

SEPTEMBER

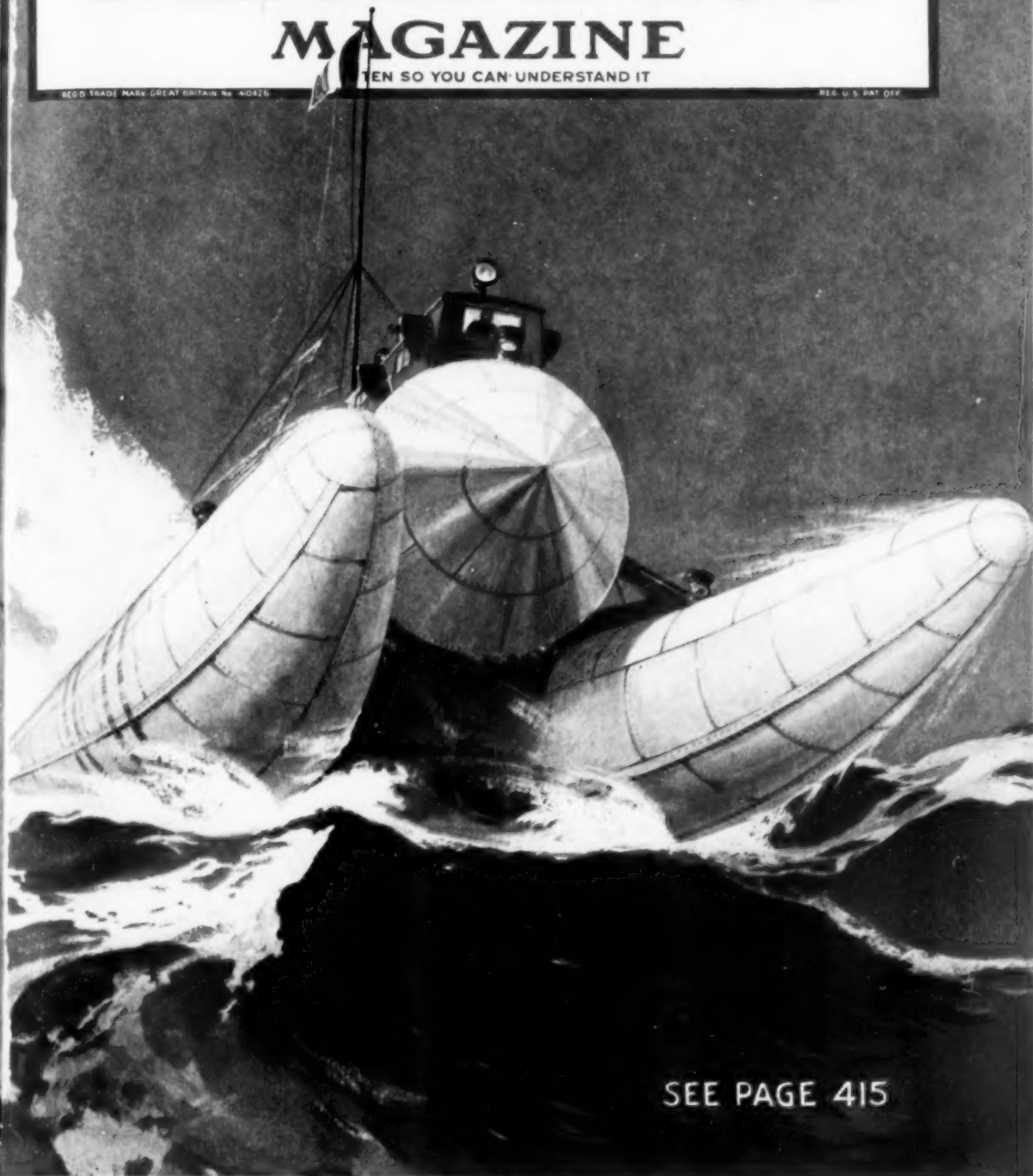
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POPULAR
MECHANICS
MAGAZINE

TEACH YOU SO YOU CAN UNDERSTAND IT

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SEE PAGE 415

ATKINS SILVER STEEL SAWS

3

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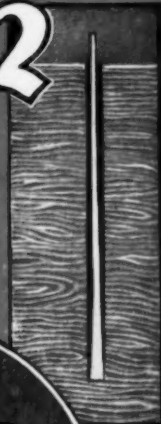


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Vol. 50

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WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 50

SEPTEMBER, 1928

No. 3

Radio Phones Link Ship to Shore

By F. B. HOWE

"SAY, BILL, this is the 'Avalon.' We've been held up by a storm and will be three hours late in docking. Have the stevedores ready and I'll call you again if we run into any further delay."

Such conversations as this are being carried on every hour between Los Angeles harbor and the fleet of steamers and tugboats that scurry about in southern California waters as a result of the perfection of a radio telephone which enables conversation to be carried on between the various ships and from the boats to shore with the same ease as over ordinary land telephones.

R. D. Lemert, radio operator, some time ago conceived the idea of equipment that would enable a man on the dock to pick up an ordinary telephone, lift the receiver off the hook, and immediately talk with any one of the eight tugboats or three steamers operated by the Wilmington Transportation company.

After a year and a half of experiment, the equipment is in daily operation and looked upon as a matter of course by the ship officers. Where heretofore a tugboat finishing the job of taking a steamer out to sea had to return to the dock—with loss of an hour's time and burning of con-



Tugboat Captain Receives Instructions from Shore While Towing a Ship, through Radio Telephone Installed on Deck

siderable oil—the captain now drops the lines of his charge, picks up an ordinary telephone, lifts off the receiver and turns a single dial to the wavelength of the particular office on the dock to which he wishes to talk.

Communication between the various ships of the fleet is similarly accomplished. If the captain of a steamer of the line, upon arriving in a harbor, finds he needs a tug where he had thought one would not be necessary, he no longer anchors and frantically blows signal blasts on the ship's whistle until someone hears the call. Instead he phones to any tug he sees in the vicinity and, in a jiffy, the ship is on its way again.



Radio-Phone Office at the Docks, with Loud Speaker and the Radio Instrument in Use; at Right, the Ship Captain Talking with Men on Shore by Wireless

Although the system has not been in operation long, there have been numerous interesting instances of the radio telephone's immense value. At least one shipwreck has been avoided through its use. This occurred when one of the tugs was taking a ship to sea and the steamer's steering engines suddenly broke, leaving the craft helpless. With only the single tug to aid her, the ship began to drift rapidly shoreward. The captain of the tug grabbed his phone.

"The ship I'm towing just broke her steering engine," he told the dock. "She's starting to drift ashore and I can't hold her off without some help. Get three tugs out here quick."

There wasn't a single tug idle at the dock, but that didn't handicap the dispatcher. Quickly he called three of his tugs, all at sea or under way in the channel, and informed them of the situation. In ten minutes they were at the scene of the trouble and the steamer was saved.

On another occasion a German merchantman arriving in the harbor was taken in tow by one of the phone-equipped tugs. The German skipper thought he was supposed to go to one dock; the tugboat captain understood another, and the pilot had been told it was to be a third.

"Come down on my tug and I'll let you telephone to shore and find out," offered the captain. With difficulty he was per-

suaded to descend to the deck of the tugboat. The captain handed him a telephone. "Go ahead and ask them," he said. "That's your man on the phone now."

When the German master had been con-



vinced that the offer was legitimate, he went ahead with the conversation and in five minutes had the information and was on the way to the dock. A saving of not less than two hours was effected thereby, while the time of a hundred stevedores and further delay for the ship were spared.

Describing his accomplishment, Mr. Lemert says:

"At present all tugs and steamers are equipped with telephones operated on 2,750 kilocycles or 109 meters with a radius of 200 miles on the smaller tugs and 500 miles on the larger ones. This is by voice entirely. There is practically no variation in day and night operation.

"The equipment is very simple and has very few controls. The transmitter itself has but one dial for the control of the transmitted frequency. It is possible to vary the frequency of these sets from 70 to 140 meters with this one control. After the set has been tuned to the wavelength it is licensed to operate, this dial is locked and left alone.

"The equipment consists of a regular desk phone and loud speaker. When the person operating one of the stations de-

sires to call another station, he simply takes the receiver off the hook, which, in turn, starts the transmitter. The connection is made by speaking the call letters of the station wanted and the conversation begins.

"Further elaboration has been made on the steamers 'Catalina' and 'Avalon' by having the ship's wireless operator act as a sort of central station from which calls are connected to the bridge, captain's cabin, engineering room or purser's office as may be desired."

COTTON-PLANT SHAKER AIDS WAR ON BOLL WEEVIL

One of the latest units in the battle against the boll weevil, which does more than \$300,000,000 damage in this country annually, is a plant-shaking machine which treats twenty acres a day and at little expense. It is drawn by horses, straddles two rows at a time, and as it passes along, the plants are bent and shaken in such a way that infected bolls, trash, weevils and other insects fall into a pan of oil carried on the machine below. The oil is fatal to the weevils. When the pan is filled, it is easily cleaned and the contents may be burned. Waste oil, such as is drawn from automobile crankcases, can be used, hence the expense of the treatment is slight. The shaking is said not to damage the plants or the sound bolls. The mechanism that performs the shaking is an elaboration of the hand method of executing the same operation.



Shaking Weevils from Cotton Plants: the Pests Fall into a Pan of Oil and Are Killed



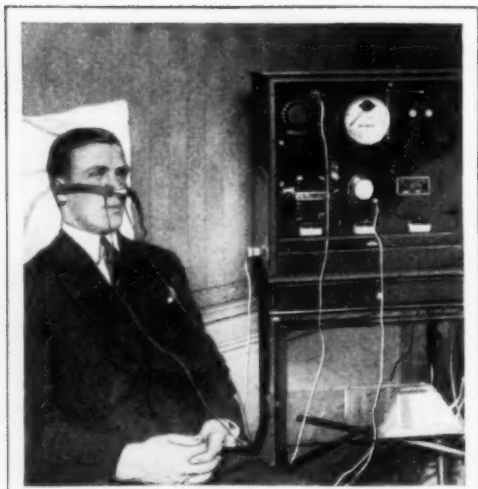
Propeller of This Model of the "Spirit of St. Louis" Does Duty as an Electric Fan

FAN LIKE LINDBERGH'S PLANE KEEPS COURTROOM COOL

Modeled after the famous "Spirit of St. Louis," an electric fan has been devised by a California jurist to keep his courtroom cool. The propeller corresponds to the usual blades in an ordinary fan and furnishes a pleasant breeze on sultry days.

CLIPPER-SHIP LINES RETURN FOR OCEAN YACHTS

Removal of the ten-per-cent luxury tax on the over-all length of pleasure yachts has brought about a return to the long graceful lines of the clipper-ship era, marked by ornamental bows, long bowsprits and flaring overhang at the stern. Yacht design has changed radically in recent years, largely because of the turn to Diesel engines for power. A 175-foot yacht with heavy-oil engines has as much room for owner, guests and crew as a steam yacht 250 feet in length, due to the saving of engine and fuel space. The engine room need only be about one-half as long in the Diesel-engined craft, and the casing above it, carrying the smokestack and covering the upper part of the boilers in a steam vessel, is much smaller. Another advantage of Diesel power is the decreased weight of machinery, providing more space and tonnage for fuel, water and supplies, so that the yacht has a greatly increased range. The low center of gravity of this engine also increases the stability of the boat.



Treating Nose Tissues with High-Frequency Electric Current to Help Cure Cold

"ELECTRIC DOCTOR" IS USED TO TREAT COLDS

Beneficial results in treating colds with an "electric doctor" are reported from France. The instrument employs high-frequency current to generate heat that penetrates the nose linings and thus destroys germs. Relief has been obtained in ten minutes or less, it is said. The treatment does not injure the nose tissues.

VACUUM-BOTTLE FREIGHT CAR CARRIES MOLTEN METAL

Tons of molten iron are transported from furnaces to the rolling mills in Ohio, in big ladle cars that resemble giant vacuum bottles. They are lined with fire brick and fitted with lids somewhat like those of the familiar containers. To empty them, they are tilted by an electrically operated mechanism and the molten iron



Special Ladle Car for Hauling Molten Iron

runs out like so much water. When filled, the car weighs more than 340 tons. Each is fifty-six feet long. To prevent accidents, the tilting machinery can be operated only when the car is stationary.

ROCKET PLANE IS SUCCESSFUL IN FIRST FLIGHT

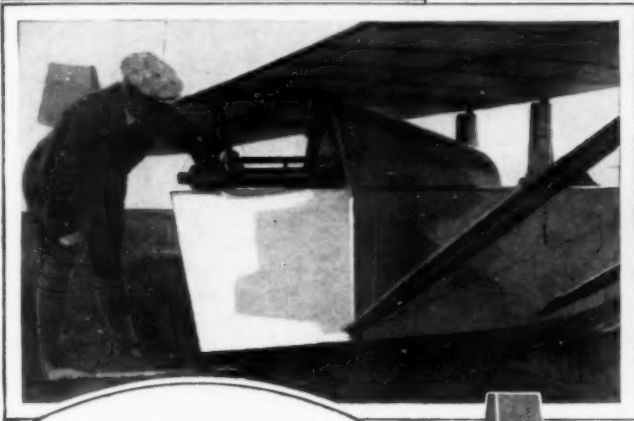
A rocket airplane, built by Fritz Opel, the German automobile builder who produced a rocket-driven automobile a few months ago, has been successfully flown in a secret test in the German mountains. The craft, a monoplane, is of the tail-in-front type, with no fuselage behind the wings, thus giving a clear space for the rocket discharge. A shield back of the pilot protects him against accidental explosion of the ammunition, and from the heat generated in its discharge. Prior to the test of the big machine, a six-foot model was flown successfully for about 1,000 feet under power, gliding safely to earth after the last rocket had exploded. Another German inventor, working along the same lines, flew a model biplane of conventional design, with the tail behind the wings. Following Herr Opel's experiments with his rocket automobile, which attained speeds of 125 miles an hour within a few seconds after the start, he built a rocket railroad car which came to a disastrous end about the same time the plane was being tested. Through some fault in the ammunition, all of the rockets became ignited at once, blew the car high in the air and killed a cat which had been placed aboard to test the effects of wind pressure.

WASHABLE WALLPAPER

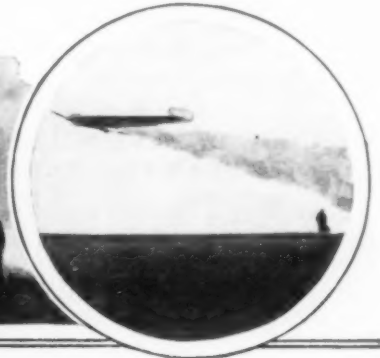
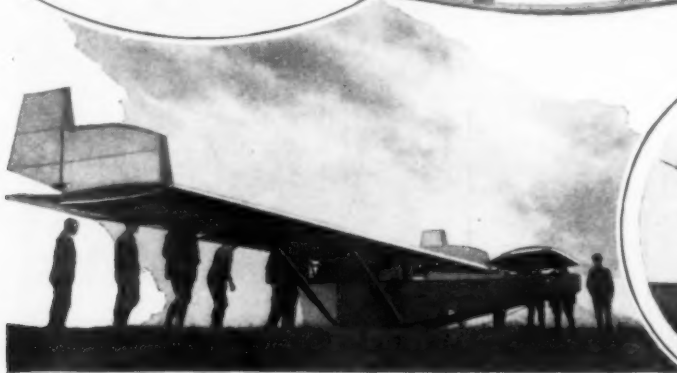
Dust, grease and even ink stains can be washed from a special wallpaper that is colored in soft tones and has none of the high gloss usually associated with washable wall coverings. A damp cloth will remove most of the marks. The paper is especially suited to kitchens, bathrooms and rooms where children play and are likely to smear the walls with their fingers.

FLYING FIREWORKS LATEST THRILL OF GERMANS

New Opel Rocket Plane in Full Flight, and, Below, the Rear of the Fuselage, Which Carries Its Tail in Front; the Arched Shield Protects the Pilot from Heat and Possible Premature Explosion of the Rockets



The Pilot's Cockpit of the Opel Rocket Plane; the Shield behind Him Covers the Rocket Compartment, While, in Front of Him, the Fuselage Is Carried Forward to Support the Stabilizer, and the Rudders, as Shown Below, Are Built above the Wing Tips; the Insert Shows the Machine in Flight, the Figure of the Watcher on the Ground Giving an Idea of Its Size; These Pictures of the Secret Tests of the Rocket Airplane Were Taken at the Trials Conducted by Herr Opel in the German Mountains, Following the Tryouts of the Rocket Idea on an Automobile and a Railway Car; the Former Developed a Speed of More Than 125 Miles an Hour, the Rail Car Being Even Faster





Combination Motion-Picture Camera and Microscope
Operated by Clockwork for Filming Germ Life

FILM MYSTERIES OF GERM LIFE WITH CLOCKWORK CAMERA

Photographic records of the life of a chicken within the egg, of the beating of a turtle's heart, how germs and flowers develop, and many other interesting phenomena, are accurately made with a combination microscope and moving-picture camera apparatus devised by a student of the University of Maryland. A feature of the apparatus is that exposures are made at regular intervals and at almost any frequency desired, by setting the clockwork mechanism that operates the shutter and moves the film, so that, after the instrument has once been properly adjusted, it needs but little attention.

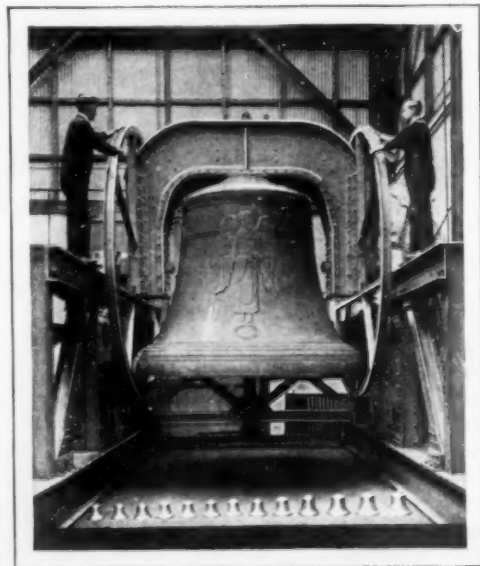
BRIDGE TWELVE MILES LONG TO SPAN FRISCO BAY

Stretching a slender white arm across the blue waters of San Francisco bay, a bridge, twelve miles long, will soon be at the service of motorists. It reaches from Mt. Eden, near Oakland, to San Mateo, just south of San Francisco, the bridge

proper being seven miles long and the approaches five miles. With the exception of five steel spans near the western shore, the center being a lift span to permit the passage of vessels through the ship channel, the bridge is constructed entirely of concrete, piles, decking, sills and hand-rails all being of this material. The piles for the structure are being sunk with what is known as a four-lead driver which sends down two piles at the same time. Special cranes have been built to handle the piling and the deck slabs from the barges. Although extremely stiff, concrete piling has to be lifted with care, so, in order to distribute the weight evenly, the crane is equipped with a system of equalizing blocks which automatically distribute the weight, to the pound, between four lifting points, before the piling leaves the form.

BELL WEIGHING NINETEEN TONS CAST FOR CHURCH CHIMES

One of the largest bells in the world has been cast at Croydon, Eng., for the chimes to be installed in the Laura Spelman Rockefeller carillon of the Riverside church in New York City. It weighs nineteen tons and is ornamented with an angel figure in bas-relief. Many smaller bells will be needed for the finished set.



Nineteen-Ton Bell for Carillon in New York Church;
Compare Its Size with Little Bells in Front

GOLF COURSE FOR HOTEL GUESTS BUILT ON ROOF



Golf Course on Hotel Roof Has Many Hazards and Tests the Skill of the Best Players; a Round of the Eighteen Holes Gives Helpful Practice in Putting and Other Strokes

Golfers at a southern hotel may keep in practice and enjoy their sport even when unable to go to the regular playing links, as an eighteen-hole course has been laid out on the roof of the building. There are fourteen sand traps, six water hazards, and the fairways average six feet in width and forty feet in length. A player of average skill requires thirty-five to forty minutes to complete the course. To keep the balls from falling to the street, a wire netting has been placed around the building at the edge of the roof. It curves several feet over the course.

PLAN TO SAVE TOWER OF PISA BY FREEZING GROUND

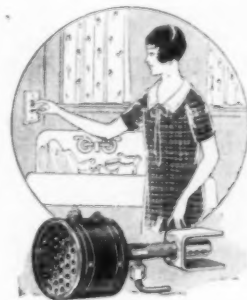
Engineers have discovered that the leaning Tower of Pisa is being undermined by subterranean springs and a way to halt the damage has been proposed by refrigeration experts. They hope to keep the water at bay by freezing the ground with refrigerating machinery, then build a

water-proof circular wall, thirty-six feet deep, around the foundation. When this is completed, they believe it will be possible to force cement into the well so fashioned and stop the inroads of the water.

BUTTON TURNS ON GAS HEATER SAVING TRIP TO CELLAR

One of the latest conveniences for the home is an electric push-button device to turn on the gas water heater in the basement. It saves many trips up and

downstairs, is easily installed and is safe and certain in operation, the manufacturers assert. If forgotten, it automatically shuts off the gas when the water reaches a predetermined temperature.



Polar

Despite the long roll of men who have disappeared into the frozen seas, never to be seen again, the lure of the earth's poles remains as great as ever, and probably will not die until the north and south have yielded their last bit of information.

Wireless and airplanes can keep the world informed from hour to hour of the dangers and perils of the explorers, but neither can overcome the obstacles of ice, fog and storms and insure prompt relief,

SAILING home to its base ship after a successful flight over the North Pole, the dirigible "Italia," became loaded down with ice, then crashed and broke up, leaving one dead and nine living men on the ice, while the gas bag, freed of the weight of control-car and engine gondolas, floated away and disappeared, with six men aboard. Some time later, a great column of smoke, twenty-five miles or more away, indicated its probable fate, and another mystery had been added to the toll of the polar seas.

Three parties had already been to the North Pole before Gen. Umberto Nobile and his companions started their last flight. Peary had arrived on foot some twenty years before; Byrd and Floyd Bennett flew over and back in a plane; and Amundsen, Ellsworth and Nobile had crossed in the "Norge." Two expeditions, that of Amundsen and that of the ill-fated Captain Scott, had stood at the South Pole within a few weeks of each other, yet at the moment the "Italia" started on its last voyage, Commander Byrd was organizing an expedition to explore the antarctic ice continent by air.

The Ill-Fated "Italia" in Flight, Leaving Spitzbergen for Its Last Trip to the North Pole

so that polar exploration, despite all the aids of science, remains virtually as dangerous as when the greatest polar tragedy of all time swallowed the 129 men of Sir John Franklin's expedition. The "Italia" party was in touch with civilization within a few days after the crash—as soon as the radio could be repaired—but fourteen years passed before searchers found a clue to the fate of the Franklin expedition, and it remains as great a mys-

Mysteries



Sir George Wilkins, the Australian Explorer, Using a Dog Team to Tow His American-Made Plane to the Starting Point at Point Barrow, Alaska, for His Flight to Spitzbergen

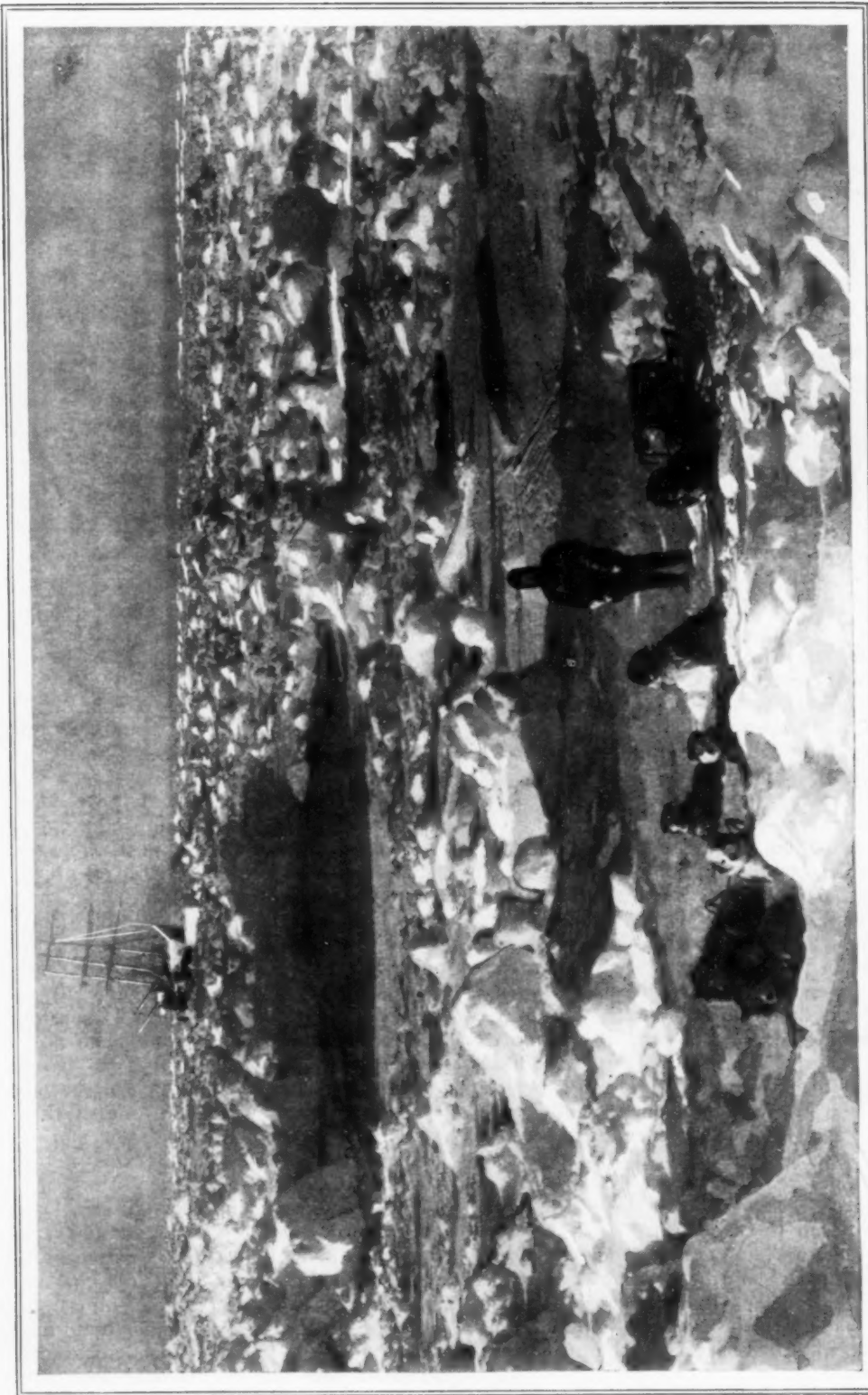
tery today as it was sixty years or more ago. For the 129 men died, apparently from starvation, while surrounded with tons of canned food and in a land abounding in seal, walrus, polar bears and food of similar nature.

Sir John Franklin set out from England in May, 1845, with two ships and his 128 companions, the pick of the British navy. A third vessel, carrying supplies, accompanied them to Greenland. The food supplies included 32,000 pounds of tinned meat, 17,416 pints of soup, 2,176 pints of gravy, and vast supplies of navy salt rations. On July 26, 1845, a whaler met them in Lancaster sound—and they were never seen again by white men.

Years later, after nearly a score of searching parties had patrolled the northern coast of Canada and the arctic lands stretching toward the pole, a party of Hudson's Bay company men, coming overland from the north, met Eskimos who had seen a large party of white men six years before. They were dragging heavy sledges overland toward the south. Following up the clue, thirty-five skeletons were found, and the Eskimos produced silver spoons and other articles obtained from the sleds. Assuming these thirty-five had starved in a land abounding in game, what had become of the other ninety-four?

Fourteen years after the expedition had disappeared, Lady Franklin's final expedition in search of her husband came across a cairn at Point Victory, and in it was a message from one of the officers, dated May 18, 1847, telling of the death of Franklin and twenty-four others. The 105 remaining (including the thirty-five whose bodies had already been found) were that day abandoning their ice-locked ships to start overland to a trading post. The rescuers followed the trail and eventually came on a ship's boat mounted on runners. In it lay two bodies but no food. Nine years before, a great pile of canned meat had been found, where it apparently had been cast aside. It was generally accepted that it had spoiled and therefore had been abandoned, but in the far north temperatures are seldom high enough to permit bacterial growth which might have ruined the meat. In 1926, one of these cans was opened in England, and its eighty-one-year-old content was fed to two rats, with no ill effects.

Five years ago Knud Rasmussen, Danish explorer, born in Greenland and speaking the Eskimo dialects like a native, gathered the final facts. Natives told him that their fathers had found a great ship caught in the ice, had gone below and found men lying dead in their bunks, apparently Franklin and the twenty-four who died



The Last of Sir Ernest Shackleton's Ship "Endurance," as the Ice Pack Crushed In Its Sides, Leaving the Explorer and Twenty-Two Companions Stranded on the South-Polar Ice



The Ground Crew Holding the "Italia" Down, Just before the Signal Came to Release the Ship for Its Final Flight, the Trip over the North Pole from Which It Never Returned

with him. The natives, knowing little about ships, cut a hole in the side to admit more light, but the hole was below the water line and the ship filled and sank.

No record has ever been found to explain whether some of the food was bad, why the canned meats were abandoned or how and why the men died.

Equally unexplained is the tragic disappearance of Major Andree and his two companions, first to try to fly over the North Pole. Andree was an expert balloonist, a trained scientist and head of the Swedish patent office.

On July 11, 1898, the three climbed aboard the basket and their balloon left its moorings on lonely Dane's island, driving northward before a fresh wind, for which they had waited for weeks.

The balloon expedition was one of the best equipped ever to enter the polar seas. The bag was fitted with automatic safety valve and emergency rip panel; it carried buoys, landing grapnel and ropes, sledges, spars, electric batteries, medical supplies, charts, compasses, three months' food supplies, alcohol stoves, guns, sleeping equipment and a collapsible boat and oars,

and, in addition, several carrier pigeons.

A pigeon was shot by a fisherman in the far north. It carried a message written on the second day out, reporting due progress, and stating that it was the third pigeon message dispatched. The message, translated from the Swedish, read:

"Andree Polar Expedition,

"To the Aftonbladet, Stockholm,

"July 13, 12:30 p. m., 82 degrees, 2 minutes north latitude, fifteen degrees, 5 minutes east longitude. Good journey eastward, 10 degrees south. All well on board. This is the third message sent by pigeon Andree."

The other two pigeons were never seen. Two cork buoys were picked up containing somewhat similar messages. But the thirteenth buoy, which, according to pre-arranged plan, would have been discarded near the pole, did not turn up until two years later, and it was empty.

If the balloon kept to the air, they should have crossed the pole in four or five days after leaving Dane's island, but what became of them, their balloon and their instruments and equipment remains an unsolved mystery.



The Car of Andree's Balloon, Which Carried Three Men and Five Tons of Supplies; His Last Message, Sent by a Carrier Pigeon, and the Crew on Top the Gas Bag Overhauling the Rigging

The fate of Captain Scott's expedition, in contrast, is well known, for the bodies, the records, diaries and equipment, all were found. But the why and wherefore of their death for a time was as inexplicable as the disappearance of Sir John Franklin.

Scott and his companions crossed the antarctic ice cap, and, after weeks of terrible suffering, arrived at the pole, only to find the Norwegian flag which Amundsen had planted there but a few weeks before. Weary and discouraged, they started the long trek back to their base ship. Immediately things began to grow wrong. A terrific blizzard, blowing almost without interruption for a month, sapped their strength

and shortened their marches, throwing them far behind schedule. The blinding snow dust blew with such fury that it cut away pillars of ice and even ate an eighth of an inch off their wooden supply boxes.

Then Captain Oates, one of the leaders, became ill, further delaying the party. Finally he got up from his sick bed, announced he was going out and might be gone some time, and deliberately walked away into the storm to die, that his presence might not handicap the others. Lying on his death bed in a snow and ice hut, only eleven miles from a supply depot that might have saved them, Captain Scott wrote the full story in his diary.

"I do not think human beings ever came

through such a month as we have come through," he wrote, "and we should have gotten through in spite of weather but for the sickening of Captain Oates and a shortage of fuel in our depots, for which I cannot account, and finally for the storm which has fallen on us within eleven miles of the depot, at which we hoped to secure final supplies."

The rescuers who discovered the bodies found also

A MESSAGE FROM ANDREE.

A message from Andree has been forwarded to us showing the progress made by the hardy explorer. We reproduce it.

FRAN ANDREES Polarlog
in Årshöjden, Stockholm
 d. 13 Juli
 kl. 12.30 mitt
 Lat. 82° 2'
 Long 15° 5' öst.
 god fart ut
 ut 10° syd.
 Allt väl
 ombord.
 Batta at
 Fredrik def.
 horten.
 Andree

TRANSLATION.

"ANDRÉE POLAR EXPEDITION,
 "TO THE Årshöjden, STOCKHOLM.

" July 13th, 12:30 p. m., 82° 2' north latitude,



that the oil-fuel cans were firmly stoppered, but empty, or nearly so. Science, years later, advanced the explanation, setting at rest the first guess that the oil had evaporated through the stoppers. B. T. Brooks, of the Mellon institute of industrial research, and Dr. Alan W. C. Menzies, professor of chemistry at Princeton, suggest what probably is the true explanation.

Tin, at low temperatures, is attacked by a disease which turns ordinary metal into the allotropic form, a gray powder. This change reaches its maximum rate at fifty-four degrees Fahrenheit, below zero. With the tin plating gone, air or acid in the oil would come in contact with the iron of the container and oxidize it rapidly, leaving the can spotted with small holes.

The searching party which found Scott and his companions reported that food supplies, seven feet below the oil cans in the depot cairns, were oil-soaked.

When Commander Byrd's expedition enters the antarctic ice continent, they will meet conditions totally unlike those encountered at the North Pole. The northern tip of the world is a sea, in which no land has yet been found. Through it the ice pack drifts, leaving open water lanes, making it possible for polar bear, seal and walrus to live there.

The ice barrier of the South Pole presents an unbroken front that endangers explorers long before they even set foot on the plateau. Sir Ernest Shackleton's expedition, which planned to cross the ice cap from the side below South America, was prevented from even landing. It was on August 4, 1914, that the king summoned Shackleton to Buckingham palace and presented the flag which he planned to carry across Antarctica, passing the



Captain Wilkins with His North-Pole Map and Navigating Instruments, Just before Leaving Point Barrow

pole where Amundsen and Scott already had been. That same night war was declared, and Shackleton offered his services, but was ordered to proceed.

Two years later the leader, with five foot-sore men, staggered into a lonely trading village in South Georgia, off the tip of South America, with a tale of incredible hardships and bravery. Their ship had been ice-locked and drifted for months, until finally it was crushed in the ice and abandoned. In open boats the crew started to civilization. After months of hardships they reached Elephant island, practically without food, and their boats battered and patched. Leaving most of his men there, Shackleton and five men started in one boat over 800 miles of stormy open sea to South Georgia.

Three expeditions by boat were led to Elephant island before one finally succeeded in penetrating the pack ice and accomplishing the rescue.



Telephone Conversation Being Amplified through the Cabinet That Aids the Hard of Hearing

ELECTRIC EAR AT TELEPHONE LATEST AID TO DEAF

For persons who are hard of hearing, an electric sound-amplifying apparatus, which may be plugged into a wall socket and is easily moved about on rubber-tired rollers, has been introduced. It is especially useful in handling telephone calls. The receiver is placed over a diaphragm so that the sound passes through the apparatus and is conveyed to the user through a headphone, leaving both hands free for work. Although the outfit is equipped with rollers, these are not intended to make it a portable aid.

PINS TO HOLD RUGS ON FLOOR PREVENT ACCIDENTS

Pins to keep rugs from slipping on polished floors have appeared on the market.



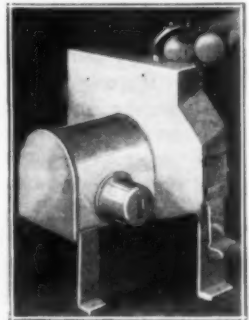
They may be sewed to the underside, where they cannot be seen, or driven through from the top of the rug. A sharp point of small diameter, holds the rug securely and makes only a scarcely noticeable mark in the floor.

WHY FISH DO NOT BITE

Change in the temperature of the water is an important factor in governing a fish's feeding. Many species are more or less inactive when the temperature is low and require little food at such times. Some varieties gorge themselves with enough to last a day or more and, after showers have washed an unusually large food supply into lakes or streams, the angler probably will not get so many bites. The time of day is also an important factor, for fish do not eat at all hours. There are many instances when the fish take the bait even though they are not feeding. They appear to be pugnacious and strike at anything that gets in their way. Some fish that need cool water, collect in favorable places where an abundant supply of food is available. This may often explain why the bait does not tempt them, even though they are present in great numbers. Under such conditions, the angler must exert his ingenuity in finding a lure that will prove attractive to them.

TENNIS-BALL RESTORER HELPS IMPROVE GAME

Tennis balls can be used longer, and with much better results, it is claimed, by treating them in a small electric machine which whitens them and restores the nap after they have been worn smooth. The nap functions in somewhat the same manner as the roughened surface of a golf ball: It helps in hitting the sphere straight. A smooth ball is more likely to curve in the wrong way, and it is difficult to place it accurately, no matter how the stroke is made. The restorer has no rejuvenating effect on the rubber, but simply brings back the rough exterior and thoroughly coats the ball with whiting so that it can be seen with ease. The machine works from a lighting socket, a few moments of treatment is sufficient, and the current cost does not exceed two cents for a dozen balls.





Like a Flying Boat without the Wings; Paddle-Wheel Craft, Operated by Hand, with Its Roomy Body and Folding Top; It Is Safe and Comfortable

QUEER HAND-PROPELLED BOAT HAS FOLDING TOP

Propelled by a hand-operated paddle wheel, a small pleasure boat of unusual design was tested recently in New York. The body is shaped somewhat like the fuselage of a flying craft and has a folding top of bright-colored material that protects the occupants from rain or sun.

QUAKE RECORDERS ON DAMS TO WARN OF COLLAPSE

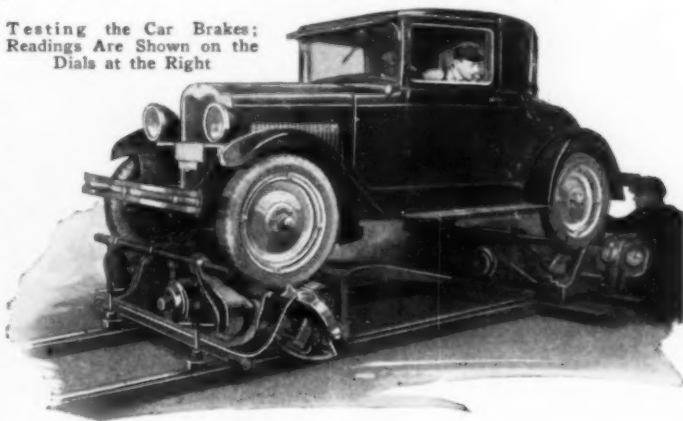
By placing seismographs, the sensitive instruments used to record earthquakes, upon dams, warning of an impending collapse of the structures might be received so that life and property could be saved. In the opinion of R. M. Wilson, of the Hawaiian volcano observatory, had such apparatus been used on the St. Francis dam, which burst not long ago in California, inspectors might have realized the condition of the dam days in advance, and so have given adequate warning. The dam crumbled because of weakened foundations, engineers have

found. Although seismographs in the neighborhood gave no evidence of earthquakes, such an instrument on the dam might have registered the slight motions of the structure as it settled and yielded.

VISUAL AUTO-BRAKE TESTER PROMOTES SAFETY

Adaptable to cars with two or four-wheel brakes, a brake tester recently introduced registers the true condition of the brake on each wheel on gauges, prominently displayed, so that there is slight chance for error and no need of guesswork. The unit is especially serviceable in assuring exact equalization and balance of brakes to eliminate skidding.

Testing the Car Brakes; Readings Are Shown on the Dials at the Right

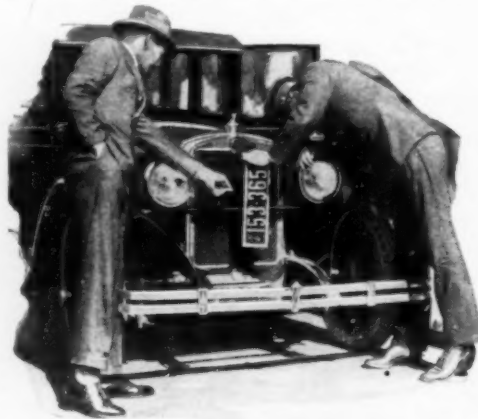




Cutting a Firebreak through Brush and Grass with the Big Tractor Outfit That Helps Protect California Forests

ROAD BREAKER GUARDS FORESTS FROM PERIL OF FIRE

Stands of valuable timber in the Stanislaus national forest in the California sierras are carefully guarded from fire, and one of the means employed to prevent the spread of blazes is to cut wide firebreaks like rough roads so that the flames cannot leap across them. Some of this work is done with a big tractor outfit, a "logging cruiser" and a sturdy leaning-wheel grader that tears through brush and scrub trees, leaving a barren swath that acts as an effective arrester of fires. The value of the timber in this tract is seen by the fact that, last year alone, the gov-



Locking License Plate on End, to Prevent Theft

ernment sold more than \$200,000 worth of trees from the forest.

RABBIT SKINS RIVAL LEOPARD FUR

To supply the large demand for furs of various kinds, rabbit skins are being treated to imitate the pelts of leopard, mink, seal and other animals. Millions of skins are imported from Australia each year, and workers have become so skillful in preparing them that the imitations are difficult to detect even by experts. In making the leopard, for instance, the rabbit skins are carefully sewed together and the markings applied with brush and dye through a stencil that in turn has been prepared from a real leopard skin. The process takes about four days. Goat

skins are made into quite convincing imitations of wolf, although the Manchurian dog furnishes a still better substitute.

LICENSE PLATE LOCKED ON END HELPS FOIL AUTO THIEF

To thwart automobile thieves, an Australian has devised the simple plan of tipping the license plate on end when he leaves the car and locking it in this position. The adjustment is made with a lever and the plate cannot be straightened again without the key. Should a car be found with it tipped on end in this way, it would afford immediate proof that the car had been stolen.

PURIFY WATER BY ELECTRICITY INSTEAD OF DISTILLING

Pure water is obtained commercially by an electric process which is reported to be fully as efficient, and more economical, than the familiar method of distillation. The whole of the electrical energy is used in the purification and the crude water required is never more than four times the amount of pure water produced. In distilling, from forty to 100 times the quantity of crude water is used. The method is based on a physical phenomenon known as osmosis, which manifests itself as follows: If two liquids are placed in a container and separated by a porous diaphragm, some of the liquid on one side of the partition will pass through to the other side and vice versa. If an impure water solution is placed in a semi-permeable container and then stood in a vessel of pure water, some of the water of the impure solution will pass into the pure water but the impurities, usually in the form of salts, will not penetrate.

SHELTER FOR TRAFFIC OFFICER HELPS GUIDE MOTORISTS

Automobile drivers in Jersey City, N. J., are warned of a dangerous intersection by a large booth in the center of it. The shelter protects the traffic policeman from inclement weather and has wide windows to give him an unobstructed view.



Ornamental Shelter for Traffic Officer in Jersey City



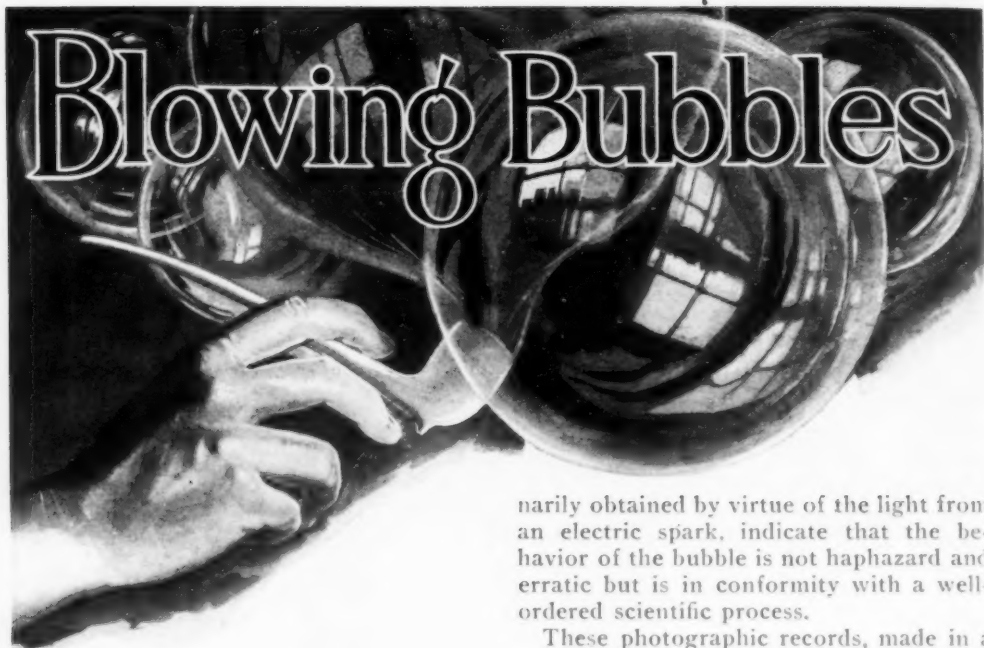
Courtesy Field Museum of Natural History

Diseases and Malformation in Egyptian Children Revealed in X-Ray Photographs of Mummies

X-RAY STUDIES OF MUMMIES REVEAL SECRETS OF PAST

That Egyptian children who lived centuries ago had diseases common among youngsters of today, is one of the interesting facts revealed by X-ray studies of mummies at the Field Museum of Natural History. Photographs taken with the penetrating rays show cases of curvature of the spine and of malnutrition. The latter condition is disclosed by transverse lines of irregular calcium development in the bones and is caused by improper and inadequate feeding. The X-ray apparatus is used not only on mummies but also on various other specimens and helps to establish many scientific facts without doing any damage. The Field museum is the first institution of its kind to adopt this method of examining relics of the past.

☞ About 16,000,000 tiny eggs are produced by a single oyster.



BLOWING bubbles, once an exclusively childish pastime, now is a research activity of vast scientific significance. The lowly soap bubble has already demonstrated its usefulness as a replica of the internal-combustion engine; as a miner of gold and other precious metals; as an object in studying the properties of light, and, for the first time, defines the rates at which gases explode.

Formerly regarded as an extremely simple thing, science has disclosed that the soap bubble represents a complicated process. This is true to such an extent that the heat division of the bureau of standards is consulting this flimsy mixture of soap and water to determine the exact behavior of our automobile and airplane engines. In fact, when the bubble is filled with a charge of explosive gases, Uncle Sam accepts it as a perfect internal-combustion engine—operating without bearings, cylinder or piston.

The gaseous bubble is fired by a spark from the center. The extreme delicacy and transparency of the soap film permit a continuous photographic record to be made of the progress of the explosive reaction, from the instant the ignition spark passes to the moment the reaction is completed. The photographic records, ordi-

narily obtained by virtue of the light from an electric spark, indicate that the behavior of the bubble is not haphazard and erratic but is in conformity with a well-ordered scientific process.

These photographic records, made in a constant-pressure chamber, give all the quantitative dimensions necessary for a precise study of the behavior of an internal-combustion engine; for the degree of disassociation of the fuel or combustion products, and, in the event an inert gas is present in known quantity, for the specific heat of that gas at the high temperature of the explosion. All of the relationships involved in the determination of these magnitudes are essential to a complete knowledge of what goes on when fuel is exploding in automobile and airplane engines.

The soap bubble, other than being an internal-combustion engine, is an important factor in the mining industry. It separates the dross from the gold. Rocks containing precious minerals are reduced to a powder and placed in water, to which has been added a small amount of special oil. This mixture is agitated, resulting in a froth of bubbles rising to the surface of the container of the liquid. Each soap bubble is a bearer of a particle of gold or other precious mineral. The dross or worthless rock remains at the bottom of the liquid. A valuable concentrate of mineral is obtained when this froth of soap bubbles is skimmed. Scientifically, this process is known as flotation and it ranks high as a modern development in



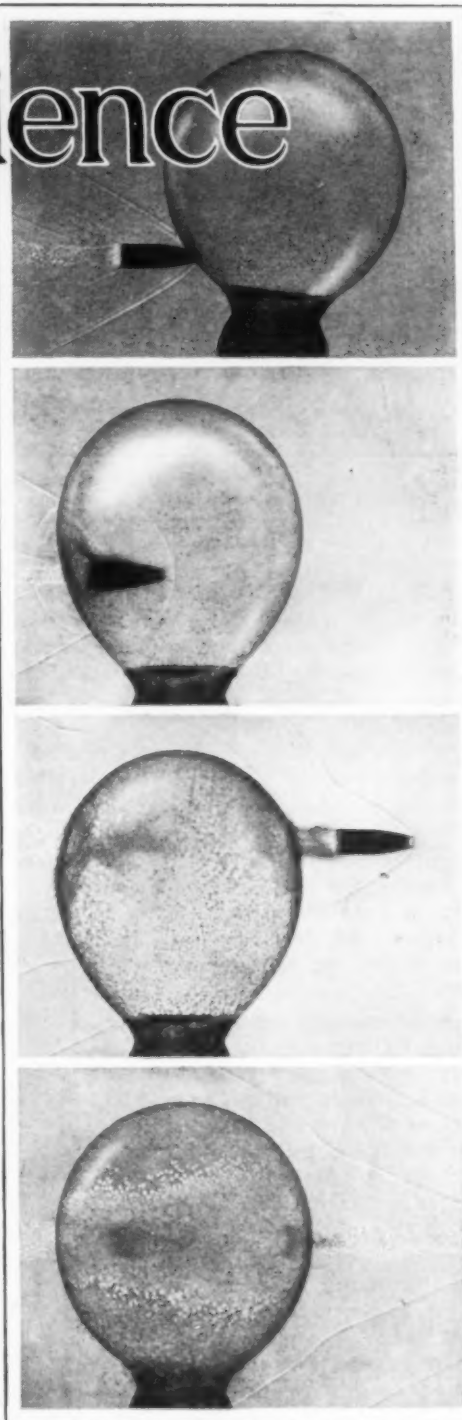
to Aid Science

the mining industry in all its branches.

At least two divisions of the bureau of standards are exploring into the mysteries of soap bubbles—the heat and sound sections. The latter laboratory has, by use of light from an electric spark, made hundreds of photographs of bullets being fired through soap bubbles. These pictures, snapped with incredible rapidity, apparently show the bubble and bullet at rest. “When a bubble once gives way its complete disappearance is so rapid as to lead to the common impression that it is instantaneous,” notes Dr. Paul R. Heyl, of the bureau. “The very rapid spark photographs taken of a breaking bubble show that the bursting is a progressive process, though a very rapid one.

“Photographs have been obtained of a bubble which has had a bullet fired through it. For a few millionths of a second (long enough to be photographed) the bubble stands as if in amazement, with a hole in each side. The holes rapidly increase in size, the water film spraying off at the edges into fine drops, until, in a thousandth of a second or thereabouts, the bubble is gone entirely.

“One of the first things to catch the attention when a bubble has been successfully blown,” reports Dr. Heyl after analyzing hundreds of bubbles, “is the shimmering play of colors reflected from its surface. These colors, we notice, are formed somehow in the act of reflection of the colorless light of day from the surface of the bubble. It is possible, with a little practice, to detach the bubble from the pipe by which it was blown, and to catch it upon a piece of cloth, where it may remain for some time. If we closely examine the distribution of colors on such a quiet bubble, we may be fortunate enough to perceive colored bands moving



Slow-Motion Movies of a Bullet Shot through a Soap Bubble; the Curious “V” Lines Are Sound Waves; Note Disturbed Air in the Bubble



Soap Bubble Filled with Explosive Gas Ready to Be Touched Off by the Spark Plug in Its Center

downward from the top of the bubble to the bottom. The north pole of the bubble seems to be the storehouse whence the bubble draws these colors in succession. And if we are exceptionally lucky, we may see at the north pole, just before the bubble breaks, a black spot. It is as if the store of colors had been exhausted.

"It may be perhaps a new idea that anything can be so thin that it cannot reflect light; but the study of thin films, such as found in bubbles, teaches us that light is not reflected strictly from the surface of bodies, but that it must penetrate a very little way into the substance of the body itself before it can be turned and sent back. Like a motor car, the beam of light requires a little room in which to turn. And if this necessary turning space is not to be found, the light will not be able to turn at all, but will pass through the film and out at the other side.

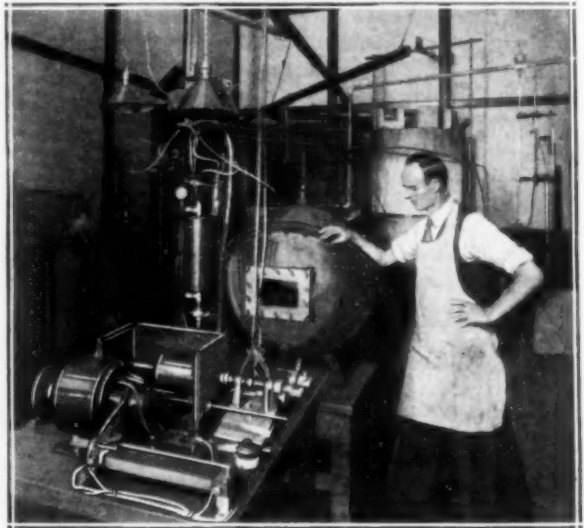
"This is true in the case of bodies ordinarily considered to be opaque, such as polished surfaces of metal. But even metals are transparent in thin enough layers, as is evidenced by ordinary gold leaf.

"In penetrating the reflecting surface to this minute depth, certain qualities characteristic of the reflecting material are impressed upon the light, so that by exam-

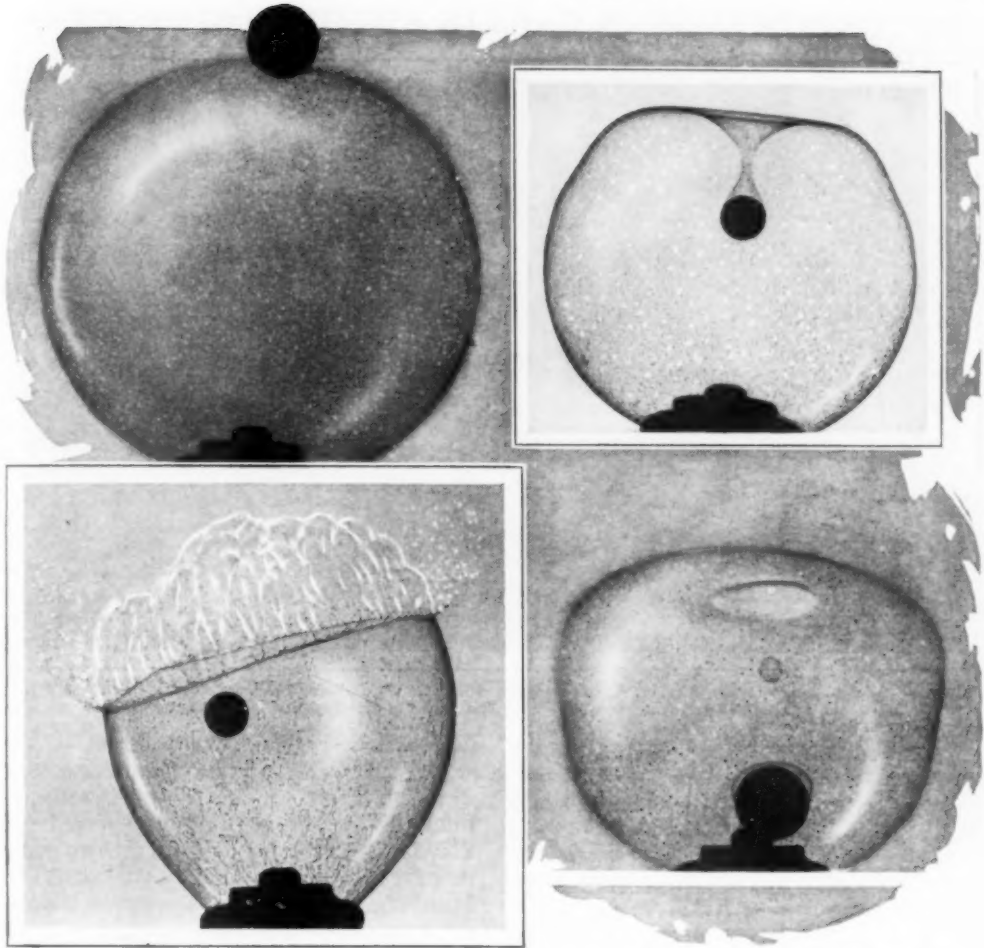
ining the reflected beam, even many miles away from the reflecting body, we can tell something about the material of the reflector. In fact, some scientists have attempted to gain by this means an idea of the different materials composing the surface of the moon. The moon shines by reflected sunlight, and the idea is that the light reflected from different areas of the moon's surface may, by its characteristically altered quality, betray the nature of the material which has reflected it.

"How thin is this black spot in a bubble, and what sets a limit to it? Why cannot a bubble thin out indefinitely? These questions lead to one of the most interesting things which a bubble can teach us. Water is made up of molecules, particles so inconceivably small that a soap bubble when freshly formed may be many molecules thick. But as the film thins out it is gradually reduced to a thickness of but a few molecules; and obviously this process cannot go on forever. The film cannot be less than one molecule thick. Any further thinning out is bound to break the bubble.

"Every liquid acts as though it were incased in a stretched elastic skin. Liquids in quantities such as ordinarily handled do not show this property because so much of them is inside and so little on the outside, and the surface properties are



Soap Bubbles Are Blown inside the Steel "Bomb" and Then Exploded While the Slow-Motion Camera Records the Result



Dropping a Steel Ball into a Soap Bubble; the Bubble Surface Is Bending, but Not Broken, in the Upper Left Picture, Has Been Flattened in the Second, and Broken in the Third and Fourth

masked by the properties characteristic of the inside. But a soap film is nearly all surface, and very little inside, and the contractile property of the surface becomes evident. This contractile property (surface tension is its scientific name) is responsible for a great many happenings in nature. It is the cause of the globular shape of a dew drop, for instance."

FOOD AS MEDICINE

Nourishing food and plenty of it, is regarded as one of the most beneficial "medicines" used in treating nervous and mental diseases at a Louisiana hospital. Some of the violent inmates, whose activity burns up so much energy that it is almost

impossible to keep them properly nourished, are fed as often as seven times a day. A basis for the treatment is the theory that good physical condition leads to mental recovery.

PLASTER CUTTER BORES HOLES WITHOUT MAKING DUST

To make round holes in plaster for electrical and other installations, a saw-tooth cutter now on the market is said to per-



form the task quickly and efficiently. A special feature is an apron that prevents dust from falling into the workman's eyes or upon the floor.

MOTORISTS SHOP IN CARS IN AUTOMATIC GROCERY



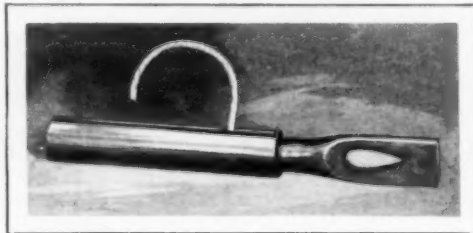
Interior of the Automatic Grocery in Which Persons Select Goods without Leaving Their Cars; Cans Are Displayed on Revolving Shelves within Reach of the Purchaser as He Rides By

"Drive in and do your shopping," is the message of an automatic grocery to motorists. The customer can make all his purchases without getting out of the car or even opening the door. One side of the store is devoted to a driveway with curbs on each side of the track, to guide the car so that the driver does not have to touch the wheel. A turntable at one end, swings the car around to enable its return on the other side of the store. Goods are displayed on slowly revolving shelves. The purchaser picks them off as he wants them and places the articles in a metal container moving on a conveyor that takes them to the cashier, where they are sacked and handed to the buyer after payment as he drives out. Only four men are required to operate the store, the cashier, a butcher, a man to run the turntable and another to keep the display shelves filled. Particular care has been taken in planning the ventilating system.

Large fans, revolving in ducts along the walls, keep the air in circulation and draw off gases produced by the automobiles. In the rear of the building are large double doors which may be thrown open in case of fire, to permit rapid exit. The butcher shop is the only part of the establishment that does not operate automatically for the simple reason that, so far, no mechanism has been found that will slice off a desired quantity of meat, wrap it and hand it to the customer.

EXPLODING WEDGE SPLITS LOGS SAVING HAND LABOR

To save time and labor, an exploding wedge has been introduced for splitting logs. It has a chamber into which a charge of powder is poured and set off by means of a fuse. The wedge may be used repeatedly, as the explosions do not damage it, and the process is safe and



Wedge with Powder Chamber for Splitting Logs

certain, it is claimed. The wedge also may be used effectively for the splitting of stumps, thus facilitating their removal considerably.

WHISTLES ON CARRIER PIGEONS KEEP HAWKS AWAY

Light bamboo whistles, strapped to the tails of carrier pigeons are proving effective in protecting them from hawks and other birds preying on the useful messengers, army signal-corps officers report. The whistles blow of themselves as the pigeons fly rapidly along, and the noise tends to frighten the birds of prey. The plan is an innovation in this country, but has been used for many years in China.

ARTIST USES VACUUM CLEANER AS PAINT BRUSH

The household vacuum cleaner has been adapted to artistic as well as useful ends by a Cleveland artist. She sprinkles flour on a piece of carpet and then, by using the window-drape attachment of the cleaner, removes portions of the flour to create different designs and figures. She has



Drawing Portrait with the Vacuum Cleaner; Window-Drape Attachment Is Used to Remove Flour

developed considerable skill in portraiture with this method. The flour is worked into the nap of the carpet to prevent it from falling off, and the carpet may be left on the floor or tacked to an easel. The results are rather pleasing in effect.



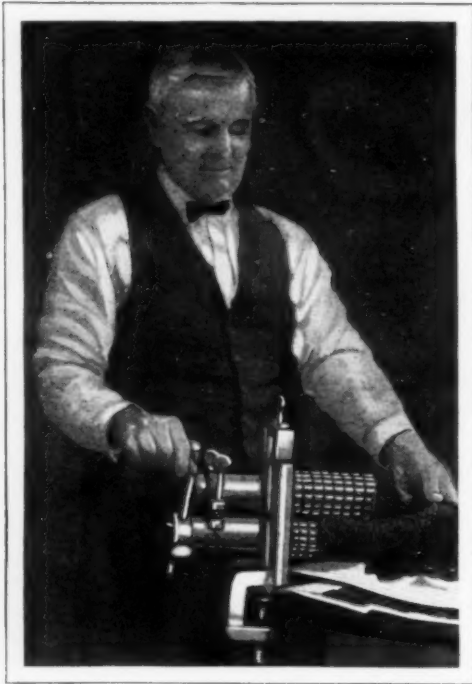
Drift Indicator Used on the "Southern Cross" to Help in Its Flight across the Pacific; Plane's Position Is Gauged by Shadow of Wire on the Lined Board

WIRE'S SHADOW GUIDES PLANE FLYING ACROSS SEA

The shadow of a slender wire was one of the aids that helped the crew of the "Southern Cross" in reaching their destinations across thousands of miles of sea. The shadow fell across a special drift indicator that served essentially as a compass without the usual magnetic needle. The unit is a semicircular metal plate, mounted horizontally on the fuselage and graduated in degrees. At intervals on the degree lines are holes into which an upright post, carrying a vertical wire, is inserted. The navigator places the post in the hole at the end of the proper degree line according to his course, so that the shadow of the wire falls on the center of the scale. By observing when the shadow falls to one side or the other, and measuring the degrees of departure as indicated on the gauge, the pilot is able to tell the number of degrees the plane drifts from its course.

☐The Popular Mechanics Bureau of Information offers its free service to all readers of this magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession, will be promptly furnished upon application to the bureau.

