low cost if battleship gunfire hadn't softened the beach defenses. Shore bombardment in the Pacific is called "the Spruance haircut"—derived from the stubby appearance of Kwajalein Island after guns of the Third Fleet, under the command of Admiral Spruance, sheared the tops off coconut palms.

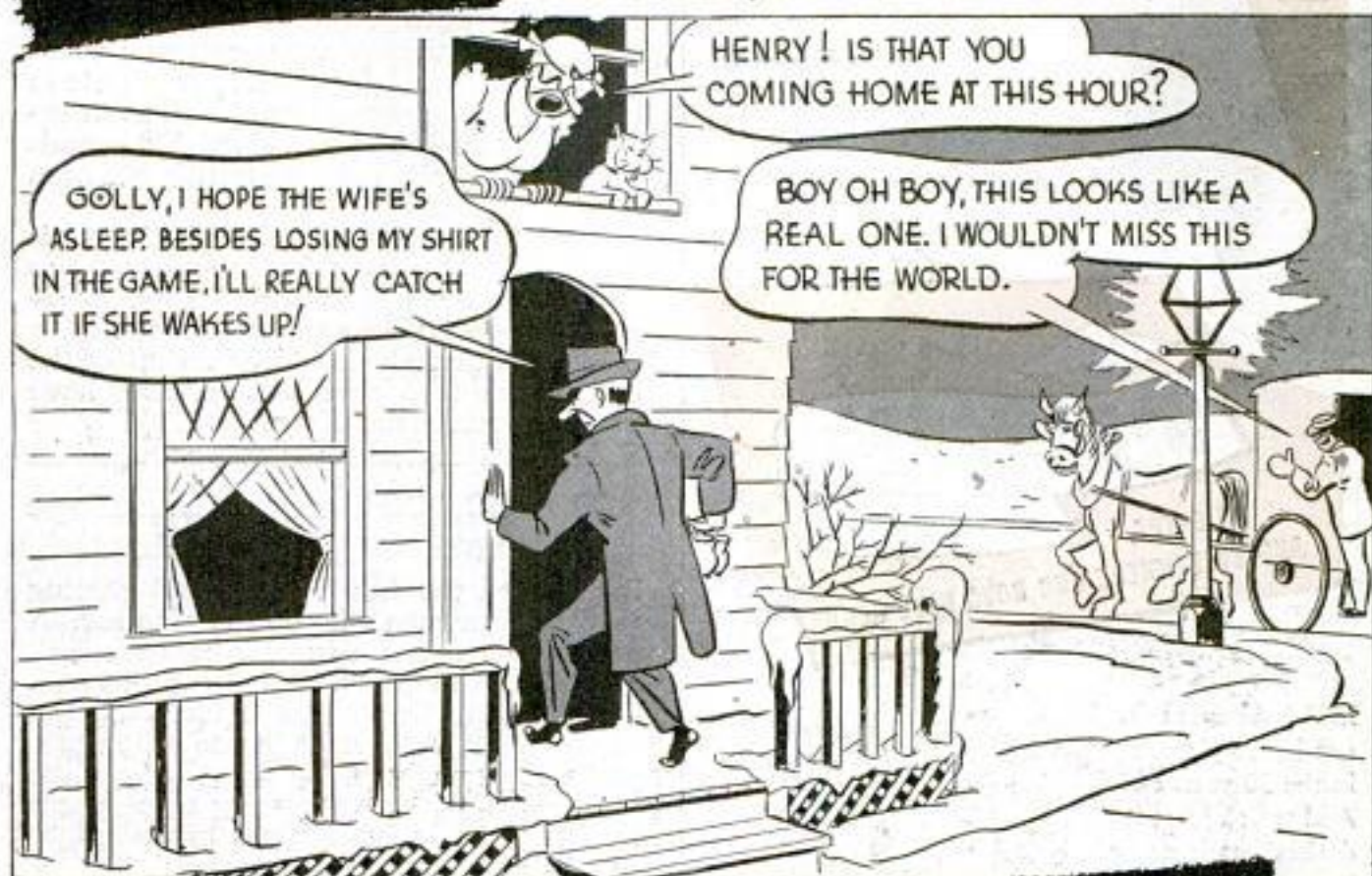
Some battleships, the Pennsylvania, for example, former flagship of the United States Fleet, supported as many as 14 landings in the North, Central, South and Western Pacific. The "Pennsy" has shot 11,000,000 pounds of steel and explosives at enemy positions and more than 75,000 rounds of ammunition ranging from 14-inch shells to .50-caliber machine gun bullets.

Battleship gunners treat their giant weapons with loving care. Like flyers and

(Continued to page 160)

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THE TIME YOU PLAYED POKER ALL NIGHT



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Expert battleship gunners can put as many as 18 heavy projectiles per minute in a small target area at 20 miles. The intermediate guns can throw about 150 rounds per minute while the antiaircraft guns can do slightly better.

One of the minor miracles of this war is that youngsters from farms and factories have become seasoned "men-o-war's-men." A battleship represents a collection of seagoing experts, but 90 percent of the officers and men aboard them today have had no previous naval service.

\$200,000,000 Gateway to Europe

(Continued from page 15)

bundles of the beach grass and passing them to four men who do the planting. A small plow opens a furrow beneath each planter and in it goes the clump of grass. The machine then fills the furrows as it moves along. A foreman inspects the work, and a workman walking along back of the machine makes any necessary adjustments by hand. All six machines can plant 30 acres a day, working at top speed.

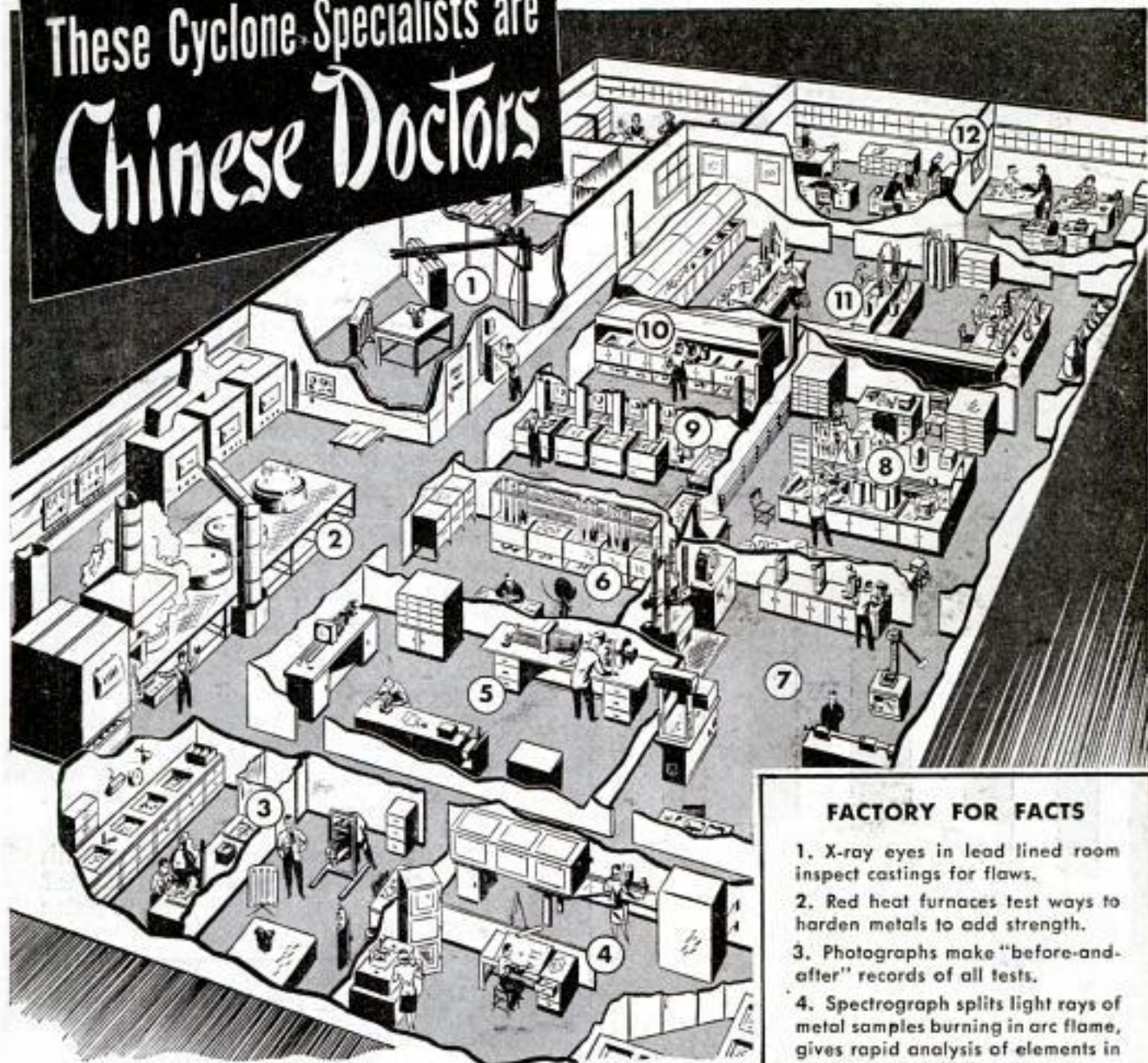
Sixteen cubic yards of good sand fill are scraped up in 30 seconds by a giant Diesel-powered earthmover which lowers a scraper body to the ground and is dragged along by a powerful tractor. When the load is aboard, the operator raises the body and carries the fill to its destination.

