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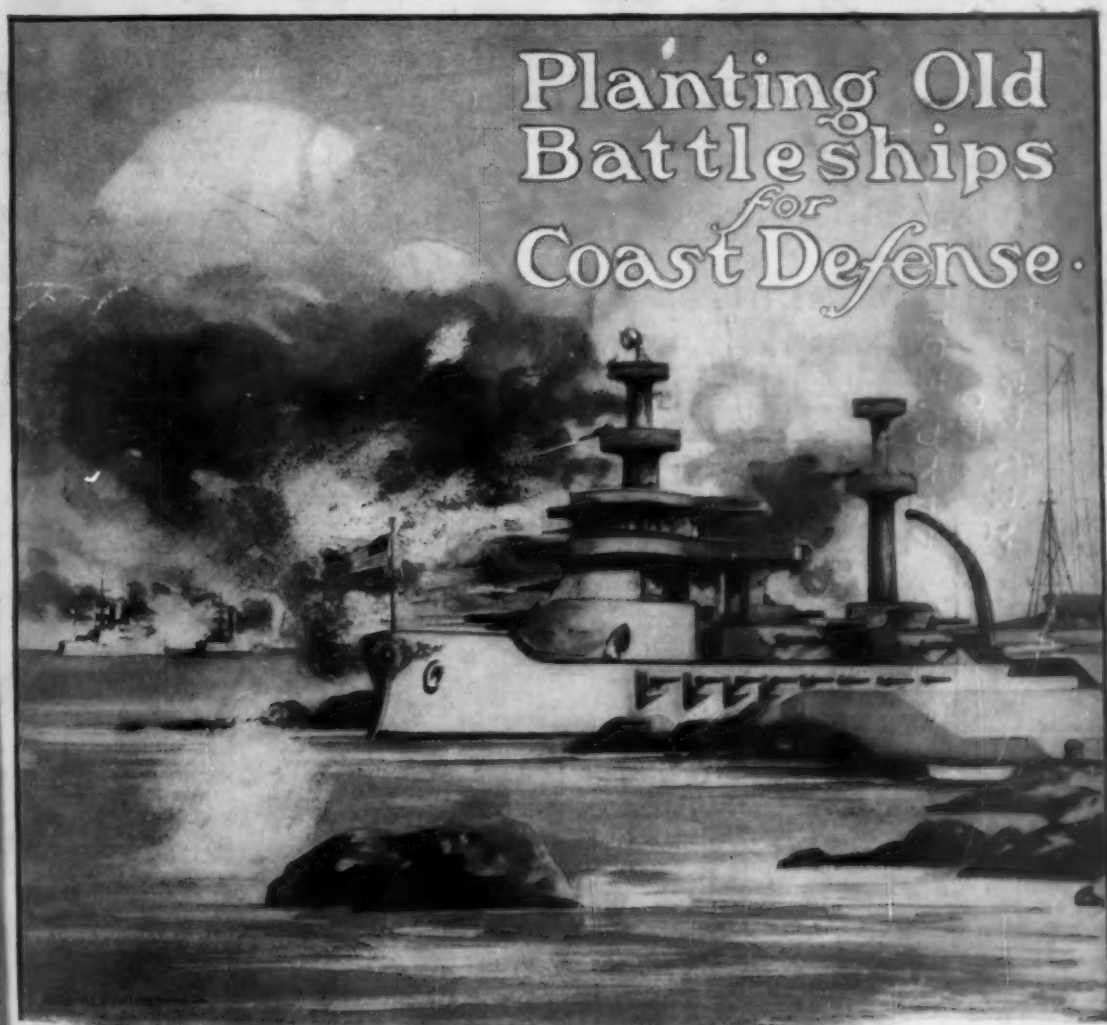

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Popular Mechanics

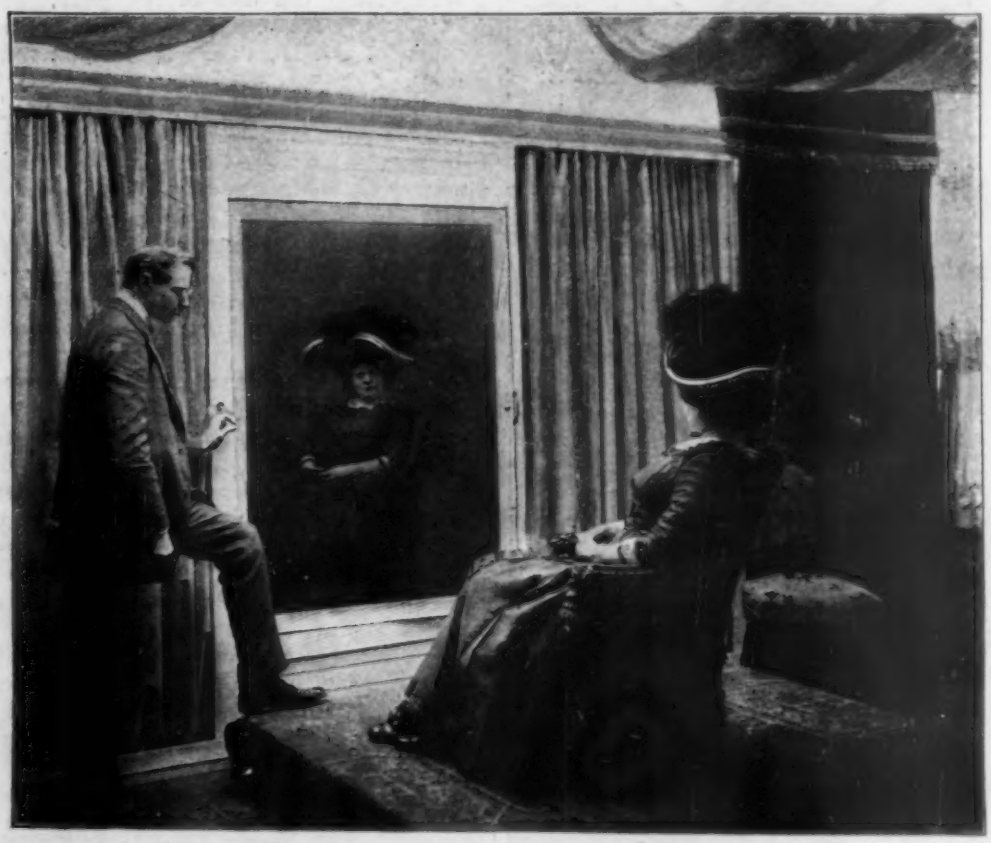
Written So You Can Understand It

Vol. 14 **JULY, 1910** **No. 1**

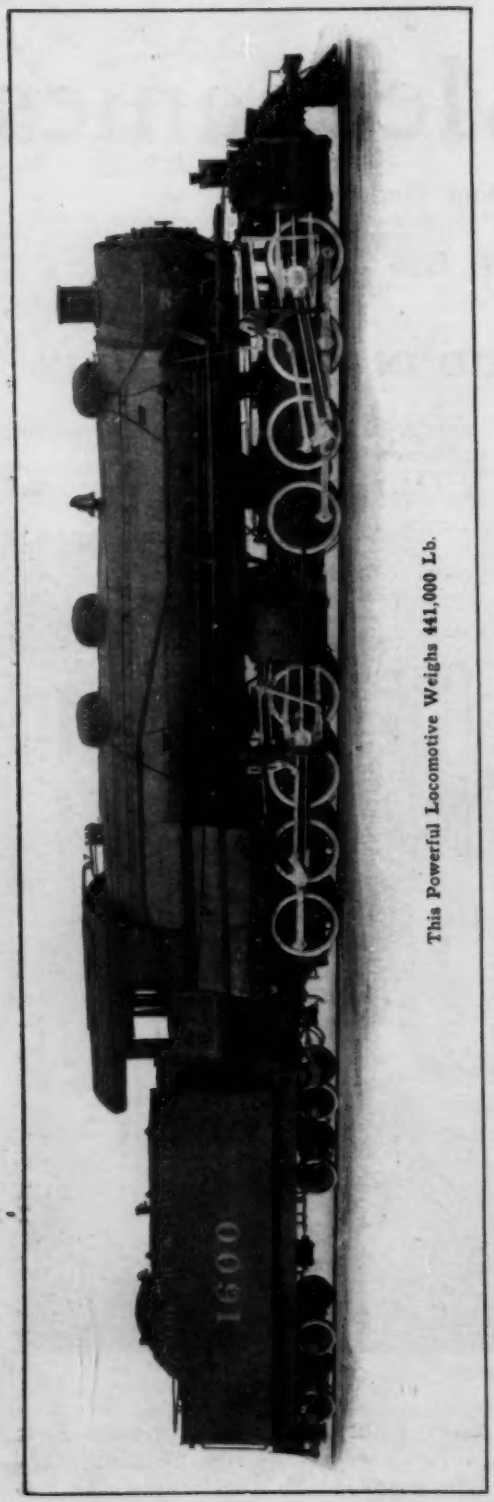
LOOKING-GLASS AN AID IN PHOTOGRAPHY

The looking-glass shown in this illustration of a Berlin photograph gallery is one of the latest innovations in photographic work. Posed before it, the person being photographed can observe the posture as it will be reproduced in the photograph, and judge of its excellence.

The photographing apparatus stuck up in front of the person posing for a picture is often disconcerting and troublesome. In this studio the ma-



Looking-Glass as Part of Photographic Equipment



This Powerful Locomotive Weighs 441,000 Lb.

chine and operating photographer are hidden behind the glass, which swings out of the way after the pose has been selected.

The poses thus taken are usually neither unnatural nor affected.

NEW "MOST POWERFUL" LOCOMOTIVE PLACED IN COMMISSSION

Every few months a more powerful locomotive than any previously built is placed in commission on some one of the railroad systems in this country, and announced as the most powerful in the world. The latest locomotive to acquire this distinction, which it may lose before the end of the year, is a Mallet articulated compound monster built for the Delaware & Hudson railroad.

Ready for the road, this great hauling machine weighs 441,000 lb., not including the weight of the tender. This enormous weight is carried on the driving wheels, of which there are 16, arranged in two groups of eight. High-pressure cylinders, which take their steam direct from the boiler, drive the rear group of wheels, while the forward group is driven by the low-pressure cylinders. The rear group of wheels is carried in frames rigidly secured to the boiler in a manner similar to the ordinary locomotive, but the frames in which the forward group is carried are not attached to the boiler but have a pivot connection with the rear group. With this construction, the front group becomes a truck, which swivels radially about its articulated connection with the rear group, and it is from this feature that the type derives its name. The arrangement makes possible a locomotive with a long flexible driving-wheel base, with the weight distributed over a large number of axles, yet the rigid wheel base is no greater than that of the ordinary locomotive. The locomotive is thus capable of traversing curves of very short radius, while the weight being distributed over a large number of axles, it is no harder on the

track than the ordinary engine of half its weight.

The boiler alone of this locomotive weighs as much as a complete freight engine of a few years ago. It is 44-ft., 10 in. long, and, filled with water and with steam up, weighs 159,700 lb. The weight of the water in the boiler is 52,100 lb., and the tubes, of which there are 446, each 24 ft. long and 2¼ in. in diameter, weigh 30,185 lb. The firebox has a grate area of 100 sq. ft.

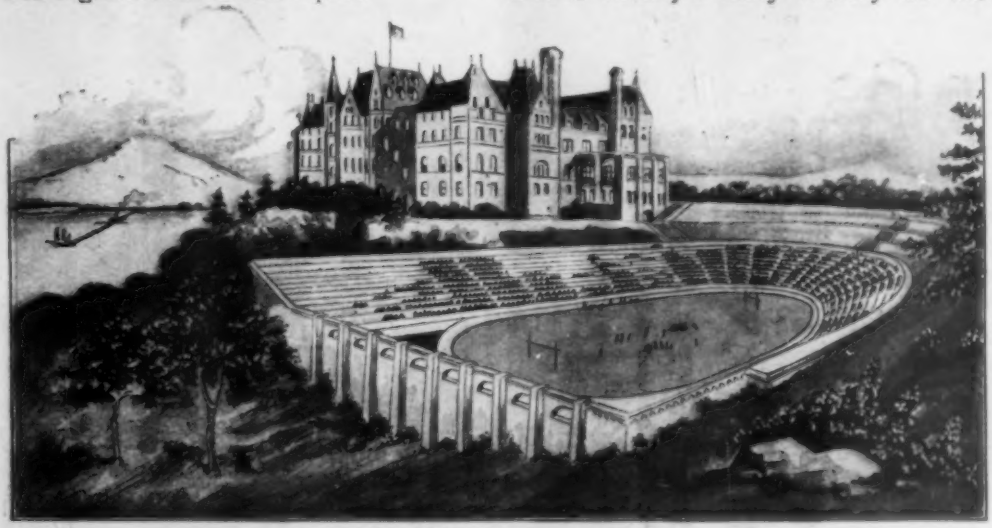
On a straight level track the locomotive will haul 100 loaded cars of 50 tons' capacity each. Five more locomotives of the same size are about to be delivered to the Delaware & Hudson Co. They will be used on the Carbondale division, where the grades are long and steep.

TACOMA'S GREAT STADIUM

Tacoma's high school, which plays an important part in Pacific coast athletics, is the only high school in America having an Olympic stadium, if not the only one in the whole world.

It is a ponderous mass of steel and concrete, just completed at a cost of more than $100,000, in a gulch at one side of the high school building. The gulch happened to be just the right shape for the stadium, so but little excavation was required. The structure is shaped like a horseshoe, with the open end overlooking Commencement bay. It will seat 25,000 people, has a center sufficiently large for baseball, football, track, and field events, and will also be used for outdoor musical concerts and entertainments.

The stadium will be dedicated shortly with a historical pageant depicting the stirring events of Tacoma's and Pierce county's early history as the feature. A movement is already on foot to secure the next Olympic games in America, the people of Washington believing that in the Tacoma stadium they have one of the best arenas in the United States for such an event.



Tacoma's High School and Stadium

The idea of building the stadium was conceived by Frederick Heath, architect of the Tacoma board of education. He made blueprints showing how practical and economical the idea was and explaining how the natural ravine walls, if cement covered, would make ideal seat banks, while the natural gulch floor, with a little sprinkling of dirt, could not be surpassed as an athletic field.

¶Aeronautic experts are now trying to devise a simple method of signaling between airships and between airships and terra firma.

Wheaton as It Will Look When Transformation Is Complete

Wheaton, Ill., as It Is at Present

CHANGING THE FACE OF A STREET

The commonplace appearance of the main street of the town of Wheaton, Ill., but a few miles from Chicago, caused the public-spirited citizens of the town to cast about for a means of improving it. A Chicago architect was consulted, and a short time ago he evolved a plan which gave the Wheaton citizens much delight.

The idea involved the transformation of the front of the buildings on the main street from squatty-looking brick and wooden structures of varying heights into a row of buildings such as might be seen in some of the picturesque towns of England. The old English style will be secured by the use of pebble and cement, and it is estimated that the cost for the entire work will not exceed $15,000.

CAMELS FIGHT TO THE DEATH

Camels are usually peaceable beasts, but at certain times of the year they become aggressive and provide the Arabs with a sport as cruel and picturesque as the bull fights of Spanish countries. The combat is always of the fiercest description, and one camel is killed before the fight ends. The fatality in every fight is due to the fact that camels fight with their necks and knees, never with their teeth. Each camel endeavors to twist his neck around that of the other in a manner that will suffocate, to catch his adversary's neck between the knees and choke off the breath, or to crush the body between the knees. The hold that wins the fight is exerted until the loser is dead.

Beginning of the Fight

End of the Combat

DESTRUCTIVE EFFECT OF LOCOMOTIVE BLAST

Several bridges over railroads in Boston have provided excellent examples of the destructive effect of locomotive blast. One of these, the Cottage Farm bridge, built in 1896, with a clearance of only 15 ft. over the tracks of the Boston & Albany railroad, has a floor supported by hollow-tile arches strung between the webs and flanges of steel I-beams. Thick lead plate was used as a protection but within 10 years the blast ate entirely through the lower faces of the tile and cut out pieces of the lead protection, so that the tile, in many instances, fell.

Another Boston bridge, over the Boston & Maine railroad, furnishes a second example. Over the up-grade track, where the locomotives pass under forced draft, the wooden stringers have become corroded to a depth of about ¼-in., while over the down-grade tracks, where running is not under forced draft, no erosion is noticeable.

METALS ARE SAID TO HAVE DISEASES

That metals have diseases, and spontaneous change is as true of inorganic materials as it is of organized entities,

Scoring Device in Operation

is advanced by the London Lancet.

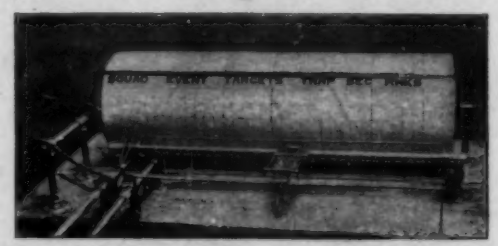
"Yellow phosphorus gradually assumes a new complexion, if left to the agencies of time, finishing a beautiful dark red," says a recent article. "Tin crumbles to a gray powder if exposed for a long time to the cold, and this is known as 'tin plague.' This plague is even infectious, for on inoculating other masses of smooth polished tin with small portions of the crystalline metal, the disease spreads, the area affected increasing in diameter daily. Tinfoil succumbs to the infection in the same way and becomes brittle all the way through. Why does the railway line snap except that it is attacked by the same crystallizing disease? It would even appear that certain metals have their 'illness,' as though their activities were interfered with by a toxic process which may be pushed in many cases to such an extent that the metal 'dies.' Platinum, for example, in its colloidal form, in which it is very remarkably active, is positively poisoned by prussic acid or corrosive sublimate; its great energies cease to act; it is killed."

AN AUTOMATIC SCORER FOR SHOOTING CONTESTS

A scoring machine for use at competitions among marksmen has been invented by a Decatur, Ill., man. The machine is set on the field in front of the gunner and as each shot is made the result is registered—hit or miss—in plain figures in view of the marksmen and the gunners.

The cylinder, 36 in. long and 37 in. in circumference, holds a sheet, capable of scoring four squads of five men each. The sheet is held in place by four steel bars so that the score of each squad can be torn away when complete.

The type which print the figures 1 and 0 (the only two needed for scoring) are on a carriage, moved by a chain and cog wheels which are moved forward or backward across the sheet at will by the operator. Two separate cords control the type. When the figure "1" goes up and leaves an impression on the cylinder, the ink roller rests on the figure "0" and vice versa. In a tournament where the contestants are average shots there would be little use for the figure "0," so it is possible to ink the "1" by a slight pull of the cord. In a test the machine scored 125 targets or 5 men shooting 25 targets each in 4½ minutes, which is a good time record for a 75-target event.



The Scoring Cylinder

As the figures over an inch high are easily read 25 or 30 yd., the machine can be set at longer distances by add-

ing more pipe, through which the cord passes. In rainy weather, a cover like a buggy top protects the machine.

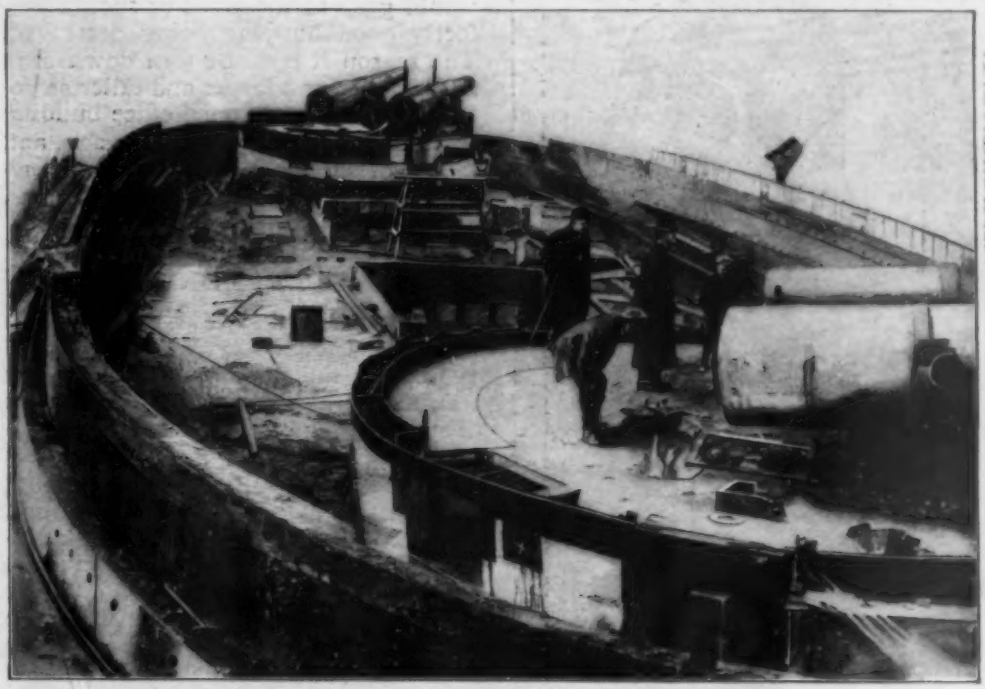
Scoring has been done by hand in the past, but the new device keeps the result in view of the spectators, a previous difficulty.

TANTALUM DENTAL INSTRUMENTS

Tantalum, a non-metallic substance found in certain minerals, so named, according to Webster's dictionary, because of the perplexity and difficulty encountered by its discoverer in isolating it, is now being used as a material for dental instruments.

A manufactory of such instruments has recently been established. Many advantages, besides lower prices, are claimed for them over the steel instruments. Among these advantages are hardness, freedom from effects of acids —except fluoric acid—and capacity to withstand a high temperature.

Dentists who have used tantalum instruments say they will not rust when left exposed to the air, but retain their polished surfaces, besides proving more lasting than steel. They can be cleaned by washing in soda, and disinfected by boiling in water containing soda. In working with phosphate and silica cements and amalgams, they have special advantages.



Partially Demolished English Battleship

THE BREAKING UP OF A BATTLESHIP

The H. M. S. "Thunderer," once a great battleship, would hardly be recognizable as a battleship in this illustration, were it not for the guns, partially dismantled. The "Thunderer" saw her first day of service 33 years ago. At that time she was considered a powerful fighting ship, being 285 ft. long, 63 ft. in beam, and displacing 9,330 tons. During the last years of her active service she carried the four 10-in. guns seen in the illustration.

A few months ago she was sold to a ship-wrecking company. It will take 100 men two years to break her up for the material she contains. A great "super-Dreadnought" is to be built to bear her name.

AN ANIMATED WRENCH

A unique method of advertising the type of wrench known as the Stillson was adopted at the recent convention

Ingenious Wrench Advertisement

of the New England Hardware Dealers' Association in Boston. The handle of the wrench was formed by a man, and the movable jaw provided a canopy for his head.

SKYSCRAPER TO BE DEMOLISHED

In the eyes of European visitors, one of the most curious of American traits is the apparent joy with which buildings, only recently erected, from a European standpoint at least, are torn down to make way for new. In England and Continental countries buildings are constructed with the expectation that they will last for all time, or at least until they fall to pieces from decay in the course of several hundred years.

An Englishman approaching the corner of Nassau and Wall streets, New York, during the intended demolition of the 16-story Gillender building, would gasp at the sight of such a perfectly good building being destroyed. The reason it is to be torn down is to make room for a larger and taller structure. It is a steel-frame office building erected in 1896, only 14 years ago, and is one of the most pleasing in appearance of all the New York skyscrapers.

FLUSH MOUTHPIECE FOR TELEPHONES

A flush mouthpiece for telephones has been designed by a New York inventor for the purpose of making the transmitter more sanitary. It consists of an aluminum cup attached to the diaphragm of the transmitter by means of the bolt and nut used in fastening the front electrode to the diaphragm. The cup extends through the transmitter case and its outer edge is turned over so as to come nearly flush with the face of the case. The cup fits close enough to the case to seal its interior from dust and dirt, but does not come in actual contact with it. There are no grooves for the lodgment of dust or dirt.

Tests of the new transmitter are claimed to prove that it gives just as

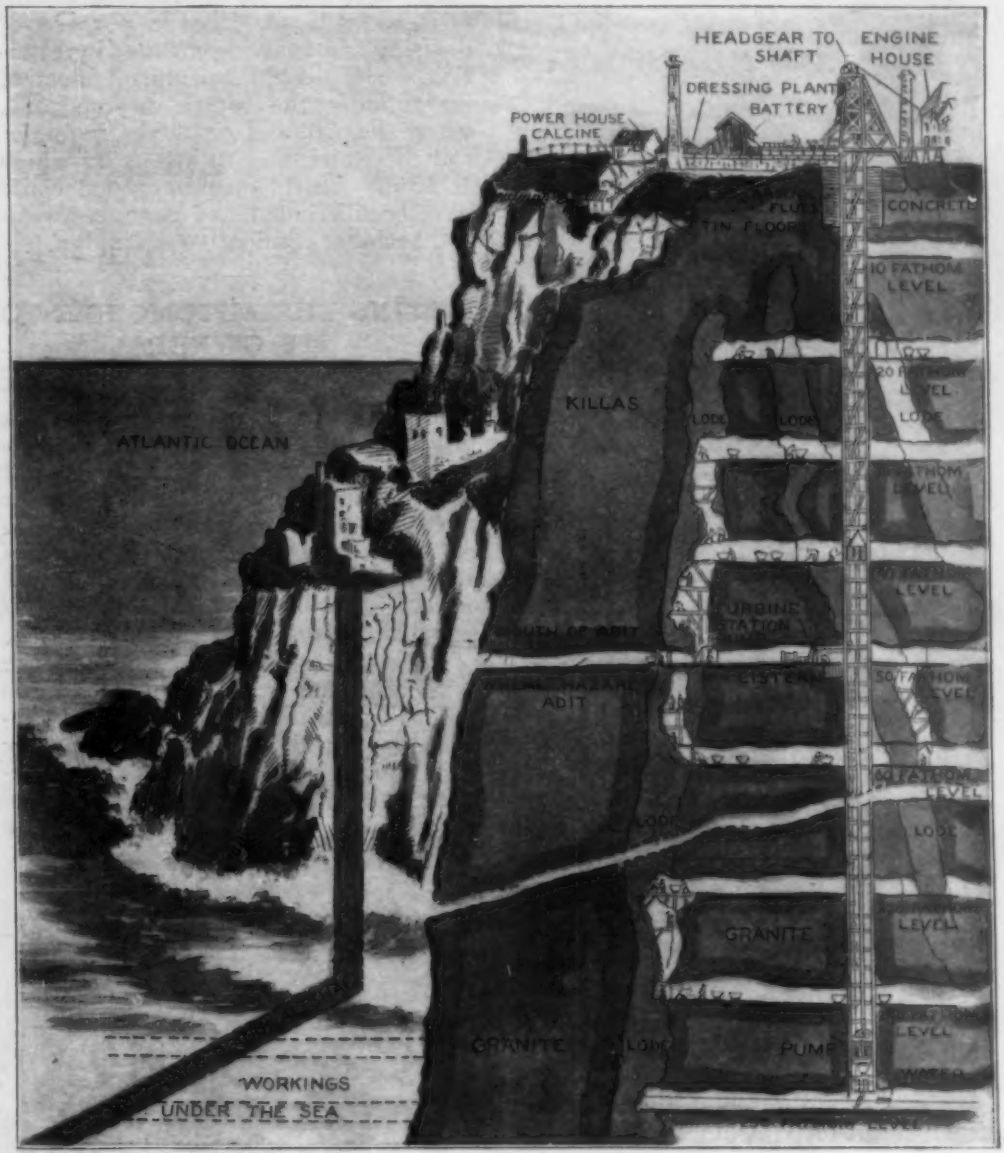
Dirt-Proof Telephone Mouthpiece

good service over distances of from 1 to 500 miles as the cup type now in general use.

MINING TIN UNDER THE SEA

Several of the tin mines of Cornwall, England, have workings extending out under the Atlantic ocean, one of the most extensive of which is the Botallock mine shown in the illustration. It is situated on the most rugged, wild, and picturesque part of the Cornish coast, a few miles from Penzance, and a large portion of its workings are under the sea.

The location of the lodes of tin in the cliff, and the method of working them from drives is shown. The same method is adopted in the working of the lodes underneath the sea, which are reached through the shaft shown in the drawing as the Boscawen diagonal shaft.



Courtesy the Graphic, London

Famous Tin Mine in Cornwall

LLAMAS TRANSPORT CEMENT AND SAND IN PERU

Llamas are used to a great extent in the mountainous parts of Peru as

Llama Transporting Sand

carriers of material for engineering and construction work. The llama shown in this illustration is carrying 100 lb. of sand for use in making concrete and mortar for the construction of a mining, smelting and refining plant. In this particular instance the llamas carried both sand and cement a distance of about three miles over a mountain pass, the owner of the animals receiving seven cents for every 100 lb. of material delivered, which was seven cents an animal per trip.

Llamas are handled in trains of from 30 to 40. They cannot stand steady work and become balky, consequently they usually work two weeks and lay off one. The loads they carry usually weigh 100 lb. If more weight is added they know it, and are quite likely to refuse to move until the excess is removed from their backs. They are stubborn enough at such times to take any amount of punishment rather than give in.

¶A farmer recently invented a device for making concrete water barrels. He put a small wooden barrel inside a larger one, and filled the space between them with concrete.

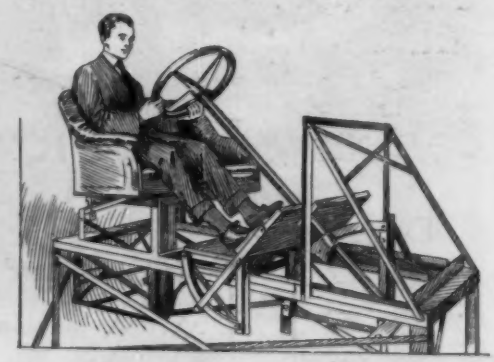
NORTHWESTERN RAILROAD TO STUDY ACCIDENTS

A systematic study of the causes of accidents is to be made by the general claim agent of the Chicago & Northwestern railroad, for the purpose of devising and applying means of prevention. The official will spend most of his time in the future on the road, where he will get employes together, call their attention to means by which accidents which have happened could have been avoided, and conduct a general accident elimination campaign.

FITTING THE AUTOMOBILE TO ITS OWNER

Nearly all of the large automobile factories do more or less custom work in fitting automobiles to their prospective users in very much the same way as a clothier alters ready-made suits or overcoats to fit purchasers. The great difference in the length of arms, legs and body sometimes makes it more comfortable for the owner of a car if the position, distances, and angle of the seat, footboard, and steering wheel are made accordingly.

The framework shown in the illustration is the adjustable means by which one concern makes measurements for such cases. The seat can be raised and lowered, the footboard tilts



Measuring a Man for an Automobile

to different angles, and the steering-wheel rod can be shortened or lengthened.

Uncle Sam's Greatest Reclamation Project Nearing Completion

The Roosevelt Dam, Titanic Structure of Sandstone and Cement, Costing Nine Million Dollars, Will Convert Barren Wastes Into Fertile Acres

By L. W. THAVIS

THE Roosevelt dam, the greatest engineering work in connection with the Salt river irrigation project in Arizona, which ranks first among the works of the United States reclamation service, will be completed in July. Should present plans be carried out, former President Theodore Roosevelt will, if he accepts the invitation, formally open the project on his birthday, October 27.

This wonderful structure of sandstone and cement, costing nearly $9,000,000, rises 284 ft. above Salt river. It is 1,080 ft. long on top and 170 ft. thick at the base. Its foundation covers one acre of ground. Placed by the side of a 20-story building, it would rise 10 ft. above it, while its length on top would be more than two city blocks. Across its top will be a roadway 20 ft. wide.

The reservoir created by the Roosevelt dam is the largest artificial body of water in the world. Its capacity is sixty-one billion cubic feet, and if its water were spread over the state of Delaware it would cover the entire surface of the state a foot in depth. Another comparison of its capacity, made by the government engineers, is that it would easily feed a canal 300 ft. wide and 19 ft. deep from Detroit to San Francisco.

Cement Plant Built by Government at Roosevelt

This government work is interesting not only to the engineer, but also to the layman. It is located in a valley which has been the abode of three races, one of which lived there when Rome was young. Two wonderful cliff-dwellings are almost in sight of the modern structure that is soon to submerge some of the lands which formerly produced their harvests.

Owing to the remoteness from transportation, the government engineer had to engage in many enterprises. He built roads to get machinery in. He sawed millions of feet of lumber from the national forests nearby. He turned farmer and raised his own produce, his hay, pork, beef, and chickens.

In the construction of the dam 330,000 bbl. of cement was required, but the lowest bid from the cement manufacturers was prohibitive. In this problem the engineer was undaunted. He found a limestone ledge near the dam and proceeded to erect a cement mill. The necessary clay was found a mile away, and a railroad was constructed to convey it to the mill. In manufacturing its own cement the government saved the sum of $600,000 on this project. Power was essential, so a dam was built sixteen miles upstream, turning a part of the river into a power canal.

Sawmills were set up in the national forest, 30 miles away, and several million feet of lumber were cut and hauled to the works. Two farms were cultivated to supply vegetables and provisions, hogs and beef for the laborers. Waterworks and electric light plants were established. A city of 2,000 people sprang up in the valley—a town of transient renown, for it has already nearly disappeared.

For laborers the government turned to the Indians living in the mountains. Though many of them were Apaches, they proved tractable and industrious, and it was largely by their labor that the remarkable highway was constructed.

From the big dam and from drops in the canal 26,000 hp. will be developed. A part of it will be transmitted to the Sacaton Indian reservation to pump water from wells upon 8,000 acres belonging to the Pima Indians—an act of justice long postponed, for the tribe was beggared by the robbery of their water supply by the white men.

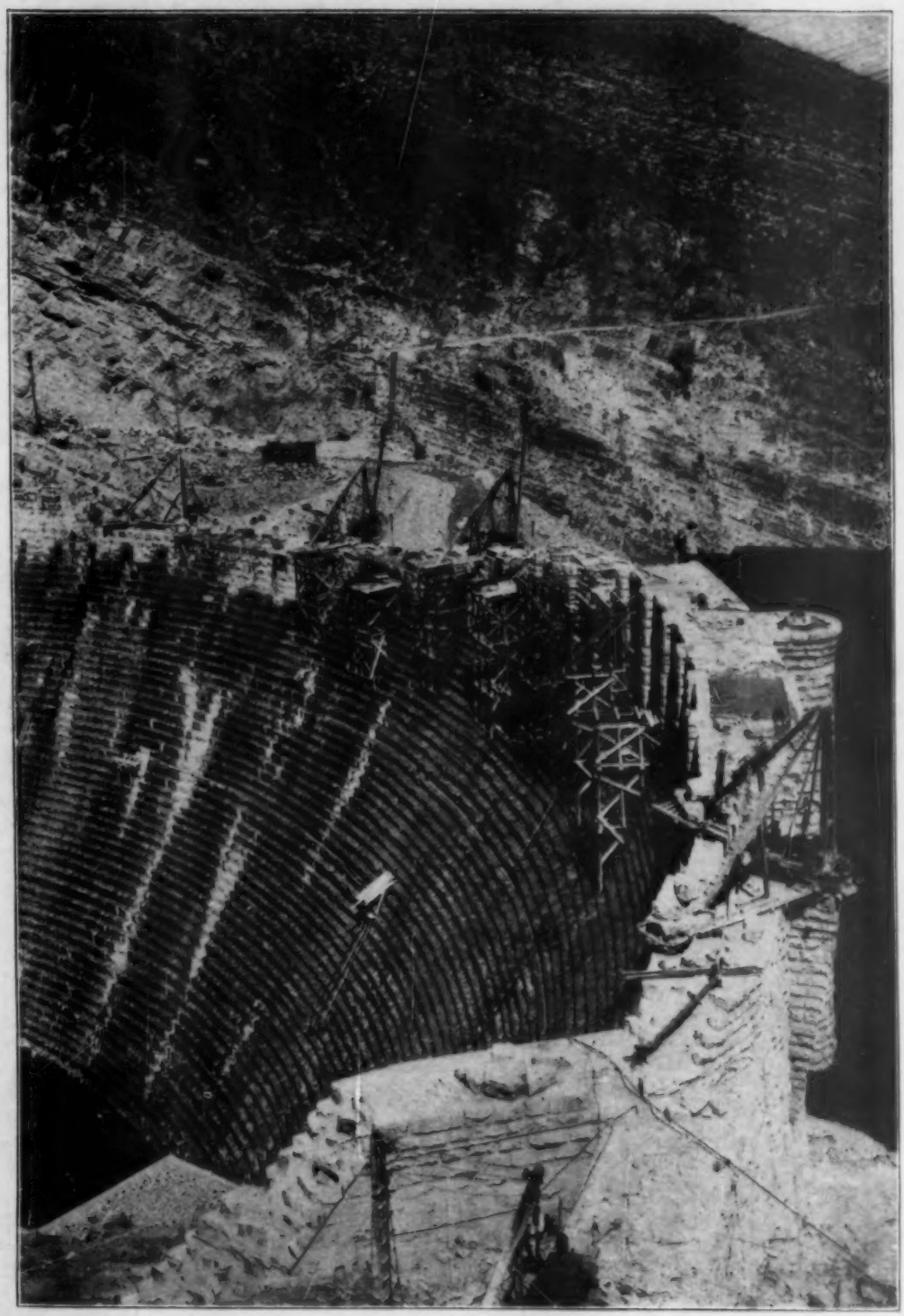
The project when completed will irrigate 240,000 acres of land. It is estimated by expert agriculturists that the crops of a single season will return enough to repay the entire investment of the government.

The acreage now irrigated by the system in operation is 131,000, the balance of 109,000 acres will be irrigated on completion of the Roosevelt dam and the necessary pumping plants in 1911. The irrigated lands in this valley are selling today from $100 to $750 per acre, according to the reclamation service officials. Lands not yet irrigated, but which ultimately will have water right, are selling from $65 to $150 per acre depending upon location, etc.

All lands embraced in the Salt river project are pledged to the repayment of the government's investment. The character of the security is indicated by the present selling value of the land. Taking the lowest unit of land value, $65 per acre, as a basis, the value of the 240,000 acres in the project is $16,400,000, which is practically mortgaged to repay the federal investment of $8,640,000 by less than $1,000,000 annually.

An estimate derived from careful compilation by a special field agent of the department of agriculture places the average value per acre of the crops now grown in this project with insufficient water supply at $39.60. In other words, a single annual harvest from this valley, when all the lands are in cultivation, will more than equal the cost of constructing the whole Salt river project.

Arizona is America's Egypt, but, unlike the land of the Pharaohs, whose secrets are revealed to us in hieroglyphics which our wise men have learned to read, the history of the ruined cities of the Southwest and the race that built



Looking Down on Roosevelt Dam

View of the Dam Showing Position in Canyon

them is yet unfathomed, despite the persistent research of archeologists and other interested persons.

This is our land of mystery and enchantment, where nature has painted the landscapes with the rainbow's hues. It is the land of the painted desert, with its inspiring scenery and colors; it is the land of the Grand Canyon, Nature's architectural masterpiece, the Titan of chasms; the land of the meteoric mountain and the petrified forests. With resources of soil, minerals, and forests as varied as the wonderful colors of the landscape; with every gradation of climate from north temperate to semi-tropic; with an area double of New England and a population less than that of the city of Washington, Arizona is yet practically undeveloped and almost unexplored.

Over its vast expanses of divinely tinted desert wander the Bedouins of the United States. Here and there on the higher mesas, or beside the deeply eroded waterways, dwell the strangest people on our continent. This land of mystic dreams, of lost races and crumbling ruins, is awakening to the touch of modern civilization. The streams that once swept on unchecked through gorge and canyon are now being spread upon a thirsty land, and emerald-tinted oases are dotting landscapes which for ages were barren and desolate.

After the long and dusty ride across Arizona the traveler who awakes in Phoenix in the early morning feels transported into a new world. He is in a land where vegetation is almost tropic in its splendor and luxuriance. Here are avenues of palms whose spreading branches bend in graceful curves. Here the orange, the lemon, the olive, and the pomelo attain perfection in color and flavor. The date palm, laden with luscious fruit, the bread of the desert; the delicious fig, the almond, and countless other donations of generous nature are seen on every hand. Broad fields of alfalfa, yielding eight tons to the acre; bumper yields of grain, vegetables, and small fruit reward the man with the hoe in this land of sunshine and plenty. The soil's response to tillage and moisture is immediate—yea, it approaches the miraculous.

But earth grants no harvest here without labor and expense. The desert, vast and forbidding, is near and threatening. Its threat of desolation is vitalizing; it energizes the man who engages in the combat. It thrusts its boundaries to the very edge of the irrigation canal which embraces the oasis. More than once in early days, when Salt river failed, the desert swept across the ditch and engulfed the fields and orchards. Such disasters emphasized the need of an assured water supply and led to the initiation of one of the most stupendous irrigation projects of our time in Salt river valley.

In the variety of the engineering problems, in the magnitude of the works, and in the extraordinary character and number of difficulties surmounted in prosecuting the work, the Salt river project ranks first among the works of Uncle Sam's reclamation service.