WRINGER MAKES MEAT TENDER WITHOUT TEARING IT



Putting Steak through the Corrugated Wringer, to Make It More Tender

To make the steak tender, a wringer with special rolls has been introduced as a substitute for the usual hammers or choppers. The meat is not torn as it passes through, and the rolls are adjustable to different degrees, according to the thickness of the meat.

JUNGLE FOWL HATCHES CHICKS IN LONDON ZOO

For the first time in forty years, chicks have been hatched by the jungle fowl of Ceylon at the London zoo. This is considered remarkable as the birds have never done this in captivity in Ceylon. All domestic fowls are supposed to be descendants of the jungle variety, but the Ceylon bird has a number of peculiarities. For instance,

the cock does not crow as does the domestic rooster, but merely stretches on its toes and makes a weird cry as though calling a person by name. The tones resemble the spoken words "George Joyce," and the sound is repeated several times.

WHY GLOWWORMS GLOW

Why does a glowworm glow? Scientists cannot answer the question with certainty, but the light is believed to be caused by emanations possibly similar to X-rays, as it penetrates various substances. Apparently, the illumination is generated with the act of breathing. There are more than 500 glow-producing insects, the familiar glowworm being a species of beetle and not a worm at all. The purpose of the light is also a mystery. Some scholars believe that it helps the insect find its way, that it scares enemies away or lures on smaller insects to be devoured as prey.

POTATO DIGGER AND SACKER SAVES HAND WORK

Potatoes are dug and sacked by a single unit that will harvest from 600 to 800 bushels a day, performing labor equivalent to that ordinarily done by seven or more men. As the potatoes are removed from the hills, they are passed into the bags by means of an elevator. One man picks out the weeds and other foreign matter, and another manages the sacks, while a third drives. According to reports, potatoes are bruised less with this harvester than in the usual way of gathering them by hand. The parts are lined with rubber to protect the tubers.



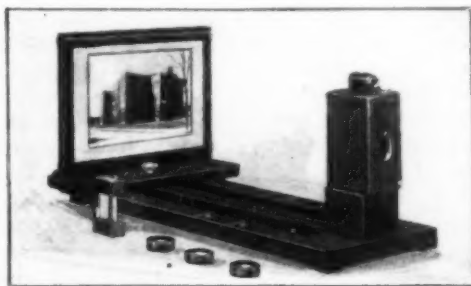
Digging Potatoes and Sacking Them in One Operation; the Outfit Will Harvest 600 to 800 Bushels in One Day

**QUAKE UNCOVERS
GEMS BURIED IN
OLD TOMB**

Fifteen beautifully carved jade objects slid out of an ancient tomb in the mysterious mountain city of Monte Alban, Oaxaca, Mexico, the other day, giving scholars possible further clues as to the origin of the Mayas and indicating that other treasures may be buried in this crumbling town that long has been a riddle to explorers. The tomb was cracked by a violent earthquake that shook the entire state. Faces and other details carved on the jade articles pointed back to early Mayan times, suggesting that the city of Monte Alban may have been a forerunner of the later cities that flourished farther south. Monte Alban crowns a mountain ridge 1,000 feet high, and today is a huge pile of pyramids, terraces, sunken courts and old fortifications. No one knows why it should have been built so high above the green valley below, as no other ancient cities of the region are found similarly located.

**SMALL-SIZE CAMERA COPIER
HAS THREE LENSES**

Used with a small camera that takes fifty exposures on one loading, a copying outfit has been introduced to simplify the task of making reproductions of prints, drawings, etc Three extra lenses are furnished with it.



Copying Outfit for Camera Which Takes Fifty Exposures on One Loading

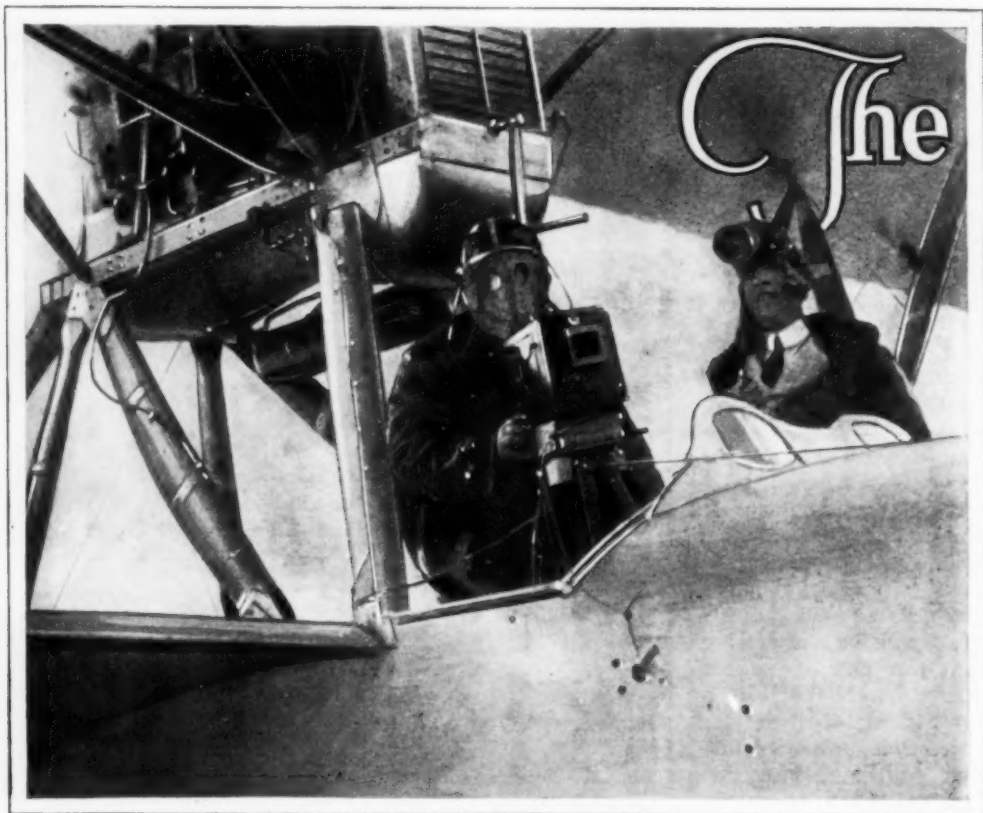


Bottom Up, the Cruiser "Moltke" Is Being Towed In for Dismantling and Salvaging as Steel Scrap

**CRUISER SALVAGED BOTTOM UP
FROM ENGLISH CHANNEL**

Scuttled by the Germans during the war, the cruiser "Moltke" has been raised from Scapa Flow and towed to port to be broken up and utilized as scrap. In salvaging, the big warship was turned completely over so that it was brought in bottom up. The broad bottom of the hull afforded ample space for workshops.

☐ Nearly one-third of Europe is covered with forests.



Umberto Romagnolo, Rome Photographer for an American News Reel, in the Plane in Which He Flew over Vesuvius during an Eruption, to Film the Boiling Fire Pit from the Air

By BERYL D. and ORVILLE H. KNEEN

CLARENCE Chamberlin is more than a member of the "transatlantic hoppers." He is a graduate in the newest fine art of flying photography. For five years before his greatest flight, he shot news pictures from the air. Harry Schoenhals, of New York, recalls that he worked the camera while Chamberlin piloted, in the days when low flying was essential to obtain sufficiently clear views.

"One day," Schoenhals relates, "while we were air cruising, we spotted burning woods toward Hoboken. We soon arrived in our Morse single-seater, an old stunt ship, where clouds of smoke revealed a great fire. I sat astride of the gas tank, high up behind the pilot.

"As Chamberlin drove into the huge column of flames and smoke, the draft, like that of a huge chimney, suddenly tossed us hundreds of feet into the air. Then it dropped us like a chunk of lead.

Chamberlin stepped on the gas, then looked around, certain that he had lost me, as there was no way of strapping me in. I was still there, but had nearly squeezed a leak in the tank with my knees. Later on he almost flew into the flames. I yelled: 'You're flying pretty low, aren't you?' He never batted an eye—all he said was: 'And you're getting pictures, aren't you?'"

All flying cameramen are oblivious of danger, as long as they are getting pictures. Chamberlin learned how to release his joystick and to take his own pictures, a stunt few pilots would undertake. Once he shot a motion-picture reel and dropped it to be picked up. The reel caught on the tail of his plane, and he had to go through his entire bag of acrobatics before he could shake it off. When it dropped it landed miles away. He took views of storm wreckage on Long Island

Flying Cameraman

while he was testing the "Columbia" for its long hop.

It was the Frenchman Montgolfier who made the first bird's-eye view possible to earthbound men, just 145 years ago. As he soared a few hundred feet on that first daring balloon ascension, no doubt he longed for a means of recording the marvelous picture of field and city and sea that spread under his feet. But not till the Wrights invented wing warping and a controllable plane, did aerial pictures become feasible. The telephoto lens is only a few years old.

Comm. Richard E. Byrd, on his scientific expedition to the Antarctic, will be the first polar explorer to bring back a complete photographic record of the regions he traverses.

"We are planning to take a special mapping camera," he said recently, "which will take photos as we fly over the Antarctic at 100 miles an hour. This camera will enable us to obtain pictures of a strip of the continent eight miles wide. The pictures may reveal unknown mountain ranges. We want to put something on the maps where now there is just a big white space. We shall look into regions never seen before."

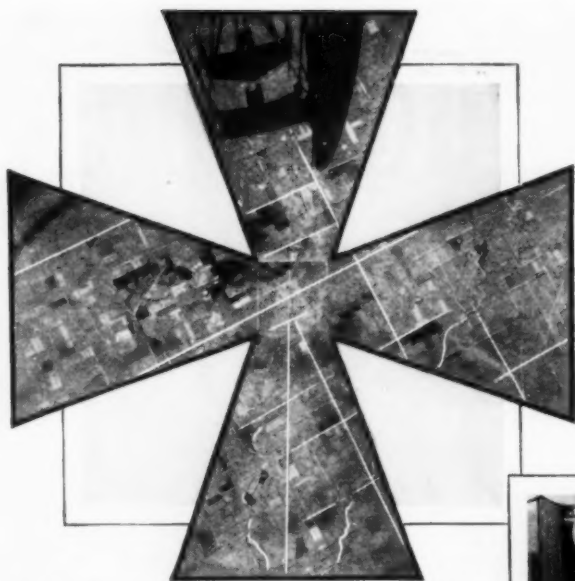
Thus for the first time we at home shall see with the eyes of a bird or a pilot the vast wastes of dazzling snow and ice—probably enormous icebergs, a half-mile in depth and five miles long. Man-made wings and the "recording eye," two marvels of the age, have brought into being a new profession requiring the highest daring and skill—the flying cameraman's.



There are scores of these photographers who do not hesitate to crawl out on a wing, hang on to a strut, even balance themselves by merely straddling a wire brace. Frank Jacobs told of taking the first aerial views of Seattle, sitting on the edge of a wing and dangling his feet in space. This on a plane so old it was expected to "crack up" at any trip.

An Irish Cameraman, Suspended from a Balloon, "Shot" the Start of the "Bremen's" America Flight

Marine disasters, such as that of the "S-4," offer plenty of hazards to the camera-



Single Exposure of a Hundred Square Miles of Ohio, Made with a New Five-Lens Mapping Camera, Above, and, at the Right, a New Electric Mapping Camera Which Is Used in England

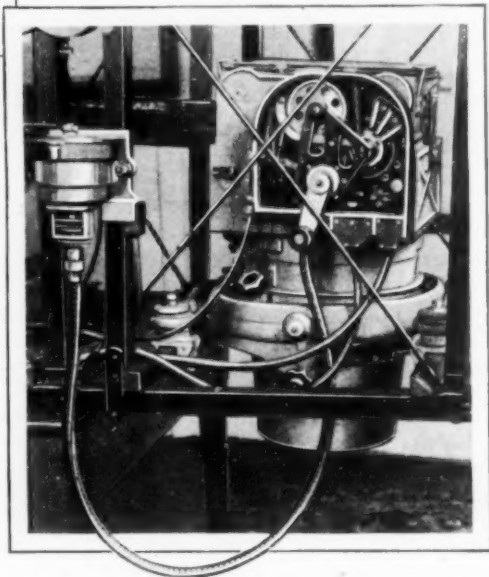
man. When the "S-51" went down off Block island, Martin McEvilly was sent by a New York newspaper in a land plane. Forty miles from land—and safety—they circled and swooped and tilted. His paper got a "beat" of five hours on the pictures, and for a week McEvilly made a flight of 176 miles daily, 1,050 miles in all, to picture the salvage work. A stalled motor would have meant a plunge and oblivion.

Greater calamities now mean flocks of planes sent by the big news agencies and news-film concerns. Norman Alley made numerous flights over the flooded Mississippi basin, where no safe landing could be made. He not only got some very fine pictures, but spotted refugees and even dropped food to some. News films during the early stages, shown to the president and the cabinet, proved the necessity for prompt relief.

Alley was staying overnight in Pittsburgh, on his vacation, when the dirigible "Shenandoah" was wrecked in a storm. In the middle of the night he received a wire, rushed out, doubled the price for the only airplane available, which reporters had already hired, and zoomed into the air. Twenty miles from his destination the plane crashed. Alley crawled out, dusted himself off, routed out the owner of a fast

car, and reached the crumpled gas bag hours ahead of any other cameraman. Scores of others flew to the scene, and some crashed, while several, on their first trip, were airsick. But they all got good pictures.

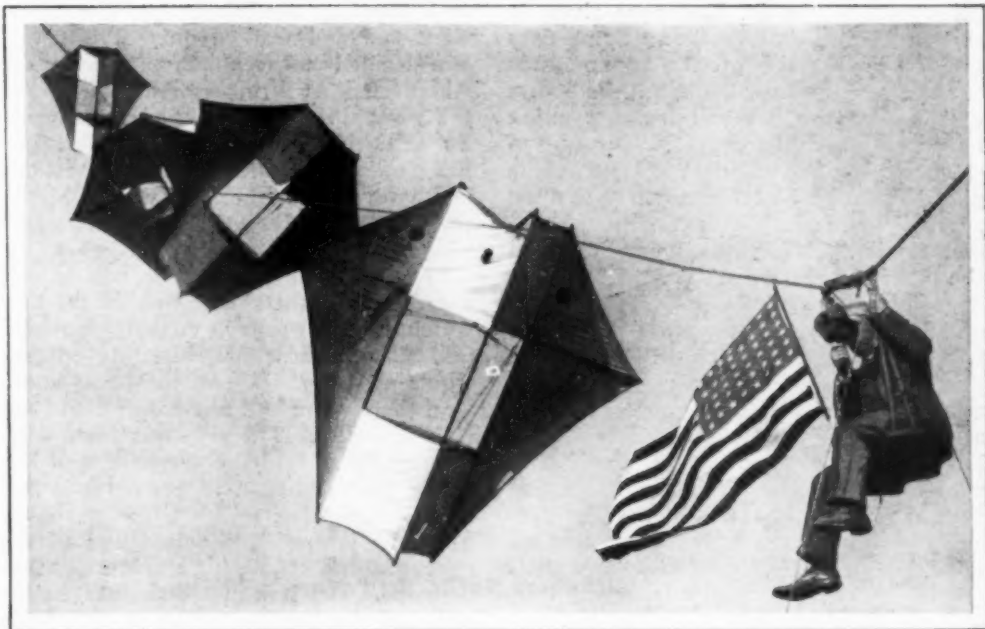
Few who see movie or still pictures of dangerous stunts realize that the photographer may be experiencing even greater hazards. When the famous parachute jump of Sergeant Boes was made, John A. Bockhorst, news-reel man, had to "shoot" the falling body from another plane. He had to ride astride a slender bar in the bomb



pit, his camera lashed to another bar, its nose pointing downward. If he had lost his balance, he would have plunged 3,000 feet to the earth.

As Sergeant Boes stepped off, Bockhorst started grinding his camera. His pilot pointed the plane's nose straight downward, paralleling the swiftly falling body of Boes, who dropped 1,500 feet before he opened his parachute. Thus Bockhorst made pictures which have never been equaled, for it was the first and only time that anyone tried to fly straight downward for such a distance—an extremely hazardous stunt.

Bockhorst met the army round-the-world flyers in Maine and accompanied



Movie Cameraman Aloft, Attached to a String of Box Kites to Film a Fair; Box-Kite Flying, Once Used in Army Observation Work, Is Almost Passe Nowadays

them to Seattle. He has flown across the continent several times, and went with the air expedition to the Panama zone, being lost with it for several months in dense jungle. Recently he varied his stunts by flying through the Grand Canyon of the Colorado, where the slightest touch of the wings on the sides of the great chasm would have meant disaster.

Aerial pictures have been taken of the eruptions of Mt. Vesuvius, of the Miami tornado, and similar hazardous events. It is even proposed that Mt. Everest be photographed, to aid future climbers. When pictures were made at Teller, Alaska, as Amundsen's dirigible landed from its north-pole flight, a photographer carried them by plane to Nome, thence over the highest range of mountains on the continent to Juneau. They were placed aboard a vessel just leaving for Seattle.

But 300 miles before they reached Seattle, T. G. Randolph took them off by airplane, made prints at Seattle for the papers there, and then flew to Elko, Nev., to catch the air mail for the east. By these devious and highly hazardous maneuvers, a beat of several days was made.

The same company had Robert Hartman at Spitzbergen when Comm. Byrd re-

turned from his north-pole flight, who also snapped the take-off of Amundsen twenty-four hours later. By some unexplained means, Hartman induced a Norwegian gunboat at Spitzbergen to take him and his precious films to Oslo, where he hired an airplane and flew over snowclad ranges, crossing Sweden, Denmark and the Baltic into Germany. From there he made a non-stop flight to Southampton, England, arriving just in time to place the pictures aboard a liner pulling out for New York.

Aerial-surveying (photographing) concerns permit flying only in perfect weather, with planes in tiptop condition. Thus they have few accidents. A large firm in New York reports never having had a serious accident, and only one of any kind. But two of the most mysterious accidents of record befell aerial-survey parties. Last July, a Canadian government machine, near Lake Manitoba, was seen to enter a cloud bank. When it emerged it acted erratically, and suddenly three bodies came hurtling from the plane, falling a thousand feet in a few seconds. The machine was wrecked in a nose dive. The engineers were experienced and careful.

Count de Lesseps and his mechanic, also on an aerial-survey trip, disappeared com-

pletely along the St. Lawrence river, in the eastern part of Quebec. Some days later the wreckage of their plane was found along the river bank, but the bodies of the noted airman and his companion have never been discovered.

These are exceptional cases, but the photographer who takes to the air must accept hazards rather heavier than those of the pilot. Even the stunt acrobat and the plane changer have their hands to use in maintaining their hold, while the cameraman usually must have both hands free to operate his machine. When the plane swoops over such a raging inferno as at Lake Denmark at the time the naval arsenal blew up, with fourteen-inch shells bursting and enormous dumps going up with a roar, the photographer can make good use of his "charmed life."

Probably the medal for narrow escapes goes to Eddie Dowling, who was a lieutenant in the air service during the war, and was later assigned to get official pictures of the aerial bombing of the "Iowa" and other obsolete vessels off Hampton Roads. He was operating from the "D-2," a lighter-than-air craft from Langley field. "Off Cape Charles on our way home,"

said Dowling reminiscently, "the motor went bad and worked only at intervals. We decided to free-balloon as far as Aberdeen. At Princess Anne, however, the wind shifted and carried us seaward. So we decided to try to land. We saw a ball game going on, and dropped messages and a rope. But the high wind whipped the rope across the field and the two men who did grab it were flung flat.

"The only thing left to do was to pull open the rip panels placed under the bag, which, when opened, convert the ship into a huge parachute. Letting out gas would not help. One of the pilots and I worked hard on the ropes, but could not rip the panels. The ship was then drifting rapidly toward the seashore, and one of the officers began to get nervous and impatient.

"So he jumped and seized one of the rip cords, and swung his whole weight on the rope. The jerk pulled the panel clear out, and the big bag broke in two. We hit the ground a few seconds later, the wreckage on top of us. When I came to, with the radio set in my lap, I was so sure my bones were all broken that I did not dare move.



Clarence D. Chamberlin, Pilot of Charles Levine's New-York-to-Germany Plane, as a Cameraman; Aerial Cameras Shoot Straight Down or over the Side, as in This Case

"Just then a farmer came running up and inquired in earnest tones: 'Do you fellows always come down like that?' I was the only man aboard who was unhurt."

The aerial cameraman flies "high wide and handsome," but he has a good time just the same, and he gets the pictures!

NAVY TO TEST FOUR THOUSAND SUBMARINE SAFETY IDEAS

Sixty thousand proposed inventions to make submarines safe, the product of the brains of more than 6,800 people scattered all over the world, were submitted to the navy following the sinking of the "S-4" last December by the coast-guard destroyer "Paulding." This fact was disclosed recently when the navy department, in accordance with an act of congress, appointed a board to study 4,000 of the ideas which were considered worthy of investigation and, possibly, actual trial. The "S-4," reconditioned at Boston navy yard, has been set aside as an experimental ship and turned over to the board, with authority to try out on it any of the devices which appear practical. Congress appropriated \$200,000 for the work.

WHISTLE ON TIRE AIR GAUGE STOPS OVERINFLATION

As it can be adjusted to sound a warning whistle at any predetermined pressure from twenty to sixty pounds, a patented pressure gauge eliminates the necessity of making a separate test. The adjustment is obtained by turning a graduated sleeve on the handle. In use, the head of the gauge is slipped over the tire valve, while the air-hose valve is pushed down on the top of the gauge. When the pressure inside of the tire corresponds to the reading on the gauge, a whistle warns the user to remove the hose.



Pouring Water over Waterproof Silk Hose, to Demonstrate Their Protection from the Wet

WATERPROOF SILK STOCKINGS LATEST LUXURY

Silk stockings, specially treated so that they will shed water, were demonstrated recently in successful tests. Besides helping to protect the health of the wearer, they are said to be more easily kept clean.

OLD BUILDINGS ARE SAFEST FROM VIBRATION

Alarmed by the peril to some of London's most famous historical buildings from the constant vibration of modern traffic, engineers have installed vibration recorders in Westminster Abbey, St. Paul's Cathedral, the Nelson Column in Trafalgar Square and the National Gallery to determine the extent of the danger and plan measures to offset it. The increase in automobile traffic, particularly of heavy motor busses, and the vibration from the subway trains have set up stresses the buildings were never designed to stand. Strangely enough, according to H. V. Lancaster, a London architect, the modern steel-frame buildings are giving more alarm than the older ones. The old buildings of brick and stone are so loosely built that they absorb much of the vibration.



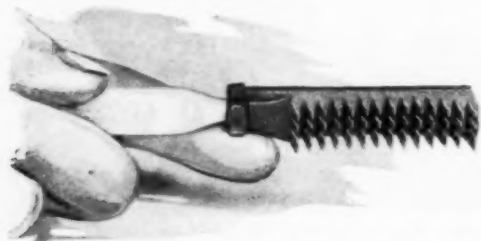
Recalling the Early Days of Motoring; the Rear-Exit Car, Showing How Passengers in Back Seat Are Accommodated

AUTOMOBILE WITH REAR DOOR GIVES BACKWARD VIEW

Easier exit and entrance and elimination of the "back-seat driving" problem are claimed for an automobile equipped with a rear door at the center. The rear seat also faces the back so that the occupants cannot see the road ahead and are not tempted to make suggestions to the driver. They have an unobstructed view to the rear through the glass of the door and the windows on either side of it.

TOOTHBRUSH MADE OF RUBBER MASSAGES THE GUMS

Instead of the usual bristles, a toothbrush now on the market has wedge-shaped rubber "fingers" from which foreign matter is easily removed, insuring cleanliness at all times. They will not come out and are also said to have a beneficial effect on the gums.



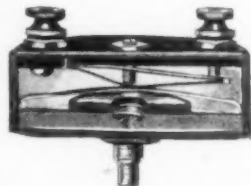
Easily Cleaned and Beneficial to Gums; the Toothbrush with Rubber "Fingers" Instead of Bristles

ANTI-TUBERCULOSIS VACCINE SAVES BABIES' LIVES

Use of a special vaccine as a preventive of tuberculosis, has been found effective after administering it to nearly 9,000 infants of tuberculosis parents, according to reports. It is known that twenty-five per cent of the babies born of and living with parents so afflicted, normally die during the first year of life. But of the number of infants treated with the vaccine, only 1.8 per cent died of tuberculosis. Apparently, the vaccine saved the lives of 2,088 babies. In preparing the substance, experiments were made on manlike monkeys in their natural habitat in Africa. Human conditions were reproduced as nearly as possible, and the protective value of the vaccine was firmly established, it is said.

AUTOMATIC STARTER CONTROL PROMOTES MOTOR SAFETY

To restart the motor without removing the feet from the pedals, an automatic control has been introduced to promote greater



safety and convenience in driving. It is designed to fit on all makes and models of cars having the bendix or electric type of starter and consists of but three parts. A magnetic contactor, attached to the starting system, automatically connects and disconnects the battery and starting motor and, in turn, is automatically controlled by the engine and the operation of the clutch pedal. A vacuum or governor switch, operated from the natural vacuum of the motor, is mounted on the intake manifold of the engine and automatically controls the magnetic contactor, keeping it from operating when the engine is running. The entire apparatus is easily installed.

PAPER COVERS OVER GARDENS HELP PREVENT WEEDS

By the use of a paper mulching system, demonstrated by the department of agriculture, weeds are kept from growing in fields and gardens. The paper is made of an asphalt preparation to render it impervious to water and is applied in narrow strips between the rows. It helps prevent evaporation from the soil, aids in maintaining a more even temperature and is said to increase the fertility of the ground. Spinach, sweet potatoes, beets and other products have been raised in this way with notable increase in yield.

NOVEL FLOAT TESTS FLYING ENGINES ON WATER

Tests of the assembly and gearing of pairs of English-built Bristol Jupiter engines for a huge new Dornier Super-Wal flying boat, being built in Switzerland, have been carried out on a novel hydroplane, used as a floating test bed. The pairs of engines, one equipped with a tractor and the other with a pusher propeller, were mounted on a dummy engine nacelle, just as they will be in the airplane. A pilot, seated below the engine mount, handled the boat, while a mechanic riding above him carried out the test work on the motors. Two and four-engine Dornier flying boats have been built in numbers, but the plane now under construction is to have twelve motors. The Jupiter is the largest and most widely used radial air-cooled engine in Europe, being built both in England and at several licensed factories on the continent.



The Floating Testing Ground for Airplane Engines; Hydroplane with Motors Installed for Trial Run



Carrier Packed and Unfolded as a Table; If Desired, Long Legs Are Furnished for Standard Height

CAMPING TABLE AND CARRIER COMBINED IN ONE

For the convenience of automobile picnickers, a holder for the luncheon, and other things, is quickly converted into a small dining or card table. It is easily carried in the car and is also furnished with standard-length legs, if desired.

JUDGING THE WIND'S SPEED

When the tree leaves are still, there is no appreciable wind, or its speed is usually less than two miles an hour. Faintly stirring leaves indicate a wind speed of about five miles an hour. When the branches move slightly, the speed is nearly ten miles an hour and, if they bend a little, the wind is moving in the neighborhood of fifteen. A twenty-mile wind will cause the branches to rock and sway. At twenty-five miles leaves will sometimes be blown from the trees, and when small branches are broken off, the rate is thirty-five miles an hour or more.



LOCK HOLDER FOR MILK BOTTLE PREVENTS THEFT AND DIRT

To keep the milk bottle safe and sanitary until it is taken into the house, a lock container has been introduced. The bottle is inserted through the bottom and is securely held by springs that close over the neck ridge and prevent it from being drawn out except at the top. This is unlocked with a key. The holder is easily attached in any convenient position, is made of heavy metal and is quite attractive in appearance.

RADIO SAVES SCORES OF SHIPS IN GREAT LAKES STORMS

Radio, the modern right arm of the lighthouse, saved more than forty ships on the Great Lakes during the past year, according to the department of commerce. The radio compass is taking most of the danger out of navigation, particularly on the lakes, which are swept by wireless signals from twenty radio-beacon broadcasting stations, serving 300 vessels equipped

with receiving apparatus. Four times each day, regardless of weather conditions, these stations send out messages for a half-hour period on a wavelength of 1,000 meters, far above the channels used for entertainment broadcasting, to eliminate interference. The compass includes a loop antenna over the ship's pilot house with axis extending downward and carrying sight wires over a compass in the house. The loop is connected to a radio receiver and can be revolved by the observer swinging the sight wires over the compass. After picking up the station, the observer turns the loop and notes the varying strength of the signals until a point is reached where they are lost entirely or nearly so. At this point, the loop is perpendicular to a line connecting the ship and the station heard and the sight wires are placed so that they point directly to the station. By referring to the compass beneath the wires, the observer is thus able to get his direction from the station.

QUICK-ADJUSTING WRENCH FITS TEN SIZES OF NUTS

For quick adjustment, a wrench now on the market, is fitted to the nut by means of a notched spring release and catch which is arranged to work on ten different sizes of nuts for each wrench. This plan saves turning a screw and gives an exact fit that prevents slipping. There are three different sizes of wrenches so that the set is equivalent to thirty wrenches.



Three Wrenches Equal to Thirty; the Different Sizes and Method of Adjusting to Fit the Nut

How to Stop Without Skidding?



Tuning Up Midget Models for Spins down an Inclined Plane: the Bureau of Standards in This Way Studied the Cause and Effects of Skids and Discovered the Remedies

By G. H. DACY

IN ORDER to eliminate the millions of motoring accidents due to skidding from the American records, Uncle Sam is playing a novel laboratory game with midget models and a simulated hill whose steepness can be varied.

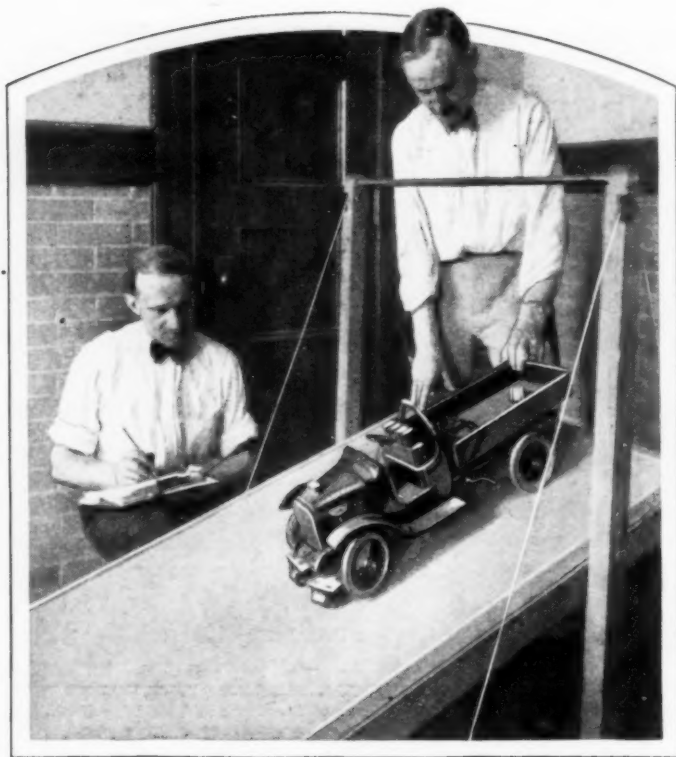
Automobile pivoting, as you know, is one of the most serious menaces of modern cross-country transportation. The majority of spills and smash-ups during wet, slippery weather are due directly or indirectly to skidding. If science can solve the secret of skidding, subsequent publicity will educate drivers about practical control measures, and this frightful annual loss in life and limb can be blotted from the motoring picture.

Even today, the automotive industry knows but little about motor-car pivoting, its causes and control. It is a question which has given rise to innumerable undemonstrated viewpoints. So the national engineers devised an adjustable imitation hill whose angle or grade could be changed rapidly by lowering or raising control cables. The midget motor cars used in the

practical experiments are toy models. Their skidding, scooting, sliding spins down this inclined plane with brakes in various adjustments imitate the pivoting and pirouetting of automobiles which descend mountainsides during wet weather to crash in dangerous accidents.

One of the test cars is a metal model of a truck. Its wheels are equipped with rubber tires and have small electric magnets which act as instantaneous brakes on each wheel. The arrangement is such that the toy truck can be started by gravity down the inclined plane and then, by manipulation of the magnets, maximum braking power can be applied to the various wheels. Three smaller models with free-turning wheels, which are braked with pieces of wire or wood, have also been used in these simple tests.

The plane is covered with white paper over which carbon or ordinary tracing paper is placed in the tests with the three models. Their metal wheels thus write a permanent record of the course of the car in each descent under different brake ad-



Toy Automobile Equipped with Electric Four-Wheel Brakes for Government Tests of Cause and Effect of Skids

justments. These diagrams have brought to light important information about motor-car pivoting.

The maximum skid results when the front wheels of an automobile are turning and the rear wheels are locked suddenly by emergency braking. Although the center of gravity of the car will continue along a straight course during the resultant pivot, the rear wheels, acting as rubber-mounted skids, will carry the machine through a curve of 180 degrees—or more. At the end of the skid, the car will be pointing uphill, having completed a half turn during its pivot. Skids made at high speed on a very slippery pavement are even more dangerous. The tests show that there is no way of predicting in which direction the car will skid.

The government specialists have ascertained that by applying from sixty to seventy per cent of the braking power to the front wheels, on a car equipped with four-wheel brakes, and the balance to the rear wheels, skidding can be eliminated at the

momentary sacrifice of steering control. These laboratory results have been verified by road tests made with several different makes and models of automobiles. Where the majority of braking force is concentrated on the front wheels of an automobile traversing a very slippery highway or curve at a speed of twenty-five to thirty-five miles an hour, the car will not skid when the brakes are applied suddenly, but will continue straight forward in its course until the brake control brings the machine to a standstill.

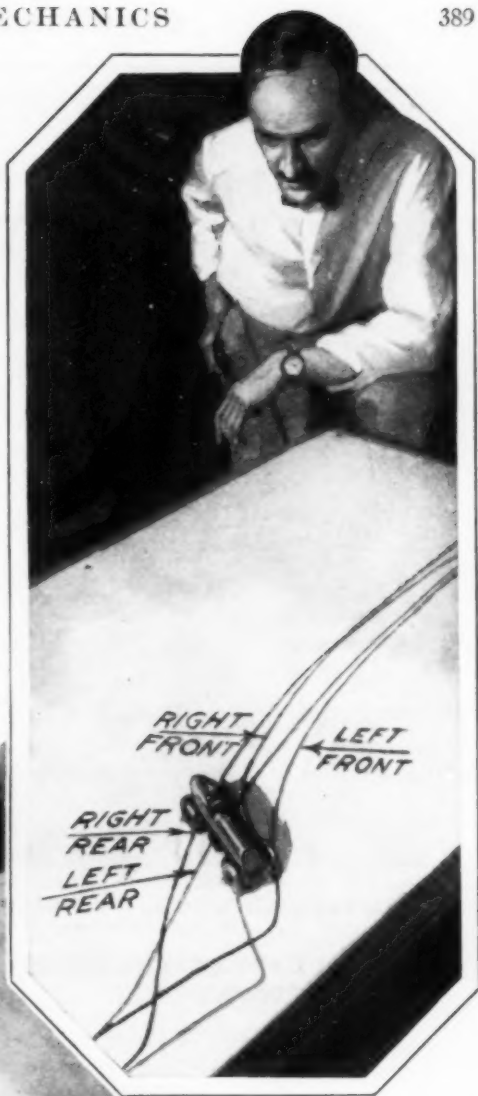
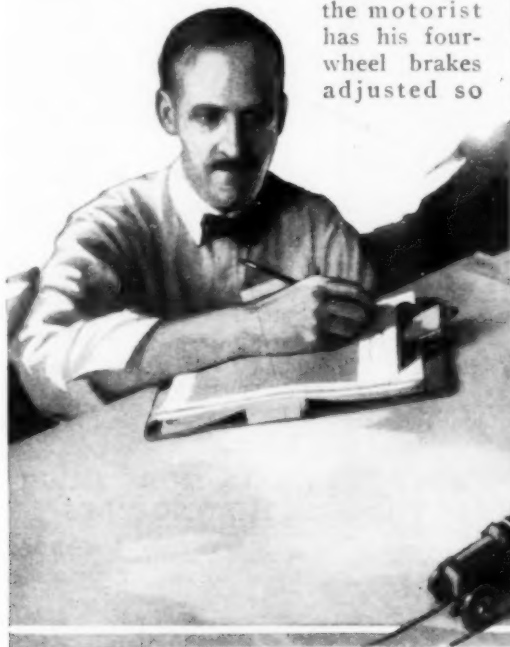
The popular objection among automobile drivers to dominant front-wheel braking is that it results in a temporary loss of steering control. The national authorities, who are deeply interested in the reduction of motor-car

mishaps, answer this objection by saying that steering control can be regained immediately, in the case of an emergency, merely by releasing the brake and steering the car in the desired direction away from any dangers that may occur in its straight-ahead path.

Inventors for several years have been occupied in the perfection of various appliances designed to control motor-car pivoting. Several devices have been originated that function satisfactorily, but which are so complicated and costly that their use as standard equipment on ordinary automobiles is out of the question. One man has even gone so far as to invent a contrivance which is qualified mechanically to shift the majority of braking power from the rear to the front wheels, and vice versa, simply by pulling a control like the gasoline choke on the ordinary automobile instrument board. Uncle Sam's research indicates that the adjustment of four-wheel-brake cars so that the preponderance of power is centralized

on the front wheels is practical, efficient—much to be preferred to, and far less costly than, the installation of such emergency accessories.

The experiments were also productive of important information for the owner who drives an automobile equipped with two-wheel brakes. If his car skids on a curve, or because of a slippery pavement and the sudden application of rear-wheel brakes, Uncle Sam recommends that the driver steer his machine in the direction it skids. The natural tendency, which has resulted in untoward accidents, is to steer in the opposite direction to that of the pivot. This tends to increase the skid and spin of the car wheels. On the other hand, if the driver steers in the direction of the skid, the bearing surfaces of the front wheels aid in curtailing the severity of the pivot. Where the motorist has his four-wheel brakes adjusted so



Above, with Rear Wheels Locked on a Steep Grade, the Model Skids and Comes to a Stop Facing in the Opposite Direction, Whereas, with the Braking Force Mostly on the Front Wheels and the Rear Ones Free to Revolve, It Continues in a Straight Line Until It Stops

that the maximum braking force is directed on the front wheels, he must drive his car more carefully during dry weather. If the brakes are applied suddenly at ordinary driving speed, the car will come to such an abrupt halt as to hurl any passengers from their seats. Another danger comes from the trailing car which is unable to stop as quickly as the machine with extra-power front-wheel brake con-

trol. This may mean a collision from the rear, if the driver of the first car applies his brakes suddenly without due warning to the motorist in his wake. Mastery of dry-weather driving, with four-wheel brakes adjusted as the national experts suggest, requires some little practice. Drivers who have tried out the new system are most pleased and report it a practical step toward control of skidding.



Dropping Big Torpedo from War Plane Which Can Carry More Than a Ton of High Explosives

TORPEDO CRAFT OF THE SKIES LATEST WAR UNIT

An airplane developed in Great Britain, can carry a torpedo weighing a ton besides several bombs, according to reports. It has a speed of 150 miles an hour, can remain aloft for twelve hours with a full load, takes off after a run of only fifty yards and will ascend almost vertically.

HOOK KEEPS CLOTHESLINE TAUT AND IS RUST-PROOF

Clotheslines are kept tight, without the need of tying knots, with a pair of holders recently introduced. They are made of steel, are plated with a rust-proof metal, fit a flat or rounded surface and are



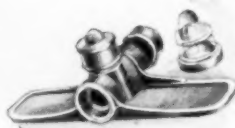
suited either for indoor or outdoor use. A slotted hook and curved guards keep the rope taut, prevent sagging and help preserve the line by eliminating kinks.

THOUSAND-FOOT SHIP TO COST 30 MILLION

A White Star liner, over 1,000 feet long, with a beam of 100 feet and tonnage of 60,000, will be ready for ocean travel at some future date, the keel already having been laid in a Belfast shipyard. The vessel will cost \$30,000,000. Engineers have not yet decided as to exactly what type of machinery to install, as the ship is not scheduled for completion until 1932 and many developments are anticipated before that time. The liner will be named the "Oceanic." It will be larger than any steamer now in service.

The largest vessels at present are the "Leviathan," the "Majestic," the "Beren-garia," the "Olympic," the "Aquitania" and the new French liner "Ile de France."

HOSE SPRINKLES MORE LAWN THROUGH MIST NOZZLES



One length of hose can be made to do the work of three or more by inserting special spraying nozzles at intervals. These distribute a fine mist in all directions, preventing injury to tender plants and insuring a thorough watering of a wide area. The sprinklers have no moving parts and are easily attached at the section joints of the hose.

Our Bureau of Information is for your benefit. Use it as often as you please.

SPEED OF PARACHUTE JUMPER HUNDRED MILES AN HOUR

Parachute experts at Wright field have been surprised to discover by actual tests that, after leaping from an airplane, a man does not fall as rapidly as had been supposed. After a jump of 1,600 feet, and just before the parachute is opened, the body's velocity is between 100 and 120 miles an hour, the experts showed. Delayed openings, such as have been popular among daring jumpers in recent years are hazardous enough, but after the first 2,000 feet, the increasing density of the air tends to check somewhat the speed of the fall, the tests disclosed. The trials were made at night by dropping a dummy with flare attached and filming the descent with a camera whose shutter opened and closed at second intervals. The finished picture shows a broken streak of light to denote the fall of the dummy. The flare is lighted before the dummy is released, and as the plane flies at right angles to the camera, its path is marked by a horizontal line.

FOOT HARNESS FOR OARSMAN AIDS IN PADDLING

By the addition of a foot-power apparatus, worked in harmony with the arm strokes while paddling, a German inventor has introduced an effective aid for the oarsman. Pedals are connected to the shaft that actuates the paddle in such a way that depressing each in turn, with the strokes, gives additional power.



Foot Gear Shown Helping Oarswoman Move Paddle



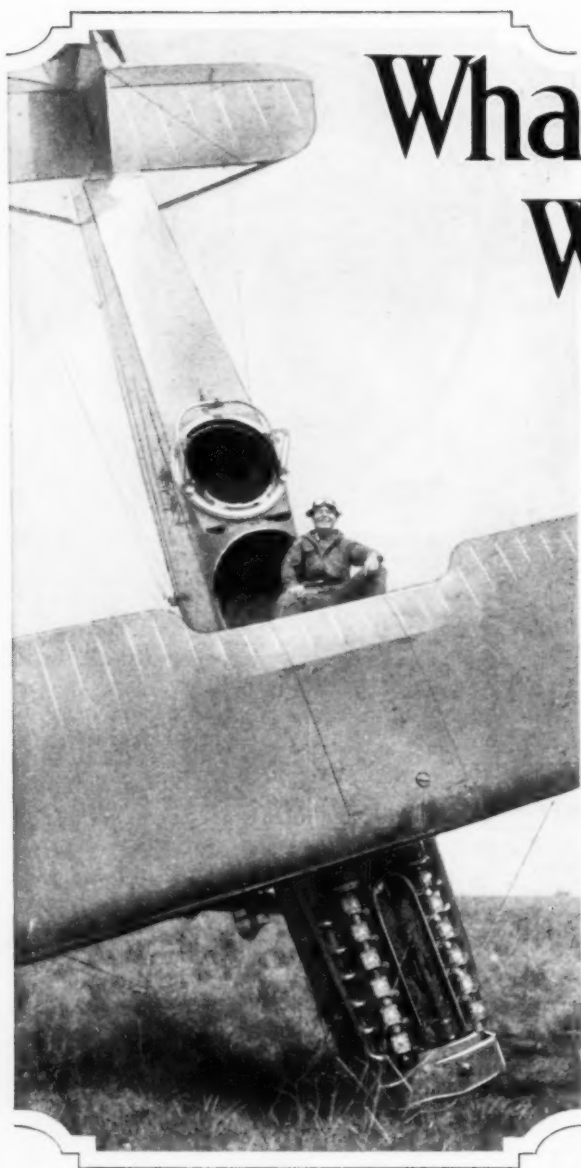
Chemist with Plant Restored to the Appearance of Life by Application of a Radium-Paint Preparation

RADIUM PAINT REVIVES PLANTS APPARENTLY DEAD

Plants and flowers, apparently withered and dead, are said to be restored to the appearance of life with a radium paint a western chemist has prepared. Care is taken in the application and manufacture of the mixture, to have just the right proportions of chemicals to achieve the results desired without injury to the blossom.

MOST OF WORLD YET UNKNOWN EXPLORER FINDS

Only about two-sevenths of the world has been properly mapped, according to Dr. Hamilton Rice, a South American explorer. The remaining five-sevenths must still be accurately measured and charted before we will have a true picture of the lands in which we live. The development of air transportation will greatly stimulate and simplify this task, Dr. Rice believes, after using a small hydroplane and radio sending and receiving sets to complete the mapping of 500,000 square miles of little-known territory in Brazil, Colombia and other countries. He advocates the establishment of courses in exploration at some of our colleges.



What's Wrong When a Plane

explanation, the investigator is apt to say: "No, the motor was working all right—I heard it myself and she was turning wide open when she hit. Controls seemed all right, too. I think it was just another case of human error—nobody to blame except the pilot." And more often than not, the investigator is right.

An answer to the question "But what's the trouble?" can be given only through a study of some of the elements of flying, of human nature and human error, for it is safe to say that fully eighty-five per cent of the accidents in flying can be traced directly to the human element. Structural failure in an airplane of modern design is so rare as to be disregarded entirely. Steel construction, plus exacting inspections, has reduced mechanical failures—with the exception of motor failures—to the very minimum. But failure of the human mind to cope with difficult situations is not at all rare. No man is infallible, and regardless

An Army DeHaviland Standing on Its Nose after "Pancaking" into a Field in an Attempt to Land

By LELAND S. JAMIESON

FIFTY per cent of the airplane crashes in which the pilot is killed go unexplained. A crash occurs and a crowd of morbidly curious people gather about the wreck. The pilot's friends examine the wreckage for a broken part, but usually there is no tangible fact upon which to build a conclusion. For lack of better

of his native flying ability, or the skill developed by extensive training and experience, any man will at times make mistakes.

Of all the factors contributing to accidents in flying—with the exception of lack of flying ability—carelessness is perhaps the most common. It would seem that in any profession as hazardous as flying the pilots and mechanics would be cautious to a fault. Some of them are,



An Army Parachute Jumper Falling, Head First, over the Side of the Ship in a "Free" Jump; the Jumper Must Fall Several Seconds to Insure That His Chute Will Clear the Tail

but a great many are not. Some pilots, as they become more experienced, tend toward greater caution, yet at the very same time they are prone to think that by their very experience they will be able to successfully overstep the bounds of sound judgment. There comes a day of reckoning, however. In the final analysis, it may be said that the foolhardy individual eventually becomes careful, or eventually he becomes by trade a plumber or a mechanic or a care to the undertaker—at any rate he quits flying.

When a plane runs out of gasoline and is forced to land, it may or may not be the fault of the pilot. But usually it is the result of the tendency of the careless man to think: "I've got enough to get me through—I'll take a chance on it." And a thousand things may happen to cause a plane to use more gas than contemplated. It is enlightening to know that of the forced landings caused by failure of the motor, about sixty per cent result from running out of gas.

While any sort of accident in an airplane is usually of some seriousness, there are quite often amusing incidents in connection with near-accidents and forced landings. An officer of the air corps, named McIntosh, when returning from a "port of call" some 500 miles distant, was disposed to land at his home field on the last quart of gasoline rather than at an out-of-the-way field to replenish his supply. One evening he ran into an unlooked-for head wind, and, thus delayed, he was some fifty miles from home when darkness overtook him. Fifty miles is a matter of some thirty or thirty-five minutes, yet the sky can become unbelievably dark within that length of time, especially when one is counting the minutes and doubting that there is enough gas to get him in. When within about two miles of home, and over a large area of very black ground, the ship ran out of gas.

McIntosh was an experienced pilot and had a steady nerve. Furthermore he was flying his own pet ship. He could, of

Kelly Field Tex.

Report by Capt. C. Lindbergh on the collision in air between S.E. 3E, No 50 piloted by Lt. McAllister and S.E. 5E, No 55 piloted by Cadet C. Lindbergh about 8:50 A.M., Nov. 6, 1925 approximately 10 miles north of Kelly Field

I was chief S.E. 5 formation commander by Lt. Blackburn was attacking a 2,144 ft. glower by Lt. Wrayton at about a 5,000 ft. altitude.

I was flying on the left of the top unit. Lt. McAllister was on the right and Cadet Lindbergh was on the left. I turned down on the 2,144. I attacked from the left and Lt. McAllister from the right. After Cadet Lindbergh pulled up, I continued to drive closer to the 2,144 before pulling up to the left. At the time I saw no other ship nearby. I passed by the 2,144 and a moment later felt a light jolt followed by a crash. My head was thrown against the ceiling. The plane seemed to shift position and heavy, weary vibrations for an instant. I closed the throttle and saw Lt. McAllister on his S.E. 5 on my left. He was apparently undisturbed and getting ready to punch. Our plane was level together with the

fuelage approximately parallel. My right wing was damaged and folded back slightly, covering the forward right hand corner of the cockpit.

When the wires began to vibrate, the ship started rolling around and the damaged wing commenced vibrating and striking my head at the bottom of each oscillation.

I removed the rubber safety, un buckled the loll, and climbed out past the trailing edge of the right wing and with my feet on the cowling on the right side of the cockpit which was then nearly vertical, I jumped backwards as far from the plane as possible.

The wreckage was falling nearly straight down when I jumped and for some time I fell in line with it and only slightly to one side. During the ship's descent, I saw I did not fall the safe cord for some hundred feet - until I had fallen several hundred feet.

There had been no falling sensation, and I had no difficulty in locating the rip cord.

The parachute functioned perfectly almost as soon as I pulled the rip cord. The reins jerked on my shoulder, the leg straps tightened, and the chute was fully opened.

I saw Lt. McAllister floating above me and the wreckage pass about 100 yards to one side continuing to spin to the right and leaving a trail of lighter fragments along this path until they cooled in the mesquite about 2,000 ft. below altitude and to flames a few seconds after impact.

Next I turned my attention to locating a landing place. I was over mesquite and drifting in the general direction of a flower field which I located by slipping the chute.

Shortly before landing I was drifting backwards but was able to turn around in the harness just as I hit on the side of a ditch less than 100 ft. from the mesquite.

Altho the impact of landing was too great for me to remain standing I was not injured in any way.

Col. Lindbergh's Report, in His Own Writing, on His First Forced Parachute Jump Following a Collision with Another Ship While a Cadet at Kelly Field

course, have jumped and landed safely; but after a moment's consideration he decided to make the best of a bad situation and try to save the ship. So he stalled the ship down as slowly as possible, "feeling" for the ground as he descended. It was an agony of waiting. At last there was a terrific bump, the ship bounced through the air and a moment later came to rest. To be on the ground with a whole skin was to Mac as much relief as a reprieve to a doomed man.

McIntosh rid himself of his parachute while still in his cockpit and jumped lightly over the side. There was a sound of breaking wood, followed by an agonized cry. Mac had fallen nearly thirty feet and had broken an ankle. His ship had landed in one tree, bounced into another and remained perched there like some huge bird of the night.

Another cause of a great number of accidents is low flying. Depending upon its load, an airplane will glide from five to fifteen feet forward for every foot of descent. Thus, if a plane has a gliding ratio of ten to one and its motor stops at an altitude of 1,000 feet, it may glide nearly 10,000 feet before it is necessary to land. If a

suitable landing field lies within a radius of 10,000 feet, there is practically no danger that the ship will be damaged; but if there is no field available, as when flying over large cities or very rough country, the ship will in all probability be wrecked.

If the ceiling is sufficient to obtain a safe altitude and there is no necessity for such flying, it is nothing but foolhardiness or carelessness that causes a pilot to fly dangerously low over cities or other inhabited areas.



Wreck of an Army Scout Plane; the Pilot Misjudged His Speed in Landing, Crashed His Landing Gear and Then Nosed Over on the Plane's Back, Yet Escaped without Serious Injury

Of the accidents untraceable to carelessness, those caused by inexperience are most numerous. Pick up any Monday morning's paper and you will immediately find from one to a dozen accounts of airplane accidents. The cause usually is not stated with any attempt to be strictly accurate, the reader being left with a bald narrative of what occurred. It is probably described as being the result of a wing slip or a tailspin or a stall, and the reader probably finishes reading the story with very little knowledge of why these accidents must happen. He knows, however, that he will see to it that he shall never be involved in one.

The large majority of the pilots, figuring in accidents where passengers are killed or injured, are men who have had very limited training and practically no experience in flying. They are in all probability using planes of war-time vintage, or craft in a more or less serious state of disrepair. They cannot be blamed for wishing to fly, for flying is a fascinating business, but it is likewise expensive, and to the novice with little money, the older-type plane offers the only means of flying at all. But regardless of his love for flying, no young flyer should carry passengers until he has had in the neighborhood of 100 hours as a pilot, and then such

passenger carrying should be allowed only when done in ships of modern design and construction.

The accidents of inexperience may take almost any form from digging a wing tip into the ground to spinning the ship in. Even with the number of war-time-type ships yet remaining in the United States, a report of a collapse of a plane is comparatively rare, the accident usually running true to form when the account describes it as: "..... the plane took off and climbed a short distance before attempting to turn. When well in the turn, the pilot seemed to lose control and the ship went into a tailspin and crashed to the ground."

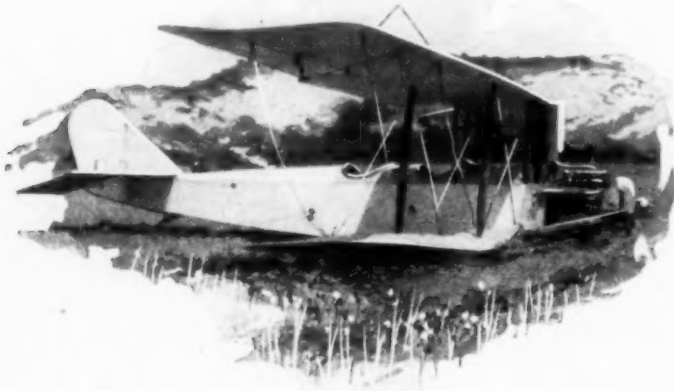
Some years ago a young man was eliminated from one of the air corps' flying schools because of extremely poor judgment, coupled with lack of flying ability to such a degree that he was dangerous in the air. He had received a total of perhaps 100 hours in the air when he returned to his home. With that much experience he considered himself a good pilot in spite of his inability to pass the tests in the army and, with his father's financial aid, purchased a plane of war-time construction and went into the business of passenger carrying, or "barnstorming."

In the course of his travels he chanced

to go into a mountainous district where he had to fly rather high; and having obtained all of his flying training and previous experience at very low altitudes, he did not take into consideration the rarefied air. One Sunday afternoon business was very good. He had, in previous flights, taken some care that he did not fly over the city near the flying field, but when two young men approached him with the proposition of going up over town to get some pictures and offered him a good price for the flight, he decided he would risk it. His motor had been functioning perfectly and there could be no danger, he reasoned.

It was late in the afternoon when the plane finally got into the air. At the request of one of the photographers, the pilot was hurrying to get his altitude before the light became too poor for the work. He was flying almost directly over the center of the city, climbing as fast as possible, and the air speed was dangerously low. Without warning the motor suddenly stopped. He was in such a position that he could perhaps have glided to an outlying field. Why he did not do this is a matter for conjecture. But instead of flying the plane away from the town, he tried to turn and go back toward the flying field. He pulled back harder on the control stick and kicked full rudder in an attempt, in a pilot's language, to "wish" the ship around without losing altitude—and the plane fell into a tailspin.

Here Is What Happened to the Plane of a Novice Flyer When the Engine Suddenly Quit, Making It Necessary for Him to Attempt a Landing



Whether he "lost his head" and forgot how to recover from a spin will never be known, for afterward he was unable even to remember how he had been injured. So, with the stick full back and full rudder on, the plane spun into a street in the city and struck an automobile. Fortunately, the car broke the fall to some extent, and the trio escaped with more or less serious injuries.

In any kind of activity accidents are bound to occur. Man-made machinery, regardless of how skillfully designed and expertly constructed, will at times fail. Hence in flying there are accidents which must be termed "legitimate." When the ship is flown by an experienced man who is exercising all possible caution; when the plane is in seemingly perfect condition; the weather fine and still an accident occurs, it must be laid to the doorstep of fate. There can be no other explanation. Yet, in a case of that kind, fate is always a combination of forces and coincidences.

A number of years ago the army maintained an aerial border patrol. The pilots were made up of war-trained men, and the problem of flying the length of rock-bound and mesquite-covered border became in the end a process of elimination. Motor failures were quite frequent, even for those days, and the failure of a pilot to return at night was a matter of no great moment. Usually he came in on a train or an automobile the next day.

One of these border-patrol pilots had flown a year and had had no forced landings. Naturally, in flying over the rough country, he operated with a constant thought of being forced down, and took all the possible precautions against being caught "short." He developed, in time, a habit of checking landing fields as he passed over them, so that he could tell with precision just when he was within reach of a place to land.

The border along the Rio Grande is subject to periodic fogs at certain times of the year. These



The Army Air Corps Operates These Hospital Planes to Bring in Injured Flyers Who Have Crashed Some Distance from Their Home Fields, Thereby Saving Several Lives

fogs may lift in a few long minutes—long minutes to the pilot flying in one—or may last a day or a week. Usually the fog lies just above the mesquite, and a plane may be forced through when caught a short distance from the home field.

This pilot was caught thus late one day. He debated for some time whether to hunt a field and land immediately or try to go through. Finally he chose to plow ahead, flying blind a good portion of the time. His motor was running sweetly, the slight wind was at his back pushing him home fast. At last there came a feeling of security, and he relaxed somewhat, yet continued to watch for hills that extended high enough toward the base of the fog to offer a menace. Then, with no warning, the motor quit. There was no stuttering. Just a steady rumble—then silence. Not half a second before, he had seen a field. So he swung around on his excess speed and flopped the ship down. There was mud on the ground, and the plane sank in but did not turn over. If he had not developed the habit of looking for landing fields, he would never have been quick enough to get the ship down safely.

So, when a plane crashes, something is wrong. I have outlined by illustration the most outstanding causes: carelessness, ignorance or lack of ability, and mechanical failure. By training, pilots may overcome ignorance. They can overcome carelessness if they will. To some extent, they can overcome their lack of flying ability by exercising proper caution in their work.

A solution of the trouble may be reached by training the thought process of pilots to the point that they will avail themselves of all possible odds, that they will at all times fly in such a way and over such ground that, if "something happens," they can get safely down. That method of thinking, plus adequate flying training, will reduce flying accidents to a minimum.

HANDBAG WITH ELECTRIC LIGHT SAVES SEARCH IN DARK

One of the latest conveniences for the traveler is a handbag equipped with an electric light inside, to eliminate the bother of hunting for articles in the dark. The light is furnished from a small battery and the bags have many pockets.



Remodeled Locomotive, with the Cab in Front for Easier Control of the Engine, Weighs 322 Tons and Is More Than 104 Feet Long

CAB IN FRONT OF BIG ENGINE AFFORDS BETTER CONTROL

So that the engine men can more easily control it, the cab of a huge rebuilt locomotive on a western line has been placed in front, directly over the cowcatcher. The engine and tender together are more than 104 feet long, weigh over 322 tons, and a tractive effort of 105,340 pounds is possible.

COIN CARRIER IN VANITY CASE SAVES TIME AND TROUBLE

Attachable either to the inside or the outside of the vanity case, a secure carrier



Vanity Case Equipped with Coin Compartments at the Top, to Save Time and Prevent Loss

for loose coins has been introduced for the convenience of women. It saves disturbing the other articles in the bag when searching for money, helps prevent loss and takes up but little room.

SEEK BIRTHPLACE OF ICEBERG TO PROTECT SHIPPING

Coast-guard explorers this summer are cruising the waters between Labrador and Greenland to study the birthplace of the icebergs that menace navigation in the Atlantic. They will endeavor to discover more accurately how and where the bergs drift so that their paths may be predicted and their menace thus reduced. Before 1912, comparatively little was known about these roving mountains of ice, but following the sinking of the "Titanic," with a loss of 1,500 lives, extensive research has been conducted. During the last ten years, more than 3,000 observations have been compiled by ice-patrol vessels. Studies have been made as to the temperature and saltiness of the water at various depths and in various locations. From these data, ocean currents have been computed in accordance with mathematical formulas. One of the principles involved is that the currents are in a large measure due to differences in the specific gravity of the water, which will flow from the place where it is relatively light to another region where it is proportionately heavy. This, combined with the fact of

earth rotation, permits the issuance of regular weekly current maps, similar to weather maps. Among other questions, the investigators will endeavor to determine whether a branch of the Gulf Stream dives to the bottom of the Atlantic ocean and emerges in Baffin bay.

ODD MINERAL USED IN PAINTS MINED ONLY IN UTAH

One of the oddest minerals in the world is gilsonite, a black substance used in the preparation of paints and varnishes and in the manufacture of different kinds of buttons, telephone mouthpieces and other articles. It is mined only in Utah, where it was first discovered in 1862. It was at first believed to be a kind of coal, but when it was burned, it created a dense black smoke, a peculiar odor and, instead of forming ashes, it was reduced to a stringy residue somewhat like tar. Getting the gilsonite to market is a tedious process, as it starts over one of the steepest and most crooked railroads in the world.

REVOLVING BRUSH ON HOSE HELPS CLEAN AUTO



Attached to the garden hose, a special brush lightens the task of cleaning the automobile. Its chief feature is a whirling center portion that revolves under the force of the water from the hose, while on the rim are stationary bristles that catch the water from the moving center and help polish the finish. The user of the brush is spared considerable labor and water is less likely to spatter upon his clothing.

Our Bureau of Information will answer all questions regarding articles appearing in this magazine.



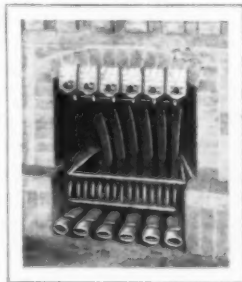
Operating the Private Central Box in Automatic Phone System; It Is Specially Suited for Office Use

PRESS-BUTTON PHONE SYSTEM LATEST OFFICE AID

For business houses having a number of branch or extension telephones, a special exchange system has been devised. It is an automatic arrangement, but eliminates a central and, instead of turning a dial to obtain a number, a master button is pressed. The unit is so adjusted that ten different numbers may be called.

PORTABLE FIREPLACE FURNACE SAVES FUEL

Increased comfort and efficiency are enjoyed from the fireplace by means of an air-circulating unit that reduces fuel waste and helps prevent heat from going up the chimney. It is simply a set of pipes that pass under the grate, arch back of it and extend to the top of the fireplace where they open out. Colder air, being heavier, sinks to the lower part of the room where it enters the pipes under the grate, is heated, rises and passes out the openings at the top. This promotes better circulation in the room and gives more heat.



DUMMY THAT SELLS TICKETS HELPS ADVERTISE THEATER



Obtaining Ticket to Theater Performance from the Dummy Salesman near the Entrance

At the entrance to a small theater in Arras, France, is a lifelike dummy that dispenses tickets when the correct amount of money is placed in a container. The automatic salesman attracts attention to the playhouse and has become a favorite with children because of the jovial expression on its face and the novelty of obtaining tickets in this way.

CAMERA DETECTIVE CONVICTS POOR-BOX THIEF

A camera detective, invented by a New York patrolman, recently won its first case when it produced the photograph of a man who had robbed the poor box in a New York city church. The device, called a "photo-detect," consists of a concealed camera and a flashlight charge, electrically connected to the safe, strong-box, or whatever else it is set to guard. The inventor built twenty of them, and obtained permission from various friends, including the priest in charge of the church, for their installation. The man arrested for the theft was on probation from the penitentiary for a similar offense, but denied he had committed the second one. The

photo-detect, however, provided a picture, three inches square, showing him kneeling at the altar rail in front of the box. As the camera could only have been touched off by tampering with the lock on the box, the court found him guilty.