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By 1947, the permanent six-story administration building will be ready for use and the greatest railroad terminals will pale in comparison with the gigantic structure. The central area accommodating the building will cover 466 acres, nearly as large as LaGuardia Field itself. Three miles long, the building will have three-lane motor highways running through it, and 102 service gates for the various airlines using the airport. The central area and building are planned on the lines of an oval stadium, with connecting links to all present and projected runways.

(Continued to page 162)

These Cyclone Specialists are Chinese Doctors



FACTORY FOR FACTS

1. X-ray eyes in lead lined room inspect castings for flaws.
2. Red heat furnaces test ways to harden metals to add strength.
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11. Chemists analyse alloys, study corrosion-resistance tests.
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Accessibility to the heart of Manhattan will result from construction of Van Wyck Expressway, a six-lane depressed highway running directly from the airport to Queens Boulevard, which will provide 26-minute service from the center of the city to the airport. Bridges will separate grades at intersections to eliminate any direct cross-traffic. Southern Parkway will bring fast motor service to Brooklyn and the southern tip of Manhattan when the Battery-Brooklyn tunnel has been completed. Long Island Railroad trains from Pennsylvania Station will connect with an airport bus system.

General supervision of the project is under John McKenzie of the City Department of Marine and Aviation. Commissioner Robert Moses helped plan the connections between airport and parkways and expressways.

Figures on the completed project are staggering. There will be parking space for 30,000 cars. Approximately 40,000 persons are expected to be employed permanently in various airport activities. About 30,000 persons will go through the airline gates daily, besides thousands of tons of mail, express and freight. Plans are being made to handle 41 plane arrivals and 43 departures at the peak hour next year, and in five years 98 peak hour arrivals and 110 departures are expected.

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Tiny Wire Measures Pressure by Stretching Millionth of Inch

Liquid or gaseous pressures in various kinds of machines are measured accurately by an electronic instrument whose "nerve" is a hairlike filament wire. The slightest pressure variance in a machine to which the meter is attached changes the length of this wire—possibly stretching it a millionth of an inch. This changing of the wire's length also changes the amount of electric current that flows through it. And it is the measurement of this increase or decrease of current—amplified many times—that enables the engineer to measure the change in pressure. In one system, the pressure variance is registered on a dial. The Baldwin Locomotive Works, which designed the instrument, predicts widespread use for measurement and control work in steel mills, refineries, power houses, gas and oil pipe lines, chemical plants and by food processors and plastics manufacturers.



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Super Fuels for Your Car

(Continued from page 5)

Note that in the L-head engine octane requirements rise as speed increases, while the reverse is true in the valve-in-head engine. This means that a fuel in which the higher-octane material is concentrated in the lighter boiling fractions, first to reach the combustion chamber at low speeds, is suitable for the valve-in-head motor. By the same token, it does not perform well in the L-head engine, yet the proper fuel for that engine, with its higher octanes concentrated in the high boiling fractions, is rated by the same octane number as is the fuel best for valve-in-head operation.

New refining processes brought to a high point of efficiency during the war will continue to hold a major role in peacetime production of motor and aviation gasoline, lubricating oils and many more by-products than were ever obtained before from a barrel of crude oil.

Fluid catalytic cracking, a process by which high-octane gasoline and heating oil are obtained in profusion through use of a fine powder as catalyst, is certain to be a large source of motor gasoline. Another process that will provide fine motor gasoline is polymerization, through which high-octane gasoline can be made from gaseous, low-boiling hydrocarbons. Both iso-octane and cumene, highly antiknock material, are obtained in polymerization processes.

Alkylation and isomerization processes, transforming former by-products into efficient blending agents for aviation gasoline, will continue to provide gasoline for planes, with some motor fuel use for alkylate as a blending agent. The same raw materials used for production of butadiene for synthetic rubber turned out the essential aviation alkylates during the war; butane and iso-butylenes from the butadiene plants were a valuable source of supply.

Hydroforming or catalytic reforming, the process used for raising antiknock ratings of low quality naphthas, played an additional war role in production of toluene, base material for manufacture of explosives. Coke ovens, the normal toluene producers, just didn't have the capacity to turn out the enormous quantity required for the bombs and shells of World War II.

Through its ability to raise octane rating of the low quality naphthas, hydroforming will continue to supply improved gasoline in the peacetime market.

Lubricating oil products can be obtained in a wide range from any type of crude available, including many previously con-

(Continued to page 166)

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sidered completely unsuitable, through new methods developed during the war. The Juik process makes it no longer necessary to employ "select" crudes for lubricating oils of top grades.

Research on all phases of petroleum operations is going ahead full steam despite the end of the war. Peacetime requirements, because of the economic factor not present in wartime operations, call for readjustments to permit use of all the advances made in the last four or five years. Fuel evaluation tests keep single cylinder test engines running 24 hours a day in the laboratories, and much new equipment has been designed to make this work more efficient. The large refinery designers and constructors such as the Lummus Company and M. W. Kellogg Company, the research and development laboratories spearheaded by Universal Oil Products Company, and the laboratories of the major oil companies all are welded in one general purpose—the improvement of motor fuel and full utilization of crude oil in the many new fields opened by war research.

Much is expected from the Synthol process of manufacturing gasoline from natural gas, with the Kellogg Company prepared to build plants for manufacturers desiring to enter this field. A refinement of the Fischer-Tropsch European process, the Synthol process is declared to permit manufacture of 75-octane gasoline (motor method) from natural gas at a production cost of about five cents a gallon. Diesel oil also can be produced by the process. Low-grade coal can be substituted for natural gas in the event that the supply of gas becomes inadequate.

The war has created an even closer basic relationship between the petroleum and chemical industries, with crude oil producing such things as synthetic rubber, solvents, insect repellents, polishes and waxes, plastics and fibers, refrigerants, resins and other products too numerous to mention. Coal tar has found a worthy rival in crude.

Plastic Torpedo "Retriever"

When torpedoes are tested by the Navy before the explosive heads are attached some of the costly "tin fish" dive to the ocean bed. Formerly, many were lost in this way. A plastic disk which dissolves in sea water helped solve this problem. This polyvinyl alcohol disk dissolves after a predetermined interval and admits water to the torpedo chamber. Water pressure forces a float through the disk which acts as a buoy, marking the location of the sunken torpedo.