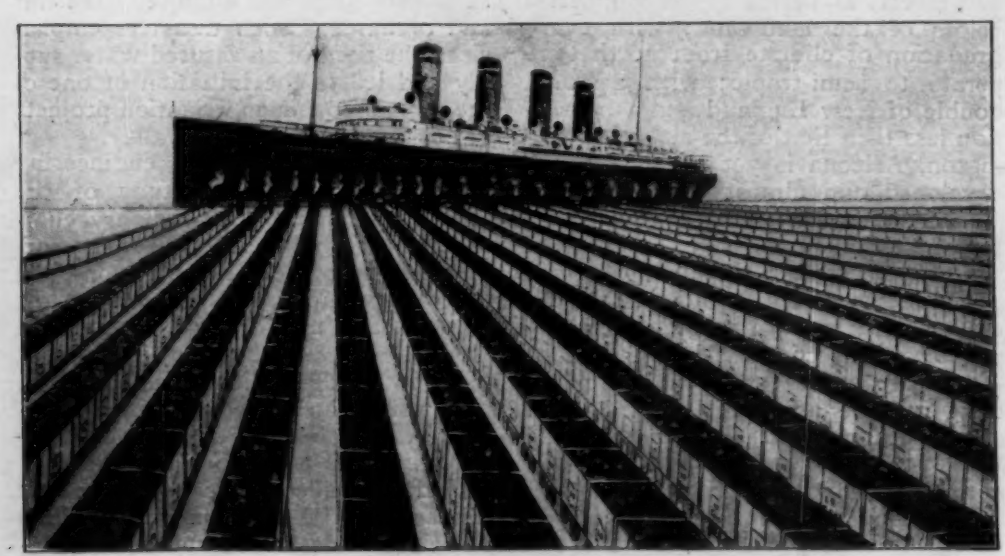
A few of these difficulties are made manifest by an inspection of the country in which the work is going on. The Salt river for a number of years furnished an inadequate supply of water for the needs of the farmers. At times great floods destroyed important headworks and caused heavy losses until the necessary repairs could not be made for lack of money. Near the headwaters, in an almost inaccessible mountain region, was one of the best natural reservoir sites in the West. To develop it involved an expenditure so vast that it was beyond the means of the community to attempt it. Congress enacted the reclamation law and the reclamation service took up the great work.

For 20 miles across a desert of cacti and mesquite, an absolutely waterless plain, a broad highway was laid out to the foot of the mountains. For 40 miles further into the most rugged mountain country in the West the road was blasted from the rocks.

In scenic beauty and in artistic and changeful coloring no highway in the

West compares with it. The mountains are inspiring and the rocks are clothed in richest colors. No language can describe the glories of the sunrise or sunset pictures on those crags and cliffs, or the witching beauty of the deep canyons veiled in purple shadows. It is a drive, once taken, never to be forgotten.

The entrance to the canyon which Salt river has cut through the mountains was selected as the site for the Roosevelt dam.



Coal for One Trip

COALING THE "MAURETANIA" IN ENGLAND

The coaling of either of the great Cunarders, which will hold the record of being the largest vessels in the world until the completion of the two White Star monsters, is a tremendous task, made all the more difficult because care must be taken to keep coal dust from flying.

Just how much coal is required for a journey across the Atlantic is graphically shown by this illustration used through the courtesy of the Sphere, London. The amount of coal necessary is 7,000 tons. It is taken to the Mersey docks in small coal cars of 10-ton capacity. These cars, allowing 32 to a train, would make the 22 trains shown in the illustration. Yet, this amount of coal, which, in the drawing, looks as if it would completely fill the ship, occupies but a small proportion of the space. It is hidden deep in the bowels of the leviathan, below the 700-ft. water-line of the hull.

If it were possible to discharge the coal into the ship by the aid of great cranes the task would take only a few hours, but this method would expose the entire ship to clouds of coal dust. Consequently, the cars of coal are discharged into low, flat barges and towed in long rows alongside the ship. Just on the water-line a number of oblong doors are thrown open, and through these the coal is shoveled into the dark caverns by hundreds of men, working night and day until the task is completed.

"When the number of all those who are directly employed in the process is found and multiplied by those dependent on them or who make their living by catering to their wants," says the Sphere, "it may be assumed that for every 1,000 persons crossing the Atlantic the strenuous labor of 10,000 and probably the livelihood of 20,000 must be involved."

A Pond of Oil in California

STORING OIL IN PONDS

To those whose one idea of oil storage is in huge tanks, this illustration will be interesting. It shows 15,000 bbl. of oil in storage on the property of the Templor Ranch Oil Co., in California. Viewed from the hills in the distance the oil ponds might be taken for the kind of muddy ponds of water frogs delight in.

MOVING-PICTURE SHOWS PROPOSED FOR TRANS-ATLANTIC LINERS

The suggestion has been made by persons interested in the moving-picture industry that shows for the benefit of the steerage passengers be given on the trans-Atlantic liners. Thousands of such travelers arrive in America every week, and the six or seven-day voyage sometimes becomes quite tedious. The first and second-class passengers, according to the Moving-Picture World, might also find such shows on steamships interesting.

¶Eighty-three vessels met with disaster and 225 persons perished by shipwreck off the New England and British North American coasts during the fall and winter of 1909-1910.

SUGGESTED FAD IN WALKING-STICKS

A writer in Black & White, a London magazine, suggests that the handles of walking-sticks for unmarried ladies should bear the carved likenesses of the admirers paying them court. At each

Courtesy Black and White

Admirers as Walking-Stick Handles

addition to the catch, a new stick should be ordered carved, but, so advises the writer, the collection should be burnt before marriage.

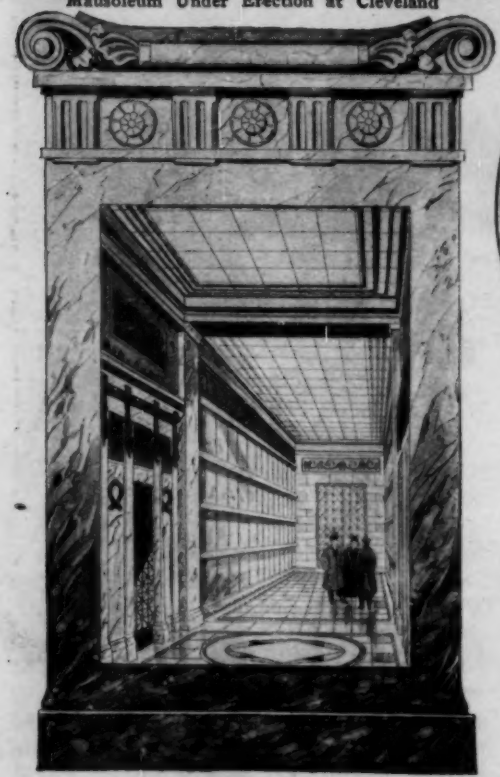
CONCRETE MAUSOLEUMS

Two fine examples of modern mausoleums, one being erected in Brooklyn Heights cemetery, Cleveland, Ohio, and the other to be built in Roseland Park cemetery, Detroit, Mich., are shown in these illustrations.

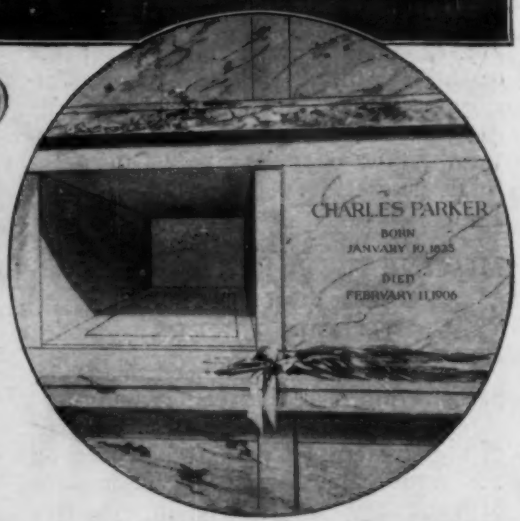
The former is of solid concrete throughout, except the interior lining of marble, and is 133 ft. wide, 32 ft. deep, and about 30 ft. high at the entrance. A main corridor provides access to 400 crypts. The crypts are 2½ ft. wide, 2 ft. high, and 7½ ft. long. When the casket is set in place a marble slab is hermetically sealed into place over the opening. The name of the deceased and such other information as is desirable is carved upon the slab. The illustrations show the exterior appearance, the corridor, and an open and closed crypt.

The mausoleum proposed for Detroit is of Roman architecture, and will be,

Mausoleum Under Erection at Cleveland



Corridor of Cleveland Mausoleum



Concrete Crypt in Cleveland Mausoleum

Courtesy Concreto

Mausoleum to be Erected in Detroit

it is claimed, the largest and most expensive building of its kind in the country. The structure will be two stories high, the outside wall being of reinforced concrete, surmounted by a concrete roof. An inner wall of solid concrete will be separated from the outer wall by a 12-in. air space. The floor arrangement, with its long middle corridor and the solid concrete columns, is shown in one of the illustrations. The middle corridor is open from the first floor to the roof. Access to the crypts on the second floor is made possible by the balconies between the crypts and the columns.

The structure is to be built under certain patents governing new methods of caring for the dead. The crypts will be drained by concrete conduits leading to quick-lime beds under the building. Formaldehyde tanks in the upper portion of the building connect with each crypt by conduits that automatically release the formaldehyde for the purification of the air.

¶Artificial rubber pavements, over which iron-shod vehicles can be run, thus confining motoring costs to gasoline and oil, is the delightful prediction of an English auto enthusiast.

IMITATION SPIDER-WEB VEILS

The appearance of a woman's face covered with one of the imitation spider-web veils being worn to some extent both abroad and in America, is shown in this illustration. The imita-

Face Covered with Spider-Web Veil

tion spider on the veil between the eye and ear takes the place of a court-plaster beauty spot.

BRITAIN'S CROWN PRINCE A CLEVER MACHINIST

Prince Edward of Wales, oldest son of King George V, of England, who be-

Copyright by Paul Thompson, N. Y.
Prince of Wales and Instructor at Work

came crown prince on the ascendency of his father to the throne, following the death of King Edward, is receiving an education which is calculated to give him an insight into every point of the government service. King George was trained as a naval officer and has mapped out a similar course for Prince Edward. He is at present a cadet at the naval school at Dartmouth. He is not afraid of getting his hands dirty working in the machine shops, and has become a skilled machinist.

OLD LACE REPRODUCED IN JEWELRY

Even the intricacies of the lovely old-lace patterns handed down by the lace workers of Brussels and Buckinghamshire are reproduced by the modern jeweler. This class of work, according to an article in the Keystone, has revolutionized his trade, as its delicate nature means that quite as much money is expended upon fine workmanship as upon the jewels themselves.

Jeweled lace effects are now very popular in the European capitals, along with wonderful bows and plaques of precious stones mounted upon gunmetal net, or diamond net. Jewel tracery is so difficult and tedious that four beautiful specimen necklaces composed of oblong pieces of diamond tracery, measuring only three-quarters of an inch in length, were recently sold for $2,000 each.

The latest plaques take the form of wreaths, sprays, and little baskets filled with diamonds and pearls, leaves and flowers.

THE "URSULA" RUNNING 43 MILES AN HOUR

The world's official record for speed on water was broken at the recent motorboat races at Monaco by the Duke of Westminster's powerful racer "Ursula." This wonderful racing craft made an average speed of 43 miles an hour over a course about 4 miles in length. She is 50 ft. long, and her power plant consists of two 400-hp. engines, giving her a total horsepower of 800.

The Fastest Boat in the World

TEACHING OUR BLUEJACKETS TO SWIM

Rear Admiral Schroeder, while training the men on his fleet down in Guantanamo bay, has discovered that some 2,500 of them don't know how to swim, and he reports to Washington that he has taken measures to remedy this defect in their nautical education.

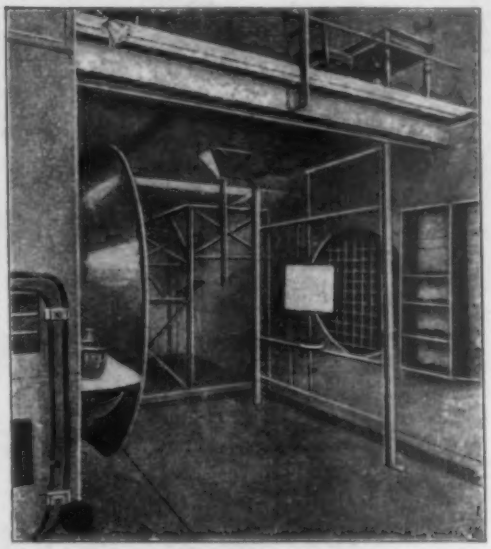
It seems rather remarkable that sailors, with large amounts of water always conveniently near, should lack an art which so many landsmen possess, especially as it is an art the possession of which a sailor is at any moment likely to be in more or less desperate need. It is a fact, however, that seamen as a class swim badly or not at all, and the reason is not far to seek, for, when one comes to think about it, a ship in motion is about the worst thing in the world from which to go in swimming, and the sailor's opportunities for taking to the water, except by an accident, are much less numerous than those of the men ashore.

Moreover, old sailors have been known to argue that since for them falling overboard usually means death, whether they can swim or not, it is better to lack a knowledge that only serves to prolong a hopeless struggle with the merciless waves. That, of course, is bad logic, but it has just enough of truth in it to create something of plausibility to the claim.

AERODYNAMIC TESTING MACHINES ABROAD

The air has undoubtedly been conquered by the flying men in the past couple of years, but that aerial flight is in a measure still in its infancy is being recognized to such an extent that great machines for the study of aerodynamics have been erected in England and France. Tests leading to a better understanding of the actions of the air are being continually made and the fund of scientific knowledge is growing apace.

The scientific end of military aeronautics in England is cared for by the National Physical Laboratory at Teddington, where many testing machines are operated by a committee of well-known scientific men. One of the most interesting mechanisms is a chamber in which various plane surfaces are tested for resistance in air currents of known pressure. The artificial wind is supplied by a powerful fan driven by a dynamo. A delicate set of recording instruments shows the lift and drift of each body in the current. Two of the illustrations show the experimenters watching the effect of a 30-mile-an-hour wind. The planes arranged for testing in the air-chamber are also shown.



French Wind Mechanism for Testing Planes

Another device depended upon for scientific data is the great whirling table, with its 60-ft. arm, at the end of which different types of propellers are mounted to test their "thrust." This is also shown in one of the illustrations. The man in the foreground is turning on the electric current.

France also has machines for experimenting with wind pressures, one of which is illustrated. This is in the lab-

oratory of M. Eiffel. The air is driven through a cellular diaphragm, the rim of which is shown at the left of the illustration, and which strikes against the plane and goes out through the cellular circular opening in the wall on the right. The cellular arrangement is to insure parallelism of the air currents.

UPPER view shows whirling table with 60-ft. arm. This machine tests the efficiency of different types of propellers. Propeller drives long arm around.

LOWER view shows chamber for testing lifting power of different plane surfaces. Smaller view shows planes with which tests are made. Blower on right.

Courtesy Illustrated London News.

THE LAUNCHING OF THE U. S. S. "FLORIDA"

U. S. S. "Florida" Just After the Launching

Huge 10-Ton Steel Jacket For 12-In Rifle of "Florida"

Although the "North Dakota" and "Delaware" have held the distinction of being the most powerful American battleships afloat, that honor was lost to them in May when the "Florida" was slipped into the water at the Brooklyn navy yard.

The "Florida" was about 68 per cent completed when she left the ways and her dead weight was slightly in excess of 9,000 tons, making her the heaviest vessel ever launched in the United States. The fact that there is no drydock at the navy yard big enough to accommodate her made necessary the completion of many details while still on the ways that are usually done after the launching. Her propellers, rudder, and much of her armor was in place, also all of her boilers and most of her machinery.

This newest and greatest of American fighting ships is 510 ft. long, has a beam of 85 ft., will have a displacement of 21,825 tons, and is expected to make a speed of at least 24 miles an hour. Her propelling machinery consists of turbines. The main battery comprises ten 12-in. guns and sixteen 5-in. rapid-fire guns.

During construction, the weight of the ship was carried upon the keel blocks and upon hundreds of shoring timbers. A few minutes before the actual launching, the weight was transferred from the central keel blocks and the shoring timbers to two parallel lines of launching ways. Each of the permanent ways, built up of heavy square timbers, presented a sliding surface, 4 ft. wide, extending the whole

length of the ship and a considerable distance into the water. On top of the permanent ways were the launching ways, which were attached to the hull of the ship and moved with it down into the water. Between the under surface of the launching ways and the upper surface of the permanent ways was a thick coating of grease and oil. Crushing timbers, provided throughout the entire length with a series of oak wedges interposed between them and the launching ways below, were attacked by hundreds of men about half an hour before the actual launching, and the wedges were driven home, eventually lifting the hull sufficiently to clear the keel blocks.

The final moment came when, at the word of command, carpenters, armed with cross-cut saws, commenced to saw through timbers holding the launching ways from starting down the permanent ways. When the sawing reached a point where the strength of the timbers could no longer hold the vessel, it started, slowly at first, and then more rapidly for the water.

TAKING MOTION PICTURES OF THE MOUNT ETNA ERUPTION

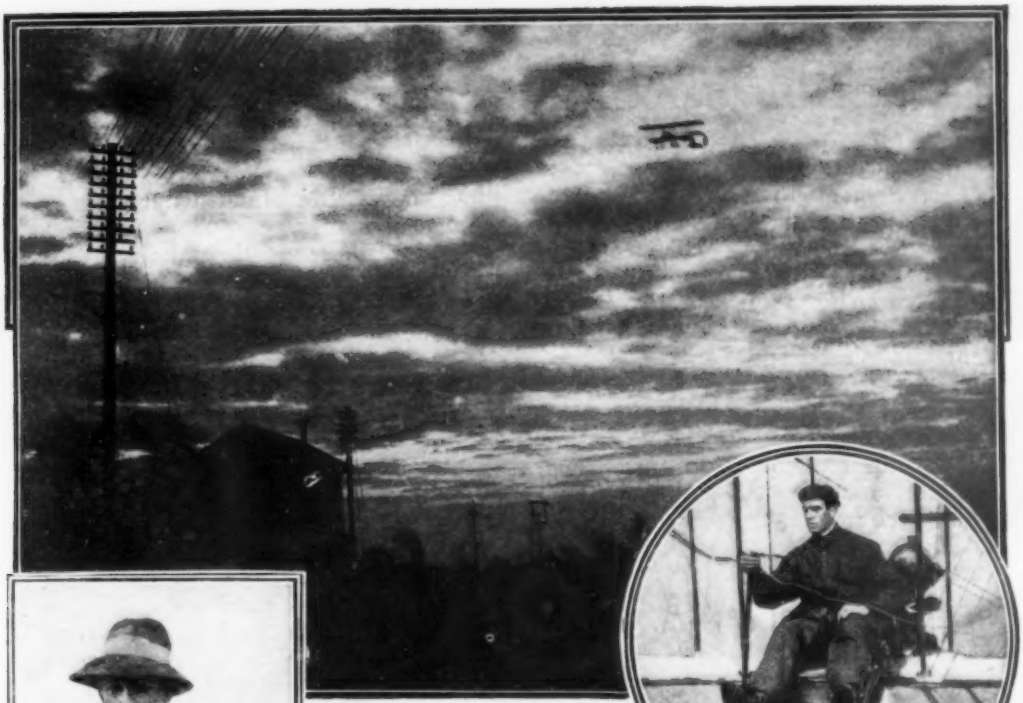
No task seems to be too difficult or hazardous for the motion picture photographer. Often they risk their lives for the sake of securing a thrilling subject to delight the millions of persons all over the world who take pleasure in watching the strange and unusual scenes brought from distant corners of the earth.

The illustration shows two photographers training their apparatus on the belching crater of Mount Etna during the recent eruption. They are located on a neighboring hillside. Despite the dense clouds of suffocating smoke which enveloped them, they, with their native guide, remained until the work was accomplished.

Photographers Working Under Difficulties at Mt. Etna

¶The English Channel was crossed for the second time by an aeroplane on May 21st, when Count Jacques De Lesseps, a French aviator flew from Calais to Dover.

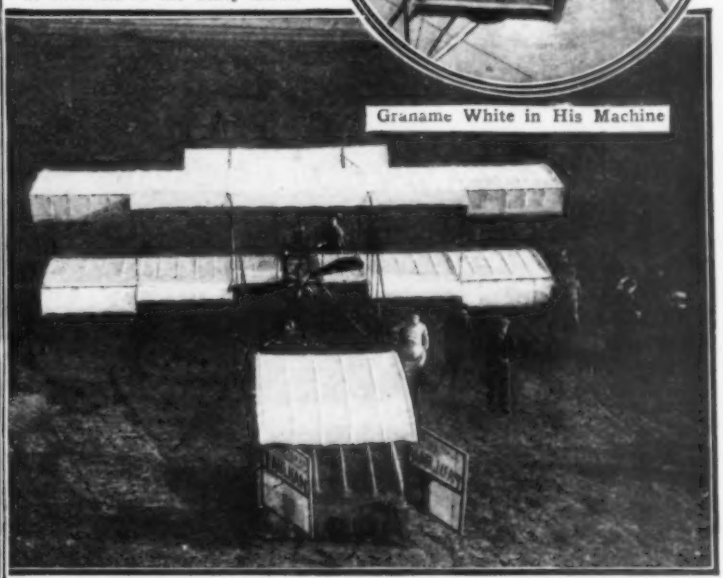
¶That the telescope and marine and field glass business received the greatest boom in its history during the recent comet excitement, is the report of the large dealers.



Paulhan Soaring Over Railway Line at Lichfield in the Early Dawn

Graname White in His Machine

Louis Paulhan



The Farman Biplane in Which Paulhan Made the Prize-Winning Flight

THE RECORD-BREAKING LONDON-MANCHESTER FLIGHT—By accomplishing the flight between London and Manchester, England, in April, for which the London Mail offered a prize of $50,000, Louis Paulhan, the French aviator wrote his name indelibly on the pages of the history of aeronautics. Grahame White, his English rival, won honor by his plucky attempt.

THE ULTIMATE UNIT OF ELECTRICITY

By FRANCIS J. SCHULTE

THAT most powerful and terrible and yet most beneficent of Nature's forces which we call electricity is at the same time the most mysterious. Inspiring at first only terror, then speculation, and finally experiment, its phenomena have been mastered by science and subjected to man's dominion so that now awe has given place to wonder and fear to gratitude. For it gives us not only light, heat and power, but transmits also sound and intelligence, and awaits only the further efforts of inventive genius to shower still greater benefits on humanity. It is the physical manifestation of divine power over life and death, and yet it is servant as well as master of the world.

Prof. Robert A. Millikan, the Man Who Isolated the Ion

What this mysterious force does for us is known; what more it may do is subject for endless speculation and experiment; but what it is has always been a mystery. The generation before this lived in the age of steam. What steam is was known then as it is now. We of today live in the age of electricity, but to this hour no man has yet been able to answer the oft-repeated question: What is electricity? While scientists have been able to harness this mystic force they have all had to admit that they know little about what it is or whence it comes.

The ion is the smallest, the most minute particle or atom in that hitherto imponderable power. The term was introduced by Faraday to denote the current-carriers—the ultimate units bearing the electric charge, either positive or negative. Until this year of grace 1910 nobody had been able to determine accurately the size and character of these units. It remained for Prof. Robert A. Millikan of the University of Chicago, to discover, after four years of study and experiment, that for which scientists have been searching for ages. As a result the world may now confidently anticipate at an early day the unveiling of the mystery—the actual discovery of electricity—for Prof. Millikan has not only reduced the unknown to the ultimate unit, but has measured and observed it, not once only, but repeatedly.

The announcement of this great discovery was made on Wednesday, May 25, to the Sigma Chi Fraternity, the graduate scientific research society of the University of Chicago. In addressing that body, and after giving credit to Mr. Harvey Fletcher, who for five months had assisted in the experi-

ments which have resulted so gratifyingly, Mr. Millikan said:

"1. We have succeeded in isolating an individual ion, and holding it under observation for an indefinite length of time—an hour or more if desired.

"2. We have been able to give a very tangible demonstration of the correctness of the view advanced many years ago that an electric charge is not a homogeneous something—a 'strain in the ether' or an 'imponderable fluid'—spread uniformly over the surface of the charged body, but that it has a definite granular structure, consisting, in fact, of a definite number of specks or atoms of electricity, exactly alike, peppered over the surface of the charged body. It follows, of course, that an electric current, which is simply a charge in motion, consists of a movement of these atoms of electricity through or over the conducting body. This is not asserting anything about the ultimate nature of electricity, but is merely pushing the unknown down into these ultimate electric units or atoms. As a matter of fact, we are pretty certain that all material atoms contain as constituents these ultimate electrical atoms, and it is the vogue now to surmise that these electrical atoms are the ultimate units out of which all matter is built up.

"3. We have succeeded in making a very precise measurement of the value of this ultimate or elementary electrical charge and find it to be 5.13x10 of our absolute electrostatic units. We think this value cannot be in error by more than one-half of one per cent.

"4. We have been able to bring forward new, direct and most convincing evidence of the correctness of the kinetic theory of matter, for we have not only shown directly that a molecule of air is in rapid motion, but we have measured the order of magnitude of its energy of agitation and find it to agree with the computations based upon the kinetic theory.

"5. We have been able to prove that the great majority of the ions of an ionized gas of both positive and negative sign carry one single elementary electric charge, but we have strong evidence that some of these ions carry multiples of the elementary charge.

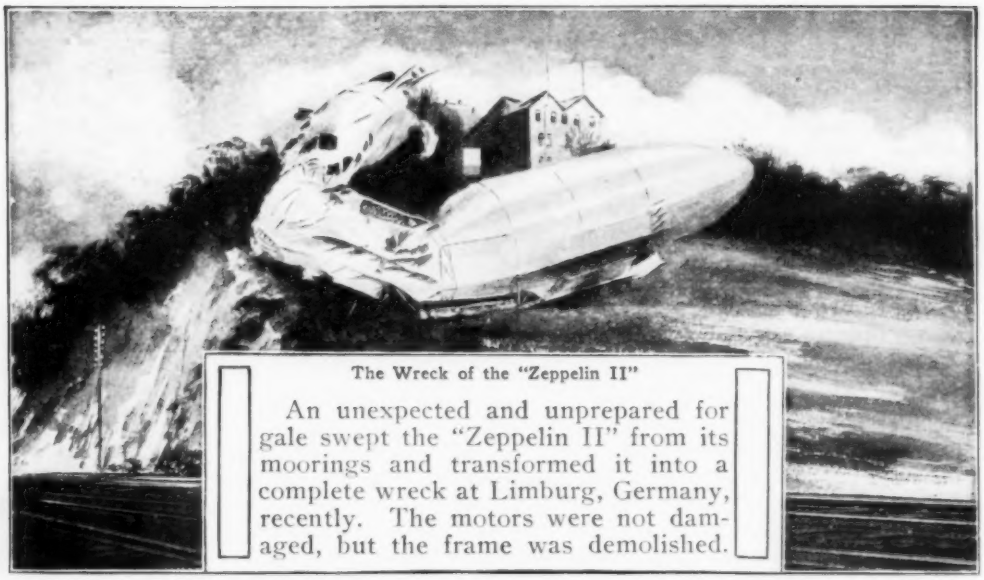
"6. Our results demonstrate in a new way that the negative ion in air is considerably more mobile than is the positive ion. This means that its velocity of agitation is greater and that it moves faster under the influence of an electrical field.

"Our results show that the law of fall of a droplet through a resisting medium, commonly known as Stokes' law, breaks down for droplets whose radius is less than .00026 centimeters. The results further show in just what way this law breaks down."

Prof. Millikan, who was born 42 years ago at Morrison, Ill., and who consequently is now in the prime of life, appears even younger than his years, as will be seen from the portrait printed herewith. He is a graduate of Oberlin College and obtained his doctor's degree from Columbia University, New York. Later he devoted several years to special studies in physics at the Universities of Goettingen and Berlin. He is now associate professor of physics at the University of Chicago and resides with his wife, who is deeply interested in his work, and their two bright little sons, near the institution in whose laboratory—Ryerson Hall—he made his great discovery. He is a very modest man, and averse to talking about his work except before his classes.

The apparatus with which Mr. Millikan made his fruitful experiments is very simple and occupies but little space in the Ryerson Hall laboratory. Describing the method by which his results were obtained, he said:

"We blow a cloud of fine oil of mercury drops by means of an atomizer and introduce one of these drops through a pinhole into the space between the plates of a horizontal air-condenser. The droplet there catches one or more of the ions which normally exist in air or which have been produced in the space between the



The Wreck of the "Zeppelin II"

An unexpected and unprepared for gale swept the "Zeppelin II" from its moorings and transformed it into a complete wreck at Limburg, Germany, recently. The motors were not damaged, but the frame was demolished.

plates by any of the usual ionizing agents, like radium or X-rays. The time of fall of this droplet through a measured distance is observed when no electrical field exists between the plates. Then a field of strength between 3,000 and 8,000 volts per centimeter is thrown on and the time of rise of the droplet under the influence of this field through the same distance is again measured. This operation is repeated and the speeds checked an indefinite number of times, or until the droplet catches a new ion, when its speed under the influence of the field instantly changes, though the speed under gravity remains constant. From the sign and magnitude of the change in speed the sign and exact value of the charge carried by a captured ion is determined."

CURTISS FLIES FROM ALBANY TO NEW YORK

On May 29th Glenn H. Curtiss flew from Albany to New York City in an aeroplane, a distance of 137 miles, winning a prize of $10,000 offered by the New York World. Curtiss made the flight in 2 hours and 32 minutes, an average speed of 54.06 miles an hour, which exceeds the average speed of most of the fast express trains.

The aviator outdistanced a special express train that started out to accompany him on the trip.

Glenn H. Curtiss

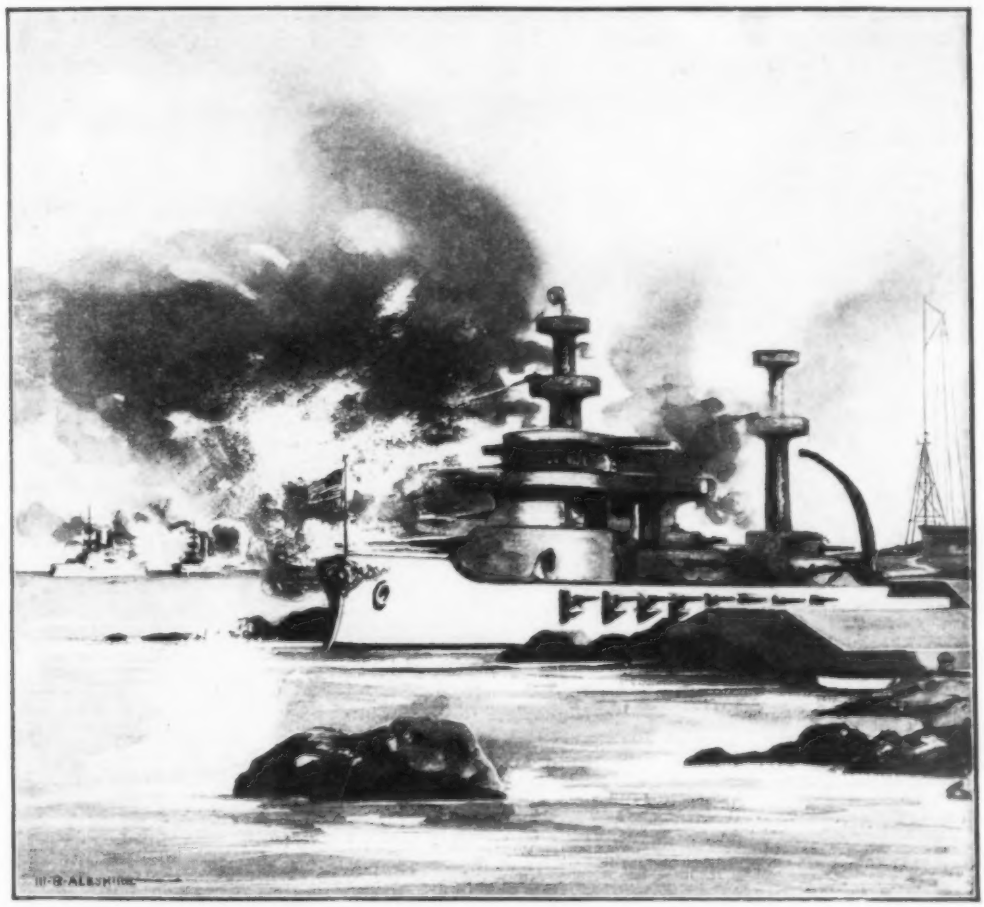
Curtiss made one descent, at Poughkeepsie, where he stopped for an hour.

SHALL OUR OLD FIGHTING SHIPS GO TO THE JUNK PILE?

THE disposition of about 30 ships which have been made practically obsolete as modern fighting ships by the rapid development in the construction of naval vessels and the increased efficiency of the more recent guns, has confronted the navy department with a perplexing problem.

Suggestions for the utilization of the craft are not lacking, for Secretary of the Navy Meyer has many kind advisers on the question. But up to date the secretary is still racking his brain for the solution.

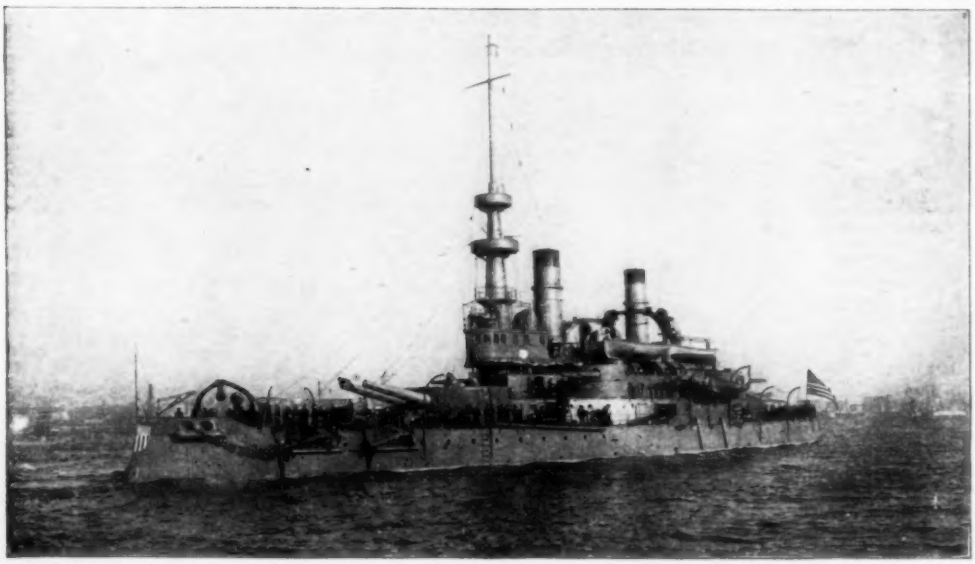
"Sell them for private yachts," was the advice of one member of congress. If there is anyone in the country who pines for an armored cruiser as a yacht, he could undoubtedly negotiate for the purchase of one of the vessels, but strange as it may seem, the navy department has not been overwhelmed with proposals of this kind. Nobody seems to hanker after a yacht which would take a crew of two or three hundred men to run it. Then again, the fuel bill of the proud owner of the cruiser-yacht would be quite a husky



A Battleship Planted in Accordance with Suggestion of Commodore Beehler

one, not to speak of the expense of feeding such a crew, keeping the old craft in repair, and other little incidentals.

The use of a few of the vessels as training ships will undoubtedly dispose of some of them, but that helps only a little. The suggestion which sounds the most practical of any is the utilization of the more powerful ships as forts, stationing some of them in the approaches of important harbors, and planting others on convenient resting places such as small islands, at the mouths of harbors. Where no such



Copyright by Enrique Muller

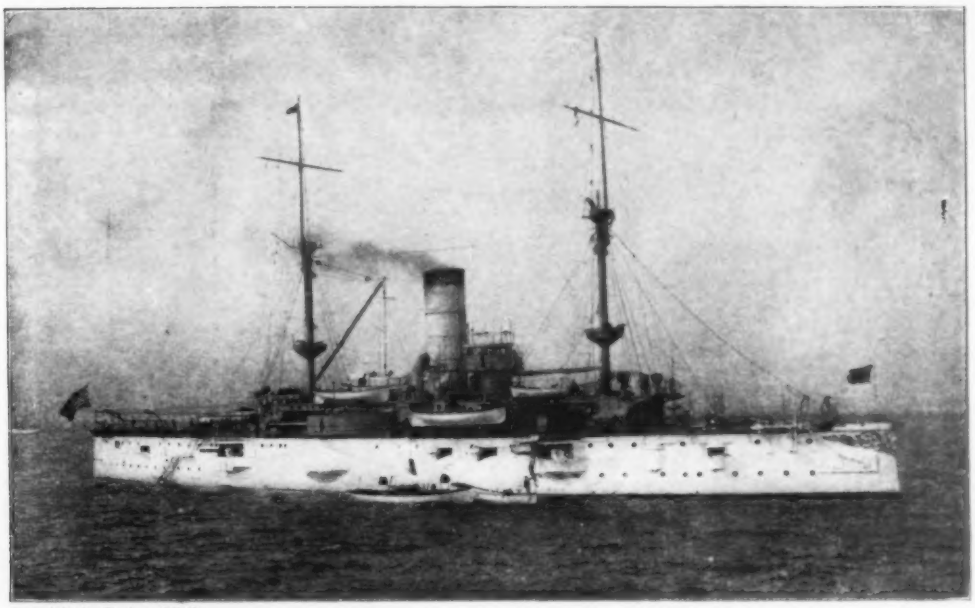
The Famous "Oregon"—May Be Planted as a Fort

places are available it has been proposed to construct small islands around them.

This idea has been approved by Commodore W. H. Beehler, U. S. N., and Congressman Richard P. Hobson, who was, until his resignation from the navy department to enter congress, one of the most able of our naval constructors.

The former declares that Key West, Fla., might be protected by vessels planted on the shoals lining the harbor approaches. He points out that in place of high hills or a huge rock as at Gibraltar, for the mounting of coast defense guns, Key West harbor, 25 miles in length, is sheltered on the north by a line of low reefs and shoals which form a complete protection on that side, while seven miles to the south of this line there is a parallel line of eastern shoals, some of which are scarcely awash at low tide, and none more than 8 ft. above high water. To build forts on these outer reefs would be so costly that it could scarcely be considered, but Commodore Beehler proposes to take our monitors and older battleships which have passed their period of usefulness on the high seas, mount them in selected positions upon these reefs, and utilize them as permanent turret forts. Thus, for instance, selecting the shoal known as Rock Key, where there is a small natural harbor, he would lighten the old monitor "Amphitrite" by the removal of her propelling engines, haul her into the harbor, build around the vessel a dike of piling, rock and riprap, and then fill in the space between the inner face of the dike and the ship with material hydraulically dredged and deposited. He estimates that the work would cost not more than $50,000, and he claims that the seacoast defences would then be increased by a double-turreted fort containing four 10-in. breech-loading rifles, and provided with admirable protection.

The vitals of the fort, that is, the



Copyright by Enrique Muller

Would You Like This Warship as a Private Yacht?—It Is the "Texas"

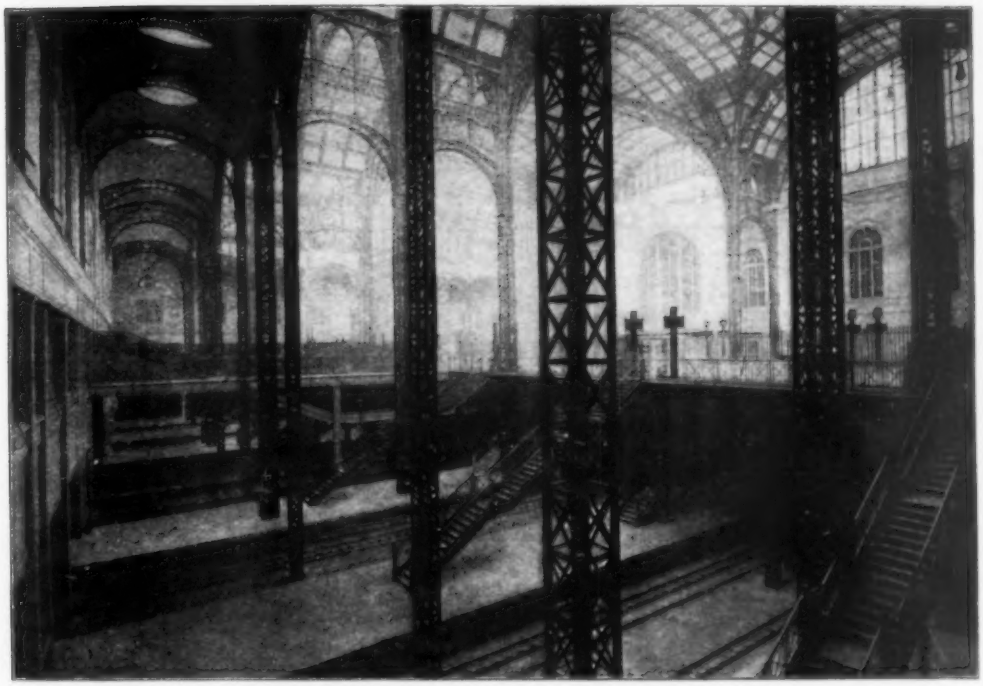
ammunition rooms, turret-turning gear, etc., would be protected, not only by the armor of the ship, but also by many feet of the enclosing earth and riprap. The deck of the monitor would be about 8 ft. above mean low water, and the riprap would be carried up the sloping face, leaving only the turrets and superstructure exposed. The ship, as thus embedded, would furnish, says the Commodore, a complete, modern, double-turreted fort, with every necessary feature to operate the guns, and with quarters for the officers and men of the garrison. And, moreover, the entire cost of the installation would be less than the cost of maintaining such a ship in the navy for one year. The monitors "Miantonomoh," "Terror" and "Puritan" could be installed upon the adjacent reefs, and the range of the sixteen 10-in. and 12-in. guns of these forts would command a large part of the Straits of Florida, and especially that part which is used by westbound vessels entering the Gulf of Mexico which navigate close to the Florida reefs to avoid the strong currents of the gulf stream. Referring to the proposed island fortifications for the entrances to the Chesapeake, it is suggested that it would be a great economy if one of our old battleships, such as the "Oregon" were used as a central point about which the island could be built.