LOST CITY FOUND BY PICTURES TAKEN FROM AIRPLANE

Aerial photography has proved of aid in finding the borders of the ancient city of Opis in Mesopotamia. The pictures, taken from an airplane, showed the differences between mounds formed by nature and those which were made by the heaped-up ruins of the sun-dried-brick homes that were destroyed when invaders pillaged the city. Following its location, the ancient settlement was excavated, resulting in the discovery of undisturbed foundation stones, coins, vases and other evidences of ancient civilizations.

HANDMADE SMOKE SCREEN AIDS MINE SAFETY

To detect air flow and measure its velocity in mine shafts, a little bulb instrument developed by the bureau of mines ejects a puff of smoke which can be photographed to show the direction of the air currents. The unit is serviceable also in the study of other ventilating problems.



Studying Air Currents in Mine with the Aid of a Smoke Screen That Drifts with the Breeze

ASPHALT EMULSION ON CONCRETE TO AID CURING

Applied to finished concrete in the form of a fine spray, an asphalt emulsion is said to result in better curing for the material and also reduces work. It is suitable not only for sidewalks but for floors, foundations, bridge decks and practically any flat-surfaced type of construction. One of its chief functions is to prevent the too rapid evaporation of water from the concrete mixture. The asphalt sticks to the cement as a continuous film which absorbs heat from the sun and so is said to accelerate curing. There is no chemical effect, as the emulsion is chemically inert. To apply the asphalt, a compressed-air outfit is employed, the supply being held in a large tank and distributed to the concrete through a flexible hose. The weight of the machine, loaded, is about 300 pounds and a hose, fifty feet long, is suitable for most jobs. According to the manufacturers, it is possible to apply the emulsion to the finished concrete at a rate of 150 to 200 square yards per hour.

MAIL BOX AND PORCH LANTERN COMBINED IN ONE

Illuminated mail boxes, bearing the house number and having a holder below for magazines, have been introduced for convenience and to add an attractive touch. The light makes a handsome porch lantern at night and the number is visible from a considerable distance.



Mail Box and Lantern with Illuminated House Number



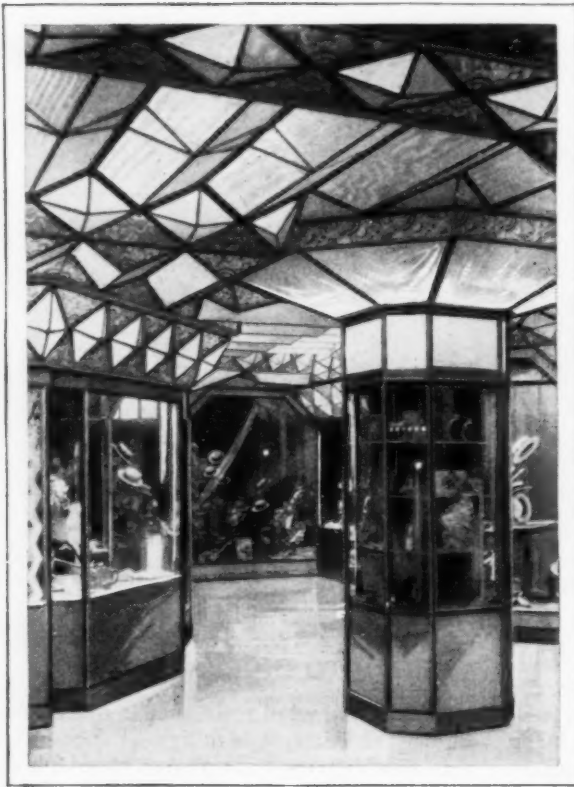
In Flight, with the Landing-Gear Wheels Folded Inward to Decrease Resistance from the Air, the Plane Develops More Speed

AIRPLANE'S LANDING WHEELS FOLD TO INCREASE SPEED

Decreasing wind resistance is one of the objectives in airplane design as success in this direction means greater speed. The monoplane "Roma" has landing wheels that can be folded up close to the fuselage, just as a bird folds its legs when flying.

SEEING THROUGH METAL

To protect eyes, a Hungarian oculist has devised a pair of spectacles that have an exceedingly thin piece of metal foil between two sheets of plain or curved glass. This not only keeps out rays of light that would be hurtful to the eyes, but is also said to exert a healing effect as it admits short waves of daylight which are beneficial to the organs. In case of inflammation of the iris, platinum foil is recommended, as it passes but two per cent of visible light.



Decorated Glass Panels and Transparent Ceiling with Colored Lights Make This Store Front Very Attractive

STORE FRONT OF GLASS BOOTHS HELPS DRAW TRADE

Instead of the usual plain store window, a shop in Los Angeles has many decorated glass panels and small booths, all illuminated with striking color effects, to help display the goods and attract customers. The entire ceiling over the entrance is also of glass and concealed lighting produces novel illumination. The appearance of the store is doubly attractive at night.

WHY "JOHN HANCOCK" MEANS YOUR SIGNATURE

"Put your John Hancock here," is one of America's most familiar slang expressions, but few people know why the revolutionary-war statesman should be associated with the act of signing one's name. The answer is that John Hancock was the first person to sign the Declaration of Independence, and his signature has since

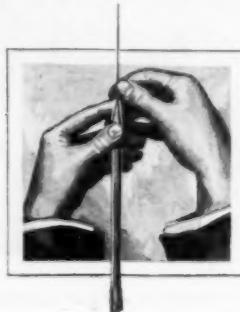
become symbolic of authority, particularly when one is first to sign important papers. Hancock was a member of the continental congress from 1775 to 1780, the first governor of Massachusetts, serving from 1780 to 1785, and, after two years' respite, governor again until his death in 1793.

MAGNETIC PROBE FINDS FLAWS IN STEEL

Magnetic analysis to detect hidden flaws in steel, without cutting, scratching or marring the surface, has been developed so far that the American society for testing materials has awarded the Charles B. Dudley medal to Alfred V. de Forest, Bridgeport, Conn., research engineer, for his success in making it practical. Dozens of scientists have worked for years to make magnetic probing practicable. Under the methods developed, a chunk of steel, five or six inches thick, can be examined as carefully as though it were made of transparent glass. A sensitive galvanometer will detect a flaw no bigger than a pin-head in the center of the mass. The most important use for the system at present is the inspection of steam-turbine bucket wheels. As these operate at high speeds, a flaw which might cause one of them to burst could produce enormous damage.

ONE-PIECE AUTOMATIC PENCIL SELDOM NEEDS FILLING

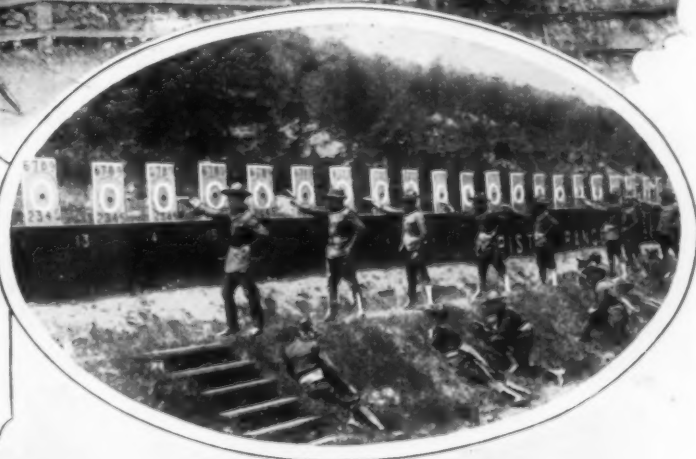
Absence of complicated parts and leads more than five inches long are the chief features of an automatic wooden pencil now on the market. The lead is inserted at the tip and is brought forward or backward simply by turning the eraser holder. One filling is sufficient for several weeks.



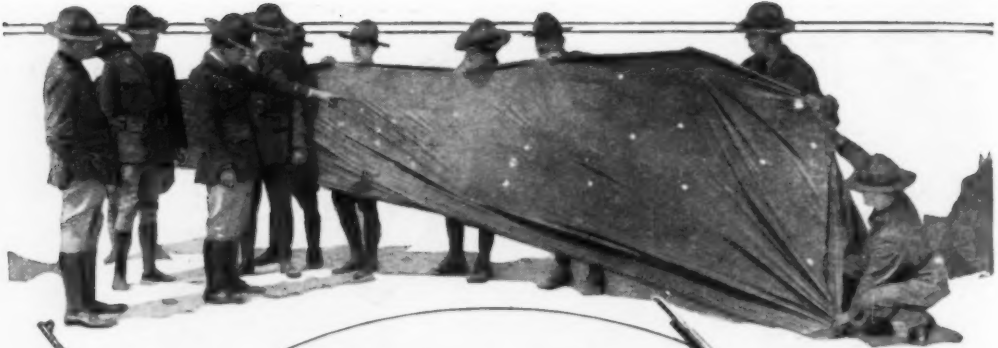
Uncle Sam's Latest Weapons



The Latest Coast Defense on the Pacific Is This Giant Railway Gun, Which Can Be Moved up and down the Shore Wherever an Attack Threatens; It Hurls a Powerful Shell 20,000 Yards Out to Sea; the Mount Is a Complete Unit, Including Cranes for Hoisting the Shells; at Right, Soldiers of an Infantry Regiment at Pistol Practice



Four Whippet Tanks Climbing a Hill in Battle Formation during Maneuvers for Reserve Officers at Fort Wadsworth



Officers Checking the Holes in a Sleeve Target Towed behind an Airplane for Gunnery Practice of an Anti-Aircraft Battery; the Cloth, No Larger a Target Than a Plane Itself Would Be, Has Been Riddled with Machine-Gun Bullets, as the Many Holes Show. In the Next War the Doughboy Will Have a New and Lighter Pack; at the Left, Sergt. James Laughlin Is Bowed Down under the Seventy-Nine-Pound Weight of World-War Equipment, While, at the Right, Corp. LeRoy Nicholson Steps Briskly Out with the Fifty-One Pounds of the New and Scientifically Designed Equipment; Many Things That the Infantryman in France Carried on His Own Back Will Be Hauled by the Accompanying Motorized Transport in the War of the Future; the New Pack Is Said to Be the Lightest Carried by Infantry in Any Army in the World



New York Is Ringed to Seaward with Coast-Defense Cannon and Anti-Aircraft Batteries; Here Soldiers of the Sixty-Second Are Repelling an Imaginary Night Attack by Enemy Planes; Powerful Searchlights Sweep the Skies as the Quick-Firing Guns Pour a Hail of Shrapnel and Machine-Gun Bullets into the Air; with Newly Developed Devices, It Is Easier to Locate Unseen Airplanes by the Sound of Their Engines, and Controls Operated from the Listening Station Automatically Train All Guns in the Battery on the Target

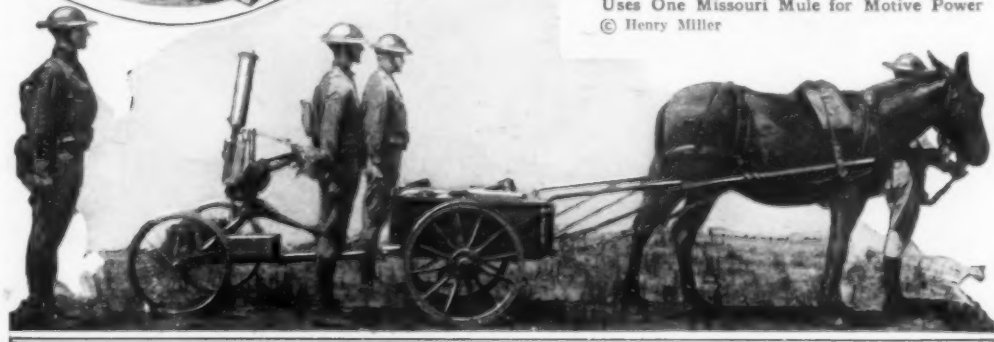


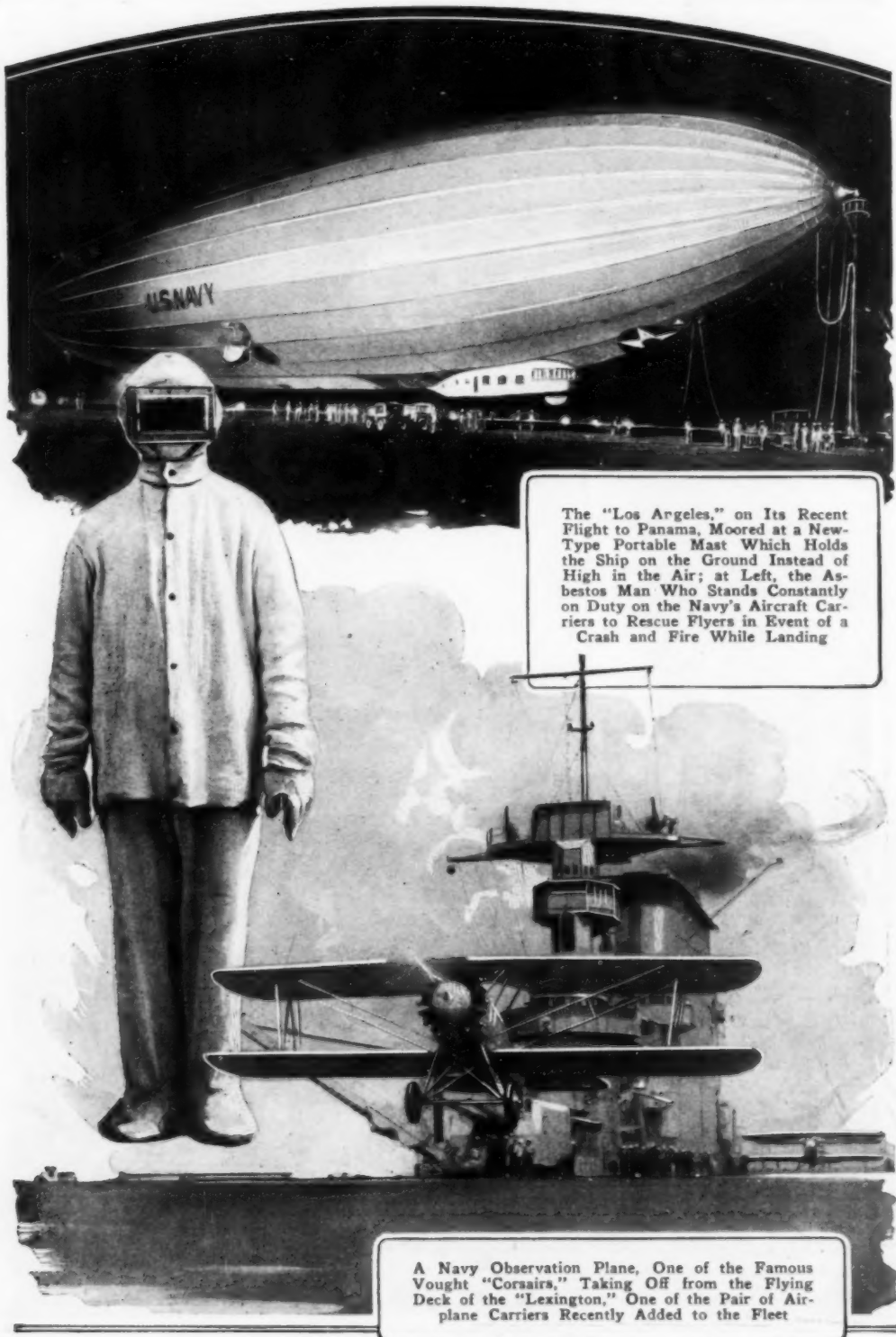


The Army's Latest Twin-Engine Curtiss Bomber; Instead of a Third Engine in the Nose It Carries a Machine Gunner There, While Another, behind the Pilot, Fires toward the Rear, and the Bomber Drops His Missiles through the Floor; Left, a 4,000-Pound Bomb



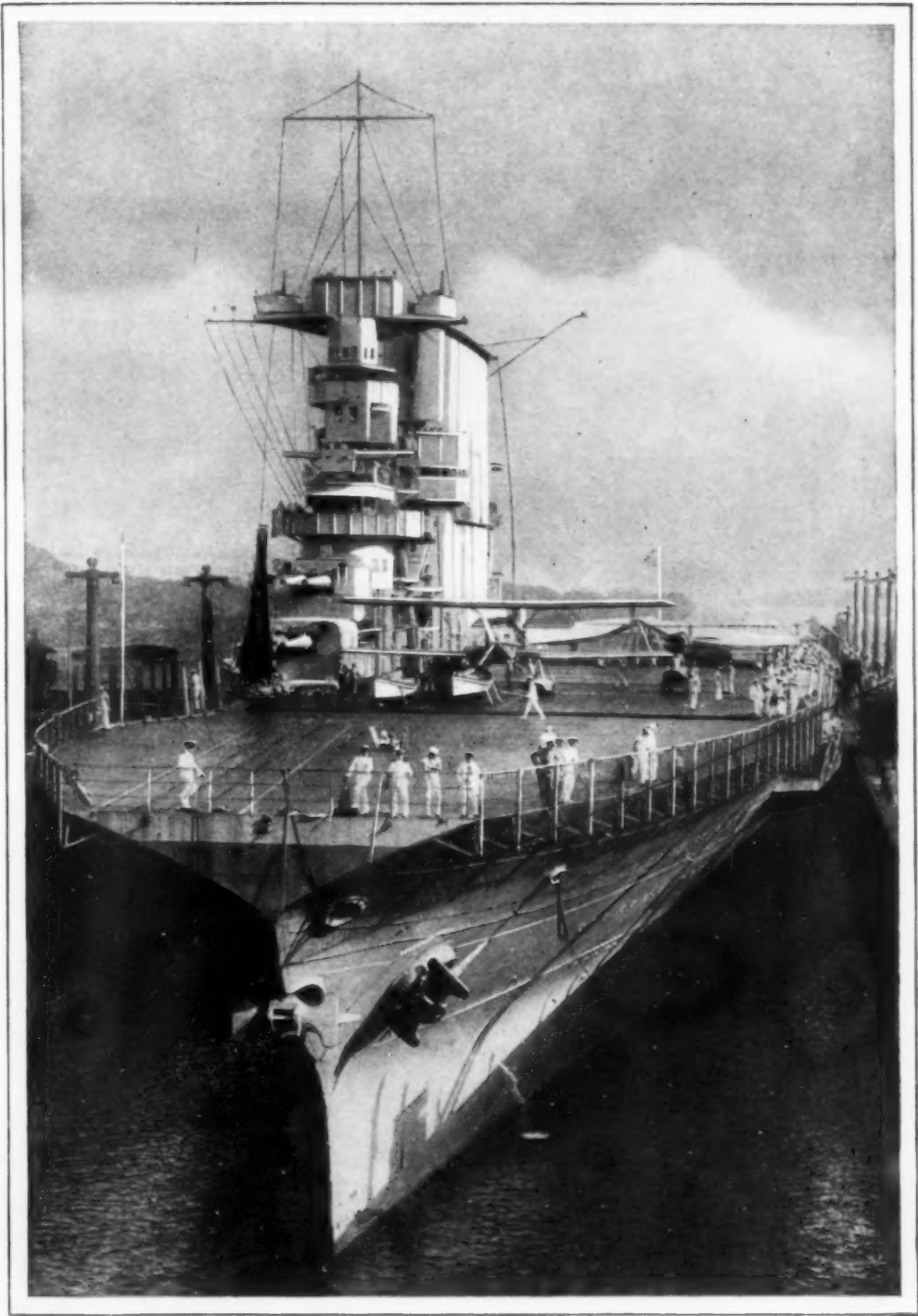
An Infantry Machine Gun Built to Protect Troops on the March from Airplane Attack, and, Below, the Same Gun Mounted on Its Carriage, Which, with the Ammunition Cart, Uses One Missouri Mule for Motive Power
© Henry Miller





The "Los Angeles," on Its Recent Flight to Panama, Moored at a New-Type Portable Mast Which Holds the Ship on the Ground Instead of High in the Air; at Left, the Asbestos Man Who Stands Constantly on Duty on the Navy's Aircraft Carriers to Rescue Flyers in Event of a Crash and Fire While Landing

A Navy Observation Plane, One of the Famous Vought "Corsairs," Taking Off from the Flying Deck of the "Lexington," One of the Pair of Airplane Carriers Recently Added to the Fleet



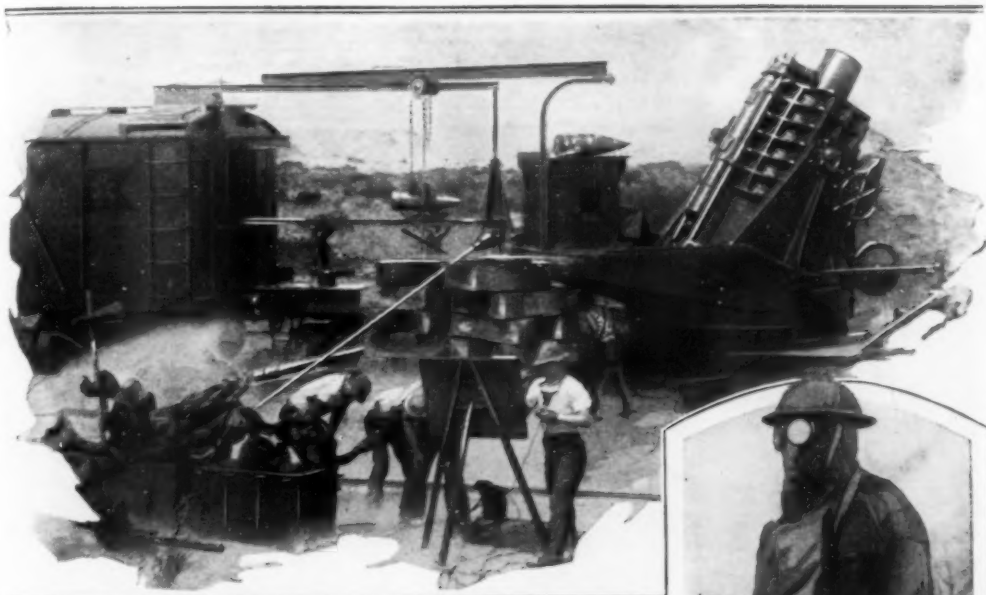
The "Saratoga," Sister Ship of the "Lexington," Passing through Gatun Locks in the Panama Canal; with a Clearance of Only Two Feet on Either Side, Part of the Superstructure Overhung the Lock Walls



For Contrast with the Army's Whippet Tanks, Here Is a Trio of British Land Forts Maneuvering in the Clinging Mud of Salisbury Plain, a Terrain Still Remembered by Many American Soldiers Who Camped There en Route to France; the British Army Is Experimenting with Complete Mechanization on a Large Scale; at the Left, Navy Officers Inspecting the Latest Thing in Complete Gas Protection for the American Soldier; Even the Suit Has Been Chemically Treated to Resist the Attack of Mustard Gas and the Flaming Phosphorus Used in Incendiary Shells



War-Time Lessons in Trying to Keep the Artillery Up with the Infantry in the Final Weeks of the War Led to This Mount for Six-Inch Guns

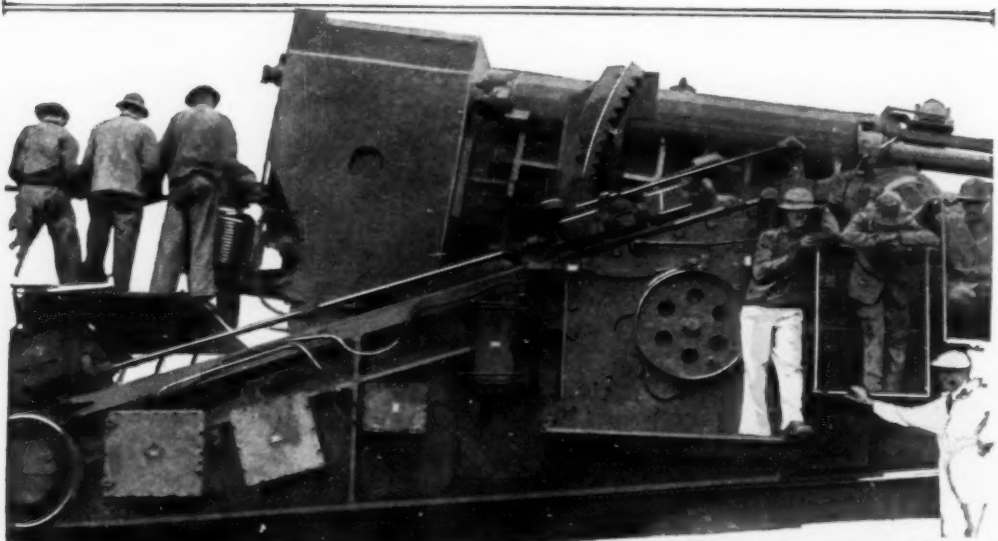


A Twelve-Inch Railway Mortar of the Coast Defense, Complete with Its Ammunition Car and Conveyor Hoist to Handle the Shells, Firing Gas Missiles at Imaginary Battleships off the Virginia Capes; Sixteen-Inch Howitzers and Eight-Inch Guns on Railway Mounts (Below) Also Were Used in the Demonstration

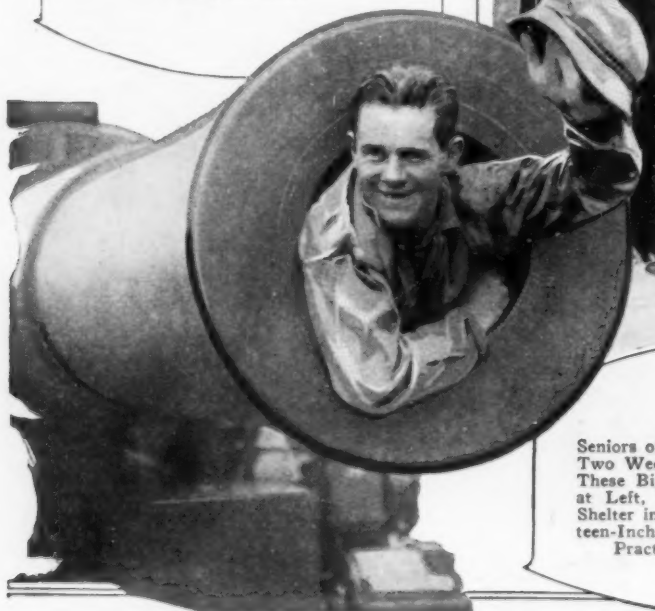
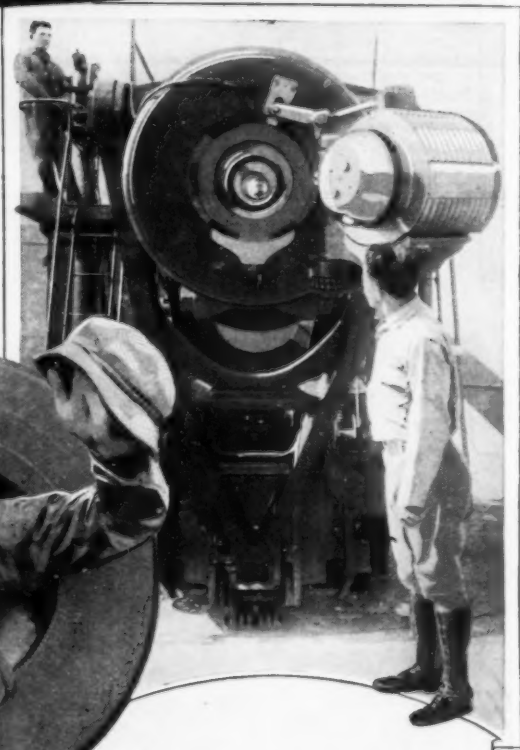


Another Type of Gas-Proof Uniform, Which May Be What the Well-Dressed Soldier Will Wear in the Future, If Tests Prove It to Be Successful



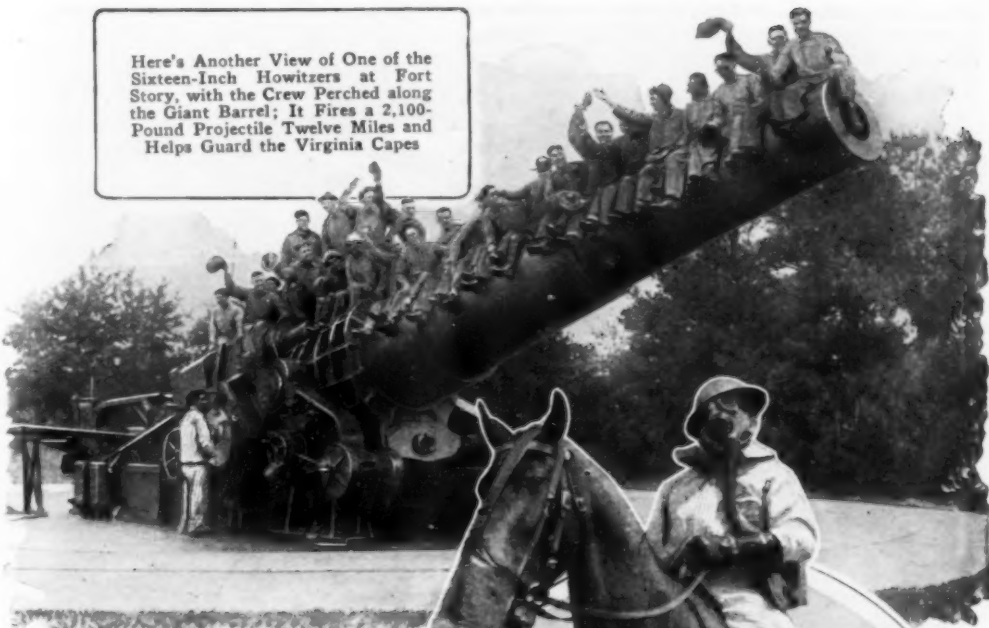


The Breech of a Fourteen-Inch Railway Gun Tested in California; Specially Built Concrete Emplacements Are Necessary to Take Up the Shock of the Recoil, but They Can Be Built in Advance at Every Vulnerable Point along the Coast



Seniors of West Point Each Year Spend Two Weeks at Fort Wright, Operating These Big Coast-Defense Guns; Above; at Left, a Coast Artilleryman Seeks Shelter in the Muzzle of One of the Sixteen-Inch Howitzers Used in the Battle Practice at Fort Story, Virginia

Here's Another View of One of the Sixteen-Inch Howitzers at Fort Story, with the Crew Perched along the Giant Barrel; It Fires a 2,100-Pound Projectile Twelve Miles and Helps Guard the Virginia Capes



Even the Horse Must Wear a Gas Mask Now. While Its Rider Blossoms Out in Gas-Proof Suit, Boots, Gloves and a Mask to Protect Him against the Burns of Mustard Gas and the Flaming Particles of Phosphorus from Incendiary Shells or from Flame Throwers



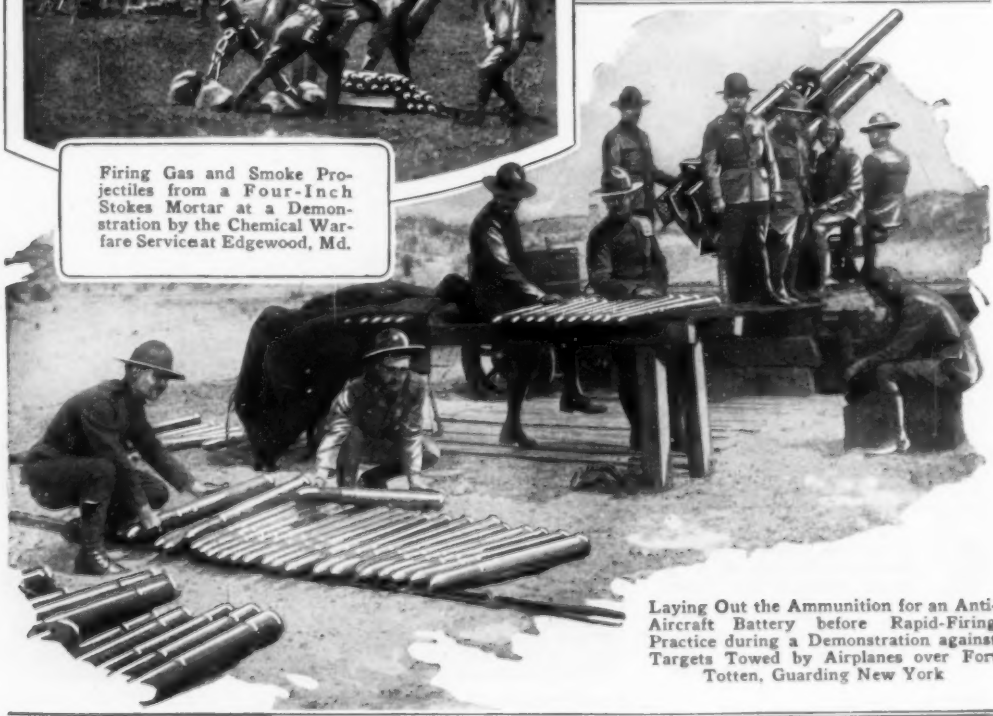
Uncle Sam's Mightiest Gun Roars at Aberdeen When the Army Presents Its Latest Weapons; This Huge Sixteen-Inch Rifle Was the Feature of the Greatest Display of Fighting Equipment Since the Close of the World War



Brig. Gen. R. E. Callam inspecting one of the eight-inch railway guns which joined the sixteen-inch howitzers and twelve-inch mortars at Fort Story



Firing gas and smoke projectiles from a four-inch Stokes mortar at a demonstration by the Chemical Warfare Service at Edgewood, Md.



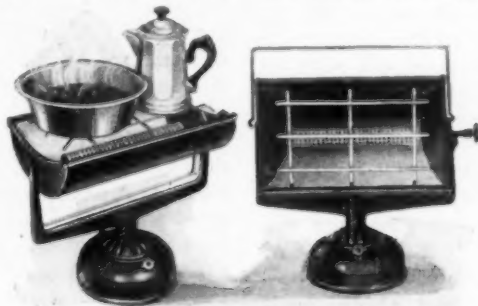
Laying out the ammunition for an anti-aircraft battery before rapid-firing practice during a demonstration against targets towed by airplanes over Totten, guarding New York

ARMY SEEKS SILENT AIRPLANE TO AID IN ATTACKS

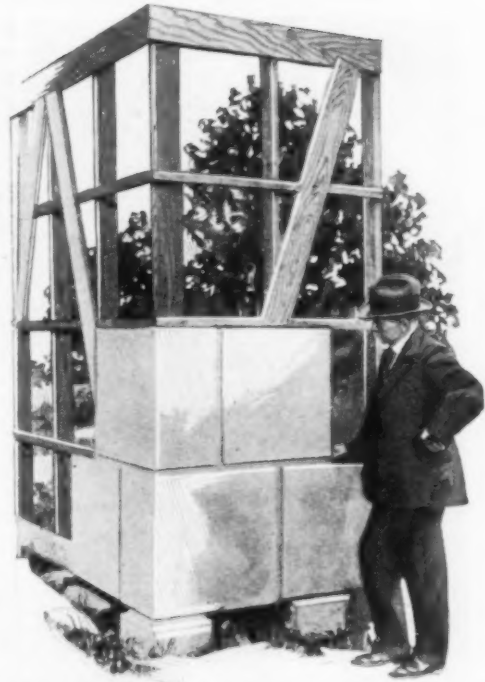
Extensive experiments have been conducted by the army air corps in an effort to develop a plane that will be noiseless in flight, so that an enemy might be surprised by an attack from the skies. Merely making the planes less noisy will be of little use, as they must be perfectly silent to carry out their mission. By muffling the engine, the noise from that source has been checked considerably, but the propeller presents the most difficult problem. It makes the greatest din of all. As the blades whirl through the air, thousands of revolutions per minute, they create a sound easy to identify and carrying for a considerable distance, so that it is not difficult to detect with the aid of special listening apparatus. Mufflers on the engine reduce the power and, as yet, no way has been found to eliminate the propeller noise. However, the experiments are to be continued and one of the immediate objects is to devise a muffler that will cause a total loss of not more than one-half horsepower. A five-per-cent reduction of power is not uncommon with the mufflers already introduced.

GASOLINE HEATER AND COOKER LIGHTS INSTANTLY

Immediate lighting without preheating of any kind, is the chief feature of a portable combination heater and cooker that burns gasoline and requires no hose or pipe connections. The burner lights instantly after a valve is opened and a match applied. The reflector or heating element revolves in a ninety-degree angle so that it can be set in a horizontal plane and used as a cooking or heating grid as well as a heater. The outfit is especially serviceable for campers, for an emergency water heater and to warm bathrooms or any other parts of the house where auxiliary heat is required.



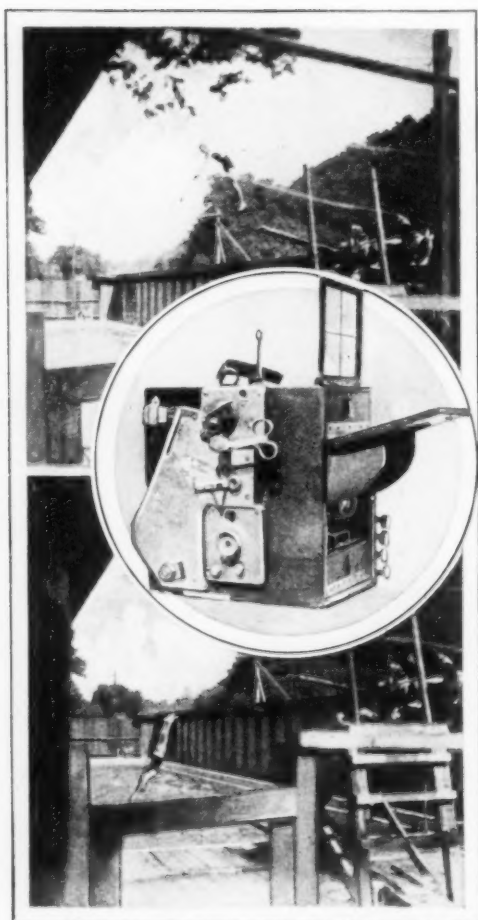
Heater in Use as a Stove, and as a Portable Unit for Warming a Cold Room



Model Section of Concrete-Slab Plan of Wall Construction for Houses and Other Buildings

CONCRETE-SLAB HOUSE WALLS SIMPLIFY BUILDING

Three houses can be built in the time required to erect two of brick, by using a patented form of concrete-slab construction, the inventor claims. The method is illustrated in the accompanying illustration, showing a model section. The slabs are attached by screwing or nailing them to strips fastened to the studs, and the wooden frame back of the concrete units is built to give greater strength and to permit faster construction than is possible with the usual methods. Between the slabs is a one-inch groove which is filled with water-proof cement to cover the joints. A recess is left for appearance. In case the building settles, cracks will occur only at these joints, it is said, as the slabs are stronger.



Semi-Automatic Camera Is Specially Useful in Taking Pictures of Sports Events

SIX PICTURES IN THREE SECONDS WITH SPORTS CAMERA

Designed especially for making photographs of sporting events, a semi-automatic camera makes six exposures in about three seconds. The shutter is tripped and a fresh section of film is wound up, all with one stroke of a hand lever, and a quick focusing device permits adjustment to any desired distance simply by pressing a button. The inventor asserts that the camera is also well adapted to airplane work and will eliminate the need of an extra man. A direct-vision folding finder, compartments for extra rolls of film, and a special thumb-and-finger stall to help steady the camera, are other features.

JUNKERS REVEALS HIS SECRET OF HANDLING DURALUMIN

"When we first began experimenting with aluminum and duralumin, its alloy, we had a terrific fright," Prof. Hugo Junkers, famous engineer and designer of the first plane to cross the Atlantic from east to west, says. "The stuff literally dissolved after but little use. We feared it would be entirely unsuited to airplane construction. Our men, entirely familiar with the handling of steel and other metals, had been treating aluminum in the same way as these other materials. They heated it and hammered it. But we soon discovered that aluminum and duralumin could not be subjected to steel-handling methods and still retain its strength. In riveting, for instance, we found that if we pounded too hard, the metal was weakened. So we measured the force necessary to drive a single rivet, controlled the weight of the hammer, and, in actual driving, we used a container filled with a measured quantity of compressed air. This had to drive the rivet. Long experience proved that the amount of air could not be increased or diminished if we wished to achieve the maximum strength and service from the material. In our laboratories, we have a dozen special machines just to work with duralumin, testing and applying it."

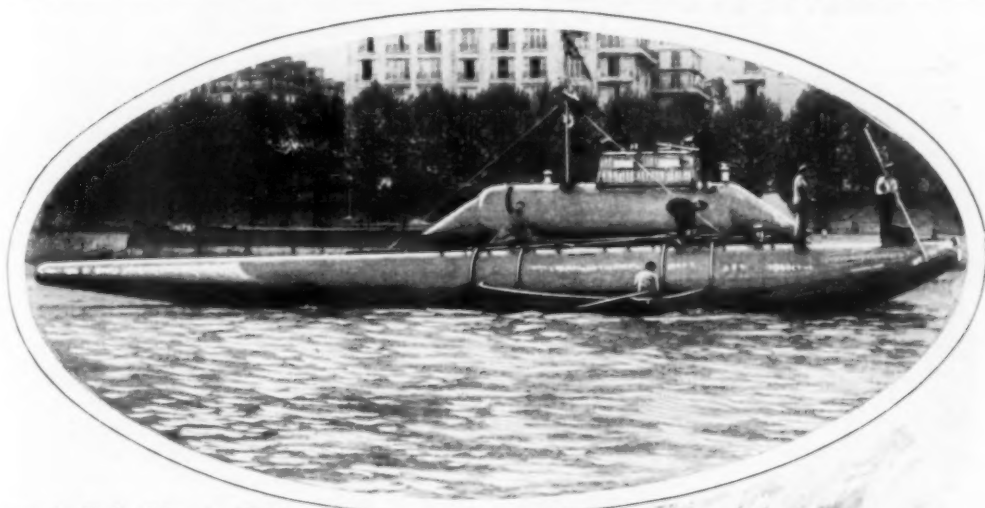
PORTRAIT PLAQUES IN BRONZE RECALL ANCIENT ART

Photographic portraits in special finish and mounted on bronze plaques have been copyrighted and placed on sale. They eliminate the need of a frame and glass and the figure is in bas-relief, suggesting a medallion. A decorative background is used for mounting.

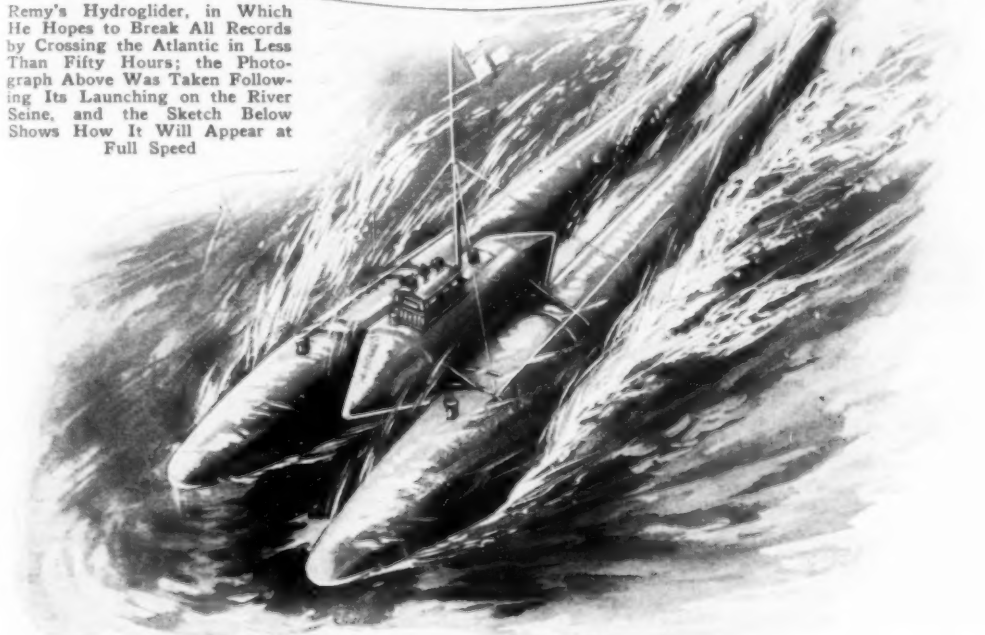


Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information.

HUGE HYDROGLIDER BUILT FOR ATLANTIC RECORD



Remy's Hydroglider, in Which He Hopes to Break All Records by Crossing the Atlantic in Less Than Fifty Hours; the Photograph Above Was Taken Following Its Launching on the River Seine, and the Sketch Below Shows How It Will Appear at Full Speed



Designed to try for a new speed record in the crossing of the Atlantic ocean from Cherbourg, France, to New York, a queer hydroglider, designed by a French engineer, M. Remy, was launched recently on the River Seine. Remy hopes to make the crossing in less than fifty hours, cutting the time of the fastest liners in far less than half. The ocean glider has been developed from a smaller craft that was tried out some months ago on the English

channel, crossing from Calais to Dover in twenty minutes. Essentially the craft consists of three metal pontoons, fastened together and supporting a motor superstructure, which houses engines that drive airplane propellers, and a pilot house. The two main pontoons, carefully streamlined to reduce friction and resistance to the minimum, glide along the water surface at full speed; at least that is the action in fairly calm water.

GLASS SIGNS ON STREET LIGHT EASILY READ AT NIGHT

Transparent
Street Sign
on Lamp-
Post. Where
It Can Easily
Be Read



To assist motorists and others in finding street locations at night, a physician's widow has devised a plan to have the signs painted on glass and attached to a frame about the electric-light globe in the center of an intersection. In this position, the names are visible at a considerable distance by night, and by day from almost any point of the compass. The plan is the result of difficulties experienced by her husband in reaching his destination when responding to night calls. The frames are adjustable to globes of different sizes, and the strips of glass do not appreciably decrease the effectiveness of the light.

MIDGET RAILROAD USES AUTOS AS SUBSTITUTE FOR STEAM

Combination motor cars that haul freight, express, mail and passengers, and that are propelled by a familiar make of auto engine, are now in use on the Tabor and Northern, Iowa's nine-mile railroad. Private and public automobiles greatly reduced the line's business so that the directors decided to enter the competi-

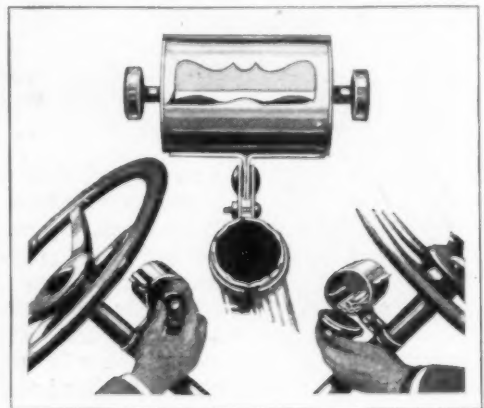
tion on even terms. Steam trains were discarded for the combination cars of home manufacture. Three are now in service. They maintain a thirty-mile-an-hour average and make two round trips over the line each day.

WHITE CRUST ON BRICK WALLS CAUSED BY SALTS

Nearly everyone has noticed the white formation that sometimes discolors brick walls, particularly after a season of damp weather. It somewhat resembles mildew and may occur on comparatively new as well as old walls. The crust is caused by the solidification on the surface of various kinds of chemical salts that become dissolved within the brick and gradually seep to the surface. Usually the formation disappears after a few seasons, as the salts gradually are washed away. Better design of walls to prevent moisture penetration and careful mixture of the brick and mortar are effective preventives in many cases.

CIGARET DISPENSER FOR CAR CONTAINS A HUMIDOR

Clamped to the steering column of the auto, a cigaret dispenser exposes one of the contents at each turn of a little knob, and also has a humidor within to keep the cigarets fresh. The attachment saves the trouble of searching through the pockets while driving, does not interfere with operation of the car and is finished in attractive styles.



Views of the Cigaret Dispenser Attached to Steering Post Column; a Humidor Keeps Contents Moist



Completed Cabin, and Units as They Come Ready for Connecting; Roof Is of Wood or Canvas

CAMP CABIN BUILT IN HOUR REQUIRES NO NAILS

Consisting of about twenty-five pieces and assembled in an hour or less, a folding cottage for camping requires neither hammer nor nails for erecting, as it is held together with a few screws. The various units are plainly marked so that almost anyone can connect them. The roof is of wood or double canvas with an air space that helps to keep the interior cool in summer. There are five windows.

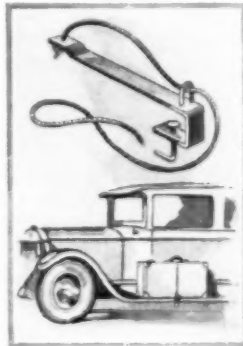
QUARTER-HOUR AIR TAXI LINE ACROSS ENGLISH CHANNEL

An aerial taxi service connecting France and England and making the hop from Calais to Dover in fifteen minutes, is being inaugurated by a French company. The planes operate in conjunction with the boat trains from London and Paris, and eliminate the terrors of a channel crossing. As the hop is made in a quarter of an hour, there is hardly time for the most susceptible passenger to become

either seasick or airsick. Seaplanes are to be used exclusively, so they can land on the water in case of trouble. The first ships carry two and three passengers each, but later, larger vessels may be built.

CLAMP TO HOLD AUTO LUGGAGE PROTECTS BODY OF CAR

Easily attached and inconspicuous when in use, a simple luggage-holder unit has been introduced for the motorist. It consists of two clamps, which are fastened to the underside of the running board, and lengths of rope tied to them that are passed around the articles to be carried. Luggage is kept from rubbing the body of the car, is quickly removed and the clamps do not disfigure the auto.



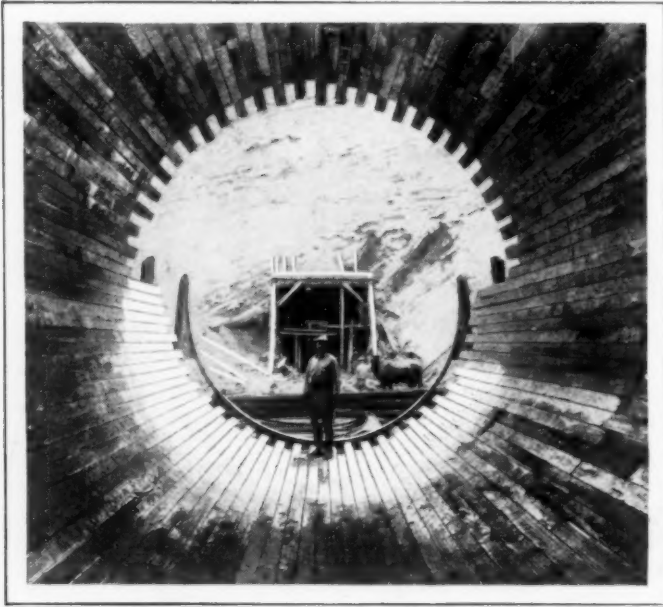


Figure of Man Illustrates the Enormous Size of the Wooden Stave-Pipe Line for Hydroelectric Company

PIPE LINE FOR WATER POWER BIG ENOUGH TO HOLD RIVER

A pipe line being constructed by a hydroelectric power company in California is large enough to hold a good-sized river, as it is sixteen feet in diameter. It is several miles in length and is made of wooden staves. The line crosses mountain and desert country.

TEST CONCRETE PAVING'S SAG TO MAKE BETTER STREETS

Civil engineers at Cornell University have been making a number of interesting tests on concrete pavings to find out why they break. An apparatus that duplicates the effect of a loaded vehicle on the road is one of the instruments used. It bends a concrete beam a fraction of an inch. This is what happens when a heavy vehicle passes over the pavement. The concrete bends downward under the wheels while the material ahead and behind is actually bent upward at the same time. A moving load causes waves in the concrete as it progresses. The result is a reversal of stress that renders the material even more liable to fracture by fatigue. To counteract this difficulty, engineers are

endeavoring to find better ways of placing the steel reinforcing, improving the foundations under the pavements and otherwise fashioning the slabs so that they will be enabled more successfully to resist these strains.

MYSTERY OF INDIAN MOUNDS CLEARED BY RECENT FIND

Additional proof that not all the Indian mounds were built by a mysterious race who vanished long before the coming of the white man, has been discovered near Joliet, Ill., in a mound that was partly filled with funeral gifts of European manufacture. A number of silver spoons, a crucifix,

bangles and other ornaments were among the objects taken from the diggings along with Indian skeletons. Brass pots, a pair of scissors and knives bearing a French trade-mark were also found.

CUTTER TO SHRED CORNSTALKS HELPS CURB BORER

To help keep the corn borer in check, an Indiana inventor has devised an outfit which cuts the cornstalks into inch lengths on the field after the grain has been harvested. A rapidly rotating cutter drum is the essential part of the apparatus, which is run by a motor.



Motor-Driven Cutter That Chops Cornstalks into Small Pieces and Helps Check Spread of Insect Pest

Are Your Senses



A Test for the Taste Buds on the Tongue; a Clean Glass Rod, Tapped against the Tip of That Member, Should Produce a Sweet Taste, and Farther Back at the Side a Sour Acrid Sensation

THE TELEPHONE jangles. You pick up the receiver.

"Hello! Who? What's the name, please? Oh yes! Speak a little louder, can't you? You say you'll meet me at Sea Shells? Oh—Three Bells. Yeh! Huh? All right! All right! G'by."

You hang up the receiver viciously, disgusted.

"Thunderation, but that fellow can't talk over the phone. Why....."

And then you think of something—a little sneaking thought: "Maybe it's me; maybe these auditory channels of mine are not quite up to snuff."

It only happens occasionally, but once in a while you wonder if your hearing is as good as the next fellow's; if you can see with the keenness necessary for the full enjoyment of life; if your meals taste as good as Bill Jones'; you wonder vaguely, "Are my senses perfect?"

It means a lot to have the five major senses—sight, hearing, smell, taste and touch—in good working order. And are they? Well, here's the answer: Give yourself the following tests and see how your senses measure up.

First your ears. There is no common sound which is always uniform at a given distance, and modern doctors giving tests for hearing invariably use the audiometer or a tested tuning fork. In your case, however, the ordinary pocket watch will serve quite well. Some of these tick a little louder than others, but most of them you should be able to hear beat quite distinctly at a distance of one yard. By testing several persons with the same watch, you can establish a definite average at which the watch tick should be heard by anyone possessing normal hearing.

That's one test—old but reliable. The next thing is this: Your sense of hearing may be normal as regards density, but has it perception enough to distinguish between various sounds? Can you let a friend strike a safety match on a box, rub his wet finger over a glass, play a tune on a comb, operate a typewriter, turn the pages of a book and unhesitatingly name at least three of the tasks at which he is employed. Try it! You will be surprised how unfamiliar a sound can be when dissociated from its accustomed combination with a visual setting.

So much for the hearing. Next comes something which is considered relatively unimportant—the taste. Only a very few classes of people—food testers, chemists and pharmacists—appreciate the value of a delicate sense of taste. They alone know that the taste organs must be fully developed before anyone can enjoy to the full a really delicious meal.

Taste alone is not really taste. Although the various taste buds in the mouth give distinct sensations of taste, most foodstuffs must be smelled as well before we really taste them.

That fact is best illustrated by the following little test: Ask an inveterate smoker if one cigaret tastes differently from another. He will invariably say that, his favorite brand, has an entirely different taste from all others. And yet, blindfold this smoker, plug his ears with cotton, bid him hold his nose, place him in a room where the temperature is eighty or above and let him take irregular puffs at a lighted cigaret and an unlighted one, and, in the course of two minutes, he will be unable to distinguish the lighted cigaret from the unlighted one by normal inhaling and exhaling. His sense of taste alone is insufficient; it is only through the contributory sensation of smell that a smoker can really distinguish his favored cigaret.

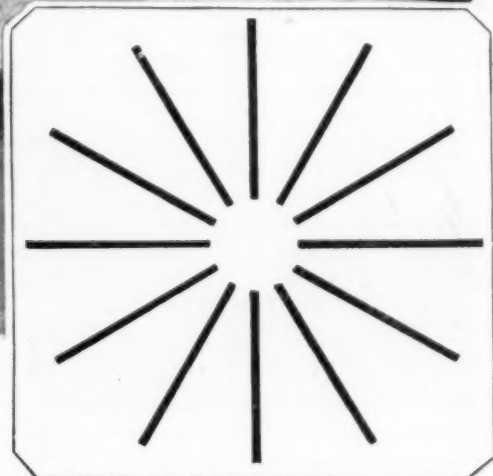
In the same manner, the average person finds it extremely difficult to taste any difference between raw potato and ripe apple if the sense of smell has been shut off.

So, taste is really taste and smell combined. The taste organ itself can be tested quite apart from the organ of smell. Like this: Take a clean glass rod and gently tap the tip of your tongue. A normal tongue will immediately register a sweet taste because the sweet-taste buds, which are situated at the tip of the tongue, have been stimulated into action. If these buds have been dulled through a diet heavy in sweet stuffs, the sensation will not be distinct, and in some cases, especially in that of a continually candy-eating individual, the glass-rod test will fail entirely. The same glass rod, if tapped against the side of the tongue, far back, will give rise to a bitter acid taste.

Smell, in itself, can be tested by blindfolding yourself and then smelling several



Testing the Eyes for Seeing at a Distance, and a Simple Test for Astigmatism; the Lines Should Appear, at Ten Feet, to Be of Equal Blackness, Otherwise the Eyes Are Wrong





Making One Marble Feel Like Two, and Getting One Sensation from Neck Nerves and Two from Finger Tips

familiar odors. Official tests of smell, as used by large medical institutions, employ from eight to twenty odors, and of these the average person can distinguish but twenty-one and a half per cent.

For your own test, then, use an onion, a weak solution of chocolate, cinnamon, ammonia, cloves, roses, coffee, tea, lemonade and castor oil. Of these ten very familiar odors, you should distinguish five for a fair average. It's not so easy as it sounds. Without the aid of a picture of the object, as seen by the eye, the sense of smell alone can roughly distinguish the odor, but not to the extent of labeling it with a name in fully half of the test objects.

The sense of touch is quite important. The girl who clicks a typewriter for a livelihood illustrates the importance of this sense, as does also the safe-lock picker, although in an entirely different manner.

Sense of touch varies but very little in the average group of persons. It is either entirely all right or decidedly wrong. At the tip of the fingers and tongue, touch is much more delicate than on the back.

Testing with a sharp pair of scissors, you can easily distinguish the two points at a distance of one-eighth inch apart at your finger tips, but will need to separate the points fully two inches before two distinct pricking sensations are experienced on the back of the shoulder.

Another peculiar experiment in touch is performed with an ordinary marble. By crossing the first and second fingers in the manner shown and rotating them on the marble, the average person will get the sensation of two marbles instead of one.

Finally in the list of senses comes sight. It is by far the most important, the most studied and, perversely, the most neglected of all the senses.



Trying, with the Back Turned, to Identify Various Sounds, and, Below, a Smoker Discovering He Can't Tell the Difference between a Lighted and an Unlighted Cigarette by Taste Alone

Tests for your sight are three in number: Simply can you see at a distance; can you see close at hand; are your eyes free from astigmatism?

For the first, you should be able to read the following line at a distance of fifteen feet:

S H F K

You also should be able to read, easily, the large type which is found in the average magazine at a distance of fifteen inches.

The test for astigmatism is taken with the aid of a chart with a circle of lines as shown. Set this magazine up at a distance of ten feet and look at these lines. If they appear of uniform blackness, there is no astigmatism, but if one set of lines appear blacker than the others, astigmatism is present in that direction. Normally, most eyes are slightly astigmatic.

QUICKNESS OF EYE BIG FACTOR FOR SUCCESS IN SPORTS

Babe Ruth's batting skill, a wonder of the baseball world, is largely due to his remarkably keen and accurate eyesight. Tests in the laboratory have proved that his visual reactions are far more rapid



than those of the average person. By quickness of eye is meant the co-ordination of visual impressions with nervous and muscular reactions. This is an exceedingly important factor also in boxing, where dodging and delivering blows on split-second schedules is constantly demanded. Automobile racers, at a speed of 200 miles an hour, must be able to see clearly 1,500 feet ahead, and efficient co-operation of eye, hands and feet is essential to guide the car safely. In golf, even greater exactness is required. Lack of accurate eyesight and response is one of the chief causes of automobile accidents. The all too frequent statement, "I didn't see him coming," as heard in court cases, is substantial evidence of this.

MOTHPFREE HOMES MEAN CONSTANT VIGILANCE

Well-heated homes and factories provide excellent breeding conditions for moths with the result that the pests are on the increase. L. E. Jackson, of the Mellon Institute, declares. Instead of there being a short "open season" for hunting moths in the family closets, the housewife must be vigilant at nearly all times of the year. Where formerly but one generation of the insects was produced during the warm summer months, now there are two or more generations, due to the conditions of artificial heat. Exhaustive studies have been made in search of chemicals that will kill the pests without damaging fabrics or producing unpleasant odors. Certain products of the cinchona tree have been found to meet the varied requirements, it was said.

AUTO'S SUPER-BALLOON TIRES ADVERTISE SERVICE STATION

To attract attention to an automobile-accessory shop in Los Angeles, the proprietor has equipped a small car with 44 by 10 tires. As a stationary display, it causes considerable comment and, when the car is driven about the city, it never fails to excite curiosity and amusement.



More Tire Than Car: Display Auto Equipped with Super-Balloons to Advertise an Accessory Shop



Interior of Berlin Theater, Where Circular Style of Decoration Supplants the Customary Angles and Corners

THEATER INTERIOR OF CIRCLES LATEST MOVIE STYLE

A firm of Berlin architects has introduced an innovation in theater interiors with a movie palace designed in curves and circles. An oval stage, curved balconies and a tremendous rounded arch in which the pipe-organ units are installed over the stage, are special features.

REINDEER MEAT BY AIRPLANE SERVED IN ALASKA

An Alaskan village was thrown into excitement recently when an airplane dropped from the skies with a cargo of reindeer meat. It was the first plane they had seen and their amazement was increased when the chief of an Indian tribe that long had been hostile to them, stepped out of the cockpit for a friendly visit. The plane was piloted by C. P. Crawford, an American. During favorable seasons, fortnightly trips are planned to take supplies to mining camps 150 miles from Shungnak, the base of the meat supply.



Adding Section to Big Smokestack While Fires Burned Below; Workmen Completing Second Half of a Joint

BUILD STACK WHILE FIRES BURN TO KEEP PLANT RUNNING

Engineers accomplished the "impossible" the other day in adding a twenty-foot extension to the smokestack of a gasworks in Seattle, Wash., while soft-coal fires burned under twelve boilers. Skeptics said it couldn't be done. The plant could not be shut down, for the city needed the gas. Clouds of smoke poured continually from the stack and the temperature at the mouth was about 300 degrees Fahrenheit. The job was accomplished by a special method of construction and with the co-operation of the firemen. The stack sections, which were of metal plate and eight feet in diameter, were rolled to fit the stack, the holes punched and then each joint was split in half. After a good head of steam was up, a

fan was set running and a damper in the stack was closed to lower the temperature to about 150 degrees and to decrease the smoke. By putting up half a joint at a time, the men were able to screen themselves from the smoke. When the steam pressure was lowered, the work was temporarily halted while the firemen shoveled on more coal and brought the pressure back to the required point, ready for another period at the stack. A pair of ten-foot tongs was used to help hold the two halves of the sections together, and when they were finally in place, they were electrically welded to make a secure joint.

OIL IS REMOVED FROM STEAM BY ELECTRIC PROCESS

An electric method of removing oil from water condensed in a steam engine has been developed by a German scientist. He passes a direct current through the water. This collects the oil in small foam flakes, destroying the emulsion and making filtration possible. A relatively small quantity of electricity is required. The oil gets into the water from the pistons, becomes atomized and is carried away in the waste steam. The milky emulsion that is thus formed in the condensed water creates a residue which, if left there, interferes with the efficient operation of the engine.