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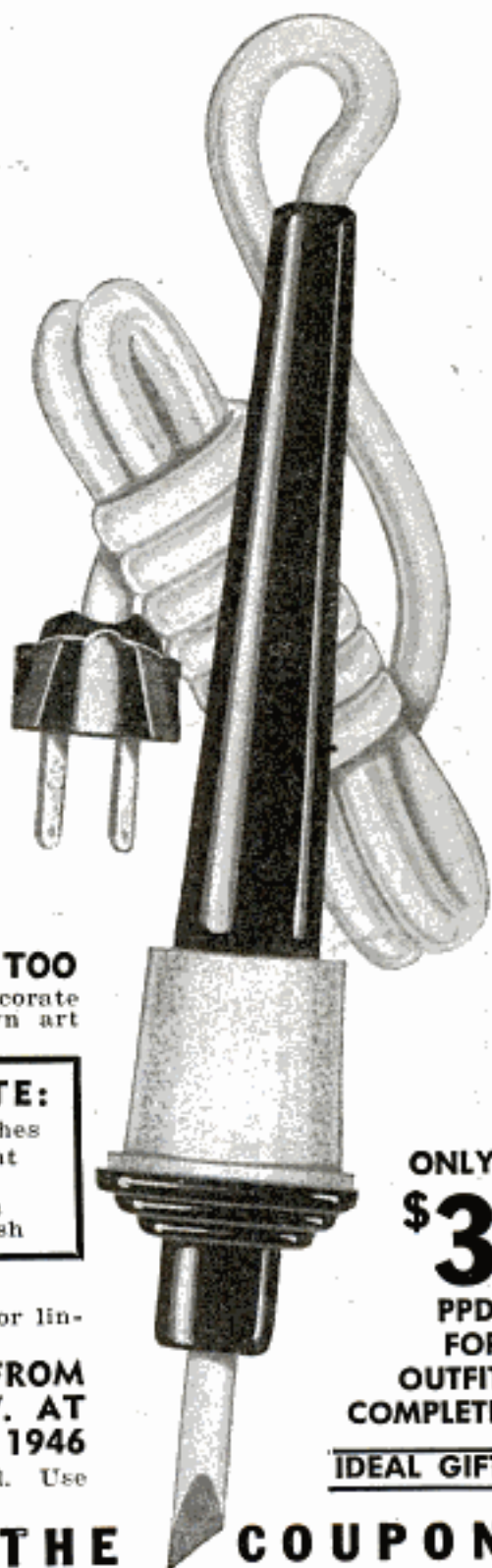
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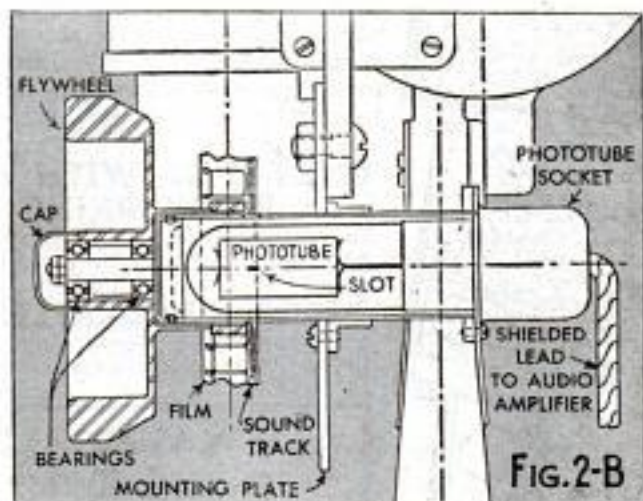
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How to Convert a Silent 16-mm. Movie Projector for Sound

(Continued from page 143)

removed from the sound track side. From sprocket (C) the film runs around the flywheel extension (D)—see Figs. 2 and 2-B—which is just wide enough to permit the sound track edge of the film to run in the clear. The light beam from the exciter lamp, passing through a commercial lens slit (N), goes through the sound track and the slot in the phototube housing to plate (O) in the phototube. These varying sound track light impulses are changed to corresponding electrical impulses by the phototube and fed directly to the input of the audio amplifier unit, just as a microphone changes sound waves to electrical impulses which are then amplified and again changed to sound waves by the loud-speaker.

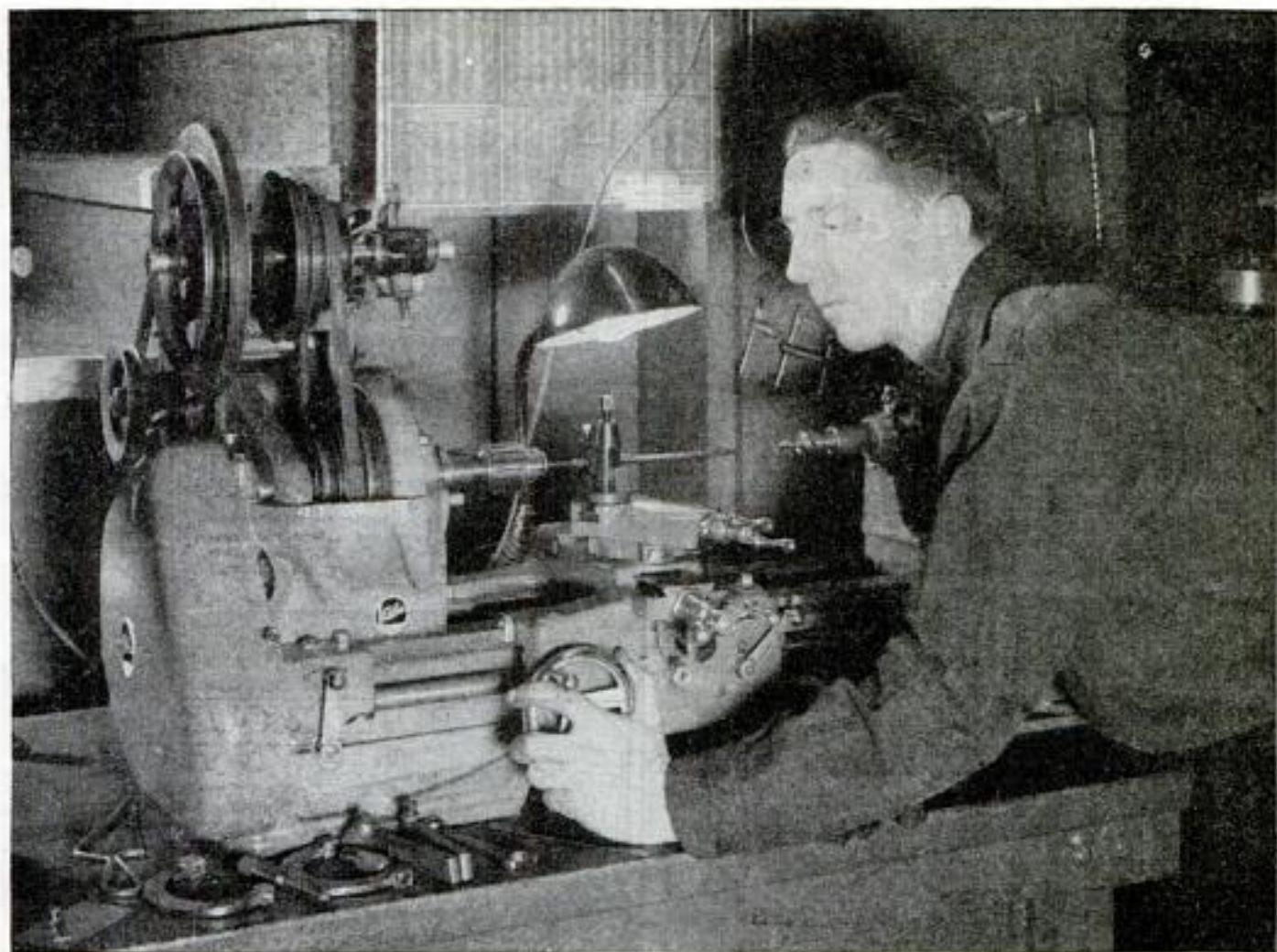


After passing over the flywheel extension (D) the film goes up and around the home-made single-row-tooth sprocket (E) which is detailed at right in Fig. 1, then over and around the tensioning device (F)—detailed in Fig. 2—and to the take-up reel (G). Take-up sprocket (E) is driven from the shaft on sprocket (C) through two little spur gears (K). These are Boston No. G-143, 48-pitch, 1/8-in. face, 14 1/2-degree pressure angle, 54 teeth, 1 1/8-in. pitch diameter. The bearings for the flywheel also were selected from Boston and were catalog No. 404-2, 1/4-in. bore by 1/4-in. wide by 1 1/16-in. outside diameter.

The film guide (L) for sprocket (E) is attached to a stud which is in turn fastened to the vertical slide on this projector so that when the slide moves up for film threading it also lifts the film guide; after the film is in position the slide is moved down into place.

Tightening roller (M), detailed in Fig. 1, keeps the film tight around flywheel extension (D).