Congressman Hobson goes further than this. In his opinion it would be well to build torpedo tubes right in the islands, thus making them more effective. At Hampton Roads, the mouth of the Mississippi, the entrance to Puget sound, the Golden Gate, San Diego, and Mobile, these ships would make fine practical forts, he says.

RATS IN THE CAPITOL

Several tons of seed, sent over from the Department of Agriculture, to be distributed to the constituents of congressmen, was the attraction which drew thousands of rats and mice of various sizes to the basement of the house of representatives at Washington recently, and caused the officials in charge of the capitol great worry and apprehension. The nuisance was abated only when the supply of seeds began to run low.

View of the New Pennsylvania Terminal from a Nearby Roof, Showing the Immensity of the Structure



Concourse and Track Level of Pennsylvania Terminal

PENNSYLVANIA RAILROAD STATION IN NEW YORK

The new Pennsylvania terminal in New York is undoubtedly the finest structure of its kind in the world. It covers two city blocks and one intersecting street, covering an area of about eight acres. It is 774 ft. long, 433 ft. wide, and has an average height above the street level of 69 ft., and a maximum height of 153 ft. The main waiting-room is 277 ft. long, 103 ft. wide, and 150 ft. high, while the concourse is 340 ft. long and 210 ft. wide.

The huge building is of steel skeleton construction, with masonry curtain walls, supported by a system of columns extending to rock foundation. The level of the track system below the street surface varies from 39 to 58 ft., and is from 7 to 10 ft. below mean high water in the harbor, thus necessitating the establishment of an elaborate system of drainage over the entire station area. Access to the street is gained by elevators and stairways.

The design of the interior of the general waiting-room was suggested by the halls and basilicas of Rome, which are the finest examples in the world, ancient or modern, of large roofed-in areas.

CHINESE BOMBARD COMET WITH FIREWORKS FROM HILLTOPS

When the excitement due to the return of Halley's comet was at its height in May, a great wave of fear swept over the Chinese empire. In January when the comet was first seen, the Chinese began to send up fireworks, and when the comet made its nearest approach, they were so convinced that it was headed for the earth, and if not swerved from its path, would destroy it, that they began discharging fireworks more abundantly than ever, taking deliberate aim at the visitor. Great columns of inflammables were also erected on almost every mountain top in an effort to show the comet that it was not wanted.

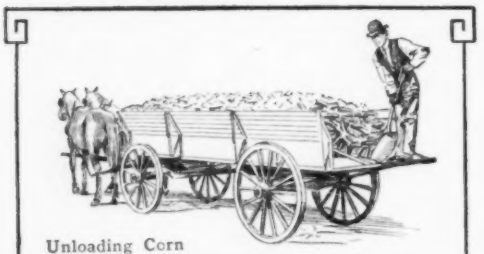
A WAGON BED OF MANY USES

A convertible wagon bed which can be changed into 15 different kinds of bodies for different uses around a farm, without adding to it or taking from it a single piece, has been designed, and is undoubtedly the most radical improvement made in farm wagons for a decade.

In a few minutes it can be transformed from a hay rack into a wagon for carrying livestock, and with equal quickness it can be converted into a vehicle for carrying a large number of passengers who can be provided with comfortable seats along the sides for picnicking, etc.

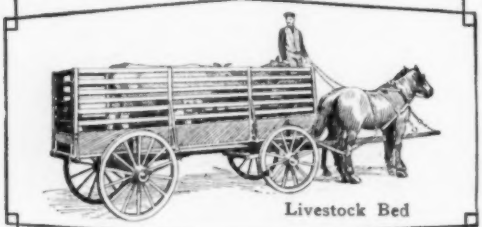
The remarkable versatility of the new wagon bed is secured by hinged malleable iron pieces attached to the sides. These support two folding sections on each side. The strain which is put upon these pieces when heavy loads are placed on the wagon makes it imperative that they should be of strong, dependable material.

The agriculturist has often found it a hardship to be obliged to buy or build a number of wagons for the multifarious requirements incident to the operation of a farm. The wagon that would serve to carry boxed or crated vegetables and berries to market



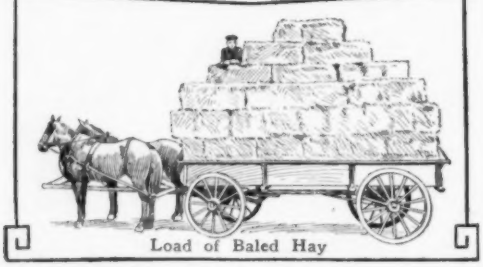
Unloading Corn

Party Wagon



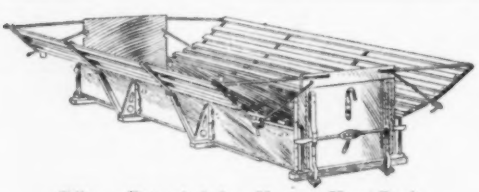
Livestock Bed

Market Wagon

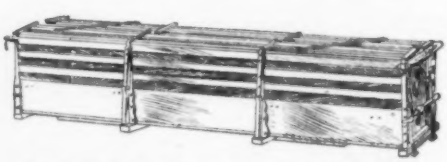


Load of Baled Hay

As a Hay Rack



Wings Extended for Use as Hay Rack



Wings Folded Over for Hogs, Sheep, Etc.

would not be of any use when haying time came around. When it was necessary to carry calves or livestock, still another wagon must be called into service.

While reapers, threshers, and other farm implements have been continually improved, the farm wagon has remained practically at a standstill. Perhaps the fact that the automobile has made such wonderful progress has served to overshadow the humble beast of burden and his reliable wagon. Old Dobbin may be a second rater now, but he will continue for some time to fill his particular sphere of endeavor with a faithfulness which the motor car cannot always be relied upon to give.

THE DALAI LAMA AND HIS PEOPLE

Lassa, the ecclesiastic city of Tibet, and for many years the most mysterious city in the world because prohibited to the white man, was advanced upon several months ago by several thousand Chinese troops, whose mission was to depose the Dalai Lama. At one time the authorities of Tibet refused to allow Europeans to even enter the country.

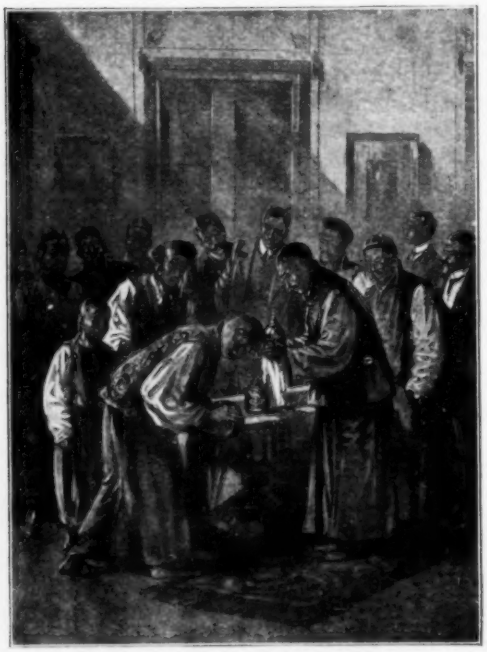
Tibet is a dependency of the Chinese Empire, lying between China and India. It covers an area of about 600,000 square miles, and has a population of over 6,000,000. China, however, up to the present time, had only interfered with foreign and military affairs, the civil and religious government being left to the Tibetan clergy. In theory, supreme rule was in the hands of the Dalai Lama, the sovereign pontiff.

The Dalai Lama and Attendants

Typical Tibetan Type

When China decided to depose the present Dalai Lama he refused to yield and the troops were sent against him. He escaped and became a fugitive in India. The figure in the center of one of the illustrations is the deposed ruler, whose full name, by the way, is "A-Wang-Lo-Pu-Tsang -Tu - Pu -Tan - Chia-Cho-Chi-Chai-Wang-Chu - Chio-Le-Lang-Chieh." The wretched condition of the people over whom he held almost undisputed rule is evinced by the raggedness of the curious clothing they wear.

When the Dalai Lama was a fugitive in India a very interesting occurrence took place. The ashes of Buddha and many relics, discovered about the time the Dalai Lama fled from Lassa, were discovered in India. The remains of Buddha were taken to the Indian museum house at Calcutta, to be formally



The Dalai Lama Holding the Ashes of Buddha

handed over to those representatives of the Buddhist religion who had journeyed from Burma for the purpose. There the fugitive Dalai Lama, who is said to be the reincarnation of Buddha, was allowed to view the ashes of his first embodiment.

One of the illustrations shows the Dalai Lama holding the gold casket containing the ashes, and touching the crowns of the heads of his followers with it, as they passed before him.

Tibetan Family and Home

JAPANESE TO HONOR COMMANDER OF LOST SUBMARINE

The public in Japan is preparing to erect a monument to the memory of Lieutenant Sakuma, the commander of the submarine which was lost on April 6th during maneuvers, the entire crew of 14 men perishing. The submarine, which was known as "No. 6," was one of a flotilla of seven taking part in the meneuvers. They had been under water for four hours, and all came up at the end of that time with the exception of "No. 6." Search was then made, and the little craft was found at a depth of 52 ft.

The loss of the boat was caused by a broken chain in the ventilation tower, which opened the sluice valve and allowed the water to pour into the boat. Desperate efforts were made to close the valve, but without avail. The electric regulators and lights were put out, and the machinery which supplied the crew with air came to a stop.

The commander of the submarine, when he saw that the end was inevitable, sat down and calmly prepared a record of the accident, begging the forgiveness of the emperor, and taking upon himself the blame for the accident. The record closed as follows: "The air pressure becomes high, and I feel as if my ear drums were bursting. I feel great pain in breathing. I thought I had blown out the gasoline, but I have been intoxicated by it—."

¶ Furniture casters are now being made with a bearing surface of compressed felt, which will not mar a polished floor.

EDITORIAL

THE average yearly number of patents issued during the past four years is about 35,000. An examination of the records of the Patent Office shows that in a large percentage of the patents issued or granted the entire or a part interest was disposed of by the patentee for considerations running from a nominal sum of one dollar to $100,000.

Other branches of the Government are engaged in the conservation of natural resources, such as forests, the streams, the harbors, and the mines, and all of this work is carried on at enormous expense, with no expectation of direct returns, but in the belief that it is a wise policy to develop the material resources of a nation. Many of the critics who would destroy the patent system of the United States are entirely satisfied with the Government's policy in developing natural resources, but do not agree that it is good policy to develop the greatest asset of a nation, to-wit, the brains of its human members.

The only justification for any criticism of our patent system is found in the abuse of the powers and privileges it gives to the owners of a patent. It has been said that our laws should require a patentee to manufacture and offer for sale the invention covered by his patent, so that the public can get the benefit of it, this being the law in most of the foreign countries having patent systems. While our law does not say this, and while it does permit the owner of a patent to produce the article or not as he sees fit, if he fails to manufacture his machine or device, he cannot recover damages should some one make and market his invention. All that he can do is to enjoin the infringer from continuing such infringement.

The provisions of foreign patent laws which forfeit a patent unless the invention is manufactured and offered for sale within a certain specified time work hardship in many cases where the inventor is financially unable to make or market his device or machine, and is unsuccessful in securing the necessary financial backing to do so. Such laws cater to the power of wealth and make it possible for those controlling certain lines of manufacture to withhold their approval of a patented invention so that the inventor cannot successfully market or finance his undertaking; and then when his patent has expired because of his failure to manufacture and sell, these interested parties will come in and take advantage of this condition and thereby get the benefit of the improvement without compensating the inventor.

It is true that under our law patents lend themselves to the creation and maintenance of monopolies, but under the most favorable circumstances these monopolies are short lived, rarely extending beyond the seventeen years' term of the original patent. In many industries large sums of money must be spent in perfecting and commercially exploiting the invention, and the risk attending this is sometimes very great, as the investor never knows when what is believed to be a perfect development may be superseded by something entirely different and very much more desirable.

The art of street car propulsion illustrates in a most significant manner the evolution of industry and invention which renders obsolete in a few years what has required the expenditure of millions of dollars to develop. Endless cables for propelling street cars were in vogue but a few years ago, and on the strength of the apparent value of the cable system millions of dollars were invested in plants and machinery for producing the cables, pulleys, driving drums, conduit yokes grips, etc., required in such a system. Within a period of ten years all of this special machinery and thousands of tons of castings became obsolete and fit only for the scrap heap.

* * *

A YEAR ago quite a furore was made over the proposed plan, which if not to prolong our lives was literally to lengthen our days by setting the clock hands an hour ahead in early summer and back again to first principles when the sun resumed getting up late mornings. The daylight-saving bill was seriously considered in Parliament, but failed to become law, although Birmingham, England, and Cincinnati, Ohio, actually passed ordinances. Both cities after a futile attempt to enforce the undesirable measure repealed it. The idea, which like most fads was not without its good features, was given the widest possible publicity in the press, but public opinion was against it. The interesting thing is how soon the pendulum swings to the other extreme, for in the space of twelve months a most talked of incident has become the most forgotten.

THE introduction of the big "Pay as you Enter" street cars has been accompanied by the elevation of the car step to a height which makes it impossible for a child to enter unassisted. This has furnished material for sundry newspaper cartoons in which the small boy is made to say, "Lift me up, Somebody." This small boy, however, is depicted as well dressed, and accompanied by a well dressed mother.

There are some thousands of other small boys, one or more in every community, just as bright, and promising and ambitious, whose "Lift me up, Somebody," deserves attention. They are not the juvenile derelicts; they do not belong in reformatories. They are simply unfortunate in being born into conditions and environments which make difficult or impossible any great progress. Of recent years several manual training schools have been established which provide both a home and an education—education of the practical kind, where the hand and brain develop together, and where high ideals of a real life are taught. Most of these boys are orphans, who have been left penniless; boys who come of good parentage. There are no frills about these training schools; the boys work in shop and field, and develop into robust, manly men, fit to take their place in the world. These schools are supported by voluntary contributions.

Higher universities, schools of advanced learning, and specialties in education where a high-priced professor lectures to a mere handful, are good and essential. It is proper such should be generously endowed; but there are many men who came up to success and wealth out of their own efforts, to whom college endowments do not strongly appeal. The good which such can do, with comparatively little money, in supporting or founding one of the Training Schools for Boys, is so far reaching, and the net results so large, that it would seem necessary only to acquaint them with the possibilities to enlist their interest and support.

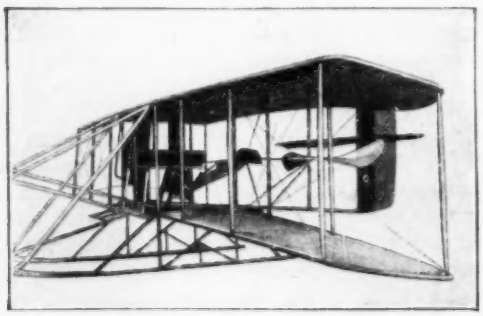
These schools can be started in a comparatively small way, with a few thousands of dollars, but the good they accomplish will continue on years after the donors have ceased making money. Succeeding generations of bright boys will cherish their memories in grateful remembrance.

The power of money to do evil may be great, but nothing like its power to do good.

H. H. WINDSOR

WARPING THE SURFACES OF AN AEROPLANE

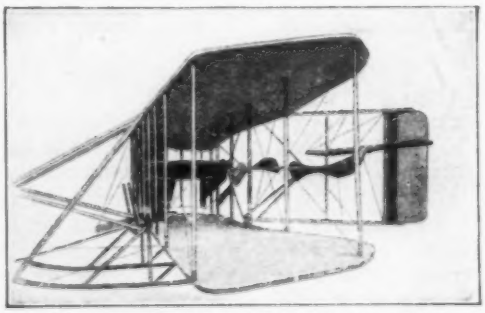
Much has been written about the warping of the surfaces of aeroplanes in making turns, but very few of the



Wing Tip Warped to Increase Lifting Effort

photographs or drawings of the process have shown it satisfactorily. The accompanying illustrations, however, show the warping process very clearly. The lower wing tip in the foreground of the first is warped to increase the lifting effort, the far tip being simultaneously warped in the opposite direction. In the second illustration the near lower wing tip is warped downward to diminish the lifting effort, the far tip being warped upward.

The illustrations were made of the United States army aeroplane bought from the Wrights. Each of the main planes or curved surfaces has three parts, a main central section and two winged tips. The central section is 13 ft. long and each tip 11½ ft. long. If the controlling wire is pulled towards the left, the right tip will be pulled down and the left up, and vice versa.



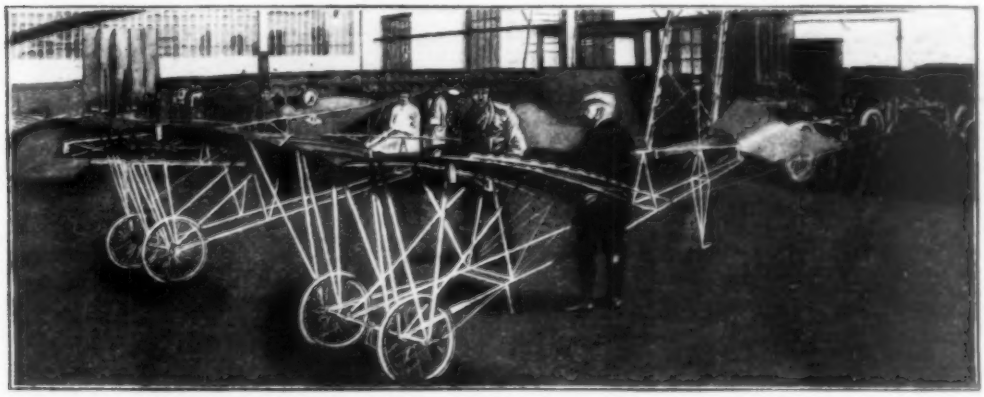
Wing Tip Warped to Diminish Lifting Effort

HOW TO BUILD THE FAMOUS "DEMOISELLE"
SANTOS-DUMONT'S MONOPLANE

By ARTHUR E. JOERIN and A. CROSS, A. M.
(Paris)

(Continued from the June number of Popular Mechanics)

Having finished the steering arrangement it would be wise to take up the construction of the wings. The wings of the "Demoiselle" are made entirely of bamboo rods with bamboo or ash lateral beams as shown in Plate V. However, Clement Bayard, at whose factory in France these monoplanes are being manufactured, makes them of poplar or ash. Aluminum tubes have also been used. It would be advisable, however, to stick to the bamboo rods which served Santos-Dumont so well.



Building Santos-Dumont Monoplanes at the Clement Bayard Factory in France

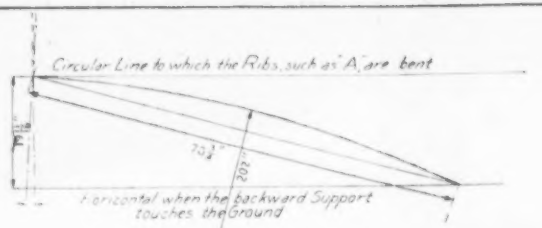
In order to secure the curves as shown at the top of Plate V, on the left, it would be sufficient to bend the rods over a form by force. They may also be bent by means of a string tied to the ends, drawing them together, and then plunging them into boiling water for about 15 minutes. The rods should be given plenty of time to dry before the strings are removed and they are placed in position. They will retain their shape if given time to dry, so no attempt should be made to hasten matters. If the builder desires to use wood he may proceed in like manner. The curve is almost the true arc of a circle.

It is not necessary to bend the rear lateral rod. It suffices to bend the one in front. The whole plane structure is kept rigid by guide wires running from the rods to the frame as shown in Plate I.

In order to attach the cloth to the extremities of the rods, it is not necessary to employ any other method than that shown at C, Plate III. This is the best method known. As with the steering device the front ends of the rods have to be covered by means of cloth hemmed over. This diminishes the friction of the air against the rods. Santos-Dumont has not always used the same method of attaching the cloth, but the method shown here is the one he used on the machine with which he made the famous flight, and is the method which the builder is advised to follow.

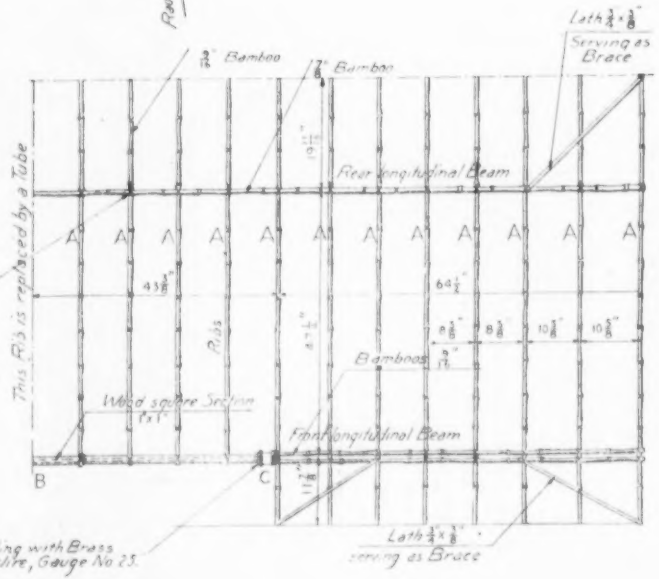
In the original flyer there was a rod just above the head of the pilot. It has been thought advisable, however, to leave this rod out. Santos-Dumont is quite short, and when he was in the pilot's seat, his head did not reach the rod. In the machines now being manufactured in France, the rod is omitted.

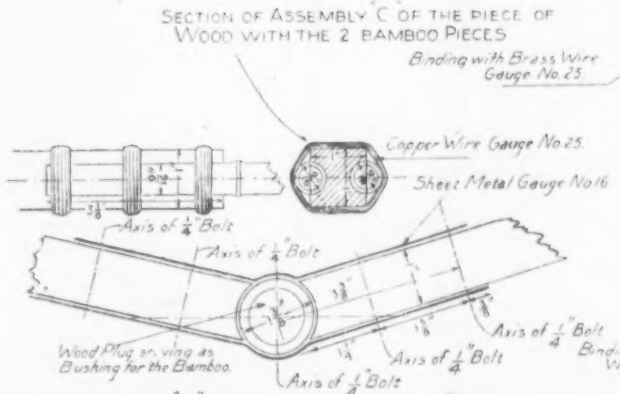
The wings completed, it would be well to next undertake the construction of the frame. The wheels are easily made, for, save that they have a longer hub, they are very similar in construction to the



Left hand Wing of the "Demoiselle"

PLATE V



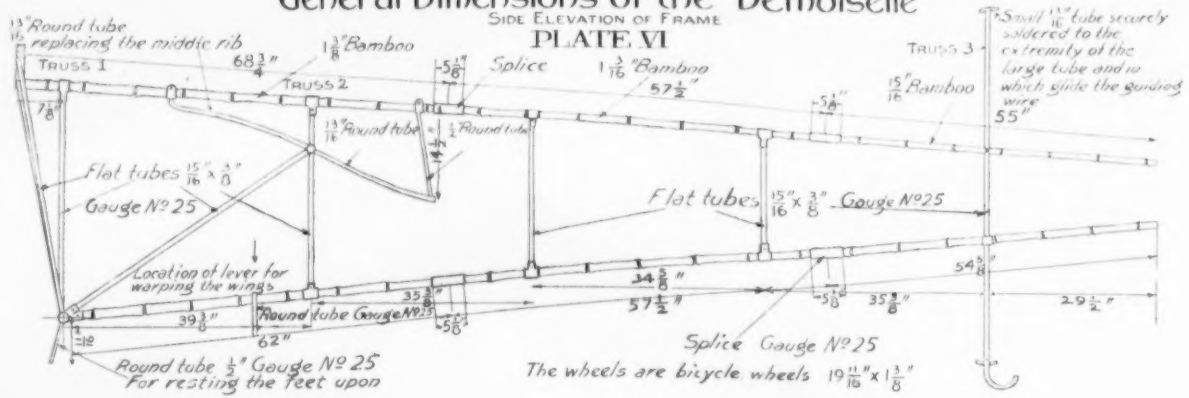


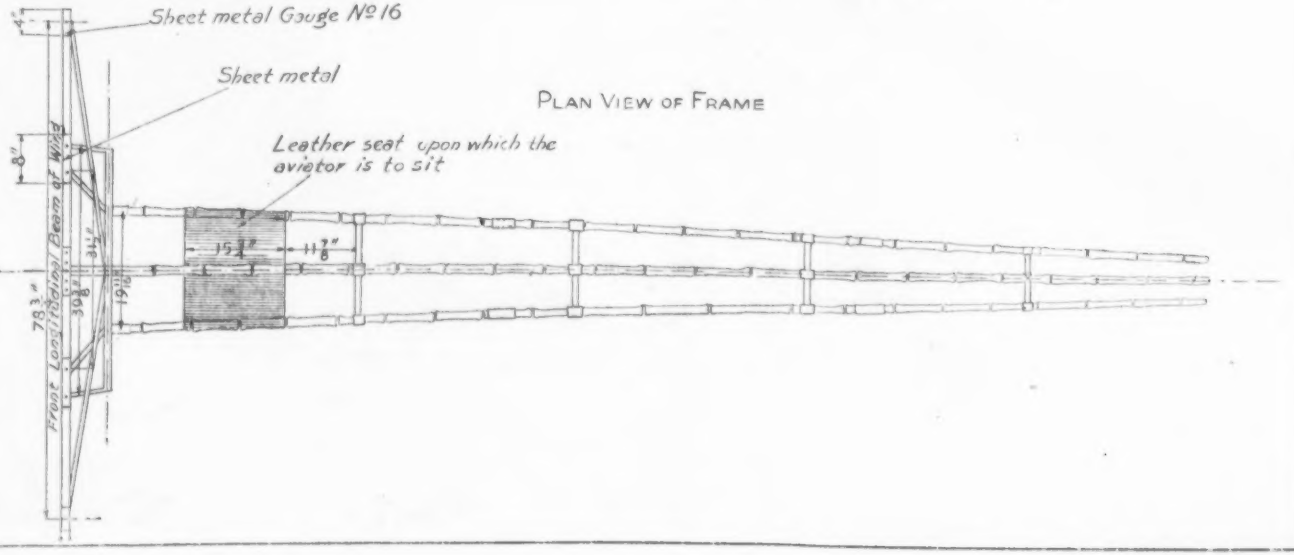
View of the "Demoiselle" Showing Position of Motor and Propeller

General Dimensions of the "Demoiselle"

PLATE VI

Side Elevation of Frame





ordinary bicycle wheel. In the construction of these wheels it would be well to use strong wire spokes, for at times, when the machine strikes the ground suddenly, great stress is put upon them. Santos-Dumont experimented a long time with the wheels before he finally settled on a hub length of 6 in. This he found was strong enough to support the machine when he used a 35-hp. motor. If a lighter motor is used, the size of the wheel hubs may be modified. These hubs are, as may be seen in the drawings, simply put on over the tubes and fastened by a cotter pin. The tubes should be allowed to extend out several inches beyond the end of the hub. Great care should be taken in the selection of this lower tube, for almost the entire weight of the machine comes upon it. It is not necessary to provide any special bearings for the wheels, as it is intended they should work with a slight friction. It may readily be seen that the wheels are inclined toward one another at the top. The angle of inclination of that part of the tubing, which forms the axle, is 1 to 9. This manner of placing the wheels prevents them from being broken when subjected to a slight jar if the machine takes to the ground unexpectedly.

The connection of the tubing with the framework of bamboo is somewhat difficult, but the details of assembling are always the same in principle, and are shown on Plate VII. The pieces, which are to hold the tubes, are prepared beforehand, and when the tubes are introduced, the whole is firmly bolted. (See Detail of Assembly "A" on Plate VII.) If the builder does not care to prepare these special pieces, the flattened end of the tube may be affixed to a square piece of metal by means of an additional bolt. It is considered better, however, to prepare these special pieces as receptacles for the ends of the tubes.

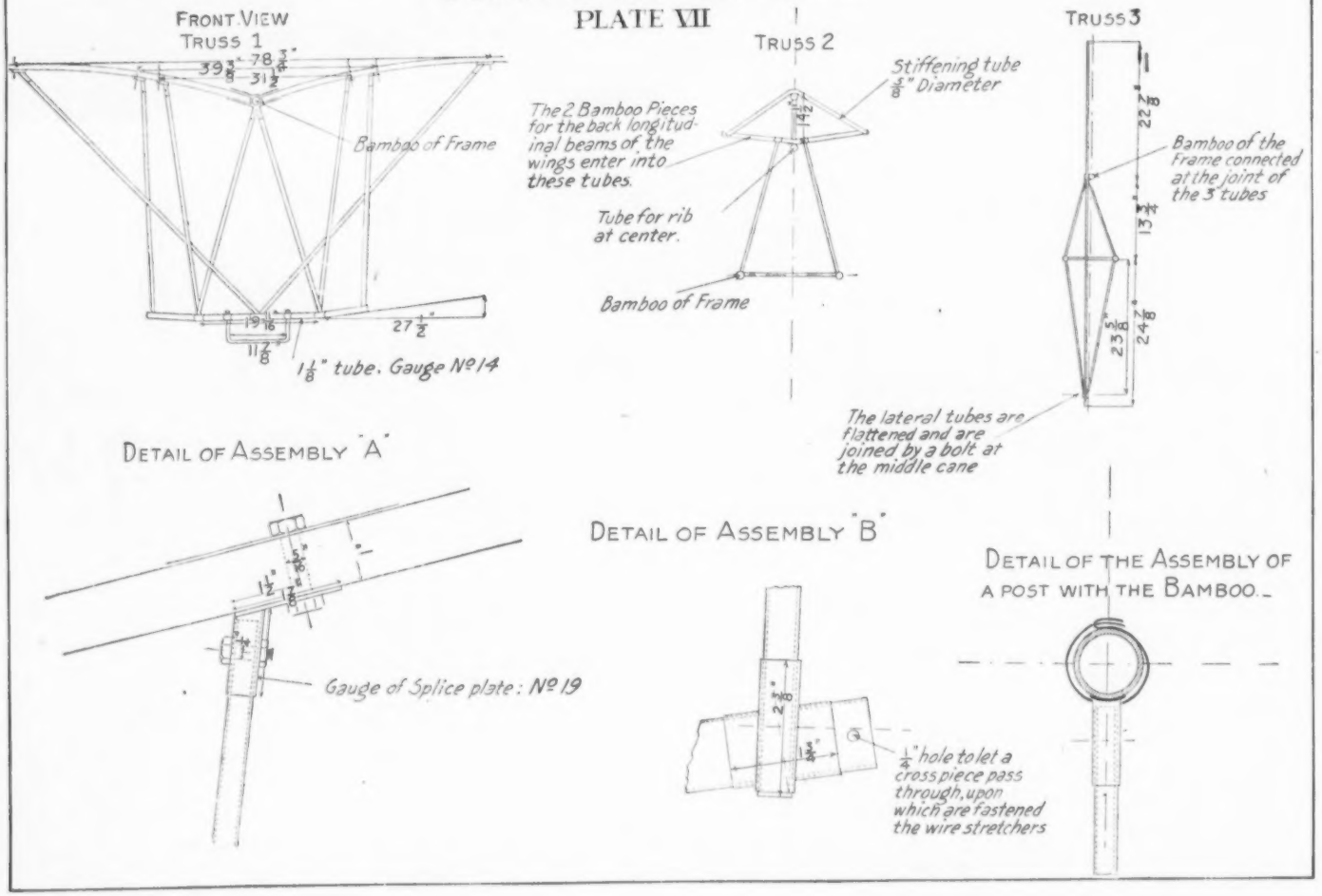
It would be imprudent and dangerous to make a hole in any of the three main bamboo rods which constitute the frame of the machine, for this would detract from their strength. When we are ready to attach the tubing to the frame, it would be well to follow the method shown on Plate VII. (Detail of Assembly of a Post with the Bamboo.) Out of a piece of sheet metal a joint may be formed so as to make a receptacle for the end of the tube. Provision should be made by a small piece of metal so that the bamboo will be protected if the end of the tube should strike it. Pieces of sheet metal can be wound around the bamboo rod as indicated on the drawing.

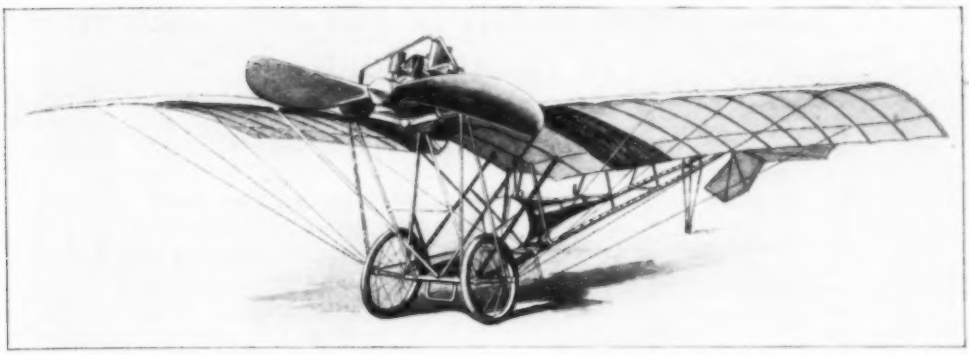
Let us now call your attention to the joint at the junction of the lower bamboo rods with the two upright tubes at the inside bearing of each wheel. This fork-like joint should be brazed in the manner of a bicycle frame. It may also be forged or made of a piece of sheet metal forced into shape. There may be some play at the joint, but this does not matter, as the wire stretchers, to be put on afterward, will give the necessary strength, and prevent the pieces from gliding one upon the other.

The machine thus far completed, we may proceed to attach the piano wire stretchers, and then the wires controlling the horizontal and vertical rudders and governing the warping of the planes. The rudder controls may be installed in accordance with the builder's ideas, and the motor controls will vary, of course, with the type of motor used. In the "Demoiselle" the wire regulating the horizontal rudder is attached to a lever within easy reach of the pilot's right hand. The vertical rudder is governed by a wheel at the pilot's left hand. The lever which controls the warping of the planes is placed behind the pilot's seat. Santos-Dumont operated this by bending his body to the right or left, the lever fitting into a tube fastened to his coat in the rear. A side movement pulls the rear end of the wing opposite to the side to which the pilot leans. The balancing of the whole apparatus, is, therefore, in a manner, automatic. The pilot has but to bend over to one side in order to balance the machine. Springs are introduced on the wires which control the rudders of some of the machines so as to bring the rudder back to its normal position without effort on the part of the operator. The seat is a piece of canvas or leather stretched across the two lower bamboo rods just behind the wheels.

Details of the "Demoiselle"

PLATE VII





This View Gives a Good Idea of the Location of the Gasoline Tank and the Radiator

Santos-Dumont had his motor control so arranged that he could regulate the supply of gasoline by his foot. The spark switch may be placed on the steering lever. These controls may be arranged differently, however, with other motors.

It is of prime importance that the motor should be perfectly balanced. It should be direct connected to the axle holding the propeller. The gasoline reservoir is located behind the pilot's seat, the fuel being forced up into a smaller one just above the motor. In his remarkable flight from St. Cyr to Buc, the inventor of the monoplane used a two-cylinder Darracq motor of 30 hp., which gave the propeller 1000 r.p.m. It weighed a little over 99 lb. The entire machine weighed 260 lb. without the pilot. At the end of the crankshaft, opposite the propeller, is a pinion and eccentric working the oil pumps. This pinion also meshes with the gear which operates the water pumps. The cams which raise the valves at the same time operate the magneto. The radiator, which is composed of a great many small copper tubes connected up to a larger tube at the front and rear, is placed under the main surface of the wings and extends from the front to the rear of the planes.

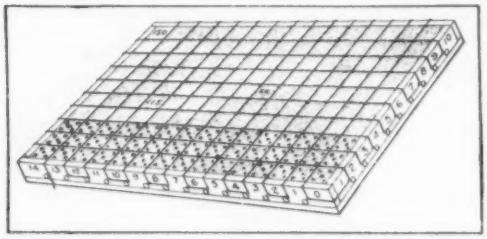
RAZORLESS SHAVING OUTFIT

A razorless shaving outfit, consisting of a sponge, two measures, a shaving cup, and a powder the mere application of which (mixed with water) removes the hair as faultlessly as the best razor, has just been introduced as the latest tonsorial discovery. The fact that it is warranted to contain no acids, give out no offensive odor, and accomplish shaving without danger of cutting, might persuade some shavers to contemplate substituting it for the time-worn razor. The powder is, however, only for post mortem shaving.

How Santos-Dumont Conveyed His Aeroplane to the Aviation Field

TEACHING THE COUNTRY BOY AND GIRL TO TEST SEED CORN

The importance of testing seed corn before planting, and testing it in the ear rather than after shelling, is now understood by every farmer. To continue to keep the lesson alive and teach



Sand Tray for Testing Seed Corn

the farm boy and girl how to test the corn the department of agriculture gives the following information:

There are at least three reasons why teachers, especially in the rural districts, should be interested in seed-corn testing as a school exercise. It furnishes an interesting study in seed germination and plant growth, extends a method of vast economic value in improving the productiveness of American agriculture, and its teaching in rural schools exerts a strong influence towards increasing the confidence of parents in the permanent worth of good school work.

Many farmers, although knowing the value of seed testing, fail to carry it out because many of the methods recommended mean too much trouble. The plan here described is simple enough to be easily followed by any boy or girl in the public schools, and costs very little.

The only materials needed are a shallow wooden tray, a small handful of carpet tacks, a few yards of wrapping twine, sand enough to fill the tray, and three or four quarts of water. The tray can easily be sawed from an empty soap or cracker box. When finished, it should be about 1½ in. deep inside, 15 in. wide, and 23 in. long. The tray is then divided into small squares by a checker-board lacing of twine across the top. It is convenient to have these squares about 1½ in. square, 10 of them in a row across the narrow way of the tray, and 15 the other way.

The illustration shows the general appearance of the tray and the method of lacing the twine back and forth across the tray and under the tacks. This lacing with the string should not be done until the tray has been loosely filled with dry sand, heaped up a little above the top edge. Then the sand should be scraped off with a yardstick. After lacing with the twine the tray is ready for planting.

Have the children arrange the ears to be tested in rows of ten, to correspond with the rows of squares across the tray. These rows of ears should be kept in a dry, warm place on the floor, on corn racks, or on shelves, where it can be certain it will not be disturbed or displaced until the test is finished. When ready to begin the test, two children can work to the best advantage, one to handle the individual ears and the other to plant the tray. The first takes up ear No. 1 in the first row, and, with the point of a pocket knife applied to the edge of a kernel, removes five kernels from each ear, passes them to the second pupil, and carefully replaces the ear in its row. The kernels should be taken in succession (taking only those of average size) from about an inch above the base of the ear to the same distance below its tip, passing spirally around and lengthwise of the ear. This insures a fair test of the whole ear, as it sometimes happens that one side or one end of an ear is sound while the other will not grow. The second pupil plants each five kernels in the square which corresponds with the ear from which they were taken. Four are placed in the corners, and the fifth, in the center. The illustration shows the first three squares planted in each of the 15 rows.

When a tray has been planted it must be thoroughly watered and kept in a warm room. The watering is best

done by laying a small piece of paper flat on the tray and pouring the water carefully upon it until the sand is fully saturated. The planted tray should not be allowed to dry out until the young corn plants are an inch or two above the sand.