LEAD ON STREET-CAR GEARS DECREASES NOISE

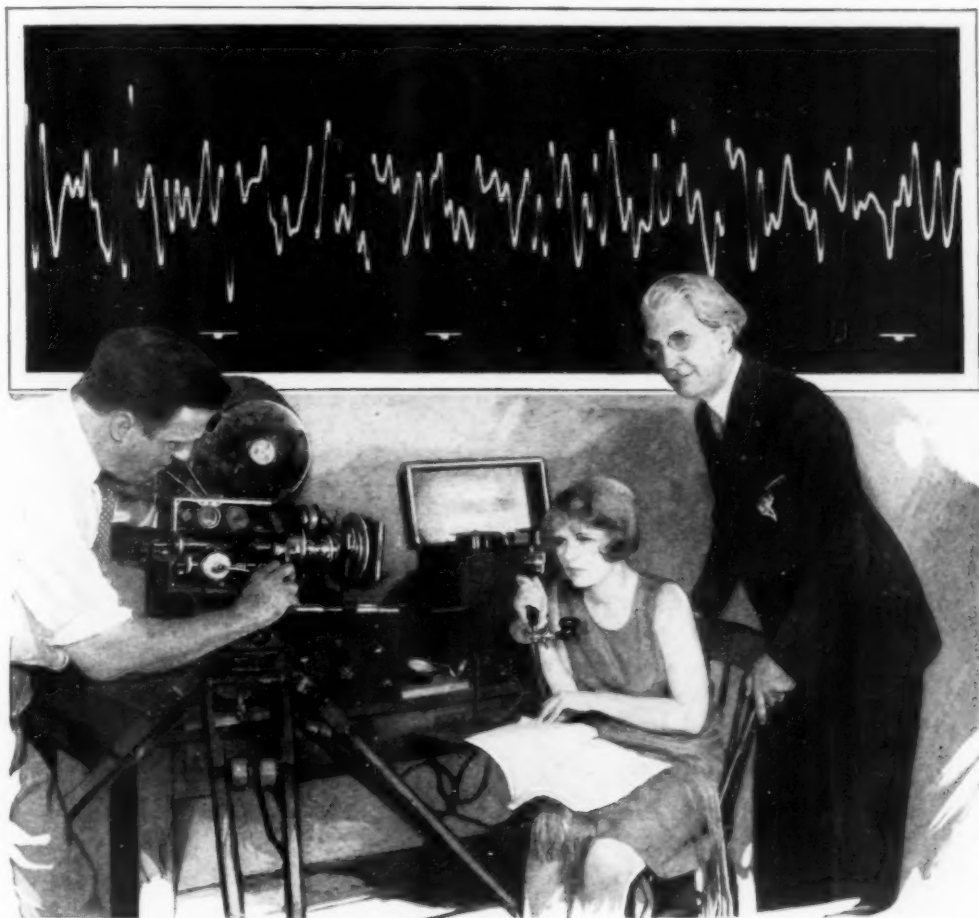
Lead has been employed effectively to deaden the noise of the gears on street cars being built in San Francisco. Rubber pads



Pouring Lead around Rim of Street-Car Gear Wheel, to Help Deaden the Noise

between the trucks and the body and a sound-deadening material under the car floor have also decreased the usual unpleasant noises. Air pumps have been insulated to make them quieter and, at crossings, the rails are sealed with asphalt to eliminate the loud pounding of the wheels in passing.

SLOW MOVIES OF VOICE TO AID PICTURE STARS



To Improve the Talking Movies: This Apparatus Films the Actress While She Speaks, and, at the Same Time, a Record Is Made of the Vibrations of Her Voice as Shown Above

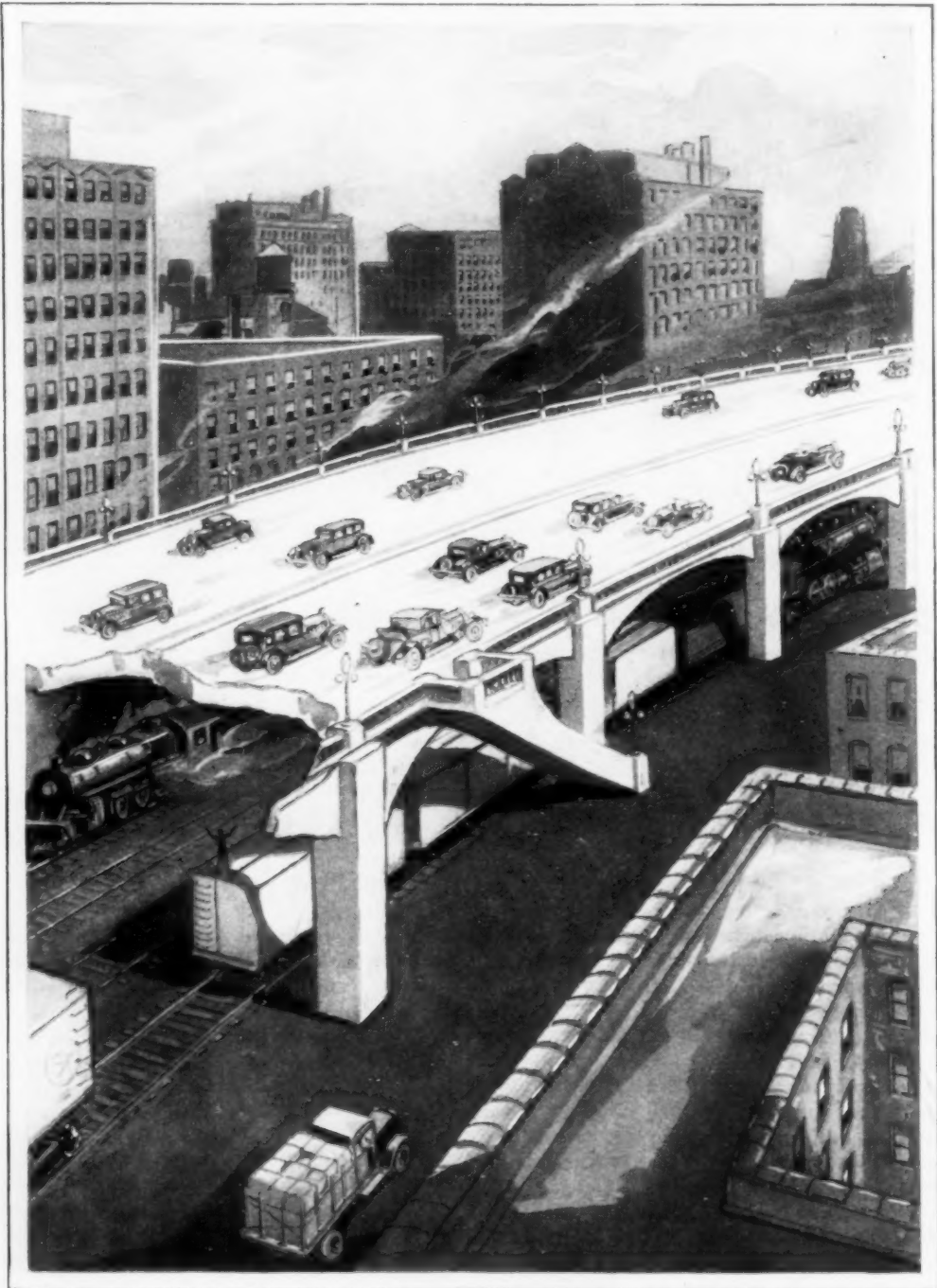
Introduction of talking movies has made a new demand on the actors, and many of them are requiring special training to fit their voices for satisfactory recording and reproduction. In this connection, an apparatus, developed by scientists at the University of Southern California and experts of a motion-picture company, has proved helpful, according to reports. A visual record of the voice vibrations is prepared directly from the spoken tones of the subject and this can later be shown in movie fashion and at a slow rate of speed so that defects can be recognized and corrected. While actors for the talking motion pictures do not need loud voices, their pronunciation must be dis-

tinct, and many of them require special teaching to attain this. The visual record helps the speaker to recognize and correct his own mistakes.

GAUGE SHOWS QUALITY OF OIL AS MOTOR RUNS

To eliminate guesswork and prevent lubrication troubles, an oil-quality gauge mounted on the dash shows the condition of the oil at all times. When installed in connection with the filter, the unit not only gives this indication but also warns of any irregularities in the functioning of the lubricating system, so that they may be remedied before serious damage is done.

AUTO ROADS OVER RAILWAYS TO SPEED TRAFFIC



Drawing of Proposed Auto Highway to Be Constructed over Railway Lines Entering Chicago; Cars Would Enter and Leave the Special Drive by Means of Ramps; Cost of the Project Is Placed at \$250,000,000

MOLASSES POURED ON WAVES SAVES SHIP IN STORM

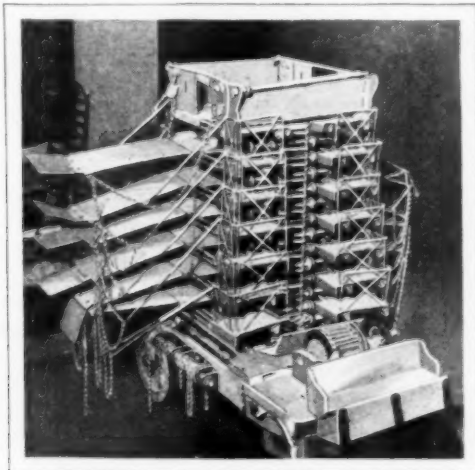
Molasses as a substitute for oil in calming the sea during a storm was used successfully recently by a ship captain off the northern coast of Cuba. When the vessel was threatened by the high waves, its cargo of molasses was opened and more than 70,000 gallons poured on the water. Gradually the sea about the ship became still and the vessel was able to proceed safely out of the storm zone.

WATER HYACINTHS ARE TURNED INTO CHEMICALS

Long considered a pest in southern rivers, the water hyacinth has commercial possibilities as a producer of chemicals and alcohol, a Calcutta scientist has discovered. From it, he has obtained pure potassium chloride and power alcohol, he reports, and the pulp that remains after the dried plant has been treated, is suitable for making strawboard.

TOWER OF STEEL GANGPLANKS TO SAVE LIVES AT FIRES

A series of collapsible steel gangplanks and platforms on a wagon has been introduced in Germany as a means of rescuing persons trapped in burning buildings. The set can be raised or lowered to various levels, affording exits from two or more stories simultaneously.



Model of Life-Saving Tower and Platforms for Rescuing Persons Trapped in Burning Buildings

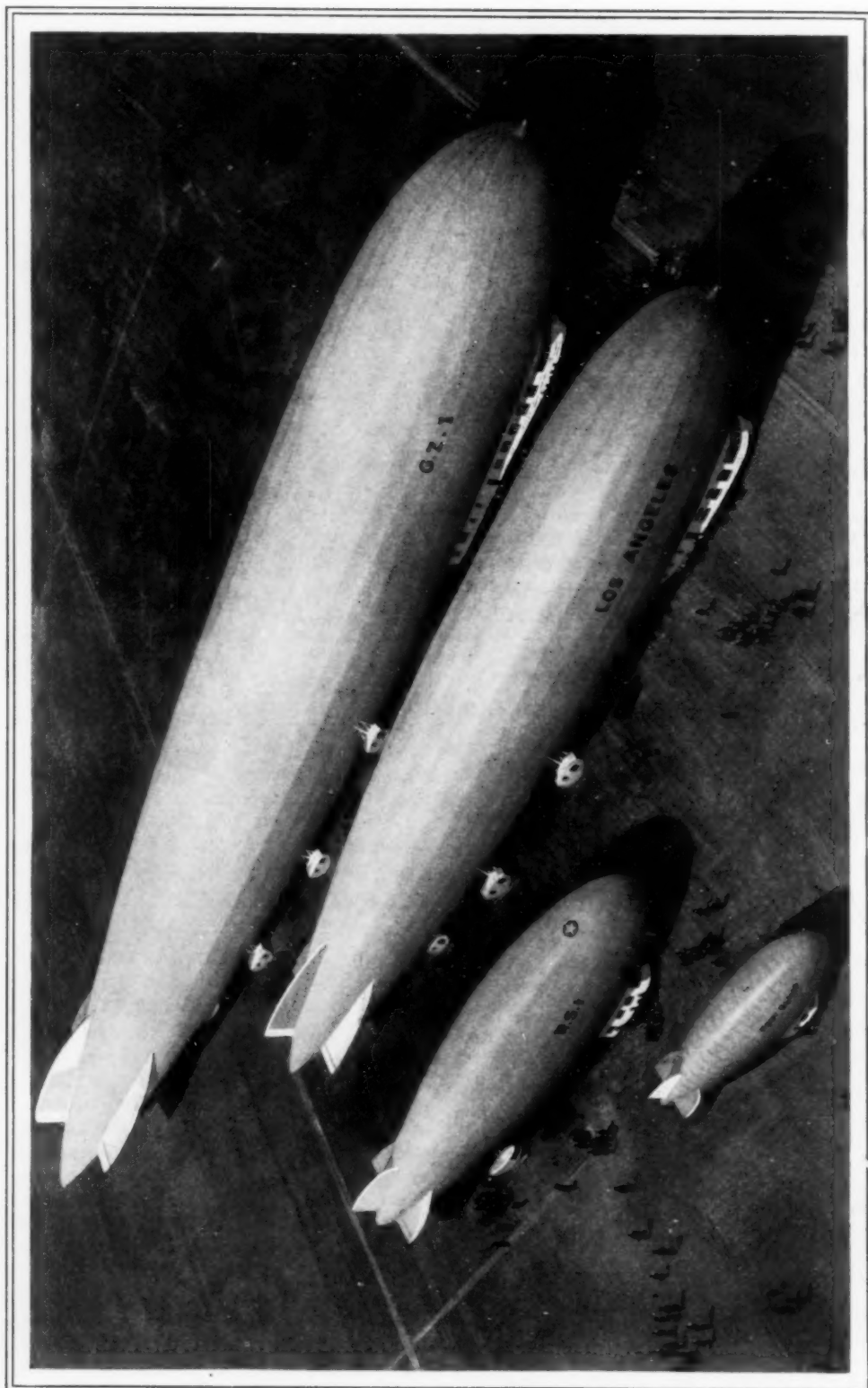


Packing Bed in Suitcase, and How It Looks When Set Up for Use

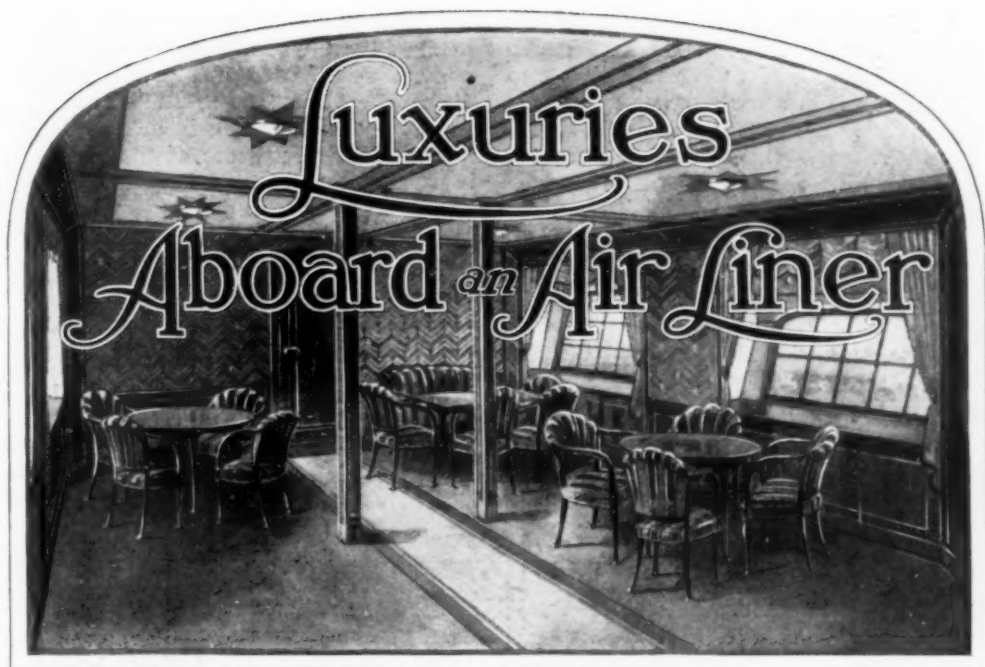
PORTABLE BABY BED WEIGHS THIRTEEN POUNDS

A collapsible outfit for the baby, weighing, with its carrying case, but thirteen pounds, has been invented by a Chicago woman. The outfit includes a bed, built of strong aluminum tubing and brass fittings, a sunshade, mosquito net, pillow and canvas side walls, and the case contains pockets for the baby's clothes, bottles and other accessories. The canvas side walls and cover of the cot bed are removable for washing. Packed in the case, the outfit can be carried in the automobile or on the train, and set up in a moment.

Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.



One of the Navy's Proposed New Airships, the "GZ-1," Compared with the "Los Angeles," the Army's Largest Semirigid "RS-1," and a Pony Blimp; the New Ships Are to Be 756 Feet Long and Have a Gas Capacity of Six and a Half Million Cubic Feet



The Lounge and Card Room aboard the "LZ-127," Germany's Latest and Biggest Zeppelin, Now Nearing Completion; the Huge Dirigible May Make a Flight around the World

THE biggest Zeppelin ever built—127th in the line from Count Zeppelin's first ship—has been completed at Friedrichshafen, on Lake Constance. Besides being the largest, with a length of 770 feet, a diameter of 100 feet and a maximum height of 110 feet, it is the first to be designed for transatlantic passenger and freight service, and the first to use gas, instead of a liquid, for fuel.

When it takes to the air this summer, its construction name, "LZ-127," will be changed to "Count Zeppelin" in honor of the inventor, who gave his fortune and his lifetime to perfecting the rigid airship.

Six reversible Maybach engines, of the same type used in the "Los Angeles," will furnish 2,650 horsepower to drive the ship, or 2,150 horsepower at cruising speed. The engines are designed to run either on a special carbohydrate gas or on ordinary gasoline. The new gas fuel is the most interesting innovation, for it has exactly the same weight as air. As a result, the weight and lifting capacity of the ship do not change as the fuel is used.

The problem of keeping the weight of an airship constant, as fuel is used, is the most important in dirigible operation. The

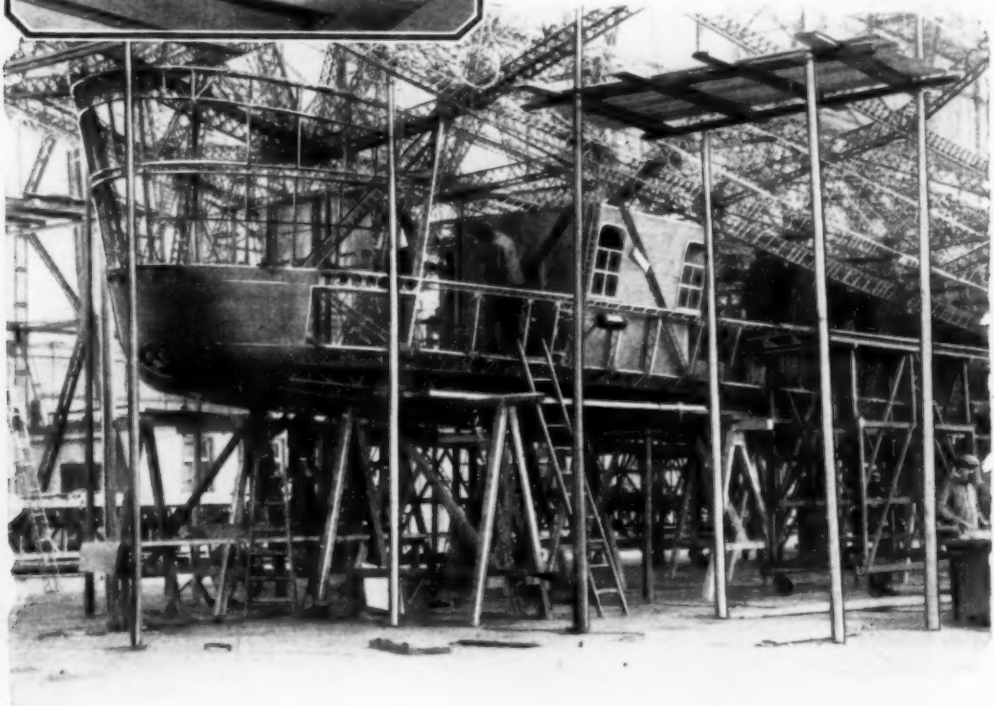
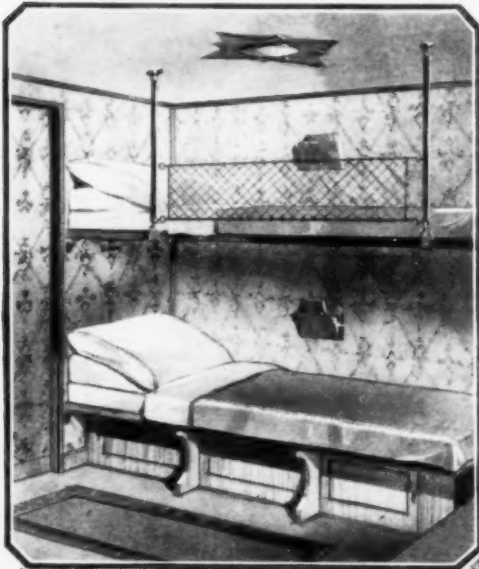
American navy developed a water-recovery system that extracted water from the exhaust gases to offset, as nearly as possible, the gasoline consumed. With the new German gas, the additional weight and complication of the water-recovery apparatus are eliminated. Some gasoline will be carried, so that, if it is necessary to lighten the ship to rise to a higher altitude, it can be done either by burning the gasoline as fuel, or, in an emergency, dumping the gasoline, tanks and all, because it would be dangerous to release the volatile fuel into the air, as the ship would fly in a cloud of gas which might be ignited from a motor exhaust.

The ship will have a total lift of 129 tons under normal atmospheric conditions. The cruising radius depends on the amount of freight carried and the speed desired, but with 33,000 pounds of useful load, it is possible to fly 6,200 miles at a speed of sixty-two to sixty-eight miles an hour. The top speed under full power will be 79.36 miles an hour. A crew of twenty-six will be carried, including the navigators, radio men, cooks, waiters and others. Ten cabins, each with two berths, are provided for passengers.

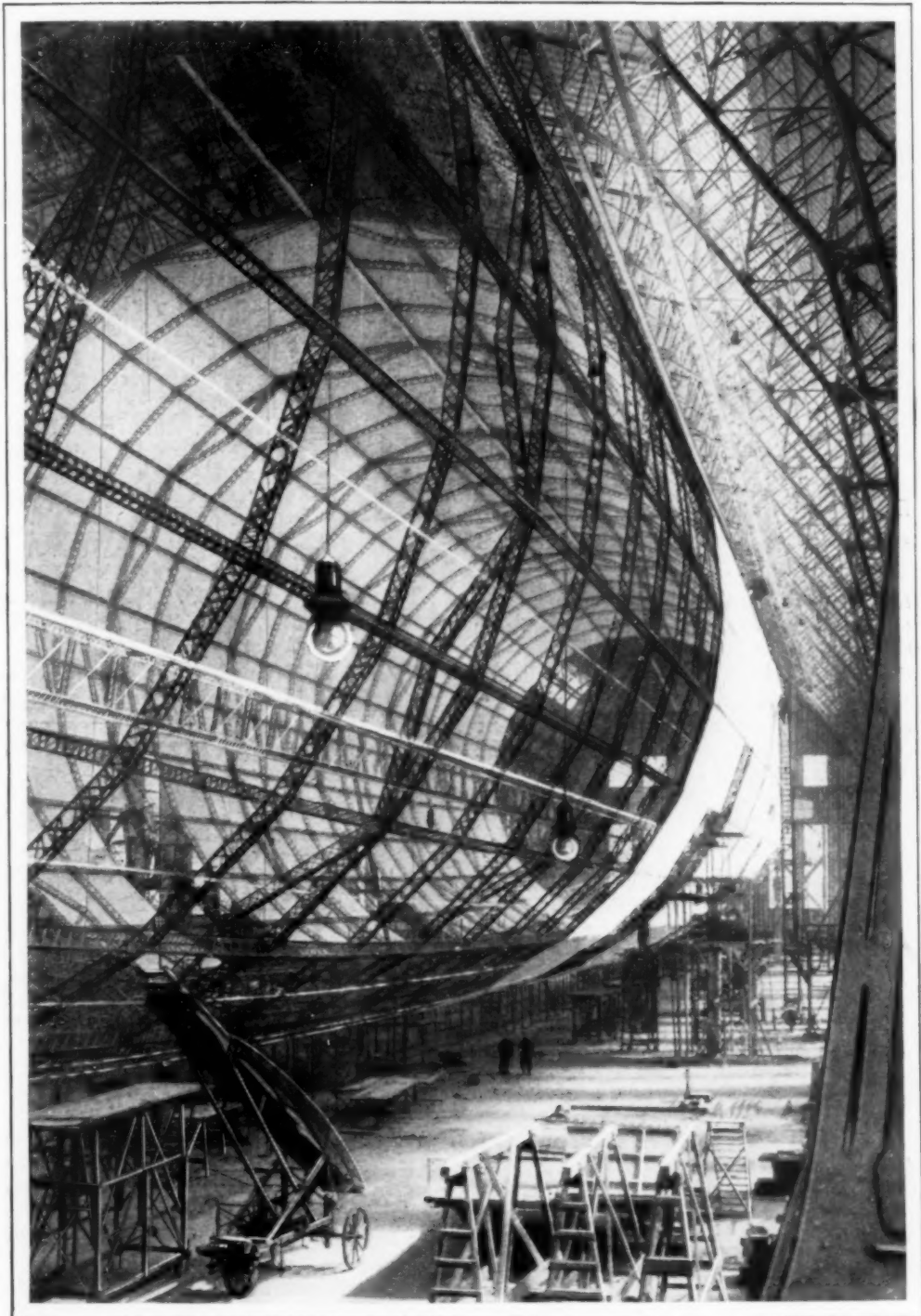
The first flight of the new airship this summer is to be made to England, marking the first visit of a German dirigible to the British isles since the war-time raids over London ten years ago. For the visit, the British government has placed a moor-

ing mast at the disposal of Dr. Eckner, head of the German Zeppelin works, who commanded the "Los Angeles" when its German crew flew it to America for delivery to the navy. A Spanish company is negotiating for lease of the airship, if it passes its flight tests successfully, proposing to operate it on a passenger, mail and express run between Spain and Buenos Aires. It is possible, however, that Dr. Eckner first may carry out his plan for a flight around the world.

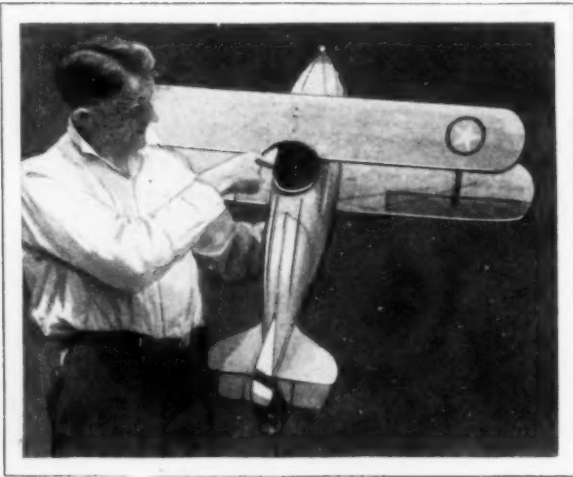
The new ship, with its length of 770 feet, outranks the two 720-foot ships now nearing completion in England, and will be longer than the proposed two 756-foot ships authorized for the U. S. navy, but its gas capacity of 3,800,000 feet is considerably under the 5,000,000-cubic-foot English dirigibles, and much below the 6,000,000-foot capacity of the vessels planned for the American navy. The reason for its smaller capacity lies in its slowness. The "Los Angeles," the biggest Zeppelin actually in operation, measures but 656 feet.



One of the Staterooms of the "LZ-127" and the Passenger and Control Gondola under Construction; the Walls in the Center Enclose the Radio Operator's Compartment



The Skeleton of Germany's Latest Zeppelin, with Part of the Outer Envelope in Place; the Workmen Standing below the Keel Give an Idea of the Immense Size of the Airship



Model Plane Equipped with Pivot Seat, Which Is Connected to the Controls for Automatically Steadying Ship

SEAT ON PIVOT STEADIES PLANE FOR SAFER FLYING

By suspending the pilot's seat on a pivot arrangement and connecting it to the ailerons with wires, an Alaskan engineer has developed a stabilizing device for safer flying. The working principle of the installation is that, should the plane go into a dive, the seat would slip forward, pulling the elevators in a position to correct the difficulty. Side slips would be stopped in the same manner, it is claimed, and the stabilizing apparatus is said not to interfere with the ordinary controls.

AUTO JACK FIXED TO WHEEL SIMPLIFIES TIRE CHANGE

Easier tire changing on pavements or dirt roads is afforded by an auto jack devised by a western taxicab driver. The jack itself is a piece of iron, weighing about three and one-half pounds, and is inserted in permanent clips that are attached to the inside of the wheels. By driving the car a short distance,



the iron support comes in contact with the road and elevates the car so that the

tire can easily be slipped off. The entire process is said to require only a few moments.

NEW PAINT TO PREVENT BARNACLES

Use of a special paint developed by the chemical-warfare service of the army will effect great savings in shipping, it is predicted, as it is believed to prevent barnacles from attaching themselves to the underwater portion of a ship's hull. It is estimated that these troublesome pests involve an extra fuel expense of at least \$75,000,000 a year, while great sums are spent in docking and cleaning the hulls of vessels. Effective

prevention of barnacles would effect a saving of in all nearly a billion dollars a year, including time losses, it is estimated.

ALARM BOX INSTEAD OF PHONE SPEEDS CALL FOR POLICE

Instead of having to telephone for the police, users of a special alarm system in Berlin, simply pull a ring attached to a box when they are menaced by burglars or otherwise need aid. The signal is relayed to a central office and brings response within seven minutes at the most, according to reports.



FLAVOR IS ADDED TO MEAT BEFORE KILLING

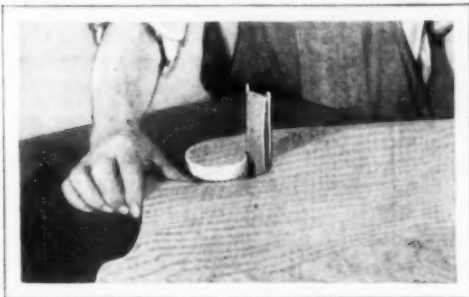
Housewives will be able to purchase meat already seasoned if a process developed in France proves successful. Various kinds of flavoring are injected by means of a hypodermic needle into the blood of the animal, experiments having been tried on 200 different subjects, including poultry, sheep and pigs. At the same time, coloring matter may be introduced to make the meat an even hue.

BELIEF IN SEA SERPENTS FADED WITH DAY OF MODERN SHIPS

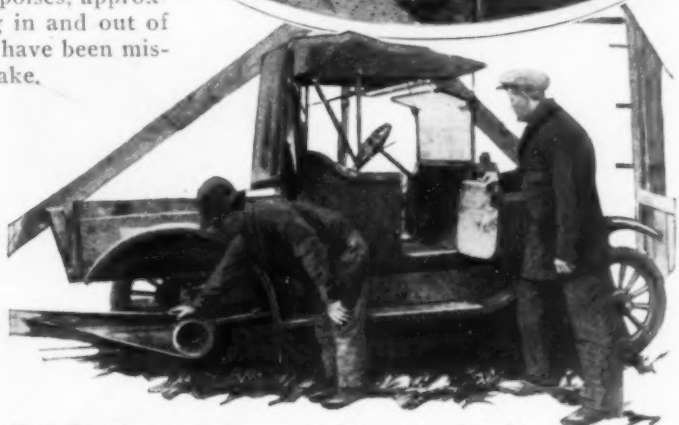
Tales of sea serpents and other monsters of the deep belong to an age that is past, but stories of these creatures have ceased, not because of any radical change in marine life, but largely because of the modern ocean liners, in the opinion of Austin H. Clark, of the Smithsonian Institution. When men knew less of the sea and sailed in tiny ships, comparatively close to the water and subjected to many dangers no longer present, such things as sharks, squids, cuttlefish and leaping porpoises assumed terrifying proportions. The tails of the squids, for instance, might easily have been the basis for legends of fearful serpents. The squid is sometimes fifty feet long, and about twelve inches in circumference. It has long arms that branch out at the ends and these may have been the fabled sea vipers. Porpoises, approximately in line and leaping in and out of the water, as they do, may have been mistaken for a single huge snake.

MOTOR SANDER SAVES TIME ON SCROLLWORK

As a substitute for files, a motor-driven sander has been introduced to smooth the edges of scroll and jig-saw work. It is said to perform the operation more accurately and, with the outfit, one man can do what ordinarily would require three or four using files or other hand-operated tools, it is claimed.



Smoothing the Sides of a Scrolled Edge with the Motor-Driven Sander



Ferry Car About to Start across the River, and a Close View of the Motive Power, the Old Automobile with Shaft Attachment

AUTO RUNS FERRY OVER RIVER SAVING LONG DELAYS

Ferry service across the Saskatchewan river in Canada continued in spite of running ice, low water and other difficulties, due to the ingenuity of W. E. Kilgour, an operator at Nipawin. He rigged an old automobile to furnish the power that pulled the car back and forth on its cable. The carrier itself was of his own craftsmanship, being constructed of timbers and steel strips, fashioned in his own shop.

☞ The Indians made hominy before the time of Columbus.



Dog Fighters

with motor wide open, shoves the ship's nose down into a dive. Like one ship, the squadron follows suit. The whine of wind through the taut brace wires of the little single-bay wings rises to a shriek as the needles of air-speed indicators whirl from 150 to 200,

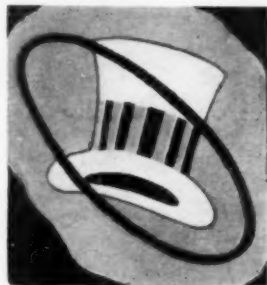
A LONG line of little clipped-winged fighting ships, 450-horsepower motors roaring, cruises across the sky at 150 miles an hour. In groups of three, the squadrons rise like giant stair steps in the sky, flying in echelon, each plane and each group slightly to the side, slightly behind and slightly above the one ahead.

At 15,000 feet they are alone, the world beneath blanketed under billowing seas of fleecy white clouds that rise and fall and twist and roll as they drift along before an idle wind. Suddenly, through the mist pops a little plane, climbing steeply, and an instant later, on either side of the leader, appear his flying mates, to be followed again, in a long echelon off to the right, by the successive trios of his squadron.

The leader of the patrolling flight catches the glint of sun on bright yellow wings, shakes his joystick to waggle his ship's wings in signal to his followers, and,



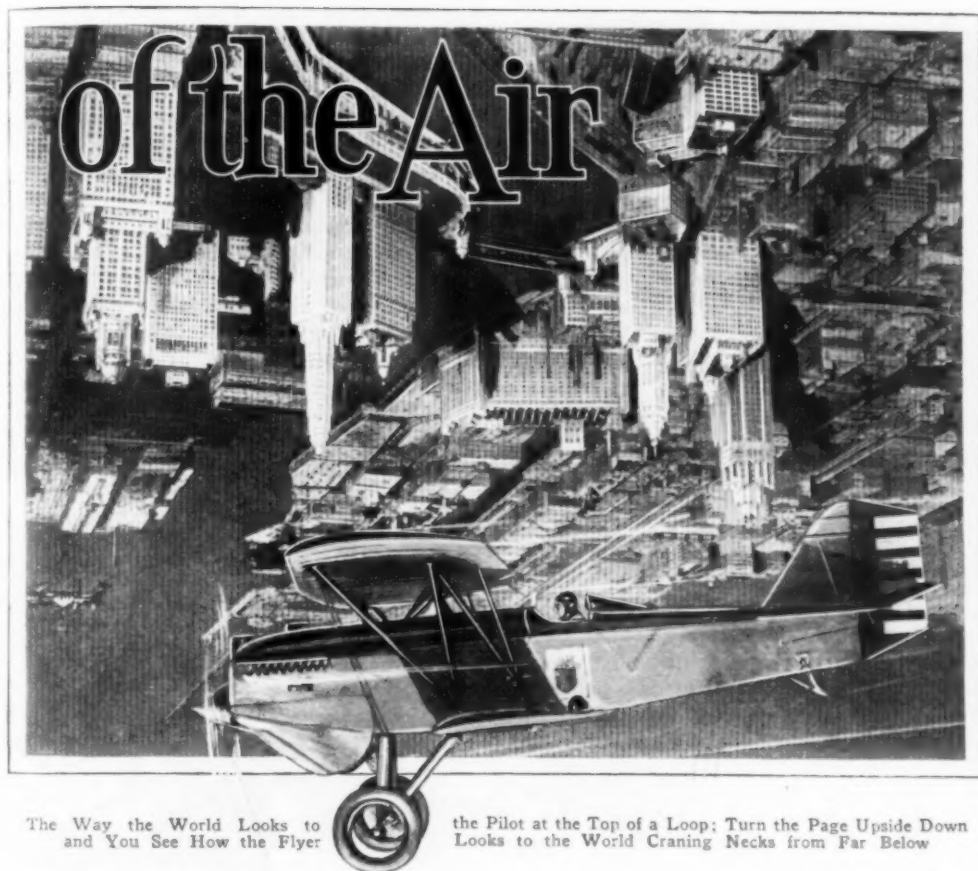
95th PURSUIT SQDN.



Major Tom Lanphier beside His Personal Plane, "Man-O'-War," with the Arms of the Pursuit Service on Its Side, and Four of the Squadron Insignia Made Famous in France

250 and mount toward 300 miles an hour.

The leader below sees the diving menace from above and flips his ship over to dive back into the protecting cloud bank, but, laboring from a steep climb and with maneuverability lessened by the rarefied air of the upper altitudes, he and his flight are not quick enough to dodge an



The Way the World Looks to
and You See How the Flyer

the Pilot at the Top of a Loop; Turn the Page Upside Down
Looks to the World Craning Necks from Far Below

attack that drops straight out of the sky at nearly 300 miles an hour.

The attackers and attacked meet just above the cloud line in a roaring, whirling mass of planes, and the dog fight is on. The first pursuit group of Selfridge field has started the day's play.

A dog fight in the air is like a dog fight on the ground, one of those free-for-all dog fights in which all the town's mongrels for blocks around join in, with one notable exception, for the first pursuit fights in a three-dimensional world, free to move not only to left and right, but up and down, in zoom and dive, as it seeks an advantage that will bring the sights of the dummy machine gun to bear on a vital spot of an opposing plane.

There is nothing else like it in all the army flying corps. The little short-winged pursuit planes are built for one purpose—to attack. There is no machine gun trained out to the rear, or down below

or pointed aloft to ward off attackers and fight a rear-guard action. Instead there are two fixed guns, firing ahead through the propeller, and aimed by pointing the roaring projectile of the plane itself directly at the target.

The man whose nerves hold out the longest and who can keep his ship pointed straight at the foe is the winner, and the pages of the record of the first pursuit, formed originally in France, are filled with accounts of men who had steel nerves—Lieut. Frank Luke, the balloon buster from the southwest, Eddie Rickenbacker, America's ace of aces, Raoul Lufberry, Malcolm Campbell, Norman Hall, Lieut. Meissner, and a host of others.

Take the story of Lieut. White, of the seventeenth, the squadron that sported on its planes a white owl, diving with open beak and outstretched talons. Lieut. White led a patrol of the seventeenth one day when they met a flight of Fokkers,

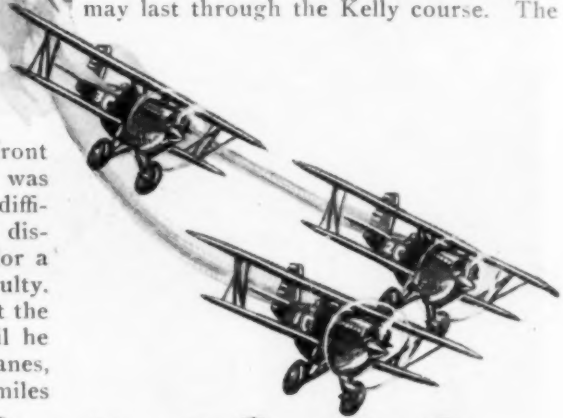


Lieut. Cox, a new pilot fresh at the front and inexperienced in aerial battle, was attacked by a German plane and in difficulty. White, the patrol leader, had disposed of an enemy plane and was for a moment free, when he saw Cox' difficulty. With motor wide open, he roared past the new flyer, and held straight on until he rammed the enemy ship. Both planes, meeting at better than a hundred miles

an hour, shed their wings under the terrific impact and dropped to earth in flames.

How does one become a flyer in the branch that produces the aces of aces? There are still some old-timers in the first pursuit who graduated from war-time schools and fought in France, Maj. Tom Lanphier, the flight leader, for example. But with those few exceptions all the rest are products of the army school at Kelly field, in Texas.

A couple of thousand likely candidates apply each year for admission at Kelly. In the first rigorous preliminary examination, nine out of ten fall by the wayside and the best two hundred or so are selected. Out of 200, about twenty per cent may last through the Kelly course. The



Pursuit Pilots of Selfridge Field Ready to Take Off for Winter Maneuvers in Northern Michigan, and, Above, Nine of the Little Fighting Ships Roaring Down in Formation

others are shunted aside for training in other and less strenuous branches of flying. Of the twenty per cent who get through Kelly, five per cent may qualify for pursuit flying. The class that graduated Colonel Lindbergh was an exceptionally good one—of 200 there were six, including the "Lone Eagle," who made the grade and were qualified to fly the world's fastest fighting ships.

The first is the one and only pursuit group actually organized within the United States. There are pursuit planes stationed at Panama, Hawaii, and in the Philippines, but the flyers at Selfridge field, twenty-five miles north of Detroit, are unique in continental United States. They are unique, too, in other ways. Instead of training under the lazy skies of Texas, or beneath the warm sun of California or Florida, they have been set down beside Lake St. Clair, on the Canadian border, where for three months out of



the year they can take the wheels off their landing gears, substitute skis, and fly off snow and ice, in temperatures that often fall to thirty or forty below zero in the higher altitudes.

They have a bomb and gunnery school far up in northern Michigan on an ice-locked lake at Oscoda, and here each winter they set up a camp, ferrying in their supplies by air. It is so cold at Oscoda in winter that ether is used to start the engines in the morning, and stoves are used to keep the oil in the crankcases liquid overnight. At first they used heaters, set on the ice, and piped the hot air around the engine through canvas tubing. Then a clever sergeant designed a two-burner gas heater that remains permanently attached to the engine, draws its fuel supply from the plane's gasoline tank, and heats the cooling water at the lowest point in the engine. Thermostatic action takes care of the circulation, and the motor remains warm through the coldest night.

Inventing gadgets to improve the planes is an active side line in the pursuit group.



Each Pursuit Ship Has Its Own Crew of Mechanics to Keep It Flying; Center, Changing from Wheels to Skis for Winter Work

As befits their position as the premier flyers of the air corps, the pursuit pilots each has an individual plane assigned to him. On one side the engine cowling, in a neat panel beneath the flying-wing insignie of the service, is the pilot's name. And on the opposite side, in a similar panel, is the name of the sergeant who acts as crew chief to take care of that particular ship, and the privates who assist him. With pilot and crew interested in the upkeep of only one ship, rivalry is naturally intense and the planes are washed and groomed to the last minute.

The pursuit planes—Curtiss "Hawks"—are tiny things, as planes go. Like Lindbergh's "Spirit of St. Louis," they are one-man affairs, and after all the instruments, the machine guns and ammunition, the bomb releases and other attachments are installed, the pilot, in flying suit, can barely squeeze into the cockpit. Spurred by the constant cry for speed and more speed—Major Lanphier hopes to have 200-mile-an-hour ships next year—the designers are faced with the problem of reducing the frontal area of the plane, for it is the front section that offers the wind resistance. To keep the front as small as possible, water-cooled engines are used. A radial air-cooled engine cuts the speed twelve to fourteen miles an hour. Each successive model has a bit clipped off here, or

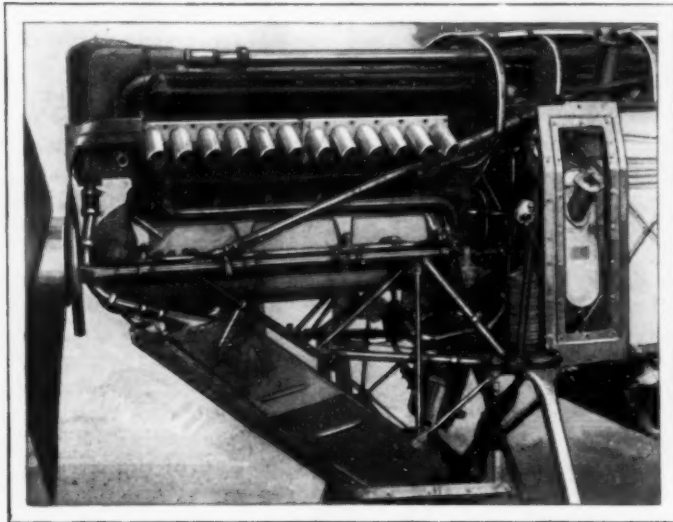
weight lessened there, to make it faster. Aviation leaders are even seriously considering creating a special class of small-sized jockey pilots, picked for their light weight, as riders are picked for the horse races. Around them would be designed a new type of ship, with cockpit tailored down to their small size.

Most of the present pilots are husky fellows, in fact, present army regulations fix a minimum for height and weight. Instead of trying to save a few pounds by skimping on the ship, it may be that in the future fifty pounds or so may be saved on the pilot, and the speed or load-carrying capacity of the plane correspondingly increased.

The present ships can carry about 350 rounds of light machine-gun ammunition, 250 rounds of heavier cartridges for the larger guns, or can take on a bomb rack with one 300-pound bomb, three of 100 pounds each, or a dozen of the small twenty-five pound size, used to harass enemy troops when caught marching along the road or lining a trench fire step.

If a long flight is planned, the load must be decreased to carry more gas. A "belly" tank is attached in place of the bomb rack beneath the fuselage. After the gas in it has been consumed, the tank can be dropped off, while the engine is switched to the regular fuel supply.

A squadron of the first pursuit in action is the finest sight that aviation has produced. Flying with wing tips almost touching, keeping perfect formation through the most intricate maneuvers, the entire flight moves like one ship. With their tremendous speed and consequent high maneuverability, they dive and loop, sideslip and zoom, and perform the rest of the fighting acrobatics with ease. On a big field, such as the mile square at Selfridge, as many as two squadrons—thirty-six planes—can take off and land without breaking formation. In



The Power Plant of the Curtiss "Hawk," the World's Fastest Single-Seater Fighting Plane



One of the Flock the Dog Fighters Shepherd over the Enemy Lines; Signal Corps Men Fitting Radio to a Big Douglas Communication Plane for Observation Service

flight they have improved on nature as represented by the high-flying goose, for they fly but one side of the "V" instead of both sides, as do the slower ships. Flying in echelon leaves them free to turn in either direction, without danger of running into an opposing line.

The fighting group is three ships, a leader, and, behind, at either side, and slightly above it, the two mates. When the leader turns or climbs or dives, the two followers perform the same evolution like one plane.

Off to the side, behind and slightly higher in the sky, is the next group of three, and each successive group follows in order.

The squadrons of the pursuit group boast the war-time insignia made famous in France—the falcon of the twenty-seventh, the white owl of the seventeenth, the kicking Missouri mule of the ninety-fifth, and the hat in the ring and Indian head which followed it, of the ninety-fourth.

Although the youngest branch of the fighting service, the first came home from France with a history and a set of heroes that cannot be surpassed by the century of history of many of the famous ground units. Take the twenty-seventh—

the falcon squadron. Its war-time fighting strength was twelve planes, but it took fifty-four pilots to keep it going from May until November, 1918. Eleven were killed in battle, seven made prisoners and three wounded, while one died in an accident.

Six distinguished service crosses went to the twenty-seventh alone.

The seventeenth—the white-owl squadron—boasted Second Lieut. J. H. Stevens, hero of one of the most famous incidents of the aerial war. Six pursuit planes had been assigned to escort an observation machine on a photographic mission into German territory. The observer had taken his pictures, which were badly wanted at headquarters, and was on his way back when his machine was forced down behind the enemy lines because of engine trouble.

It looked as if all the work had been wasted, when Lieut. Stevens swooped down in his fast little ship, took the negatives aboard, and got away safely before the Germans could reach him. The world war saw many such exploits in the air, for aerial battle tactics were only in the process of evolution. In the next war, says Major Lanphier, pursuit fighting will be a thing of perfectly kept formations,

for the side that will win will be the one that can keep its man and gun power together and deliver a telling blow, instead of separating into individual duels.

TRAVELING DESERT SHOE SHOP SERVES FARM WORKERS



Traveling Cobbler's Shop and Dwelling for the Shoemaker Installed in Wagon

One hundred and sixty miles from Los Angeles and 120 feet below sea level, is an odd cobbler's shop, serving farm workers and others on the large ranches about. It is rigged in a wagon and also has living quarters for the shoemaker who hitches a team of mules to his outfit and drives to a new location when business lags.

EXPLOSIVE IS MORE POWERFUL THAN T. N. T.

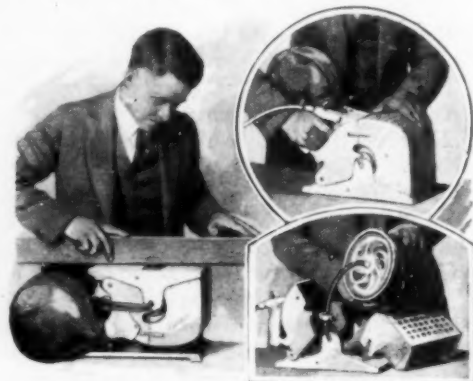
Interesting experiments with an explosive, said to be more powerful than T. N. T. or dynamite, have been conducted by army engineers. The substance, known as radium atomite, can be produced for about one-half the cost of T. N. T., the inventor declares; it is more stable, and is not affected by dampness. It is a light greenish powder, dry and very finely divided. Tests showed that it had greater force than other kinds of explosives and acted more rapidly.

SOFT COAL TURNED INTO HARD TO REDUCE SMOKE

By transforming soft coal into artificial anthracite, engineers vision a marked reduction of the smoke evil and a greater efficiency in fuels. The process is already in operation in Germany, and plans for the establishment of a large plant in this country have been announced. By the German method, soft coal is distilled at comparatively low temperatures of 900 to 1,200 degrees. Volatile oils and gases are driven off in the formation of coke, which is made at temperatures of 2,000 degrees and higher, but in the low-distillation process, only part of these valuable products is lost. The new fuel is said to be smokeless, free-burning and suitable for stoves, ranges and house furnaces. In its earlier stages, natural anthracite coal was bituminous in nature but was transformed under centuries of heat and pressure, brought on by geologic changes. The artificial method is an adaptation of nature's own way of making hard coal.

DUSTLESS SANDER FOR FLOORS ALSO WORKS ON BENCH

Operated by current from a lighting socket, an electric sanding machine now on the market may be used for floors or bench work, and the dust is sucked up in a catch bag attached to it. This is accomplished by a suction fan on the revolving sanding drum. The outfit is light in weight and is easily converted for use as a bench sander, jointer or even as a surfacer for floors.

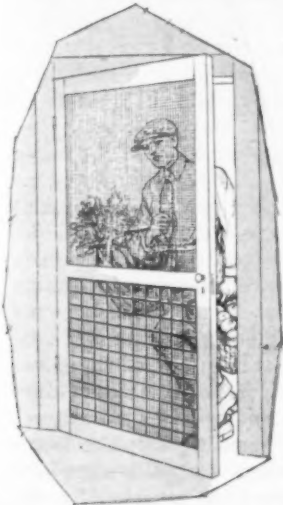


Sander in Different Positions and the Dust Bag; Outfit Is Operated from Lighting Socket

IRON DEPOSITS CREATED BY BACTERIA

Some of the largest iron deposits in the world have been caused by tiny bacteria, according to a well-known geologist. The iron was first extracted from rocks and carried away in water where it was taken into the systems of these minute organisms and transformed into solid material. The particles, gradually accumulating, formed the big iron fields known today. A single deposit of this character is said to extend far below the surface from New York to Alabama. It crops out near Birmingham. Bacteria caused the large iron deposits in the Lake Superior region, which have yielded millions of tons.

METAL GUARD ON SCREEN DOOR PREVENTS BREAKING MESH



the fact that repairs to the mesh are reduced to a minimum.

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Long Span of the Tyne Bridge between Newcastle and Gateshead, England; the Structure Cost Nearly \$5,000,000

SPAN OF FIVE HUNDRED FEET IN BIG STEEL BRIDGE

One of the most important features of the new Tyne bridge, constructed at a cost of nearly \$5,000,000, is the main span, 500 feet long. This is said to be the longest in Great Britain. The bridge has been erected to care for the ever-increasing traffic between Newcastle and Gateshead on the south bank of the river.

LEMON SQUEEZER AND STRAINER FITS OVER GLASS

Easily fitted over a tumbler or other handy receptacle, a cone-shaped extractor simplifies the task of removing juice from lemons. The liquid is thoroughly strained through the meshes of the squeezer which is cleansed simply by holding it under a stream of water. The cone is shaped to reach far into the half of the lemon so that as little of the juice as possible may be wasted.



The Ghost Towns



Panning Gold from the Sand of a Creek Bed, the Method Made Famous by the Argonauts of the Days of Forty-Nine

By IRWIN F. HARRISON

SCIENTIFIC mining and improvements in the technic of ore dressing are making it increasingly difficult for the famous ghost towns of the Rockies to retain their ghostliness.

A few of them have been shocked completely out of peaceful slumber and suddenly have become thriving communities again. Others, uncomfortably disturbed by revived mining activity near by, are stirring restlessly and threaten to shake off the cobwebs and dust heaps of long neglect.

This is happening despite the fact that, within the last few years, there have been few important discoveries of new ore

bodies in the ghost-town belt. Exaggerated reports of gold and silver "strikes" have resulted in occasional rushes into the hills, suggesting mildly the old-time wild scrambles to new diggings, but none of these temporary waves of excitement affected the old camps that had declined from boom-time glory to groups of tumble-down buildings.

Then, along came advanced methods of selective flotation for the treating of low-grade ores. Invention stepped in to offset those continued failures of plodding prospectors to stumble upon new veins of rich minerals. An unexpected impetus was felt in the western mining country. Hopes were revived, even in the face of low metal prices. New capital became available, flotation mills sprang up and ghost towns awoke.

Selective flotation, developed by continuous experimenting, showed the way for taking profits out of ores that formerly were spurned by the miner as worthless. Discarded tailings on the dumps of the silver and gold mines of the old bonanza days became valuable, and mining companies found it worth while to dig into the lower levels of the old mines and take out those low-grade complex ores present, by the hundreds of thousands of tons, at many places in Colorado, Utah, Idaho, New Mexico and Arizona.

Less than a dozen inhabitants, more or less hopeful, remained three years ago in Rico, Colo., which at the height of its prosperity had made proud claim to a pop-

Come Back



Blackhawk, Colorado, One of the Ghost Towns of the West; Stampede Camps Sprang into Cities Overnight, but When the Yellow Gold Was Worked Out, They Died Just as Quickly

ulation of 2,000. It had become a town of memories, of smokeless stacks on shaft houses, of abandoned schools and churches, grass-grown streets and long rows of unoccupied dwellings. Then a smelting company leased ore properties in the vicinity, erected a 250-ton flotation mill and began extracting profitable quantities of lead, zinc and silver from the low-grade material left in the mines by earlier operators. Rico came back with a bang, providing for the citizenry of the San Juan

country a surprise something like that occasioned by the inconsiderate arising of a corpse at a funeral. Vacant houses were repaired and reinhabited, new buildings went up, and miners tramped along streets that were no longer ghostly.

Eureka, another of the old mining camps of the San Juan region of Colorado, also was well on the road to oblivion when flotation came to the rescue. One of the mills at that place, famous in old days, was reopened with new equipment, becom-



Demonstrating the Flotation Process with a Soap-Bubble Pipe and a Few Small Shavings of Lead

ing the first plant to practice selective flotation on the zinc-lead-iron-sulphide ores of the Rocky mountain territory. Eureka prospered again and the revival was felt, too, in near-by Silverton and Ophir, which had been struggling along amid dreams of the years when they had been "gems of the Rockies."

At Central City, Colo., a flotation mill was established in an abandoned brewery, and similar projects injected new life into Pearl, Idaho, and into Wardner and other towns of the Coeur d'Alenes district of that state. A new mill at Kellogg is extracting wealth from ore tailings tossed aside after having given up only a part of their valuable content to the operators of twenty-five or thirty years ago.

The improved ore-dressing process is given chief credit for reinvigorating mining around Goodsprings and Arden, and in other Nevada communities. New Mexico has a successful 12,000-ton flotation mill at Hurley and a smaller one at Goriotta. This later process has replaced other ore-dressing methods in nearly all the mills of Arizona.

In view of what it has done for the mining industry, it is not surprising that Prof. Arthur J. Weinig, of the Colorado school of mines, writes of the flotation process as "the most important development of the present century in the recov-

ery of metals from ore." Flotation is nothing new, of course. The basic process, now called "bulk flotation," was being used in the treating of American ores fifteen years ago. But it was not until the selective feature had been developed that the invention became a godsend to the Rocky mountain mining interests. Up to that time, there had been no satisfactorily profitable way of treating the region's low-grade complex ores, particularly abundant in Colorado.

Even in this age of magic invention, the flotation process, which apparently defies the laws of gravity, is apt to strike the uninitiated as a scientific miracle. It accomplishes the seemingly impossible in making heavier particles float above lighter material, thereby enabling the ore mills to float off the minerals they wish to save.

The explanation of what happens is quite simple. Why it happens is still puzzling the brightest minds among the metallurgists. Briefly, flotation effects the separation of mineral particles from a crushed-ore pulp by means of air or gas bubbles. Adding of water to finely crushed ore produces the pulp, which flows into the tanks or cells of the flotation machine. The bubbles are formed by introducing air or gas into the pulp by suction or pressure. Certain mineral particles, which may or may not be heavier than other particles in the pulp, attach themselves to the bubbles, which act as balloons in carrying these particles to the surface. The froth formed by the bubbles resembles soapsuds, though it is grayish.

It has been found that addition to the pulp of pine oil, or certain other oils, promotes a firmer froth that will serve as a raft for support of the bubbles and facilitate the removal of the attached loads of mineral particles. There is a constant overflow of the froth into a trough, which carries the concentrated mineral thus collected to a bin. There it is filtered in preparation for shipment to the smelter for further treatment. The concentrate still contains some worthless material, but the percentage of values is high.

The earlier bulk flotation, in which the bubbles carried off a combination of all floatable mineral particles in the ore pulp, had its value in separating the useful minerals from the other substances in the

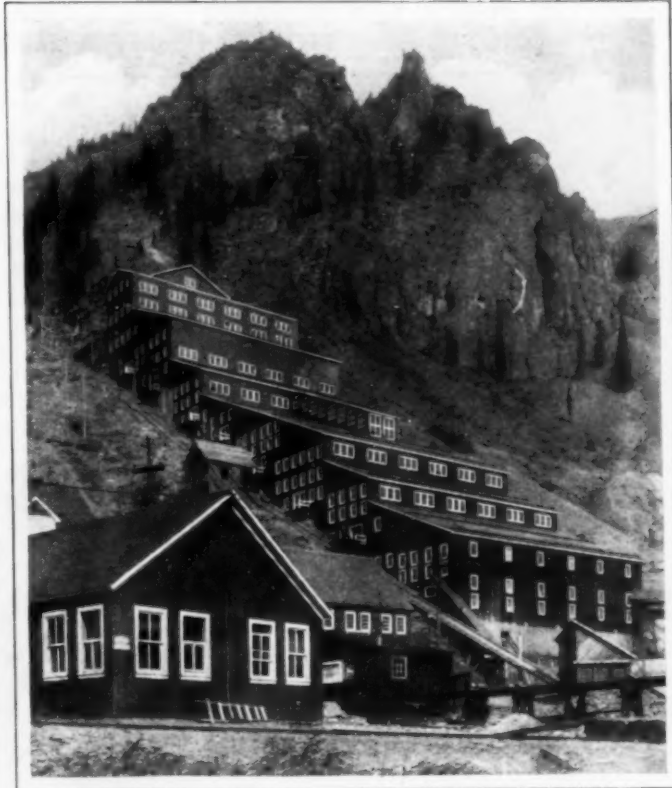
rock that goes into the mills. But something more was especially needed in the case of zinc-lead-iron and other complex ores, which usually carry percentages of silver and gold. Sending to the smelter of train loads of mixed concentrate of lead, iron and zinc might easily run the mine operator into bankruptcy. Smelting charges often ran so high that profits vanished.

Developing of the selective feature of flotation solved this problem. It was discovered that one mineral could be made to float ahead of another. This is accomplished by adding to the ore pulp certain chemicals and oils which increase the floatability of the mineral chosen to be treated first. Other reagents may be put into the pulp at the same time to retard the floating of other minerals.

Thus, in the case of a zinc-lead-iron ore, the lead could be floated off (carrying with it most of the gold and silver contained in the ore) and the zinc concentrate could be produced by a later floating. The process makes possible the same sort of selection in the handling of other kinds and varieties of ore.

Selective flotation does not require expensive machinery, and the comparatively small quantities of chemicals and oils do not add greatly to the cost. In fact, it is such a cheap method of mineral separation, and results in such a high percentage of recovery of values, that it has made profitable the handling of complex ores that do not assay more than \$6 to \$8 a ton.

Nor has the process reached the limit of its possibilities. Important improvements are predicted, both in the use of the reagents and in the flotation machinery. Experiments in laboratories and in the ore mills are making available much



A Giant Ore Reducer in Colorado; Convenient Hill-sides Solve the Conveyor Problem and Gravity Does the Work

new information on how to employ various chemicals and oils so as to produce the best results in the treating of specific types of ores.

Besides resurrecting some of the old ghost towns and aiding other mining camps, the flotation process has brought into existence new towns that, without its help, probably never would have been born; Pecos, in New Mexico, for instance, and Climax, Colo., the molybdenum town.

John T. Joyce, Colorado mining commissioner, optimistically predicts additional results in his own state and in the other areas of large quantities of low-grade ores. So convinced is he that a mining revival in the Rockies will gather momentum, that he confidently expects bustling activity to break in upon the brooding silence of such confirmed ghost towns as Nevadaville and Blackhawk, slumbering in the Clear Creek region of the state, and Robinson and Kokomo, of the San Juan country.

DUSTLESS TRUCK FOR RUBBISH PROMOTES HEALTH



Filling the Garbage Truck through the Side Doors and Emptying a Load; the Tank Is Elevated by Hydraulic Mechanism

Greater cleanliness in collecting and hauling away rubbish from streets in London is promoted by means of a special truck equipped with side doors that can be tightly closed to prevent the spread of dust and odors. The smaller bins, in which the refuse is kept, are easily dumped into the truck which is emptied

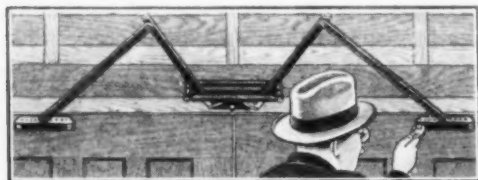
in a few seconds by elevating it and allowing the contents to pour from a large opening at the rear. The main body of the truck can be rotated back and forth by the motor so that the material inside is equally distributed and settled to the bottom, thereby continually providing room for more rubbish. The tank has a capacity of about ten cubic yards. The smaller bins are filled by placing the garbage cans against the side doors, which do not



open until then, but close automatically after they are removed.

CONTROL FOR GARAGE DOORS REDUCES ACCIDENTS

Both swinging garage doors are held open or shut by a simple gear control that can be quickly installed and requires no attention after it is in place. An iron arm for each door is connected to a steel coil spring and a gear arrangement over the center of the door opening. The doors are held under the tension of this spring.