(To be continued) --



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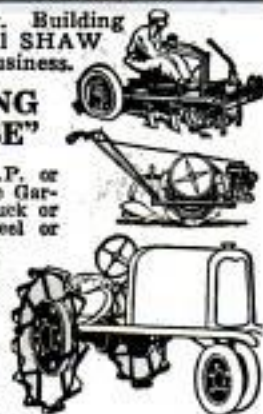
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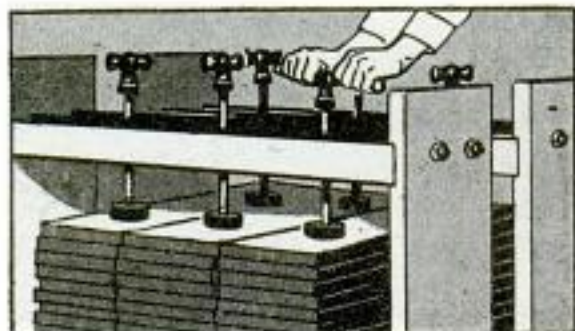
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Radio's Popular "BOSTON BLACKIE"
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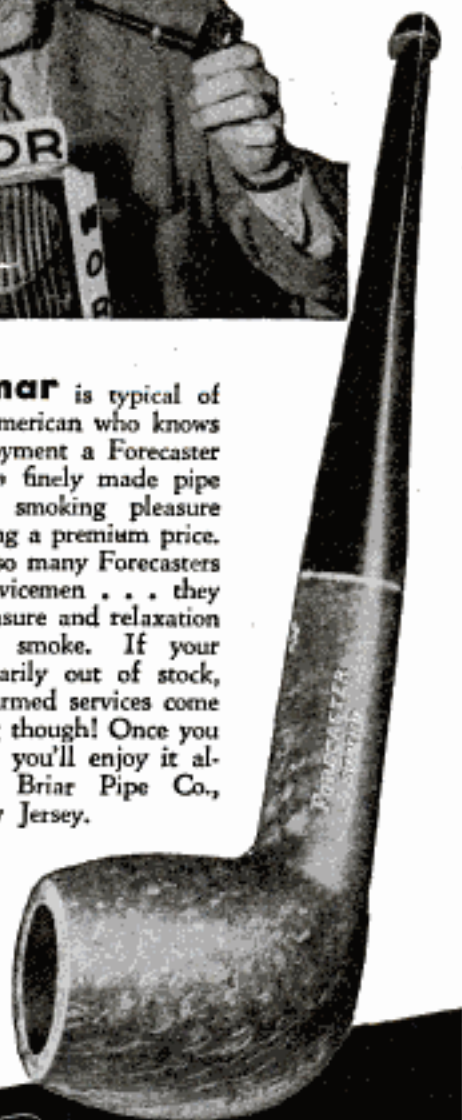
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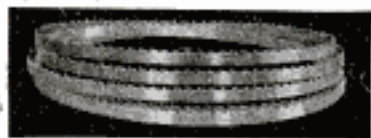
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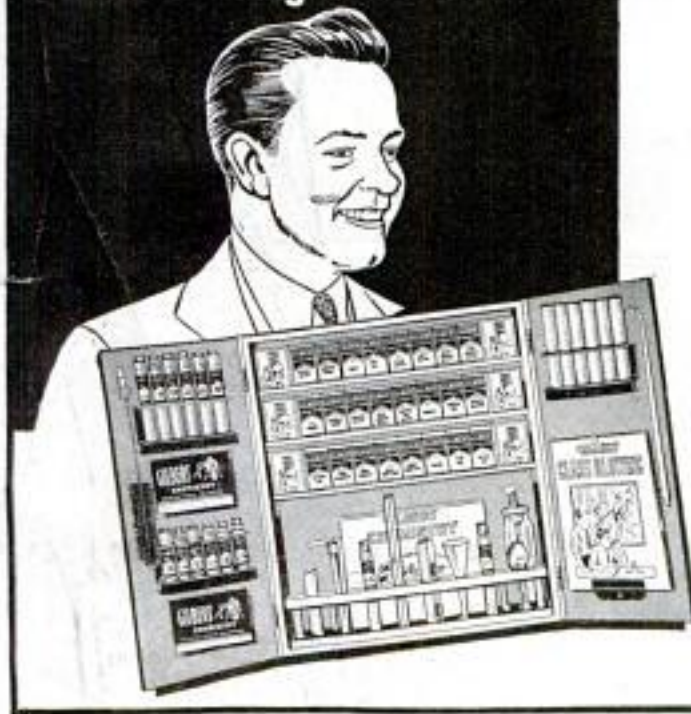
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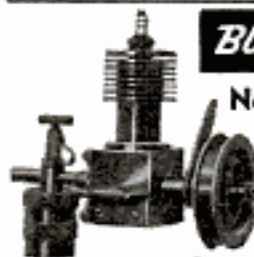
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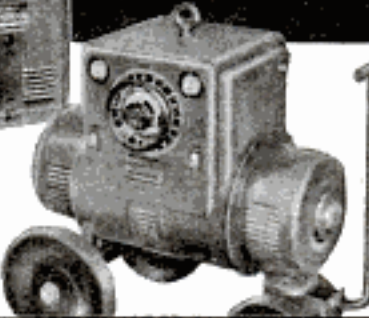
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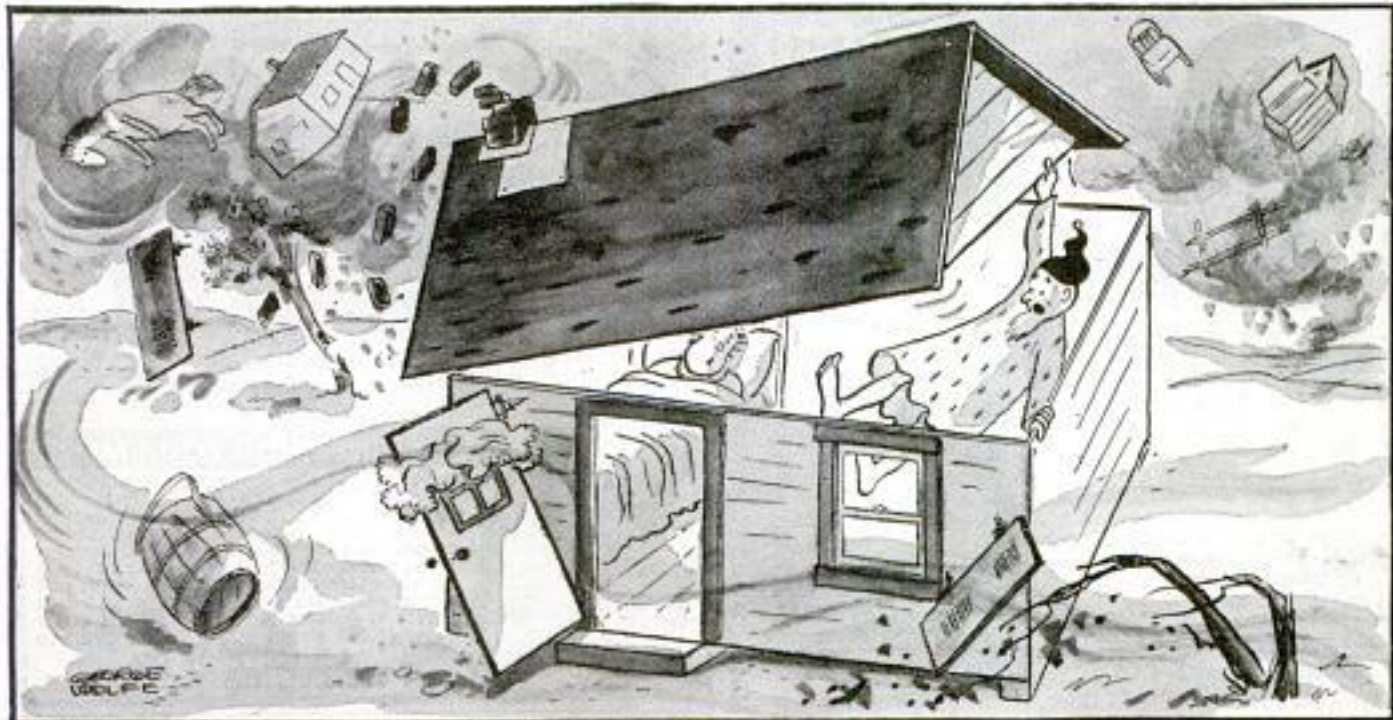
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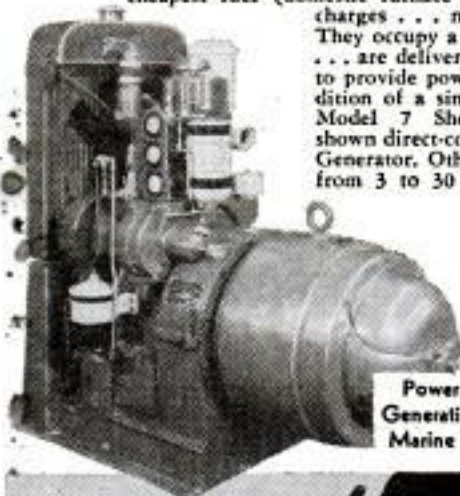