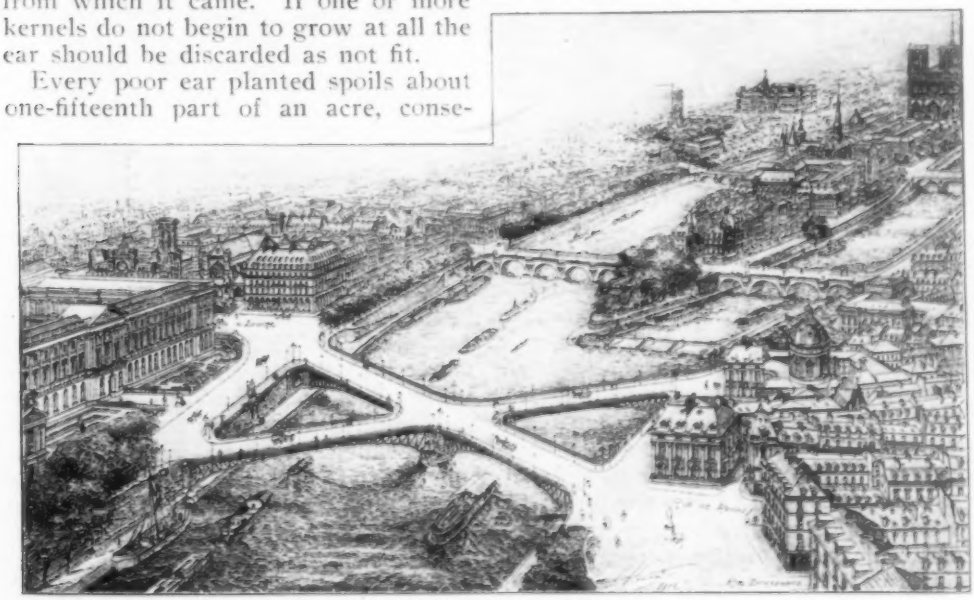
The plants should be about two or three inches high before the test is made. Begin at square No. 1 and carefully examine each square in regular order through to the last. If you find five good, sturdy plants growing from the five kernels planted in a square, the ear from which they came is all right for shelling and planting in the field. If there are five plants in the square, but two or more are shorter than most of the others in the tray, or look pale and sickly, take at once the ear from which they came out of its row and discard it. If there are four good plants in the square, but the fifth one is smaller or cannot be seen at all, dig down carefully until you find whether the kernel germinated. Sometimes the young stalk is held at the tip by the tough skin or hull of the kernel until it is bent over and starts to grow horizontally or downward. This would not show any positive fault in the ear from which it came. If one or more kernels do not begin to grow at all the ear should be discarded as not fit.

Every poor ear planted spoils about one-fifteenth part of an acre, consequently the testing of seed corn in this manner is of the greatest value to the farmer.

LETTER-"X" BRIDGE PROJECTED FOR PARIS

Paris, which is today considered one of the most beautiful cities in the world, is still striving to become more beautiful, and to make this possible the city has been authorized to borrow the immense sum of nearly $200,000,000. Half of this will be used for the upkeep of municipal edifices and the erection of new buildings, and for parks and promenades. The other half will be used for the creation of new boulevards and highways, and the maintenance of the old.

One of the interesting units in the scheme for improvement is the projected letter-"X" bridge shown in the illustration. If erected, it will cross the Seine, one branch connecting the rue de Rennes with the rue de Louvre, and the other forming a junction between the wharf of the Louvre and the wharf Conti. A single pier rising from the Seine will hold the center of the bridge up.



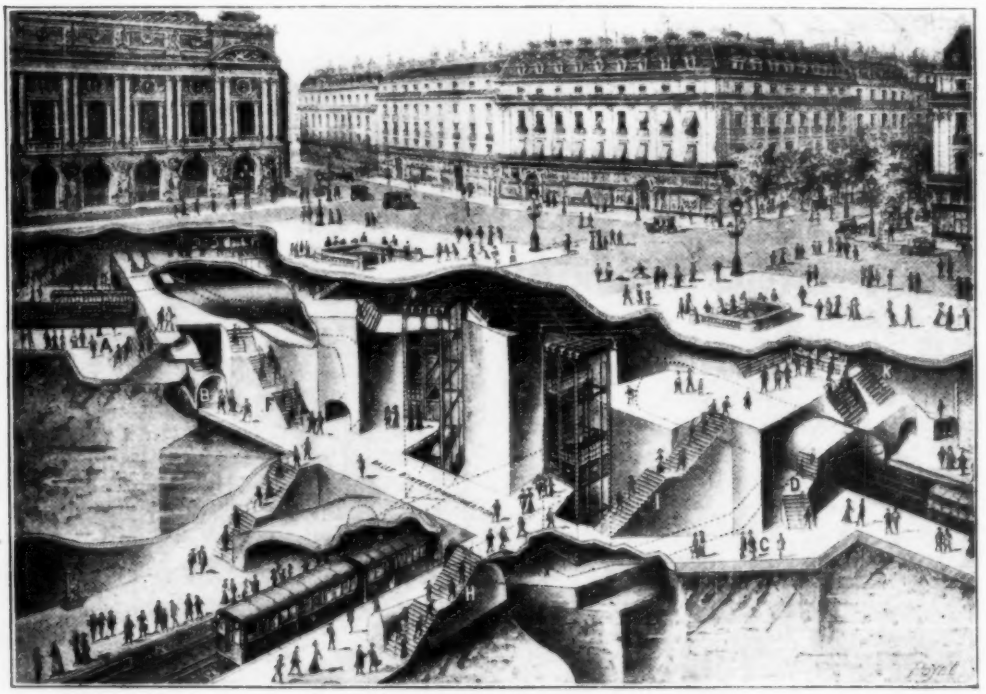
Unique Bridge Planned for Paris

THE BUSIEST UNDERGROUND CORNER IN PARIS

Of all the wonderful engineering work done by the Metropolitan underground railways of Paris the most complicated is that under the Place de l'Opera, where three great tubes cross each other, all of which must have station facilities in the crossing's tangle. The three tubes, the platform, stairways, and elevators constitute a veritable Chinese puzzle, and the wonder is that the congested underground and overhead traffic has not been even more disturbed during the work.

The labyrinth of approaches and platforms, there being six of the latter, make possible a quick exchange from one line to another, or passage to and from the surface. In order to make it easy for the public to find the direction to take, there is a vast room for intercommunication giving access to all platforms. The people taking trains will be dropped to the desired train levels by the elevators running from the ticket-rooms.

The illustration clearly shows the three subway tubes, the platforms, stairways, elevators, and two of the openings leading from the boulevard.



The Intersection of Three Underground Railways

HEAR HEART BEATS 100 MILES

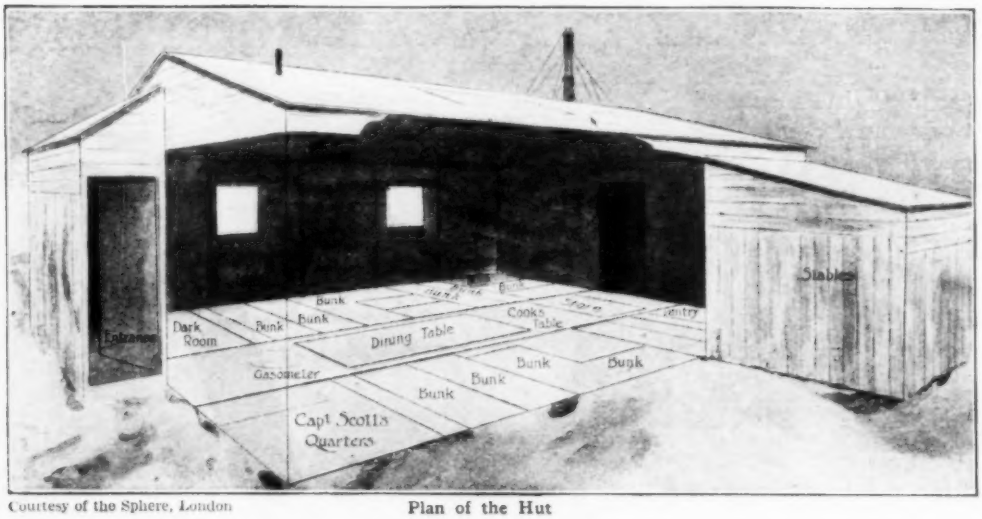
By means of a special apparatus at one end of an ordinary telephone line a group of experimenting physicians were able to note the heart beats of a patient 100 miles away. The test was made to determine the possibility of diagnosing heart trouble at a distance.

The physicians were at the house of Mr. Milne, the noted seismologist, on the Isle of Wight, and the person whose heart was tested was in London. A stethoscope, held over the heart in the ordinary manner, was attached to a special telephone instrument by which sounds are magnified.

CAPTAIN SCOTT'S POLAR EQUIPMENT

Mention of the motor-sleigh Captain Scott will depend upon to a great extent in his dash to the South Pole has already been made, but these illustrations deal with the ship on which the expedition will penetrate the ice floes, and the hut in which the explorers will live after landing.

Appearance of the Bow of Captain Scott's Antarctic Vessel, the "Terra Nova"

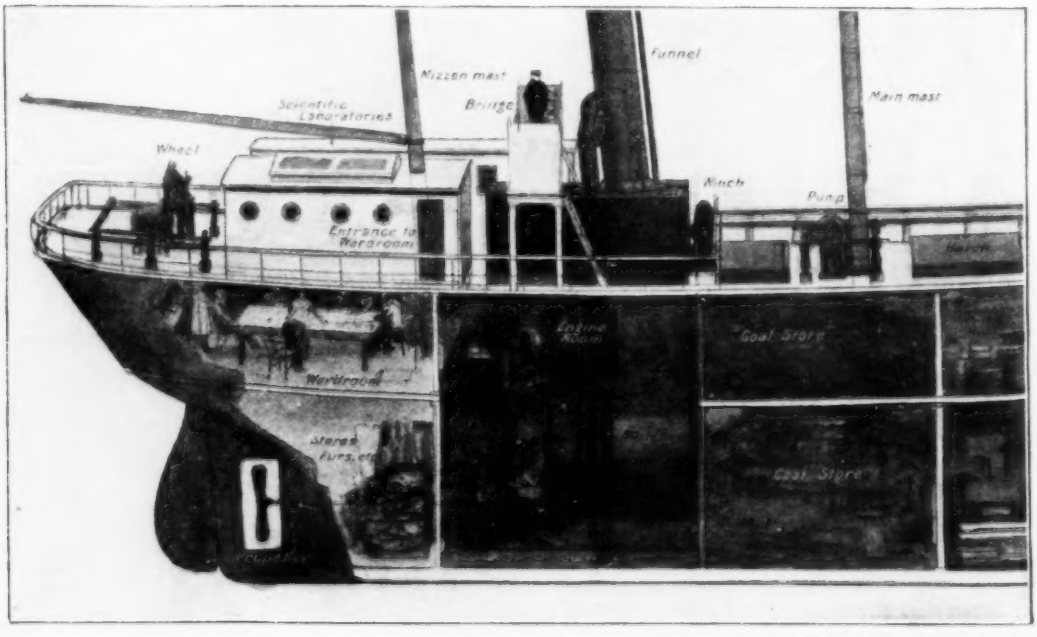


Courtesy of the Sphere, London

Plan of the Hut

The sectional view of the "Terra Nova," which is the name the staunch vessel bears, shows the disposition of stores, engine room, laboratories, officers' and men's quarters, and the deck plan. The other illustrations show a deck view taken while the outfitting was being carried on, and a bow view. Two of the three men superintending the outfitting are Captain Evans and Lieutenant Campbell. The heavy ice armor is clearly shown in the bow view, as well as the masts and booms that will carry auxiliary sail.

The hut is of the knockdown variety, and is quite commodious, as the illustration shows. The dark-room for photographic work, Captain Scott's



Sectional View of the "Terra Nova"

View of the Deck

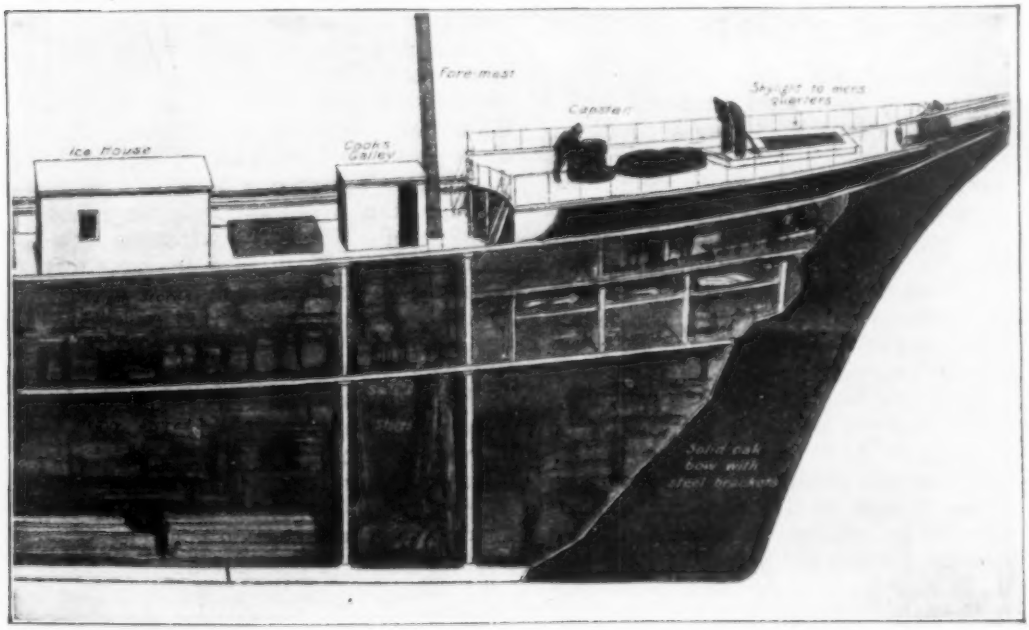
quarters, and the arrangement of bunks, dining-table, etc., are marked off in the floor plan.

The "Terra Nova" was built in 1884, and she was, and still is, the largest whaler in existence. She is 187 ft. in length with a beam of 31 ft. The displacement is 749 tons.

The vessel is bark-rigged and is equipped with a 140-hp. steam engine. This will enable her to make nine knots an hour without sail.

The "Discovery," which carried Capt. Scott's previous expedition was smaller and somewhat cramped as to accommodations.

A special expedition left England recently for Vladivostok, thence into northeast Siberia, for the purpose of securing dogs.

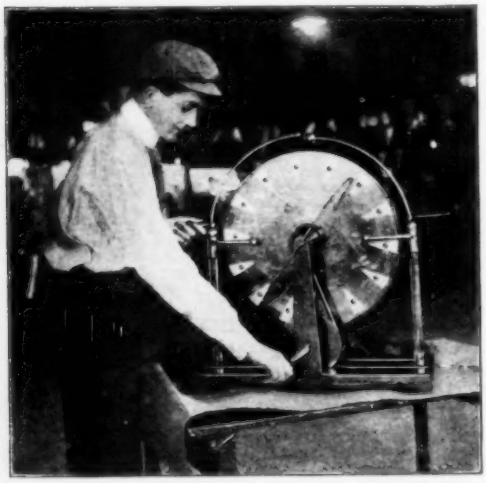


Captain Scott's Antarctic Ship

CLEVELAND BOYS SHOW WORK OF HANDS AND MIND

By E. C. HOPWOOD

A UNIQUE exhibition, one which may be generally copied throughout the country, was recently held at Cleveland, O. The exhibition was



A Static Machine and Its Maker

planned to show what the boys in a city of half a million people could do in mechanics, the arts and crafts, music and literature, and the training of animals.

The mechanical and arts and crafts part of the exhibition attracted by far the most attention. Men of years of experience in scientific work were surprised at the knowledge of mechanical principles, electrical theories and practice, and other intricate subjects, which was shown by the boy exhibitors.

Skilled workers in carpentry, iron, and other crafts were no less astonished at the results attained by mere lads at bench or forge.

Cleveland has of late been putting a great deal of emphasis on technical training in its school work, as well as upon manual skill. Its technical high school is one of the finest, and most thoroughly equipped in the United States. Settlement houses and the Y. M. C. A. have also devoted much time to the study of arts and crafts and mechanical and scientific topics. So that the boys of Cleveland have been pretty thoroughly taught the advantage and dignity of doing things with their hands.

The Boys' Exposition, as it was called, grew out of the practice of holding small exhibits by those interested in this phase of boys' work. The Y. M. C. A. organizations, particularly, had done this for some time. Such exhibitions had always proved attractive both to the boys concerned and to all who took an interest in what they were doing. The logical step was an exposition, at which all the boys of the city, irrespective of class or affiliation, should have a chance to exhibit their work.

The exposition was held in the Grays' armory, one of the largest auditoriums in the city, and it was none too large. There were in the neighborhood of 2,000 entries. They included almost everything to which an active American boy could turn his brain and hand.

Electricity and airships were two lines of endeavor on which much work was spent. Models of airships of all sorts were scattered throughout the industrial department. There were monoplanes and biplanes of all forms.

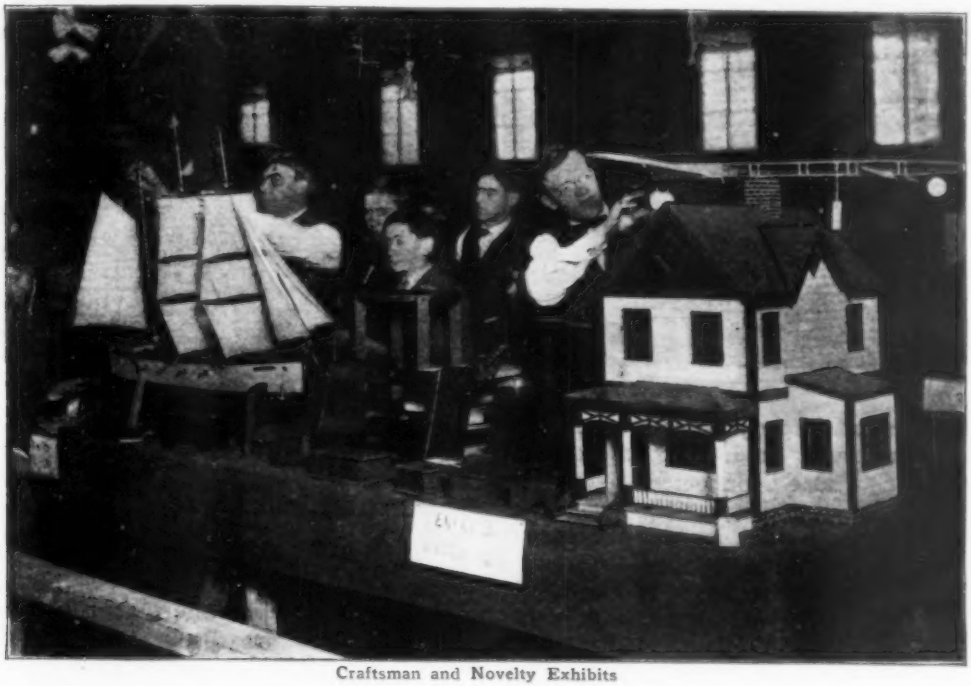
Wireless telegraphy was even more popular than aviation to judge from the number of exhibits of wireless apparatus. Many of these were practical instruments and had caught messages as they were shot from station to station along the Great Lakes. The mystery of the wireless made this section of the exposition one of the most popular of all with the visitors.

In connection with the electrical exhibit considerable attention was attracted by a device devised by a 15-year-old boy which permits a telegraph circuit to be intact and at the same time devoid of electric current. Electrical engineers who inspected the device thought it contained valuable pos-

sibilities and the young inventor will secure a patent for it.

Frames, gavels, trays, chairs, tables, stands and scores of other objects represented the work of the boys in carpentry and other crafts. The metal and forging department produced, among other things, knives, tongs, umbrella racks, lamps, castings and Venetian iron. In the electrical department, aside from the wireless instrument, entries were given. Entry A was for boys less than 13 years of age, entry B for boys less than 16 years of age, and entry C for boys less than 19. All the boys of the city were eligible. Many of them entered three or four different exhibits in the various departments.

The following partial list of the subjects for which prizes were awarded shows something of the scope of the exhibition:



Craftsman and Novelty Exhibits

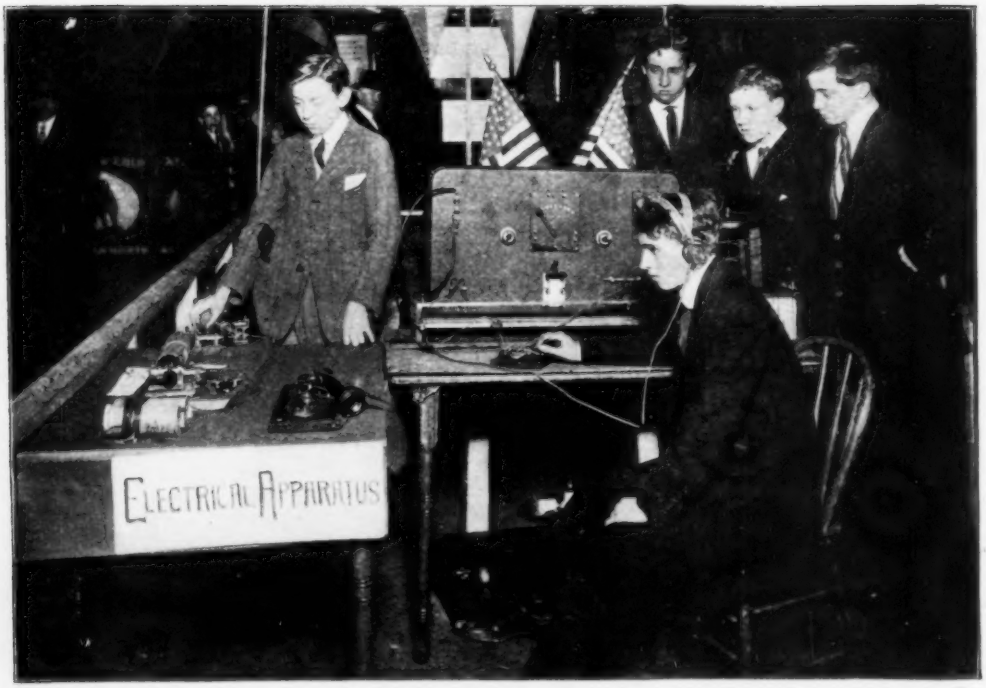
were half a dozen different forms of the telegraph, medical batteries, static machines and various forms of the telephone.

Though most of the exhibits were serious attempts at serious work, there were several of the novelty order which attracted attention. One lad appeared with a violin made from a cigar box and rigged with a single string. His instrument raised a laugh when he appeared, but he quickly got the attention of his audience when he began to play, for the queer little fiddle had a fine tone and the lad handled the single string with much skill.

First, second and third awards in all

Photography, motorcycle, coins, buttons, carpentry, broom holder, whisk broom holder, tie rack, T-square, picture framing, boxes, coat rack, sleeve board, book rack, magazine rack, tabourette, pedestals, book stalls, table, footstool, cabinet, model boat, aeroplane, iceboat, turning, gavel, darners, handles, burnt wood, china painting, Dutch dolls, lamps, amber carving, hammered brass, casts, Venetian iron, leather, copper, hatpins, rug weaving, pottery, putty modeling, and printing.

The expense of the exposition was not great, probably less than $1,000, and the small admission fee charged is expected to meet practically the entire



Part of Electric Exhibit at Cleveland Boys' Exposition

expense. Already plans are being laid for an even greater exposition next year. Those connected with boys' work in other large cities were much interested in the Cleveland exposition just held and many came to study it. It is probable that other cities will hold similar expositions the coming year, as manual skill and technical knowledge are coming to be considered an important part of modern education and the competitive idea contained in the exposition was held to be a valuable incentive to work along these lines.

AMERICAN GRANITE SENT TO THE STRONGHOLD OF SCOTCH GRANITE

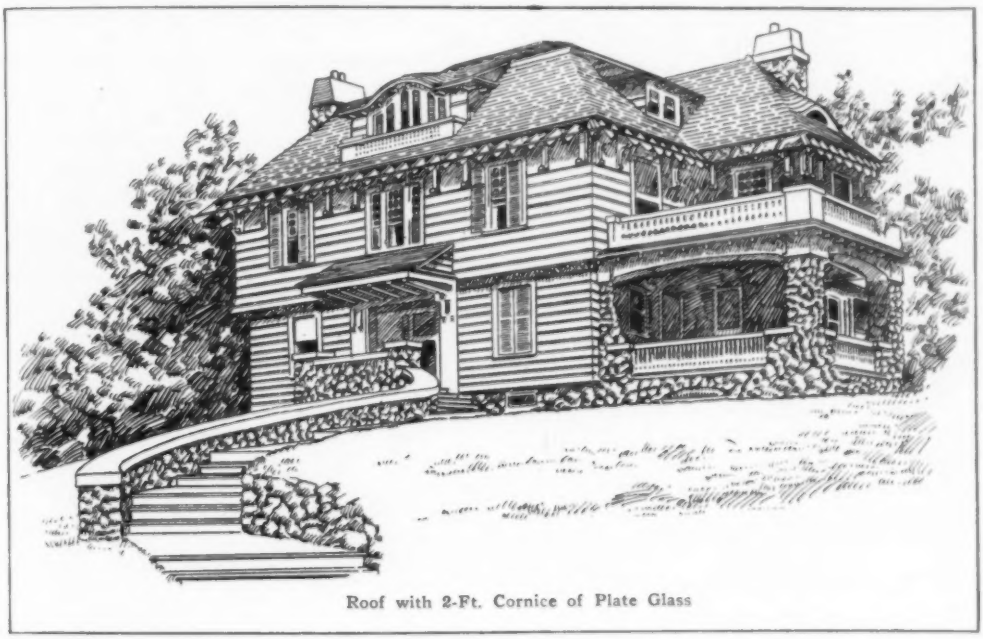
Regardless of the fact that Aberdeen is the home of Scotch granite, a granite company of that city has imported a large shipment of the stone from quarries in South Carolina. Why the Scotch company expects the venture to prove successful, regardless of the cost of transport across the ocean and the excessive cost of quarrying in the United States as compared with similar work in Scotland, is told by the following extract from an Aberdeen publication:

"It is expected that there will be a demand for the American granite because the trade is suffering badly from a scarcity of good grey stone for polished work. All foreign granite coming to this country is brought because there is a demand for a variation from native stones, and on account of special beauties in color. Photographs taken of the American quarry show a remarkable evenness of the granite, and it is pointed out that a block of almost any size could be procured." The first shipment of the granite consists of about 350 tons of blocks. If the experiment proves a success, a cargo of 1,000 tons is ready to be shipped.

¶Cocoanut mats have been provided for engineers and firemen on the Baden State Railways to prevent their hearing from being affected by the vibration of the engines.

OVERHANGING ROOF OF POLISHED PLATE GLASS

A residence at Waterbury, Conn., is of interest because of the novel use to which plate glass is put in the construction of the roof. An overhanging roof is a conspicuous feature of the exterior design, but the owner absolutely refused to have the second story rooms darkened by such a roof, and also disliked doing away with the overhang. Consequently, the architect and builders solved the problem by making the outer 2 ft. of the overhang of plate glass all the way around.



Roof with 2-Ft. Cornice of Plate Glass

The illustration clearly shows the overhanging cornice of glass. The glass is carried on extended or false rafters. The shadows cast on the side of the house are made by the rafters, and they graphically illustrate what a difference in light would have been made by an ordinary non-transparent cornice, as all the space between the lines of shadow would also have been in shadow.

The glass was provided in plates about ¼ in. thick, 2 ft. long and 18 in. wide. Being highly polished, the surface is expected to keep comparatively free from accumulations of dirt.

AEROPLANE TIRES

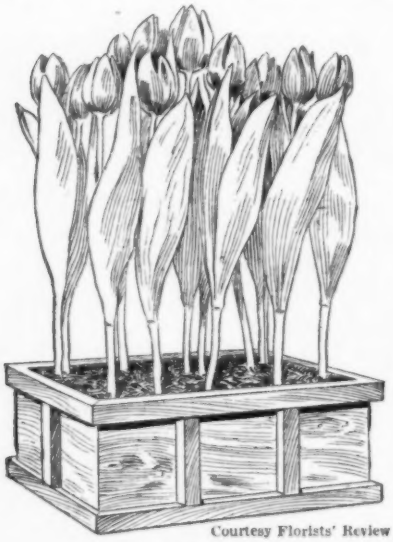
The demand for special tires for aeroplanes has grown so large in the last year that at least one big tire concern has made the providing of such tires a branch of the business and is finding a ready sale for the product.

The special requirements of aeroplane tires are strength, coupled with extreme l'ghtness and resiliency. It must be strong for the work it has to do when the machine is on the ground, and yet so light that it adds but little weight.

¶The Wright brothers are endeavoring to devise a means of silencing the motor of their aeroplane. At present the throbbing of the engine can be heard half a mile away, a handicap for army use.

BOXES FOR TULIPS

The beauty of potted tulips is greatly enhanced by the nature of the receptacle in which they are placed. In this



Courtesy Florists' Review

Artistic Boxing of Tulips

illustration they are potted, or boxed, in a green-stained box. Such boxes are obtainable in many sizes or can easily be made, and go well with tulips of any color.

THE NEW QUEBEC BRIDGE

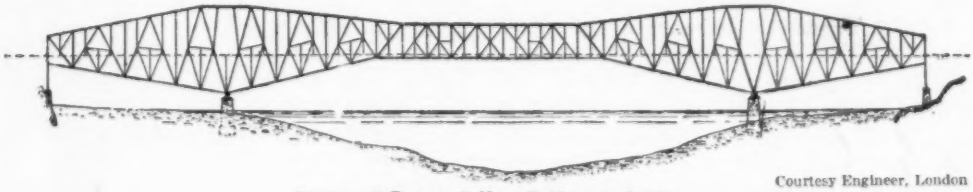
Following the fatal collapse of the partially completed Quebec bridge in 1907, which cost about 70 lives, a royal commission was appointed by the Canadian government. The result was that Canada had to pay for the ruined structure, and sometime later an English, a Canadian, and an American engineer were authorized to draw the plans for a new structure.

The general design prepared by the three engineers is shown in the accompanying drawing. The work of designing took about 18 months, and is said to have cost $150,000. The new structure will be 2,929 ft. long, the central span will be 1,758 ft. long, and the width of the bridge where it rests on the piers will be 88 ft.

In March, the London Engineer published an article stating that the commissioners were not satisfied, notwithstanding the outlay, with the design, and had invited competitive plans.

A curious feature of the new plan is that the bridge will not have a curved member in it. It is all straight lines, and the trussing is very peculiar, not being triangular in the ordinary sense of the term as applied to girders. The top and bottom booms are united by a series of "A's," inside of which is placed another of about half the height inverted. It will be remembered that the cause of the accident in 1907 was the collapse of a curved compression member in one of the shore spans, and this is one reason why the new plans do not incorporate a single curved member.

The width of the proposed bridge is said by both American and English technical journals to be insufficient. The width determines the stiffness of such structures against wind stresses, and it is claimed that the vibrations due to the narrowness might become excessive at high speeds and create danger of derailment of trains running over the bridge.



Courtesy Engineer, London

Design of Proposed New Bridge at Quebec

¶The amount of carbonic acid gas given off to the atmosphere of New York City by fuel combustion in a year is estimated at 400,000 tons.

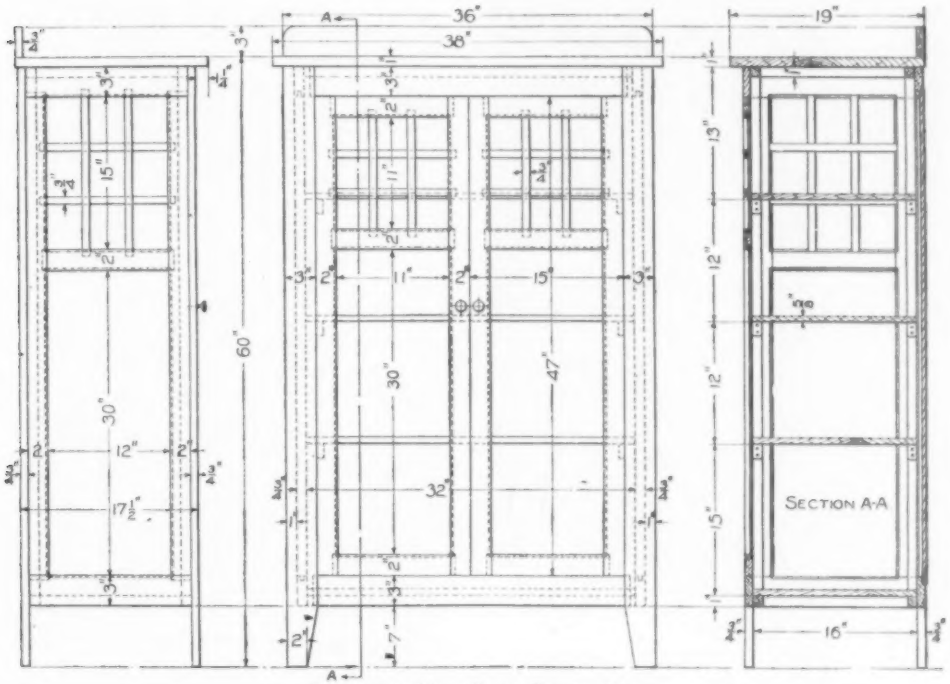
HOW TO MAKE A CHINA CLOSET

The china closet shown in the accompanying illustration is well proportioned and of pleasing appearance. It can be made of any one of the several furniture woods in common use, but quarter-sawed oak will be found to give the most pleasing effect. The stock should be ordered from the mill ready sawed to length, squared and sanded. In this way much hard labor will be saved. The following pieces will be needed:

1 top, 1 by 19 by 38 in., S-1-S.
4 posts, ¾ by 3 by 59 in., S-2-S.
4 side rails, ¾ by 3 by 31 in., S-1-S.
4 end rails, 1 by 3 by 16 in., S-2-S.
2 lattice rails, 1 by 2 by 13 in., S-2-S.
1 top board, ¾ by 3 by 36 in., S-1-S.
4 side door rails, ¾ by 2 by 47 in., S-2-S.
6 cross rails, ¾ by 2 by 12 in., S-2-S.
4 slats, ½ by ¾ by 16½ in., S-2-S.
4 slats, ½ by ¾ by 13½ in., S-2-S.
8 slats, ½ by ¾ by 12½ in., S-2-S.
4 shelves, ⅝ by 16 by 32 in., S-1-S., poplar.
4 cleats, 1 in. sq. by 55 in., soft wood.
4 cleats, 1 in. sq. by 28 in., soft wood.
4 cleats, 1 in. sq. by 14 in., soft wood.

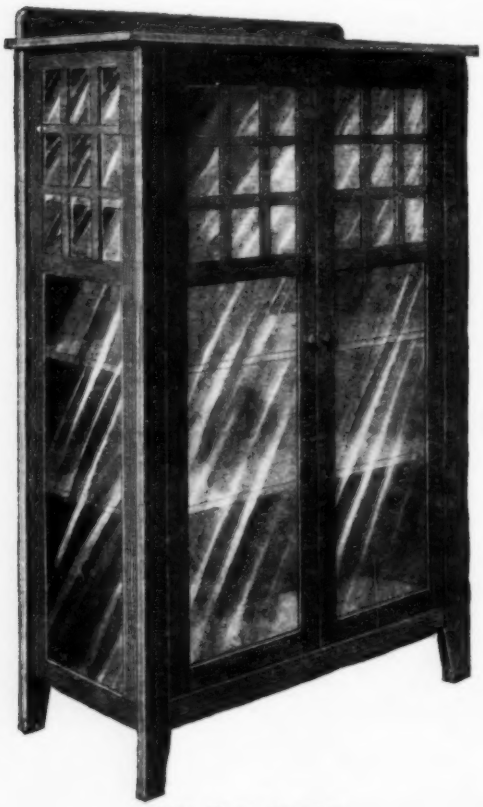
Having this material on hand, start with the four posts, as they are all alike. Clamp them together, being careful to have them of the right length, and the ends square. Trim the bottom, as shown in the detail drawing, and then lay out the mortises for the front and back rails. These rails can now be laid out and the tenons cut to fit the mortises in the posts. The back rails should, in addition, be rabbeted for the back board as shown. The end rails are fastened to the posts by means of screws through 1-in. square cleats, fastened on the inside of the posts as shown in the section A-A. In all cases the screws should be run through the cleats into the framing so the heads will not show. The end rails should be rabbeted on the inside for the latticework and the glass.

The back board should have the corners rounded as shown and be fastened to the top board with screws through from the bottom side. The top board is then fastened to the top rail cleats in the same manner.



Details of China Closet Construction

The doors are put together by means of tenons and mortises. The frames should be rabbeted on the inside for the latticework and the glass. Leaded glass can be used in place of this lat-



China Closet Complete

ticework if it is desired. Suitable hinges and a catch should be supplied. These can be purchased at any hardware store.

The shelves should be cut out at the corners to fit around the cleats. They rest on small blocks which are fastened to the cleats, or if desired, small holes can be drilled and pins used instead.

The back is put on in the usual manner. A mirror can be put in without much trouble if it is desired.

When putting the frame together, glue should be used on the joints, as it makes them much stiffer. Be careful to get the frame together perfectly square, or it will be hard to fit the doors and the glass. When it is complete, go over the whole carefully with fine sandpaper and remove all rough spots. Scrape all the surplus glue from about the joints, as stain will not take when there is any glue. The closet can be finished in any one of the many mission stains supplied by the trade for this purpose.

A FLOATING RUSSIAN EXPOSITION

One of the most novel and ingenious expositions ever devised was the floating exhibit arranged on a steamship by the business interests of Russia for a visit to the ports of the Black and Mediterranean seas. The floating exposition started from Odessa, going first to Yalta to be formally opened by the Tzar, after which it visited 24 ports, remaining from 1 to 12 days at each, according to its importance.

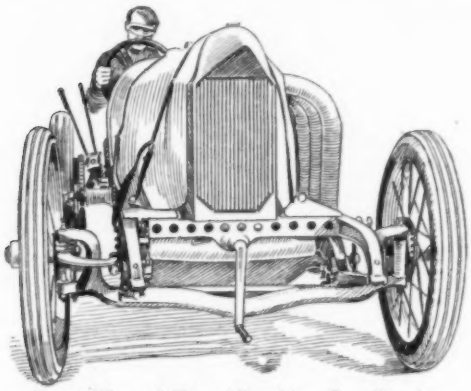
Over the hatchways of the vessel were erected fancy tents, while hemlock and pine trees were arranged about the deck. The ceilings of the holds of the vessel were specially painted and ornamented, and the many display sections were lighted by electric bulbs in beautiful chandeliers. Goods, samples and agents from 133 Russian firms were on board. The exhibit was varied, including fine silks woven with gold and silver, such as are used for ecclesiastic purposes; cloth goods of all kinds, especially woolen goods and printed cotton; gold, silver, and jeweled articles for churches; household furnishings and utensils; lumber and mining exhibits; photographs, plans, and models of railroad engines, cars, river boats, marine engines, and bridge work; electric dynamos and ice machines in operation; farm implements, and other exhibits covering a wide field of occupations and industries.

¶A taximeter for use on public vehicles, now being tested by the London authorities, issues a ticket at the end of the journey stating the amount of fare due.

MASSIVE AXLE OF OLDFIELD'S RECORD-MAKING CAR

The average automobile enthusiast would naturally expect that the axles and other parts of racing cars would be light. The front axle of the huge 200-hp. Benz racer with which Oldfield made the new world's straightaway record of :27.33 seconds for the mile proves the contrary.

If the speed of an automobile is doubled, the stresses which will be set up in the component parts will be quadrupled, and, according to the Automobile, an axle that would be quite satisfactory at 30 miles per hour, would have to work four times as hard at 60 miles an hour, and 16 times as hard at

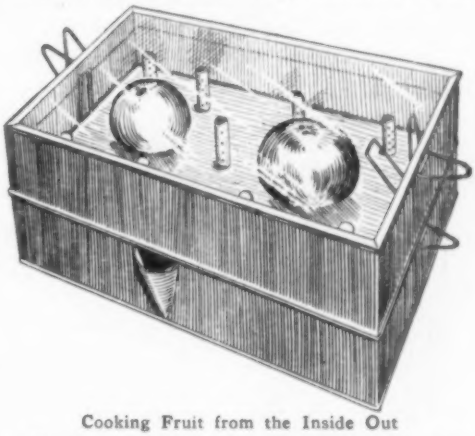


Front View of Record-Breaking Car, Showing Massive Axle

120 miles an hour. That the relatively enormous amount of metal used in the front axle of the Oldfield car is a nearer approach to correct axle proportions for racing cars than relatively light axles is proved by the large number of axles that have failed under racing conditions.

COOKING APPLES FROM INSIDE OUT

Apples and other fruits of like nature are usually cooked from the outside in, that is, the heat cooks the outside first and gradually penetrates to the center. With this cooker the procedure is reversed. It consists of two vessels, a lower one for receiving the water, and an upper one for steaming the fruit. From the lower vessel the steam passes up through small capped



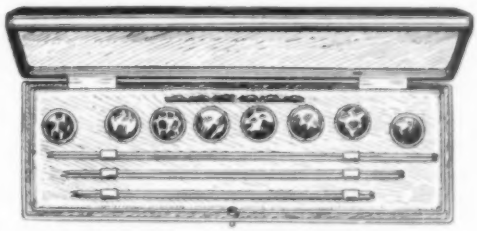
Cooking Fruit from the Inside Out

cylinders, or cones, perforated with tiny holes. The apples, after being cored, are impaled on these cones, and are cooked from the inside as the steam rises.