Close View of the Gear Control for Garage Doors, Showing Method of Installation

A slight pull on either door, opens or closes both, and the spring is of such strength that there is no danger of their blowing shut after once opened.

PENNY'S WORTH OF ELECTRICITY MILKS TEN COWS

At the average rural rate, a cent's worth of electricity will perform any one of the following tasks, according to data collected by the New York state committee on public-utility information: shell eight bushels of corn, grind half a bushel, thrash one bushel of barley, separate sixty gallons of milk, cut 300 pounds of ensilage, cut 200 pounds of fodder, stuff 200 pounds of sausages, churn thirty-three pounds of butter, and provide enough energy to milk ten cows or groom two horses.

BETTER WAYS OF STORING COAL TO PREVENT FIRES

Interesting tests to determine the best methods of storing coal in order to prevent spontaneous combustion, have been conducted by the bureau of mines. It has been found that all coals, except anthracite, undergo some spontaneous heating, but that the greatest hazard is involved with coals of the inferior grades. Care should be taken in the segregation of fine coal in the storage pile. All foreign matter should be excluded. The investigators differ as to the effect of moisture in coal. Generally speaking, the results are believed to be dependent largely on the storage conditions. In some coals, application of water may reduce the temperature sufficiently to prevent spontaneous combustion, but in others, if the pile is wet, the ventilation may be curtailed, resulting in dangerous overheating. The experiments proved that allowing adequate ventilation for the coal pile, so that excess heat could be carried off, is one of the most important factors to prevent fires from spontaneous combustion.

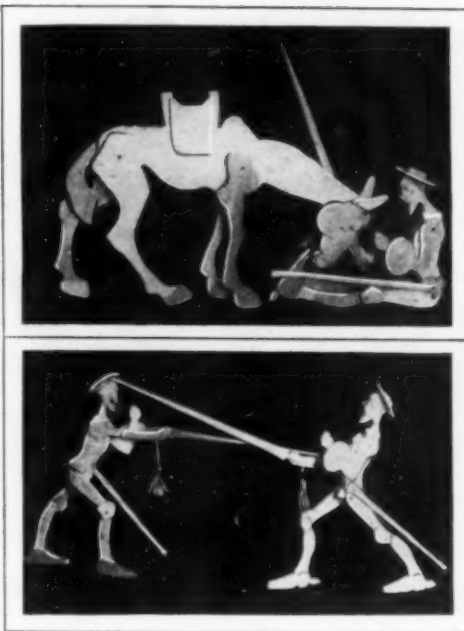
GUIDE FOR BILLIARD PLAYERS TEACHES CORRECT STROKE

For the novice at billiards, a special support and guide has been devised for the cue, enabling the player to hit the ball at the desired spot and to hold the cue in the correct position. In connection



Billiard Practice with the Special Cue Rest, and a Mirror to Study the Stroke

with the guide, a small mirror is used to study the proper method of play.



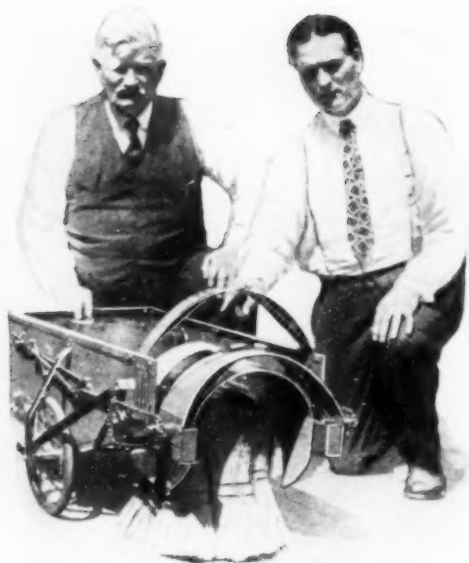
Don Quixote in Wooden Figure That Can Be Adapted in Many Poses, as Limbs Are Jointed

DON QUIXOTE CARVED IN WOOD ASSUMES DIFFERENT POSES

Don Quixote fights with his shadow, rides his horse and "performs" numerous other stunts in wooden figures that a New York artist has carved. The units are jointed so that they can be posed in many positions, and the models reflect much of the humor contained in the story.

"CREAM" FROM SUGAR CANE SUBSTITUTE FOR SIRUP

Cane cream, a sugar-cane product recently developed in the south, is being used as a satisfactory substitute for sirup, as it does not spoil so easily, retains the flavor and food value of the sirup, and has many uses in cooking. It is essentially a mixture of very small sugar crystals surrounded by a film of sirup which remains after crystallization has occurred. The thickness of the mixture can be altered to suit the purpose for which the cream is intended. It is said to be especially suited for making icings, for eating with pancakes or cookies, and has the great advantage that it can be handled the year round with little danger of spoiling.



Model of the Grain-Bundle Gatherer That Piles Bundles in Shocks, Saving Hand Operation

SHOCKER FOR GRAIN BUNDLES SAVES HAND LABOR

To pile the bundles in shocks after the grain has been cut and bound by the harvester, a western farmer and mechanic have devised a labor-saving unit. It is said to take the place of the ordinary bundle carrier and is controlled by a pedal, leaving the shocks in straight rows along the field for easier pitching into wagons. The shocker also reduces loss of grain.

TIME TRAP TO SHUT WINDOWS SAVES GETTING UP

Windows may be closed at any time desired without the necessity of getting out of bed by a simple clock mechanism that fits on the sill. It operates on somewhat the same principle as similar units for opening furnace doors or drafts, is easily regulated and, owing to its simplicity of construction, is positive in action.



ROTATING RADIO-BEAM SYSTEM TO AID COMMUNICATION

Experiments with a revolving radio-beam transmitter and receiver are being conducted by Senator Marconi, who visions the system as of particular aid especially when establishing contact with fleets or other objectives, whose location at the moment is uncertain. The aerial and its reflector, he explains, will turn about in somewhat the same manner as a searchlight is revolved so that the beam can be directed upon any point wanted.

FILMS OF AMATEUR MOVIES DEVELOPED AT HOME

Film strips of small cameras and short pieces of standard motion-picture film are developed with precision and a minimum of trouble in a reel tank now on the market. Advantages claimed for the unit are that the film is retained in a separated condition, permitting the solution to have free access to all parts of the surface and there is no handling of wet film to cause scratches. With a little practice, the reel may be loaded in darkness, eliminating the need of a special dark room and red light, and when the film is all on the reel, in the tank and the cover on, the rest of the developing may be done in the light. Tanks are made to handle three reels at a time. There are also smaller sizes accommodating one or two.



QUEER AERIAL CARGOES

Airplanes have often flown queer cargoes, ranging from an African lion to a grand piano, but in their regular daily travels the cross-channel planes, linking England with France, Germany and other continental countries, regularly get unusual mixtures of freight. On one recent trip a big aerial freighter carried a package of diamonds valued at \$60,000, half a ton of gold and 500 one-day-old chickens.



Giant Tires Were Required When England's Newest Bomber, the Beardmore "Inflexible," Took the Air; the Huge Tri-Motored Monoplane Is the World's Biggest Ship of Her Type

WORLD'S LARGEST MONOPLANE WEIGHS FIFTEEN TONS

The world's largest all-metal monoplane, the Beardmore "Inflexible," built recently for the British air service, boasts the biggest aviation tires ever built. To support the shock of landing fifteen tons at high speed, the huge wheels are equipped with specially designed rubber tires, seven feet six inches in diameter. The ship, a three-engined bomber, has a wing spread of 150 feet. Instead of a tail skid, the plane has a third wheel, mounted as a caster and fitted with a tire larger than the ordinary landing-gear tire of smaller planes. The Beardmore company also is producing a Diesel engine for dirigible airships. Running on heavy oil, the fire risk of gasoline in the neighborhood of hydrogen-gas bags, is eliminated.

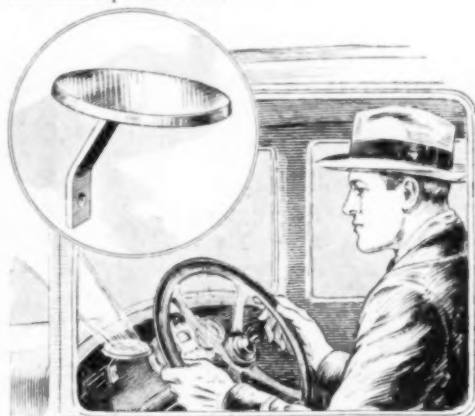
GARDENS PAINTED WITH LIGHT FOR NIGHT DISPLAYS

By the use of electric floodlights, gardens and lawns at an eastern suburb are revealed in pleasing color effects at night. Special lenses of different hues and producing unusual color values are employed in illuminating individual rose bushes or flower groups, for instance, while spot-

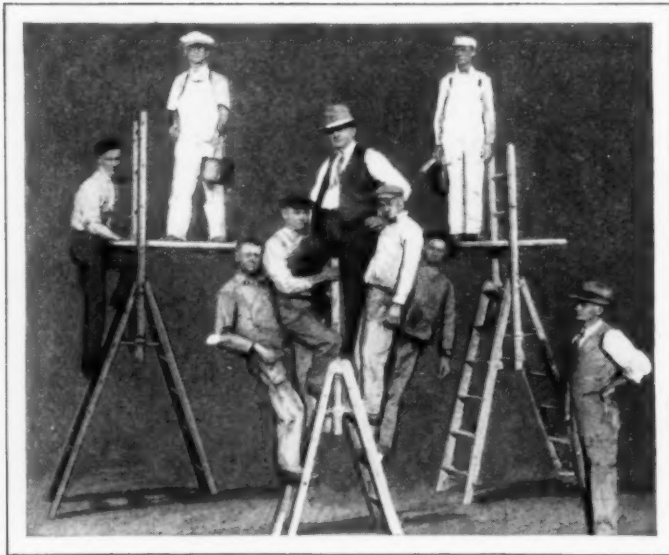
lights bring out bits of rock decoration or other details. The equipment is carefully concealed so that it does not mar the gardens during the day.

TRAFFIC-LIGHT MIRROR IN AUTO PROMOTES SAFE DRIVING

Easily attached in a convenient position on the dash, a chromium-plated reflector gives the driver an opportunity to observe any change in overhead traffic-light signals by day or night. This saves him the trouble of peering out of the car with its consequent risk.



Drawing to Show Traffic-Light Mirror Installed for Reflecting Overhead Light Signals



Extension Ladder Arranged as a Scaffold and Showing How It Supports Heavy Weights

LADDER FOLDS IN SMALL SPACE AND HOLDS HEAVY WEIGHT

Several interesting features are claimed for a ladder that can be collapsed into a unit no larger than a stepladder of six rungs, but which provides twelve rungs when extended. The inventor demonstrated that it would support the weight of five men, while resting wholly on its own standards.

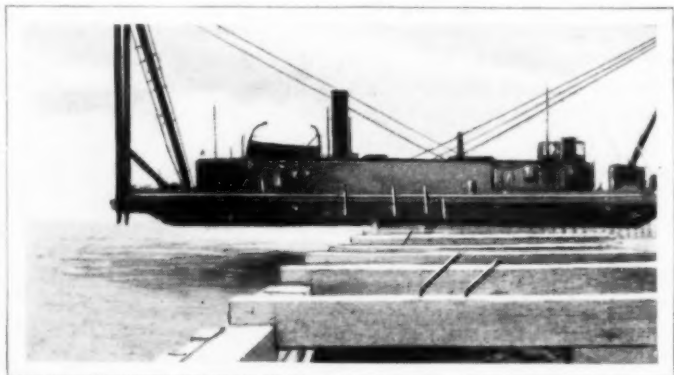
FRENCH BUILD CHINESE WALL

Following the example of the ancient Chinese, the French are about to build a wall of concrete and steel from the North sea to the Mediterranean as a war defense to guard the border. A preliminary sum of \$10,000,000 is being spent on the first section in Lorraine and lower Alsace, where Marshal Petain, the famous French military leader, is supervising the work. Fortresses are to be built underground in connection with it and will be linked up by more walls of steel and concrete.

STRANDED DREDGE IS LIBERATED WITH ICE

How ice was used to salvage a million-dollar dredge employed in the construction of the Port Nelson terminal of the Hudson bay railway, is an interesting story of modern engineering resourcefulness. The huge unit, weighing 2,000 tons, by an odd twist of a terrific gale, was lifted up and deposited squarely across a stone-and-timber mole at the end of a steel bridge. How to get it down again, proved a puzzling problem. The usual method of timber-

ing was considered, but there was not enough of the right sort of material for the work in the whole Hudson bay region, and to wait for it, meant a delay of months. A mechanic conceived the idea of waiting until the river was covered with ice and then building up cribs of ice blocks under the bow and stern of the dredge. In the spring, the craft would be allowed to settle as the ice melted. The plan was improved upon by building up a sort of ice monolith, under the dredge, using a reservoir made of ice blocks, filling it with water and allowing it to freeze. Instead of waiting for spring, the ice was melted with steam.



Big Dredge Washed upon Mole during Gale; It Was Removed and Floated again by Using Ice Blocks and Thawing Them

A Jungle Mystery



Dancing Girls before the Temple at Angkor-Vat, the Religious Center of Ancient Cambodia; These Dancers Are Trained from Infancy and Are Highly Proficient in Their Art

FOR the traveler who wants to leave the beaten trails, a land packed with romance and adventure is waiting in Cambodia, the southwestern section of Indo-China. Lost cities and forgotten temples are locked within its tangled jungles which may hold further clues to a mystery that still perplexes scholars. Just who were the people that built these shrines and cities, and what happened to them? They were as skillful as the artisans who built the cathedral of Notre Dame; they had developed a high degree of culture and civilization and, at one time, they had hundreds of miles of seacoast in their control and millions of men under arms. But they suddenly vanished, and no trace of them has been discovered.

Within the last two years, nearly sixty of the forgotten temples have been found. Recently, Robert J. Casey, of the Chicago Daily News, lured by the fanciful tale of a native guide, fought his way through the jungle 100 miles east of Angkor and stumbled upon one of the lost cities, a huge pile of crumbling ruins apparently as large as Angkor. So far as is known,

he is the first white man to have reached this city. Hundreds of square miles of jungle territory yet remain to be explored in that region.

This land of mystery has been surrounded by civilization for centuries, but, so far as men living today are concerned, it is a frontier. It was opened up only sixty years ago when French explorers found Angkor, at the head of a large lake. Since that time, scholars and engineers have been at work digging and hunting, but they have learned comparatively little of the people who originally settled here. It is believed that they came out of India, mixed with the natives and slowly built up a powerful nation. Then, an invasion, a plague, or some other disaster, occurred and the entire people disappeared. Save for the ravages of time, their cities and temples have been found much as they were when the occupants departed.

Tales of buried treasure persist, adding to the interest in searching through the ruins. So far, none has been found, but lists of golden Buddhas, jeweled ornaments and other valuables, apparently the



Carved Detail from a Temple Wall, Showing the Expert Craftsmanship of Cambodian Stonecutters

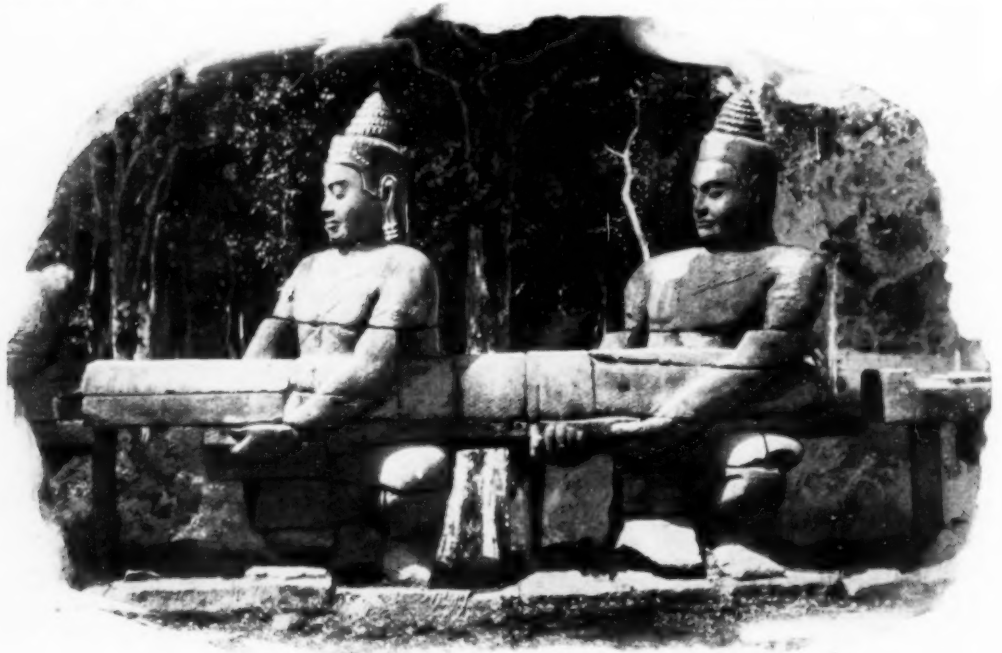
temple invoices, have been discovered. The story is that the priests discouraged the people from returning to the cities by making them believe that the curse of Siva, the Destroyer, was on the land. But before they left, they hid their treasures in secret vaults and sealed the doors. Possibly invading tribes found the jewels and took them away, but there is a chance that riches may be discovered.

Among the interesting features of these stone temples and cities are the arches.

The builders did not know the curved or keyed arch but constructed flat ones and were such skillful masons that they fitted the big blocks together without the use of mortar. Metal clamps were used in places, but the strength of the structures lay mainly in the exact fit of the pieces.

Mr. Casey found that the jungle city was surrounded by a swamp, apparently the remains of the deep moat that had been dug about it for protection. He was unable to enter the city proper, but obtained the first movie photographs of it ever taken. Because of the intense heat, his camera became so hot that he could scarcely touch it, and the emulsion on some of the film was melted, ruining many of the pictures.

Iron mines are being developed in the district, and the French are building roads. In a few years, this part of the jungle may become as familiar to the tourist as the section around Angkor is today, but in the meantime, there is ample opportunity for exploration. Small automobiles are driven into the wilderness over rude trails, but much of the jungle can be traversed only on foot and the traveler stakes his chances against tigers and wild elephants.



Row of Giants Bearing Balustrade That Leads to the Gate of Victory at Angkor-Thom; This City Once Had 1,000,000 Inhabitants; What Became of Them Is a Mystery

ENGINEERS SEEK RICH MINERALS IN METEOR

Diggers are at work in Arizona, trying to find what is believed to be a gigantic meteor that shot from the skies ages ago and buried itself in the desert sands, hundreds of feet below the surface. It formed a natural crater as it hurled aside the soil in its swift descent and this odd scar, together with fragments strewn about the area, have convinced most authorities who have studied the matter, that a meteor did fall there and may lie buried far below the top of the ground. Engineers are sinking a shaft and expect to make a cross cut over to the point where the big meteor is believed to be. Iron, nickel and small quantities of platinum and iridium have been discovered in the fragments. At current prices, the minerals make the material worth about \$85 a ton.

DRIP PAN GUARDS AUTO COWL WHEN TANK IS FILLED



One of the first accessories to be introduced for the new Ford car, is a drip pan to keep gasoline from spilling on the cowl when the tank is filled. It is

shaped to fit evenly, the underside is covered with heavy felt to prevent scratching the finish, and there is a rubber ring that fits snugly around the tank inlet.

☛The Popular Mechanics Bureau of Information offers its free service to all readers of this magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession, will be promptly furnished upon addressing the bureau.



Model of Dummy Policeman and Traffic Lights for Installation at Intersections, to Replace a Human Attendant

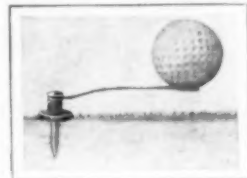
DUMMY AS TRAFFIC POLICEMAN SUBSTITUTE FOR LIGHTS

In place of the usual control lights or traffic policeman to guide automobiles at intersections, an electrically operated dummy figure has been tested in a western city. It is six feet high and stands on an illuminated concrete base, three feet thick. The figure turns half or quarter way around, according to the setting, and at the same time, the hands and arms are moved to signal cars to stop or go. On the up-rights about the dummy are red and green lights that flash in harmony with the signals. Greater visibility and economy of operation are claimed for this system.

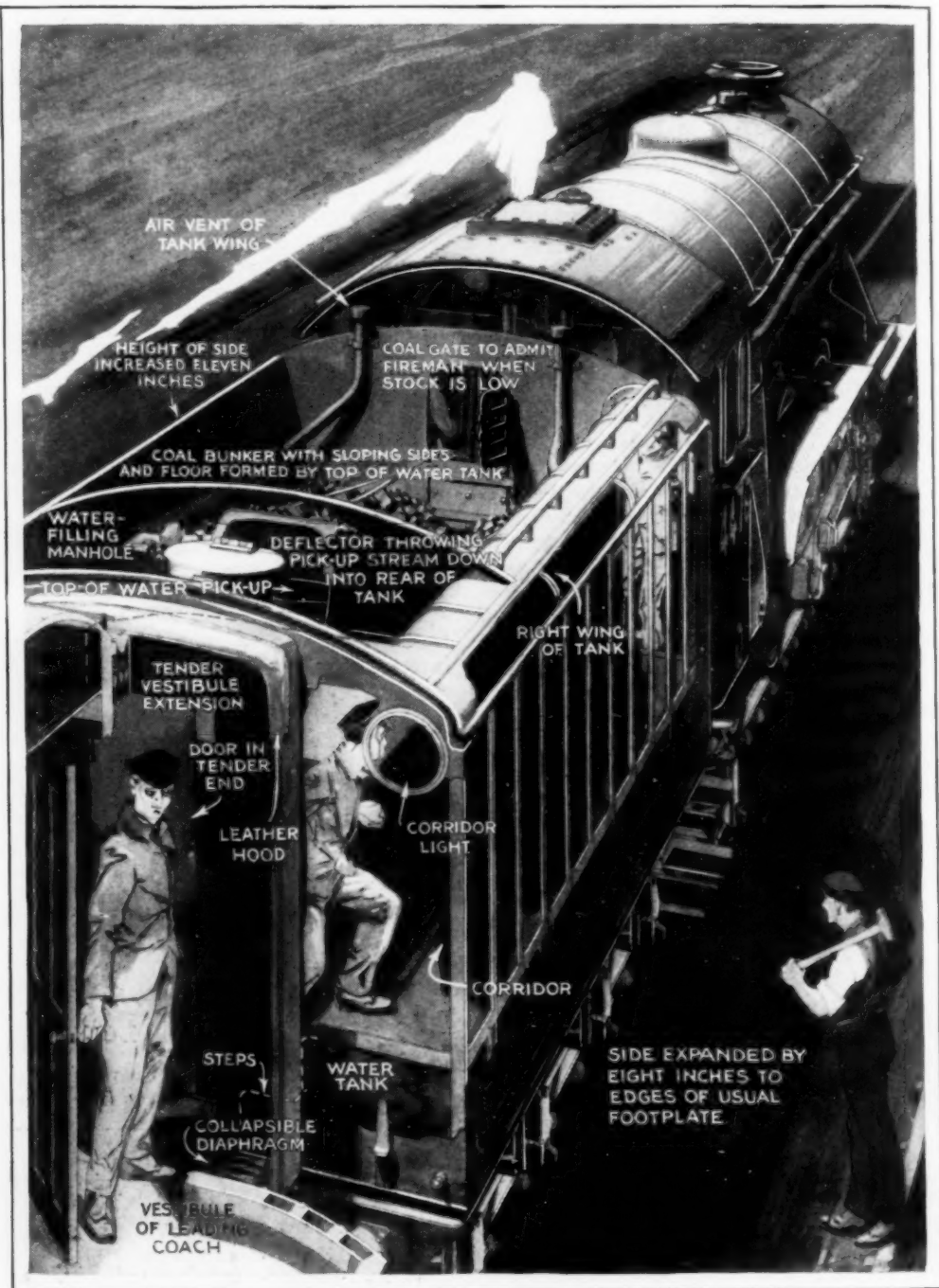
GOLF TEE AIDS LONG SHOTS AND DOESN'T GET LOST

Fitted with a spring that throws it back into place after a shot is made, a golf tee now on the market offers little resistance to the ball so that longer and more accurate shots are possible. It is non-breakable, cannot easily

become lost and may be used with practice balls as well as in actual play.



NON-STOP TRAIN CARRIES SPARE CREW IN COACH



© S. W. Clatworthy

The Famous "Flying Scotsman," Which Runs from London to Edinburgh, Now Makes a 392-Mile Non-Stop Run between the Two Cities; Crews Are Changed Midway by Means of a Corridor through the Tender, the Spare Crew Riding as Passengers in a Baggage-Car Compartment

ENGLAND'S CRACK TRAIN TAKES NON-STOP RECORD

The famous "Flying Scotsman," the crack train between London and Edinburgh, recently lifted the world's non-stop-run record from another British railway, when it began running the 392 miles without a pause. Previously a stop had been made to change engine crews, the fast run being too much of a strain on one crew, though it is only eight and a quarter hours long. Elimination of the stop was made possible by building a special tender, with a corridor to connect the engine cab with a passenger compartment built into the first baggage car. The spare crew ride as passengers, and midway in the journey walk through the tender corridor, relieve the original crew, and the latter move back for lunch and rest. Despite the fact that it is a non-stop run, the running time of the Scotsman is not particularly fast, averaging 47.515 miles an hour. The New York Central's Twentieth Century, covering 960.6 miles in twenty hours, including time out for some ten stops, averages 48.03 miles, or more than half a mile an hour faster than the English train. There are several faster trains both in England and on the continent. The Great Western express from London to Exeter covers 173.7 miles in 175 minutes, or 59.55 miles an hour. The fastest train in the world is credited to France. The "Fleche d'Or," or "Golden Arrow," runs from Paris to Calais, 187 miles, at 60 miles an hour. Another French train, the "Etoile du Nord," or "North Star," runs from Paris to Brussels, 193 miles, at 56 miles an hour. The fastest trains in the United States are on the Pennsylvania's Philadelphia-Atlantic City line, making 59.7 miles in 65 minutes.

Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine.



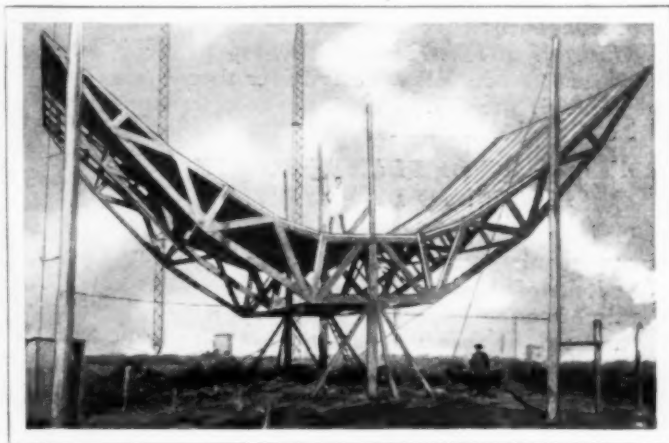
Cylindrical Electric Oven in Which Heat Is Distributed Evenly from Elements in Top and Bottom

CASK-SHAPED ELECTRIC OVEN SPREADS HEAT EVENLY

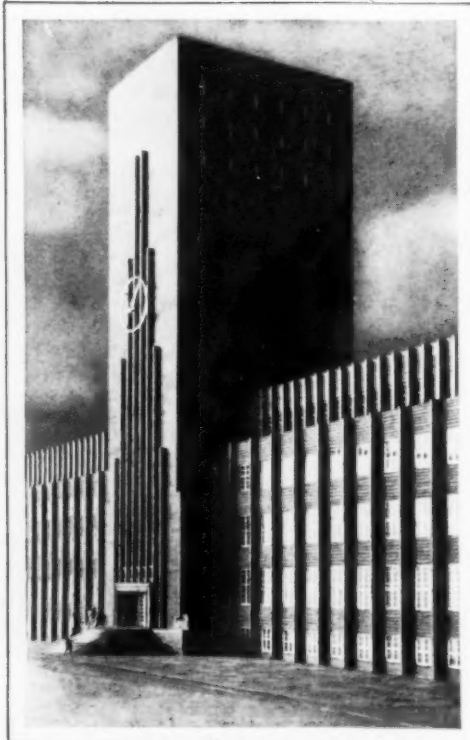
One of the chief features of a cylindrical electric oven is that the heat is more evenly distributed than in ordinary kinds. The heating elements are placed both in the top and bottom of the oven.

RADIO STATION SET ON INCLINE TO HELP CONTROL WAVES

At a German radio station in Nauen, where extensive experiments are being conducted in controlling the direction of wireless waves, an incline has been built. It is intended to place the apparatus at such an angle that the "beam" waves may be concentrated more fully.



Incline at Radio Station in Germany. Where Experiments Are Being Made in Directing and Focusing Wireless Waves



Modern Art in Exterior Design; Front of the New City Hall at Raestrungen, Germany

CITY HALL AND WATER TOWER COMBINED IN ONE

Modernism is the outstanding feature of the design of the new city hall at Raestrungen, Germany. Straight lines predominate and colored brick have been used effectively with gold-glazed tile to produce an unusual effect. The top of the structure conceals a water tower that helps supply the city.

MYSTERIES OF PLANT GROWTH REVEALED BY RAYS

Recently scientists, affirming a discovery announced in 1924 by Prof. Alexander Gurwitsch, of Moscow, have found that the tip of certain rapidly growing vegetable and animal tissues emits some sort of invisible radiation which has the power to stimulate the growth of living matter with which it is not in contact. Apparently, these radiations are akin to ultraviolet rays. Gurwitsch found that if the tip of one of the rootlets of an onion or

turnip was fixed so as to point at right angles to the side of another root, though as much as a quarter of an inch away, the cells in the side nearest the tip would multiply more rapidly than elsewhere and so bend the root away. That the influence was not due to the emission of some sort of gas from the root tip was proved by interposing a thin sheet between the two roots. Glass and gelatin sheets stopped the transmission of the growth-stimulating power but quartz did not. This is characteristic of ultraviolet rays. N. Wagner, a German botanist, discovered that, in bean and onion roots, the number of new cells produced by this stimulation was as high as seventy per cent. Other experiments are reported to show that growing animal tissues, such as cancer, emit such rays.

FORK FOR GARDEN IS TILTED TO INCREASE LEVERAGE

To save time and work, a garden fork now on the market is tilted at a much greater angle than is usual and, besides this, it has a crossbar handle to afford a better grip. In using it, the worker does not have to stoop so far. The tool is also provided with a spade arrangement which may be attached over the prongs.



Tilted Garden Fork Which Affords Additional Leverage for Use in Tilling Tough Soils



The Hon. Lady Mary Bailey, Wife of Sir Abe Bailey, the South African Mine Magnate, and, in the Front Seat, Mrs. Geoffrey DeHaviland, Wife of the Famous Designer of Airplanes

By HAROLD T. WILKINS

SEPARATED by a distance of 8,000 miles of land and sea, with two continents in between, two women recently set out to fly alone—one from London to Capetown, S. A., the other in the reverse direction from Capetown to London. They expected to pass each other in the clouds, somewhere in central Africa, but actually the one woman reached Capetown fifty-one days late, and the other woman completed the trip only after a long delay, due to an attack of fever.

Lady Abe Bailey, the first woman to make the solo flight from London to Capetown, regarded the flight as a holiday and used a light plane, a DeHaviland "Moth," equipped to carry only one passenger. There was an extra gasoline tank in front of the cockpit, and all her luggage was packed in two suitcases. She was her own engineer.

"My intention is to fly in easy stages, and to prove to people that anyone who

can drive an auto can make the trip by air from London to Capetown," she declared before the start.

On the first lap of the run over the gusty straits between Dover and Calais, France, she headed into a gale and her little plane was rather badly buffeted. Then a fog came on, and so hid landmarks that she was forced to land at Sacy le Petit, about twenty miles north of Paris. She reached Le Bourget airdrome, the airport of Paris, in a blinding snowstorm. Next morning, she took off for Lyons, in the south of France, and had great difficulty in beating up against swirling snowstorms, which blotted out the landscape. Also, she discovered that her compass was faulty, and this gave her a lot of trouble until she landed at Lyons.

Crossing the gulf of Genoa, Pisa, Italy, was reached three days after leaving England. Then came a flight over the Mediterranean to Tripoli, on the edge of the

desert of north Africa. Here, she landed safely, overhauled the little plane, and then took off for Cairo, where her adventures began in earnest. The Egyptian government tried to persuade her not to proceed on the perilous trip over the Nile and across the burning sands of the Libyan desert into the even hotter Sudan. She would not listen, and the authorities seized her plane, locked it up in a shed and set an armed sentry to guard it.

The Sudan government pointed out that if Lady Bailey were forced to alight on the desert sands, she ran a risk of abduction or even murder at the hands of fierce and fanatical desert Moslem tribes. If she wanted to fly over the Sudan, they said, she would have to take an escort with her. She flatly refused. In this battle between a determined woman and an equally determined government, neither would give way, and it looked as though the flight would have to be abandoned. Then a British lieutenant, who was flying to Cairo with his wife, agreed to escort her.

Lady Bailey's plane was at once re-

leased and she flew along the Nile to Luxor, near Thebes, the city of dead Pharaohs, which she reached nineteen days after quitting London.

After passing Assuan, above the first cataract, she encountered a fierce sandstorm, which blew up in choking clouds from the Libyan desert and blotted out the ground. At last she landed at Wady Halfa, just over the border of the Sudan. The heat was intense. Approaching Tabora, in old German East Africa, she met with an accident which might easily have cost her life. The airdrome there is 4,000 feet above sea level and the air is hot and bumpy.

"I am afraid I took insufficient notice of the conditions of the atmosphere and the landing place," said Lady Bailey. "I crashed heavily, and my machine turned right over, breaking the fuselage and a spar. Luckily, I wasn't hurt, but my little 'Moth' was smashed and only the engine and petrol tanks could be saved."

This accident took place in the middle of central Africa, 300 miles south of the



Lady Bailey and a French Officer After She Landed at Le Bourget Airdrome, Paris, in a Snowstorm on Her Outward Trip from London to Her Cape Colony Home

Courtesy The London Mail

equator, thousands of miles from any big airplane depot, but a new plane was obtained from Capetown and the flight continued to Broken Hill, where Lady Bailey fell ill of influenza. Four days later she struggled on to Livingstone. A strong wind buffeted her plane on the next stretch to Bulawayo, in Rhodesia, and a few days later she landed at Capetown.

"Anybody who can drive an auto could do it," she said. "My flight was long but uneventful, and not extraordinarily difficult. In fact, my only difficulty was when my machine was locked up in Cairo."

As a matter of fact, however, her solo flight was a perilous undertaking. In March, 1928, four royal air force planes, flying from Capetown to Cairo, crashed in Rhodesia, and so badly injured the crew that they could not go on.

Lady Bailey looked quite fresh after her fifty-two days in the air and on the ground. She learned to fly in 1926, and, in 1927, flew a light plane to a record height. She was the first woman to fly solo across the Irish sea, and, in January, this year, the international league of aviators conferred on her the title of champion airwoman of the world.

OLD SHIPS GUARD BIG BRIDGE AGAINST COLLISIONS

To protect the center pier of the huge steel bridge that spans the Carquinez straits, near San Francisco, the hulks of famous old windjammers have been securely anchored in V-shaped formation at the central pier. Two are placed on the upstream and two on the downstream side. Big steamers, loaded with raw sugar, as well as other large craft, pass under the bridge and, should one of them collide with the pier, serious damage might result. The wooden ships are intended to bear the brunt of any such mishaps.



Old Wooden Ships Guarding the Central Pier of Big Steel Bridge from Damage by Collisions



Midget Motor Used to Keep Time in Metering Operations at Electrical Laboratory

FLY-POWER MOTOR KEEPS TIME FOR ACCURATE METERING

Weighing less than three ounces, a tiny motor developed by Westinghouse engineers, keeps accurate time for various metering operations. Supplied with steady electric power, it makes exactly 600 revolutions per minute. A clock run by it will vary not more than ten seconds in an entire year. Some 200,000 of these motors would develop only a single horsepower.

ROAD AMONG VOLCANO CRATERS OPENED IN HAWAII

Steaming volcanic areas and miniature lava flows are visible from a picturesque automobile highway just opened in Hawaii. The road, nearly seven miles long, cost nearly \$160,000 and is especially constructed for motor cars. Besides offering tourists new thrills, it will help geologists and other investigators.



Testing the Portable Fire-Engine Units for Combating Blazes in Western Forests; a Burro Brigade in Action, to Show Efficiency of the Traveling Apparatus

MULES CARRY FIRE ENGINES TO HELP GUARD FORESTS

Portable pumps on burros have been used effectively in fighting forest fires in areas of the west, where rough country makes it difficult to employ motor equipment. Portable reservoirs are also provided for small fires. Five pumps, working together, project a fifty-foot stream of considerable volume, recent tests of the apparatus revealed.

CROSS WIRES OVER RESERVOIRS KEEP BIRDS AWAY

By stretching wires over city reservoirs near San Francisco, engineers have been successful in keeping seagulls from alighting on the water. The birds became a serious pest, and various means, such as automatic exploders to frighten them away, were tried without avail. It was finally found that the gulls would not pass through a network of wires forty to fifty feet apart. Strands were therefore stretched tightly over the surface of the

reservoirs in crisscross fashion and allowed to hang about a foot above the surface of the water. On longer spans, pipes were driven into the reservoir, projecting above it as props to hold the wires from sagging into the water. The plan has proved successful on ponds of wide area.

LONG-BLADED WEEDER PULLS OUT DANDELION ROOTS



Effective removal of dandelions and other bothersome weeds is achieved with a long-bladed rooter that pulls out the entire plant. Its sharp blades are pushed deeply into the soil on either side of the weed; then, by squeezing the handle grips and pulling, the complete plant, roots and all, is extracted.

COTTON LETS ULTRAVIOLET RAYS REACH BODY

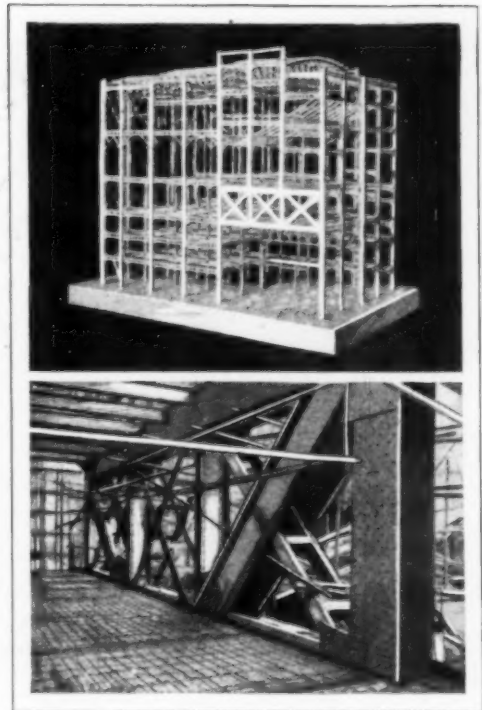
Tests with textiles of different kinds have shown that silk or woolen garments are best suited to the prevention of sunburn, while cotton or linen allows much of the beneficial ultraviolet rays to reach the skin. Among the factors that determine the protective qualities of the cloth are the looseness of the fibers, and whether they are of vegetable or animal material. The latter, which is found, for instance, in silk and wool, will absorb most of these rays and therefore protect the wearer against sunburn.

VACUUM BRAKE FOR AIRPLANES STOPS THEM IN FEW FEET

Airplanes can be brought to a stop within a few feet after they land, it is reported, by means of a braking device controlled by an automatic clutch in the cockpit and adaptable to almost any style of plane. It consists of two duralumin wings, or "ears," that swing out from the side of the fuselage, offering greatly increased wind resistance and a powerful restraining effect at the rear since the extensions are cup-shaped at the back. The inventor says that the brakes afford fifty-four square feet of air-resisting surface and that an airplane can be brought to a halt within fifty feet of the point where it touched ground in landing.



Model Plane with the Brake System Installed on Each Side of the Cockpit



Details of Truss Bracing, and Model Showing How Japanese Builders Are Fortifying against Quakes

QUAKE-PROOF BUILDINGS MARK NEW CONSTRUCTION STYLES

Japanese engineers are developing new styles in architecture through their efforts to erect structures that will be proof against earthquakes. By an inner-truss system of bracing, and other innovations, a steel building has been made to withstand shocks twice as great as the last most serious temblor there, when the "vibrating width" was placed at four and one-half inches. It is said that this new building can stand vibrations having an amplitude of ten inches.

TURTLES FROZEN FOR SHIPPING ON LONG OCEAN VOYAGE

Turtles to supply the London markets are being sent from Australia, by an elaborate freezing method. About 200 a month are being transported in this manner. Turtle catchers along the great barrier reef, get about twelve cents a pound for the turtles, while the price of turtle meat in London often is as high as \$5 a pound.

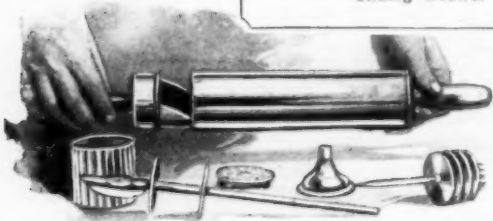
TIME and MONEY



Dust Receiver on Wheels Eliminates Unsanitary Practice of Shaking Mops and Cloths Out of Windows; Dirt Is Collected in Sliding Drawer



Molds for Freezing Custards or Creams in Fancy Shapes; after Filling, They Are Packed in Ice or Snow and Salt



Rolling Pin as a Pantry; It Holds Eleven Different Articles and Is Made of Nickel-plated Metal



Bag, Easily Attached to the Ironing Board, Catches the Long Pieces So That They Will Not Drag on the Floor



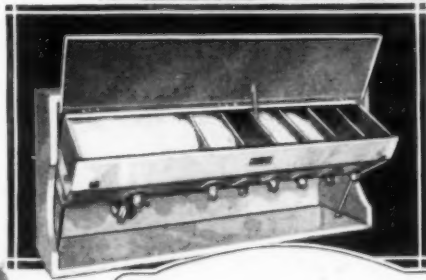
Cork-Handled Bath Brush Will Not Warp, Always Floats and Is Pleasant to Use

SAVING THINGS

for Your Home



To Prevent Staining the Tablecloth, This Drip Catcher Is Easily Attached to the Sauce Bottle and Keeps Its Neck Clean



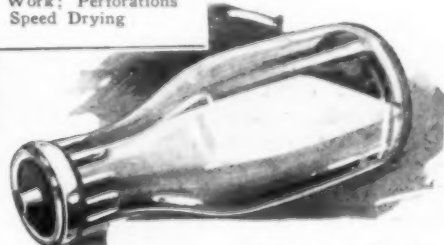
Bringing Store Conveniences to the Kitchen; This Row of Bins Holds Sugar, Flour and Other Supplies, and Dispenses Them through Handy Valves



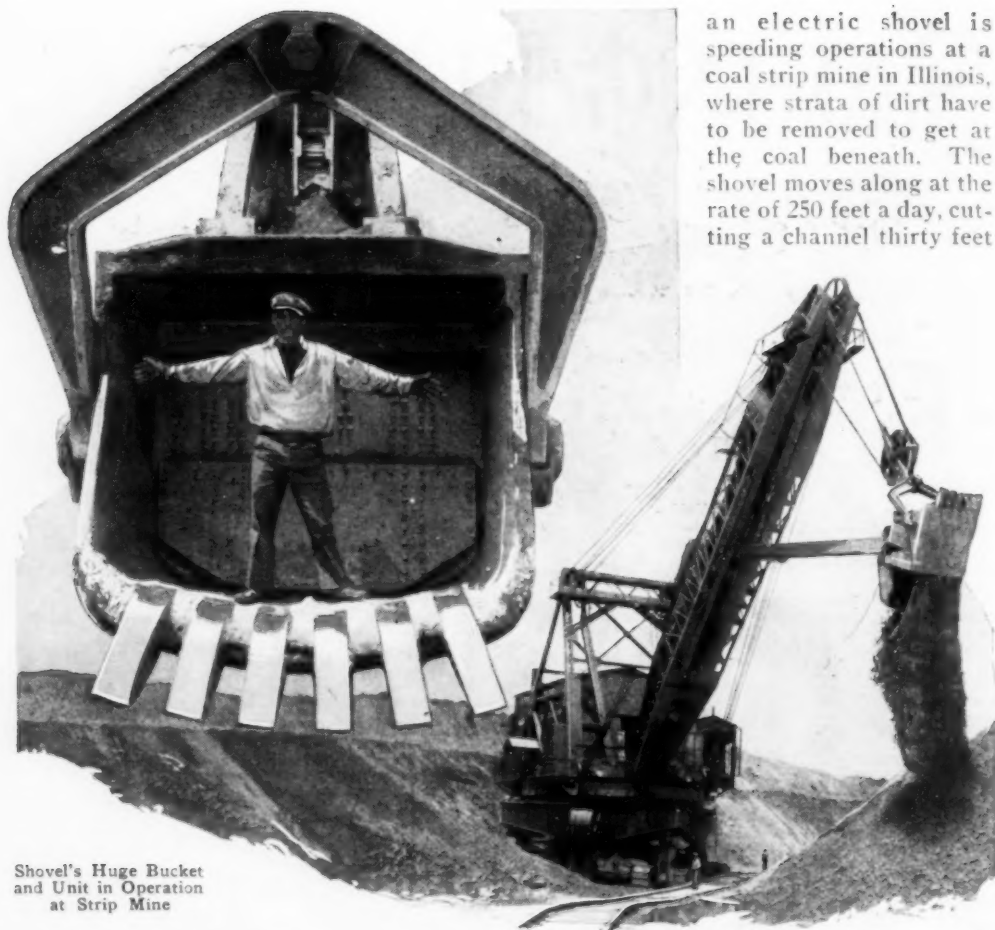
Pocket-Size Washboard for Women Travelers Is Made of Rust-Resisting Metal and Has Rounded Corners to Prevent Damaging Fabrics



Wash Your Gloves on Celluloid Form to Preserve Their Shape and Save Work; Perforations Speed Drying



Acid-Proof Milk-Bottle Stopper of Rubber Keeps Out Air and Is Simple to Wash



Shovel's Huge Bucket and Unit in Operation at Strip Mine

an electric shovel is speeding operations at a coal strip mine in Illinois, where strata of dirt have to be removed to get at the coal beneath. The shovel moves along at the rate of 250 feet a day, cutting a channel thirty feet

GIANT ELECTRIC SHOVEL SPEEDS WORK AT COAL MINE

Weighing 875 tons and capable of taking twelve cubic yards of earth at a "bite,"

deep and several feet wide. According to engineers, there is enough coal in the field to keep the shovel busy for thirty-five years, removing the material at the rate of 1,000,000 tons a year.

LINOLEUM BASEBOARD HELPS KEEP ROOMS CLEAN

An easily cleaned, weather-tight continuation of the linoleum floor covering up the side wall is afforded by linoleum baseboards now on the market. They are united with the floor linoleum by a cemented joint



which eliminates the usual crack at that point. The boards may be installed in old or new rooms and in bathrooms.

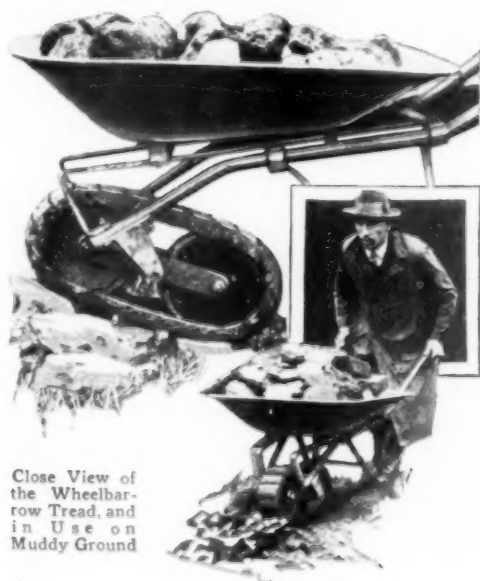
CONQUER ICE PERIL IN FLYING WITH THERMOMETER

A way to reduce the hazard of ice forming on the wings and struts of airplanes has been discovered at Langley field, Va. The dangerous formation occurs only within a very narrow range of temperatures close to the freezing point, it has been found. At a few degrees above or

below that point, there is freedom from the ice danger, and it is therefore suggested that pilots be equipped with a reliable thermometer which will give ample warning of the approach of the ice-forming cold. Flying toward a cloud that might clog his plane with sleet, the pilot can thus determine whether to descend to a warmer level or rise to a greater height where the increased cold would protect him. In case the cloud were too deep to permit rising above it, and the temperature near the ground so close to the freezing point that a descent would merely increase the danger, the flyer could pass through the cloud at the higher level with greater safety. At the lower temperatures, the vapor does freeze, but it clings to the wings of the plane merely as a light, fluffy snow which is shaken off by shifting the angle of the ship and adds but little to the weight of the plane.

ENDLESS-TREAD WHEELBARROW GOES THROUGH MUD

Soft soils, ruts and other obstructions are less likely to interfere with a wheelbarrow recently introduced, for it is fitted with an endless-tread arrangement, common to the tractor. Demonstrations have shown that it can be pushed through miry ground that stopped the ordinary wheelbarrow with a narrow wheel.



Close View of the Wheelbarrow Tread, and in Use on Muddy Ground



Coin-in-Slot Cigaret Dispenser Which Says "Thank You" and Talks about the Goods

MACHINE SELLS AND TALKS TO ADVERTISE GOODS

Cigarets are dispensed from a coin-in-the-slot machine that also says "Thank you," and pronounces a few words in praise of the particular brand selected. This is done by a phonograph attachment which operates as the package is delivered. A change-making machine that provides the customer with the proper coins for insertion in the slot is an added feature of the installation.

JAP CHILDREN GROW TALLER PLAYING WESTERN SPORTS

From 1902 to 1920, Japanese boys between twelve and eighteen years old increased, on the average, half an inch over the normal height for their age, while girls grew almost an inch taller than the average. These results are reported by the ministry of education and are believed to be due to the effect of playing western games like tennis, baseball and basketball and wearing western clothing.



Watching Another Ship Take Off from the Rear Cockpit of a "Swallow," a Typical Two-Place Instruction Plane Powered with the War-Time Curtiss OX-5 Ninety-Horsepower Engine

By J. EARLE MILLER

"PUT YOUR feet on the rudder bar," says a loud, clear voice that seems to be shouting in your ear, "and keep the ship on a straight course."

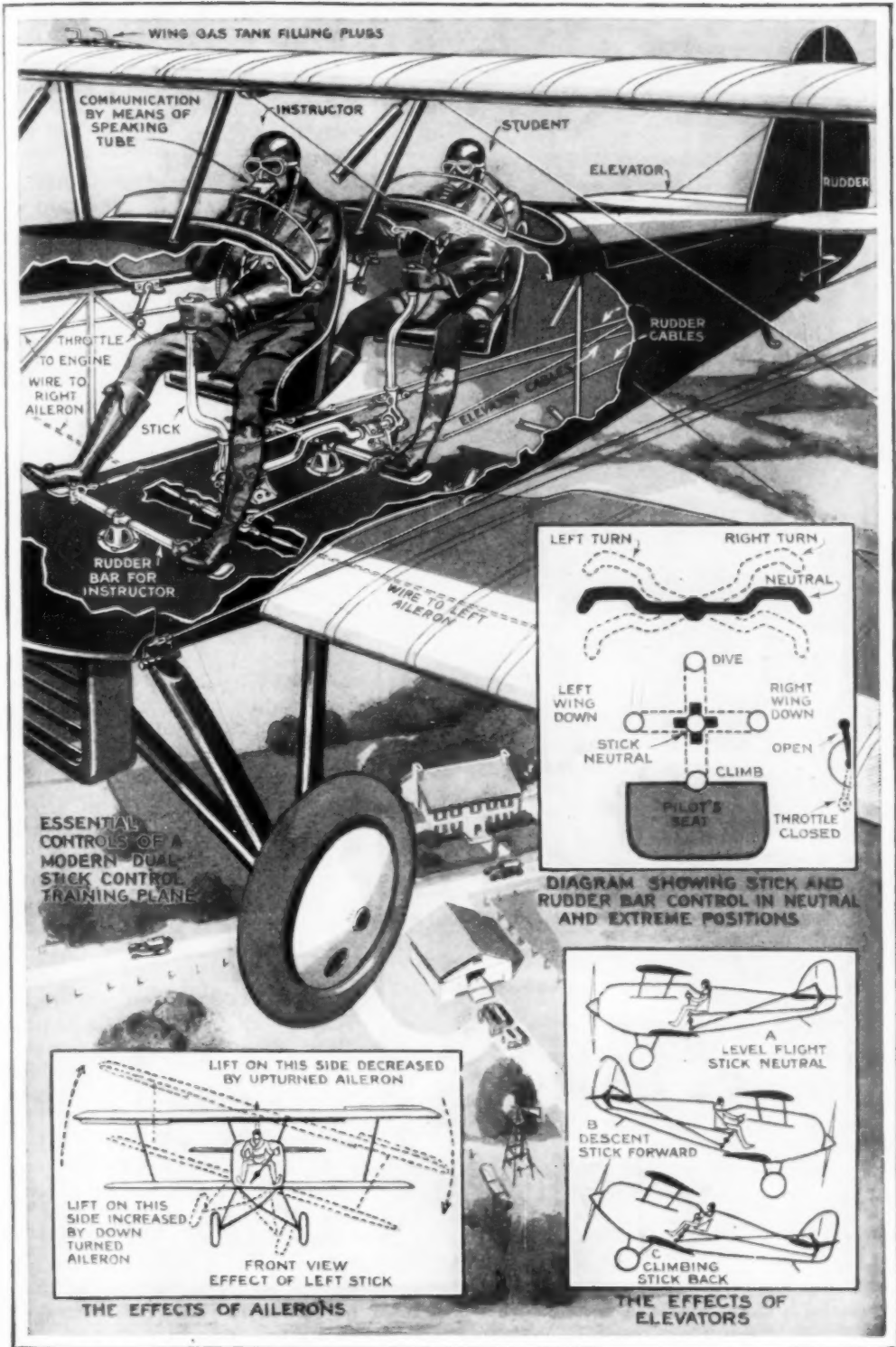
You are a thousand feet off the ground on the first hop of the great adventure—learning to fly an airplane. Your hands are lying, according to instructions, on your knees, while a control stick gyrates between your legs as the pilot in the rear seat moves it forward and back or from side to side, keeping the ship in lateral and longitudinal trim.

Gingerly you plant the soles of your shoes against the rudder pedals and concentrate all your attention on keeping the distant horizon coming straight at you over the engine cowling. To your surprise, the horizon immediately starts swinging off to one side in a crazy fashion, and you wake up to the realization that your craft has begun to turn. A desperate push on the opposite pedal halts the

process, but the ground, still trying to fool you, reverses itself and starts traveling the opposite way. The trouble is you have overcontrolled, so you take a cautious little stab at the other rudder, ease up and peck it again with your toe, trying to come around just enough and not too much.

"Don't be afraid of it," says the loud voice, and a pair of much more purposeful feet in the rear cockpit begin flaying the rudder from side to side until the ship wiggles through the air. Emboldened, you try the same thing, and behind you the tail of the ship wriggles across the sky, and, surprisingly, nothing serious happens. You have learned the first lesson of flying: that a little pressure isn't going to break anything, nor is a bit of movement going to send the ship immediately into a tailspin.

Helmeted, goggled and incased in coversalls, you have strapped yourself into the



ESSENTIAL CONTROLS OF A MODERN DUAL-STICK CONTROL TRAINING PLANE

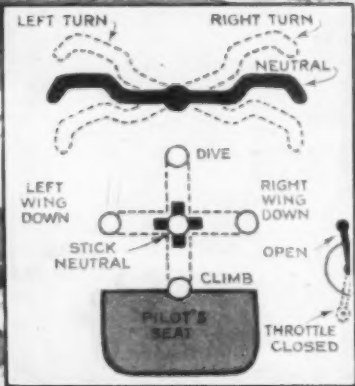
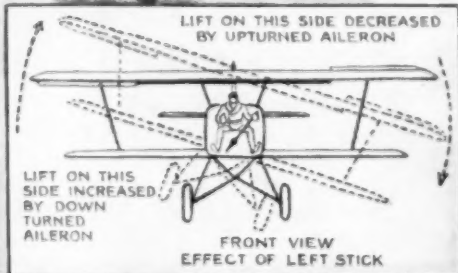
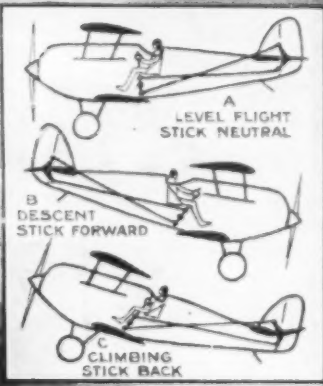


DIAGRAM SHOWING STICK AND RUDDER BAR CONTROL IN NEUTRAL AND EXTREME POSITIONS



THE EFFECTS OF AILERONS



THE EFFECTS OF ELEVATORS



An Airplane Is Always Warmed Up on the Ground, to Bring It to the Best Operating Temperature; Then It Takes Off, Climbs for Altitude, and Levels Out

front seat of the dual-control training plane for this first lesson. You have been told it will be only twenty minutes, which seems an awfully short time for your first day's schooling, but before the day is much older you will know all about why one short hop is considered enough. In front of you is a bare, black instrument board, ornamented only with an ignition switch and, beyond it, the motor, which, in most training planes, is that war-time surplus product, a Curtiss OX-5 of ninety horsepower.

For your first lesson, the instructor, with the leather mask of his voice tube strapped across his face, rides the rear cockpit, delivering orders through a receiver wedged inside your helmet, over the left ear. As the ship taxis clumsily out to the runway, races down it and faces upwind for the take-off, he has explained the program for the day.

"I will take you up," says the voice in your ear. "I will take you up a thousand feet and then let you try flying the ship."

Simple instructions follow. If the ship is rigged with throttle levers on the right side, you are to fly with the left hand on the stick, and the right, for the present, lying relaxed on your right knee. You are to sit in the center of the seat, and if the pilot tells you to release the controls or waggles the stick from side to side to indicate he is taking over, you are to release all pressure instantly. When flying the ship, you are not to "freeze" to the stick with a tightly clenched hand, but to grasp it firmly between the finger tips, for little pressure is needed.

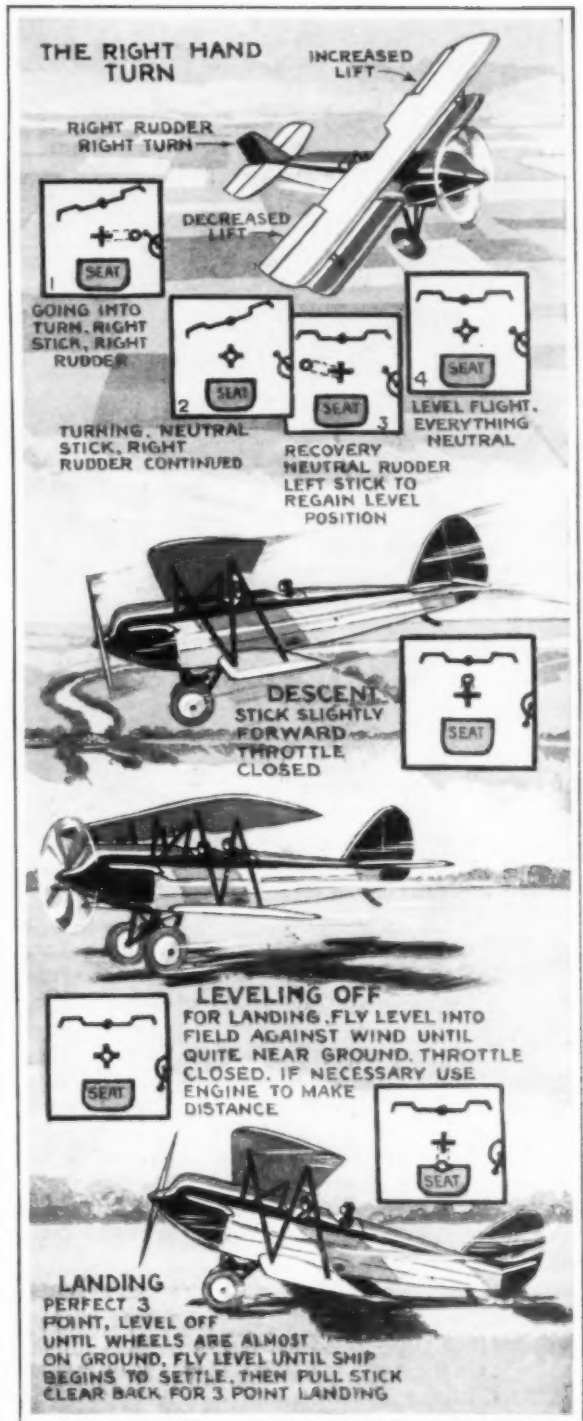
By the time these instructions are over, the ship is off the ground and climbing rapidly, while a checkerboard of green fields slips by beneath. Then comes the order to put your feet on the rudder bar, and you have started to become an aviator.

The rudder lesson proceeds apace. Turn right, straighten out, turn left, straighten out, turn right, and on and on for five minutes, while you master the workings of the foot controls. At each maneuver the stick between your knees swings from side to side as the instructor banks the ship on the turns to keep it from skidding across the sky, just as an automobile would skid if trying to turn at high speed on a level road. Always the bank and turn must coincide—not enough bank and the plane skids outward; too much, and it slips toward the inner side of the turn. Finally comes the order to take the stick, and then your troubles begin, for you have to keep the ship leveled fore and aft and from side to side and steer a straight course, and do all three at the same time.

All the control movements are instinctive. If you want to climb, you pull the stick back, and that pulls the nose up by changing the angle of the elevators at the rear. If you want to descend, you push the stick forward, and the nose drops. If a wing begins to drop, you push the stick in the opposite direction to raise it, and if you want to drop a wing to bank for a turn, you push the stick toward the wing that is to fall, and at the same time apply rudder on that side.

It sounds easy, and it is easy after you learn how, but if you let the stick move forward or aft as you push it from side to side, the nose will fall or rise, or if you get it slightly off center as you pull or push, one wing will drop. The voice droning away in your ear apprises you of all these perils.

"Keep your nose down; keep your nose down," the instructor half chants. "What are you trying to do—loop this ship? Get that left wing up; get that left wing up. Don't let your ship wobble around. Keep your nose down. Line it up on the horizon.



Turns, Glides and Landings Illustrated, to Show How the Stick, Rudder Bar and Throttle Are Manipulated to Maneuver a Plane in the Air and on the Ground



When you can just see over the nose that line where earth and sky meet, your ship is level fore and aft. No, don't drop it so fast. What do you think you're running—an elevator!"

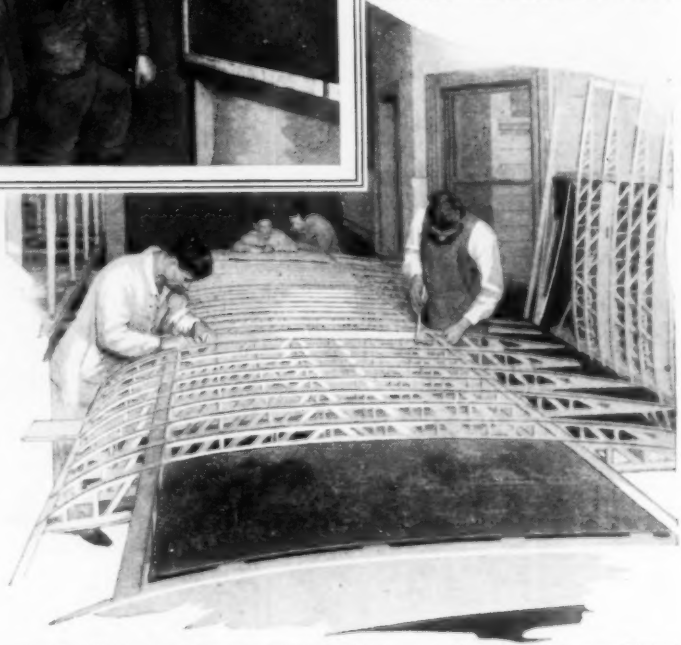
The voice talks on and on, as you wrestle with the controls, trying to make your hands and feet conform with your sense of balance. It's the rudder lesson all over again. First you overcontrol and, in trying to get out of one difficulty, you go too far and fall into its exact opposite. Then you become overcautious and peck away with little half-hearted movements, until a firmer hand jerks the stick away from you, throws it all around the cockpit, while the ship lurches in ungainly fashion. You get it back again, and the lesson goes on, with your confidence in airplane builders restored.