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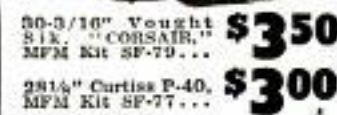
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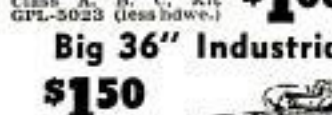
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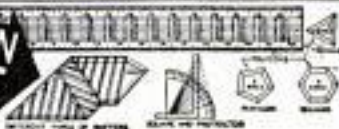
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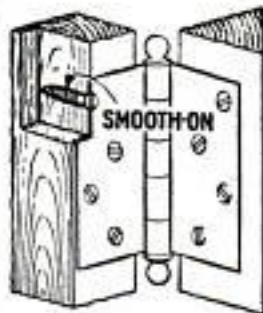
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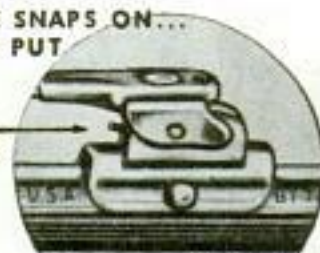
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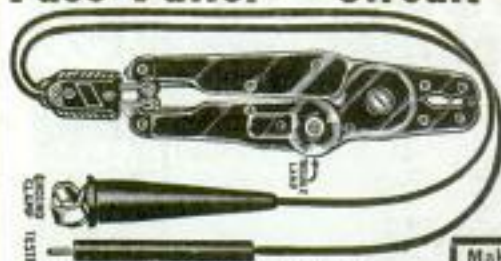
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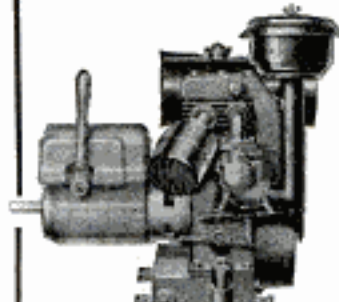
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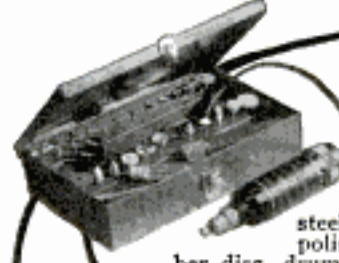
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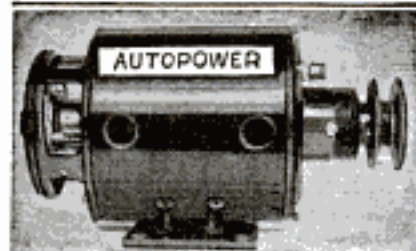
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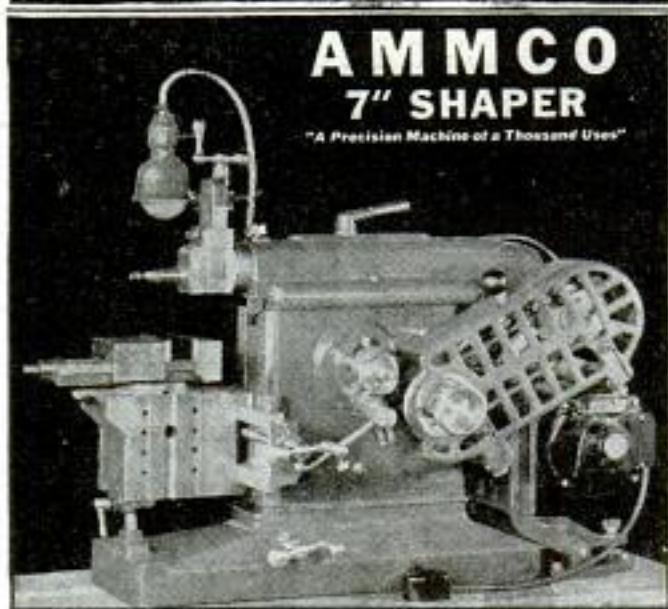
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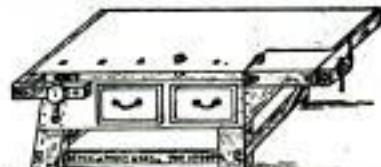
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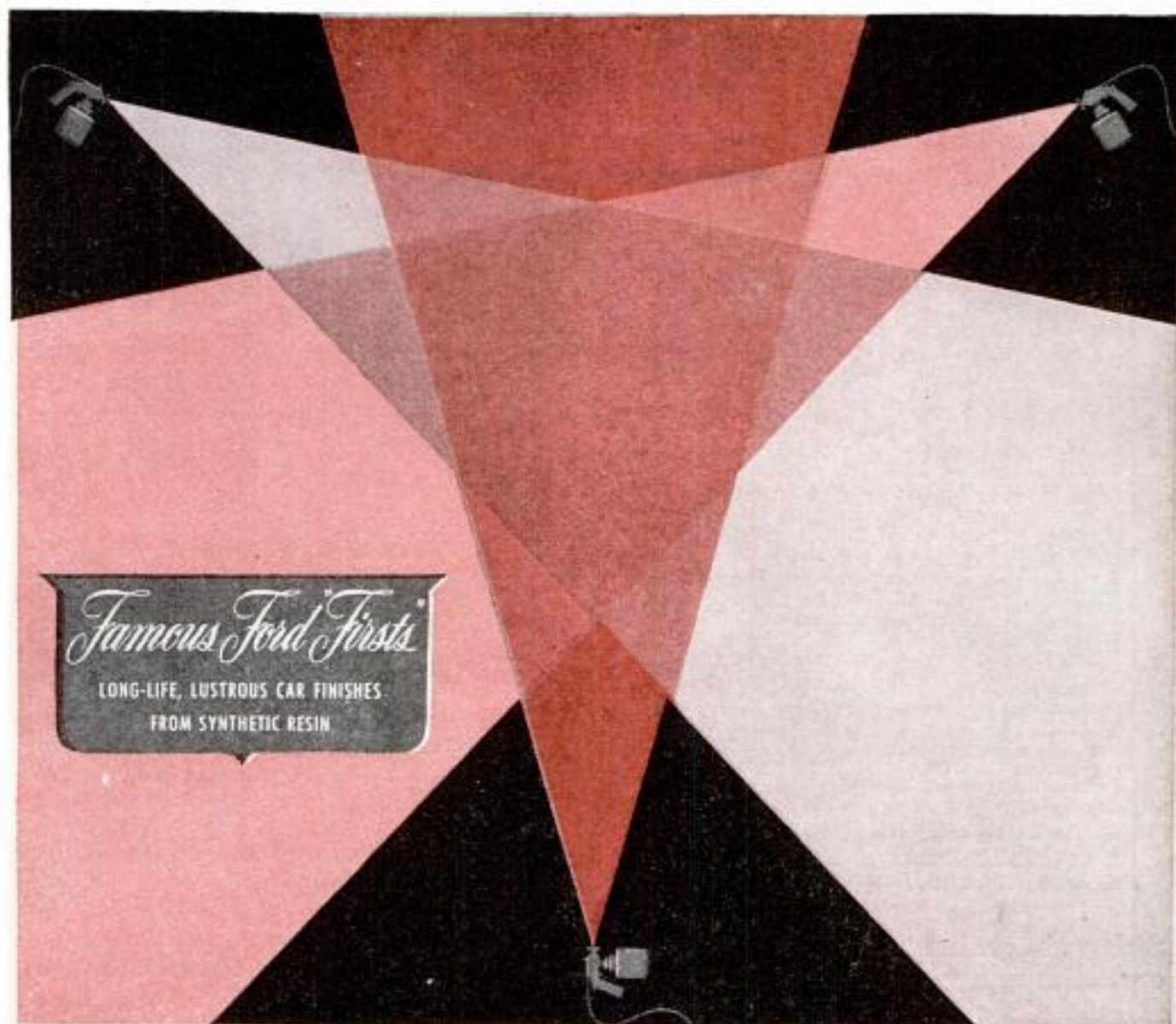


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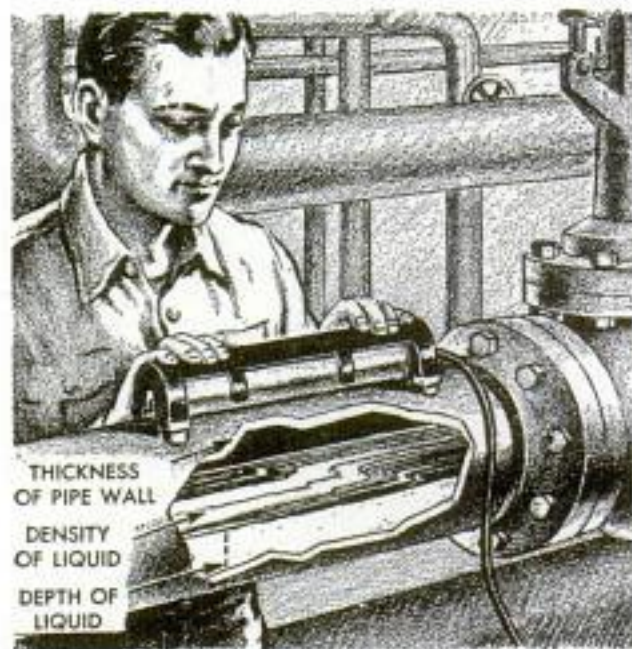
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Radium rays now are utilized to shoot through iron pipes and the steel walls of boiler tanks to tell engineers exactly how thick the metal is. The same rays penetrate liquids, such as chemicals or oil, to supply accurate information on the level and density of the liquids—which would show, for example, if the proper "mix" was present. An electronic device called the Penetron employs rays created by radium salt to make these precise measurements. In checking the wall thickness of an enclosed container that would be difficult to measure in any other way, the rays are directed into the metal. Some of the rays are scattered in all directions by the electrons in the atoms of the wall. The rays that bounce back—called back-scattered radiation—are "captured" in a recording instrument that reveals their intensity. Thickness of the wall can be determined by measuring the intensity of the rays.