The upper vessel is covered with glass, so that the cooking operation can be watched. The cooking cones rise from a tray, which may be lifted out with the fruit attached.

HATPINS WITH DETACHABLE HEADS

An ingenious English jeweler has devised a hatpin with a detachable head, so that different lengths of pins can be used for different hats and coiffures.

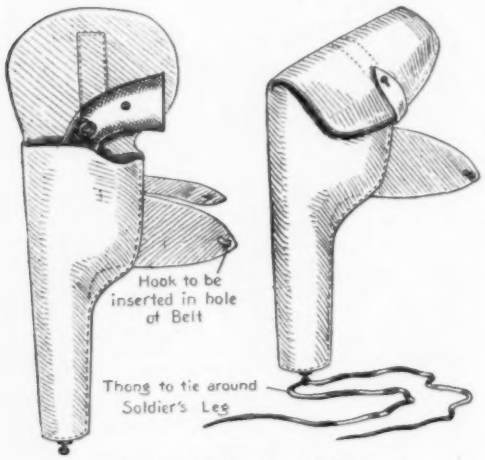


Hatpin Set with Detachable Heads

They are sold in sets of six pins and eight heads, the pins being three different lengths. The heads are in different colors of mother-o'-pearl, or imitation jewels, so that the wearer has the choice of colors for different hats.

REVOLVER HOLSTER PROVIDED WITH SPRING FLAP

The War Department insists upon a holster with a flap to protect the revolver from the weather and to prevent



Spring Flap Closed and Open

loss of the weapon. The fact that this flap is greatly in the way when drawing or returning the weapon, because it retains the shape in which it is buttoned and remains folded over the top, has led the department to devise a holster provided with a spring flap. A flat spring, working in a pocket on the under side of the flap, bends when the holster is buttoned, and causes the flap to fly open and remain in a vertical position when unfastened.

The act of drawing the revolver from a holster provided with this spring only requires a downward movement to release the button and an upward movement to draw out the revolver, while the same procedure with the holster now in use requires four movements. During the Spanish war the cavalry soldiers adopted the expedient of tying the flap open before going into an engagement, in order to have the revolver ready for instant use.

The new holsters are also to be provided with a thong that passes around the leg from a button at the base, thus keeping the holster from flopping when riding hard.

MAKING MOVING PICTURES IN EXCESSIVE TEMPERATURES

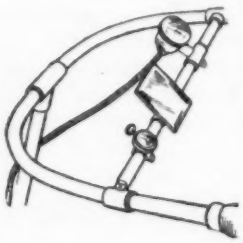
Making moving-picture films in a temperature of 34 below zero is only possible by exercising the utmost care and ingenuity, yet considerable work of this nature was successfully carried out recently in the northern latitudes.

Such temperatures render the films as brittle and fragile as glass, making it almost impossible to reel them on the spool inside the magazine. The films were kept in blankets, which, in turn, were kept as warm as possible by artificial means. They were taken out of the blankets just a moment before their using. Developing was impossible.

As a contrast to these conditions were those of just the opposite extreme met in India. The general tendency there was for the emulsion of the films to run and the material to become gummy. The films had to be packed in air-tight, wax-sealed tin boxes. More than once the camel or elephant used to carry the supplies showed indications of a desire to take a bath by wallowing in deep pools, film packs and all.

HANDLE-BAR ARRANGEMENT CARRIES ACCESSORIES

The motorcycle provides but little room for the carrying of even needed accessories, but by this handle-bar attachment at least three of these necessities are taken care of in a very practical way. A small piece of tubing stretches across between the bars, and on this is clasped a speedometer, a watch, and a map carrier. All three are in the best possible position for the rider to glance at them.



¶Sanitary engineers are now considering the advisability of using ozone for flushing and disinfecting sewers.

THE DEVELOPMENT OF THE CRUDE OIL ENGINE

WHILE comparatively little attention has been paid to the crude oil type of internal combustion engine in the United States, the general interest being centered in the gasoline engine, it has been making great headway in Europe, where thousands of engines using the coarser oils are in operation.

But even in this country it has been encroaching into the field of the gasoline type, and, according to its ardent supporters, will supersede it for many purposes. Crude oil engines, aggregating approximately 500,000 horsepower, are in service in this country at the present time, principally in the south and west. The fact that the source of the fuel production is close at hand is said to be partially responsible for its popularity in those sections.

The United States geological survey, recognizing the increasing use of the engine, is preparing to make an extensive investigation into its merits.

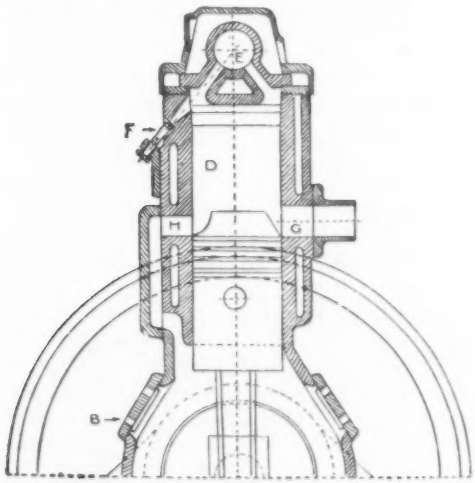
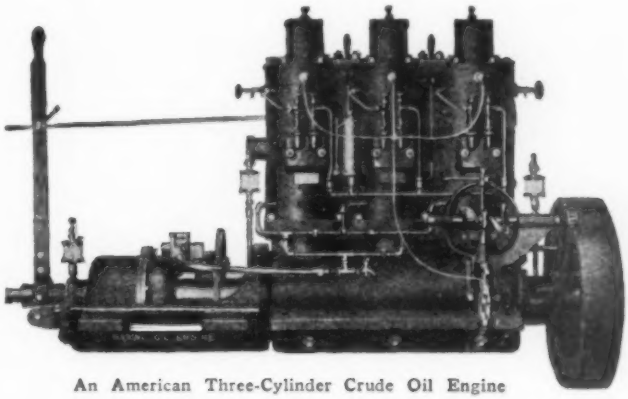


Diagram Showing the Special Construction of Combustion Head

To this end a large amount of chemical work on oils has been in progress.

Economy is the great advantage claimed for the engine. Oils costing three or four cents a gallon have been used with very satisfactory results



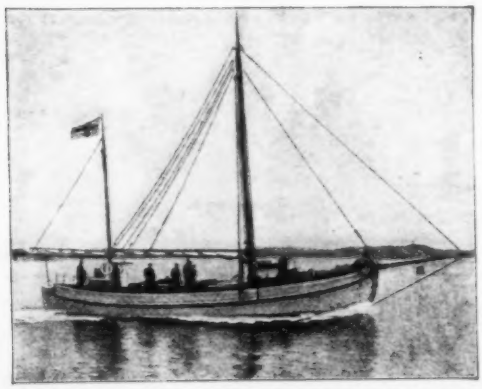
An American Three-Cylinder Crude Oil Engine

with some of the American makes. For many years the problem of burning crude oil successfully in an engine baffled engineers. Now the crude oil engines are being adapted for many purposes, having proved especially fitted for marine work. No attempt has been made as yet to supplant the gasoline engine in automobiles, however.

It is only a few years ago that a round-bowed fishing boat of the Swedish type visited some English ports, and created somewhat of a sensation. She was fitted with a heavy oil motor, and was sent by Swedish manufacturers to demonstrate the merits of the crude oil engine to English shipbuilders. "Bolinders VII" was the name of the craft, and that her errand was well carried out is attested by the manner in which the crude oil engine was adopted and developed in England.

In addition to its economical operation the engine has the advantage of being extremely simple as internal combustion engines go. No slide valve, electric or tube ignitor is used, the ignition being effected by compression. It requires a longer time to start than the gasoline engine, for it requires the heating by a kerosene burner of what

is called an ignition bulb or ball, located in the cylinder head, before combustion can commence. This bulb or ball is marked E in the accompanying



The "Bolinders VII," the Swedish Fishing Craft Used to Demonstrate the Merits of the Crude Oil Engine

diagram. Once started by the burner, it is kept hot automatically.

In one of the more simple types, a cross-section diagram of which is shown, the oil is injected directly into the bulb at F, and assisted by the action of the baffle plate on the top of the piston, circulates through the bulb, and surges into the cylinder head, D, through the passage E. The air-intake ports B in the crankcase C are provided with leather flap valves. The port H of course, leads to the cylinder, G being the exhaust port.

The engine receives an impulse at each turn of the crankshaft. The air and fuel injection, the compression and burning of the mixture, and the explosion of the exhaust, are all performed at a single turn in the most direct and simple method.

In most of the engines of this type now manufactured a vaporizer is provided. The system of vaporization is in reality a distillation in which the heavy asphaltum base is rejected in the form of tar, and is discharged automatically. Any small percentage of ash is retained in the vaporizer, from which it can be easily removed with an ordinary wire brush. Some makers guarantee that even such oils as turpentine refuse, creosote, shale oil, Scotch fuel oil, Texas liquid fuel, or lubricating oil can be successfully used.

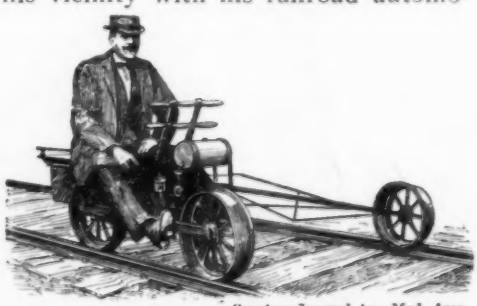
SALT RIVER FLOWS INLAND FROM THE SEA

A current of water will flow back and forth in a tide-water river, but on the Island of Cephalonia, near Greece, is the curious phenomena of a river steadily flowing inward from the sea and disappearing. All rivers naturally flow towards the lower levels to the sea and this curious instance on the island in the Mediterranean is not duplicated anywhere else in the world, so far as is known.

The sea, which is almost tideless, enters the land at four points where the coast is practically on a level with the surface of the sea. These four streams unite to form the little river that flows inland until it finally disappears in the limestone rocks and sinks into the earth. The volume of the river is too great to be removed by evaporation, and the question is where does it go?

PHYSICIAN USES MOTOR SECTION CAR

A motor-driven section car is the means by which Dr. Philip Stephens, of Caliente, Nev., visits his patients. He is district surgeon for a railroad in a valley 100 miles long, and can reach practically all the towns and ranches in his vicinity with his railroad automo-



Courtesy Journal Am. Med. Assn.

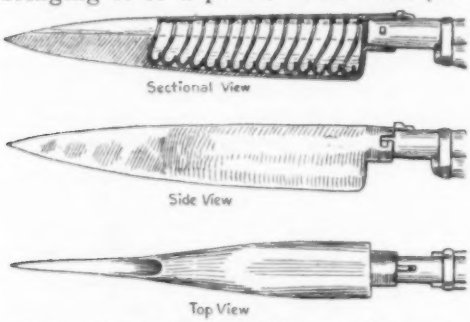
Nevada Physician Starting on a Call

bile. He uses it for both railroad and private calls, makes a speed of 30 miles an hour, and is never bothered by muddy roads or punctured tires.

COMBINATION SILENCER AND BAYONET

The latest type of silencer for use on military rifles is a combination silencer and bayonet, designed to meet and overcome the two serious objections to the device brought out by Maxim. These objections were based on the added weight, and the necessity of interchanging the silencer and bayonet.

The combination silencer and bayonet is of the disk type, having a series of disks within a cone, curved so as to retard the escaping gas and cause it to leave the silencer with a circling motion. The bayonet is made by extending the lower part of the silencer and bringing it to a point. The bullet, in



Construction of Combined Silencer and Bayonet

leaving the silencer, passes just above the top of the bayonet blade.

PRIMITIVE INDIAN SCULPTURE REPRODUCED IN MARBLE

The burial places of the Indians exclusively inhabiting the northern part of Vancouver Island, British Columbia, abound with monuments remarkable in their primitive design and the modern monumental workmanship expended upon them. Although clinging to the ancient beliefs of the race, and the type of sculpture with which the race expressed these beliefs in the carving of totem poles during the hundreds of years of the past, the present generation of Indians have recognized the superiority of marble and granite over wood and sought out a modern monument maker.

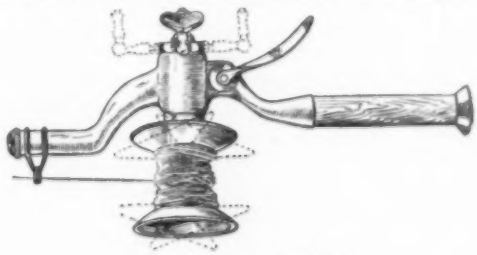
They first whittle the models out of soft pine logs, then, instead of painting them in gaudy colors, take them down

Indian Monuments Reproduced in Marble and Granite

to Victoria to be reproduced in either marble or granite. They often, however, paint the marble or granite after setting the monuments up.

GYRATORY FISHING REEL

This gyratory reel is so named because the spool not only rotates, but performs eccentric gyrations, the purpose of which is to cross-wind the line so that it cannot tangle. It is applying to the reel the winding principle employed in winding a ball of twine by hand, and it cross-winds the line without the aid of hand or a compli-



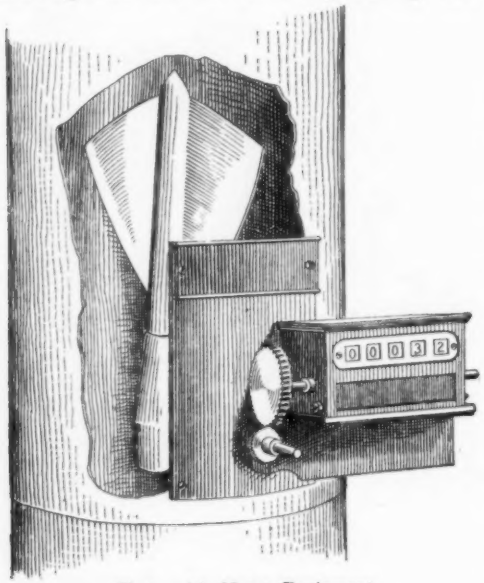
Ingenious Fish-Line Reel

cated spool. When the line is being cast, no part of the reel is in motion except the spool itself.

¶Black River Falls, Wis., has placed cuspidors along its streets to prevent the spread of tuberculosis.

METER MEASURES COAL DISCHARGED BY CHUTE

A meter that sits inside a chute and measures the amount of coal passing through it has been designed by an



Chute with Meter Equipment

inventor of Scranton, Pa. The meter itself is simple, consisting of vanes attached to a spindle. These vanes are caused to rotate by the movement of the coal down the chute, and the revolutions are transmitted to a counter outside the chute by means of bevel gear. By weighing a small quantity of coal passing through the chute, and counting the revolutions of the meter, it is possible to adjust the counter to register in tons, hundred-weight or other units, as desired. The chute, however, must constantly remain filled with coal so that the vanes are always entirely submerged.

The apparatus can also be used for measuring grain in elevators, and for other products handled through pipes or chutes.

¶Notwithstanding the addition of many bridges and tunnels at New York, there are 130 ferryboats in commission.

BOLIVIA A RICH GOLD FIELD

Rich gold resources still untouched in Bolivia, provide, according to Alexander Benson, secretary of the U. S. legation at La Paz, excellent prospects for an American gold dredging enterprise.

"It has been known for some years," says Secretary Benson, "that the interior of Bolivia is one of the richest unexplored gold fields in the world, and experts of wide experience have prophesied that once this country is opened up, it is likely to be the center of the world's gold supply. The immense difficulties, however, that have beset the steps of explorers and prospectors have left these regions practically untouched by modern miners.

"Since the times of the Incas, rough trails have existed between the ancient Inca centers of Titicaca and Cuzco and the deep forest-clad ravines of the Eastern Cordilleras. The most important of these precipitous valleys have been formed by the Tepuani, Mapiri, Challana, and Coroico rivers. The ancient trails leading into these valleys were built by the Incas for extracting gold from the immense deposits of gravel existing in every one of these valleys.

"The origin of so much gold is still a matter of conjecture. It is probably derived from two principal sources. The first is the many ancient glacial deposits in the high Cordilleras, a large proportion of which carry gold in varying quantities. Nuggets weighing as much as 52 oz. have been washed out, and it is on record that a huge mass of gold weighing 50 lb. was taken from one mine in former times by Spaniards. The second source of gold is in the numerous veins of quartz that run in every direction. These veins are mostly too narrow and patchy for profitable working, but they are both rich and numerous.

"In any of the rivers mentioned it is rare that a pan of gravel, even from the surface of the river bed, fails to wash out at least a trace of fine gold, and it is not uncommon to wash a pan

of surface dirt and find gravel averaging a dollar a yard on the surface. This would indicate enormously valuable deposits below. The upper rivers, difficult to work because of the great boulders with which they are strewn, their torrential nature, and the mighty floods which sweep their course each year, form the river Kaka just below Guanay. This river receives gold bearing gravel that never had a chance to settle in the turbulent torrents of the higher hills, and the operation of a dredger would be perfectly feasible on parts of it."

SPRING SHOCK ABSORBER FOR TUNGSTEN LAMPS

A simple but effective shock absorber for tungsten lamps is shown in this drawing. It is a spiral wire spring, provided at both ends with a metal device that engages with the flexible wire.

¶Ice wagons and automobiles seem to be about the extremes in vehicles, yet motor ice trucks have made their appearance. Four of them have just been placed in operation in Cincinnati, Ohio.

MOVING A DEPOT ON ONE CAR

A 2-story frame depot, 20 by 40 ft. was recently moved intact on one flat car from Las Cruces to La Tuna, New Mexico, a distance of 24 miles. It was loaded onto a 40-ft. car. It rose to a height of 30 ft. above the rails.

To allow of its passage it was necessary to take down all switchboards, whistling-posts and overhead wires en route, and to move the track out 2 ft. at one point to allow it to pass another station. A loaded coal car was attached to each end of the car on which the depot was placed, stringers were fastened to the ends of the cars, and lines were run from the stringers to the second story to brace it, thus making a base of practically 120 ft. The car springs were blocked and made as rigid as possible.

Depot Loaded on Flat Car

The 24-mile trip was made in six hours.

THE LAST OF THE SIX-MASTED SCHOONERS

The great six-masted schooners, now so numerous in Boston harbor, are no longer to be built, according to marine men of the Atlantic coast. Within the past few months the Coastwise Transportation company, the concern which built the 8,000-ton "Thomas Lawson," wrecked about two years ago, decided to build steam vessels in the future. It is also significant that, while 43 sailing vessels, 38 of which were schooners of 300 tons gross register, were lost on the coast last year, only eight new schooners were constructed.

The 3-masted and 4-masted schooners, however, according to the same authorities, may stay for a long time yet, as the smaller and shallower New England harbors will not accommodate the steamships.

CORRECT HOLDING OF AUTO STEERING WHEEL

There are several excellent ways of holding an automobile wheel, as well as many very awkward ways, but the

Courtesy the Automobile

How Racing Drivers Hold Steering Wheel

way the wheel is grasped by racing drivers is probably the best to pattern after. It will be conceded, despite their apparent recklessness, that the racing drivers handle the steering wheel in the best possible manner.

As may be seen by this illustration, the right hand firmly grasps the rim just below the horizontal center, with the forearm in a horizontal position, describing a right angle. The left hand is just below the right in the same sectional space made by the spokes of the wheel.

The worst possible ways to grasp the wheel are above the horizontal center, and at diametrically opposite points. The arm muscles under such conditions are at a great disadvantage, and body bracing is almost impossible.

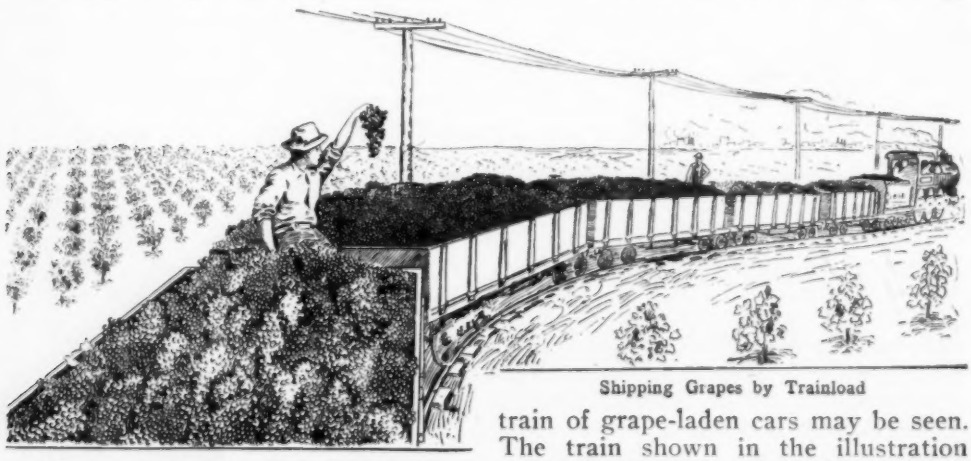
MOVING PICTURES OF RIOTS AS EVIDENCE

During the traction strike in Philadelphia one or more film manufacturing companies had their men in the streets taking moving-picture productions of the scenes of rioting. These films were for ordinary display in the moving-picture theaters, but the police authorities, according to one source of information, will have detectives watching them whenever exhibited.

The police believe the films may be valuable as crime detectors. They may show men throwing bricks that seriously injured other persons, or the police may be able to identify strikers the moving pictures show wrecking street cars or assaulting strike-breaking car operators.

A TRAINLOAD OF GRAPES

Grapes are shipped by the carload from the irrigated districts of California to the wineries, and often a long



Shipping Grapes by Trainload

train of grape-laden cars may be seen. The train shown in the illustration might be taken for a gravel train were not the reader told that the load consists of grapes.

CURIOUS BATHS IN PENANG HOTELS

One of the many things that strike the tourist as curious at Penang is the type of baths with which the hotels are provided. Penang is in the Straits Settlements, a British crown colony in the Malay Peninsula, deriving its name from the Straits of Malacca, which forms the great trade route between India and China. From each of the first-class rooms opens a dark, cement-paved, damp-smelling little room which serves as the bath. In it is an immense jar of porous brown earthenware, about 5 ft. high, nearly 3 ft. in diameter in the middle, and but 1½ ft. in diameter at the top. It stands huge and graceful of outline, but dark and uninviting, and is full to the brim with water, not, however, to get into. Near it is a supply of soft soap and a long-handled quart dipper. The proper procedure is to soap the body well, then throw several dippers of water over it, repeating the process until satisfied. There is water enough to keep it up for an hour or so, and a huge crash towel, as large as a sheet, to wrap up in when the bath is over.

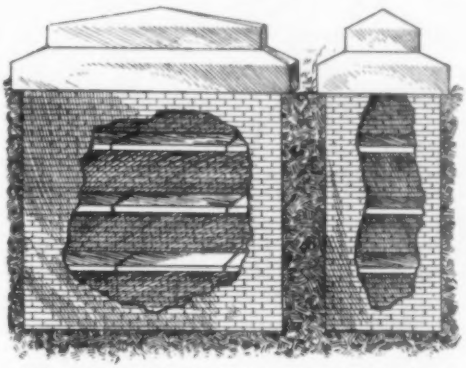
GERMANY'S AERIAL DASH TO THE POLE

Steady progress is being made in Germany for the dash for the North Pole in a Zeppelin airship in 1912. At present the committee of the expedition is inviting the general public to assist in furnishing the funds for a great dirigible garage at Hamburg. Its cost will be $250,000, about $150,000 of which has now been raised. When it is completed, two specially constructed dirigibles will use it as a base for a number of experimental cruises over the ocean.

Following these cruises the airships will, it is expected, be transferred to the Arctic zone in 1912. The dash for the pole will then start from Spitzbergen. Prince Henry of Prussia expects to accompany the expedition to that point.

BRICK GRAVES OF PHILADELPHIA CEMETERY

This illustration shows the construction of the three-crypt brick graves



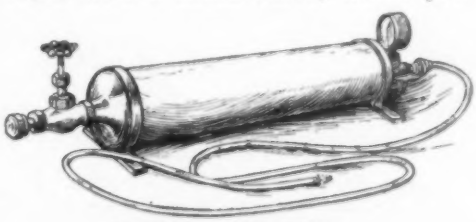
Side and End Views of Three-Crypt Brick Grave

built at a Philadelphia cemetery. The brick walls extend to the surface of the ground, and are capped by a stone. Stone slabs divide the interior into coffin compartments. The material used in construction is either hard red brick, or enameled brick.

TIRE INFLATOR CHARGED BY ENGINE'S EXPLOSIONS

This cylindrical tire inflator, carried on the running-board of the automobile, is connected with one of the cylinders of the engine, so that with every explosion a part of the exploded gases enters the tank, thus maintaining a constant pressure in it.

The connection between the tank and cylinder is a ⅜-in. copper tube, provided with a check valve, which pre-



New Form of Tire Inflator

vents the gas backing up into the cylinder. Within the tube is a filter which is claimed to remove the oil from the gases.

CHARGING BY METER FOR TELEPHONE SERVICE

This illustration shows the meter of a system by which telephone service may be charged for in the same manner as electric light and gas. When the user of a phone so equipped removes the receiver from its hook and gets connection with central the meter begins to register, and continues to do so until the receiver is again placed on the hook. The charge for the call is ordinarily made on the meter of the phone from which the call is made, but, if desired, may be reversed by consent of the receiving party. The subscriber can read his meter, and thus at all times has full control of the economy of his service.

This means of charging for telephone service was studied with much interest at the last convention of the National Independent Telephone Association in Chicago. The flat yearly rate for unlimited service which is still in vogue in many cities, is said to be impracticable in large exchanges, as it places upon the telephone company the burden of handling a large per cent of frivolous and unnecessary calls. The measured service rate was adopted to overcome this nuisance, but even this has proved only fairly satisfactory. By this system a charge of a few cents is made for each outgoing call, plus a small fixed annual payment. A talkative person, however, might occupy a circuit for half an hour for the payment of one fee, while in the same period a business man might make a dozen calls, for which he would be charged 12 times as much.

INSIDE WHEELS RISE IN MAKING TURN

The general impression is that the outside wheels of a racing automobile rise when a sharp turn is being made at high speed, but according to this illustration and the accompanying data it is always the inside wheels that leave the ground. Writers in automobile magazines have again and again tried to impress the general public with this fact, and have filled much space in telling what this photograph shows so clearly.

Inside Wheels Leaving Ground in Turning

The photograph was taken when Knipper was making a turn in the last Vanderbilt cup race. The car is shown coming from the extreme right, although the casual observer would think it had come from the left. The high embankment seen on the left, however, would soon dispel this idea. Why the inside wheels lift from the ground is explained as follows by the Chalmers Co. of Detroit:

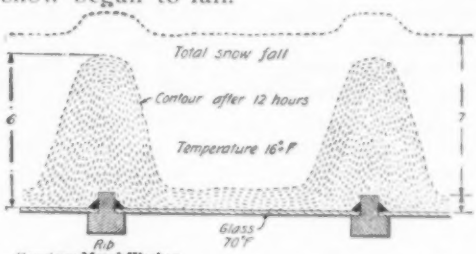
"In running on a straightaway a car gains momentum in proportion to its speed. It also loses what is known as inertia; that is, were the power suddenly shut off, the car would continue to travel in the direction in which it was going until the momentum was overcome by inertia. In science inertia is also that quality which impels a moving object to continue its line of motion when the mechanical impetus is removed. In the case of a motor car rounding a turn the power is not shut off, but the force of inertia which tends to keep the car traveling in one direction is suddenly shattered. The impetus given by the motor compels the car to continue its momentum around the turn, but in overcoming the force of inertia the car tips. When the car shown in the illustration made the turn, the tendency was to follow its former direction from right to left, and the inside wheels left the ground. A car always follows its earlier motion in tipping, so that the inside wheels always are those which come off the ground."

ELECTRIC AND STEAM LOCOMOTIVE RIVALS

The accompanying illustration gives a comparison in size of steam and electric locomotives of equal capacity. The electric locomotive is a powerful machine for the hauling of passenger traffic on the Simplon Tunnel railroad in Switzerland. The total length of the road is 13 miles, the tunnel itself consisting of nearly the whole of this. The electric locomotive will operate at four speeds, 15, 21, 33, and 43 miles an hour, the corresponding horsepower being 550, 650, 750, and 850.

HEAT LOSS THROUGH GLASS

The relative transmission of heat through glass and through wood is well illustrated in this drawing of the condition of snow on the top of a greenhouse roof some 12 hours after the snow began to fall.

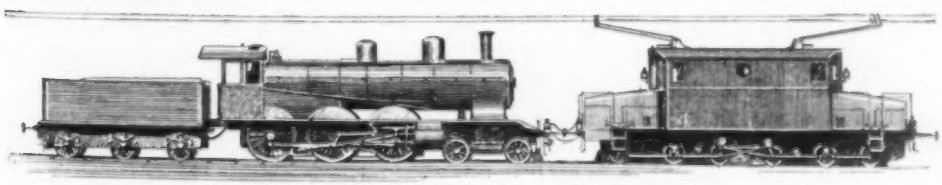


Courtesy Metal Worker

Snow on Greenhouse Roof Shows Relative Heat Loss Through Glass and Wood

The total snowfall is shown by the dotted line across the top. After the 12-hour fall the snow above the 2-in. thick wooden ribs of the roof was 6 in. deep, and only about 1 in. deep over the greater part of the glass surface. The loss of heat through the glass was five times as great as the loss of heat through the 2-in. wooden ribs.

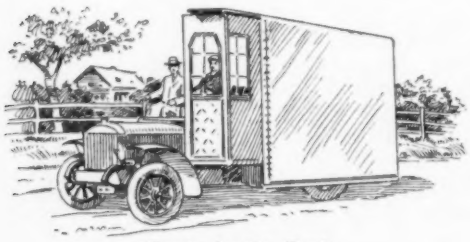
¶The Zurich Corporation, which governs the famous Swiss community, has decided to grant no further licenses to gasoline cabs, holding that electric cabs can be operated as efficiently and economically without the noise and odor of the gasoline vehicles.



Steam and Electric Locomotives of Equal Capacity

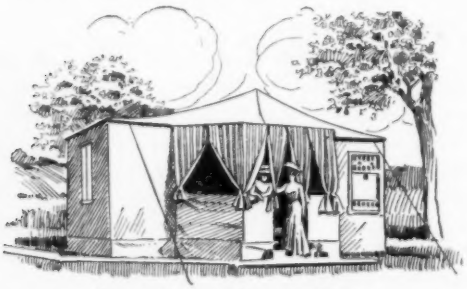
AUTOMOBILE IS PORTABLE HOUSE

An artist of Coburg, Germany, is touring the southern part of that coun-



Ready for the Road

try in a remarkable automobile which he converts into a summer house when he wishes to linger in a certain locality to paint. When running on the road it would resemble a large motor moving-van were it not for the curious window-section in the front. This, as one illustration shows, forms a dust and rain protection for the driver, while in the other illustration, which shows the



Converted into Summer House

machine transformed into a house, it is seen as a bay-window at one end.

As a house, the curious outfit boasts of a living-room, a bed-room and a kitchen.

THE WORLD'S DREADNOUGHTS

The activities of the navies of the world in building Dreadnoughts and the comparative strength of each in such ships is shown by the following figures: England has 12 completed, 2 launched and completing, 8 building or ordered, and 8 projected, making a total of 30. Germany has 4 completed, 5 launched and completing, 4 building or ordered, and 4 projected, making a total of 17. The United States has 4 completed, counting the "Michigan" as a Dreadnought, 1 launched and completing, 3 building or ordered, and two projected, making a total of 10. Japan has 5 completed, 1 launched and completing, 2 building or ordered, and 2 projected, making a total of 10. France has 6 launched and completing and 2 projected, making a total of 8. Austria has 3 launched and completing, but neither Italy, Russia, nor Spain has any.

MOTORBOAT GARAGES

Now that motorboats are as numerous in favorable water localities as are automobiles on land, the practicability of the motorboat garage as a paying business is becoming more and more assured. Probably not more than a tenth of the motorboat owners belong to clubs which have facilities for taking care of their craft.

That such garages, centrally located and properly equipped, are a good investment has been proven by the success of the few already in operation. One of these is in Pittsburg, and today it is taking care of from 300 to 400 boats, while a garage at Baltimore netted its owner more than he put into his outfit within five weeks after it was started.

A successful motorboat garage, according to the Nautical Gazette, must be able to haul a launch from the water and put it back again. It must have room for working on from 12 to 20 launches at one time without interference; handy machine, carpenter, and paint shops; a complete stock of marine hardware; a gasoline supply, and ample room for the safe mooring of a large number of boats.

¶Although Germany has clung to its faith in the dirigible for many years, its military authorities now recognize the superior effectiveness of the aeroplane.

Men of Tomorrow at the Glenwood School

A Farm for Raising Ambition

By JAMES R. QUIRK

ONCE upon a time there was a man who owned three hundred acres of land. It was a beautiful piece of ground, far better to look upon than the average farm, even in Illinois. It contained an orchard, some handsome shade trees, and through it there flowed as picturesque a little stream as ever rippled its way through a poem.

The owner of the land, who was then an editor, had been a farmer, and he dreamed of great crops which would be produced upon it. The crops he dreamed of were not wheat, nor corn, nor hay, but crops of ambition and character in the souls of dependent boys—boys who, because of force of circumstances or the influence of an unfortunate environment, needed just a little material help and a little inspiration to turn their steps in the right direction at the critical point in their lives.

Milton George

He saw the need of providing for a class of youngsters who are the result of every large, complex community such as the city of Chicago—not delinquents, but dependents because of the vicissitudes of life or the negligence of parents. It would be little short of criminal to send these boys to a reform school to consort with juveniles steeped in crime and aged in viciousness. It would break their spirit to send them to an institution such as the ordinary orphan asylum. Left to their own resources, some of them would, in all probability, develop into the type that is such a familiar and sorry sight in every large city—the floater, the corner loafer, or perhaps a more acute social menace.

Milton George, the man who owned those three hundred acres at Glenwood, Ill., was keenly alive to the existence of what today we call the "boy problem." And that was twenty years ago. He loved boys,

The "Cottage Mother" and One of Her Boys

and, while he was not a man of great wealth, he determined that what he had should be given in an attempt to save some of them. Milton George believed there were no bad boys. He believed every single one was worth saving. Six thousand have gone forth from the Glenwood school, founded in a great measure by his munificence, and although he gave but three hundred acres of land to found this haven, he experienced more satisfaction from his gift than if he had planted a thousand libraries.

Up to the time he was forty years of age Milton George followed his vocation of farming. Then, in 1871, he engaged in editorial work on an agricultural journal and continued as its editor and publisher for 25 years. He died but a few months ago. He first offered the land to the city of Chicago if the city would do its part by raising $300,000 for buildings and endowments. Chicago was very busy making fortunes, and the pathos in the lives of thousands of children was too insignificant to distract attention from the pursuit. Friends urged the man to convert his land into a town site, and join in the chase for gold. But the fate of a few boys meant more to him than money. So he made a second offer. He would donate the land if Chicago would raise $100,000. Chicago did not hear him, and it was not until he lowered the amount to $40,000 and succeeded in interesting a number of other philanthropically inclined men and women that the work was started. Then Mr. George devoted the remainder of his life to it. His wife, who was as deeply interested, and who survives him, also made many sacrifices to aid it. In fact this childless couple, who nevertheless had in their hearts a boundless love for children, gave their all to the cause which they deemed paramount.

Clancy Hall, the Chapel

The Illinois Manual Training School Farm at Glenwood is the result. It is an institution unique in its accomplishments, its aims, and its methods. Today 350 boys of from seven to sixteen years of age are there living a healthy, normal life, surrounded with every influence that makes for good moral and physical development.

At Glenwood every boy looks you in the face. If you were not otherwise informed you would imagine yourself at a regular boarding-school maintained by liberal tuition fees from well-to-do parents. Every boy is taught to believe in himself, to respect himself as well as those with whom he comes in contact. There is no physical restraint, no oppressive atmosphere of charity. There are no "inmates" there. There are students. It is not a "home" as that word is applied to some institutions. It is a school. And there is little or no punishment, for there is rarely any wrongdoing. It is hard to imagine 350 boys behaving themselves in such a manner that punishment is not meted out to some of them. Yet at Glenwood this ideal state of affairs has been brought about.

A group of buildings, dormitories, administration offices, etc., form the basis of the average institution. Not so at Glenwood. While there are cottages, administration buildings, schools and shops, back of everything is the Glenwood idea. This idea is that, given clean, homelike surroundings and proper guidance, a boy would rather do right than wrong. In the abstract the idea sounds familiar, but the manner in which that idea is carried into effect is responsible for the magnificent results.

No one who does wrong is a hero at Glenwood. The lad who defies his instructor is not placed on a pedestal and worshipped. Far from it. One boy tried this and that evening his mates held him to account for detracting from the standing of their cottage. They even took him out to a secluded spot and gave him a drubbing which made him feel like anything but a hero.

Everything worth having must be gotten through merit, and, remarkable as it may seem, every boy is made to feel confidence in his own ability.

Helping the Matron Darn the Stockings

"I am as good as any other boy, and I am going to be a good man," is the feeling inspired in them. A teacher or instructor at Glenwood would not think of telling a boy that he was stupid or bad.

During a visit to the school I went through the cottages where the boys live amid such home-like surroundings. The "cottage mother," or matron takes great pride in the thirty or more young-

Settee of Glenwood Design

Assembling an Engine

Glenwood Boys Making Bread in Bakery

Learning the Printers' Art

sters under her charge. In the pleasant living-room of one of them, which was more tastefully furnished and decorated than the average home, a little shaver of nine was sitting at the table, his head upon his arms.

"Is he sick?" I asked.

"Oh, no, Frank is not sick," answered the cottage mother in a tone loud enough for the boy to hear. "Frank is thinking. He's a good boy, one of the best boys I have, but he forgot. He is just thinking for five minutes about what he did. We were painting the beds today and Frank scratched his name with a pin in the fresh paint on his. Yes, Frank is a fine boy."

A few minutes later he was out flying a kite.

That's the way the little fellows are handled there. It would be well if many boys were treated in the same manner at their homes.

The cottage life at Glenwood is one of its most attractive features. The cottages are not built along lines which would suggest dormitories. They look more like large individual homes, each one different in appearance. The last one erected was the Farm Cottage. It is like a large bungalow, and the interior arrangement and furnishings delight the eye. There is a large living-room with a huge brick fireplace, book-cases along the walls, several fine rugs, and comfortable chairs. The matron has a suite of two rooms, and upstairs are large, well-lighted, well-ventilated rooms in which the boys sleep. Each has his little white cot, covered with spotless linen and a bedspread. Each boy has a little closet for his clothes, and in the basement he has a locker and a box for his playthings. These little fellows take great pride in these boxes, and vie with each other in keeping their belongings neat and orderly. I was permitted to peep into some of them, and a few minutes later noticed a little

fellow making a frantic effort to put his in order lest some one should see in it a chaos of kite strings, shoes, marbles, magazines and a hundred things dear to a boy's heart.

The manner in which a feeling of self-confidence is instilled into the men of tomorrow who are fortunate enough to live at Glenwood was well illustrated by a handsome little fellow of seven, the youngest boy at the school. A baseball game was going on behind the administration building, when Mr. V. P. Randall, the military instructor, was crossing the field. Up to him marched the little boy.

"Mr. Randall," he said, "they say I'm not big enough to play ball. I think I can play, don't you?"

He was assured that with practice he would undoubtedly make a good player, and he trotted away determined to show his larger comrades that he could.

That little incident was typical.

In the manual training classes and in the schoolrooms this same spirit is manifest. The boys are led to believe in themselves, and they accomplish results.

Three hours a day are devoted to the school work, and an equal number to manual training. When a boy leaves Glenwood he has acquired a good grammar school education and a good start in a useful trade. The manual training building is considered one of the best equipped in the country.

There are seven departments: machine, forge, cabinet and wood-working, printing, shoemaking, laundry and bakery. Great care is taken that the instructors are not only skilled in their lines, but capable teachers as well, and men of good moral character. Under the direction of the instructors all the repairs in machinery, iron work, carpentry, plumbing and steam-fitting are made by the boys, so that while they are learning the trades they are assist-

Youthful Wood-Workers

View in the Machine Shop

A Corner of the Laundry

The Glenwood School

ing in cutting down the school expenses. Some truly remarkable work has been produced by the lads in the wood-working department, some of the original furniture designs being of a high standard.

Monotony is not allowed to creep into the daily study and work. Military drills are made enjoyable, and to rank as an officer is a prize which every boy seeks to secure. Honor medals are given to those who have perfect records, and they have rarely been forfeited once they have been earned. Every boy's record in school work, manual training, military drill, cottage deportment and general deportment is kept by a careful system. Sickness is practically unknown, for the combination of good air and carefully prepared food with plenty of recreation keeps the boys in perfect condition. The subject of sickness is never mentioned in the presence of the boys, and this may, in a measure, be responsible for the prevailing good health. They never think of bodily ills.