"Turn left," comes the order through the voice tube, and you kick the left rudder and apply the left aileron with the stick. As the left wing drops and the ship begins to bank to a steep angle, you forget about the safety belt that holds you fast to your seat and make a futile grab for the support of the cockpit side, at the same time trying to lean away from the bank, just as an automobile rider holds the side and leans away from a sharp turn.

"Don't lean away from it," says the voice. "Lean with the ship, otherwise

you will jerk the stick. You can't fall out, and if you crash the ship being on the top side of the seat isn't going to make any difference with you."

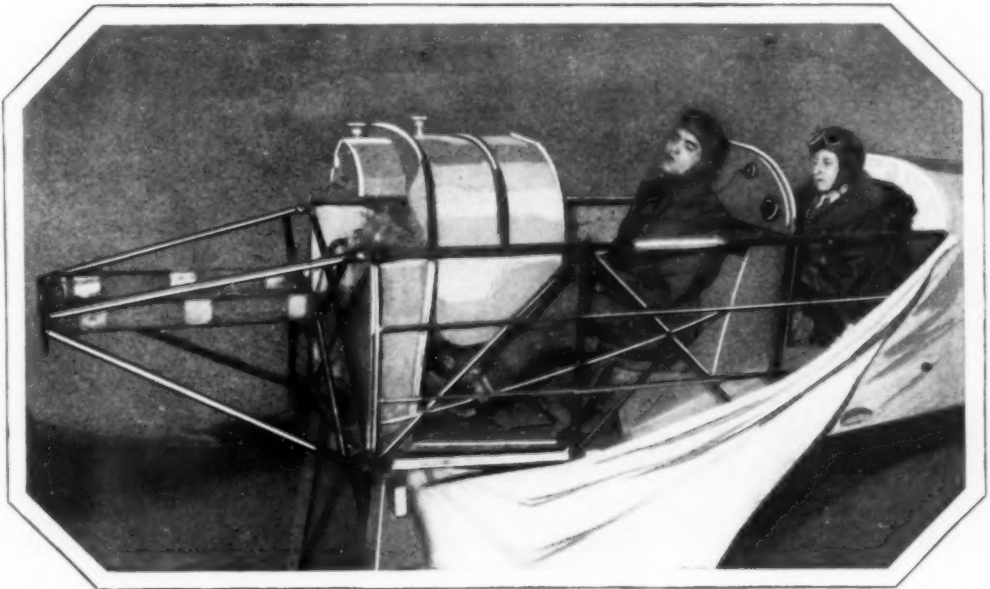
You follow the cynical advice—and learn to trust



Class in Motors and School Turns Out One in Wing Building; the Ground Work at a Flying Qualified Mechanics, and Also Teaches Navigation, Meteorology and Similar Subjects

your safety belt and that a steep bank is really a pleasant feeling, if you don't fight the ship. Suddenly the even roar of the engine dies away, a hand behind you shoves the stick forward under your unresisting hand, and you look over in surprise to see the airport runway coming up to meet you. Until the engine idled down to lose flying speed, you hadn't the faintest idea where the airport might be.

You cast off your safety belt as the plane taxis in to the line, climb out, and feel pretty good. But that feeling doesn't last long. If you are a normal person, in a half hour or so there is going to be a sinking feeling in the pit of your stomach, a weakness at the knees, and you are going to burst into a violent perspiration. That's why there is only one lesson the first day—for the instructor knows how the reaction is going to hit.



Typical Steel-Tube Fuselage of a Training Plane with Fabric Covering Removed, to Show the Interior Arrangements and the Gas and Oil Tanks in Front of the Instructor

Next day, everything is changed. You have been shifted to the rear cockpit, where the view is better, the ship easier to fly, and a whole instrument board full of interesting gadgets takes your mind, and your eyes, too, off the controls. The instructor may keep on with the voice tube, or he may switch to signals. A finger pointed up means to climb; pointed down, it means to descend; pointed to either side it means to turn, and a hand clapped to one side of the face means you are skidding, so apply more rudder on that side, or, in a bank, give it more aileron. A finger tapping the pilot on top of the head, or a hand shaking the stick means the same thing: He wants to take over the controls.

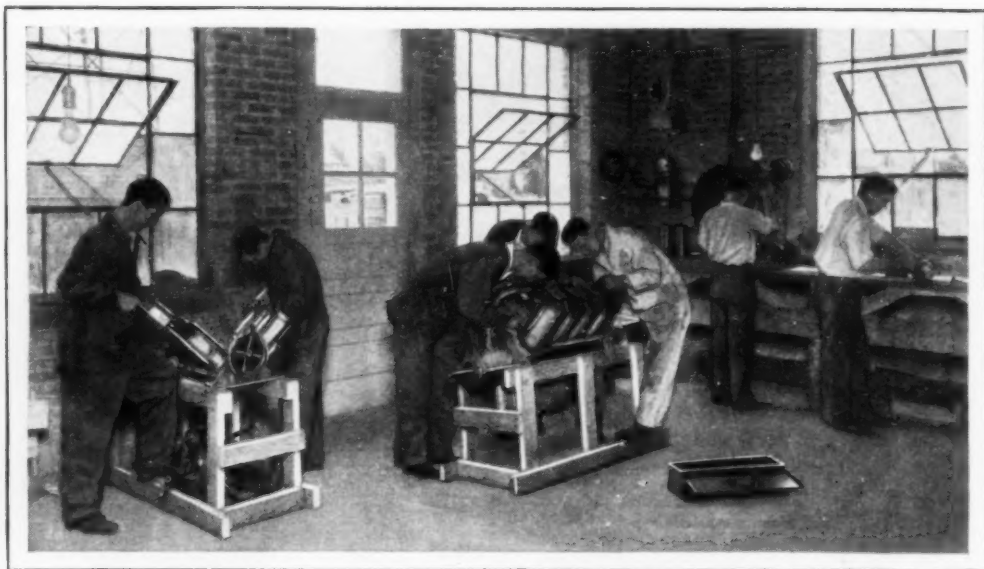
As soon as the ship is well off the ground, you get the controls, with orders or a signal to keep on climbing straight into the wind. Instead of the uncertainty of the first lesson, there is absolute confidence in yourself and the ship. You know you can fly it, and rather enjoy the air bumps that throw the plane out of trim, for they give a chance to exercise your new knowledge and bring it back again. Not that it is necessary, for a modern ship almost flies itself, and if you keep the controls steady, it will recover automatically.

You fly round and around, left turns,

right turns and straight ahead. No climbs or glides, just straight air work, learning to keep a ship level, to hold a course, that for every degree of bank the controls act a bit differently, that once you have reached the desired angle of bank, the stick comes back to neutral, or even carries a bit opposite control, if you are to keep your nose on the horizon and keep the horizon flowing past it evenly and steadily. You learn just how much right rudder must be carried to offset the torque of the engine when you want to go straight ahead, for the propeller is always trying to pull you around to the left.

And so it goes on for the first two or three hours. If you are lucky, there will be a windy day or two when the motor labors like a car climbing a steep hill in high gear, when you have to fight the elements every second of the time, and when, flying across or quartering the wind, you seem to make more side drift than you get speed ahead.

Along about the fifth lesson the instructor turns around as you climb aboard and announces that you can taxi the plane out, and take it off, too. The ship that answers to a finger touch on the air is a sluggish, perverse thing on the ground. Some are almost impossible to steer; the rudder bar must be worked like lightning;



Class in Motors at a Flying-Field Hangar; the Ground Course Includes a Thorough Training in Repairing All Types of Water and Air-Cooled Aviation Engines

the ailerons work just the opposite of the way they do in the air, and if a good wind is blowing, the student may have to get out and run along, guiding one wing tip, until the runway is reached.

The take-off isn't so hard. You ease your throttle lever smoothly forward until the engine is turning up to flying speed—1,300 r.p.m. is the cruising speed for OX-5-engined training planes—push the stick all the way forward and hold it there. It takes pressure to do that, for you seem to be lifting the tail off the ground with brute force. But as the ship picks up flying speed, the pressure drops, and you let the stick ease back almost of its own accord, until the ground drops away.

In all the preliminary training, the pilot has been preparing you for the day you will try your first landing—the most difficult feat in flying. Each time he comes down, you keep hand and feet on the controls and feel the way he does it. You watch him nose down to keep flying speed as he throttles down the engine for the glide into the field; sense the easy, quick shifting of rudder as he turns to keep the nose pointed straight at the runway, and feel the stick shift a bit from side to side as wing tips are leveled up, lest a stray air current or a bump send the plane side slipping to a crash.

Watching over the side as the ground comes up, your finger tips telegraph the message when the pilot pulls the stick back just enough to level the ship out of the glide and let it lose more speed as it settles toward the earth, and catch the final pull back to drop the tail so that landing wheels and skid will all touch ground together in a perfect three-point landing.

When the time comes to try it yourself, with the instructor's hands and feet ready to correct your errors, the feat is no longer an unknown mystery, but something you know well how to do, if you can co-ordinate your movements and make hands and feet answer your brain fast enough.

All the time you are practicing landings, the drilling in air work goes on. If there is a good wind, the instructor signals to bank around until you are flying across the wind, then points out a road or a fence line or a railroad track parallel to your course and signals the student to follow it. In a cross wind, the plane drifts sideways at virtually the same speed as the wind, and to offset this and follow a straight course, it is necessary to turn the plane at an angle toward the wind. Holding a ship at the right angle in a twenty or thirty-mile wind requires your constant attention.

(To Be Continued)

Improving the Battery Hookup



ALTHOUGH A and B-battery eliminators are becoming increasingly popular among radio owners, a large number are still using batteries as a source of filament and B-supply and will continue to do so, especially where suitable power lines are not available. Every set owner using batteries should know not only how to take care of them and keep them in good operating condition, but also the proper methods of connecting them to the set to obtain best results.

Corroded terminals, acid-eaten wires and wrong connections are a common source of trouble that may easily be avoided. Fig. 1 shows a very untidy battery installation, which not only is almost sure to breed difficulties but, of course, is also most offensive to the eye. Such an installation may be satisfactory for temporary use when testing but should never be permanent. Instead of separate leads, the use of multi-wire cables, similar

to the type shown in Fig. 2, is advised, and the batteries and charger should be kept out of the way, and out of sight if possible. If a radio console or table with battery compartment is not available, a neat closed box of suitable size may be used, in which holes are drilled to provide air circulation.

Attention should be given to binding posts. Loose posts and poor terminal connections cause crackling noises and high-resistance contacts, with which no radio receiver can possibly give good results. The posts may loosen from vibration or may not have been turned down tightly when the receiver was first installed.

The correct and incorrect methods of attaching the bared ends of the leads to the binding posts are shown in Fig. 3. After the insulation has been removed from the end of the wire (see insert), the wire is scraped to free it from all trace of rubber, and the strands are twisted so that they will not spread apart when the

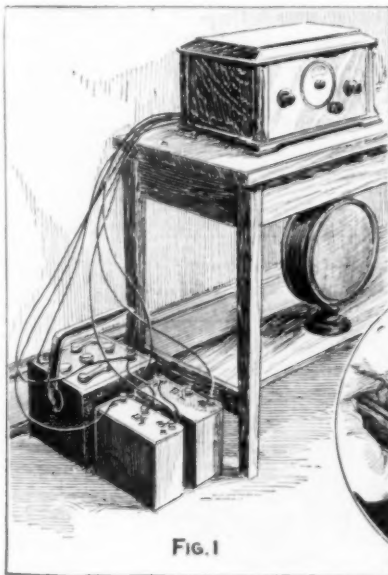


FIG. 1

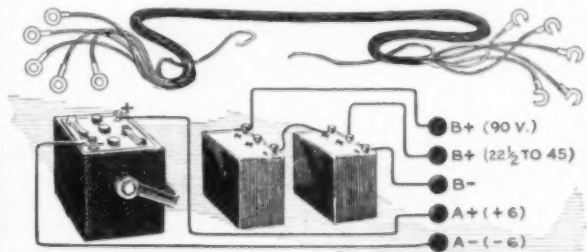


FIG. 2

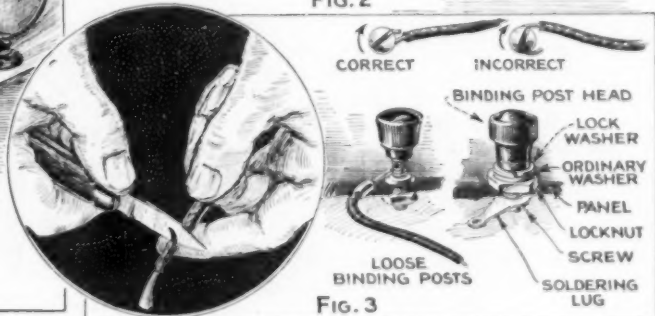


FIG. 3

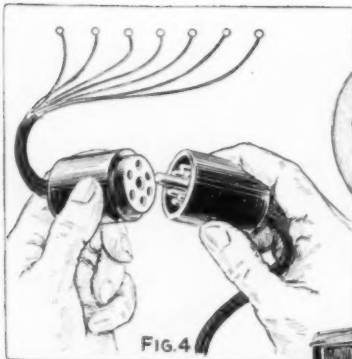


FIG. 4

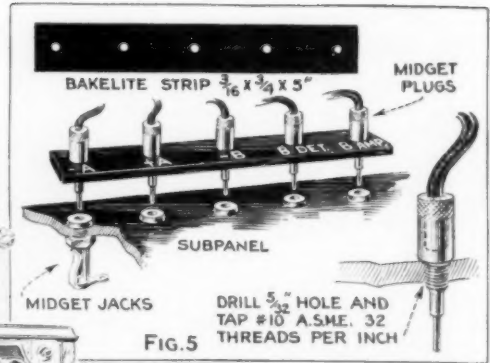


FIG. 5

binding posts are tightened. As a further precaution, and to make the end easier to connect, it may be coated with solder. The wire should be bent around the post in the same direction that the head turns, which is clockwise. This tends to keep the wire securely under the head. Some binding posts have a hole drilled in the shank, through which the wire is inserted, whereupon the head is screwed down tight. Cord tips or midget jacks also are useful here.

If you are annoyed by binding-post heads coming loose repeatedly, it is a good idea to use a washer and then a lock washer, if the binding-post head is removable, as shown in Fig. 3. Figs. 4 and 5 show two handy methods of attaching battery leads to receivers. The separable plug and socket provided with the multi-wire cable, shown in Fig. 4, provide a quick method of connecting or disconnecting all battery leads. These are of different colors and identified with markers, and the plug is designed so that it is impossible to make a mistake when inserted in the socket whose corresponding terminals are connected to the posts in the set. In Fig. 5, a homemade device, built up from midget plugs and jacks, answers the same purpose.

Another safety method against short-circuiting the leads and making quick

connections possible is shown in Fig. 6. The bare ends of the leads are securely soldered to the inside ends of the tips on a discarded X-type vacuum-tube base, from which the glass shell has been removed. An X-type socket is fastened to the subpanel at a convenient location and the leads from the

wiring of the receiver are connected to it. Be sure that the receiver leads are all connected to the terminals on the socket in correct relation to the battery leads fastened to the tips on the tube base. The same illustration clearly shows the idea, and if there are more connections to be provided for, an additional socket and

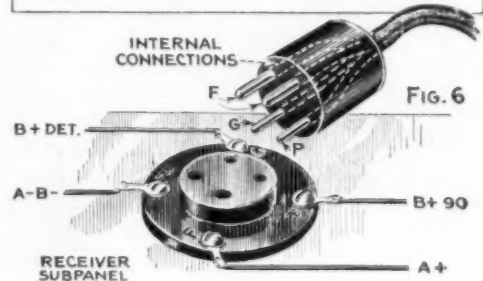
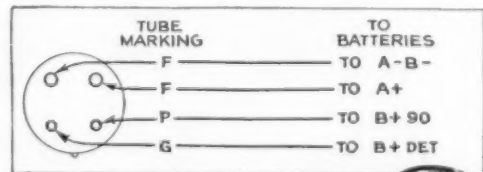


FIG. 6

tube base may be used. The connections will, of course, vary according to the type of set used, and in all cases the various leads should be tagged carefully so that they can be identified easily.

Loose connections at the battery terminals often make trouble. It is, therefore, a good idea to solder lugs to the ends of the leads that are connected to the batteries, to insure good contact. The lugs are flat and will be held more firmly by the terminal heads than the bared ends.

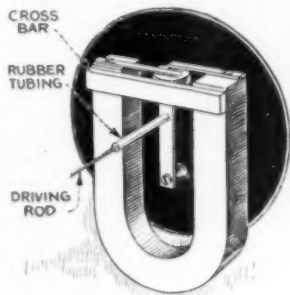
In all cases use well-insulated, stranded wire, not less than No. 18, for battery connections—never bell wire or wire of similar gauge with thin insulation, as short circuits are sure to occur sooner or later.

Service Hint for Power Units

To obtain the maximum results possible with power units, have the service man set the variable resistances to definite values, or else check them with a suitable voltmeter. Once set, do not disturb them until tubes are changed or other alterations are necessary. Constant meddling with variable resistances upsets the balance of the receiver and causes many unnecessary service calls.

Quieting Loud-Speaker Units

Owing to the greater power available from the new amplifiers now in use, some loud speakers are required to handle more volume than they are designed for, with the result that rattles and other extraneous noises will be heard which were not noticeable with low power. One of the most common causes of rattle is contact of the drive rod with the adjacent cross member which, in most units, extends across the magnet. This noise may be eliminated by slipping a rubber tubing over the drive rod, as shown. Tubing of the right size may be obtained from rubber-insulated flexible or stranded wire.



Coil-Winding Kink

Small coils wound on tubing in usual radio practice may have the primary over the secondary as shown in the photo. Empire cloth, paraffin paper or other insulating material is used between them. Coils wound in this manner will be found effective and are neat in appearance as well.



Light Plug from Tube Base



Handy electric-light plugs may be made from old X-type tube bases, as shown in the photo. After removing the tube from the base, two of the prongs are cut off. The ends of the light cord are bared and slipped through the hollow prongs where they are secured at the ends with a drop of solder. Sealing wax, which may be taken from an old battery, is poured

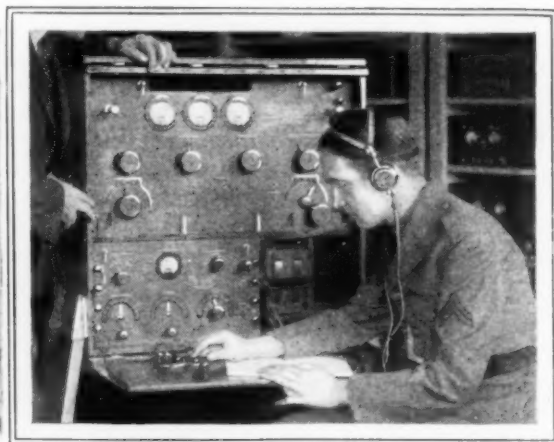
into the base, care being taken to keep the wires separated so as to prevent a short circuit. The prongs may be filed to fit a wall socket of the plug-in type, or a socket may be made from a piece of bakelite and two standard contacts, for use at the workbench.—W. J. Rose, St. John's, Newfoundland.

☐ The tube life in many receivers may be greatly lengthened by operating the filaments below their normal rating; reduce the filament current to as low a point as possible without interfering with the tone of the receiver.

Facts and Fads for Radio Fans



Chief Charles W. Rankin of New York City Directing the Operation of a Fire Boat by Distant Radio



© Harris & Ewing
New Aircraft Radio Equipment, Designed by the Signal Corps, Which Permits Both Telephone and Telegraph Communication, Sending and Receiving at the Same Time



Left, Automatically Controlled Broadcast Receiver, Recently Demonstrated by Its Inventor, Harry N. Marvin, Eliminates Tuning with Dials, the Station Being Obtained by Merely Pressing a Button or Throwing a Lever; Above, Scene in the Office of J. L. Baird, the English Television Expert, When Living Images Were Transmitted for the First Time across the Atlantic; Parts for Elementary Sets Are Now on Sale in a London Department Store on Which Silhouettes Broadcast after Midnight by Mr. Baird May Be Received

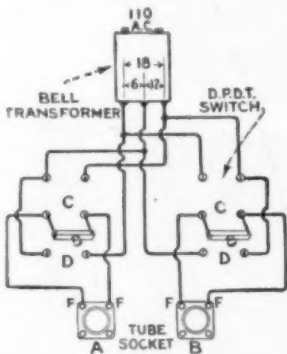


Use Care with Power Apparatus

With the increasing popularity of power amplifiers and packs, radio has entered the field of high-voltage equipment. In many power packs the voltages supplied to the power tubes will exceed 400. In using such equipment, no danger is involved either to persons or equipment if ordinary precautions are taken, but it is well to remember that the current source should always be turned off before changing tubes, equipment or wiring.

Reactivating Radio Tubes

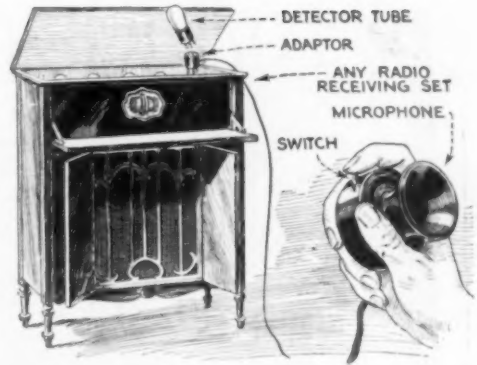
A very simple tube booster, or reactivator, may be made with a bell-ringing transformer tapped for 6, 12 and 18 volts, which can be bought at any electrical store. The circuit provides for both the 199 dry-cell tubes and 201-A storage-battery types. The socket A is for the 199-tube and B for the 201-A type; two d.p.d.t. switches are required to change the tube from the flashing voltage to a lower voltage for aging. The same time is applied



to both types of tubes. They are flashed for one minute at C, and then changed to position D and left on this lower voltage for ten minutes. After reactivating, the tube will be greatly improved, if there was sufficient thorium left in the filament to complete the operation; if there was not, the tube cannot be brought back to normal.—D. A. Brown, Marion, Ohio.

Home Broadcasting Device

The simple device shown in the illustration enables the set owner to broadcast voice or music through his own set, without making any changes in the set or battery connections. The voice is amplified by means of the a.f. stages and is heard in the loud speaker in the same manner as a station. The microphone unit is pro-



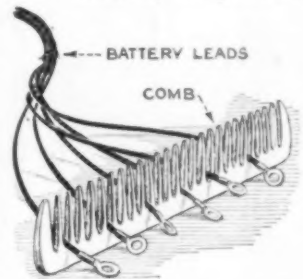
Microphone, Showing the Adaptor Inserted in the Detector Socket of the Set

vided with a small switch, which, when pressed down, cuts off the radio program and enables the operator to speak; when the switch is released, the radio program is resumed. To install the device, it is only necessary to remove the detector tube and insert a special adaptor in the socket; the tube is then plugged into the adaptor, and the instrument is ready for use. A long cord is supplied with the outfit so that the microphone may be located in the next room. If it is desired to broadcast phonograph music, the microphone is placed against the sound chamber of the phonograph and the switch button pressed. A device of this kind may be used for many novel stunts for the mystification of those listening in.

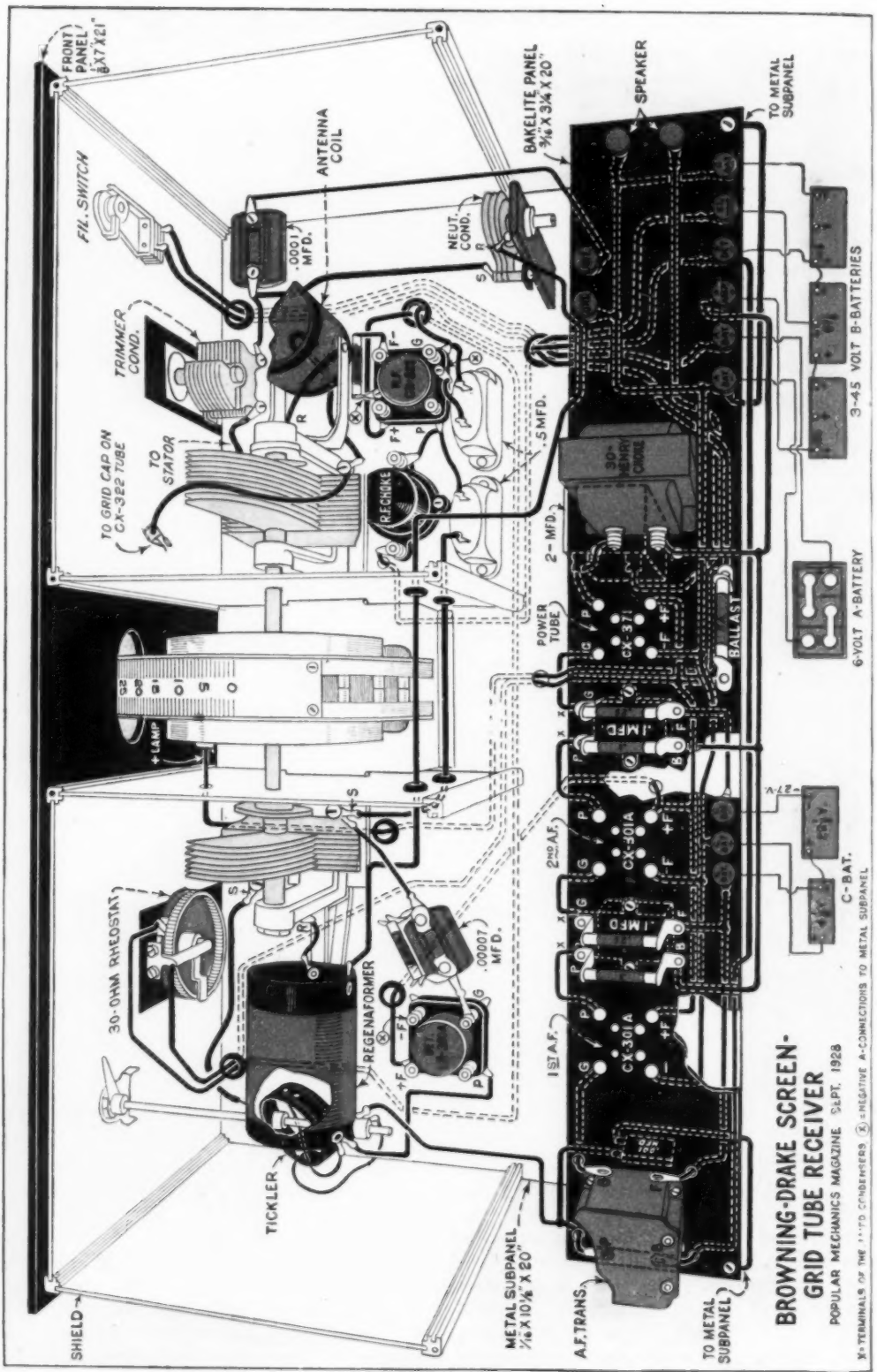
Comb Spaces Battery Leads

In making some alterations in the radio set, the writer disconnected the battery leads and found it necessary to provide some means

of keeping them separated, to prevent shorting, and in their proper order for replacing. An ordinary pyroxylin comb was



used for the purpose and the various voltages marked on the comb. By stretching a rubber band lengthwise about the comb the wires will retain their respective positions.—Millard Comstock, Buffalo, N. Y.



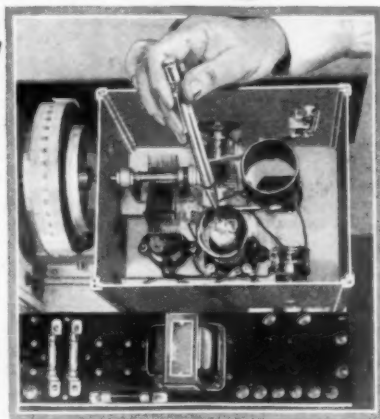
**BROWNING-DRAKE SCREEN-
GRID TUBE RECEIVER**

POPULAR MECHANICS MAGAZINE SEPT. 1928

X¹ TERMINALS OF THE 11-TD CHUBBERERS X² NEGATIVE B-CONNECTIONS TO METAL SUBPANEL

New Browning-Drake Uses Screen-Grid Tube

Tube
by
Glenn H. Browning

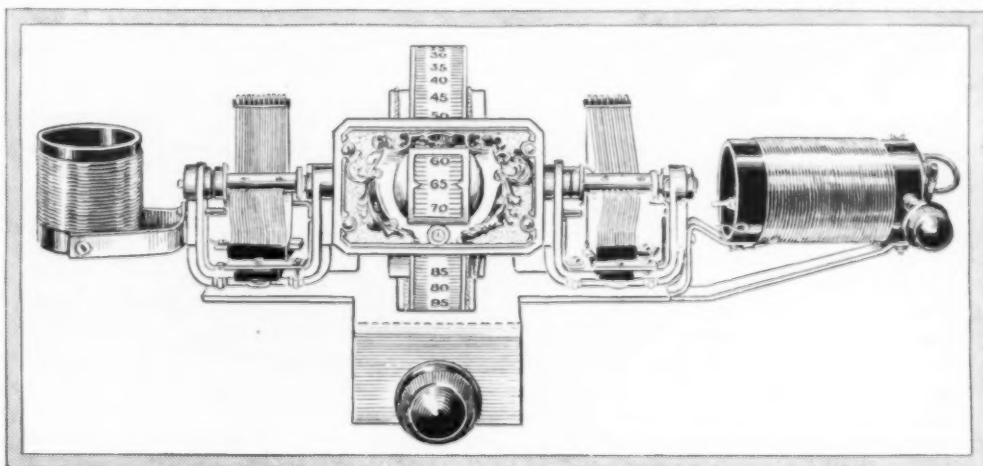


THE screen-grid tube has a number of advantages when used as a r.f. amplifier, and it has been employed in this capacity in the latest Browning-Drake receiver, with the further refinement of single control. Too much cannot be said in favor of the new screen-grid tube as a r.f. amplifier. The amplification is so great that this set, using one stage of r.f. amplification with regeneration, and operated on a 10 to 20-ft. antenna, provides as much volume as the writer has ever obtained with a receiver.

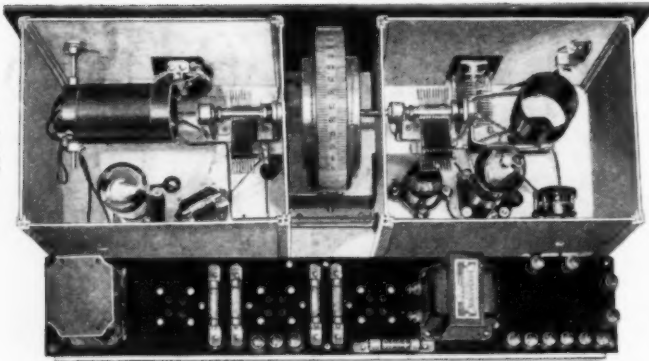
The screen-grid tube has two grids, one forming a complete shield around the plate, while the other, which is known as the control grid, and is connected to a terminal at the top of the tube, corresponds to the grid of the standard tube. This tube has two advantages; one is the very small capacity between the plate and

makes neutralizing unnecessary in many cases, but, when regeneration is employed on the r.f. transformer, as in this set, any capacity, small though it may be, must be neutralized in order to secure the greatest efficiency.

For the information of those who wish to alter earlier Browning-Drake sets to employ the screen-grid tube in the r.f. stage, the following change is necessary in the circuit. The plate of the screen-grid tube is connected through a .5-mfd. condenser directly to the stator plates of the second tuned circuit instead of to the primary of the r.f. transformer. Thus, as will be noted, the primary of this trans-



Single-Drum Control Unit with Condensers and Coils Ready for Mounting on Front Panel



Completed Receiver with Tops of the Compartment Shields Removed. Showing the Screen-Grid and Detector Tubes in Position, and at the Right, Schematic Diagram of the Circuit

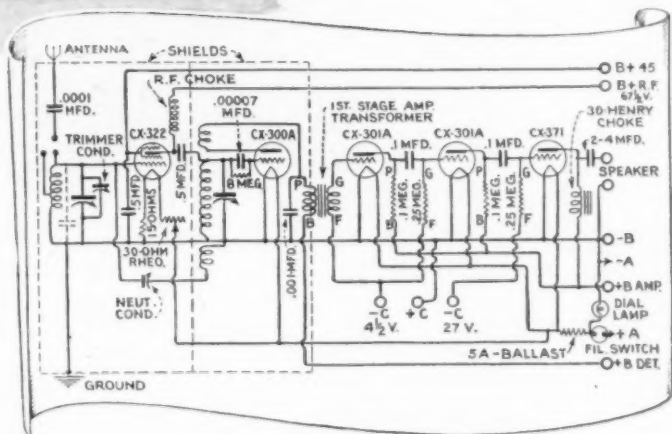
former is not used when the screen-grid tube is employed, but it is not detrimental to leave this primary in position; in fact, it is preferable, as the builder might wish to change to a.c. tubes later on.

It is, of course, necessary to provide the resistors shown, to supply the required 3.3 filament voltage and a filament current of .132 amp. for the screen-grid tube; also the .5 mfd. condenser connected between the screen grid and the ground. If the constructor wishes to use the 199 tubes for detection and amplification, and three No. 6 dry cells for supplying the filaments of these tubes, he will find that the screen-grid tube can be quite satisfactorily operated with 3 volts. In this case, the fixed filament resistances are the only pieces of apparatus in the set herein described that must be changed.

The assembled unit shown in the illustration on page 479 is now available and saves the builder a large part of the assembly work. This well-built unit comprises the necessary coils, variable condensers and illuminated vernier dial neatly mounted and ready for installation. The small trimmer and neutralizing condensers are not included, but a neat escutcheon plate for the front panel is provided, and

the vernier knob at front controls the ganged condensers.

The r.f. portion of the circuit and the detector unit must be completely shielded, and suitable heavy aluminum shields are obtainable for this purpose, as shown in the illustration on this page. These shields are easily assembled on the heavy alumi-



num base by means of grooved uprights and short machine screws, the sides and backs being placed in position after the wiring has been completed, as shown in the upper photo on the opposite page. The front plates are of course assembled when the tuning elements are screwed to the rear of the front panel.

The complete wiring diagram (given on page 478) shows every wire in position. Note that the audio-amplifier portion of the set is mounted on a bakelite shelf at the rear and consists of a transformer-coupled first stage, followed by two resistance-coupled stages. The power-tube output is filtered through the choke coil and either a 2 or 4-mfd. condenser, making an ideal a.f. amplifier. The shelf is supported above the aluminum subpanel on six metal rods screwed to the subpanel. Note that this panel is grounded to negative-A, and is utilized as a negative-A connection at the point indicated by X in the circles; it also completes the circuit to the dial lamp through the metal dial

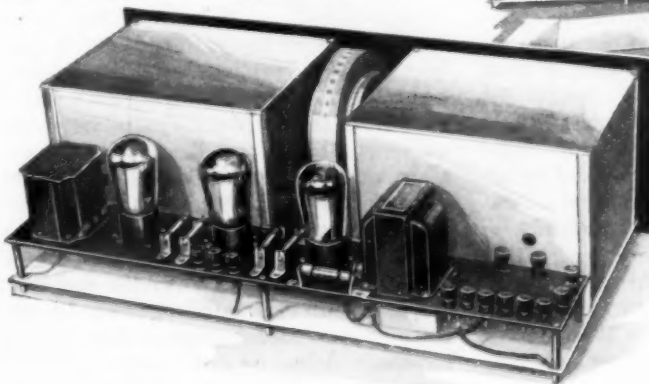
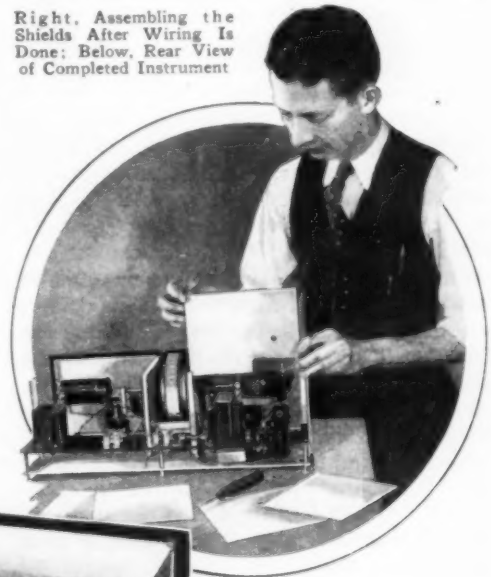
housing. Rubber gaskets or fiber insulating rings may be used in the holes where leads come through the subpanel, but, as all wiring should be done with flexible rubber-covered hookup wire this is not essential.

The schematic wiring diagram is given on page 480 for those who prefer it to the simplified type. Note in this diagram the taps indicated on the antenna coil for obtaining the effect of either a long or short antenna. A suitable antenna switch may be obtained from any dealer in radio supplies for this purpose if desired, or a simpler method is to use an additional post. It is necessary in some cases to place a small fixed condenser of about 15-mmf. capacity across the first tuned circuit; this condenser is shown dotted in the schematic diagram. However, connecting the .0001-mfd. condenser in series with the antenna, as shown in both diagrams, is usually sufficient to make the trimmer condenser effective.

Little comment is necessary on the audio end of the receiver, as every detail has been taken care of in the simplified diagram. A power tube of the CX-371 type is recommended in the last stage and the proper biasing batteries are shown. The C-bias on the two resistance-coupled stages may be varied from $1\frac{1}{2}$ to $4\frac{1}{2}$ volts, the proper voltage to be found by trial. The C-bias on the power tube, when used with 135 volts of B-battery as shown, will be 27 volts, but, if 180 volts of B is applied, this bias must be increased to 40 or 45 volts. The C-battery for the resistance-coupled stages remains the same. If a B-eliminator is used, it has been found advisable to lower the grid-resistor value

on the power tube to .1 meg., to eliminate any tendency to "motorboat." The .1-mfd. blocking condensers are mounted directly under each of the double resistor mounts, and the terminals are indicated at X in the wiring diagram; each of these condensers is connected directly across G and P of each resistance-coupled stage. When wiring the socket for the screen-grid tube, note that the negative-A connection is taken from the socket-mounting screw at the front, which, being connected to the metal subpanel below carrying the negative-A supply, eliminates extra wiring. This negative-A connection is taken to the negative filament post on the socket through the 15-ohm resistor. Also note that one side of the .5-mfd. fixed condenser nearest this socket is grounded to the subpanel through the other mounting screw of the socket, both of these points being indicated by the X in the circles. The negative filament connection for the

Right, Assembling the Shields After Wiring Is Done: Below, Rear View of Completed Instrument



detector tube is also taken directly to the metal subpanel either through a wire run to the socket-mounting screw or by extending the negative binding-post screw down through the subpanel.

When the receiver is

completely constructed and connected, neutralization may be effected in the following manner: The compartments which



Front Panel Showing, from Left to Right, Switch and Trimmer Condenser Knobs, Dial Knob, and Rheostat and Tickler Knobs

contain the r.f. and detector circuits should have the shields completely on and screwed down as shown in the lower photo on page 481. The operator should then set the dial at about 20 on the scale and turn the tickler by means of the knob on the front panel, either in one direction or the other, until a distinct click is heard in the speaker or headphones. Next adjust the tickler coil until the detector circuit is not oscillating. A test to determine whether or not the set is oscillating is to place the finger on the terminal of the .5-mfd. condenser, which is connected to the grid of the second tuning circuit (to get at this condenser the top of the shield on the screen-grid tube compartment must be removed). The terminal referred to is the one with the lead running through the side of the shield. A distinct click will be heard if the circuit is oscillating. Then turn the tickler back to where oscillation just ceases. Turning the trimmer condenser will then throw the circuit into oscillation if the neutralizing condenser is not properly set. The neutralizing condenser should be adjusted until the trimmer condenser has no effect on oscillations produced in the detector circuit. It will be found that the neutralizing condenser must be set almost at a minimum value. Stations may now be tuned in at will with the vernier dial knob without further adjustments. Where extreme selectivity is required, a short aerial will give the best results, but try various lengths from 10 to 40 ft. for best results.

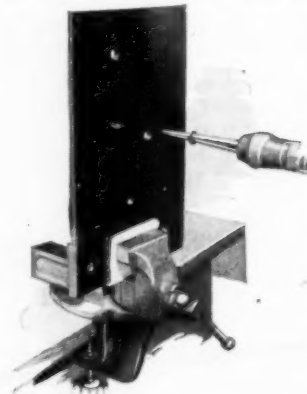
A postal card will bring you, free, a list of parts for this set, with prices, and enlarged blueprints of the circuit diagrams may be obtained by sending 25 cents to Popular Mechanics Radio Department. Specify blueprint No. 135.

Simple Panel for Speaker Connection

In wiring connections to various parts of the house for the loud speaker, a small phone-tip-jack panel proves a convenience. The usual speaker jack, because of its size and shape, is not easily concealed. It can be replaced, however, by a little panel that can be screwed underneath a window ledge. Procure two $\frac{3}{4}$ -in. nickered brackets from the hardware store, or bend two such brackets from $1\frac{1}{2}$ -in. lengths of $\frac{1}{2}$ -in. wide brass, drilling a hole near each end to take the bolts and screws. Cut a strip of bakelite, $\frac{3}{4}$ by $2\frac{1}{4}$ in., from a scrap of old radio panel. Lay the brackets on it, flush with one edge and the ends, and mark and drill the bolt holes. Get two small phone-tip jacks, and drill and mount them on the panel between the brackets. Saw off the ends of the bolts, and attach the panel, wiring the speaker extension to the jacks.

Gauging Reamed-Hole Sizes

The writer recently lost a front panel and considerable layout time, all because



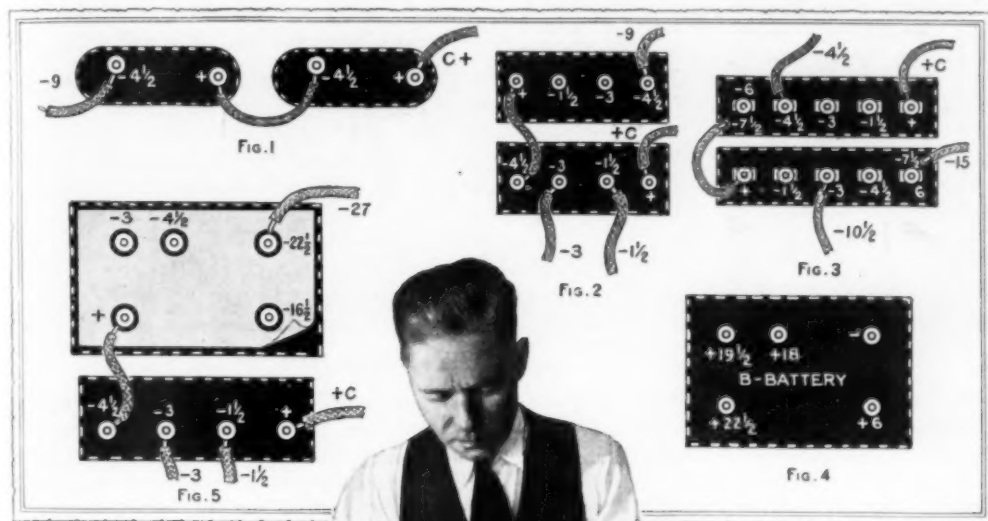
he reamed one hole a bit oversize. This has happened to many others, and it is not irreparable, but, in this case, the job was not for personal use, and it had to be just right. To prevent a possible repetition,

I obtained some ordinary flat iron washers with from $\frac{1}{4}$ to $\frac{5}{8}$ -in. holes. The washers were reamed to the sizes desired and to clean out the holes, then heated over a gas jet and dropped into water to harden them. Now, when reaming a hole in a panel with a taper reamer, I just slip the proper size of washer over the end of the reamer, and, as it butts against the panel when the reamer has gone deep enough, I cannot make the hole too large.—E. R. McCoubrey, Pawhuska, Okla.

How to Obtain C-Voltages

It is universally agreed that C-batteries are necessary in the present-day receiver for economical and satisfactory operation.

$4\frac{1}{2}$ -volt tap in the C-battery, and so on. The B-battery shown in Fig. 4 is a convenient size, having five taps and weighing only two pounds. To use this same battery as a C-unit, as shown in Fig. 5, some man-



The correct C-voltage for various types of tubes, when used with specific B or plate voltages, is important, and charts giving this information come with the tubes, but as the voltages vary over a wide range it is often quite difficult to obtain single C-battery units for the purpose. Small standard C-batteries may be connected in series to obtain the common lower values as shown in Figs. 1, 2 and 3, but for the higher voltages this is not practical and a larger unit is necessary. In this case the B-battery shown in Fig. 4 may be utilized for C-battery purposes and combined with a small standard C-battery as shown in Fig. 5, or with an additional B-block to give any required biasing voltage.

However, when using B-batteries for C-battery purposes it should be kept in mind that B-batteries are marked from the negative end, the $22\frac{1}{2}$ -volt terminal being the positive, as shown in Fig. 4, while C-batteries are marked from the positive end and the high-voltage terminals are negative. The intermediate values vary in the same way, what was the positive 18-volt tap in the B-battery becoming the negative

manufacturers supply a perforated, white cardboard sheet correctly marked for C-battery values, as shown in the illustration. If this cover is not supplied, it is a simple matter to cut one out and mark it in the same manner, noting carefully the reversed voltage values.

Electric Plugs of Soft Rubber

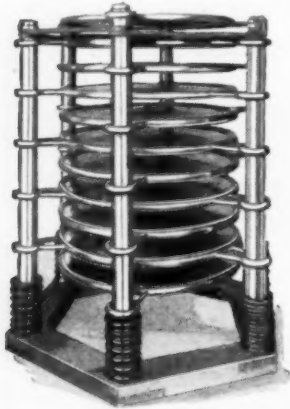
A new electrical plug of unusual design has made its appearance on the market. It is made of solid, soft rubber and may be dropped and knocked about without injury. Several designs are available for household appliances, office and radio equipment, portable shop tools, and all other devices requiring plugs. They are shaped to form a handy finger grip.



⦿ Oscillator tubes work best at the lowest practical plate voltage, which is from 17 to 45 volts, according to the circuit used.

Giant Air Dielectric Condenser

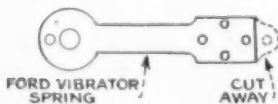
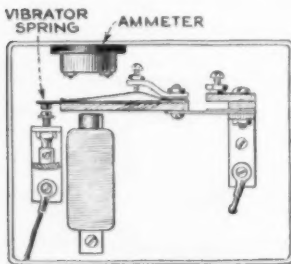
Two condensers of the type shown were recently built for use in a 50,000-watt broadcasting station, which are believed to be the largest ever built as an article of sale by a manufacturer of a standard line of radio condensers or accessories. As may be seen, the plates differ from the ordinary form in that they have rounded edges of fairly large radius, which reduce leakage. Laboratory tests have shown that voltages, approximately two-thirds higher than would be possible with flat plates, may be safely used with this design. This condenser will stand pressures up to 60,000 and 70,000 volts. It is approximately 42 in. high, 30 in. in diameter and weighs about 350 pounds.



ordinary form in that they have rounded edges of fairly large radius, which reduce leakage. Laboratory tests have shown that voltages, approximately two-thirds higher than would be possible with flat plates, may be safely used with this design. This condenser will stand pressures up to 60,000 and 70,000 volts. It is approximately 42 in. high, 30 in. in diameter and weighs about 350 pounds.

Contacts for Vibrating Charger

The writer uses a charger of the vibrating type, and the little kink illustrated saved a good program and a 40-mile trip for new contact points when the original ones burned out. The vibrator spring was taken from a Ford coil and the end indicated by dotted lines cut off. Two extra holes were then drilled in the spring to take the small mounting screws in the charger. The lower contact was obtained from the local accessory store, and although the contacts were smaller than the original ones they have given



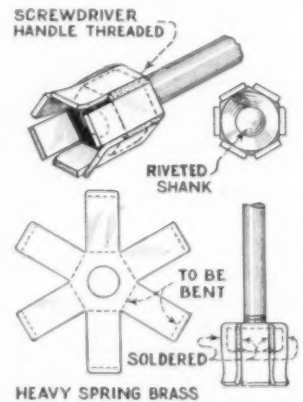
good service. The new spring was mounted under the old one and the setscrew above readjusted until the ammeter indicated the proper charging rate.—C. S. Cook, Mount Hamilton, Ontario, Can.

Heavy Wire for A.C.-Tube Circuits

One of the most important things to watch in using the new a.c. tubes of the CX-326 and C-327 types is that the wire for the connections to the filaments should be heavy enough to carry the required current. Ordinary battery cable is not heavy enough; rubber-covered twisted pair lengths, not smaller than No. 18, and larger if possible, should be used.

Handy Hint for Set Builders

When building radio sets, it is often necessary to place nuts in positions not accessible with the fingers. To meet this difficulty, saw the end off of a cheap screwdriver, or other similar tool, provided with a round shank slightly larger than the opening in the nuts. Thread the end to take one of the nuts, then cut a piece of spring brass to the shape shown and slip it over the shank of the screwdriver. The nut can now be screwed on tightly and locked in position by means of a center punch or by heading up the end of the shank. Bend the projecting tabs of the brass piece over the side of the nut as shown, and clamp them in position in a vise, after which they may be soldered firmly in place. Nuts can now be picked up from any flat surface and will stick in the opening until placed on the screw. If heavy brass is used for the clamping flanges, the nuts may be tightened sufficiently without using any other tool. It is, of course, necessary to make a tool for each size of nut used.





Helpful Hints *from* Radio Experts

A New Use for Old Tubes

Here is an idea I have found useful and no doubt there are many radio experimenters who would like to try it. Most experimenters possess some discarded old-style 1-amp. tubes. These can be used to good advantage as rectifiers. The writer has a B-eliminator employing a Raytheon tube and by accident the tube was broken. Filament rectifiers are very efficient, and having a number of old-style C-300 and C-301 tubes, I decided to alter the eliminator so that they could be used. The eliminator had a $7\frac{1}{2}$ -volt winding for lighting the filaments of the tubes. Where the eliminator is used with sets having less than four tubes, two C-300 or C-301 only will be necessary. Four tubes are used as rectifiers in order to insure a uniform output where there is a heavy load on the eliminator, as in the case of multi-tube sets. The old tubes will give an even flow of B-current and will continue to do so for a long time. In case there is no provision in the eliminator for a $7\frac{1}{2}$ -volt filament supply, old tubes of the C-301A type may be employed as rectifiers if an ordinary bell-ringing transformer is used for the filaments.

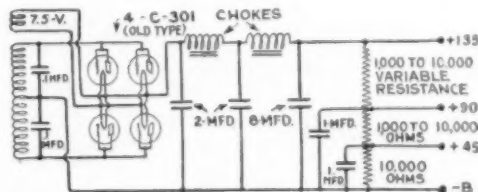
Four of these tubes require but 1 amp., and the bell-ringing transformer can sup-

ply a maximum of $1\frac{1}{4}$ amp. at 8 volts. If the filaments burn too bright, a heavy resistance should be put in series with the filament lead.—G. Niemann, engineer, Benjamin Electrical Mfg. Co., Chicago.

Paste Protects Battery Terminals

A paste that will prevent corrosion at battery terminals may be prepared very cheaply at home. Corrosion is checked by service men by the use of grease or vaseline, but although this prevents creeping of the acid, some alkaline preparation should be used in connection with either to neutralize the acid. Fill a $\frac{1}{2}$ -pt. cup with a cheap grade of vaseline, transfer this to a pan and melt it over a slow fire. When melted, add 3 tablespoonfuls of common baking soda, remove the pan from the fire and stir the mixture until cool. Spread the paste over the battery terminals after they have been thoroughly scraped and cleaned. Any acid solution that has been sprayed over the top of the battery when charging or spilled when a hydrometer reading is taken, should be carefully removed with a rag that has been moistened with a weak solution of household ammonia.—

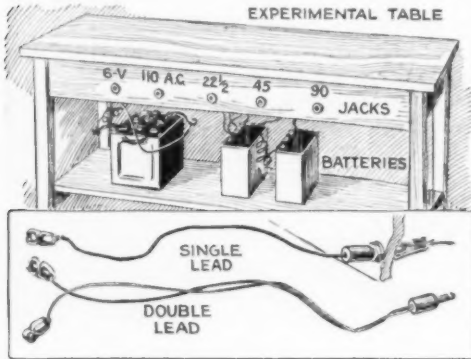
Harry Saine, chief engineer, Station KQW, San Jose, Calif.



Schematic Diagram. Showing the Method of Using Old Tubes as Rectifiers

Voltage Supply for Test Table

Connecting and disconnecting batteries and power supply, to test or demonstrate radio sets or other apparatus on the ex-



Above, Table Showing Jacks with the Various Voltages Indicated; Below, Single and Double Leads

perimeter's table, is not only tedious but mistakes are likely to occur. The idea illustrated in the sketch was used in a busy radio store where several sets an hour had to be demonstrated, and anyone can use the same idea and will find it very handy. Several holes were drilled at the side of the table, and radio jacks were inserted and wired to the batteries hidden under the table. Several plugs with long leads, either single or double, were used for connecting the various voltages to the sets demonstrated. The jacks may be placed under the top of the table if desired.—H. R. Wallin, radio operator, Brooklyn, N. Y.

Insulating the Screwdriver

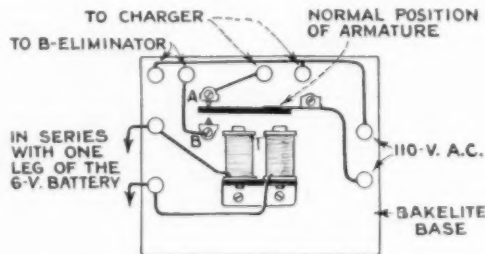
It is frequently necessary to make slight adjustments within a radio set when it is in operation. It is common practice to use a screwdriver for this purpose, but, even in the hands of an expert, this may cause a short circuit that will result in burned-out tubes. To prevent this, the screwdriver should be insulated, and there are three ways of doing this effectively: The first and simplest con-

sists in carefully covering all but the edge with insulating tape; the second is to slip a length of rubber tubing over the metal shank, and the third, for small screwdrivers, is to use spaghetti.—E. Stuart Capron, consulting engineer, Buffalo, N. Y.

Simple Control Relay

There is a tendency to control some of the new trickle chargers and B-eliminators by means of the filament battery switch on the panel of the radio set. Actually this does not perform the desired function in all cases, owing to the fact that most of the trickle chargers should be disconnected from the 110-volt supply when the set is in use. The simple relay shown in the diagram is an inexpensive homemade affair, and controls both the charger and B-eliminator, automatically switching the 110-volt a.c. supply from the trickle charger to the B-eliminator when the set is in operation.

The heart of the device is a good doorbell buzzer, and, in selecting this, there are three points to bear in mind: First, make sure the contacts are good; second, see that the magnets and contacts can be removed for remounting, and third, that the magnet coils are of fairly heavy wire. A piece of scrap bakelite or hard rubber, about 4 by 4 in., is required for the mounting base. Disassemble the buzzer from its metal base and drill a hole, to pass a 6-32 screw, in the base of the contact point. Then drill two holes in the base of the magnet assembly for the same size screws, and one in the armature base. Take a spring with a good contact from an old jack, and bend it so that the contact point will come opposite the armature contact when both are remounted on the bakelite base. Now mark the holes



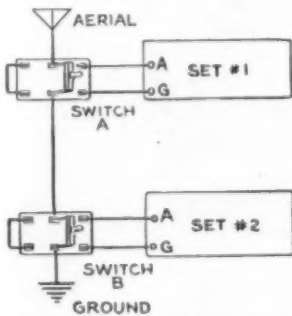
Layout and Wiring Diagram for Control Relay

for mounting these parts according to the layout. No exact dimensions have been given because they will vary with the type of buzzer selected. The assembled relay may be mounted under the table or in the battery compart-

ment of the console, where the wiring may be hidden. When, in operation, the filament switch on the set is turned to the on-position, the filament-current drawn by the tubes closes the B-eliminator contacts at B, automatically supplying B-power to the set and at the same time shutting off the a.c. supply to the trickle charger. In this way the tubes are protected from surges in the line of voltage, and much hum is eliminated.—J. B. Bayley, chief engineer, Station WAAT, Jersey City, N. J.

Two Sets on One Aerial

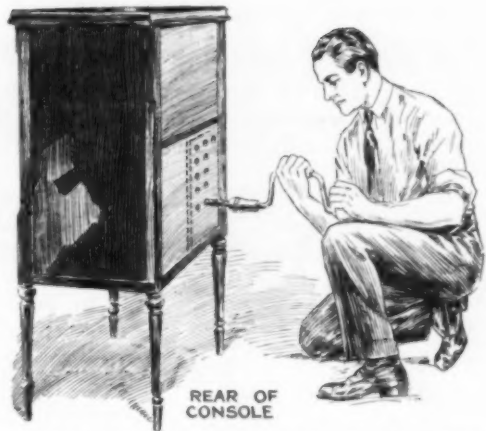
Frequently it is desirable to use separate broadcast receivers in different parts of the house, or to experiment in the workshop with several receivers. Even if only one aerial is available, this can be done by the arrangement shown which quickly shifts the aerial and ground from one set to the other. Two d.p.d.t. switches of the small panel-mounting type are required and may be mounted under the table or at any convenient location near the installation. With switch A thrown to the right and switch B to the left, the aerial and ground will be connected with



set No. 1, and reversing the switch arms will cut out set No. 1 and throw the aerial and ground to set No. 2. This method is handy in conducting comparative tests of receivers.—J. M. Pawson, chief engineer, Station WOO, Philadelphia, Pa.

Power Installations Require Air

If you are using a console or cabinet and house the power unit in an inclosed compartment, air vents should be provided, because some rectifier tubes generate considerable heat. The simplest way to do this is to drill holes in the back of the compartment as shown. A few other timely hints on the proper installation of power apparatus may be appreciated, as

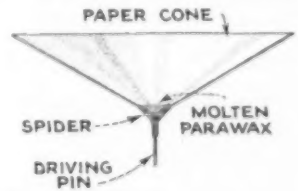


Drilling Holes, to Provide Air Circulation in Power-Unit Compartments

a great deal of the present apparatus was built before the new high-voltage rectifiers came into use. Careful attention should be given to insulation. Use the heavy insulated wire now available for power-unit connections and see that jacks or switches are not of antiquated, poorly insulated types. There are a number of safe and efficient relays to throw the 110-volt a.c. supply off and on the B and A-eliminators, or charging apparatus. Another precaution well worth while is to put a piece of asbestos under the rectifier tube, and between it and other near-by apparatus.—J. B. Bayley, chief engineer, Station WAAT, Jersey City, N. J.

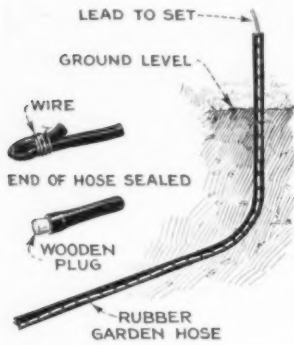
Cone-Speaker Kink

In some cones used for loud speakers, the paper is much too thin to respond properly to the volume available, resulting in poor reproduction. To remedy this condition, pour melted paraffin in the apex of the cone as shown. This will lower the pitch of the speaker and slightly drop the volume, but this loss may be compensated for by readjusting the volume-control on the set. The method may be applied to practically any type of cone speaker and is well worth trying.—M. G. Goldberg, engineer, Beacon Radio Service Co., St. Paul, Minn



Homemade Underground Antenna

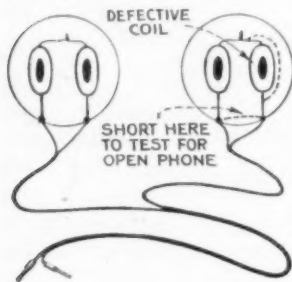
A homemade antenna of this type may be made for experimental purposes at a small cost, although, of course, it cannot be compared with the manufactured article.



The simple antenna described will produce good results. A section of rubber garden hose, from 50 to 100 ft. long, is required. A length of No. 14 rubber-covered wire, one end of which is taped, is pushed through this hose, and the hose is sealed by bending it over as shown, tying it with wire or by means of a wooden plug. Examine the hose carefully for holes through which moisture can enter, and if none are found, bury it as deep as possible in a narrow trench. The end of the hose nearest the building is turned up as shown. A length of lead pipe should be slipped over the wire at this point, several inches of the pipe being inserted in the ground. This pipe shields the antenna wire to a point as close to the aerial binding post on the set as possible. —H. R. Wallin, radio operator.

Repairing Headphones

Many sets of headphones are discarded because of burned-out coils, although they could be salvaged by a simple repair. I am offering the following suggestion. Usually there is only one open circuit when the phones fail to work, and as most phones have two coils of very fine



wire, shorting each phone enables the operator quickly to locate the faulty unit. It will be found that the coils are connected in series, and the

simple expedient of shorting out the defective coil will complete the circuit as shown in the diagram. Of course the repaired unit will be somewhat weakened but not seriously so.—C. R. Yarger, chief operator, Station KFNF, Shenandoah, Ia.

Simple Method of Testing B-Batteries

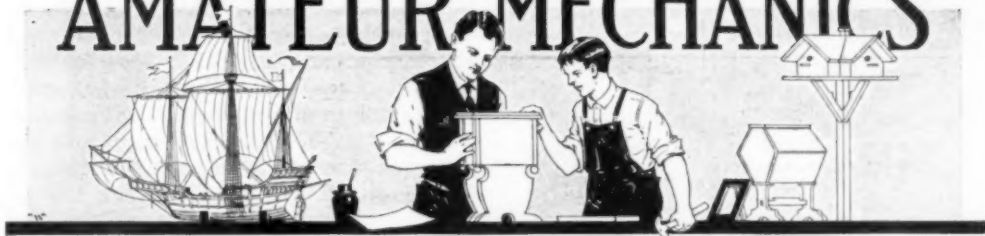
Sometimes B-batteries will check properly for voltage but, when hooked up in the circuit, fail to work. This is due to the run-down condition of the battery and, though the voltage reads high on an open circuit; it immediately drops when a load is placed on the battery. In order to determine just how much service may be expected from the battery, the writer has used the following method for the past six years with unflinching results: A 40 or 50-watt lamp of the Mazda (not carbon) type is used as shown in the sketch. A wire is soldered to the screw base of the bulb and another to the tip connection on the base. One wire is then connected to the negative post of the B-battery and the other wire momentarily



touched to the positive post of the battery. If the bulb lights to about half the brilliancy obtained when used on the ordinary house supply, the B-battery is in good condition. On the other hand, if the bulb fails to light, or is very dim, the battery is exhausted and should be replaced. This test is not very hard on the battery, as the resistance of the bulb is in series with the battery, and very little current is therefore consumed in making the test.—Edward Stanko, chief engineer, Station WGR, Buffalo, N. Y.