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Cotton fabric treated with various acids, including acetyl, has been developed by the U. S. Department of Agriculture's Southern Regional Research Laboratory at New Orleans to resist mildew, dampness and other conditions which cause materials to rot. To test the new fabric, scientists buried it for six months in soil teeming with microorganisms that would have rotted ordinary cotton in a week. The treated material withstood the "bugs" and the dampness. It seems well suited for making mildewproof clothing, rotproof tents and awnings for damp climates, and fish nets that can be stored wet.

POPULAR MECHANICS

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MOTO-TOOL ★ THE "POCKET-SIZE" MACHINE SHOP

PUT THIS "WAR VETERAN" TO WORK *Approximately 27,000 R.P.M.*

READ MOTO-TOOL'S RECORD

Long before Pearl Harbor Dremel Moto-Tools had won their spurs in tool rooms, machine shops, home workshops. Now they have the respect of every branch of the armed forces. And thousands of them helped establish production records at General Electric, Westinghouse, Remington Arms, Ford, Nash-Kelvinator, Consolidated Aircraft, Douglas and others.



MOTO-TOOL KIT

Kit No. 2 with 23 high grade accessories and Model 2 Moto-Tool, in hardwood case. \$23.50
Model 2 Moto-Tool, with 1 accessory. \$16.50

Now that priorities have been lifted, Moto-Tool can work for you. Moto-Tool owners daily discover new jobs that can be done more expertly in less time. In fact, new purchasers find dozens of uses in addition to those they had in mind. So great is the time and labor that Moto-Tools save, thousands of mechanics and craftsmen would find it difficult to get along without these mighty little midgets.

ONLY MOTO-TOOLS HAVE ALL THESE FEATURES

A Model 2 Moto-Tool develops a speed of approximately 27,000 rpm. Weighs only 13 oz. Shaped to fit the hand. Sturdily built with shock-proof bakelite housing. Balanced for vibrationless operation. Uses 110-120 AC or DC current.

10 DAY TRIAL—MONEY BACK GUARANTEE

Ask your dealer today about Dremel Moto-Tools and Accessories. If he does not handle them, order direct from factory on 10 day trial. We ship postpaid if cash in full accompanies order. If you prefer to send only \$2.00, Moto-Tool will be shipped C.O.D. for balance plus postage. Catalog sent FREE.



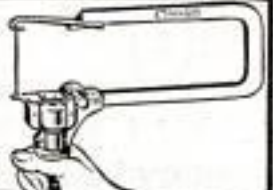
Model 2 Illustrated

A FEW OF THE JOBS THAT MOTO-TOOL CAN DO FOR YOU

- Sharpening
- Finishing
- Touching Up
- Sanding
- Drilling
- Mortising
- Engraving
- Burring
- Grinding
- Polishing
- Burnishing
- Inlaying
- Sawing
- Scoring
- Cleaning
- Routing
- Cutting
- Rasping
- Carving
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Dremel Moto-Saw... the sensational electric scroll saw... will be back as soon as materials are available.



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Can be pedaled by merely releasing clutch. Speed 5 to 40 M.P.H. Shipped prepaid complete with 4 cycle, 2 1/2 H.P. motor, all attachments and heavy duty stand. Get complete facts about this low-cost, convenient transportation.

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DECEMBER 1945

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Note these Special

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Not only surface planes toughest woods and plastics to precision limits—but rabbets, routs, tenons, panels, grooves, beads. Will cut rabbets, tenons, panels, etc. to a depth of 1" with special Barron extra long hi-speed cutter blades. Thousands now in use. Made of Alcoa aluminum, machine finished thru-out. Vibrationless. Fits any drill press. Shipped prepaid on 10 DAY MONEY BACK GUARANTEE on receipt of cash, money order or C.O.D. for \$7.50.

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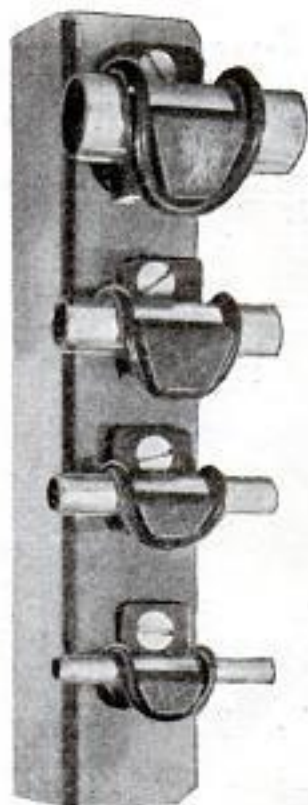
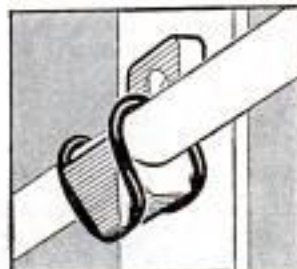
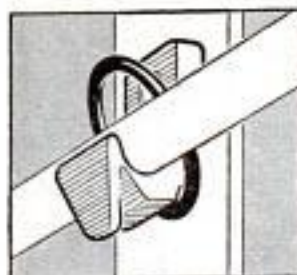
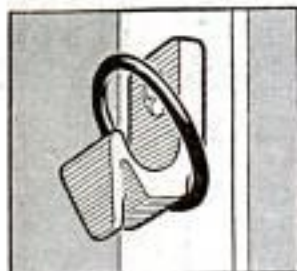


A 50 gallon oil barrel is used for the outer shell, a 30 gallon oil barrel for the inner container, and the compressor unit is salvaged from an old household refrigerator. Easy to make. Zero temperature keeps meats, fruits, vegetables, etc. in fresh condition for indefinite period of time.

Complete instructions, material list, and fourteen view composite photograph of construction details sent for... **\$1.00**

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Electric Eye Counts Meteors

Meteors, or shooting stars, now can be recorded automatically and their brilliance measured by an instrument which employs two electric eyes. This is the first known electrical recording of meteors, according to the developers of the "sky detective," Dr. C. W. Gartlein of Cornell University and Joseph C. Logue of the school of electrical engineering. In operation, the photoelectric cells are aimed at various portions of the sky and synchronized so that when one cell intercepts light brighter than that being received by the other cell, a recording pen on a graph is set in motion. The jagged line made by the pen not only records the presence of the shooting star but also gives a reading of its brilliance.

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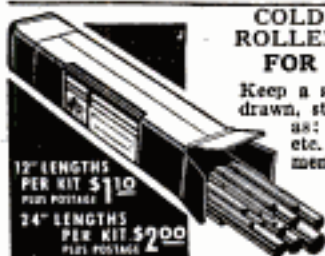
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do you WORRY?

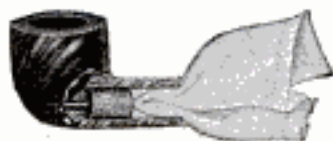
Why worry and suffer any longer if we can help you? Try a Brooks Patented Air Cushion. This marvelous appliance for most forms of reducible rupture is GUARANTEED to bring YOU heavenly comfort and security—day and night—at work and play—or it costs you NOTHING. Thousands happy. Light, neat-fitting. No hard pads or springs. For men, women, and children. Durable, cheap. Sent on trial to prove it. Not sold in stores. Beware of imitations. Write for Free Book on Rupture, no-risk trial order plan, and proof of results. All Correspondence Confidential.



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Motorists no longer need worry about losing gasoline to siphon thieves if they equip their car with a new keyless, theftproof, siphonproof gas tank cap. Designed in such a way that one model fits all shapes and sizes of filler pipes, the cap has a swaged neck to permit rapid filling and cast-in bottom baffles to prevent siphoning of gasoline from the tank. You simply screw it on and it stays put.



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Smokers of the old style screw-stem pipes have long dreamed of the time when they could own a pipe that would be free of the usual screw-stem ailments. That day—and the VanRoy Ajustomatic—are here! • This is more than just another screw-stem. It is a totally new kind of pipe. New—because the stem is “float-mounted”—accurately lines up with the bowl as straight as a die every time. • The patented Ajustomatic stem can be turned as often as you like—it will never lock at an off angle. Thanks to VanRoy precision, you get this care-free alignment for the life of the pipe. Ajustomatic rates your life-long friendship, too, for its fine smoking qualities. • Give yourself the satisfaction of owning this latest—and greatest—VanRoy contribution to pipe contentment.