Frequent entertainments, such as lectures at the chapel and little parties at the home of Superintendent Leo A. Phillips, also rout any possibility of monotony. Almost every week some interesting lecturer takes the ruddy-faced youngsters to some foreign country with stereopticon and description, and they look forward eagerly to these treats. They are brought to appreciate wholesome, rational amusements, and it is safe to say that after spending a short time at Glenwood the boy goes forth into the world with a fine sense of discrimination between the good and the bad.

One hundred acres of land are devoted principally to the raising of vegetables for the table and fodder for the horses and cattle, and here, under the direction of a trained farmer, some of the boys put in their share of the work. An orchard, a berry patch and a vineyard contribute to the food supply, and milk is supplied by a herd of cows.

When summertime approaches there is a keen rivalry for the privilege of

Spending the Evening in the Living Room—Sunnyside, a Typical Cottage—A Corner in One of the Bedrooms

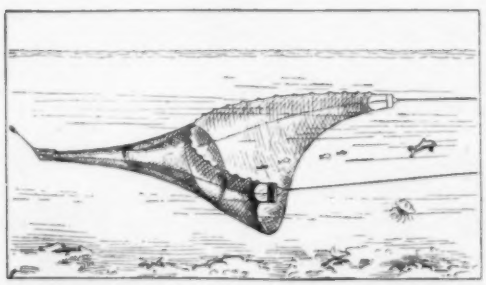
serving as caddies on the links of nearby clubs. One summer the boys erected a fine greenhouse with the funds they earned in this manner. They are permitted to use the money they earn for themselves, but they preferred to do something for their school.

So quietly has this good work been going on at Glenwood that even Chicago is not fully aware of its significance. No loud-voiced demands are made upon the public purse. The judges in the different courts are familiar with it, and often send charges there when they wish to insure the child's future. The city pays a nominal sum for those it sends to the school, and parents often place their children there when circumstances do not permit their remaining at home. The Commercial Club of Chicago has, through its president, Mr. Edward B. Butler, taken a great interest in this school and has been the donor of a handsome school building and other necessities. Mr. Butler is also president of the board of directors of the school, and, although the head of one of the largest mercantile houses in the country, always finds time to take an active part in the management.

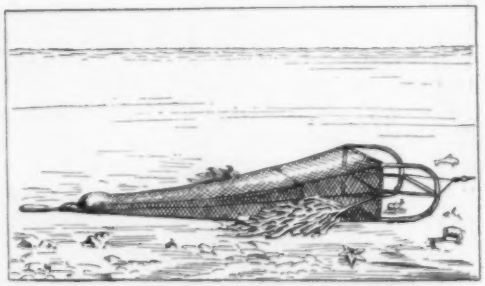
After all, any institution is best known by the results which it has accomplished. Every now and then a former Glenwood boy returns to visit the school, and letters are frequently received which show that the good work started on Milton George's three hundred acres is producing crops whose value cannot be estimated in gold.

HUNTING SEA SPECIMENS WITH NETS

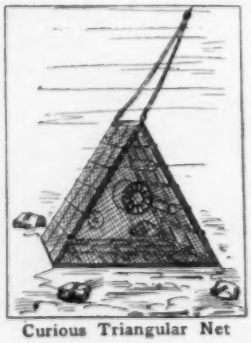
The principality of Monaco is of course, chiefly famed as a pleasure and gambling resort, but the Prince of Monaco is famed for many things, among them being his sportsmanship, enthusiasm for the development of aerial craft, motorboating on a large scale, and his studies of the science of the sea.



Net Hauled Above Sea Bottom



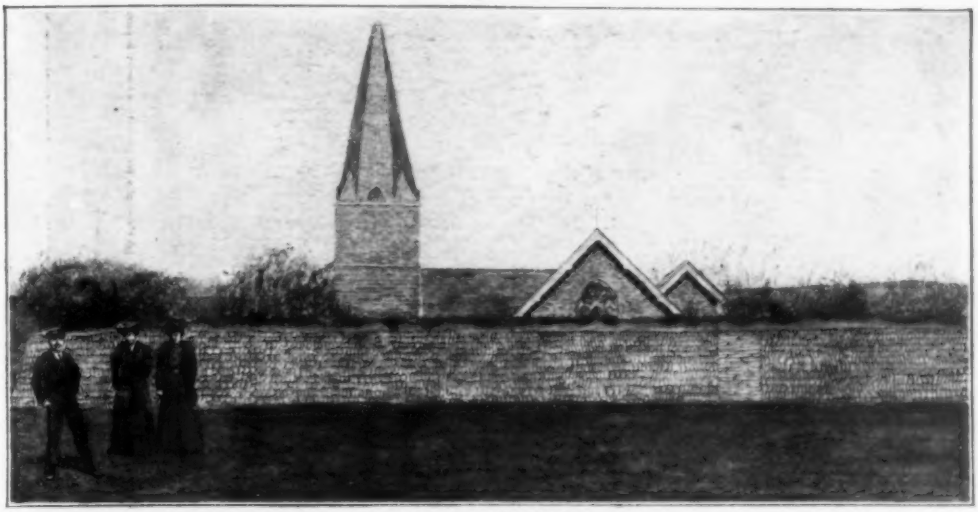
Net Dragged Along Sea Bottom



Curious Triangular Net

The last named is his special hobby, and his yacht, the "Princess Alice," is well equipped for gathering specimens of the sea. The illustrations show three of the many nets he uses in gathering specimens. One is adapted to be hauled along above the sea bottom, another is dragged along the bottom, and the third is a remarkable triangular net. The tassel attached to the net which is dragged along the bottom catches animalculae.

An oceanographical museum, founded by the prince, was recently opened at Monaco, also.



Built About 1200 A. D.

ENGLISH CHURCH BURIED IN SAND FOR CENTURIES

After having been buried for several hundred years in immense sand drifts, St. Edenock's Church, in Cornwall, England, is now being used once more as a place of worship. The edifice was built about 1200 A. D. It is situated near the shore, in a section of the country which is almost devoid of vegetation, great sand drifts covering many square miles. High winds, blowing in from the sea, piled the sand up over the church, completely burying it. No attempt was made to dig it out for several hundred years. A few years ago, however, work was begun, and the ancient church was repaired and services held in it.

EARTH'S SURFACE BOWS ACROSS THE SEAS

Twice each day the buildings upon the seaboards of every country in the world bow to the advancing tide, this movement measuring the yielding of certain sections of the earth's crust under the influence of tidal loads. A few months ago the Bidston observatory, near Liverpool, England, commenced a series of records to determine the exact extent of the movement. According to the Illustrated London News, these records show that, when the tide is high, the ground slopes at that place towards the sea. Twice a day, therefore, the houses in Liverpool bow to the advancing tide, and the buildings on the Irish coast return the salute. The extent and rapidity of the movement depends upon the quickness with which the tide rises to its height.

NAILS AND CEMENT IN EVERY ROLL

A New York manufacturing concern producing various grades of mineral asphalt roofing packs it for shipment to domestic and foreign buyers in a very ingenious way. In the center of each roll of the roofing is packed enough nails for securely fastening it to the roof, and pure asphalt cement for welding and waterproofing all joints and laps. The roofing is composed of two asphalt-saturated wool felts, with waterproofing cement between.

ARTISTIC CONCRETE BUILDINGS—No. 9, Bungalow of W. Bassett Jones, Bryn Mawr, Pa.

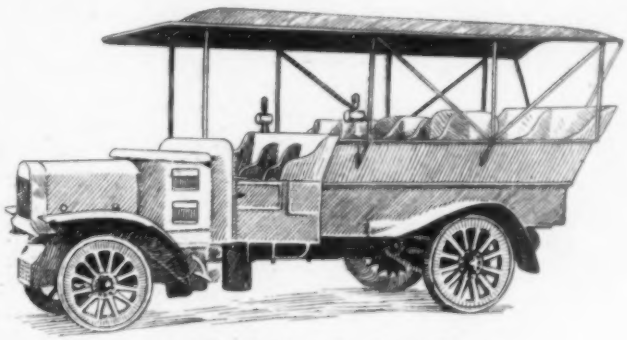
PRODUCER GAS INVADES AUTOMOBILE FIELD

Great strides have been made within the past few years in the development of the producer-gas engine. Its great feature is economy of fuel, and the engine, because of this and its many other good qualities, has now found its way into nearly every industry.

The appearance of a motor car propelled by a producer-gas engine has not been expected for some years to come. The success, therefore, of an automobile fitted with such an engine comes as somewhat of a surprise at this time.

The first producer-gas automobile underwent some pretty severe tests in Scotland recently. As can be seen by the illustration it is of the char-a-bancs type. Its total weight with passengers and a day's fuel supply is over five tons. As a result of the tests made to show its consumption of fuel on a run of 35¼ miles, the engine used 189 lb. of anthracite coal, which at the rate of $4.80 per ton, would mean that the entire fuel cost for the trip would be about 47 cents. Gasoline costs 26 cents per gallon in Scotland, and the same load run over the same course by a gasoline engine, would take about 26 gal. of this fuel, making the total cost $2.86. A comparison of the fuel costs, therefore, shows that the producer-gas engine operated at one-eighth the cost of a gasoline engine under the same conditions.

Nothing distinguishes the appearance of the producer-gas automobile from the ordinary type except the case between the bonnet and the dashboard, which is in no way disfiguring. This case contains the producer with sufficient anthracite for a 10-hour run. At the bottom of the case is the door for lighting up the producer, and above this is the hopper, the lid being lifted for filling. Air is forced through the bottom of the producer by a blower, and as the gas rises to the top of the hopper, it is strained and led through a pipe to the cleaner at the back of the car. From here it goes to a suction-box where it is mixed with air, and thence to a four-cylinder engine working with a compression of 115 lb. The water is fed to the producer by a specially designed pump, which is controlled by the same wire that actuates the throttle, so that the gas is kept at a uniform quality at all speeds.



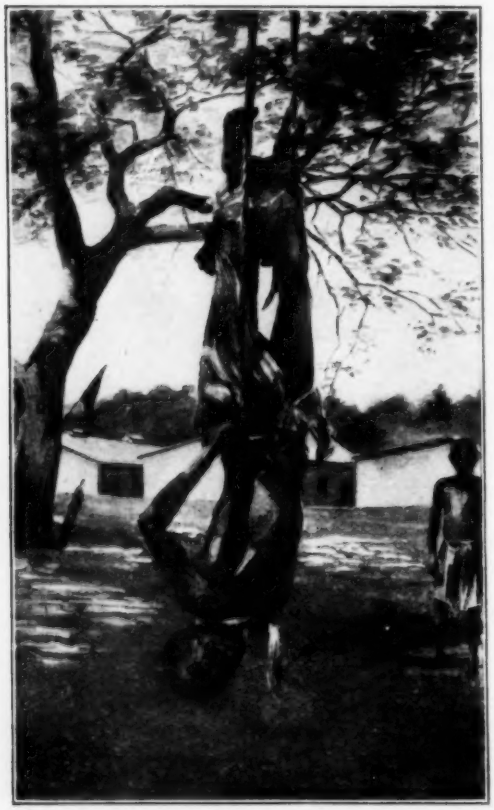
The First Producer-Gas Motor Car

One point observed during the trials was that the exhaust was entirely free from smell and quite invisible. If this can be relied upon in ordinary working it would remove one of the chief objections to producer gas for motor vehicles, since it implies that there is no carbonizing of the valves or cylinder walls, which would cause irregular working and necessitate frequent cleaning.

CA wireless telegraph station near Berlin claims to have succeeded in maintaining wireless communication with a steamship during the entire voyage from Hamburg to Cameroon, Africa, the greatest distance signalled being 4,000 miles. The messages had to pass over the Alps, the Algerian tableland, and the Adamana range. This would establish a new record in combined overland and ocean transmission of wireless messages.

HANGS HEAD DOWNWARD EVERY DAY FOR THREE YEARS

In a small village outside Bombay, India, is a fakir who spends all the



Hanging Head Downward as a Daily Occupation

hours of daylight of every day suspended head downward with his head about two feet from the ground. Two fiber ropes, attached to the limb of a tree, constitute his support. Early every morning he takes hold of the handles at the ends of the two ropes, reverses the natural position of the body, and hangs in such position until sunset.

He has been doing this now for more than three years.

¶"Deadly Weapons" is the flaring sign over the window at the license bureau of the Chicago city hall, where automobile owners apply for permits to run machines.

SPEEDOMETERS FOR SHIPS

A speed indicator which does the same service for a ship as the speedometer does for an automobile or motorcycle is now available for large vessels, such as warships, passenger liners, and large steam yachts. But the apparatus, in its present form, is not practical for small craft of the motorboat type, because of its prohibitive cost, which exceeds $500. The demand for an adequate speed recorder for small boats is rapidly growing, however, and will probably be filled before long.

The apparatus furnished by an English company for large ships is a combined distance recorder and speed indicator. It consists of a tube running through a sea-cock projecting below the bottom of the vessel, preferably at a point about one-third of the vessel's length from the bow. In the lower portion of this tube, facing downward, and in the upper portion, facing aft, are openings through which the water passes as the ship moves. The water enters through the lower opening, passes through the tube, and emerges from the upper opening. In the tube is a small propeller, carried on a shaft which runs up through the tube into the ship.

Three guide rods are attached to the casting which forms the body of the sea-cock, and by the aid of these the tube can be drawn up into the ship without the adjustment being altered, and when the sea-cock is closed it can be taken away for cleaning or examination. At the top of the tube are two distinct pieces of mechanism. One of these is a small magneto generator, driven through gearing by the propeller in the tube, and its purpose is to supply electric current for working the speed indicator. The voltage of the current generated is in proportion to the speed of the propeller in the tube, which in turn is in proportion to the speed of the ship. By leading this current to a voltmeter, which has the scale marked off in knots, an accurate indication of the speed of the ship is obtained.

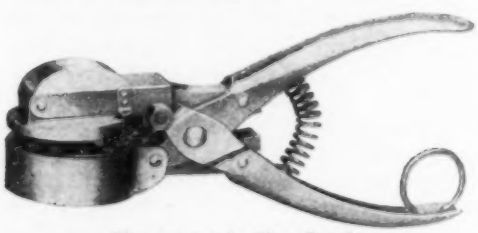
The second piece of mechanism at the top of the tube is a commutator. From this, connections are taken to the distance-recording dial, and, as the number of contacts made in the commutator depends upon the number of revolutions of the propeller, the indications are a true measure of the real distance traveled by the ship. Contact is made 100 times while the ship travels one mile.

Owing to the fact that the apparatus works electrically, it is possible to have a number of dials distributed over the ship for the benefit of passengers as well as for the officers.

AUTOMATIC TIME PUNCH FOR STREET-CAR TRANSFERS

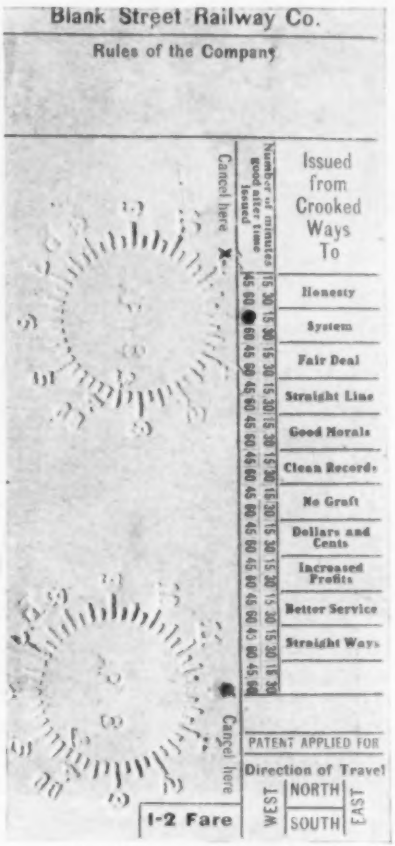
A conductor's punch provided with a clock mechanism that automatically impresses the time on a transfer has been placed on the market to take the place of the ordinary punches used by street railway conductors. One punch with the new device indicates upon the transfer the month, date, time of day, number of punch, and destination of passenger, while the conductor provided with an ordinary punch has often to use it five times to get the same result.

The punch also places upon the transfer the time beyond that of actual issue within which the transfer may be used by the passenger. This time limit being automatically placed upon the transfer enables the receiving conductor to see at a glance whether it is



The Automatic Time Punch

being used within this limit or not. The punch contains a reliable time mechanism and dating wheels so arranged that they can be easily changed at the office from day to day. The indications made by the punch cannot be changed except by an authorized person, as the operating mechanism is sealed after being wound for the day.



Impressions on a Transfer

The same punch is used by the receiving conductor in canceling the transfer. One of the illustrations shows a transfer punched twice, once by the conductor giving out the transfer, and once by the conductor receiving it.

¶The East is making great progress in aviation. Ceylon is to have exhibition flights by Sands, a pupil of Latham, a Punjabi has invented a successful biplane, and Bangkok is planning an aviation meeting.

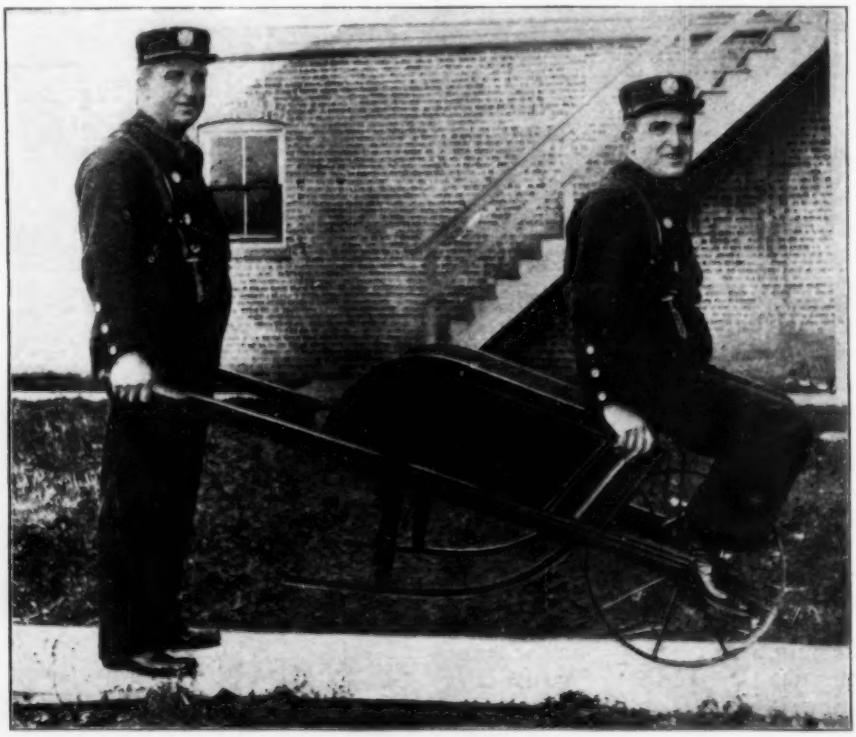
VACUUM-CLEANING STREET CAR REMOVES DIRT FROM RAILS

The vacuum cleaning principle, which is rapidly extending its scope of usefulness from the cleaning of vehicles and building interiors to such tasks as cleaning streets, has been adopted by the street railway of Hanover for the purpose of removing dirt from the grooves in its tracks.

When streets are cleaned by brushes the dirt is pushed into the grooves of the rails and is hardened into a compact mass by the weight of the passing cars. The rails become so coated with dirt as to offer resistance to the electric current, and it is to remedy this that a special car has been provided with a vacuum-cleaning system.

Between the front and rear wheels on both sides of the car are steel brushes, which loosen the dirt from the rails. Working in connection with the brushes are tubes which draw the loosened dirt into pipes that deposit it in a dirt receptacle. The pump providing the air suction is driven by an electric motor attached to the dirt box.

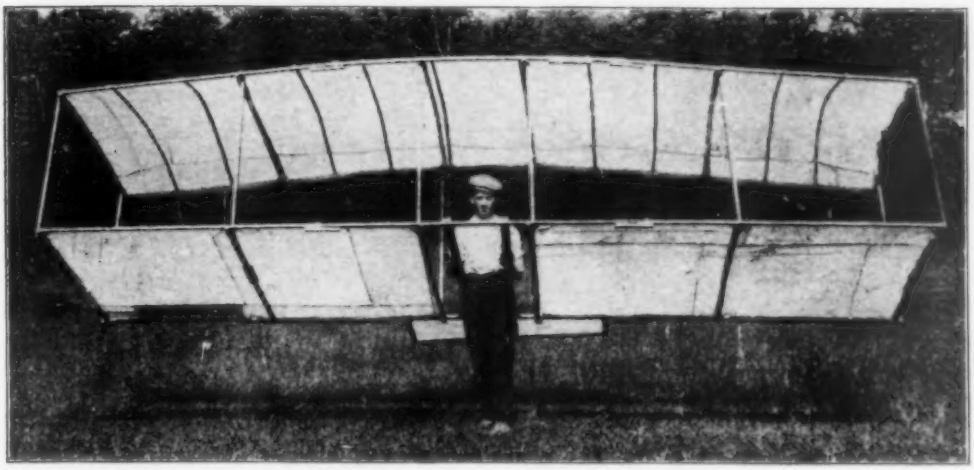
The car cleans an average of 45 miles of track a day, is operated by one man, and will work with good results at any speed not exceeding 18 miles an hour.



A Successful Duplicate Photograph

WHAT OUR READERS ARE DOING

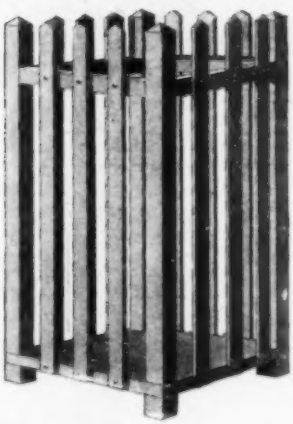
The accompanying half-tone engravings are reproductions from two of the many original photographs we receive illustrating articles made from the descriptions given in the Shop Notes and Amateur Mechanics departments of Popular Mechanics. In one of our recent numbers there was given a complete description and dimensioned drawing of a glider. One of the many gliders made from this description is shown in one of the illustrations, and is the work of N. Chadwick, Philadelphia, Pa. The half-tone picture show-



Successfully Made According to Our Instructions

ing a person wheeling himself was reproduced from a photograph made by G. E. Sandman, Chicago, Ill., who used a duplicator on his camera, made from our description.

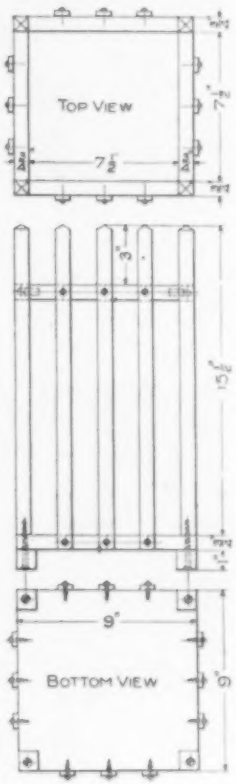
A WASTE PAPER BASKET



A waste paper basket of pleasing design, and very easy to construct, is shown in the accompanying sketch. Quarter-sawed oak is the best wood to use, and it is also the easiest to obtain. The following pieces will be needed:

1 bottom piece, ¾ by 9 in. square.
4 corner pieces, ¾ in. square by 15½ in.
4 top rails, ¾ in. square by 7½ in.
12 slats, ¼ by ¾ by 16¼ in.
4 blocks, 1 in. square.
4 F.H. screws, 2½ in. long.
24 R.H. screws, ¾ in. long.

If the pieces are ordered from the mill cut to length, squared and sanded, much labor will be saved. First bevel the ends of the corner posts and the slats, as shown, and finish them with sandpaper. Bore the holes in the posts and the railing for the dowel pins. These pins should be about ⅜ in. in diameter and ¾ in. long. When this is done the parts can be glued together and laid aside to dry. The four blocks 1 in. square are for the feet. Bore holes through these blocks and the corners of the bottom board for the large screws to go through. Fasten them together by running the screws through the blocks, and the board into the ends of the corner posts as shown in the sketch. The ¼-in. slats can now be fastened on with the small round-headed screws. They should be evenly spaced on the four sides. This completes the basket except for the



finish. This can be any one of the many finishes supplied by the trade for this purpose.

MECHANICAL ELEPHANT IMPRESSES AFRICANS

A British expedition to the Kasai basin in the Congo Free State received

Toy Elephant Which Served British Expedition

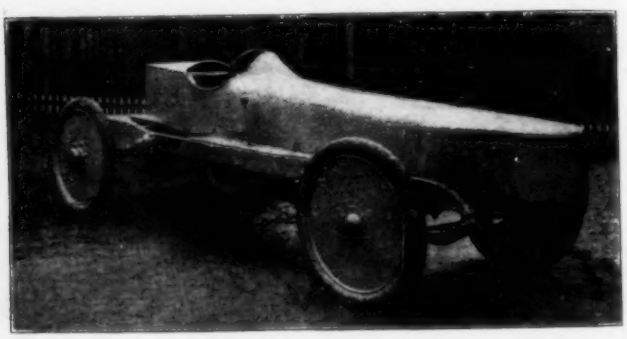
much consideration and aid from natives that otherwise would have been more or less unfriendly through the simple means of a toy clockwork elephant. The toy, with trunk extended upward, stood only 10 in. high, but its movable trunk and legs inspired the natives with considerable fear.

INCREASE IN UNITED STATES BATTLESHIP BREADTH

The remarkable increase in the breadth of American warships since 1903 is shown by the following figures: Between the authorization of the "Texas" in 1886 and the "South Carolina" in 1905 the average increase of beam was about 9 3-5 in. annually. For the period of 21 years between the "Texas" and the "Delaware," authorized in 1906, the total increase in beam was 22 ft. 1½ in., an average of approximately one foot a year. Since the authorization of the "Michigan" in 1905 the rate of increase has been nearly trebled.

The "Arkansas" and "Wyoming," the 26,000-ton monsters authorized in 1909, will have a breadth on the load waterline of 93 ft. 2½ in.; the "Florida" and "Utah," authorized in 1908, are 88 ft. 2½ in.; the "Delaware" and "North Dakota," authorized in 1906 and 1907, 85 ft. 2½ in.; the "South Carolina" and "Michigan," authorized 1905, 80 ft. 2½ in.; and the "Idaho" and "Mississippi," authorized in 1903, 77 ft.

AUTO OF 20 HORSEPOWER MAKES 88-MILE-AN-HOUR SPEED



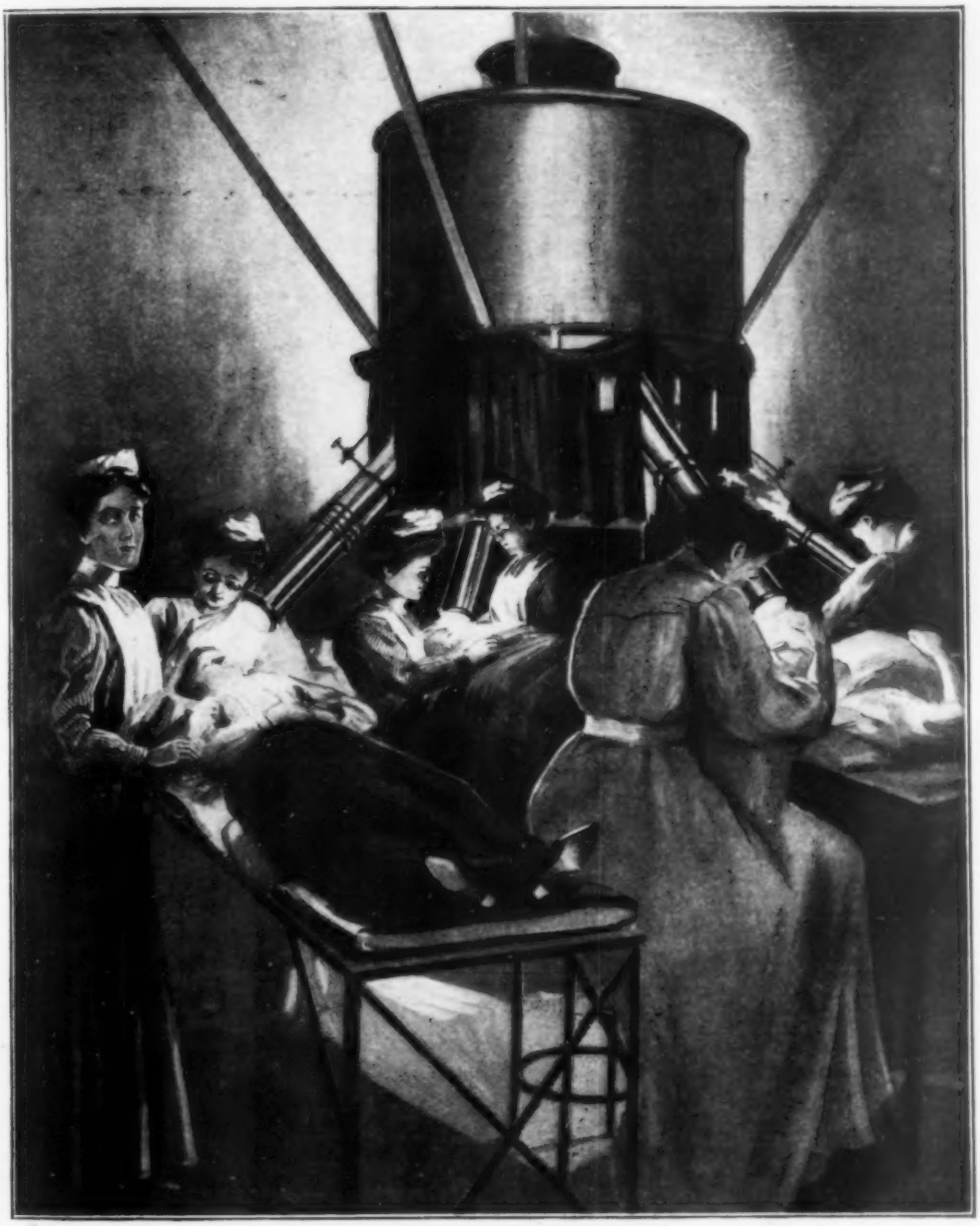
A 20-Hp. Flyer

High-powered, heavy racing automobiles have made speeds, for short periods, of over 100 miles an hour, and one car, equipped with a 200-hp. engine, has attained a speed, for a minute or so, of 132 miles an hour. But the car shown in this illustration has made a speed of 88 miles an hour on but 20 hp. It is provided with a special wind resisting body, and its speed is the greatest ever attained with such small power.

¶A minister of Lima, Ohio, advertises his Sunday sermons in moving picture theaters.

HEALING LUPUS WITH ELECTRIC LIGHT

A few years ago Queen Alexandra of England introduced from Denmark the Finsen treatment for lupus into the London Hospital, presenting the first lamp. The installation is now the finest in the British kingdom. The light is supplied by a powerful arc, the rays passing through telescopes, parts of which are filled with water to absorb the heat. The skin of the patient



Lupus Room of London Hospital

is first made bloodless by pressure, and then a spot of light about the size of a penny is allowed to fall on the afflicted part for an hour, after which a cooling ointment is applied. Twelve lamps, with a nurse at each, are in use, and about 70 patients are treated for an hour each day. The treatment is painless, and the cure takes from three to 18 months, according to the severity of the disease.

Lupus is a disease of the skin occurring in two distinct forms. One form is characterized by an eruption of red patches, which become incrusted, leaving superficial scars. The other is marked by the development of lumps, which often ulcerate deeply and cause great deformity. Formerly it was often confounded with cancer, and some varieties of cancer were included under lupus.

The Modern Mechanic

Oh, I'm a professional auto-man,
A driver of daring and skill.
In goggles and cap, I'm a stunning chap,
Gotten up in a style to kill.
I know all the merits of each machine
In every particular part;
There isn't a thing from a spoke to a spring
That I haven't got down by heart.

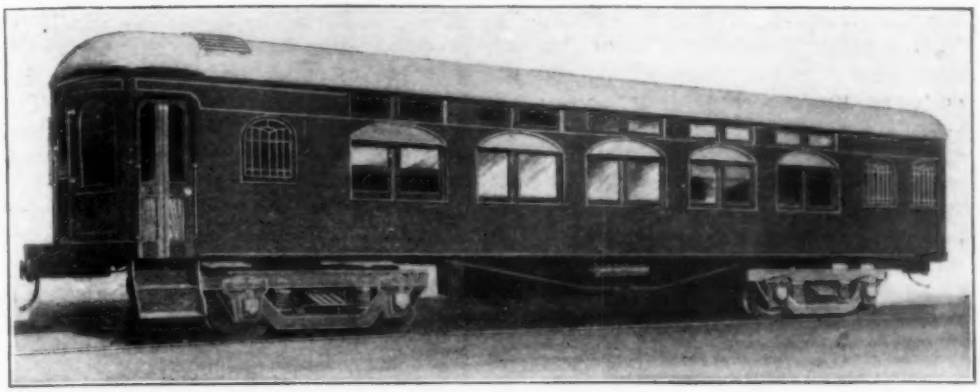
Of jack and packing, connectors and sectors,
Flanges and bevels and joints,
Of shaft revolution and weight distribution,
I know all the decimal points.
Selective control is dead easy to me,
The battery simply a snap;
The plug of the spark I could see in the dark,
Fix the nozzle while taking a nap.

In friction, ignition, combustion and power,
In sprockets and ratchets and cams,
I'm right up in front and can do every stunt
When the what-yer-may-call-it-em jams.
Rarefaction, velocity, fuel, viscosity,
Cylinders, throttles and pumps,
Are simple to me as A, B and C,
When the thingumbob sputters and jumps.

The mud guards I know from the lamps at a glance,
The tires I can tell from the brakes;
Valves, clinchers and strokes are mechanical jokes;
Ratios, mathematical fakes.
Garages, speedometers, gasoline tanks,
Vibration, displacement and sprays,
Bolts, rivets and chants, co-efficients and strains,
I can talk of in technical phrase.

There's only one thing I am waiting for now,
Ere my knowledge can fully prevail;
If I only could steal an automobile!
I have cribbed all the rest by mail.

—Frederick Maxon in Life.



Exterior of Electric Railway Sleeper

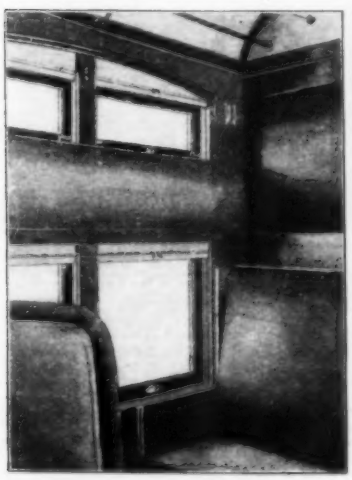
SLEEPING CARS FOR ELECTRIC RAILWAY

An Illinois traction system has placed two exceptionally interesting sleeping cars in service on its line between St. Louis and Peoria, Ill., a run of 172 miles. The cars are not provided with motors, but will be used as trailers behind an ordinary service car, thus doing away with much of the noise.

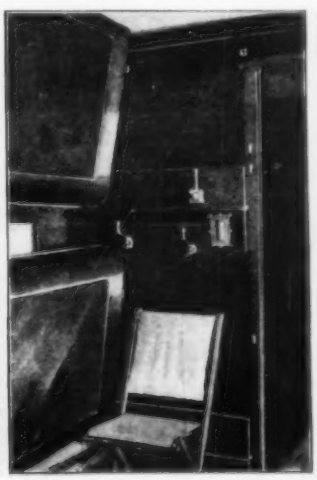
Probably the most interesting feature of this new design of sleeping car is the window arrangement by which fresh air and an outside view are provided for the upper berths. As shown by the illustrations, two narrow windows are provided for each upper berth. These are just above the ordinary windows of the cars and add much to the appearance of the exterior.

The cars are 54 ft. long. They have 10 upper and 10 lower berths, both upper and lower being 37 in. wide, and at one end is a smoking room and toilet facilities for men, while the other end provides toilet facilities for women, a heater compartment, and linen lockers.

The arrangement of berths is very ingenious. The two end compartments are provided with seats for daytime use that form berths at night. In forming the berths, the seat cushions slide together in conjunction with two auxiliary cushions stored during the



An End Berth Section



Middle Section with Berths Folded

Berths of Middle Section Lowered

day, and provide a lower berth with deep springs, while the seat backs, hinged at the top, swing upward to form the upper berths. These sections have an appearance similar to Pullman car sections, but the three compartments on each side in the middle of the car are of a new design, as it is not intended that the passengers shall be seated in them except just before retiring and after rising. These berths, both lower and upper, are hinged to the framing of the car and their weight is so balanced that they may be folded up against the windows. Each berth is removable, a feature that makes it possible to carry them outside the car for thorough cleaning and airing. The occupant of one of the lower sections may push the berth up against the window before retiring or on rising and thus have the entire floor space and room under the upper berth for disrobing or dressing.

A colored porter attends the passengers on the car, and serves them with a light breakfast of hot coffee and rolls from a portable fireless cooker.

THE ARGUMENT AGAINST A SANE FOURTH

[The following is from a well known company engaged in the manufacture of firearms.—Editor.]

"Editor: I read in your May issue an article against fireworks, firearms and blank cartridges on the Fourth of July.

"This of course is not liable to help us and I enclose herewith an article giving a few points on the other side."

So many articles in favor of a noiseless Fourth of July, have been published lately, that perhaps the other side may interest the public.

In the first place it is a boys' day; the greatest celebration day in the year for the American Boy, and to him, celebration means enthusiasm and noise. These are his means of showing patriotism. He cannot understand the orators' words picturing the signing of our independence and thus the significance of the greatest American anniversary is lost to him.

Do we want our future men to lose sight of the significance of this big day? Generation after generation has celebrated with noise and enthusiasm, awakening the patriotism of our youth; do we want this enthusiasm dulled?

The following extract from an article written last year by Police Commissioner O'Meara of Boston, throws a different light on the subject. He says: "The Fourth is a day to celebrate. I believe in celebrating. If I didn't, I wouldn't be a thorough American, and I don't think that the celebration should be confined to pink lemonade and peanuts. It is an occasion to warm up and let the world know that you are alive. If we didn't want to shoot off firecrackers and fireworks we wouldn't be human. This doesn't mean to try to kill our neighbors or ourselves. We don't have to make the Fourth of July a day of slaughter. We are sensible enough to know this. If you go too far, we will have to stop you. The day is yours. Have your noise, your excitement, your firecrackers. We won't interfere as long as you remember that you are law-abiding Americans."

Another point in favor of the "real" American Fourth is self-protection. We must depend on our young men in case of war because our standing army is so small. If we bring up our boys in the fear of gunpowder they cannot be so efficient, if they are needed in the field later.

Let the father instruct his sons how to handle fireworks and firearms and the accidents will be stopped. Let the American boy vent his enthusiasm on the Fourth and stamp the significance of this great day on his mind.

E. M. Benson.

¶The latest torpedo boat destroyer of the United States navy, the "Reid," recently attained a speed of 36 miles an hour.

GLASS BRICKS AS BUILDING MATERIAL

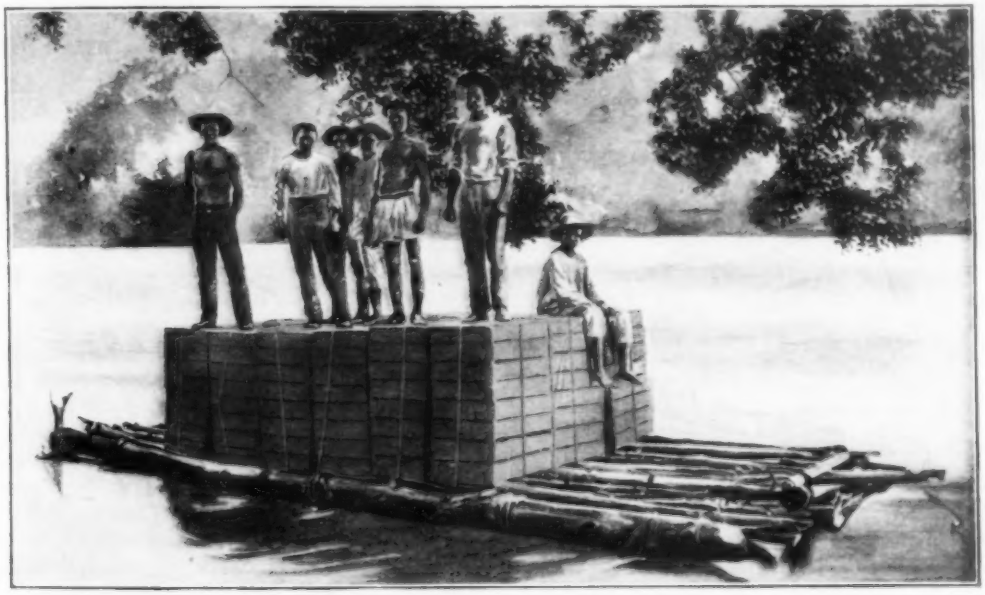
Glass bricks are attaining such a wide popularity in Europe as a material for interior wall construction that the dealers in junk find a ready market for such refuse glass as old window panes, broken bottles, and the like. This glass, gathered from the refuse heaps, is melted and run into molds. The bricks thus formed present a smooth impervious surface.