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AMATEUR MECHANICS



Getting the Most Out of Your Outboard Motor

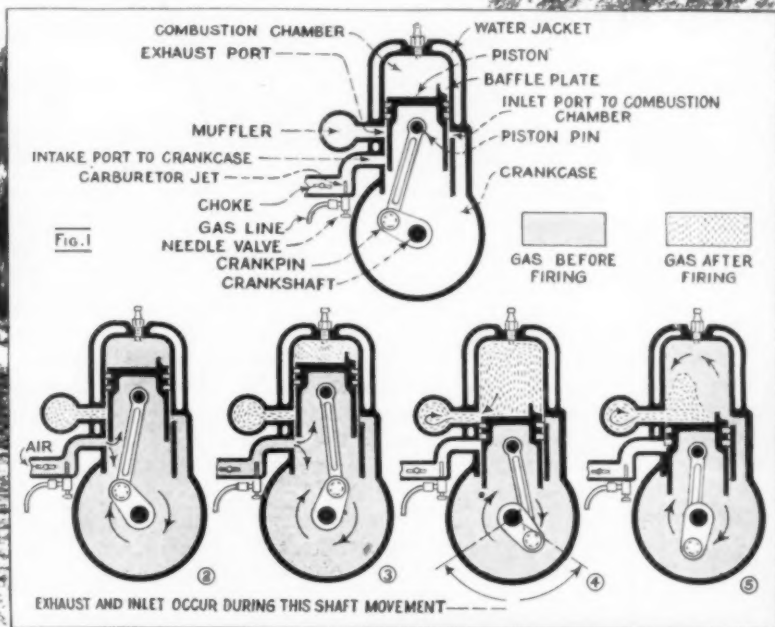
By DICK COLE

AN OUTBOARD motor, like any other mechanical device must receive a certain amount of intelligent attention and care if it is to function at its best. This can be given only when the mechanical workings are understood. So let us review the mechanics of the outboard motor.

At the present writing, all outboard motors are of the two-cycle type. Nearly everyone, in this age of automobiles, has at least a limited understanding of the

four-cycle motor. He knows that each cylinder fires once with every two revolutions of the crankshaft; that each stroke of the piston constitutes a cycle, and that the four cycles are: intake, compression, explosion and exhaust.

In the so-called two-cycle motor the four cycles, or operations, take place dur-



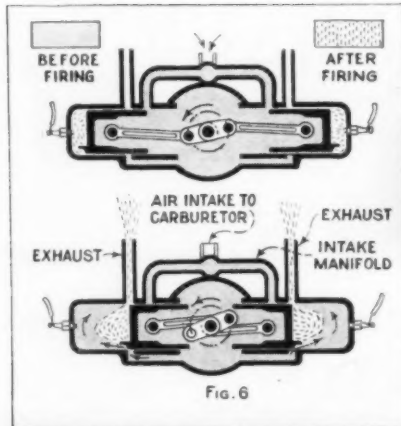
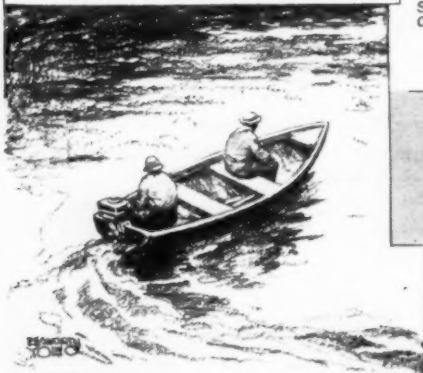


Fig. 6



ing two strokes of the piston, instead of four. The name two-cycle is really a misnomer. Two-stroke four-cycle defines it better. However, I will continue to call it two-cycle. Fig. 1 shows this type in its simplest form. The upper sketch designates the principal parts of the motor. Let us assume that the motor is running, and we start analyzing its operations, beginning with the piston as shown in Fig. 2. It is nearly at the top of the stroke and has compressed the gas above it. At the same time a partial vacuum has been created in the crankcase. At the position shown in Fig. 2, a port, communicating with the carburetor, is uncovered by the bottom rim of the piston. There is an inrush of gas mixture into the crankcase from the carburetor or mixer valve. Fig. 3 shows the piston just over top center. The spark occurs at this point, firing the gas taken in during a previous stroke. The piston is forced downward on the explosion, or impulse,

stroke, compressing, at the same time, the mixture already drawn into the crankcase. When the piston reaches the position in Fig. 4, the exhaust port is uncovered by the top rim of the piston and the gases rush out into the muffler. A fraction of an inch farther down on the stroke the piston uncovers another port, diametrically opposite the exhaust port. (See

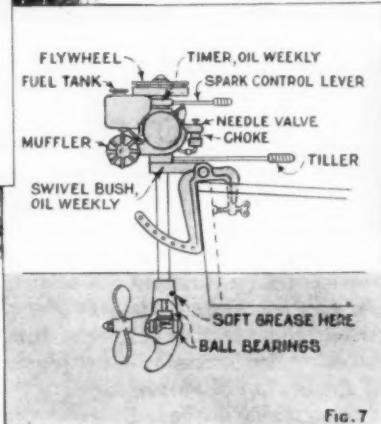


Fig. 7

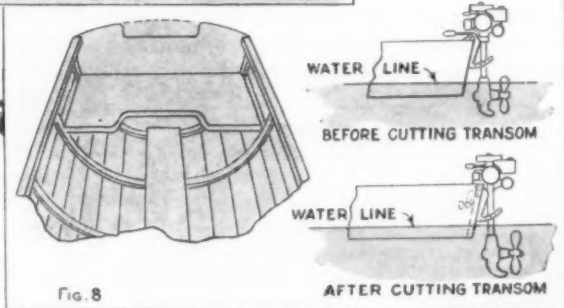


Fig. 8

Fig. 5.) This communicates with the crankcase, in which a volume of gas mixture already has been compressed. This gas rushes into the combustion chamber, strikes against the baffle plate on the piston and is diverted upward, displacing most of the exhaust gases of the previous explosion. The piston is now ready to resume the position of Fig. 2 and repeat the cycles.

It is obvious that the four cycles take place (intake, compression, explosion and exhaust) but the exhaust and intake cycles occur during the brief period from the uncovering of the exhaust port on the downstroke to its closing on the upstroke. The compression and explosion strokes are the same as in a four-cycle motor.

For outboard-motor use, the single-cylinder motor has been almost entirely supplanted by the opposed-type twin-cylinder. Fundamentally, it is the same as the single-cylinder. Fig. 6 shows its operation. Note that the cycles in each cylinder coincide with each other.

Contrary to the belief of many people, the two-cylinder two-cycle opposed-type motor does not double the number of explosions per revolution. Both cylinders fire simultaneously. What, then, you might ask, is its advantage? The two-cylinder construction affords perfect mechanical balance of the reciprocating parts. Even the explosions are balanced, as it were, all of which tends to lessen vibration. Also, by the addition of the second cylinder, the power can be doubled with only a slight increase in weight.

While we are examining the two-cycle motor, it may be well to call attention to several points where its operation

differs radically from the four-cycle type. This should enlighten the outboard-motor operator as to why he must not fail to do certain things.

The older two-cycle motors cannot be satisfactorily controlled with a throttle. Reference to the internal workings explains why. Regardless of engine speed, a full charge of fresh gas mixture is always necessary to displace the burnt, or exhaust, gas of the previous explosion in the cylinders. If the amount were skimped, as would be the case if the throttle were

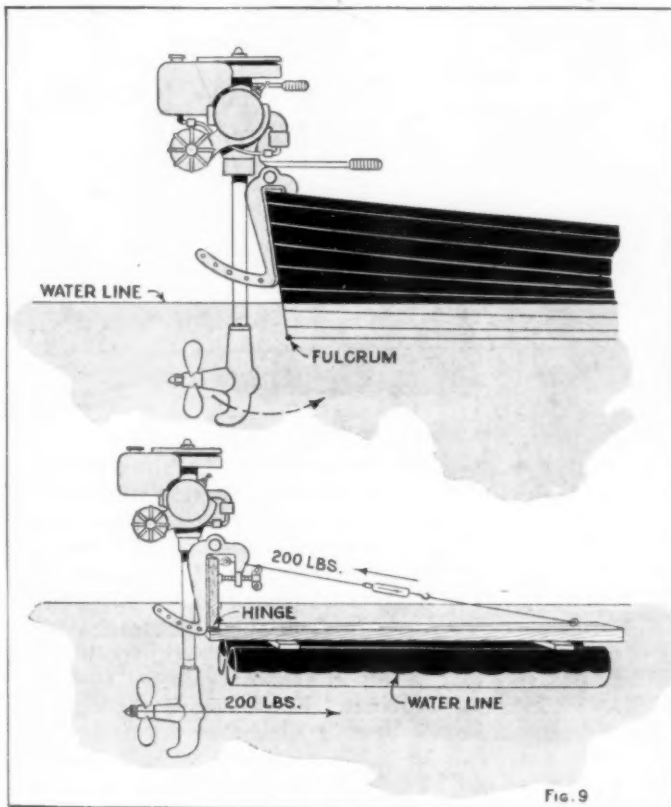
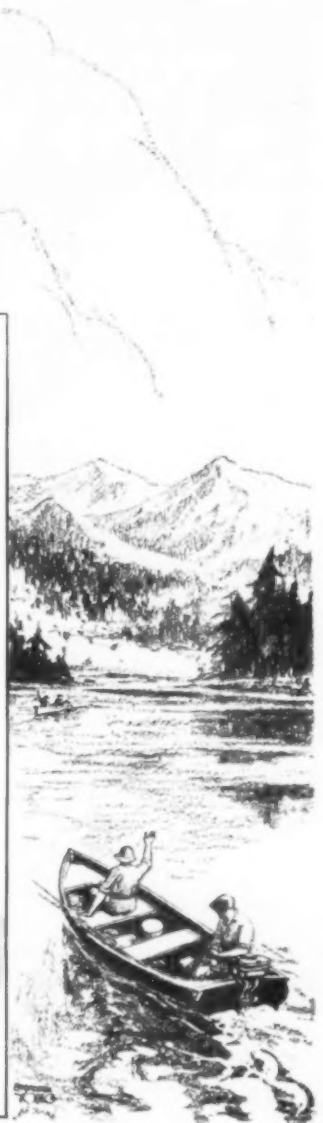


FIG. 9



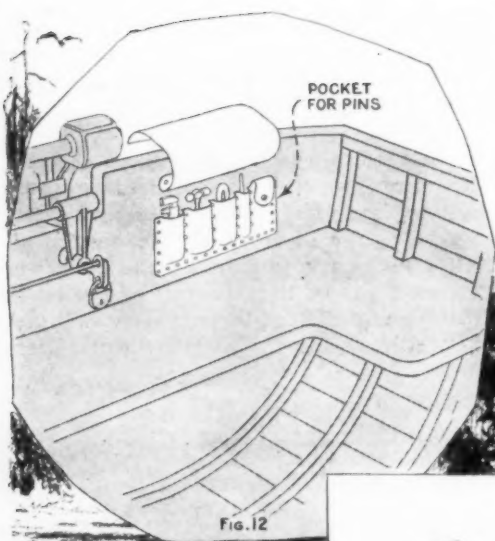


Fig. 12

Edmund
YOUNG

partly closed, then the fresh charge drawn into the crankcase and later injected into the cylinder, would be so diluted with the residue of burnt gas of the previous explosion

that the spark could not ignite it. Only to a very limited degree can the older two-cycle motors be controlled by a throttle. The speed is regulated by varying the spark position, and the manufacturers allow for a wide range of spark. Motor manufacturers have overcome this trouble, however, and modern outboard engines are quite satisfactorily controlled by the throttle.

Another feature of the two-cycle motor that differs widely from the four-cycle is the method of lubrication. The splash or pressure systems, as used in the automobile, cannot be employed in the two-cycle motor. The reason is obvious. If an unrestricted amount of oil were permitted

in the crankcase, it would be carried with the gas mixture into the combustion chamber on the intake cycle. Fouled spark plugs immediately would result.

The two-cycle motor is lubricated by mixing a quantity of oil with the gasoline.

This oily mixture is drawn into the crankcase and the revolving crank throws it upon the cylinder walls. It also finds its way to all bearing surfaces. Much of the

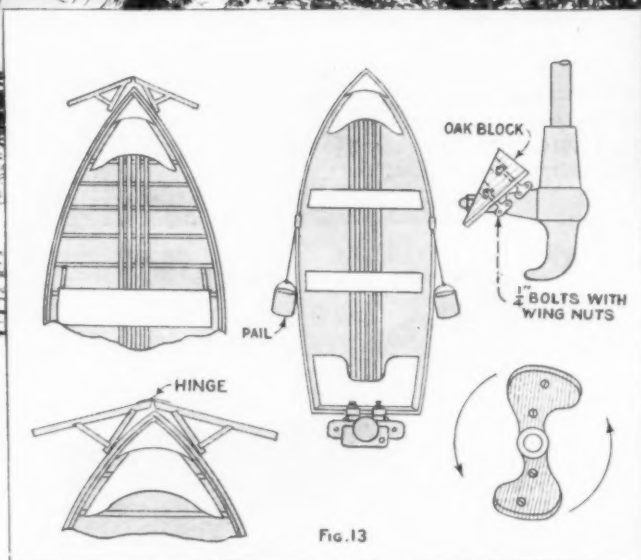


Fig. 13

gasoline will evaporate, but the lubricating oil, being less volatile, remains behind and maintains a protective film upon the friction surfaces.

The proper amount of oil to mix with the gasoline has been accurately computed by the manufacturers. To deviate from the established proportion will not profit the operator. Too much oil means carbon formation and loss of power; too little oil may result in scored cylinders or burnt-out bearings. Furthermore, the operator should bear in mind that the best results can be obtained only by using high-grade oil. The writer suggests Pennsylvania oil—paraffin-base oil.

The bearings of a modern outboard motor are usually of the ball or roller type. Those of the motor crankshaft receive their lubrication from the oil-mixed fuel in the crankcase. But the bearing on the lower end of the vertical driveshaft, and those on the horizontal shaft, must be lubricated from another source. A hole with a screw plug is provided in the housing at this point, through which grease can be injected with a gun. A very light, soft grease

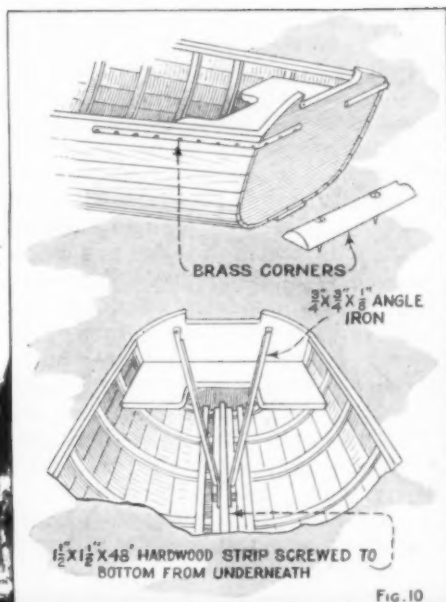
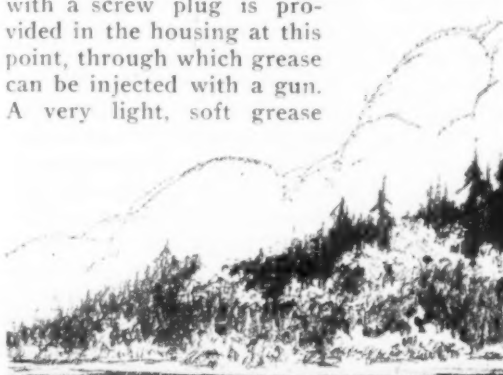


Fig. 10

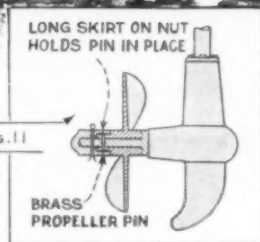
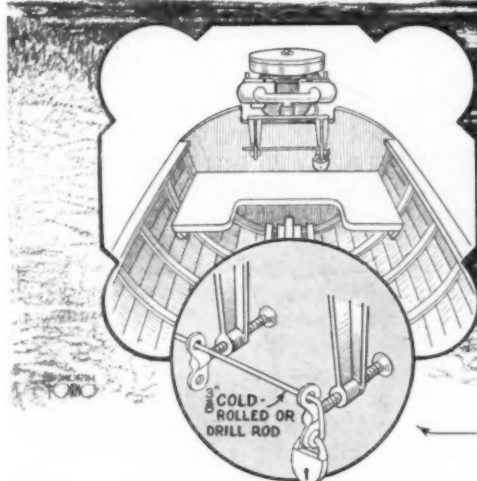


Fig. 11

should be used. Thorough greasing of the bearings and bevel gears is essential. Since these parts are always in comparatively cold water, the use of heavy, non-fluid grease must be avoided. (See Fig. 7.) The only other points on an outboard motor which require oiling are the pivot bushing upon which the whole motor swings when steering, and the magneto, or timer, shaft. The latter needs a drop of good light oil occasionally.

Other features of the outboard motor, ignition, carburization and water circulation, vary with the makes of motors, but fundamentally all differ very little from

those of the automobile motor, so they need be touched upon only briefly. The exact details of a motor can be had from the manufacturer.

Ignition is by means of a battery and coil or by a high-tension magneto. Either system is practically fool-proof. Each is thoroughly waterproof, and the only attention either needs is the occasional adjusting and surfacing of contact points.

The carburetor of an outboard motor is of the simplest construction. A needle valve is the principal adjustment. This is opened a turn or two to provide a rich mixture for starting, and afterward is screwed down as the motor warms up.



One can feel out the needle-valve position to find the point where the motor runs smoothest. This will be the most efficient point. Most motors are also fitted with a choke to facilitate starting.

The water circulation is maintained by a pump or by a scoop device which picks up and circulates the water when the boat is under way. The only trouble likely to arise with the circulation is due to foreign matter lodging in the intake. Should an outboard motor suddenly overheat, the cause usually can be located at that point.

Now let us deal with the motor in its application to the boat. First of all, know your boat. See that the top of the transom (sternboard) is low enough to permit complete submersion of the propeller. Sometimes it will be found necessary to cut a wide notch in this board (Fig. 8) several inches deep, to lower the outboard motor. Also be sure that the board is sufficiently strong and well braced to withstand the strain that a powerful motor will put upon it. Contrary to general belief, this stress is not toward the bow of the boat. The thrust of the propeller tends to tilt the sternboard back. The whole motor assembly acts as a lever with the junction of the board and keel as the fulcrum. This can be better understood by studying Fig. 9.

Of course, if one buys a boat especially designed for an outboard motor, provision will have been made for all stresses and strains. But many people buy a motor and fit it to the old rowboat. In that case it is probable that the sternboard will need extra bracing. There are several ways of doing this, of which Fig. 10 shows two. One consists in fitting corner brackets, made of half-round brass rod, around the sternboard and gunwales. In the other, two angle-iron brackets extend from the sternboard to a hardwood strip screwed to the inside bottom of the boat. The application of both methods is still better.

When attaching the motor, never use a wrench or other tool to tighten the thumbscrews of the bracket clamp. Ample pressure can be supplied with the fingers only. If the vibration of the motor tends to loosen these screws, they can be made permanently secure as shown in Fig. 11. Holes to allow clearance for a $\frac{3}{8}$ -in. round rod are drilled in the wings of the thumb-

screw heads. A length of $\frac{3}{8}$ -in. cold-rolled rod—drill rod is even better—is passed through a hole in each thumbscrew. If a right-angle bend and loop is made in one end of the rod, a padlock can be attached.

The operator should always carry extra propeller pins. These pins are usually made of annealed brass and secure the propeller to its shaft. They will withstand the normal driving strain, but if the propeller hits an obstruction, the pin will be sheared off, thereby saving the propeller and running gear from injury. (See Fig. 11.) Sometimes these pins will shear off without the propeller hitting an obstacle. This is due to the fact that the propeller does not fit tightly upon the shaft. When the flywheel of the motor is rocked to start, the propeller is thrown against one side of the pin and then the other, thereby weakening it. Then it may shear off at the most unexpected and inconvenient time, possibly at night or during a storm. This can be guarded against by inspecting the propeller occasionally. If it is found to be shaky upon the shaft, a new pin should be fitted immediately.

Ordinarily, the fitting of a new propeller pin is but a minute's work, if one has an extra pin and the necessary tools. An outboard-motor owner should always have an adjustable wrench, hammer, pliers, a slender punch, and, of course, extra propeller pins. A convenient way to carry this equipment is shown in Fig. 12. A canvas case, with pockets for the tools and pins, is tacked to the sternboard with copper tacks. A flap, with snap fasteners close together around the edges, covers the case. Should the boat meet with a mishap, or be tilted on its side to drain, the tools and pins will remain intact.

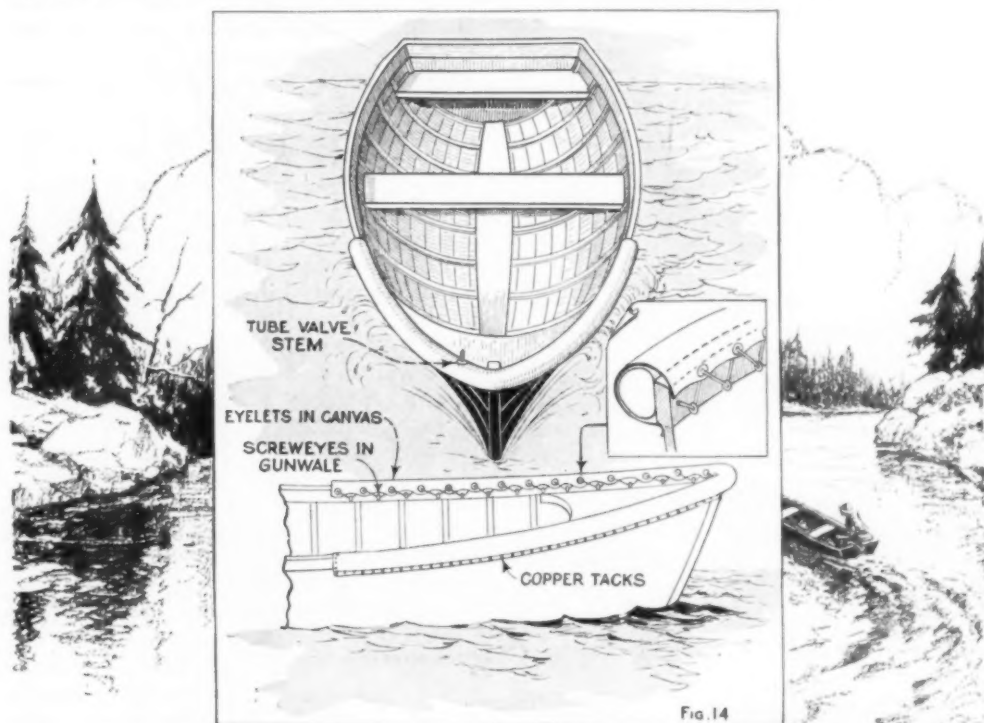
An outboard motor never should be run, for any length of time, with the spark fully retarded. The only people this ruling will affect, however, are the fishermen who use the outboard motor for trolling. Even with a fully retarded spark, the speed of a light boat sometimes cannot be sufficiently checked to permit deep, slow trolling. It is better to reduce speed by other means. Maneuvering rudders and special devices can be purchased, or one of the means shown in Fig. 13 can be used.

The first, a snowplowlike frame, made of 1 by 10 by 24-in. pine, is suspended in

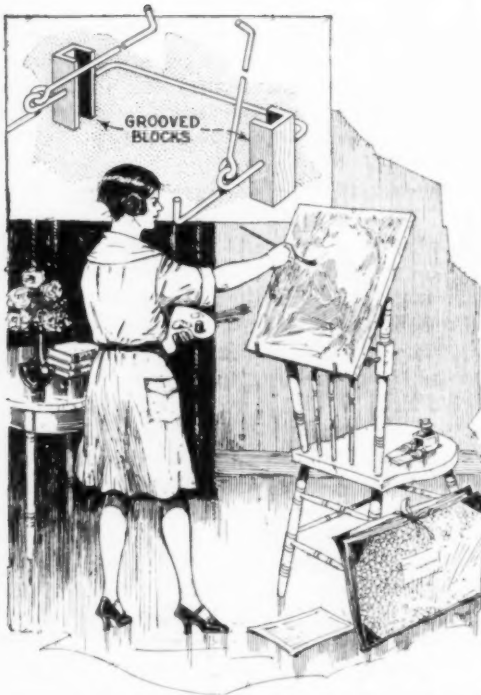
front of the bow of the boat, and speed is controlled by varying the depth of submersion. A second simple way is to drag pails, attached to the oarlocks with a short piece of rope, through the water, and still another method consists in bolting an oak block to each propeller blade and then shaping these blocks, with a draw-shave or plane, so as to change the pitch of the built-up propeller. These blocks are fastened to the blades with $\frac{1}{4}$ -in. bolts and wingnuts. With these blocks in place, the spark can be advanced and the motor run much faster without increasing the boat speed. Of course, any of the foregoing methods are handy makeshifts for the amateur mechanic. If one uses his motor much for trolling, he should buy one of the special devices for that purpose.

An annoying feature of some outboard-motor boats, particularly the converted, round-bottom rowboats, with low bow and freeboard, is their faculty of throwing spray when running into a head wind.

boat, are thrown up perpendicularly and the wind blows the water into the boat. An easy way of preventing this, and, at the same time, adding a safety element to the boat, is shown in Fig. 14. A strip of canvas, 12 ft. long and 9 in. wide, is fitted with eyelets, 6 in. apart, along one edge. The other edge is tacked, with copper tacks, to the sides of the boat, about $3\frac{1}{2}$ in. below the top of the gunwales. The canvas should extend around the bow of the boat and 6 ft. along each side. A 12-ft. tube is made of sections of old $3\frac{1}{2}$ -in. inner tubes and the two ends are sealed. This tube is placed in the canvas pocket and the eyelet edge is drawn over the gunwales and laced to small screweyes along the inside. The tube is then inflated until the canvas is drawn taut. The bulge thus formed will divert the upward waves striking against the bow and sides and throw the water off horizontally. A boat so fitted can run into a heavy white-cappy sea without shipping any water.



Even in a slightly choppy sea, the passengers will become drenched. The small waves, striking against the bow of the



Improvised Easel Made to Fit on the Back of a Kitchen Chair by Means of Simple Mounting

Easel Improved with Kitchen Chair

Where no easel was available, an artist on vacation improvised one by means of a simple attachment to a kitchen chair. It consisted of two wooden blocks, grooved to fit the chair. They were attached to a length of heavy wire spanning the back of the chair and two hooks were provided to hang the device from the top rail of the chair. Two ends of the wire project and are bent upward to serve as holders for the canvas. The details of construction are clearly indicated in the drawing.

Easily Made Pin Gauge



The pin gauge shown herewith is simple to make. The two rods are of steel wire, one having the end offset to bring its point in line with that of the other. The points are tempered to prevent wear and

the spring is made from a piece of hack-saw blade. After annealing it, the slots are cut at the ends, and it is then spring-tempered again.

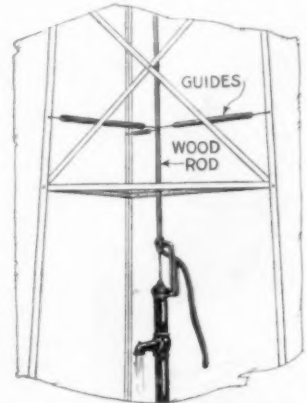
Cement in Whitewash Prevents Flaking

Ordinary whitewash that we used in the interior of a poultry house, flaked off soon after its application. Acting on the theory that possibly Portland cement would tend to make the mixture more adhesive, a half pint of cement was stirred into two gallons of whitewash. It was necessary to keep the whitewash well agitated to prevent the cement from settling on the bottom of the container. The addition of the cement overcame the difficulty.—C. M. Wilcox, Torrington, Conn.

Guide for Windmill Pump Rod

There is no part of a windmill that gives more trouble than the wood pump rod. This is caused by the guides wearing the rods until they are so weakened that they are unable to stand the strain. The illustration shows a method of providing

suitable guides which will not wear the rod. The guides are made from old coil springs, which can be taken from machinery about the farm. One end of each spring is fastened to the wood rod, as indicated,



while the outer ends are fastened to the three legs of the tower and should be drawn up quite tight. They must, of course, be of equal strength.—W. O. Hendrickson, Argyle, Wis.

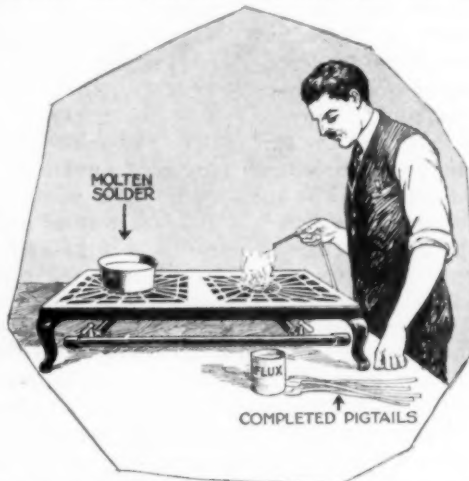
❶ A brilliant polish may be given to tarnished nickel by immersing it in a solution of alcohol and 2 per cent of sulphuric acid from 5 to 15 seconds; take it out, wash it in running water, rinse in alcohol, and rub dry with a linen cloth.

Compensating for Stripped Starter Teeth

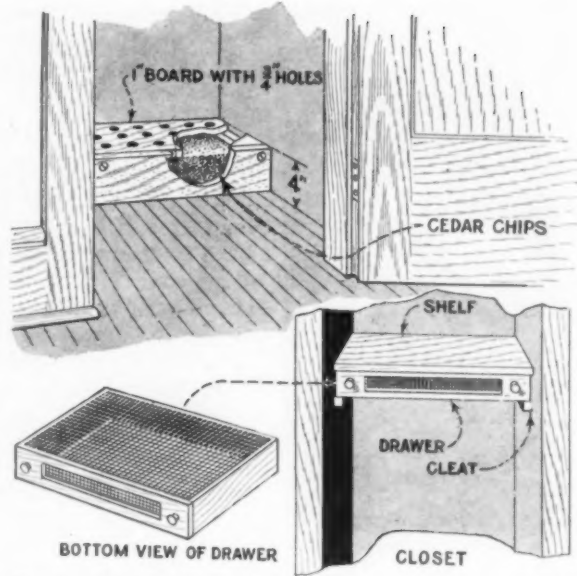
If the tops of the teeth on the starter gear of your flywheel are stripped in one or more places, it is not necessary to send the car to a shop to have a band shrunk on. Simply take your starter off and file the holes in the starter shelf larger on the side toward the engine. Elongate the holes with a round file about the depth of the broken teeth. Put the starter back and, holding it tightly toward the engine, bolt it in place. Sometimes it is advisable to put small pieces of steel next to the lag bolts on the outside of the hole to prevent the bolts from taking their original place. The starter, thus held against the wheel, will work as well as ever and will not strip any more teeth from the flywheel. Of course, if the teeth are stripped clear down to the roots, this remedy is useless, and a new gear ring is necessary.—Guy E. Clark, Everett, Wash.

Tinning Pigtail Connections

Tinning pigtail connections is usually a tiresome job when performed with a soldering copper, which, if light, quickly loses heat, and, if heavy, soon tires the worker. I have used a much better and quicker method. Heat a small pan of solder and place a can of flux close to it. Take the cleaned wire pigtail, hold it for a few moments over a gas flame but not close enough to oxidize. Insert it into the flux and then dip the treated end in the molten solder, which will coat it effectively. Then it will stick after it has been soldered.—Paul E. Garder, Washington, D. C.



Quick and Effective Method of Tinning Pigtail Connections over a Gas Flame



By Providing Holders Filled with Cedar Chips in the Clothes Closet, It Will Become Mothproof

Make Your Clothes Closet Mothproof

A neighbor who is handy about the house, fixed his bedroom closet so that it is mothproof. The idea is simple and it cost him very little besides his own time. Against the back side of the closet, on the floor, a 1 by 4-in. board was placed on edge and nailed in the position shown. Cleats were nailed along the walls on a level with the top edge, and the interior of the box thus formed was filled with cedar chips and shavings. A lid with several holes drilled through it was then provided. For months no moths were found in this closet. Another place to store cedar chips is the combination drawer and shelf shown in the lower detail. The bottom of the drawer is made of wire mesh, and the drawer should be just as wide as the shelf.—Dale R. Van Horn, Walton, Neb.

Better Visibility When Driving in Fog



"frosted" celluloid in front of each headlight, as shown in the drawing. The disks can be held in place by means of spring clips, made from a phonograph or clock spring. The disks are frosted by rubbing the surface with fine sandpaper. With the disks in place, the light is diffused so that the road is visible for some distance. —Richard P. Cole, Paterson, N. J.

Padded Skids for the Stepladder

There are several objections to the use of a stepladder on polished floors. In the first place, dirty marks and scratches are often caused by the ladder, unless the feet are well padded.

In the second place, the cross braces of old stepladders may be unsafe, and the legs may spread unexpectedly, with annoying experiences or, it might be, even disastrous results for the worker. To prevent such troubles a pair of skids will be found to be of considerable advantage. They consist of two 1 by 3-in. boards having cleats near



Every motorist knows that the piercing beams from the headlights are useless to light the way when driving through fog at night. In fact, their dazzling glare is a detriment instead of an aid. A simple method of increasing the visibility is to place disks of

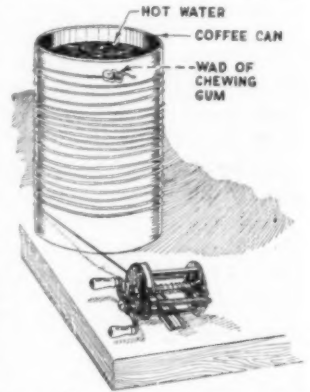
the ends to hold the legs of the ladder. Strips of carpet tacked on the underside will prevent injury to polished floors.

Transferring Newspaper Pictures

Children can be entertained on a rainy day by transferring newspaper pictures, including the colored comic sections. Prepare a liquid by dissolving one tablespoonful of ordinary yellow soap in 1 pt. of hot water, and when cool, add three tablespoonfuls of turpentine. Shake thoroughly, and then apply this mixture liberally to the surface of the picture to be transferred, allowing it to soak for a short time. Dampen a piece of white paper, place the picture on it, and apply moderate pressure for a few moments. On separating the two, a reverse transfer of the original picture will be found on the white paper.—A. T. Bawden, Ottawa, Kans.

How to Dry a Fishing Line

An expensive fly-casting line should always be thoroughly dried before it is re-wound on the reel. In wet weather this presents quite a problem, particularly to the camper. A good method of drying a line is shown in the sketch. It is simply wound around a large tin can filled with hot water, the free end being held to the can with a small piece of gum. The part of the line wound on the can will soon dry out, and if the line is very long, the operation is repeated until the whole of it is dry.



Removing Iodine Stains

To remove iodine stains from flesh, make a thin paste of any good white soap and peroxide hydrogen and apply, rubbing it on thoroughly. It takes but a moment or so to remove all traces of the iodine and the parts are then bathed with water.

The Art of Imitating Porcelain



by



ALBERT DREYFUSS



MANY of the beautiful and expensive porcelain vases that you have so often admired in shop windows, and have perhaps longed to own, can be made at home. Of course, the art of making genuine porcelain is beyond the scope of the amateur, but the making of imitation porcelain, which closely resembles the real article, can readily be performed by anyone interested in this kind of work. The art is called "potichimanie" in Paris, where it is in vogue, and may be freely translated as "china-mania." It has become very popular abroad and is awakening an almost equal interest here. By means of this art, good imitations of every kind of porcelain—Sevres, Etruscan, Japanese, Assyrian, Persian and Chinese—can be produced.

All that is required to do the work is some degree of neatness and taste; very little expense is involved. When properly done, the work is simple but beautiful, and no one will fail to succeed if he carefully follows instructions. The materials required are as follows: glass vases, bottles or similar objects, match holders,



flowerpots, jardinières, plates, etc.; some sheets of colored paper prints, representing birds, flowers, insects, Chinese figures or other ornaments; paint-brushes; several round and flat hog's-hair brushes, and some camel's-hair brushes of various sizes; a bottle of liquid adhesive glue, or preferably rubber cement; a bottle of turpentine; one of purified linseed oil, and one of copal varnish; prepared colors for grounds, preferably artists' tube colors; a package of gold powder; two pairs of fine scissors, one large and one small, and a bottle of gum-arabic water. This can be made by dissolving 4 oz. gum arabic in a pint of boiling water. Decant into a bottle when cool.

The vases are of plain glass in various shapes and sizes, and the sheets of paper are printed in black silhouette or colored designs. Some have figures in the Etruscan style, others display dragons, trees, flowers, birds and similar designs of Chinese type. There are eccentric Assyrian figures and decorations, besides other subjects exclusively French, and borders of different sorts.



Place all the materials on a table, as well as a towel, some old soft linen and a small basin of water. First clean the vase or bottle thoroughly, both the inside and the outside, with alcohol or benzine, as glass gathers an oily film on its surface, which prevents the colors and cement from adhering to it properly. After the cleaning, apply a coat of gum-arabic water to both sides of the vase, and allow this to dry thoroughly before applying any color. Now prepare an oil color for the ground, mixing it with sufficient turpentine to make it run freely. Take equal quantities of copal varnish, purified linseed oil and clear white turpentine, one-third of each, mix together in a clean bottle and shake up well. Add a tablespoonful of this to a saucepan of the prepared color and pour it into the vase or bottle through a small tin funnel, as shown in Fig. 2. Turn and twist the vase around until the color has completely covered every part of the inside, as indicated in Fig. 3. Pour the remainder back into the saucepan, let the vase dry and then pour a mixture of linseed oil, turpentine and copal varnish, one-third of each, over the color, on the inside of the

vase. When this has dried the inside is completed.

Cut out the paper figures with care. It would be well for beginners to select such subjects as are fairly compact. Running patterns, with the various parts connected only by long stems, or flowers with the pistil and stamens projecting are much more difficult to arrange than the simpler patterns. Every part of the background of the paper must be cut out, such as the space between



the body and the bent arm, in any figure where that occurs.

Fold a sheet of blotting paper into several thicknesses, lay one of the cut-outs on it, face down, and, with one of the brushes, completely cover the back with a thin layer of gum or rubber cement, as shown in Fig. 4. Let the cement dry thoroughly, and then lay the cut-out on the glass surface, as in Fig. 5, rubbing down every part smoothly with your nail, so that no air is left between the paper and the glass, as this would spoil the work. Proceed in this way with each figure,



flower, or other design, until sufficient patterns are placed on the glass. Borders may be added, if desired, but they should always harmonize with the rest of the design. When the cut-outs are perfectly dry, examine them to make sure that no air bubbles are left. A thin coat of varnish should be brushed over the cut-out. In doing this, use great care not to touch the glass. After it has dried, remove all spots of gum or varnish that may have fallen on the vase with a damp cloth. The glue or gum is soluble in warm water and the rubber cement can readily be removed with benzine.

In the vase shown below Fig. 3, the upper and lower parts are done in black, while the center is a light color. When this effect is to be produced, the color bands must be applied with brushes on the outside of the vase and the color is not poured in as

The choice of the ground should be carefully considered, as on it greatly depends the truthful hue of the porcelain. A peculiar blue and green are frequently seen in Oriental china, black and soft salmon pink are usual for the grounds of Etruscan subjects, and the blue of Sevres is well known. A vase with a running floral design in gray, edged with gold, on a soft



previously directed. Each band should also dry thoroughly before the next one is applied. Colors on such parts as handles, etc., must also be applied with a brush, as indicated in Fig. 4.



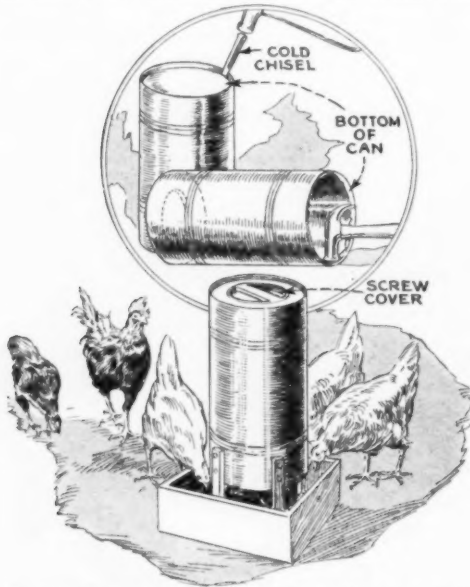
pink ground was found very pleasing. The silhouettes so popular on lampshades are well adapted for this kind of work.

Cement Repair for Old Water Tank

When the old galvanized stock tank begins to leak around the edge at the bottom, where it gives away first, its life can be prolonged by applying a quantity of strong cement to stop the leaks. The mixture should consist of common sand and cement in equal proportions. It may be laid in 3 in. thick on the bottom of the tank on the inside, and should be applied at the sides as high as the consistency of the mixture will allow.—Willis Mehanna, Bussey, Iowa.

Poultryman's Hopper for Dry Mash

A hopper that will hold 100 lb. of grit or 35 lb. of mash can be made from one



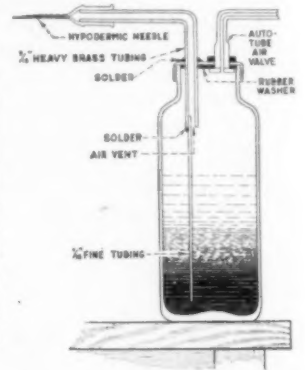
Poultry Hopper Made from Old Carbide Can Holds Large Supply of Food

of the drums in which calcium carbide is shipped. These drums can be bought very cheaply and are often even given away by those who have acetylene lighting installations. Many farmers use this gas and have these drums lying around. Turn the drum bottom up, and cut out the entire bottom with a sharp cold chisel. Now, lay the drum on its side and hammer down the rough edges. Next take a tape measure, or string, and measure the circumference of the drum, then divide this figure into four equal parts. Wrap the tape around the lower end of the drum and make a mark at each of the four division points. With a punch, file or tenpenny nail, make two holes from 2 to 4 in. apart at these points, one above the other. These holes are to receive $\frac{1}{8}$ -in. stovebolts or screws, for fastening four wooden legs, about 10 in. long and 1 in. square, to the drum, as shown. Each leg should project about 4 in. beyond the bottom of the drum. Get an empty cheese or cracker box, or make a square box, about 6 in. wider than the diameter of the drum and having sides 6 in. high. An old, round dishpan may be used as a sub-

stitute, if desired. Set the drum in the box, and you will have an automatic hopper that will hold several days' supply of mash or grit, depending on the size of your flock. By driving nails through the bottom of the box into the legs the hopper will be steadied so it cannot tip over. A good coat of paint on the outside will add to the appearance and lasting qualities. A 50-lb. lard can may be remade in the same way.—J. Herbert Ferris, Elberta, Michigan.

Ridding Upholstered Furniture of Moths

Confronted with the problem of ridding upholstered furniture of moths without removing the covering, one home owner devised the insecticide spray shown in the drawing. It consists of an empty pickle bottle with a good screw cap and a veterinarians' 16-gauge hypodermic needle, which can be inserted through the tapestry or velour without damage to the material. The needle is slipped over the end of a length of tubing, which projects inside of the bottle and is bent at right angles as indicated. The tubing should have an inside diameter of $\frac{3}{32}$ in. A tube of smaller size is soldered to the inside end, as shown, and extends to the bottom. An angle valve is soldered to the cover. With a tire pump connected to this valve, a liquid insecticide can be ejected through the needle. The operation should be repeated daily until the moths are exterminated.

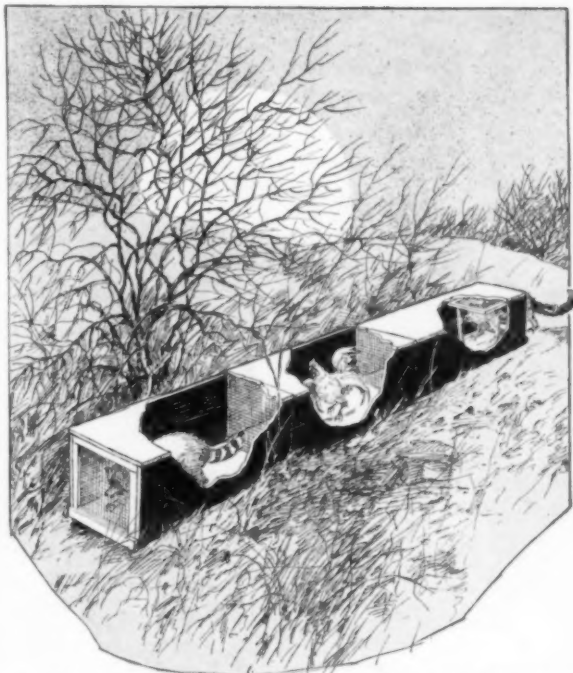


Dull Finish on Aluminum Articles

A dull finish on aluminum articles is often desired. The following method gives a more uniform appearance than painting. All that is necessary is to suspend the articles in hot caustic soda for a few moments. This solution will give a smooth, dull appearance that cannot be equaled by any other method.

An Effective Trap with Live Bait

I have used a number of different kinds of traps but the most successful of them is that shown in the drawing. Many small fur-bearing animals are fond of chicken meat. The fox will catch a chicken and carry it off, the mink and weasel will cut the throat and bite the head, etc., and a coon will catch one if he has a good chance. I give them a good chance, or at least they think so, by baiting my trap with a live chicken. The way I do it is to make a box about 12 in. square and 3 ft. long. This box is made of old lumber so that the animals will not be suspicious of it. Each end of the box is covered with wire mesh, the wooden ends being removed entirely. The mesh at one end is attached to a frame hinged to the box to permit putting a chicken in and taking it out. Two more boxes are made of similar size with one end screened securely, and a screen trapdoor fastened in the other end. The three boxes are then taken to the place frequented by fur bearers. The chicken is put into the center box, the hinged end is securely fastened, and the boxes are then placed in a row with the chicken box in the center as indicated. The trapdoors are set and all is ready for the catch. At night an animal will try to get the chicken by

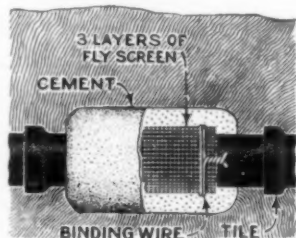


Three-Compartment Trap Capable of Holding Two Animals, the Center Box Being Baited with a Live Chicken

crawling into one of the end boxes. Once in the box the door closes and it is caught. The chicken box is long enough to prevent the animals from molesting the chicken in any way, except frightening it. This is the only way I ever was able to catch a live fox without hurting it. I have caught several this way and mink, weasel, coon and even an opossum will occasionally crawl in.—R. B. Rushing, Simpson, Ill.

Cement Repair Job on a Tile

While leveling a lawn, a workman used a pick, and accidentally fractured a tile drain connecting with the sewer. To avoid the work of uncovering the whole pipe and inserting a new section, an effective repair was made with cement as shown in the drawing. The glazed surface of the tile not being satisfactory for bonding the



cement, a cover was made of screen, wrapped around the pipe to form three layers, and fastened with ordinary iron wire. A mixture of equal parts of sand and cement was applied around the screen until it reached a thickness of 3 in. The ground under the pipe was filled in to form a mold. This repair was found entirely satisfactory, and there was no leakage even though the cement had not hardened entirely before water was permitted to flow through the pipe.

☛ Turpentine is often used to remove fresh paint from clothing, but, unfortunately, it is apt to leave a stain; this can be deleted by rubbing with alcohol.



Contents of Mail Box Attached to Door Jamb Cannot Be Removed Unless the House Door Is Open

Theft-Proof Mail Box

Theft of letters, etc., out of mail boxes can be prevented to a great extent by providing a box from which the contents cannot be removed unless the house door is opened, or the box destroyed. The box is mounted on the door jamb, with the open side against the door. Only the mail slot is exposed when the door is closed.

Slot in Bottle Cork Permits Sprinkling

Some hair tonics and similar preparations come in bottles with plain corks, making them rather inconvenient to use.



A simple sprinkler can be made by cutting a slot down the side of the cork with a sharp knife. Several slots can be made if desired. After use of the tonic, a match stem or peg may be inserted in the slot to prevent evaporation and spilling.—John Russell, Chattanooga, Tenn.

How to Keep Flies Out of the House

There are fly swatters, fly papers and various kinds of poisons for getting rid of house flies, but all of these have some disadvantages. A better and more effective way is to take a small clean sponge and place it in a dish after dipping in very hot water. Immediately after dipping the sponge, apply a few drops of oil of lavender on it. Flies do not like the odor, and will leave any place where it is present. If the sponge is moistened about twice a day, flies will not come around.—L. H. Georger, Buffalo, N. Y.

Asbestos-Covered Coffeepot Handle

Coffeepot handles of wood often have to be replaced due to burning, and this is more or less annoying, although not expensive. A handle which is not affected by heat can be made in the following way: Get a 14-in. length of old gas pipe of small size and, after flattening the ends, drill a small hole through each flat, about $\frac{1}{2}$ in. from the end, for machine screws or stove bolts with which the handle is to be fastened to the pot. Attach the handle, and wind asbestos cord over it, which will keep it sufficiently cool to insure comfort. I have had such a handle in use for four years.—George L. Michel, Jersey City, N. J.



Wallboard as Substitute for Canvas for Oil Paintings

Pieces of wallboard, trimmed square, can be used as boards for oil paintings. All that is necessary is to give one side two coats of heavy white or cream-colored paint as a filler and primer. When dry, the colors can be applied on this surface as well as on canvas. A nice blackboard also can be made of wallboard by surfacing with a filler and then painting it a dull black, made by mixing dropblack in turpentine to which a little drier has been added. Another suggestion is that long

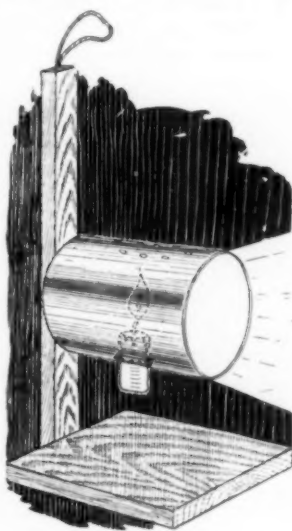
strips can be nailed directly to an old bench top and will give a clean, smooth surface, which is free from cracks and holes through which nails, screws and small tools are so easily lost.

Removal of Mercurochrome Stains from Clothing

Mercurochrome is now commonly used as an antiseptic, instead of iodine. If it is accidentally spilled on clothing it leaves a noticeable red spot. The bureau of standards states that fresh mercurochrome stains on silk can be removed by an application of benzaldehyde, allowing it to stand for a few minutes, repeating the application, and following it with a 25-percent solution of hydrochloric acid. Then sponge with alcohol and rinse freely in clean water. It has also been found that an application of glacial acetic acid to the fresh stain is fairly effective. If only partly effective, the spot should then be treated with ether. Only fresh mercurochrome stains can be removed.

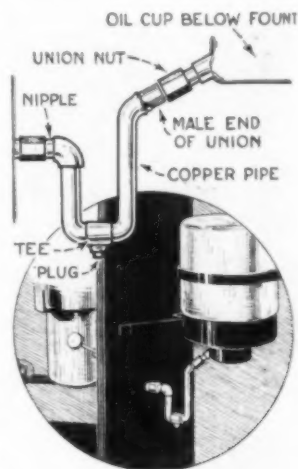
Homemade Candle Lantern

For the camp, cottage or farm, the candle lantern shown in the drawing is very useful, as it cannot blow out in a strong wind and reflects the light where it is needed. It consists of a base made of $\frac{3}{4}$ -in. wood, an upright nailed to the base, and a tin can fastened to the upright. A hole is then punched through the can to fit the candle, the edges around the hole being bent inward so the candle can be pushed up as it is consumed. A number of ventilation holes are drilled in the can above the candle.



Water Trap in Kerosene-Stove Oil Line

The writer has used one of the large multi-burner oil ranges in the kitchen and has occasionally been troubled by water and dirt, in the kerosene, getting down into the oil line and plugging the burners or soaking the wicks. The



kerosene runs from the fount into a small basin from which it goes to the burners. After the basin had become filled with water the trouble commenced. Several times I removed all the burners in order to clean them and dry out the wicks. This task was more or less inconvenient, so I devised a trap which was inserted in the line as shown. Most oil ranges take their fuel in much the same manner, and the idea can be applied in other cases, with minor variations. The oil-pipe union was disconnected from the basin, and the pipe cut off close to the stove side. This end was then threaded. The trap was made of copper pipe and fittings as indicated. All the water and dirt is removed each month by simply taking out the plug at the bottom.—L. B. Robbins, Harwich, Mass.

Polishing Plate-Glass Windows

Clean, polished plate-glass windows add much to the appearance of a store. To obtain a luster, wash the inside with lukewarm water, applied with a chamois skin. It is not advisable to use any soap or chemical unless there is a deposit of grease or an oily film on the glass. The outside is also cleaned with lukewarm water to remove the dirt and then the following solution is applied with a soft cloth: pulverized whiting, 1 oz.; denatured grain alcohol, 1 oz.; liquid ammonia, 1 oz.; and water, 1 pt. The solution is left to dry on the glass, and is then polished off with a soft dry rag.

Flowerpot Sprinkler



In the absence of a lawn sprinkler, a large-size flowerpot may be inverted and the hose nozzle inserted through the drain hole, as shown in the illustration, a notch being chipped out of the side so that the pot can be set up straight. This arrangement is quite satisfactory

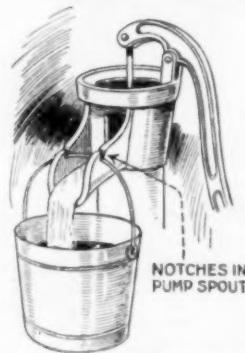
and eliminates the cost of a sprinkler.—H. R. Harrington, Berkeley, Calif.

Blue Pictures on Glass

Old negatives can be used to good advantage for making blue pictures on glass. To do this, the image must be removed from the gelatin and the gelatin cleared so that it is ready for the sensitizing solution. Make a strong solution of hypo decidedly yellow by adding powdered red prussiate of potash. Lay the plate in this solution until the image wholly disappears. If the solution acts slowly, add more potash. Then give a good washing for about one-half hour in running water. The sensitizing fluid to be used is a mixture of two solutions, one of ferric ammonium citrate, 110 gr., in 1 oz. of water, and the other of potassium ferricyanide, 40 gr., in 1 oz. of water. These should be made separately and then mixed, and filtered. The mixture will keep several months if it is not exposed to light. The green ferric ammonium citrate is preferable, and it is best to wash away every trace of powder from the potassium ferricyanide crystals, if any adheres. Lay the clear plate in this sensitizing bath for 15 minutes, which must be done by gas or lamp light or with as little of any kind of light as possible. Remove the plate and

take it by the edges in the hand and twirl it vigorously to remove the superfluous solution. Then dry in the dark. Print like blueprint paper, from 10 to 15 minutes in direct sunlight. After experimenting with a few plates, a good idea can be obtained as to the proper time of exposure, taking into consideration the density of the negative, strength of the sunlight, etc. After exposure, place the plate in a tray of water for one-half hour, covering the tray to exclude the light. Then rinse in several changes of water and dry. If the picture is found to be printed too deep, it can be reduced with 5 drops of ammonia in 4 oz. of water, washed and then dried. Of course, it will be necessary to cover the emulsion side of these blue pictures with clear glass in order to protect it and then bind the edges with neat strips of paper. Such pictures are really prettier than those on paper as they show finer detail. Black and white pictures on glass can also be made by modifying this process. Clear the negatives as in the blueprinting method and, when the plate is well washed, soak it for 10 minutes in the following bath: Chloride of ammonium, 25 gr.; citrate of soda, 5 gr., and water, 5 oz. Then twirl to remove the superfluous solution. When dry, sensitize in a solution consisting of 50 gr. of nitrate of silver to 1 oz. of water. Print rather deep. Wash the printed plate in several changes of water to remove the free silver, and then tone in the usual gold bath. Fix in the same way as paper prints.—H. E. Zimmerman, Mt. Morris, Ill.

Hanging a Bucket on the Pump Spout



Most small pitcher pumps have no provision for hanging a bucket on the spout, making it necessary to hold the bucket with one hand, or place it on the ground while pumping. A simple remedy is to cut notches in the spout with a large file or a hacksaw, as shown.—L. B. Robbins, Harwich, Mass.

A Toy Submarine That Dives

By J. C. EDDIE

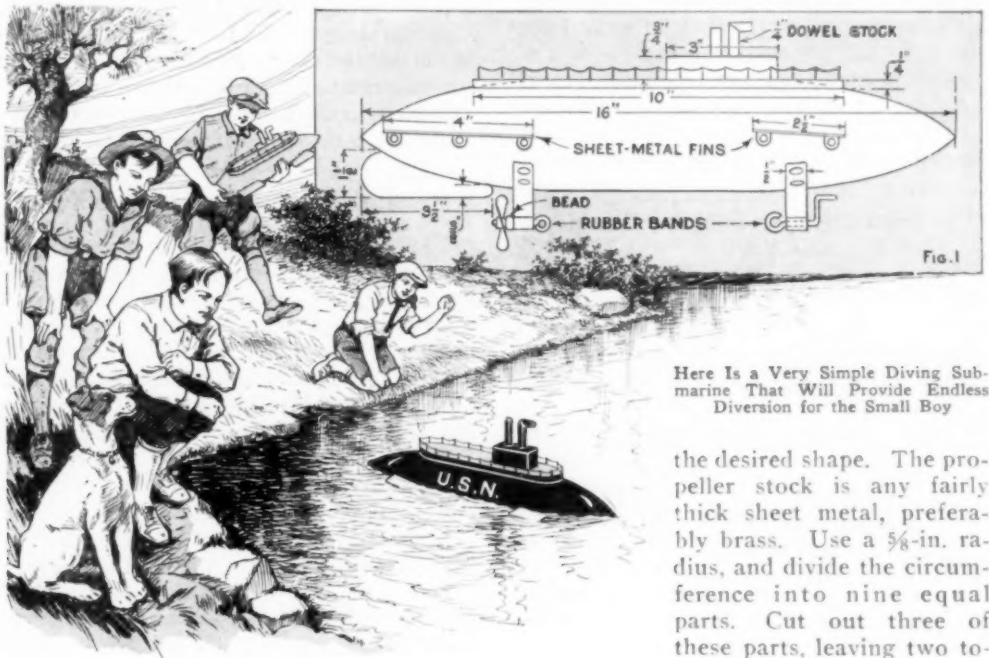
THE making of toy boats is one of the most, if not the most, popular of hobbies. This self-propelling and submerging boat gives us a little variation from the regular line of sail boats, ship models, etc. It is weighted so that the water comes within $\frac{1}{2}$ to $\frac{3}{4}$ in. of the top of the deck. With the fins shaped and placed as they are, it takes but little motion through the water to cause it to submerge. The power for propelling it is derived from a rubber-band motor directly underneath.

Obtain a block of soft wood, 3 by 3 by 16 in. in size. If you are going to use a lathe to turn the hull, about 1 in. more in length should be allowed. To make the hull by hand, first square up the work, center the ends and draw a circle on each end so that it just touches the four sides. A line drawn in the middle of each side, from end to end, may help some. Now plane the block until it is round, using the circles on the ends to gauge your work by. To shape the ends, mark the points at each end from which the hull begins to taper and, with a piece of heavy paper, draw the lines all the way around the

block. Shape roughly with hand ax and finish with spokeshave. Determine which is to be the top, and plane off a flat place $1\frac{1}{2}$ in. wide. Now, exactly opposite this, chisel out a mortise, $\frac{5}{8}$ in. wide by $\frac{7}{8}$ in. deep by 7 in. long. Drive two nails at an angle in the bottom of this groove. This is to hold the lead which is melted and poured in. Use $1\frac{1}{2}$ lb. of lead, and if this should cause the hull to sink too deeply, remove some lead by boring holes in it, thus lightening the ship.

The rudder and fins are made from not too light sheet metal, to the dimensions given, and fastened to the hull with short round-head screws at such an angle that the hull will be drawn under when in motion. The fins can be bent to a different pitch, if it is found necessary after the boat is completed and in use.

The struts to hold the "motor" and propeller are made from fairly heavy sheet metal, $\frac{1}{2}$ in. wide, shaped as in the drawing. Care must be taken to allow clearance enough so that the propeller shaft will turn freely. The shaft and crank will be made from eight-penny nails bent to



Here Is a Very Simple Diving Submarine That Will Provide Endless Diversion for the Small Boy

the desired shape. The propeller stock is any fairly thick sheet metal, preferably brass. Use a $\frac{5}{8}$ -in. radius, and divide the circumference into nine equal parts. Cut out three of these parts, leaving two to-

gether for each blade of the propeller. Round off the corners of the blades and drill a hole through the center for the

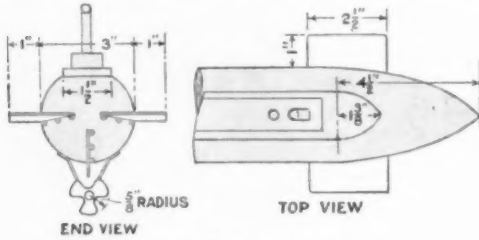


Fig. 2

shaft. Now bend the blades to such a shape that a clockwise rotation will propel the boat, and solder the propeller to the shaft. This bending or pitch can be adjusted later to conform to the needs of the rubber-band motor. A bead should be placed on the shaft between propeller and strut. The struts are fastened to the hull with four short round-headed screws.

The deck is made of 1/4-in. material, cut to the shape and size shown in the drawing. The periscope is made from 1/4-in. dowel rod. Fasten the deck with brads and screws to the flat surface on the hull. The rail is made by driving in brads at equal intervals, and soldering on some small copper wire. To finish, give the hull two coats of shellac. When this is dry, paint with aluminum paint, letter and decorate with black or red to suit.

This is exactly the way we made several models. However, due to the difference in the weight of woods, it might be necessary to make a few minor changes.

Food Chopper Used for Clamp



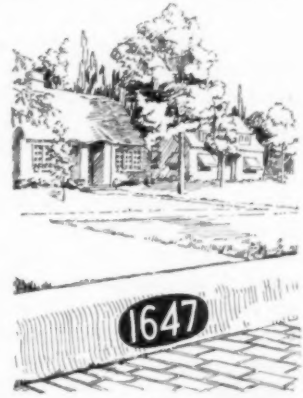
When you need a small clamp for odd jobs where a larger clamp is too clumsy, use the kitchen food chopper. It is set on the table or bench, upside down, and the work is clamped between the jaws. It may be necessary to use blocks of wood to prevent the jaws from "biting" into the work.

Dressing Floor in Small Hallway

After laying a hardwood floor in a small hallway, I was at a loss as to the easiest method of dressing it, because the space was too small to use a scraper and no sander was available. I came to the conclusion that if I used a block plane to smooth the surface, I could fasten a block of wood to a weighted floor polisher, tack a sheet of No. 2 sandpaper to the block, and do a very good job of dressing. I tried it and found that it worked very well, in fact, better than I expected.—C. J. Gose, Kinderhook, Ill.

House Numbers Painted on Curbing

It is often a difficult matter to find and read house numbers from the street, especially when driving along in an automobile. In one case, where the houses were located a considerable distance from the street, one owner painted the numbers on the street curbing in front of his house, as shown in the accompanying illustration. This was found a great improvement.



Hints on the Use of Aluminum Paint

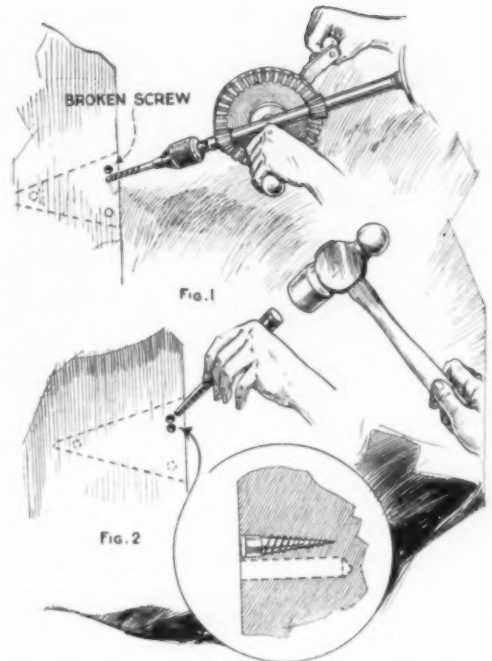
The property of aluminum paint to prevent evaporation losses has been realized by large oil-refining companies who have used it on their storage tanks. This paint reflects a great deal of heat that would otherwise be absorbed. Accordingly, this quality is used to advantage for retaining heat where it is most needed, as in boiler and engine rooms. In addition, the paint has a high degree of lighting efficiency, does not collect dirt easily, and can be cleaned readily. Its waterproofness is another desirable quality recommending it for use in dairies, garages and similar places where moisture may attack wood or structural steel.