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One wish has been fulfilled. Won by 3½ years of deadly struggle. With God's help, we have prevailed.

Now we have a chance to make another wish come true. For most of us, the outlook is a bright one. If we will simply use the brains, the will, the energy, the enterprise . . . the materials and resources . . . with which we won our war, we can't fail to win the peace and to make this the richest, happiest land the world has known.

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You can make those wishes come true by buying bonds today . . . buying them regularly . . . and holding on to them in spite of all temptation.

There's no safer, surer investment in the world. You can count on getting back \$4 for every \$3 you put in E Bonds—as surely as you can count on being a day older tomorrow.

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To dad or brother, hobby or lover
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Blue Ribbon is a sweet-smaker, light
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Driving again, you can depend on
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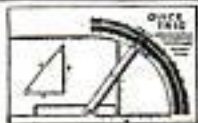
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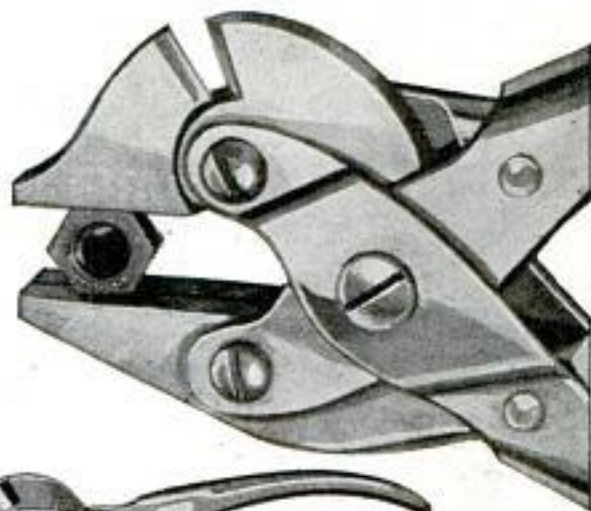
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DECEMBER 1945

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Yes, sir, this is the plier with the 3-purpose head (plier, cutter, wrench)—and the compound action that gives over twice the power. It's the **BERNARD**—and there is no other plier like it.



Jaws always parallel. Close like a vise. Hold FAST. Don't slip. Won't mar the nut.

Cutter on outside of head, convenient to use. 6" size cuts 8-penny nail easily.

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Windmill Made of Split Oil Drums Operates Pump and Generator



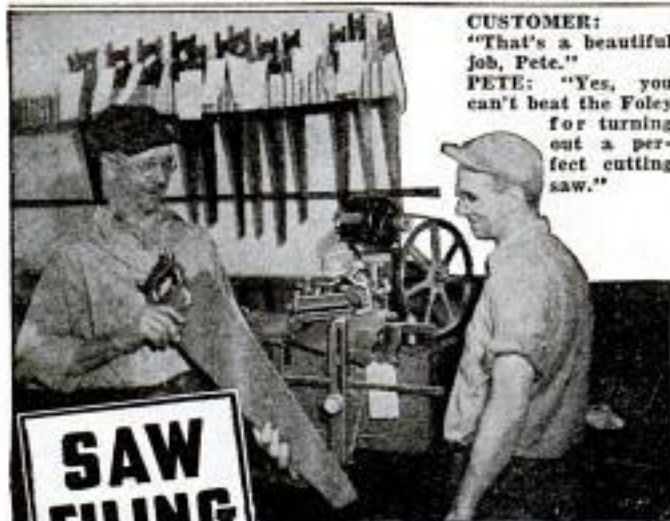
Steel oil drums were used to make a windmill on a ranch at Maybelle, Colo. Five halves of drums were mounted on a vertical shaft, three above the others, and the windmill operates a pump and a small generator. The barrel halves are attached in such a way that they are always headed into the wind.

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Boom-type cranes and similar equipment used aboard floating drydocks by the Navy have less chance of overturning with use of a crane stability gauge developed by General Electric. An indicating instrument in front of the operator shows when the crane is attempting to pick up too great a load, and also safeguards against extending the boom too far. Additional equipment automatically prevents the operator from hoisting an overload and sounds an alarm before the crane reaches its load limit.

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Engine thrust and torque and other stress and strain problems can be gauged with a sensitive instrument that measures and weighs with air. A flexible diaphragm forms one face of an airtight chamber. Compressed air enters the chamber through a pilot valve. Force to be measured is applied to the outside of the diaphragm and is opposed by internal pressure, which provides a direct measure of the external force.



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With the Foley Automatic Saw Filer you can have a fine cash business with steady customers and make a good living. The Foley automatically joints the saw, making all teeth even in size, shape, spacing. The Foley is the only machine that files all hand saws, also band and cross-cut circular saws.

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Now — you can do milling, slotting, grinding, grooving, squaring shafts, sawing at angles, and many other important operations on your lathe. **PALMGREN MILLING ATTACHMENT** is a necessary fixture for small shops, schools and emergency work in large plants. Fits South Bend, Atlas, Craftsman, Logan, Sheldon and all other makes. It has 360° graduation for rotary angle adjustments, also graduated feed and adjustment screw. Easily mounted by straddling lathe's regular tool post. Try one—it will quickly pay for itself.

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No.	Width Jaws	Depth Jaws	Jaws Open	Weight Pounds	Base Opening	Price F. O. B. Factory
150	3 1/4"	3"	3 1/2"	6 1/2	3"	\$18.75
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400	4"	1 1/2"	4"	25	2"	39.75

Order from your dealer or jobber. Write for circular No. 105
CHICAGO TOOL AND ENGINEERING CO.
Mfrs. of PALMGREN PRODUCTS for Over 25 Years
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\$75,000 for boy MODEL BUILDERS

- 8 UNIVERSITY SCHOLARSHIPS**
- 588 CASH AWARDS**
- 36 CONVENTION TRIPS**

Here's the biggest news you've read in a long time. You are eligible to try for these awards in the TWO competitions listed below—if you reside in the United States and are between the ages of 12 and 19 inclusive.

- 1. NAPOLEONIC COACH COMPETITION—316 awards, including two \$5,000 and two \$3,000 scholarships. In this, you build a miniature model Napoleonic Coach to plans we furnish you.**
- 2. MODEL CAR DESIGN COMPETITION—316 awards, including two \$4,000 and two \$2,000 scholarships. All you do is make a solid model automobile embodying your own ideas of motorcar design.**

Rules are simple and fair

In both competitions the following regulations will prevail. Boys 12 years old, or older, but not yet 16 by September 1, 1945, compete in the Junior Division. Boys 16 years old, or older, and not yet 20 on September 1, 1945, compete in the Senior Division. All boys within these age limits are eligible to Guild Membership. There are no dues or entrance fees of any kind. Each member shall receive, without charge, an official Guild membership card and button, and a full set of Guild drawings and instructions. Both competitions close July 15, 1946, and are open to all boys within the age limits, including the sons of General Motors employees. In all cases where the son of a General Motors employe qualifies for an award, duplicate awards will be made.

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An educational foundation sponsored by Fisher Body Division of General Motors

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Gentlemen: Please enroll me in the Fisher Body Craftsman's Guild for 1946, in the