The glass bricks are being used in schools, stations, hospitals, theaters, public buildings, railroad stations, and even in meat markets. Many of the meat markets in Hamburg are made to convey an impression of dazzling purity by their use. Several schools and hospitals in Milan have adopted the bricks because they reflect more light than ordinary wall material, while in Dresden and other cities of Saxony they are used in theaters and public buildings.

¶The Pennsylvania railroad is experimenting with wireless telegraphy to determine its efficiency for railroad work.

SOUTH AMERICA'S ORCHID TRADE

Orchids, admired so greatly in American and European greenhouses, are exported from the Central and South American countries, where they are found at the edges of forests, along the banks of streams, and on mountain sides. Most of the species sought are air plants, found attached to the limbs or trunks of trees in light and airy positions, rarely in dense shade. They do not take nourishment from the tree which serves to support them, but from the atmosphere through the roots spreading over the surface of the bark.



Transporting Orchids Down South American River

The most beautiful and unrivaled of all orchids is the Cottleya, which rarely grows at a lesser height than 2,000 ft. above sea level and seldom above 4,500 ft. Other beautiful kinds grow at heights ranging from 4,000 to 10,000 ft.

In collecting the orchids, parties go out into the forests carrying food for a week, shotguns, stringbags, and the knife known as the "machete." After the camp site is selected and the camp erected, the party, according to an article in the Guide to Nature, goes out during the day looking for the par-

ticular kind of orchid wanted. When they are found, the trees supporting them are, as a rule, cut down, and the plants stripped from the trunks and

An Orchid from Colombia

branches and placed in the stringbags. When a number have been gathered the men carry them on their backs to the village, where a house of some kind is secured in which to store them. Several trips are made before a sufficient quantity is procured, then they are packed in dry shavings in well ventilated boxes, made for the purpose from logs sawed into boards by hand, loaded onto mules or oxen, and transported to the nearest river.

Sometimes the journey to a river takes several days, or weeks. Once at the river the boxes are loaded on specially built rafts and floated down the stream until a place is reached from which transportation by steamer can be obtained to the coast. The coast being reached, the boxes are transferred to ocean steamers bound for the United States or Europe.

If the plants are received in good condition they will, under proper culture, produce their beautiful flowers within a year, or even less, from the time they were taken from their native forests.

INCH AND MILLIMETER CAUSE AUTO TROUBLE

The fact that several parts of American automobiles are measured in millimeters, one of the denominations in the metric system, instead of in English inches or fractions of inches, is causing so much trouble that many manufacturers are demanding a solution. They either want the metric system adopted wholly, or done away with altogether, instead of the present mixed condition of affairs. But to adopt the metric system requires that millimeters and meters must be taught instead of feet and inches, and America, it is believed, is hardly ready for such a sweeping change.

"The American car today," says Motor Age, "is, in many cases, a mixed proposition, a hybrid as many would express it. The bore and stroke of the cylinders are in inches, the diameter of the bolts is generally in inches, the tire sizes are in inches, but several parts are used which are made in metric sizes. Spark plugs of metric diameter and metric threads are used, which means that the car manufacturer must drill his cylinder castings to take these metric sizes. Also, he must fit the necessary amount of metric machinery in order to accommodate the metric products made in Europe, which he fits on his car. Some American cars are more metric than others, some of the bolts as well as the spark plugs being metric sizes."

A meter is 39.37 in., or about 3¼ ft. A millimeter is .03937 in., or, roughly speaking, 1/25 of an inch. Instead of saying the cylinder of a car has a 5-in. bore and 5-in. stroke, the European expresses it 127-millimeter bore and stroke.

¶China is to establish an arsenal to manufacture its own ordnance.

HEAT

Part VI—How Heat Travels

By J. Gordon Ogden, Ph. D., Professor of Physics, Fifth Ave. High School, Pittsburgh

[This is the sixth article of a series by Dr. Ogden, in which well known subjects will be discussed from the standpoint of their relation to modern mechanics. In the February number "The Nature of Heat and How It Is Measured" was discussed; the March article told "How Low Temperatures Are Produced;" in the April number "Some Effects of Low Temperature Upon Matter," were described, the May number treated of "The Production and Uses of High Temperature," and in the June issue "High Temperatures and the Rare Metals" was discussed. Succeeding articles will include Steam, Boilers, Ice, Radiation, etc.]

THE fact that heat does travel is familiar to everyone. Whether it is demonstrated to us in a forcible manner as when we attempt to stir a fire with a poker that has been allowed to remain a few minutes in the red hot coals, or whether it is through the warming influence of the sun, millions of miles away, we know that somehow or other, heat energy has the power of traveling from place to place. Sharp-eyed, deft-handed experimenters have not only established this truth in a scientific manner, but they have also added many interesting and valuable facts to the world's store-house of knowledge. It is the purpose of this article to make clear some of these phenomena of heat which are met with daily, but are not commonly understood.

Ordinarily speaking, heat travels in three different ways: conduction, as in the case of the poker above mentioned; radiation, as when it travels from the sun to the earth; and convection, which will be explained later.

As has been shown in a previous article, heat is simply a form of vibratory energy. The tiny molecules, which make up matter are never at rest, but are forever swaying backwards and forwards, up and down, in every conceivable direction. If this motion be increased and the molecules move through wider arcs, we say that the body has become hotter. If the motion could be absolutely stilled, then the temperature of the body would be zero—absolute zero—460° below the Fahrenheit zero. Heat is the lowest form of energy, *and eventually all matter in the universe will have precisely the same temperature.*

If this fact be true, it implies that heat must travel—not only from molecule to molecule, but from mass to mass, from earth to earth, and from sun to sun. Space is the clearing house of the universe for energy, and its emissaries and agents have been busily engaged in squaring accounts from the beginning of time, and will continue their almost endless transformations for eternities yet to come.

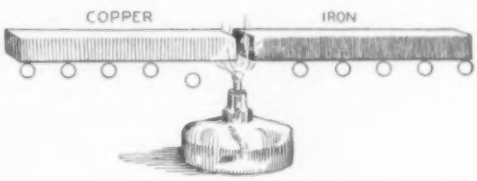


FIG. 1

Spirit Heat Lamp and Bars of Copper and Iron

Conduction, the transfer of heat from molecule to molecule, is possibly the most readily understood of the three modes of travel. A molecule is made to sway in a wider arc. This increased motion is passed along to the next molecule, and then to the next, and so on until all are swaying harmoniously.

Some molecules, however, take kindlier to an increase in their velocity than others. In Fig. 1 are shown a bar of copper and a bar of iron, with little metal balls attached to them by wax at equal intervals from where the spirit lamp heats the junction of the two elements. The balls will drop from the copper bar faster than they will from the iron. We are therefore justified in stating that copper is a better conductor than iron, although just why the copper molecule takes up the energy of motion more readily than the iron, we do not know. It is on a par with many other curious facts in nature, the reason for which is unknown, and we are

prone to pass it over with the familiar remark, "it is the nature of the thing."

Silver and German silver furnish us with a still more striking example of this variation in the conductivity of metals. Heat will pass through silver

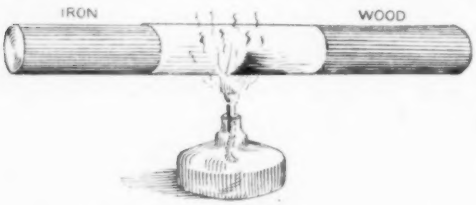


FIG. 2
Experiment in Heat Transmission

with the least possible resistance, while German silver furnishes an almost impossible barrier to the transfer of heat energy, the relative conductivity being about 14 to 1. Some day, possibly, we shall understand the reason why, and electricity will be the key to the mystery, as it is quite likely that, after all, heat is but a form of electricity, whatever that mysterious fluid or condition is; or else heat and electricity are only forms of some other unknown force. It is as hard for electricity to force its way through German silver, as it is for heat, giving us a very broad hint as to the relationship existing between those two mysterious employes so commonly used in our service.

FIG. 3
Experiment

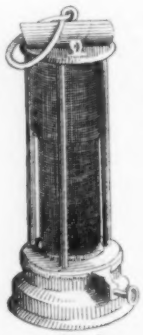


FIG. 4
Davy Safety Lamp

FIG. 5
Radiometer

A very striking experiment (See Fig. 2) illustrating the difference in the power of substances to transmit heat may be shown by heating a paper-covered cylinder one half of which is iron, and the other half wood. The paper on the wood half will char, while the other part over the iron will be unaffected by the heat, as the iron immediately conducts the heat from the paper, while the wood is unable to do so. Water may be boiled in a paper crucible, if care is taken to have the paper smooth and free from wrinkles, as the temperature cannot rise above the boiling point of water, which is not sufficient to burn the paper.

Figures 3 and 4 are illustrations of the practical use to which the high conductivity of iron is put. In order to produce combustion, three things are essential: something to burn, something to support combustion, and a sufficient temperature. The gas above the wire screen is burning, the gas below is not. The reason for this curious state of affairs is simple. The fine mesh of iron wire which forms the screen is really made up of small iron tubes. The burning gas in attempting to pass through these tubes into the unignited gas below, loses some of its temperature by the rapid conduction of heat by the iron; hence one of the conditions for combustion, a sufficient temperature, is lacking, and the gas below will not ignite. If a flame be entirely enclosed in a fine, metallic mesh, a Davy safety lamp (Fig. 4) is the result. It is hardly necessary to call to mind the inestimable value of this simple bit of apparatus, as it has probably saved more lives than any other safety device ever invented by man.

It is an interesting and important fact to mill owners and all others who use boilers, that the scale which accumulates on the interior of boilers is a very poor conductor of heat, and while the scale prevents the loss of heat from the enclosed water and steam, it also prevents to a large extent the access of heat from the fire to the boiler. Soot or grease on a boiler are also antagonistic to the economic use of fuel, and an untidy fireman is an expensive workman. It has been estimated that

one-tenth inch of scale, and one-hundredth inch of soot or grease are the equivalent of ten inches of metal. In other words it is just as easy for heat to pass through ten inches of iron as it is to pass through one-tenth inch of scale or one-hundredth inch of soot.

Metals are by far the best conductors of heat, and silver heads the list. A good conductor always feels colder to the touch than a poor conductor. A good illustration of this is afforded when we step with bare feet from carpet to linoleum. Both substances may have the same temperature, but the linoleum conducts the heat more rapidly from the body, and hence feels colder. Liquids are extremely poor conductors. Water, for example, may be at the boiling temperature at its surface, and at the freezing point a few inches below. Gases are even poorer conductors than liquids. It is exceedingly difficult to prove that dry air has any conducting power at all. This inability of air to conduct heat is a blessing in disguise, as it is largely due to the presence of air between the meshes and fibers of our clothing which enables us to keep warm in winter and cool in summer. The air space between the walls of a refrigerator acts in the same manner, and keeps down the insistent demands of the ice-man.

Radiation seems to be a favorite mode of heat travel, as by far the greatest amount of heat transference is done by this means. To understand what radiation really means we must know something about light. Light and radiant heat are so closely allied that it is difficult sometimes to make a distinction between them. They travel together with the same velocity, about 186,000 miles per second. Both can be reflected and refracted, and both cast "shadows." It might seem strange to speak of heat shadows, but anyone knows that the shady side of a street is cooler than the sunny side, and the buildings which shut off the direct sunlight, do the same for the radiant heat which accompany it. The vibrations of the ether which constitute radiant heat are a little longer than those of light, and are not hot in the sense that they have a temperature comparable to the medium through which they pass. For example the temperature of space is probably close to the absolute zero, and yet practically all the heat on the earth's surface comes from the sun through the intensely cold ether of space, a journey of ninety-three million miles, without heating it in the slightest degree. If it were "hot," it would part with its heat long before it reaches the earth in accord with the well-known fundamental principle that all bodies either give or take heat until they are equalized. Radiant heat might be likened to money. A dollar cannot be used as an article of food, but it can be transformed through the agency of a baker into good, substantial bread. Radiant heat is only a form of energy payable upon demand in what is known as "sensible" heat.

Everyone has seen the apparatus known as a radiometer, Fig. 5. The tiny little vanes whirling around without any visible cause, have always been a source of interest, if not of wonder, to the wayfarers who chance to pass a shop-window where these delicate instruments are displayed. The little globe is almost an absolute vacuum, and the radiant heat readily crosses the vacuum and strikes the little vanes of mica or aluminum. It will be noticed that one side of each vane is black, the other is bright and shining. The radiant energy is absorbed by the black side, and reflected by the other. A "kick" is thus set up by this unequal action, much the same as that which is given to a boat when one jumps from it to the shore. A radiometer has therefore two important uses, and should not be considered a toy. It demonstrates the fact that radiant energy will traverse a vacuum, and is also a good example of the law that action and reaction are equal and opposite in direction. Radiant heat meets with some trouble in passing through glass, and after it has made the journey, as through the windows of a

greenhouse, the longer waves are unable to escape, and hence are put to work by the gardener in raising the temperature of his domain.

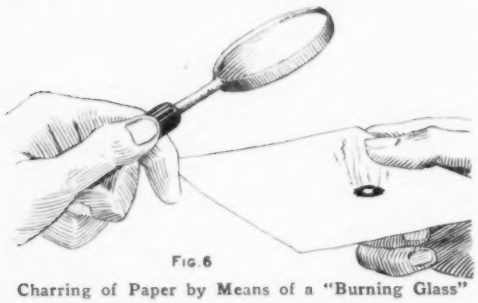


FIG. 6

Charring of Paper by Means of a "Burning Glass"

A "burning glass," Fig. 6, also depends for its efficacy upon the fact that light travels with more difficulty through air than through glass. Figures 7 and 8 show how a triangular bit of glass known as a prism will impede the waves of radiant energy which fall upon it, and while these waves succeed in passing the barrier, their direction is turned. Figure 9 shows two of these

FIG. 7 FIG. 8

Fig. 7—Rays of radiant heat approaching glass prism, which is much denser than air. The first rays entering prism are hindered, while the rays still in air are moving with the original velocity. This produces a bending of the rays.

Fig. 8—Full effect of prism on rays of heat.

prisms placed base to base, and their united action in bringing rays to a focus. A double convex lens is simply two prisms placed base to base. Burning glasses of great magnitude have been made. One made by Bernieres and Trudaine about a century ago was 4 ft. in diameter, and was hollow. When filled with water or other liquid through which radiant heat can pass, it produced heating effects sufficient to melt metals whose fusion point is very high. It is interesting to note in this connection that lenses have been made of ice, and by their use fire was readily procured. Gunpowder and paper were easily ignited by this queer kind of burning glass. Ice is certainly a strange agency through which fire may be produced.

Radiant heat is readily reflected and when mirrors are made of the special curvature known as parabolic, their power is almost unlimited as a means of heat concentration. A parabola is the same curve as is traversed by a stone which is thrown slantingly into the air, and returns to the ground. All rays of energy passing into a mirror shaped like this peculiar curve are reflected to one point called the focus, providing the rays enter the mirror parallel to a line at right angles to the exact center of the mirror. Conversely, rays of light, or heat, or sound, emanating from such a focus, are made parallel after reflection against the sides of the parabola. By combining two such mirrors, so that their axes exactly coincide, as shown in Fig. 10, it is possible to transmit heat quite a distance, and reconcentrate it upon some object. If a lump of ice be placed where the red hot coal is shown in Fig. 10 and a thermometer be substituted for the match, the thermometer will at once show a decided fall in temperature. At first thought, it might appear as though "cold" can be radiated as well as heat. This, however, is not so. "Cold" is simply the absence of heat. All bodies, as has been stated before, tend to equalize as regards temperature. The burning coal gives off heat, so does the match. The coal gives off more than it receives, while the match receives much more than it gives off. Hence the match ignites. When the ice is substituted for the

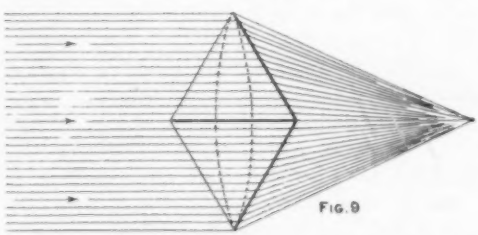


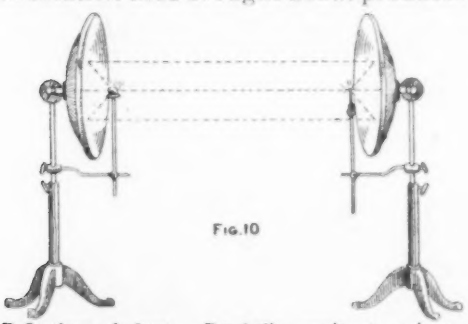
FIG. 9

Two prisms placed base to base. Dotted lines show ordinary double convex lens

coal, and the thermometer for the match, the mercury gives off more heat than it receives, and hence is reduced in temperature, and therefore contracts.

All bodies, it matters not what their composition is, radiate heat, or else absorb the same kind of rays which they give out when hot. A polished surface reflects but does not radiate. A dull surface, like lampblack, is a good radiator. A burnished coffee pot will retain its heat much longer than one that is tarnished. In other words, a good absorber is a good radiator, while a good reflector is a poor absorber and a poor radiator. As with light, radiant heat varies inversely as the square of the distance. In other words, a body placed at twice its former distance from a radiator will receive one-fourth the heat; at three times, one-ninth, etc.

Convection, the third method by which heat travels, is practically a form of conduction. Heated masses of air or water expand through the molecular action of the heat. They are therefore less dense than before, and are consequently pushed up by the descent of the colder and heavier masses. The moving particles give up their heat when brought into touch with colder bodies, and hence the statement that convection is practically the same as conduction. Heat transference in fluids is mainly by convection currents, and the circulation thus brought about produces



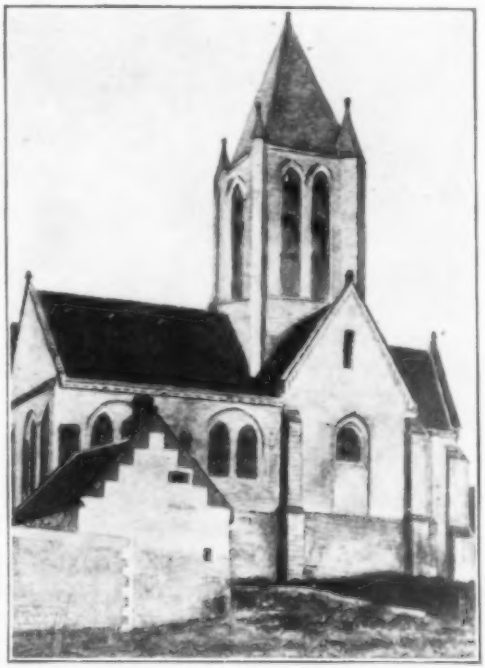
Reflection of heat. Parabolic conjugate mirrors. Match ignites at a distance of 10 ft. from red hot coal

the trade winds, and ocean currents. In our homes, convection plays an important part, as it is by means of this principle that ventilation and systematic heating are secured.

¶A Nebraska electric lighting plant manufactures ice as a by-product.

DYNAMITING A BELFRY OFF A CHURCH STRUCTURE

The removal of a belfry by the use of dynamite seems a rather hazardous



The Old Belfry Before the Operation

method of getting rid of it. Nevertheless it was the means resorted to when the upper structure of an old edifice at Cinqueux, France, built in the eleventh century, began to show signs of approaching dissolution, and endangered the rest of the church.

The amputation of the belfry was performed under the direction of a captain of a regiment of army engineers. Three charges of powder were exploded before the old belfry succumbed. Great care had to be taken that the entire edifice would not be irreparably destroyed, but as it was intended to give the entire structure a thorough overhauling, the slight damage to the main part of the building caused by the explosions was not a serious consideration.

The charges of powder were so placed that the inner supports of the belfry were most affected, and consequently

The Structure After the Dynamiting of the Belfry

the greater part of the heavy stone and debris toppled inward. The operation was considered very successful.

WOODEN RAILROAD BRIDGE WITH 380-FT. SPAN

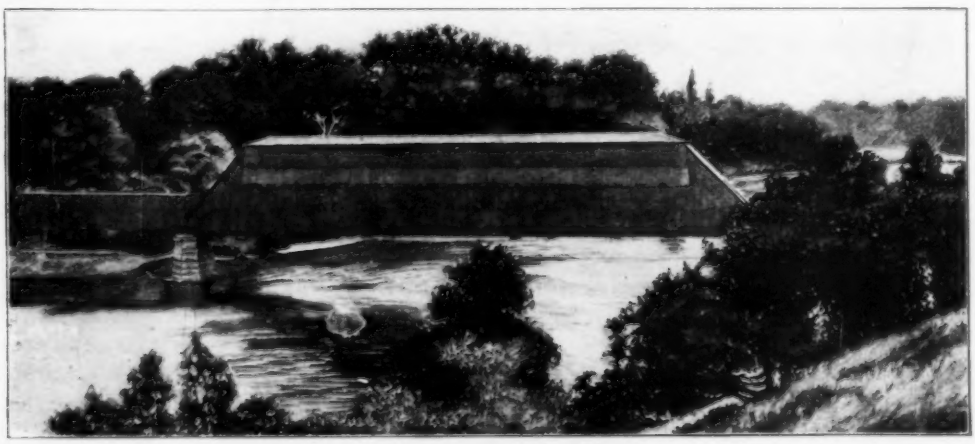
The covered 380-ft. span of this wooden bridge is said to be one of the longest of the kind in the world. The bridge is one used by the Southern Pacific railroad to cross the McKenzie river near Coburg, Oregon.

EXPORT MARKETS FOR AUTOS AND MOTORBOATS

United States consuls and a special government agent report Porto Rico, Norway and France as providing excellent fields for American automobiles and motorboats.

"The demand for automobiles in Porto Rico," says Special Agent J. M. Turner, "has been in excess of the supply. Agents have had to wait as long as three or four months for their orders to be filled, and the appropriation just made to extend uncompleted roads and join the ends of completed ones will mean a steady growth. There are at present more than 600 miles of splendid roads. The island, however, is hilly, and roads were originally built for military and heavy traffic, with little regard for easy grades. It is not unusual to find 10 per cent grades, and some maker of automobiles could easily capture the trade by turning out a machine to fit these conditions."

According to United States Consul Taylor, of Stavanger, the opening for motorboats and motorboat engines in Norway is good. "There seems to be an exceptional opportunity for both light, fast boats and the heavier more substantial class," he says.



Wooden Railroad Bridge in Oregon

Vice-Consul J. D. Wise, of Bordeaux, draws attention to the progress in motorboating in southwestern France during the past year. At Arcachon is a colony of enthusiastic water sportsmen continually on the alert for improved types of boats and engines. The bay is daily alive with pleasure boats, and although there are not many American boats or engines in use, the vice-consul believes the field is large and promising for their introduction.

the trucks are swung out and upward by the hoisting engine, thus allowing the machine to settle down on the four curved legs the feet of which rest upon the ties outside of the rail.

This arrangement leaves an open, free space under the machine through which the cars can be drawn at will for the purpose of loading.

It may be stated that the feet or bottoms of the curved legs are provided with flexibly connected crosspieces or

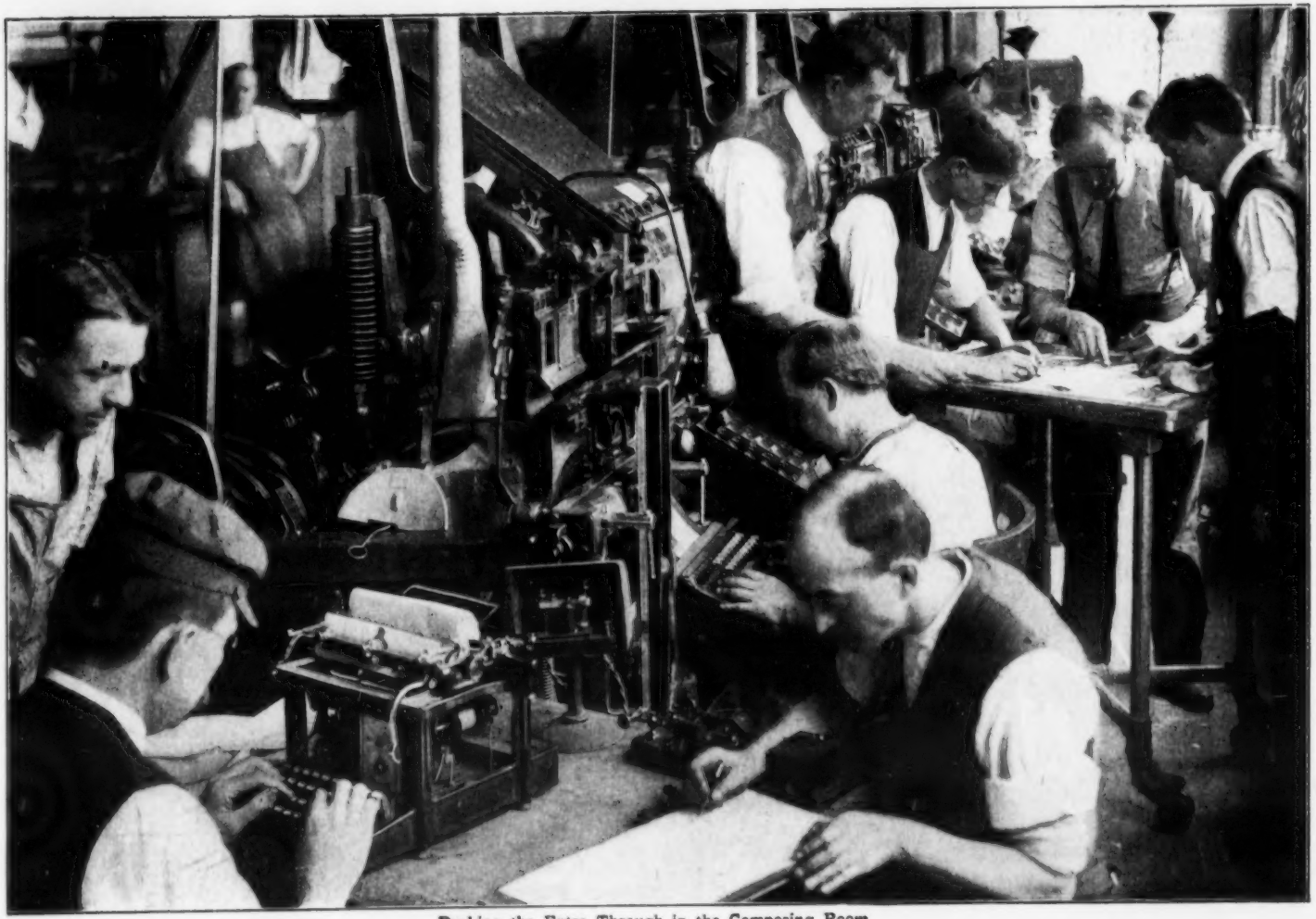
Hauls in Logs from Woods, Loads Cars and Makes Spur Tracks Unnecessary

UNIQUE STEAM LOG-LOADING MACHINE

The self-propelling steam log-loading machine shown in operation in the accompanying illustration is said to be one of the most remarkable of the various types of steam log-loading machinery in service today. Its construction is unique for loading operations, as it provides for passing the empty cars and trucks through the machine on the single main track, at the same time embodying trucks and propelling mechanism for moving itself in either direction along the track.

When the machine is in position for passing the cars through to be loaded, shoes, long enough to cover from three to five ties each. This gives the machine an exceptionally wide and substantial foundation or base. This self-propelling steam log-rolling machine is provided with a steel swinging boom, in some instances wood booms being employed where preferred.

It is equipped with two hoisting engines of two drums each, specially designed for the purpose, one of which is for skidding logs to the track for a distance up to 1,000 ft., and the other located near the foot of the boom and having one drum to carry the hoisting or loading line, and the other to carry a cable for hauling or "spotting" the cars through the machine.



Rushing the Extra Through in the Composing Room

GETTING OUT AN "EXTRA" ON A BIG NEWSPAPER

Here is a scene in the composing room of a big newspaper. The working forces are concentrated into the emergency corner getting out "hot" news for an "extra" to be on the streets right after it happens.

In the lower left-hand corner is the telegraph operator taking the story on his typewriter as it is clicked by the telegraph instrument on the table near his typewriter. Alongside him, seated at the same table, is the copyreader correcting the running account of the story as it comes from the typewriter. This man hands the copy to the man seated at the linotype machine. The story is cast into metal, line by line, and is then passed to the four men gathered around the "form." Three of these are make-up men, and the tallest is the editor who dictates the arrangement of the story as it is to appear in the paper.

Just as soon as all the story is complete, the metal form containing the story in type, is locked and in less than 15 seconds is in the hands of the stereotypers and in less than two minutes the big metal plates are being locked in the presses. A few minutes after the last click of the telegraph instrument the first copies of the papers are on the streets.

DISHES SERVED BY ELECTRICITY

The wonderful electric house of Mr. George Knapp, in Paris, France, in which the owner can be served with anything he wants from a book to a meal in any room in the house by simply pushing a button, can hear everything going on in any part of the house and see approaching visitors before they gain the entrance, has been described in this magazine before. But many new things are continually being added, one of the most interesting being the means by which dishes are made to appear on the table.

The chef prepares each dish in its proper order and has it ready waiting on a tray. When the host and his guests are seated at the table, the former touches a button and the electrically operated tray arrives through a trap

The Electric Serving Tray Coming Through the Table

door in the top of the table. When closed, this trap looks like two ordinary silver covers on the table. By pressing another button, the tray, with its dish, is carried around the central portion of the table, the slender support traveling through the channel which is seen in the illustration. As the dish arrives in front of each guest, the host touches a third button which stops it while the guest is helping himself. The dish passes all around the table in this way, and then, on again pressing the first button, it disappears through the table and returns to the kitchen.

CAST-STEEL WHEELS FOR AUTOMOBILES

A concern in Manchester, England, is making wheels of cast-steel for taxicabs and light automobiles with the rim, hub and spokes cast in one piece. The wheels are of the same weight as wooden wheels, and can be fitted to standard axles.

In casting the wheel much care had to be taken to secure equal expansion and contraction, especially while in the annealing furnace.

UNCLE SAM'S NEW MONEY-MAKING MACHINES

After more than a year of study and experiment the mechanical experts of the U. S. bureau of engraving and printing have perfected two remarkable new machines which will, to a great extent, revolutionize the manufacture of currency as conducted by the Treasury Department at Washington. When a full complement of the new inventions has been installed, on or before July 1 of this year, the innovation will have the effect of displacing more than one hundred employes of Uncle Sam's money factory and saving the government about $140,000 in wages alone. This economy is due to the fact that the new machines are largely automatic in action. As a secondary consideration, only a little less important, the operations of money manufacture will be so simplified and concentrated by the new equipment that 70 machines now in use will be dispensed with entirely and there will be a great saving of floor space.

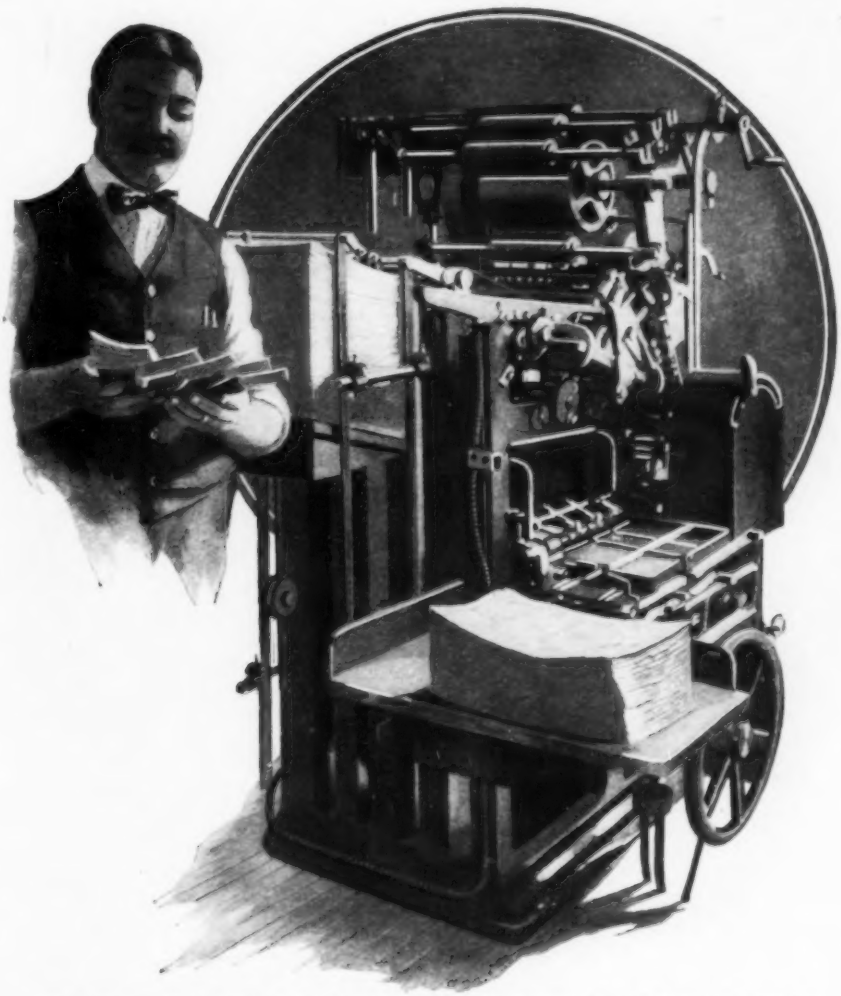
Currency Trimming Machine, Invented to Order of Government

When the officials of the government set out to promote economy by discovering a "short cut" for money manufacture, it was found that there were problems involved not presented by any other form of printing. For instance, the special paper upon which our currency is printed is subjected to so many successive wettings and dryings in its transit through the bureau of engraving that it becomes badly "buckled" and moreover no two sheets seem to be affected in exactly the same manner by this contraction. In order, therefore, to permit of automatic manipulation in all the later processes of currency manufacture it became necessary to first devise some sort of machine that would bring about uniformity in the sheets.

This boon has been obtained in the marvelous new trimming machine just invented at the bureau. This machine trims each sheet of bills on all four margins, and, more important yet, locates the printed matter in the center of the sheet so that there is an assurance of perfect register. The function of the second of the new machines may be surmised from its name—the combination numbering, sealing, separating and collating machine. It performs five different tasks, and is so nearly absolutely automatic in the performance of these duties, that there is required the services of only one man as compared with two men and four women, heretofore engaged in these operations.

Under the old plan one machine placed on the newly made paper money the successive serial numbers to be found at either end of each bill; another imprinted in color the official seal of the Treasury Department; a third separated the four bills of which each sheet is made up; then human hands had to gather together the individual bills, and finally another employe had to count the bills. Now this

new combination machine does all these various things at what is, in effect, one operation and does it in a fraction of the time formerly required. been done in the past. Moreover the feeding of the money into this comprehensive mechancal toiler is done automatically from a magazine that holds



New Money Maker, Called the Numbering, Sealing, Separating and Collating Machine

Indeed the machine, performing all five functions, handles currency at the rate of 3,000 sheets, that is 12,000 bank notes per hour. That is twice as fast as any one of these operations,—say the sealing or numbering—has 9,000 sheets. The government will require about 15 of the combination machines and 40 of the new style trimmers, but the outlay for the new equipment will not exceed $80,000 which will be saved twice over in a year.

AUTOMOBILE EQUIPPED FOR HUNTING TRIP

The illustration shows a 50-hp. automobile being used for game-bird hunting in Maine and part of New York and other states in the East.

The back part of the machine is provided with a lower and an upper berth, running lengthwise of the car, the upper berth folding back in the daytime. In addition to the sleeping quarters provided by the commodious interior arrangement of the automobile, the equipment includes a tent, 18 ft. long and 9 ft. wide, which is stretched from a ridge pole. Usually in making camp the car is backed with the rear of its top beneath the end of the tent, as shown in the illustration. By removing the boxes and the folding table from the automobile, and setting up the stove in the tent, the interior of the former auto is adapted for sleeping and the tent for living purposes. The tent is lighted at night from a storage battery, the energy of which is renewed when the automobile is running. At the rear of the chassis is located an ice box in which about 40 lb. can be carried, while the special locker and box space within the body provide room for all stores required.

With this automobile the hunters can drive to the places where the game is known or believed to be, and quickly make their camp. After a couple of days in one locality, the equipment is packed, and the party is off for another locality a hundred or so miles distant, or even in another state.

Courtesy Motor Magazine of Canada

Arrangement of Tent and Car for Short or Lengthy Camp

AUSTRIA VALUES RADIUM AT $35,000,000 PER POUND

The one place where radium is produced in commercial quantities is Joachimsthal, Bohemia, which, in the 15th century, was a flourishing silver camp. The radium laboratory belongs to the Austrian government, which fixes the price of the rare mineral, but the announcement that it produces it in commercial quantities must not be misconstrued. Just how small commercial quantities may be is well illustrated by the fact that it was only recently that a second gram of radium was finally produced. It takes 1,000 grams to make a kilogram, and one kilogram is but 2 1/5 lb. The price of radium fixed by the Austrian government is 400 crowns ($81.20) per milligram, and it takes 1,000 milligrams to make a gram. Consequently, one kilogram, (2 1/5 lb.) is valued at $81,200,000, which makes a pound of radium worth $35,000,000. Even this stupendous figure is said to be relatively cheap, and the U. S. Con-

sul at Nuremberg, Germany, speaks of it as "only $35,000,000."

To purchase radium from the Austrian government money is not the only requisite, for in order to guard against the misuse of the same, this rare mineral will be sold only to scientific institutions or learned men. Delivery is made at the risk of the purchaser, and as yet there are no rules regulating the use of the mails for such purpose. Up to date not even a single milligram has been sent by mail. It has always been forwarded by a special messenger, assistants in the government laboratory being trusted with the tiny capsules for safe delivery.

HALF-PINT BUCKET AS EAR ORNAMENT

This Kikuyu boy of East Africa has a toy bucket of about a half-pint capacity as an ear ornament. Inconceivable as it may seem, it is not hung by a hook from the ear, but is encircled by part of it. What appears to be an ordinary

Extraordinary Earring

retaining band around the bucket is the lobe of the ear, which has been stretched to the required size.

POSTOFFICES ON BATTLESHIPS

An innovation on battleships is a postoffice in which the mail for the crew is sorted and distributed. On some of

The Most Popular Place on the Ship

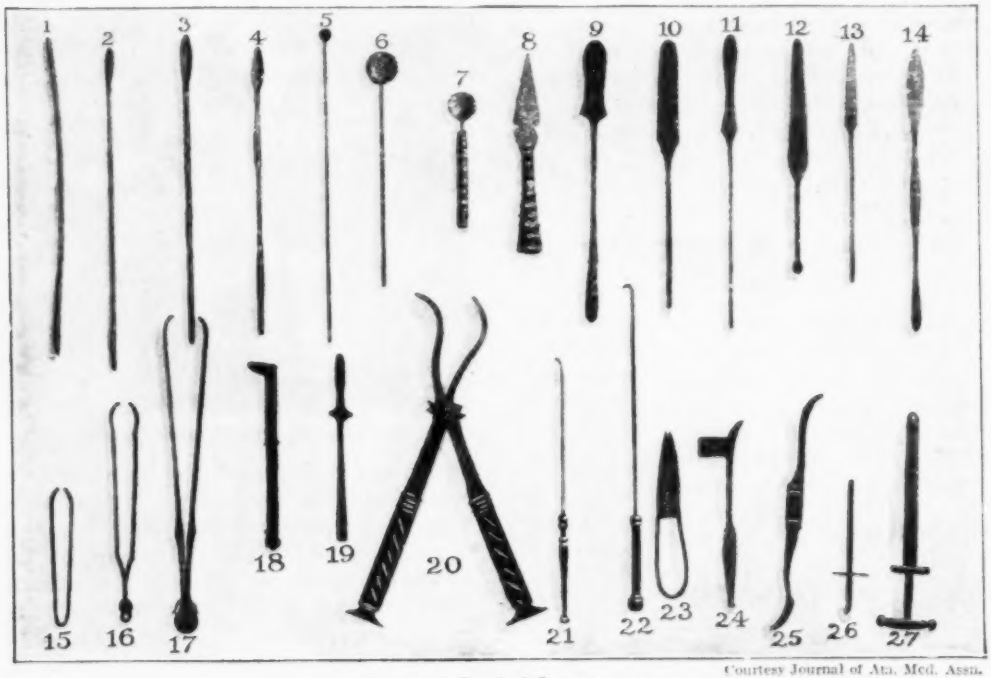
our larger fighting ships there are five or six hundred men doing regular service, a population that would make a good sized town. Heretofore the work of handling the mail has been done without a postoffice, but by the co-operation of the Navy and Postoffice Departments, arrangements have been made for the installation of an office on every large ship, one of the ship's crew serving as postmaster.

A VEST-POCKET TIRE PRESSURE GAUGE

One of the latest automobile novelties in England is a tire pressure gauge which measures the pressure that is actually in the tire. It is about the size of a pencil, and is applied to the valve after unscrewing the valve caps. A small pin depresses a valve plunger and the air forces out a little piston on which the pressure is plainly marked in pounds. The correct pressure for different sizes of tires is printed on the gauge. The device is so small that it can be carried in the vest pocket.