The best general-purpose vehicle is so-called "kettle-bodied" linseed oil, diluted with an equal amount of turpentine or mineral-spirits thinner. The aluminum powder to be added is about 2 lb. per gallon of vehicle. Spar and pyroxylin varnishes can be used as vehicles to suit special conditions. When painting wood-work it is best to apply a thin coat first. This seals the pores and prevents absorption of moisture, the effect being increased greatly by the second or finishing coat. For waterproofing, a finishing coat of almost any kind and color of paint can be used, provided a good undercoating of aluminum paint is applied.

For structural steel work, the best results are obtained by priming with some of the basic lead chromates or American vermilion. Sublimated blue lead, red lead and inhibitive iron oxides may all be used under aluminum paints. Concrete and brickwork, as well as other surfaces, can be painted and waterproofed satisfactorily with aluminum paint, although, in the case of concrete, the free lime in the material has a tendency to react with linseed oil, and paints containing this oil therefore should be avoided. The best paints for such work are those made with aluminum-bronze powder in long-oil spar varnish, containing a relatively high percentage of Chinawood oil. Just enough aluminum paint should be mixed at a time for a day's work, as the covering quality of the material is reduced somewhat by permitting it to stand.

Muffling the Alarm Clock

The morning din of an alarm clock can be damped by slipping a section of an inner tube, about 3 in. wide, around the clock. The alarm will be loud enough to awaken anyone in the same room, but it will not awaken other occupants of the house. The rubber band is easily slipped on or off as required.—Willard D. Morgan, Los Angeles, Calif.



Here Is a Simple Method of Removing a Broken Wood Screw with a Punch

Removal of Broken Wood Screw

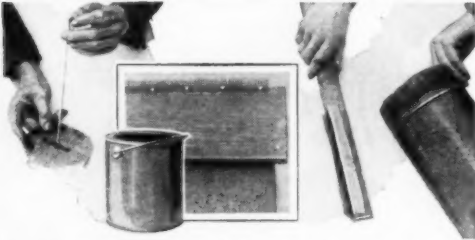
Screws sometimes break off in wood, particularly in hardwood, and it is impossible to substitute another screw until the broken one has been removed. Anyone who has experienced trouble of this kind knows the difficulty of doing this. There is a method, however, which is neither hard nor slow. A hole is first drilled beside the broken section and in line with the grain of the wood, as shown in Fig. 1. A punch can then be used to drive the broken screw into this hole, as indicated in Fig. 2, so that it can be lifted out. The hole is then filled with a wooden plug and a new screw is driven into the original hole.—G. A. Luers, Washington, District of Columbia.

Cleaning Cretonne Chair Covers

Cretonne chair covers can be effectively cleaned by using a solution consisting of two teaspoonfuls of ammonia in 1 pt. of boiled water. It is a good idea to boil a bag of bran in the water. This mixture will clean quickly and only slight pressure is required.

Uses for Old Screen Wire

Old screen wire is usually thrown away, but it can be made serviceable for various purposes, as shown in the photo. Bunched



Screen Wire Can Be Used for Many Purposes After It Has Served for Doors or Windows

together and tacked to a stick, it makes a handy wire brush for cleaning stovepipes. It is not always safe to tap stovepipes with a stick to clean them, especially if they are old and nearly worn through. We had several bird houses for small birds, but the large birds bothered the tenants by perching on the roof ridges. To prevent them from doing this, we tacked a short strip of screen along the edge of the roof so that the sharp, ragged edge projected upward. This was found to be an effective cure. From another piece of old screen, we made a false bottom in a minnow pail to facilitate catching minnows. They are difficult to catch with the fingers, even in a small pail, but by raising the false bottom they cannot get away and you can readily get any one of them.—Frank W. Bentley, Jr., Missouri Valley, Iowa.

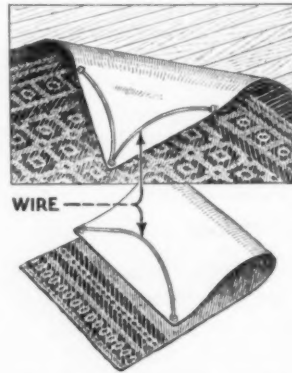
Inflation of Ford Balloon Tires

Underinflation of a balloon tire costs the owner just 700 miles of service per pound under the correct pressure, according to the results of a series of experiments conducted by the Ford company, in connection with a campaign to help owners of its cars to get the most out of their tires. To determine at just which point the Ford balloon tires yielded the maximum comfort consistent with maximum mileage, all makes of tires were tested. At the end of the test period, the exact loss per pound of underinflation was calculated in terms of mileage. A number of common tire ailments were

traced directly to underinflation. Among the most common are rim cuts, tread separation, overheating and stone bruising, in addition to a more rapid rate of natural wear and deterioration. On the other hand, every pound of overinflation takes its toll of comfort, and the fundamental value of balloon equipment is lost. Other advantages of low-pressure tires, namely, greater traction, ability to travel over soft ground without sinking, and quick stopping without skidding, are also nullified in a direct ratio to the excessive inflation. The following pressures have been found to be best for both riding comfort and long life of 29 by 4.40 balloon tires: The front tires on all types of Ford cars and the rear tires of the roadster, coupe and touring-car types should have 27 lb., while 30 lb. is right for the rear tires of a Tudor, Fordor and runabout with a pick-up body.

Keeping Rugs from Turning Up

Most rugs have a tendency to turn up at the corners or ends, which not only causes annoyance but will shorten their life. To prevent the trouble, get a length of spring-steel wire, about No. 14 gauge.



For small mats this wire should be about 6 in. longer than the width of the rug. A small cloth pocket is sewed onto the underside of the rug near each corner and the wire is

slipped in place as indicated. The larger rugs are treated in the same way, except that two lengths of wire are provided at each corner and arranged as shown.

☐ A little turpentine poured into the corners of wardrobes, trunks and drawers will keep moths away, but does not kill moths already present; therefore clothes should be given a good brushing and airing in the sunshine before they are laid aside.

SHOP NOTES



All Shop Notes published in 1927, in book form—Fifty Cents—from our Book Department

Making Attractive "Ballotini" Lampshades

By H. C. McKAY

A SHORT time ago, floor and bridge lamps were used for one purpose, namely, to give light. They were sufficiently ornamental not to look out of place in a well-furnished living room, but

there the decoration stopped. The parchment lampshade brought into being a new era. The shade was accepted as an ornament in itself, and then began the development of the modern floor lamp.



Two Steps in Making the "Ballotini" Shades: Sewing the Cotton Sheeting to the Shade Frame; Above, Painting the "Sea" to Meet the Transfer Pattern

There is no one development which has furthered its value as much as has the "ballotini" shade. For the benefit of those readers who have not yet had the opportunity of seeing such a shade upon a lighted lamp, it may be

Below, Applying the Ballotini to the Shellacked Panel, and at the Right, the Completed Shade



ing; transfer designs; transparent photo oil color; one tube plastic embroidery compound; one jar non-spread fluid; one jar best white shellac; vials of ballotini of the proper shades for the design, and the necessary braid and trimming.

The ballotini is nothing but tiny, round glass beads in various colors, and transparent. These beads are sold in sprinkler-top vials.

said that the ballotini resembles nothing so much as a beautiful opalescent crystal shade, with soft colorful designs apparently cast in the glass. No stained-glass shade could be more beautiful, yet it may be made in a few hours, and in addition to this, the design may be applied by anyone, regardless of artistic ability.

The cloth is applied to the shade as usual in making any cloth shade. In this description the details of the shade illustrated will be given, but these may be changed to suit any design in hand.

The ballotini shade is made upon a foundation of a closely woven white sheeting of good grade. The best quality pillow-slip material makes a very good material. This is sewed to the usual wire frame, and stretched as tightly as possible. The design is then painted or transferred onto the shade and finally the ballotini is applied, changing the shade from a rough, crudely decorated, amateurish article to a thing of enduring beauty.

The cloth is given a coating of the non-spread fluid, which, as its name implies, prevents excessive spreading of the color. This is allowed to dry. Then, in the center of each panel, a transfer design of a ship is placed. These transfers may be obtained from any paint, art or ten-cent store. They are given a thin coating of glue and fastened to the shade. The colored side is placed down, the side with the outlined design outward. This is allowed to dry for a half hour. Then the transfers are soaked with lukewarm water and the

The materials needed are: wire shade frame; one yard finest white-cotton sheet-

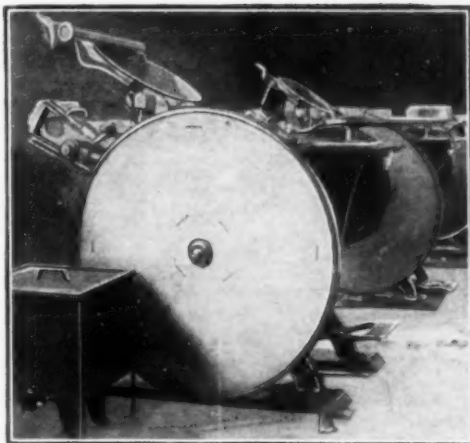
paper backing slid off. This leaves the design, a ship in full color, firmly attached to the cloth.

Conventional wave designs are now roughly sketched to meet the waves of the transfer design. Then cloud forms are marked irregularly in the sky. The waves and clouds are outlined in "plastic embroidery." This is a compound like thin putty, sold in a collapsible tube with a long spout point. It should be allowed to dry for four or five hours.

Now, in transparent photo oil color, the sea is given a coat of bluish-green, thinned in turpentine. Upon this, rough, jagged strokes of dark green are drawn carelessly. The upper part of the sky is given a dark-blue coat and the lower sky a coating of light blue, which is blended out to the white cloth about 1 in. above the waves. The white space between waves and sky is now filled with a mixed red and yellow blended-stripe design to simulate sunset. The red and yellow are placed on fairly strongly. The clouds are tinged on the underside with red or pink, and the tops left white. This color is allowed to dry. Do not get discouraged at this time, though the color is garish and the design rough.

When the color is thoroughly dry, the shade is ready for the ballotini. This is applied a panel at a time. The sea of the first panel is given a good coat of shellac and the ballotini (green) is sprinkled upon the wet shellac until it appears dry, showing that the shellac will take up no more. Shake the excess off and go to the next panel. When the green ballotini has been applied to the sea of all six panels, start with number one again and coat the clouds with shellac and cover this with cashmere ballotini. Cashmere is the name given a mixture of pastel shades which is very delicate yet effective. When the clouds are completed, start again, and this time coat the entire sky with light-blue ballotini. In this step, do not coat the ship, but leave the transfer uncoated. The shade is allowed to dry for 24 hours.

The shade is now lined with the usual lampshade material, and the trimming applied. The ribs of the frame are covered with a double-edged braid. The top and bottom edges are covered with tinsel-ruffled lampshade braid, and the decorative braid is applied to the lower edge.



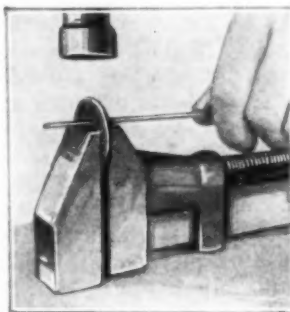
Wallboard Disks Attached to the Flywheels of Printing Presses Insure Safety

Disks on Flywheels Protect Workers

In a printing establishment, it was found that large disks of wallboard attached to the flywheels of the presses helped to insure safety to the workmen. After cutting the board to fit the wheel, holes were made at a number of places so that the board could be laced to the spokes with wire. It is, of course, advisable to twist the ends of the wire together on the inside of the wheel so that the outside surface of the disk will be perfectly smooth.

Handy Method of Snipping Wire

When short pieces of wire are needed for pins, rivets, or other purposes, the usual method of cutting it without snips is to lay the wire over a sharp corner and



then crush it with a hammer. A better method is shown in the photo. Slip the wire through a small washer, lay the wire and washer over a monkey wrench as indicated, the jaws being set so that there is just enough space for the washer to slide between them. Hit the washer a smart blow with a hammer, and the wire will be sheared off squarely.



Workbench Drawer Which Can Be Opened and Closed Easily, No Matter How Heavily Loaded

Swinging Drawer for Workbench

It often happens that deep workbench drawers accumulate so many heavy items that they either stick or are hard to pull out. This difficulty can easily be overcome by providing a swinging drawer, as shown. A soap box, a length of 2 by 4-in. wood to stand vertically under the bench, two large spikes and a weight are all the materials needed. At the lower end of the two-by-four, a spike should be driven in permanently, after first drilling a guide hole a trifle smaller than the diameter of the spike, so that the wood will not split. The head should project about 1 in. Drill a hole in the floor, slightly larger than the head of the spike and about $\frac{3}{8}$ in. deep, preferably over a floor joist. It is well to drill a hole in the top of the workbench first so that the bottom hole can be located directly under it by a plumb line. The top spike should be a loose fit in the two-by-four, so it can be withdrawn when necessary. A diagonal brace, underneath the drawer, a weight to make it swing under the bench, and a stop complete the job.

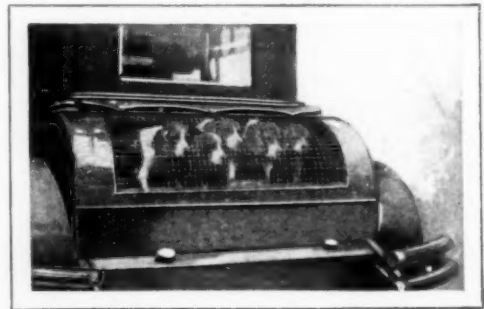
Inasmuch as this type of drawer can always be opened with little exertion, no matter how heavy, it will be found a great convenience in the workshop.—H. Sibley, Pasadena, Calif.

Removing Sulphate from Storage-Battery Plates

Badly sulphated battery plates, which do not yield to the usual treatment of a long slow charge, may be saved from the scrap pile by the following means: Pour out the electrolyte, fill the cells with distilled water and allow them to stand until any acid in the plates has been soaked out. This may take several hours. Then the cells are emptied again and filled with a solution of pure sodium sulphate. The strength of this solution is not very important, although 7 oz. of the sulphate dissolved in 1 qt. of distilled water has been found satisfactory. The cells are now put on charge in the usual way and the sulphate will slowly disappear. Before refilling the cells with electrolyte, it is, of course, important to remove all traces of sodium sulphate by soaking the plates in water, one or two changes being needed before the process is complete. Then the electrolyte is replaced and the cells are connected for charging.

"Rumble Seat" for Dogs

A sort of rumble seat to provide comfortable transportation for dogs when they are taken for exhibition at shows, has been built on an auto by a dog fancier of Peekskill, N. Y. They are protected by a screen, and in bad weather the compartment can be covered.



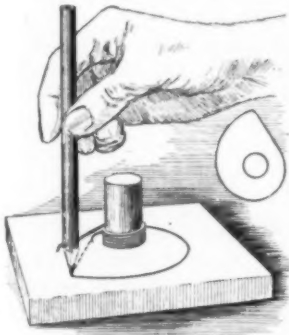
Screen-Covered Compartment for Carrying Dogs on a Roadster

Household Bluing Helps Detect Punctures in Tire Tubes

Finding small punctures in an auto tube is sometimes rather difficult, even if the tube is immersed in water, as defects or small holes in the rubber frequently close up when the tube is only partly inflated. However, if ordinary household bluing of the powdered kind is placed in a new tube before it is put in use, by removing the valve and pouring about a tablespoonful of the powder into the tube through a small paper funnel, the bluing will sift out through the opening and leave an easily seen smudge when a puncture occurs.

Laying Off a Cam

In cases where strict accuracy is not required, a cam with a uniform rise can be laid off by the method illustrated. If the cam required is to have a rise of 2 in., take a piece of wood and turn it down until its circumference is 2 in. Then wind a length of string around it a few times and place it in the position indicated. A pencil



is slipped through a loop tied at the outer end of the string and is drawn over the material on which the cam is to be laid out, the string being unwound and the pencil held so that the string is taut.—Harry Moore, Rosemount, Can.

Measuring Voltage

Sometimes it is necessary to measure the potential of a power line, and the only voltmeters at hand are of too low a range to do the work. Then it is a good thing to know that two or three voltmeters may be hooked up in series, connected across the line, and the individual readings added to obtain the correct potential. For instance, two 110-volt voltmeters can be used in this manner to ascertain the exact voltage of 220-volt mains.



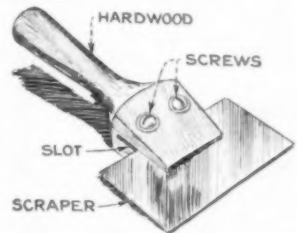
Road-Crossing Sidewalks Laid between Rails Are Fully Protected against Breakage

Protecting Concrete Sidewalk Crossings

In small towns having unpaved streets, one of the problems is to provide sidewalk crossings that will resist traffic shocks without breaking down. A good concrete crossing can be laid between two old railroad rails as shown. Earth or other road material should always be used to fill in level with the shoulders of crosswalks, in order to protect the concrete, but it is not unusual to see this precaution neglected in many towns. If rails are used as above, the concrete will be protected whether or not the earth fill is maintained.—W. F. Schaphorst, Newark, N. J.

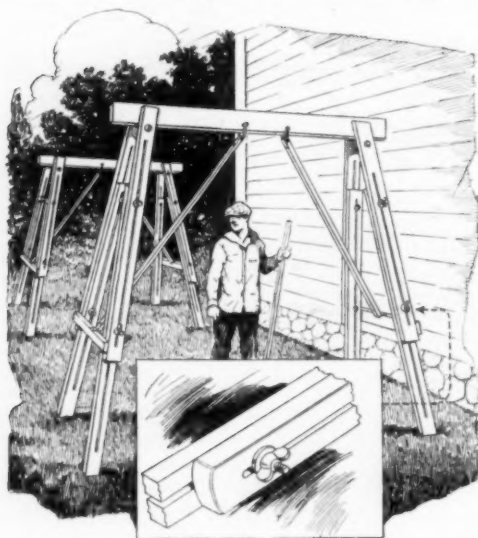
Handle for Holding Small Blades

Small spokeshaves, cabinet scrapers, etc., can be conveniently held in the handle shown in the drawing. It is made from a



piece of hardwood, cut down to the shape indicated. A slot is cut to admit the tool and two holes are drilled for screws, which, when driven tight, compress the sides of the holder against the blade, keeping it securely in place.—J. A. Stevens, East Boothbay, Me.

Adjustable Staging Found Convenient

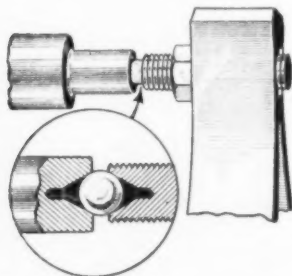


Adjustable Staging Used by Workers Engaged in Building Operations

Many workers will find the adjustable staging shown in the drawing convenient, as it can be set to any desired height. Each leg consists of two lengths of 2 by 4-in., or other suitably sized wood, slotted lengthwise and held together by means of bolts and wingnuts. Suitable braces are provided to keep the legs apart and to support the ridge piece. All the necessary constructional details are clearly shown.—Carlton Groat, Portland, Oreg.

Ball Mounting for Roll

A novel method of mounting a light roll so that it revolves with very little friction is shown in the illustration. This particular roll had to revolve by the action of paper passing over it and therefore must move very freely. Both ends are similarly mounted. A V-shaped center was machined in each end of the roll, which was supported by specially made brackets. These were drilled and tapped for small screws, also



having V-centers. The screws were provided with pins for turning to obtain the correct adjustment, and nuts to lock them in position. A steel ball was inserted between the vees of the roll and the mounting screws, the latter being turned so that the ball had just a little play. The nut was then tightened.

Repair for a Broken Oilstone

To repair a broken oilstone assemble the parts on some piece of heavy steel metal or a stove lid. Apply heat until the parts are fairly warm and then coat the fractured ends with heavy shellac. Hold the parts together with a clamp and reheat them, allowing the stone to cool gradually. After cooling, the parts will adhere and the stone will be fit for further use.

Covering Prevents Dirt from Sticking to Tamp in Clayey Soil

Workmen tamping clayey soil are usually inconvenienced by a large amount of dirt sticking to the tamp, increasing its weight and making it ineffective. A remedy for the trouble is to tie a piece of canvas, burlap, or other heavy cloth, over the tamp as indicated in the drawing. One working crew used denim from discarded overalls. The reason for the effectiveness of this method is that the cloth sags down each time the tamp is lifted, which causes the clay picked up to crack and fall off.—H. E. Benson, Denver, Col.



Darkened Brooders Stimulate Chickens' Growth

A Wisconsin poultry man has proved by repeated tests, that the growth of brooder chicks is stimulated approximately 25 percent if the brooder is darkened a few minutes several times each day. This

method is followed naturally by the mother hen, who calls her chicks to her from time to time for the same purpose. The reason for the increased growth of the chicks when this is done, is that the temporary darkness induces them to nap and doze, which, it seems, helps to digest food previously eaten. It was formerly thought that a brooding hen did this to provide warmth for the flock but the same instinct seems to rule in hot weather.

Burning Out Carbon

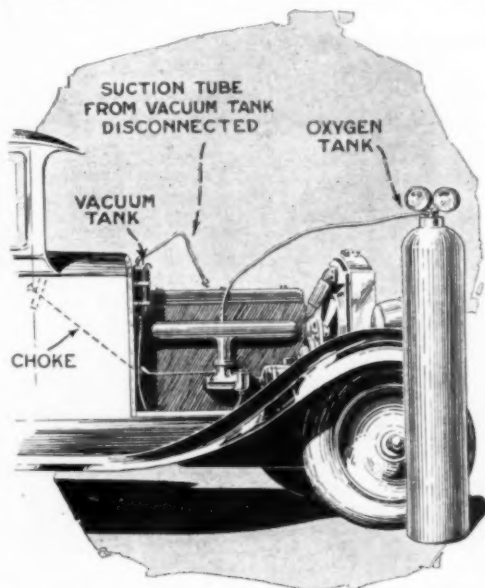
Carbon is usually burned out by blowing oxygen into the spark-plug openings. A quicker way is to draw the oxygen into the cylinders while the motor is running. Attach the hose from the oxygen tank to the intake manifold by unfastening the tube to the vacuum tank and connecting the oxygen hose to the fitting of the vacuum-tank lead. Ordinarily the tank will hold sufficient gasoline to run the motor during the oxidation. Be sure that the radiator is full of water. Start the motor and run it slightly faster than idling speed. Turn on the oxygen gradually and at the same time close the choke slowly. Adjust the oxygen valve until the motor receives so rich a mixture that it will miss. Then let the motor run for ten minutes. The surplus oxygen combines with the carbon in the combustion chamber. Not only is the combustion chamber thoroughly cleaned in this way, but also the exhaust ports and valve stems, and the spark plugs.—R. P. Cole, Paterson, N. J.



Small Waterwheel Installed in a Brook Operates a Pump Which Raises Water to a Near-By Reservoir

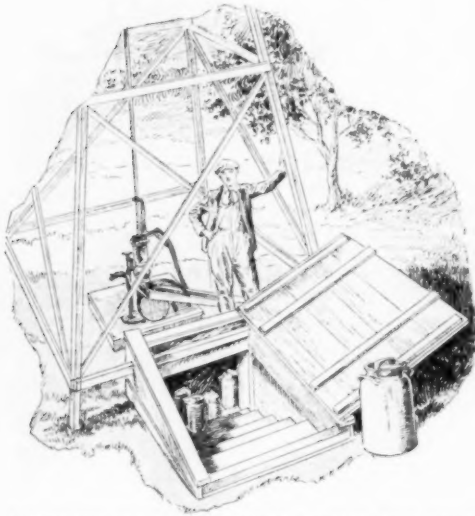
Small Waterwheel Provides Farm with Water

In the hill country near San Antonio, Tex., there is a small waterwheel which pumps water from a brook to a near-by farm house. The installation consists of an ordinary paddle wheel placed in the stream so that the current causes it to revolve. The wheel operates a walking beam to which a pump is connected, as shown. The pump forces the water through a pipe line to a reservoir. There is a constant flow of water in the brook, which insures the continuous operation of the wheel. It has supplied water for the farm house and garden for several years and needs no other attention than an occasional oiling.



Easy Method of Burning Out Carbon with Oxygen While the Motor Is Running

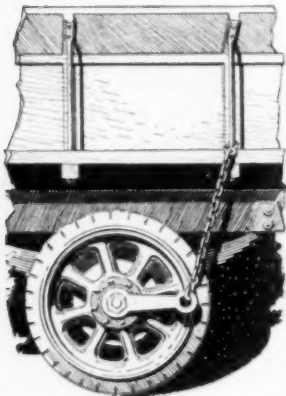
Easy Access to Well Pit



A Trapdoor and Stairway Which Provide Easy Access to the Well Pit

Many farmers use their well pit as a cooling room. Although convenient for this purpose, it is rather troublesome to raise the boards of the platform. An access which has been found handy is shown in the drawing. It is merely a trapdoor and a stairway, leading down into the pit. The arrangement is also useful during the winter when it is often necessary to wrap the pump pipe in order to prevent freezing. Obviously, it is easier to get at the pipe for this purpose, and for occasional inspection, through the trapdoor than through the platform.—Geo. R. Harrison, Council Bluffs, Iowa.

Loosening Rear-Axle Nut of Truck

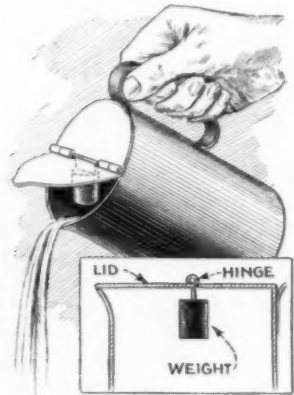


It frequently happens that the nut which holds the rear wheel on a motor-truck axle shaft of the semi-floating type, becomes rusted or otherwise jammed so that it can neither be loosened nor

tightened by ordinary methods. When such a condition exists, a sure relief will be found and much time saved, by setting the regular wrench in place on the nut, and attaching a chain between its outer end and the frame or body of the truck as indicated. The truck is then run backward a few feet. The nut will be held securely by the wrench but will be loosened by the turning of the axle shaft and wheel. To tighten a nut that cannot be run up snugly by hand, place the wrench on the nut with the handle to the left, attach the chain as before and run the truck forward as far as necessary. Many expensive axle shafts are ruined by being run loose in the rear-wheel hub and "wallowing" the keyway, and in most cases this results from the fact that a nut has been fitted improperly.—G. C. Douglas, Raleigh, N. C.

Self-Opening and Closing Cover

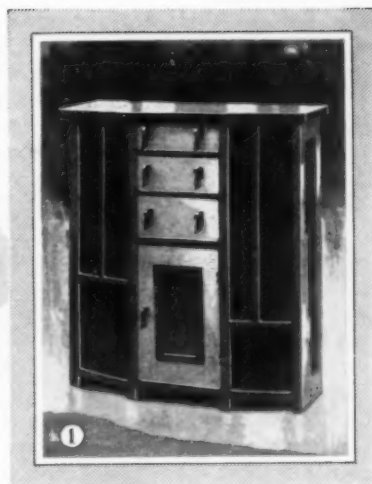
For a can containing a fluid that must be kept inclosed at all times, except when pouring, the cover shown in the drawing will be found convenient. Instead of the usual lid closing the entire top, a semi-circular piece, with two loops for a pin, was soldered in place, and another piece, shaped as indicated, hinged to it. To make the lid open and close automatically a small weight is attached to the central strip of the lid, which is bent down at right angles. When the can is tipped to pour, the weight swings forward and opens the lid, and when the can is set upright it closes.



When dismantling a machine having hardened parts it is often necessary to mark the various parts to assist in reassembling them; this can be done by applying a copper-sulphate solution to form a coppered surface on which a mark can be made with a scriber.

A WALL STAND of MODERN DESIGN

By Edwin M. Love,



THE INTEREST in modern furniture increases, and justly so, for the combination of studied space division, brilliant coloring and simplicity of effect is very charming.

The wall stand illustrated in Fig. 1 is an arrangement of elementary forms, mainly rectangles, and is well adapted to construction by the home mechanic. Any good hard or soft wood may be used for a paint finish, or a well-figured hardwood for stain and varnish. When choosing the wood, see that it is without checks, straight, flat and of regular thickness, for there is much labor in planing lumber to a true surface.

For the sides, detailed in Fig. 2, cut two pieces of 1 by 10-in. stock, 2 ft. 4 in. long. Surface each flat, occasionally resting the edge of the plane across the board to find the low places, as in Fig. 3. The twist, or "wind," of a piece can be judged by laying across each end a short, straight rod of uniform width, over which to sight.

Plane down high corners. A certain amount of wind can be corrected when the cabinet is assembled, but a condition of strain results which sooner or later may rack it out of shape.

Mark the best side for a working face, and joint the back edge straight and square. Rabbet this $\frac{3}{8}$ by $\frac{3}{8}$ in., to receive the back. Gauge the face for a width of $6\frac{1}{2}$ in., to be ripped at an angle of $1\frac{3}{4}$ in. in $6\frac{1}{2}$ in., as shown. A guide block held against the saw, as in Fig. 8, is a great help. After jointing the bevel smooth,

handle the material very carefully to avoid bruising the sharp corner.

Make a "rod" of a thin wooden strip, nailing a block to one end for hooking over the upper ends of the case sides. Lay out on it the positions of the upper sides of the shelves, thus: 1 ft. 6 in. from the top to the thin shelf for the right side, and $6\frac{1}{2}$ in. from there to the thick bottom shelf. Mark these with a knife point. For the left side, 1 ft. 3 in. to the thin shelf, and $9\frac{1}{2}$ in. to

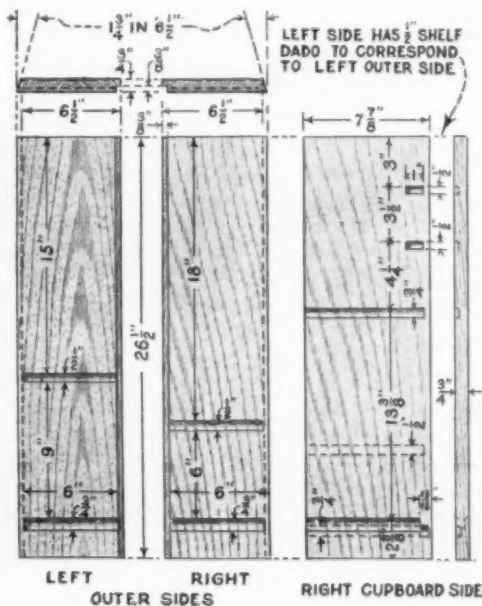


Fig. 2

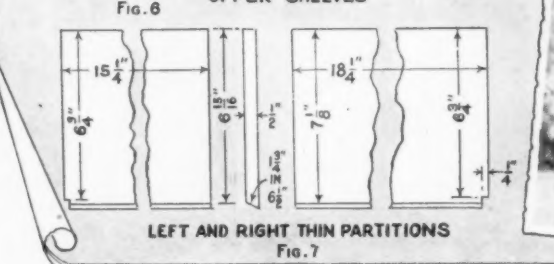
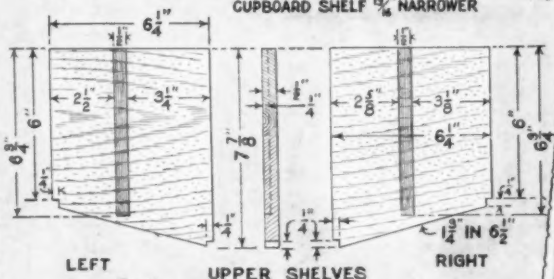
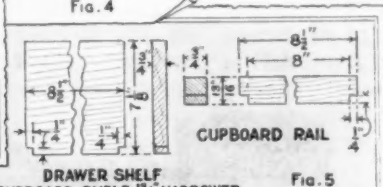
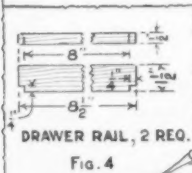
the bottom shelf are the measurements. (See Fig. 2.) Pencil letters beside these marks to identify them. Square the upper ends of the sides. Catch the rod block against these ends, and lay out the dado positions. Score lines for the upper sides with a knife, providing for grooves 6 in. long.

The cupboard sides, which have square edges, are cut 2 ft. 8 in. long and $7\frac{7}{8}$ in. wide. Mark the upper edges of all grooves and mortises, remembering that the sides must be in pairs, with grooves matching those of the outer sides. Lay out the positions of the drawer rails and cupboard shelf, on the cupboard sides, as follows: 3 in. to the upper rail; $3\frac{1}{2}$ in. to the next; $4\frac{1}{4}$ in. to the drawer shelf, and 1 ft. $1\frac{3}{8}$ in. to the bottom shelf. Notice that the door-rail mortise is $3\frac{3}{8}$ in. lower than the shelf dado, giving a margin on the shelf edge to serve as a stop.

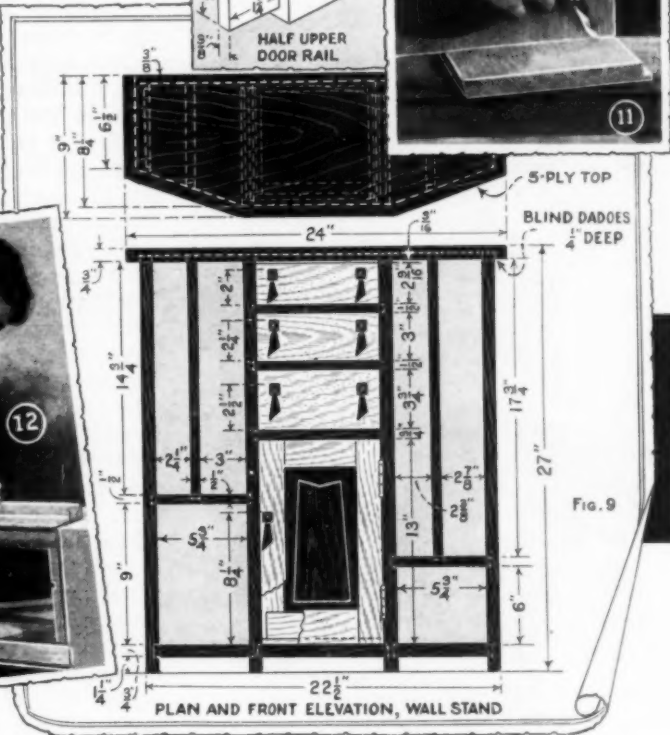
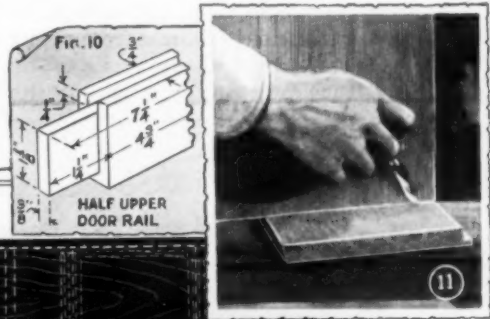
The two thin shelves are dimensioned in Fig. 6. Make these of $\frac{1}{2}$ -in. stock (easily surfaced down from $\frac{5}{8}$ -in. baseboard) cut exactly $6\frac{1}{4}$ in. long. Be very careful in squaring the ends, or the cabinet will twist when assembled. Gauge fine pencil lines across the upper sides $\frac{1}{4}$ in. from the ends, representing the depth to which they sink into the side grooves. Measuring from the back edges, lay out on these lines the exact width of the mating sides with a rod marked directly from them and draw a line for the front edge. Locate the right edge of the partition dado on the left shelf $3\frac{1}{4}$ in. from the right end, and that of the right shelf $3\frac{1}{8}$ in. from the end.

The two thin partitions (Fig. 7) are $\frac{1}{2}$ in. thick, and about $6\frac{15}{16}$ in. and $7\frac{1}{8}$ in. wide, respectively, the exact width to be taken from the thin shelves. The left piece is 1 ft. $3\frac{1}{4}$ in. long, and the right, 1 ft. $6\frac{1}{4}$ in. The lower corners are notched $\frac{1}{4}$ in. to fit over the blind ends of the grooves.

To determine the width of the shelf grooves, set the ends of the partitions with one side of each accurately on the mark. Then, with a knife, as in Fig. 11, mark the positions of the other sides, and square across. Gauge the back of each dado for a depth of $\frac{1}{4}$ in. Since the groove is not open in front, a mortise, $\frac{3}{4}$ in.



long, must be chiseled at the blind end to give room for a saw stroke. Make a chisel cut across the grain in the middle, and work toward it from both sides, thus avoiding bruising the sides of the dado and making an unsightly joint. Then, with a back or crosscut saw, splitting the line and sawing in the waste wood, cut to depth at the back and gradually work forward until the saw cuts full length



of the groove. Guide the saw with the thumb of the left hand. (See Fig. 18.) If the saw is centered on the lines, the groove will be nearly $\frac{1}{16}$ in. too wide. Chisel out the waste to a depth of $\frac{1}{4}$ in. This must be reasonably accurate. If a router is available, so much the better. Cut the front edges of the shelves and notch to fit the sides. The lower shelves are like the upper, except that they are $\frac{3}{4}$ in. thick and are not grooved.

The drawer shelf, Fig. 5, is a rectangle of $\frac{3}{4}$ -in. stock, $7\frac{7}{8}$ in. wide and $8\frac{1}{2}$ in. long, with the front corners notched $\frac{1}{4}$ by $\frac{1}{4}$ in. to fit. The bottom shelf is $7\frac{1}{16}$ in. wide, without notches.

The two drawer rails are detailed in Fig. 4. These are $\frac{1}{2}$ by $1\frac{1}{2}$ in., by $8\frac{1}{2}$ in., with front corners notched $\frac{1}{4}$ by $\frac{1}{4}$ in. The cupboard rail (Fig. 5) is $\frac{3}{4}$ by $1\frac{13}{16}$ by $8\frac{1}{2}$ in., notched $\frac{1}{4}$ by $\frac{1}{4}$ in.

Five-ply veneer is preferable for the

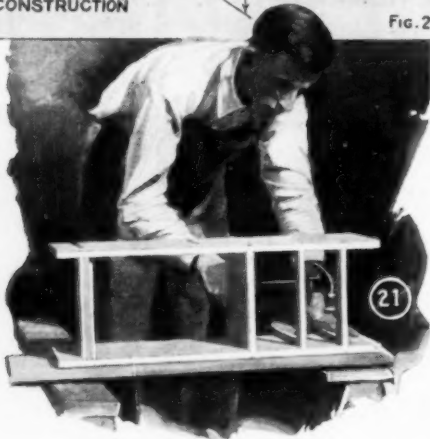
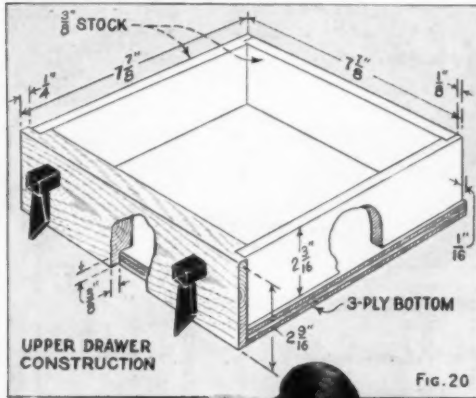
top, Fig. 9, though a well-seasoned piece of 1 by 10-in. stock will do. If veneer is used for stained work, the edges of the plies should be concealed with a flat band, glued around and smoothed off flush at the top and underside, and for paint they should be well filled.

The total length is 2 ft. Lay out the underside for dados to receive the upper ends of the sides, getting dimensions from parts already made. After cutting the dados, mark the front edge of the top by measuring $\frac{3}{4}$ in. from them and scribing accordingly. Rabbet the back between the end grooves.

Before assembling the cabinet, try every joint for fit. If some are too snug, surface off the entering pieces until a fit is obtained. Do not try to trim the grooves with a chisel. Size all end grain with glue, and smooth with No. $\frac{1}{2}$ sandpaper.

Assemble the center section, using liquid

glue, since the process is likely to be slow. Use smooth soft-wood blocks to protect the parts from scars and to distribute the clamp pressure across the width of the



boards. Apply glue to all joining parts, and when assembled, clean off squeezed-out glue before it hardens. Test the section for squareness by measuring from opposite corners, tacking a strip across the back to hold the assembly rigid while drying. Nails may be driven from the underside of the shelves (Fig. 19) and the overhanging edges of the top.

For drawer runs, nail $\frac{1}{2}$ by $\frac{1}{2}$ -in. hardwood strips inside the faces behind the rails (Fig. 21) and glue a $\frac{3}{16}$ -in. rail under the top in the upper drawer opening.

While this section dries, make the door. The upper rail is $\frac{3}{4}$ by $1\frac{3}{8}$ by $7\frac{1}{4}$ in. Mark one face and one edge, and plow a $\frac{3}{8}$ -in. groove $\frac{1}{4}$ in. deep in the latter, $\frac{3}{16}$ in. from the face. From the face side, square across the edges for tenon shoulders, and square across the faces from the grooved edge. The tenons are $1\frac{1}{4}$ in. long and

$1\frac{1}{8}$ in. wide, and the distance between shoulders is $4\frac{3}{4}$ in. Gauge for thickness from the face side. Cut in the waste wood, just splitting the line, first ripping the cheeks, then the width, and finally cutting the shoulders. (See Figs. 13 and 14.) The lower rail is 2 in. wide, with tenons $1\frac{1}{2}$ in. wide.

The two stiles are $\frac{3}{4}$ by $1\frac{5}{8}$ in., cut 1 ft. 1 in. long, as in Fig. 16. Chisel mortises in the grooved edges, $1\frac{3}{8}$ in. deep, to fit the rail tenons. They are $9\frac{7}{8}$ in. apart, placing the inner edges of the rails $9\frac{3}{8}$ in. apart. Glue the door together, inclosing a panel of three-ply veneer cut $4\frac{1}{8}$ by $9\frac{3}{4}$ in. Remember that if the door does not lie flat naturally when assembled, it will twist in use, even though dried flat under pressure.

While the door is drying, fit the molding that forms the design on the door. The side strips are $9\frac{3}{8}$ in. long, varying in width from $\frac{3}{8}$ to 1 in., and are slightly more than $\frac{3}{16}$ in. thick. The upper mold tapers on the lower edge from a width of 1 in. at the center to $\frac{1}{2}$ in. at the ends, while the lower mold is straight, and $\frac{3}{4}$ in. wide. Lay each in turn on the door panel and with a sharp pencil trace the inner edges for 1 in. from the ends. The intersections of these lines are squared up on the edges of the strips, and connected with the panel corners by straight lines. These are cut for the joints, and the strips are glued in place and put under pressure.

Assemble the rest of the cabinet parts with the center, carefully aligning the lower shelves, and squaring the whole. Fit a piece of three-ply veneer into the back rabbets, nailing with brads. Mark for the lower ends of the two outer sides, and mark the others by laying the square

MATERIAL LIST

- 1 piece, 1 by 10 in. by 14 ft., hardwood, fir or white pine, S4S, sanded.
- 1 piece, 1 by 4 in. by 6 ft., (resaw as needed for thin stock).
- 1 piece, $\frac{3}{4}$ by 8 in. by 4 ft., baseboard.
- 1 piece, $\frac{3}{8}$ by 24 in. by 4 ft., three-ply veneer (or $\frac{1}{4}$ in. thick).
- 1 pair $1\frac{1}{2}$ by $1\frac{1}{2}$ -in. loose-pin butts.
- 1 $\frac{1}{4}$ -in. forg catch.
- 1 set $\frac{1}{2}$ -in. "domes of silence."

across, as in Fig. 22. Square lines across the faces and cut the feet. Glue on $\frac{3}{8}$ -in.

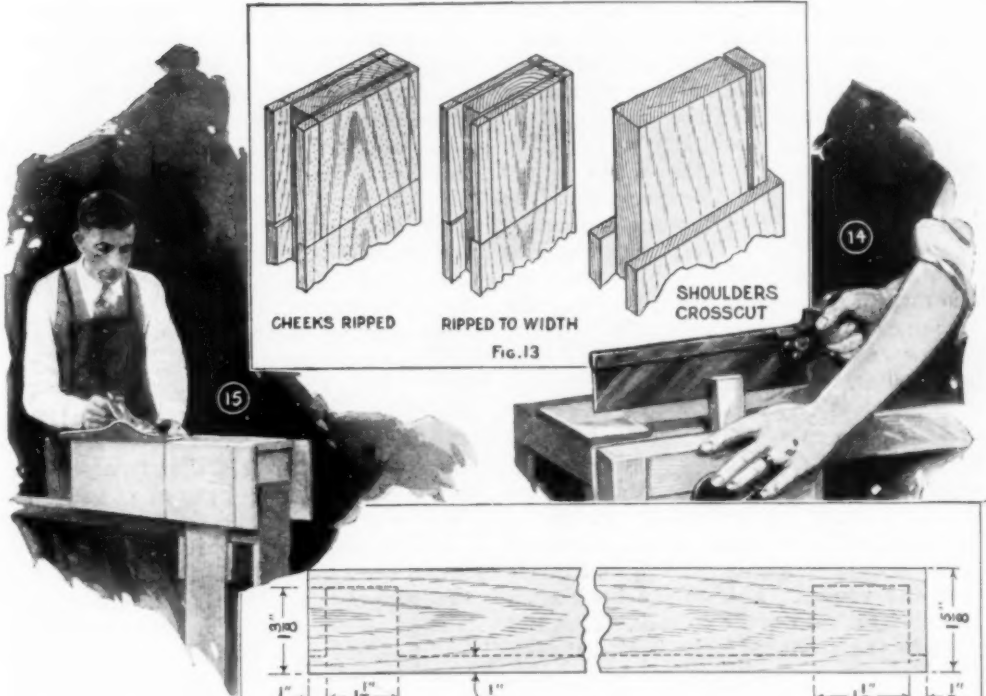


Fig. 14, Cutting a Tenon; Fig. 15, Planing Down the Sides of the Cabinet; Fig. 18, How the Saw Is Used in Cutting a Dado, and Fig. 19, Nailing In the Shelves

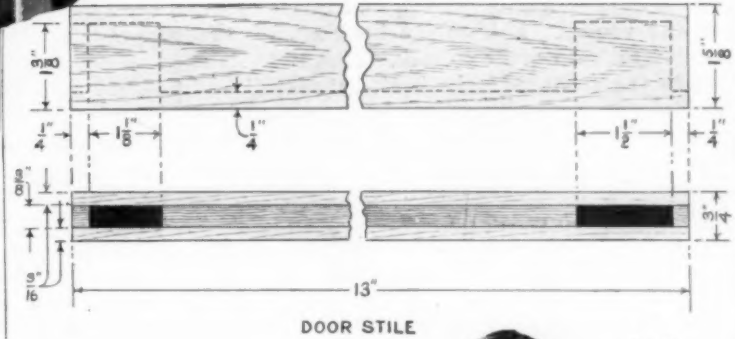


Fig. 16

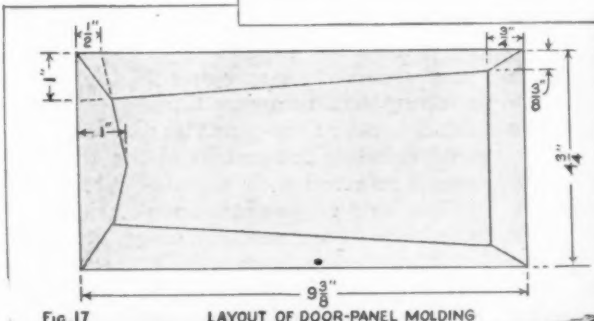


FIG. 17

LAYOUT OF DOOR-PANEL MOLDING



blocks to fill out the rabbets and middle feet to the thickness of the back veneer.

The construction of the drawers is illustrated in Fig. 20. First square up a piece of three-ply stock for the bottom, 8 by $8\frac{1}{4}$ in., and joint the width to an easy-sliding fit between the sides in the upper drawer space. The clearance should be less than $\frac{1}{16}$ in. Set it in place and scribe the underside with a sharp pencil guided on the front edge of the rail. Remove, and draw a second line $\frac{1}{4}$ in. inside of the first one.

Now cut a piece of $\frac{3}{4}$ -in. stock, $\frac{1}{2}$ in. longer than the drawer opening, and joint it to the width. Surface it to a thickness of $\frac{5}{8}$ in., and rabbet the lower edge $\frac{3}{8}$ by $\frac{3}{8}$ in. Rabbet the ends $\frac{3}{8}$ in. deep, making the length between shoulders $1\frac{1}{16}$ in. less than the width of the bottom. Make two sides of $\frac{3}{8}$ -in. stock, $\frac{3}{8}$ in. narrower than the drawer opening and $\frac{1}{4}$ in. shorter than the veneer. Rabbet the back ends $\frac{1}{4}$ by $\frac{3}{8}$ in., and make a back. Nail the sides to the front, and the back between the sides. Lastly, nail on the bottom, giving a uniform clearance overhang of $\frac{1}{16}$ in. on both sides. Fit the drawer into the opening with $\frac{1}{2}$ in. clearance. Build the other two drawers in the same way. The front of the middle one is 3 in. wide, and that of the lower drawer, $3\frac{3}{4}$ in. (See Fig. 15.) When all are fitted, draw a line across the front ends with a straightedge (Fig. 26) and cut off the projecting horns. Fit the fronts with a clearance of $\frac{1}{32}$ in. all around.

Seven drawer pulls are required. Each is cut from $\frac{3}{8}$ by $\frac{1}{2}$ by $1\frac{3}{4}$ -in. stock, having one end cut at an angle of 30° with the square. Work a tenon on each, $\frac{3}{8}$ in. thick, centering on the width, and $\frac{1}{4}$ in. wide, flush with the back, making it $\frac{9}{16}$ in. long. Trim the tapers to shape last. For the supports, make a stick $\frac{1}{2}$ by $\frac{9}{16}$ in., working a pyramidal end, $\frac{1}{8}$ in. high. Cut a $\frac{1}{8}$ by $\frac{1}{4}$ -in. mortise $\frac{1}{4}$ in. from the point base, centering on the thickness, to take the handle tenon. Glue in a handle, and cut the support to a length of 1 in. Proceed with the others in the same way.

Surface the door molding and joints flush, cut off the projecting ends of the stiles, and with an eye tool, guided by a straightedge, trace around the joint between the molding and frame, smoothing

the groove with a bit of folded sandpaper. On each side of the cabinet, a panel is outlined with the same gouge, as in Fig. 25. Square a light pencil line across, $1\frac{3}{4}$ in. from the underside of the top. From this line another, $1\frac{5}{8}$ in. from the back and parallel to it, extends to within $2\frac{1}{2}$ in. of the bottom. The front of the panel runs parallel to the front, $1\frac{1}{4}$ in. from it for $8\frac{1}{2}$ in., then drops back 1 in. and continues for $7\frac{1}{2}$ in., then moves back $\frac{3}{4}$ in. to the bottom of the panel.

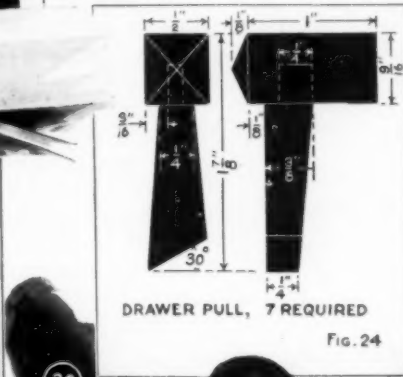
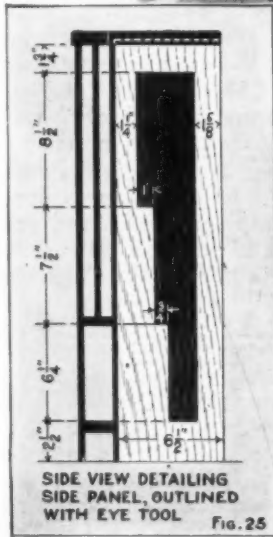
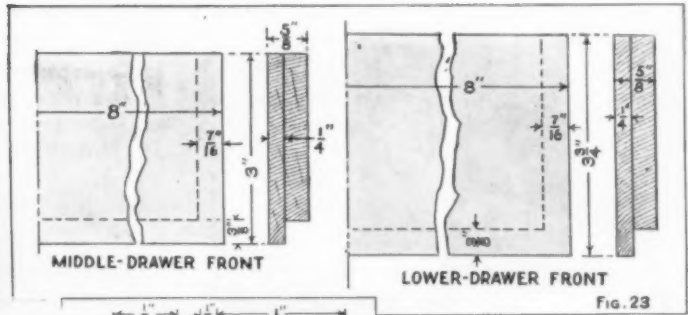
Sponge the case with a water-dampened cloth to raise the grain, and, while it dries, fit and hang the door. Give it a clearance of $\frac{1}{32}$ in. The hinges are placed $1\frac{5}{8}$ in. and 2 in. from top and bottom, respectively. Since the door is so narrow, the front edge must be beveled considerably to clear in opening and shutting.

Before finishing, sand the cabinet glass smooth, rounding off the corners with sandpaper, and give a coat of shellac, if it is to be painted. The stand illustrated was finished with lacquer, applied with a hand spray costing \$2.50. The nail holes in the back were puttied with thick lacquer from the bottom of the can. The back, end borders and door border were sprayed light green. Newspapers were then tied around under the top, and the latter was sprayed with orange. The end panels were exposed for the orange by tracing the grooves through the paper with a pencil and tearing out the center, little dabs of glue keeping the edges of the mask in place while in use. The papers were next removed for spraying the tops of the shelves with orange. Cardboard covers fitted between the partitions screened the shelves while the insides of the compartments received their coats of dark violet.

The front edges of the shelves, sides, and partitions, were coated orange by means of a small brush, as were also the door molding and the drawer pulls. The edges of the side panels were made crisp by brushing orange in the grooves.

Well-hardened lacquer can be sanded smooth and polished down with pumice and rottenstone as easily as varnish. The hand spray leaves the surface with a granular texture, which, however, is much more easily smoothed than brush laps.

Put on the drawer pulls with wood screws entered from the backs of the



A Few of the Operations Involved in the Making of the Simple Modern Wall Stand Described in This Article; Fig. 22 Shows How the Sides Are Squared across for Cutting Off at the Feet; Fig. 26, How the Drawer Front Is Marked for Cutting, and Fig. 27, How a Twist Bit Is Held in the Fingers to Bore the Hole for the Forc Catch

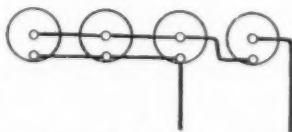


drawer fronts, the outer edges being 1 1/4 in. from the drawer sides. Put a 1/4-in. forc catch on the top of the lock stile of the door, Fig. 27, with the bolt in the underside of the drawer shelf. The hole can be quite easily bored by twisting the bit in the fingers. The stand should be raised from the floor by sliding casters.

and we therefore publish herewith a diagram which gives the correct method of boosting the voltage of a bank of dry cells in parallel. All that is necessary is to connect one end cell in series with the remainder of the bank.

Correction

In the June issue of Popular Mechanics, on page 1036, the article entitled "Increasing the Voltage of Run-Down Dry Cells," was, in part, erroneous



Tire-Valve Spring Substitute for Distributor-Cap Spring

The spring forcing down the central brush in the distributor cap of a motor-car ignition unit, will sometimes fall out and become lost when the cap is removed for roadside examination of the breaker points. In an emergency, the spring of a tire valve will replace the missing part.



A Simple Jig Which Will Facilitate the Making of Links of Equal Size

Fixture for Forming Wire Links

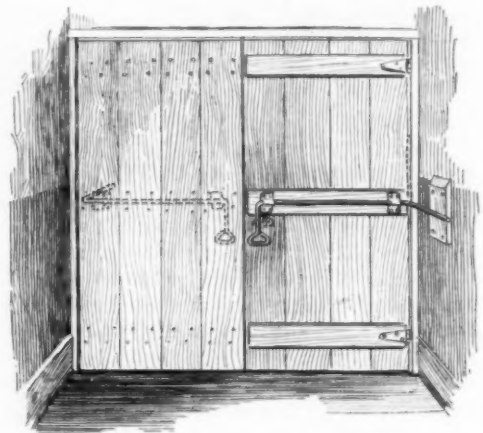
An inexpensive fixture for forming eyes or loops in wire links is shown in the accompanying illustration. It is designed to be held in a bench vise and consists of a block, A, into which are fitted two pins, the distance between their centers being equal to the distance between the centers of the loops or eyes to be formed. Two smaller pins, also driven into the block, locate the preformed wire centrally with the eyes. A hole, D, equal in depth to the length of the wire forming the eye, is drilled in the end of the block, and an adjustable stop, E, is tapped into the end as shown, and locked by a nut. The lever L, which is used for forming the link eyes around the pins, has a pin, G, and it is drilled at F to fit the link-forming pins.

The process of making wire links is as follows: First cut off the wire to the developed length of the links. Next insert one end of the wire in hole D and bend it until it touches stop E. Repeat this bending operation at the opposite end of the wire, being careful to keep the bends in the same plane, so that the partly formed link will lie flat in the fixture. At this stage of the forming operation the link is shaped as shown in the detail. The lever L is placed in position on one of the pins so that pin G engages the wire

and the eye is then formed by rotating the lever about the pins, after which the forming operation is repeated at the other end of the wire, producing the complete link as shown in detail S.—Leonard Keiser, Jr., Hawthorne, N. J.

Double Doors for One-Way Passage

Almost everyone at some time or other has experienced the annoyance of having a door pushed in his face just as he was about to open it. Here is a method of arranging double doors which make such accidents impossible. The doors can be made in any design to suit the builder, but the hinges must be put on opposite sides, so that each will work one way only. This is further assured by arranging latches as shown. These are made from rods, formed into a handle at one end and bent to a right angle at the other end, which rests against the wall when the door is shut. The latches are held to the door with two straps. The only way to open the door is to grasp the handle and pull it up to a horizontal position. Thus, although most people keep to the right, the



Self-Locking Handles on Double Doors Allow One-Way Passage Only

doors are made proof against the few who persist in doing the wrong thing.—Harry Moore, Rosemount, Can.

☞ In the process of hardening, the fine cutting edges of a tool should never be exposed to the hottest place in the fire; heat the heavy part first, allowing the heat to run to the thin edge.



Attention Newlyweds!

Build This Five-Room English Cottage on the Rear of Your Lot for Around \$2,000 and Later Make It into a Garage

HERE is a practical idea that tunes in with the heart and purse strings of newlyweds and others getting started on the road to home ownership who want to make a little money go a long way.

According to the estimate of the designer, you can build this charming five-room English cottage for around \$2,000. But build it on the rear of your lot exactly where you plan your future garage. Live in the cottage during the time you are saving money to build your dream home on the front of your property. When that time comes, you convert the cottage into a two-car garage. You salvage the casement windows, floors and, perhaps, the plumbing. Use them in the new house. Hang garage doors where the large windows

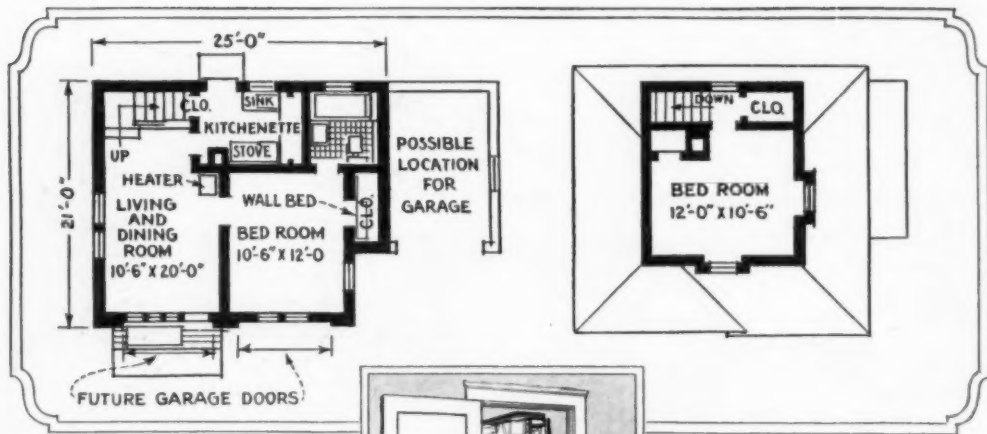
now appear. Use one stall for your own car. Rent the other to a friend or neighbor. You have an income-producing property which over a period of years pays for the original cottage.

Suppose you rent one-half the garage for \$5 per month. That's \$60 a year. The designer says that salvaging the windows, plumbing, floors, etc., would save about \$750. That brings the original cost down to \$1,250. Each stall represents \$625. Now \$60 per year return from garage rent is almost ten per cent on \$625. Not a bad proposition.

But more than this. You live on your property and avoid paying rent to a landlord during the time you are saving for your larger house. You enjoy all the privileges to be had from complete mastery

A NEW SERVICE

To help our readers get started on one of life's most glorious experiences—building and owning a home—Popular Mechanics Magazine will supply readers a one-sheet blueprint of the house here illustrated for \$2. This blueprint does away with the necessity of first purchasing a complete set of plans to find out whether you can afford to build. It contains floor plans, elevations, a section, detail, size of joists, studs, etc., and also a brief specification. Submit it to tradesmen and dealers for building estimates.



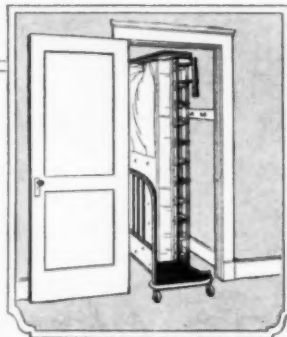
of the sweetest little kingdom you can possibly ask for.

Everybody who sees this plan and investigates the idea likes it—practical builders, real-estate men, carpenters, newlyweds. It is not a trick, stunt or makeshift in any way. It is a simple, inexpensive and highly practical stepping stone to home ownership. You pay as you go. And the financial obligations are easy. That's one reason why so many people approve the idea.

This temporary home is so attractive, charming and refined in its external appearance that you can live in it without loss of social standing in your community. Friends and neighbors may know that eventually your little cottage may be your garage. Even so, because of its small but highly attractive appearance and setting, it will in all probability be one of the most talked of homes for miles around.

What does the house contain? In the first place it offers you the efficiency and compact service of a modern city flat. But you have it all in a detached small dwelling—a distinct advantage.

The style is English. There is a snug-fitting, low-down, close-to-the-ground quality about it. You feel it grows out of the landscape. Note the broken roof lines, perky gables and snubby dormer windows. These things add greatly to the charm and character. Casement windows, rough-stuccoed walls, dark-stained exterior woodwork, and variegated shingles



The Folding Bed Disappears into the Closet by Day

in either wood or composition are in perfect keeping with the style.

Now about equipment. The plan is compact but livable. There is a combination living room, kitchenette, bath, two bedrooms and good closet space. The downstairs area can easily be opened up into one large

room. A concealed or closet bed permits the downstairs bedroom to do double duty.

The house is heated by a first-floor heating plant. There is no basement, although you may have one if you wish. The "lean-to" garage takes care of your present car. The house is of frame construction and fully insulated. There is no variation from tried and proven methods of construction.

One more brief picture and this story is complete. Placed at the rear of your lot, the cottage would look well flanked by box hedges and greenery and perhaps rambler roses will climb the side walls.

What more can you ask for as a stepping stone to home ownership and especially if you do not want to plunge into heavy expenditure to start with?

EDITOR'S NOTE: Popular Mechanics Magazine has prepared a new plan book, "Twenty Popular Low Cost Homes and Ten Commandments for Home Builders." These are selected homes and show labor, space and time-saving ideas. They are \$5,000 homes and less. Send 10 cents in stamps to cover postage. Address Building Editor.