Napoleonic Coach Competition
 Model Car Design Competition

Send me full instructions without charge

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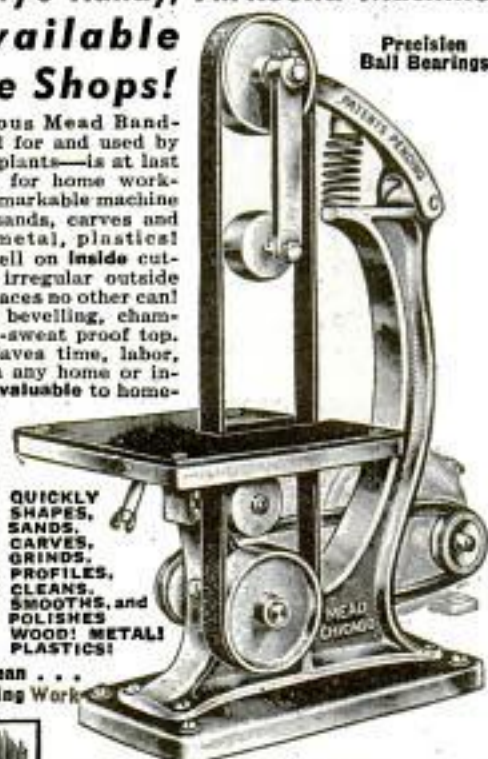
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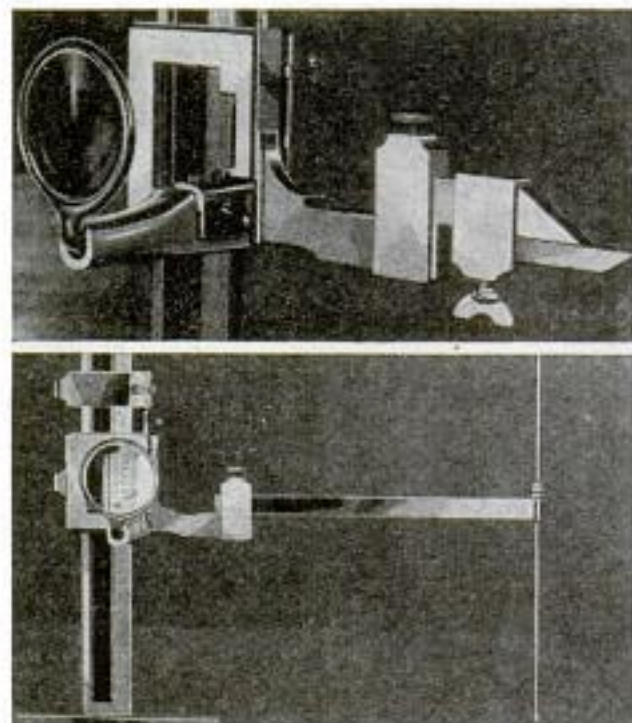
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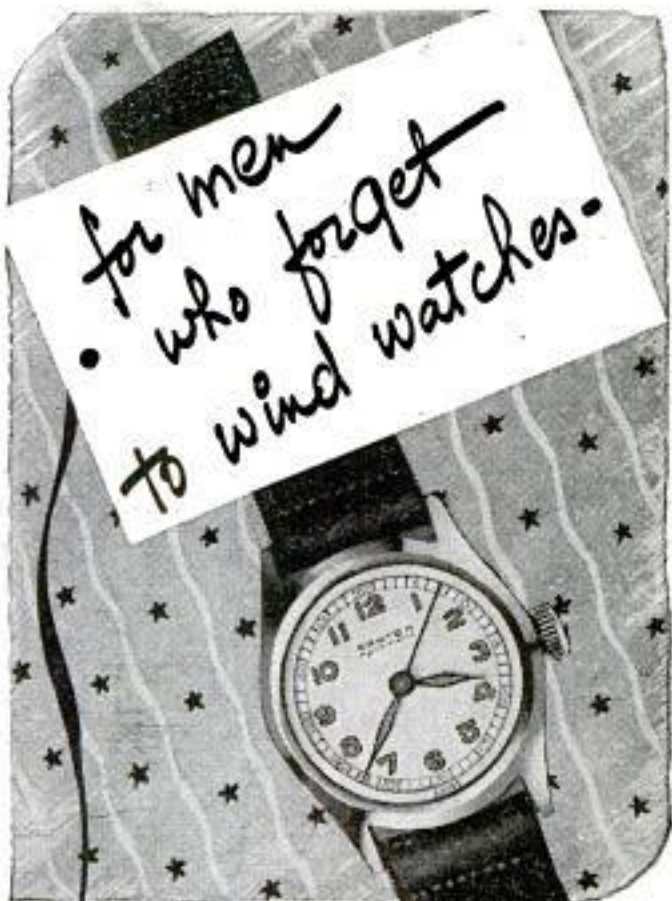
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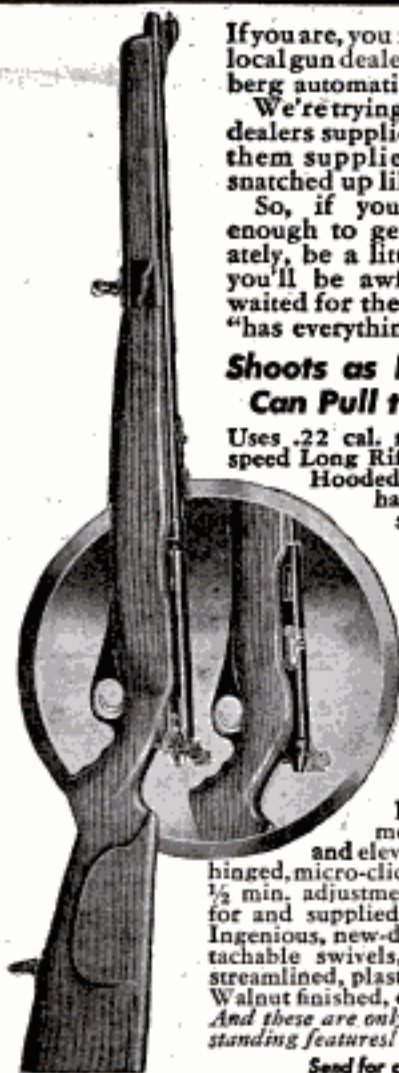
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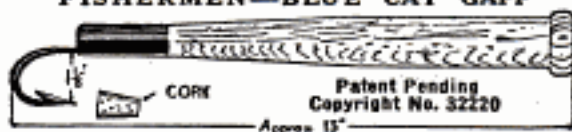
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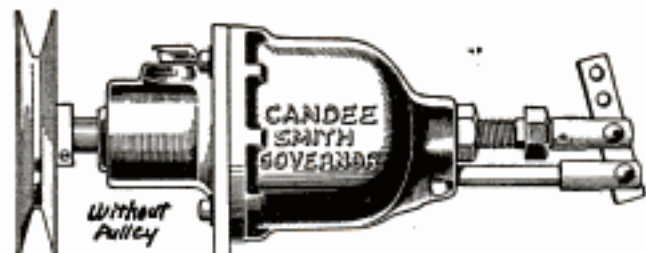
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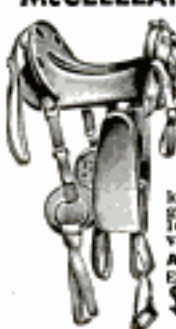
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SOUTH BEND LATHE WORKS

LATHE BUILDERS SINCE 1906

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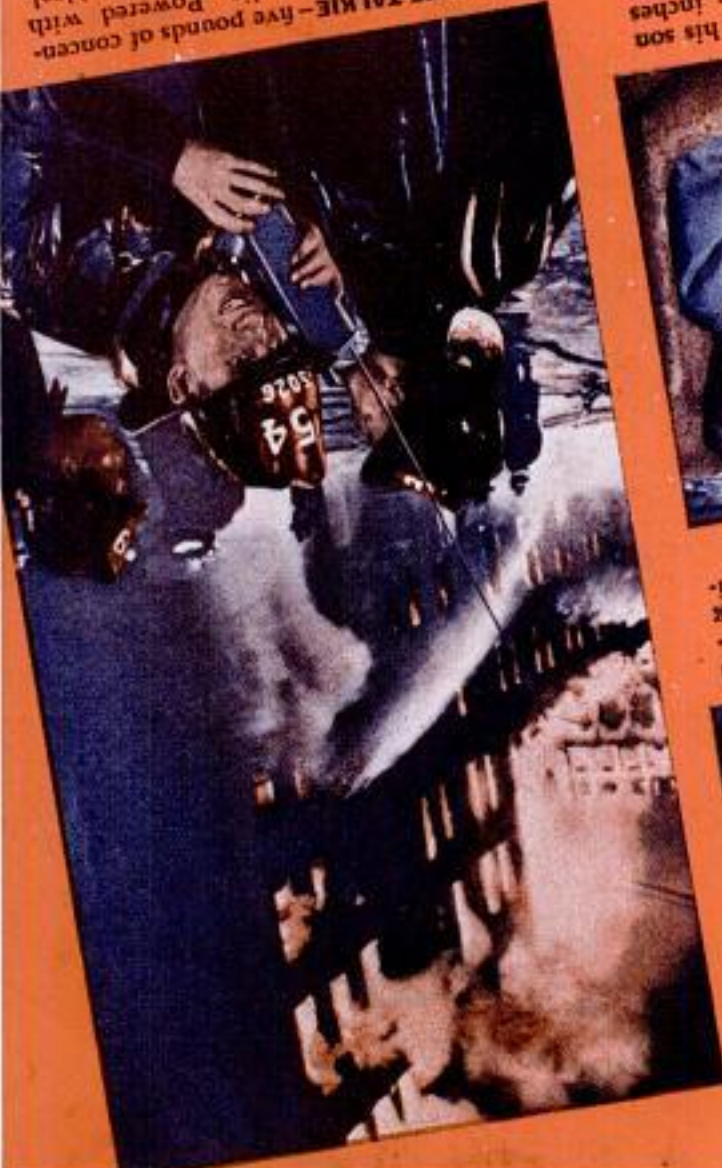


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