SURGICAL INSTRUMENTS FROM RUINS OF POMPEII

Among the many treasures and wonderful things found in the ruins of Pompeii, the famous Italian city destroyed by Vesuvius in the year 79 A. D., are a great number of surgical instruments, among which are the following in the national museum at Naples:



Courtesy Journal of Am. Med. Assn.

Pompeian Surgical Instruments

The figures from 1 to 7 are probes and spoons; 8, is a lancet; 9 to 14, spatula probes, sometimes used as cautery; 15 to 20, various forms of forceps; 21 and 22, blunt and sharp hooks; 23, scissors; 24, veterinary fleam; 25, bone elevator; 26 and 27, cannulas. Many of them are very similar to those in use today.

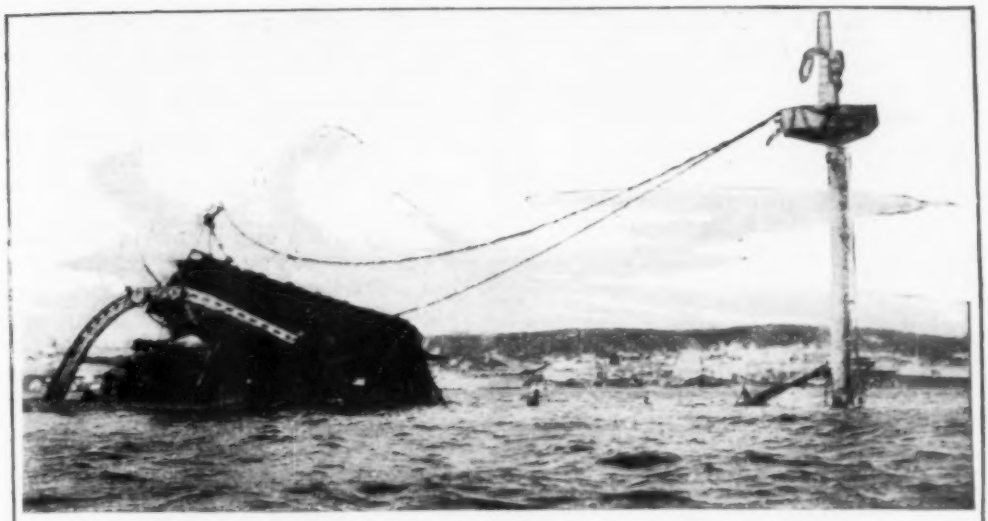
¶A train ferry across the English Channel, which will allow a man to board a train at London and step out at Paris, is being advocated by some enterprising Londoners and Parisians. The prospect is not bright, however, for its accomplishment.

LAWN-MOWER ATTACHMENT COMBS THE GRASS

The fact that the sod of golf courses and bowling greens in England is often covered with a considerable quantity of moss in the early spring has led to the designing of a device, to be used either with a lawn-mower or as a separate implement, that tears up the moss and allows the young grass to come up. It also tears out the hard, dry tufts of old grass, for which purpose it could be used advantageously on the golf courses of this country.

The device, which is called a moss extractor, is a light toothed wooden cylinder. It is fitted to a lawn-mower by taking out the knife cylinder and removing the sole plate. The teeth do not merely brush the top of the grass but actually comb it out, without harming the young grass.

¶A newspaper of Buenos Ayres is about to install a wireless telegraph plant at its main office.



The Wreck of the "Maine" as It Looks Today

AUTHORIZATION TO REMOVE THE "MAINE"

The twisted and broken skeleton of the "Maine," which has loomed above the waters of Havana harbor since the moment of the horrible disaster which drew the United States and Spain into war and gave Cuba freedom, has at last been ordered raised. The bill passed by the House and Senate provides that the work shall be done by the United States army engineers.

The sentiment of the country has always been for the raising of the fated vessel instead of its blowing up, so that the remains of the victims still in the hulk can be recovered.

HEAD ARMOR FOR DUELING ARMY HORSES

The time when heavily armored knights rode against each other in tournaments on heavily armored war horses is long past, but that the providing of head protection for horses taking part in such frays is not altogether of the past is shown by this illustration. The event is a sword and lance duel between contestants in the naval and military tournament held in England in May, and the horses are provided with leather head-armor to prevent injury. One horse in the illustration is rearing to help its rider avoid a blow, while the other has just swung into position for its delivery.

Courtesy Graphic, London

Protected for the Fray

¶ The switching off of the current at the central power station at Cape Town for a moment, causing a winking of the electric lights in every home, gives the residents the exact time every night.

GIGANTIC HEAD IN SMOKE CLOUD

This remarkable photograph, which shows the smoke forming a gigantic

Face in Burning Oil-Well Smoke

head, was taken while a big oil well was burning in Mexico recently. In the days of the primitive Aztecs such a face, rising from a huge neck and topped by a great wave of billowing smoke, would probably have been taken for Chac-mool, the war god of the Aztecs.

A FOOT-POWER COW MILKER

A milking machine operated by the movement of the feet instead of by power, and capable of milking two cows at once, is being used in several parts of the country. It consists of an air pump provided with two lengths of rubber hose and eight suction cups, and an arrangement for operating it with the feet. The operator sits between the two cows on an adjustable seat, and works a treadle with his feet. When one foot is pushed forward the treadle pushes the other back, the movement being about as fast as a slow walk.

Each suction cup is provided with a spigot, so that any one of them can be shut off when desired. On opening a spigot the suction of the air pump rapidly draws the cup over the teat it is held against, and the milk is drawn through the tube and deposited in a pail or other receptacle.

ELECTRIC CHURCH SIGN ON BUSY STREET

The minister of a church in a western city was anxious to overcome the disadvantage of a poor location, as his church was situated on a side street about a block away from the main thoroughfare. Therefore, he caused to be erected across the sidewalk of the busy street a modern electric sign, operated by flash apparatus. The proprietor of the building on the corner leading to the church refused to allow the sign on his building. But special permission from the city council made possible the placing of the sign on poles at the curb line. The entire flash-

This Church Sign Draws Attention

er, motor, switch, meter, and cut-out are mounted on one of the poles in an iron box.

The sign is of the same type as those erected by merchants and draws much attention.


L'AÉRO-CLUB
DE FRANCE
PARIS
Certifie
que Mme de Laroche
Breget n° 36
a été nommée
PILOTE-AVIATEUR
le 8 Mars 1910
LE PRESIDENT

French Aero Club's Recognition of Mme. de Laroche

FIRST AERIAL PILOT CERTIFICATE GRANTED TO A WOMAN

Mme. de Laroche, a French woman who has made numerous and successful aeroplane flights, is the first woman to be granted a certificate as an aviator. The illustration shows the certificate granted her by the Aero Club of France. As a means of identification it is necessary that a photograph of the person granted the certificate be reproduced upon it.

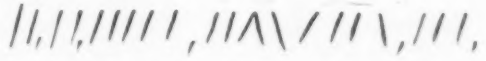
JUMPING AT A CONCLUSION

The clerk in a prominent Omaha, Neb., hotel was busily engaged making out a bill for a guest when a man walked up to the desk, picked up a pen, and, in a careless manner, as if trying the pen point, made a number of scratches on the hotel register, thus:

Throwing down the pen he was using as if in disgust, he tried another, and continued to make scratches on the book.

"See here," exclaimed the clerk, "this is not a school boy's copy book. It's the register."

Ignoring the remark, the man continued to make more scratches, until the line on which he was working looked like this:



"Maybe this will suit you," said the exasperated clerk, handing the visitor a new fountain pen.

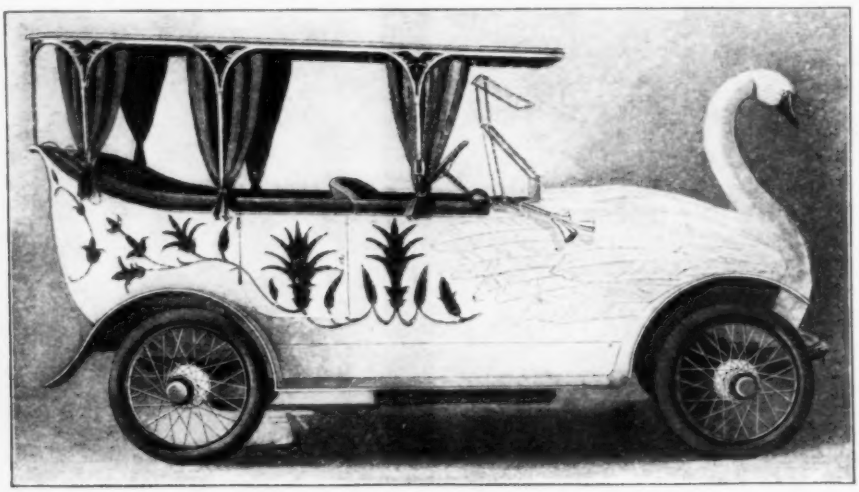
"Thank you," said the man, and he made some horizontal lines. Then he turned the book around, and this is what the clerk saw:

The clerk apologized profusely, and in his embarrassment gave Mr. Hill a room and bath for the price of a single room.

¶Statistics prove that there is 50 per cent less loss of life on the water than on land by rail and trolley in comparison to the number of passengers which are carried.

AUTO WITH SWAN-LIKE BODY

A lover of the fantastic has purchased an automobile for use in India that has a body built in imitation of the body of a swan. The exhaust from the engine, which is located in what would be the chest of a real swan, is carried up through the neck and out of the beak. The eyes of the imitation swan are electric lights with powerful reflectors that send the beams a considerable distance ahead. The exhaust can be made to emit a sound peculiar to the swan.



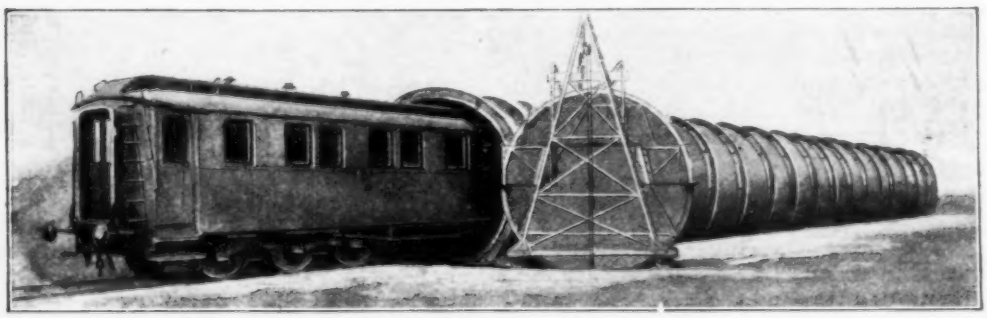
Swan Automobile

DISINFECTING TUBE FOR RAILROAD CARS

The disinfecting of the interiors of railroad cars was not considered sufficient by the Prussian state railways, and a tube system has been devised by which both the interior and exterior of a car is subjected to a treatment of formalin, a most powerful disinfectant. The cars are run into the tube one at a time, the end of the tube is closed, and the interior is filled with formalin.

HEAT AND VENTILATION IN COURTROOMS

A unique system for control of heat and ventilation in courtrooms has as its main feature two little electric switches on the bench or judge's desk, one to regulate the amount of fresh air circulated through the room, and the other to control the heat. With such an arrangement the judge can modify the conditions without having to call the attention of an attendant and interrupt the proceedings.



Disinfecting Railway Cars in Prussia

DEVELOPMENT IN COKE MAKING

By Guy Elliott Mitchell

Some fine results have been attained from a series of government experimental tests in making coke out of coal which it had been supposed could not be coked—a modern example of bricks without straw. The industrial significance of this fact can be recognized when it is known that coke has been shipped half way across the continent whereas it can now be made from coals mined right at the point where the coke is needed.

A Piece of Coke Made by the United States Geological Survey From Supposedly Non-Coking Coal

Anthracite or hard coal is the highest type of coal. Bituminous or soft coal is a less perfected piece of carbon, but if it will coke it may be as valuable. Both hard and soft coal may be found in the same seam or stratum, derived from the same source and of the same geologic age. In the early upheavals of the mountains, millions of years ago, the regions subjected to the greatest pressure and heat due to the folding and titanic squeezing of the rocks produced the best coal.

Thus anthracite may be found in the steep mountains; bituminous, where the slopes are more gentle and where there was less pressure; and still farther away from the center of the internal uplift, where the land's surface grades off into a plain, the stratum may be low-grade lignite, which is but one step removed from peat or wood.

While anthracite is the most valuable coal for house-heating purposes, bituminous coal which will make coke is of far greater importance to the country. In the government valuations of the public coal lands, anthracite and coking bituminous coals are given equal and the highest rank. These bituminous coals are valuable, not for making kitchen cooking coke but metallurgical coke.

To the housewife coke is a spongy-looking by-product of the city gas trust, the remnants of coal after the illuminating gas has been extracted, which furnishes a good summer cooking fuel. But this is quite a different article from the 50,000,000 tons of commercial coke which is produced annually to be used in metallurgical reductions. In the manufacture of structural steel, steel rails, etc., a fuel is required from which the gases have been driven off, hence the need of coke for these processes.

Fifty years ago charcoal and anthracite coal were used in metallurgical work, but coke has almost entirely supplanted them. So that, in this age of steel, good bituminous coal which will coke is of the greatest industrial value.

But not all grades of bituminous coal can be made into coke. It must be high-grade carbon, comparatively free from sulphur, and various other impurities, and up to this time Pennsylvania and West Virginia have furnished most of the coking coals. In fact it was assumed that coking coals were limited to these fields.

The tests of the United States geological survey, however, have demonstrated that the coal of many fields of supposedly non-coking kinds will, after a little preliminary treatment to eliminate the impurities, make excellent coke. The survey has made, for example, coke out of "non-coking" Colorado coal right in sections where the Colorado metalliferous plants were importing their coke from Pennsylvania, and it is now stated that a large proportion of Illinois' vast coal deposits can be economically coked.

SYSTEM OF BRAKES FOR BATTLESHIPS

When it became desirable to lessen the speed of the sailing warships of the old days in maneuvering for position, an old sail, attached to a length of strong line, was thrown overboard to

Battleship Brake Open

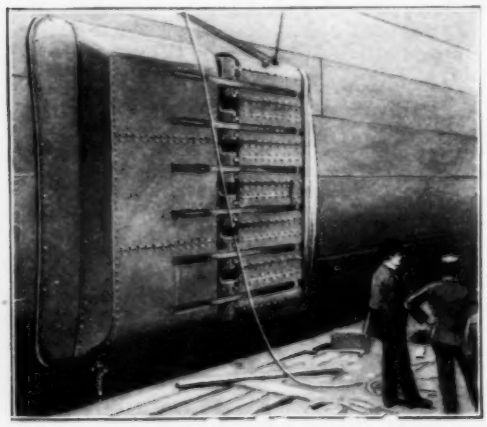
act as a drag. But this practice passed with the sailing vessel, and the great modern battleships have, up to this time, had no means other than the reversing of the propellers to bring them to a stop.

More collisions have occurred through the inability to quickly check the forward momentum of a heavy ship than any other cause, and, realizing this, a Canadian inventor a few years ago designed a ship brake which he believed would stop a vessel within its own length. Very little was done with the invention at the time, but the United States navy department has now become interested and recently gave it a test on battleship "Indiana."

The main feature of the invention is a pair of wings, or gates, as they are called, attached one on each side of the ship. The wings are made of steel, and lie against the ship's hull, pointing forward. Under ordinary conditions they are held against the hull by means of catches on horizontal bars, but, when released, the force of the water rushing past spreads them out and thus a double brake is formed. In conjunction with reversed propellers these brakes are said to be capable of stopping a large battleship within its own

View Showing Position on Ship's Side

length, while, with only one of the wings open, a ship can be turned around in about one-third of the time it has taken hitherto.



The Brake in a Closed Position

Near the other edge of the brakes are heavy steel struts, pivotally attached to the gates. It is claimed that the gates will swing into operation without jar and that the terrific resistance against the seas does not damage the adjacent plates in the hull.

When the gates swing out, a number of sliding plates attached to the lever shafts drive into covered ways, and in so doing carry a certain amount of

water with them. This water, which is compressed in the covered ways by the movement of the sliding plates resulting from the pressure of the seas on the gates, acts as a water cushion. As the pressure is more and more exerted under the terrific strain, the water is allowed to escape through the perforated ends of the covered ways.

The Engine and Some of Its Fuel

A BRUSH-BURNING ENGINE

Under difficulties that would discourage any one but a hardened prospector, an oil company has been boring on the Mojave desert in California. The absence of fuel was one of the greatest obstacles, as traffic conditions there are primitive and the only natural fuel thereabout is sage brush. This has been utilized under the boilers, however, and the method of obtaining it is rough-and-ready, but effective. A long railroad rail was used with a team hitched to each end. This was dragged broadside across the desert, breaking the bushes off at the ground. A horse rake was used to collect it in piles, and the strange fuel was then hauled to the engine. Two thousand acres of desert have been denuded of sage brush for this purpose, keeping six horses and four men busy.

NIGHT CUSTOMS SHIFT FOR NEW YORK

The faster service across the Atlantic in the past year, and the opening of the well-lighted Ambrose channel, has frequently resulted in the docking of several of the larger liners around 11 and 12 o'clock at night, and consequent long hours for the customs inspectors. To work 18 and 20 hours out of the 24 as a regular thing, however, is out of the question, therefore New York is to be made a permanent day and night port.

The innovation will mean an increased government expenditure for the port of $375,000 annually to provide for additional inspectors, collectors, surveyors, and clerks for night work.

While undergoing trials on the Clyde recently, a new twin-screw suction hopper dredger, built for the Argentine government, drew up a cannon ball, weighing 30 lb. which wrecked the internal machinery.

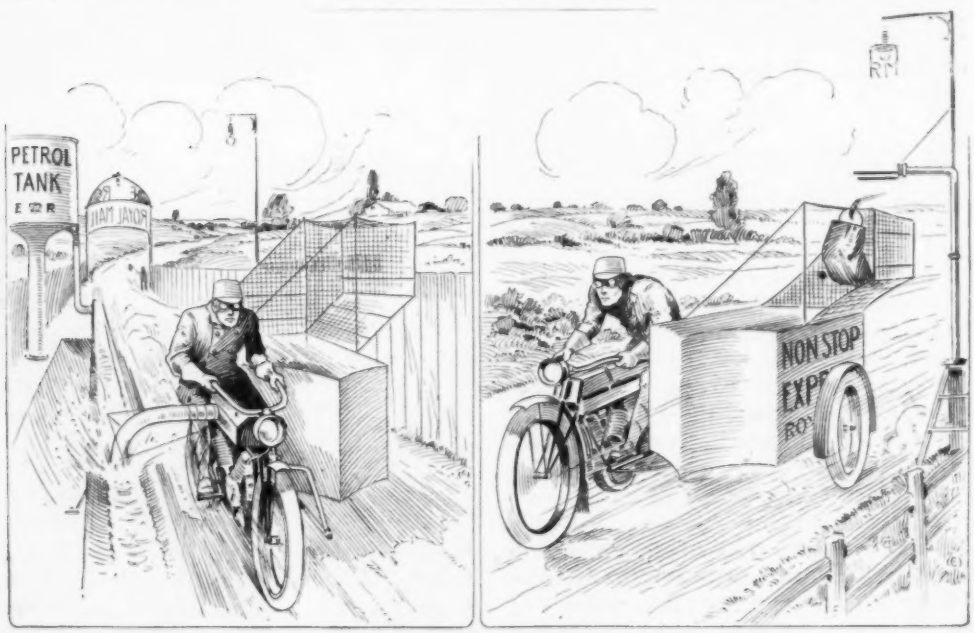
TRANSPORTING 77-TON CASTING ON CAR OF BUT 50-TON CAPACITY

A unique and successful method of transporting heavy castings on cars of much less capacity than the weight to be carried, has been adopted by a Manchester concern. On two occasions recently, castings weighing 77 tons were transported from Manchester to the Middlesborough docks for shipment to Japan on 50-ton cars, the excess weight being distributed over two other cars by means of the cantilever arrangement shown in the illustration, and still two more cars being used to underrun the counterbalance weights.

Five tons of packing was first placed on the 50-ton car, and the 77-ton casting placed on this, making the weight to be carried 82 tons. Oak beams, for leverage, were made fast to each end of the load-carrying car, and these were carried over the 40-ton cars on each side. At the outer ends of each of these beams were hung 9-ton counterbalance weights. These weights swung over small well-cars without being attached to them in any way. The oak beams were 2 ft. square, three of different lengths being used on each side.

Transporting a Heavy Casting on an English Railway.

¶A La Porte, Ind., concern values the services of its superintendent so highly that it has taken out an insurance policy of $100,000 on his life to protect itself against loss by his demise.



NON-STOP MOTORCYCLE POSTAL SERVICE—The motorcycle is proving very efficient in the English postal service. Motor Cycling, London, suggests a non-stop service, showing how gasoline and mail could be taken on while going at high speed.

"MERRY WIDOW" ROCK

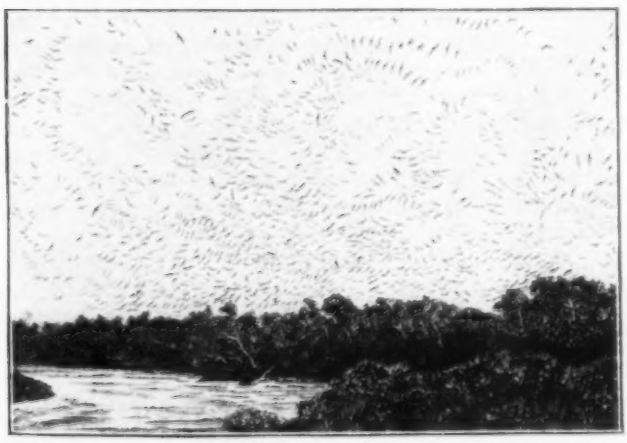
Among the many photographs taken by Professor Atwood, of the United States Geological Survey, who was making an investigation of Alaska coal deposits last year, was this one of a peculiar rock on the Alaskan coast. The tide was just lapping its base when the photograph was taken. It was named the "Merry Widow" rock because the grass and flowers growing upon its flat top gave it the appearance of a Merry Widow hat.

Curious Rock on Alaskan Coast

SUBMERGING CARS TO UNLOAD MOTORBOATS

One of the many things that point to the wonderful spread of motorboat enthusiasm in every part of the country where proper water conditions prevail, is the action of the Delaware & Hudson Railroad in constructing a marine railroad spur running into the waters of Lake George, N. Y.

Lake George, of course, is only one of the thousands of watering places, and the amount of boating upon it must be considerable to make the construction of a special launching track by a railroad practical. The flat-cars upon which the company transports motorboats, or sail boats for that matter, to the lake are run into the water upon the special track until they sink to the depth required to allow the boats to be floated off. The track extends far enough into deep water to allow a boat having a 6-ft. draft to be floated clear.



Millions of Flying Foxes

FLYING-FOXES IN AUSTRALIA

One of the most peculiar sights of the northern territory of Australia is the swarms of flying-foxes that often fill the sky in every direction for hundreds of yards. The thickly growing trees are often loaded with millions of the bat-like little animals, and when they leave the trees on excursions for water the sky is darkened.

Flying-fox is the popular name given the "colugo," a peculiar East Indian mammal with a wing-like membrane similar to that of the bat.

UNITED STATES PATENT SYSTEMS VS. FOREIGN PATENT SYSTEMS

By John P. Carson

AT a recent hearing before the committee on patents of the United States House of Representatives in connection with a bill providing for the creation of a new board of appeals in the Patent Office, Commissioner of Patents Moore made some statements which seemed to reflect upon the patent system in vogue in this country as compared with the laws and practice in Great Britain and in Germany. He is quoted as stating that about 60 per cent of the patents issued by the Patent Office are almost worthless in whole or in part. This statement if taken literally would indicate either that our patent system is very faulty, or that the administration of the Patent Office in the granting of patents is very lax, or that the patent profession is very incompetent, or that a combination of these conditions prevails.

It should be understood that Commissioner Moore was making a plea for legislation increasing the power and responsibilities of the Patent Office and naturally presented his case in the light most favorable to his contention.

If it is a fact that 60 per cent of the patents issued by the Patent Office are almost worthless, then the fault lies largely at the door of the Patent Office, for it has the granting power.

The history of patent litigation shows that during the past four years only 29 per cent of the patents litigated were found to be invalid in whole or in part and that the entire number of patents litigated during these years, 427, is only a fraction of one per cent of the patents issued during that time. As the court records are practically the only means of ascertaining what proportion of patents are worthless, it will be seen at once that the Commissioner's statement is unsupported by the records. It should also be remembered that of this 29 per cent a large proportion of the patents were found to be valid in part, that is as to certain claims, and invalid as to other claims, hence the patents as entireties were not void.

The system prevailing in this country of allowing a number of claims in a patent, each claim covering a complete structure which might alone constitute a patent, accounts for the situation stated in which some patents are found to be partially invalid and partially valid. This system does not prevail in Great Britain and Germany. Owing to the large number of applications for patents presented in the United States Patent Office, a number greatly in excess of those presented in Great Britain and Germany combined, it is practically impossible for the examiners of the United States Patent Office to conduct the thorough and complete examinations which are made by the corresponding officials in the British and German Patent Offices. The greater number of patents applied for in this country is due in part to the facility with which patents are obtained and the greater ingenuity and inventive ability of American inventors as compared with their brothers across the seas. There are undoubtedly defects in the patent system prevailing in this country which could be cured in part by legislation, and most of which could be covered by reforms within the Patent Office just as there are similar conditions in the Patent Offices of Great Britain and Germany. Man-made laws and rules are seldom perfect and to admit defects is not equivalent to a confession of failure.

These are some of the things that might be done in the opinion of the writer with resulting benefits both to the inventors and the public:

1st. Preliminary examinations by a corps of clerks in the United States Patent Office, with a view of ascertaining the probable novelty of inven-

tions submitted for such examinations, the government charging a reasonable fee for this service.

2nd. The establishment in the large cities of Patent Office libraries where full copies of patents are kept and classified in the same manner that now prevails in the Patent Office at Washington, D. C.

3rd. The raising of the standard of requirements of attorneys practicing before the United States Patent Office to a point where only those specially qualified by mechanical and legal knowledge and experience could be admitted to practice.

4th. Increasing the salaries of the Patent Office examiners so that men of experience and high attainments could be retained as examiners.

5th. The establishment of courts of patent appeals in the various United States Circuits, such courts to be presided over by judges having the necessary mechanical and legal training to especially fit them for considering the technical details involved in the average patent suit. Such judges to have exclusive jurisdiction in patent litigation and to be limited to such cases. Provision for taking the testimony of witnesses orally in the presence of the court of exclusive patent jurisdiction.

6th. The establishment of a censorship in the Patent Office of the advertising literature sent out by patent solicitors.

Some of these measures would seriously interfere with the business of certain classes of patent attorneys, and would probably be opposed by financial interests that depend for their commercial supremacy largely by dominating the market with patents and expensive patent litigation.

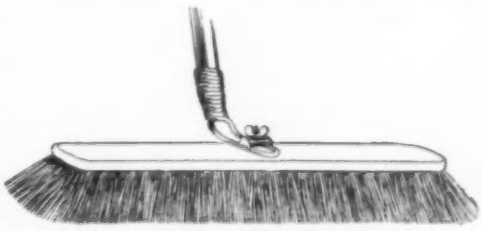
To return to the statement of Commissioner Moore, it would probably be found by comparing the administration of the Patent Office with the administration of any other bureau or tribunal conducted by our Government, that it is as free from fraud and faults as the best of them; that there is less fraud, imposition and deceit practiced in that bureau than in some other bureaux of the Government; that the personnel of the examining corps and officials of the Patent Office ranks as high as that of any other Government office either in this country or in Great Britain or Germany, and that considering the difficulties and factors involved, our patent system is superior to that of any other country in that it attains the primary purpose of a true patent system, to-wit—the encouragement of advance in the sciences and arts so that the public may be benefited by improvements in all things that tend to better the general welfare.

NEW ALCOHOL FLAT-IRON

An alcohol-heated folding flat-iron, designed especially for polishing and fancy ironing, such as is required for lace collars and handkerchiefs, is being manufactured. It folds up into a small space for convenience in carrying. In the center of the iron are four indestructible retort wicks, which are said to absorb sufficient alcohol to heat the iron in three minutes.

SPRING-HANDLED FLOOR BRUSH

The purpose of this spring handle for a floor brush is to make the brush

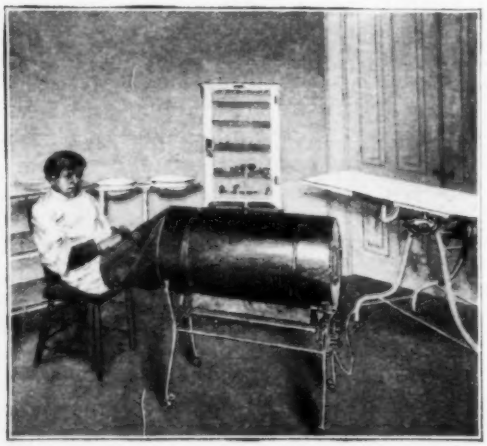


Floor Brush Shakes Itself

spring slightly at the end of every stroke, thus shaking from it the clinging dust and preventing tracking.

STERILIZING WOUNDS IN AN ELECTRIC OVEN

Electric sterilizing ovens, at first used only for the sterilization of dental and surgical instruments are now used



Patient Undergoing Treatment for Sterilization of Wound

to some extent to sterilize stubborn wounds or ulcers.

The illustration shows such an oven in the operating room of a Chicago physician. The heat penetrates the tissues in a way that surface antiseptics cannot, and even though the temperature is run up to 500 deg. F., which is nearly 300 degrees higher than the boiling point of water, the skin is not scorched. As the heat increases in the oven, the skin of the patient protects itself by throwing off a profuse perspiration, which prevents scorching.

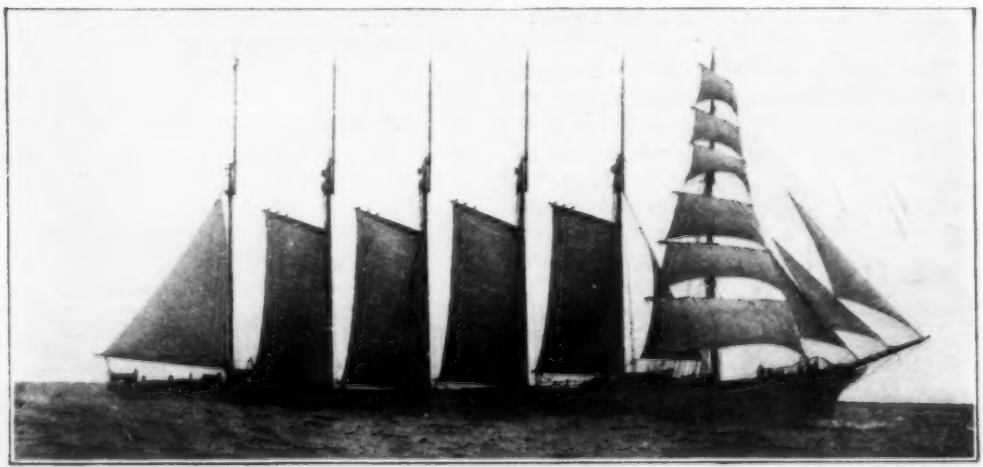
SIX-MASTED VESSEL WITH BARKENTINE RIG

The "Everett G. Griggs," a six-masted vessel with a barkentine rig has just returned from a globe-encircling voyage and is now lying at a Puget Sound port, taking on a cargo of lumber for South Africa.

She was formerly the four-masted English ship "Lord Wolseley," which was overtaken by a hurricane outside of Cape Flattery and left a virtual wreck. The dismasted vessel was purchased by an American syndicate and was thoroughly overhauled and re-rigged.

Figuring that the vessel could be much more economically run as a "fore-and-after" than a ship, the vessel was fitted with six masts, five of which were schooner-rigged, and the foremast equipped with yards.

In one respect the hopes of her new owners were realized, as 17 men were required to handle the vessel in place of the 34 formerly needed. In the matter of speed, however, she has been somewhat of a disappointment, as her voyages have been far from record-breaking. She is also said to be somewhat cranky and hard to handle.



Just Returned from a Globe-Encircling Voyage

SHOP NOTES

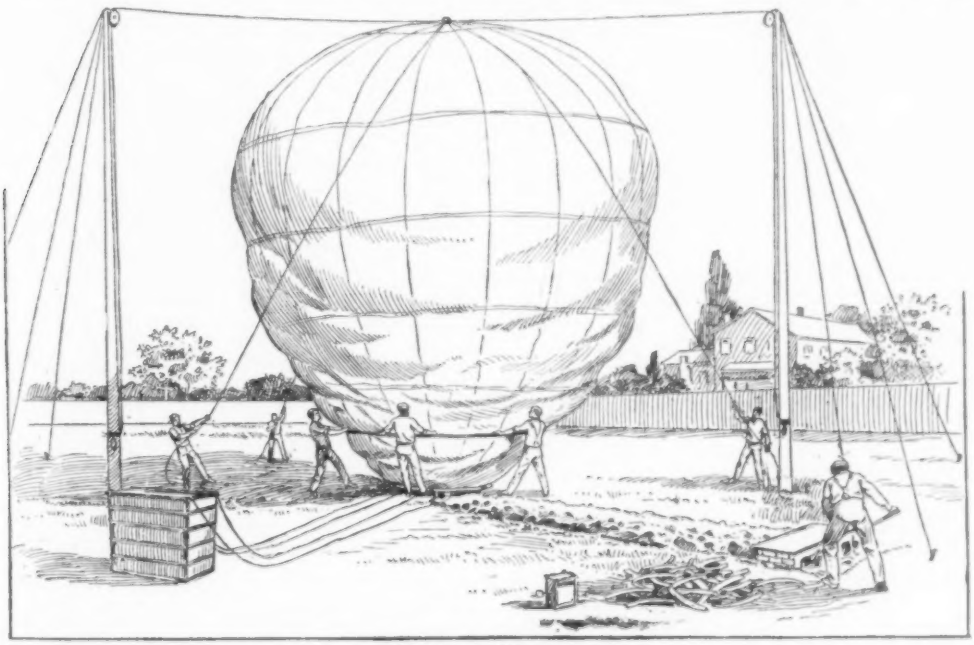
Aeronaut's Hot-Air Balloon—Part II

How to Inflate and Fly a Balloon

Having finished making the balloon, as described in a previous chapter, everything is ready for inflating and making a flight. Obtain the use of a field of suitable size, one that is in a sheltered place if possible. The best time to make a flight is in the afternoon of a still day.

Procure two poles about 35 ft. long. Each one can be made up of two pieces, joined the same as in making a high flagpole, but in either case they must be strong enough to carry the weight of the balloon. Each pole must have a pulley block at the top end, through which to pass the hoisting rope. This rope must be at least 120 ft. long to allow the part between the poles to sag and reach the ground where the balloon is to be raised. Put the rope through one pulley block and pass it through the ring in the top of the balloon, then put it through the pulley block on the other pole. Place the poles 42 ft. apart and guy each one with three ropes from the top. Each guy rope should be about 45 ft. long.

Dig a trench 2 ft. wide, 2 ft. deep and about 20 ft. long, beginning at the center between the poles. Place some pieces of heavy sheet metal over the top and cover with earth about 6 in. deep. Make a chimney of brick or sheet metal pipe about 2½ ft. in diameter over the end of the trench between the poles. At the other end of the trench make a clear place about 4 ft. square for use as a fireplace.



Inflating a Balloon

Place the opening of the balloon over the chimney and pull the top end up by

the hoisting rope as high as possible. Have a number of your friends take hold of the band that was sewed on the balloon for the purpose, and place a boy inside to direct them in keeping the cloth away from the chimney, also to give instructions to the fireman or inflater in regulating his fire. Start the fire in the fireplace of the trench, using old barrel staves as fuel, and throw a little kerosene on at intervals until the balloon is well heated and "stands on its feet," so to speak. During this period of inflation keep the cloth well out from the chimney and the ring around the opening close to the ground. The men holding the band can stand on the ring. The bag now crawls out and the hoisting rope is loosened and pulled away. If the wind is blowing enough to carry the top of the balloon around or to one side, the poles must be taken down.

The balloon is now ready for the ascent. The aerial passenger can use a trapeze or a basket, as he desires. If a basket is used, it must be attached to the ropes of the balloon before the inflation is started. Procure a strong, square luggage basket and fasten it securely to the ends of the four 12-ft. ropes attached to the bottom ring of the balloon. These ropes are laid out from the balloon's mouth to their full extent on the ground. The passenger must get in and take a secure hold on the basket to prevent being thrown out as it leaves the ground. The fireman now throws gasoline on his fire. This must be done with care, using a tin cup and keeping the receptacle away from the flames. This will give extra lifting power to the balloon. It is now time to make the start and shouting, "Get ready everybody," the fireman stops firing and places a cover on the entrance of the fire tunnel. Then with a "Let go everybody" the balloon rises upward and reaching a height of about 4,000 ft., gives its passenger a panoramic view of the surrounding country for many miles.

After about 10 or 15 minutes the balloon starts to cool and slowly descends, and, if in clear country, its passenger will make an easy landing. Care should be taken to hold the balloon, else it will rise again when freed from the load.

A Handsaw Depth Gauge

When sawing notches for joints, it becomes necessary to have some kind of a gauge to stop the cutting at the proper depth. Gauge saws can be purchased, but the small amount of use required for them will not warrant the keeping of the extra saw. The illustration shows a clamp gauge for use on any saw. In Fig. 1 is shown the construction of each clamp, and in Fig. 2 the assembled parts on the saw blade. The two gauge bars are fastened to the lower ends of the clamps with glue. When this clamp is set for a certain depth it is held in place by driving two wedges in the top ends of the clamps. —Contributed by Otto Borman, Jr., Philadelphia, Pa.

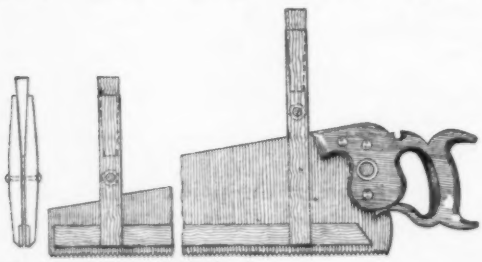


FIG. 1 FIG. 2

Gauge on a Saw

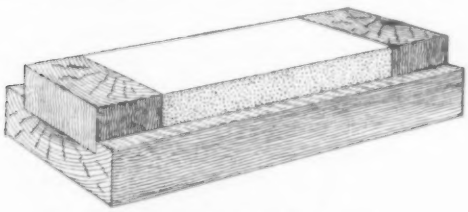
Inexpensive Concrete Culvert Forms

A new method of constructing concrete road culverts was devised by the commissioners of a township in Lee county, Illinois, using empty salt barrels for forms. A ditch is first dug 1 ft. wider and 18 in. deeper than the diameter of the salt barrel, and at either end of the trench an excavation is made about 1 ft. wide and 1 ft. deeper than the culvert trench and overlapping the culvert bore about 10 in. on either side. The concrete is filled into the excavations at the end and a bed

of concrete, 6 in. thick, is placed in the trench and smoothed off to form the bed of the culvert, with a grade of about 1 in. to 5 ft. Empty salt barrels are placed on this bed of concrete, end to end, allowing the heads of the barrels to remain in and the open end being supported with a piece of board to prevent crushing under the load. The concrete is placed in and well tamped at the sides, filling up all the space and 6 in. over the tops of the barrels. The culvert should be at least 6 in. below the grade of the road and after the concrete is set, dirt is filled in to make the grade level. The concrete consists of a mixture of 1 part cement and 7 parts sand and gravel, with sufficient water to make it rather wet. The heads in the barrels and board props can be removed with a long pole. The staves need not be removed as they will drop out in time.

Setting an Oil Stone in a Block

Oil stones wear away and make a hollow in the center caused by the bulk of the rubbing coming at that place. This can be corrected if the stone is set in a block, as shown in the accompanying sketch, with pieces of hard wood, about 2 in. long, set in at each end, their surfaces flush with the face of the stone. This will enable the workman to whet over each end of the stone as well as in the middle, thus wearing it away evenly. Should the stone show any hollow places after long use, take a piece of fine sandpaper and lay it

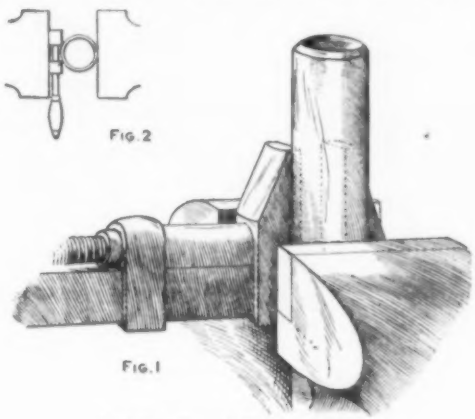


Hardwood Block at Each End

flat on a board, turn the stone face down and rub it briskly. This will dress the high places down and make the surface level.—Contributed by Wm. Lutzenburger, Dayton, O.

Holding Rods and Pipe in a Vise

All shops are not provided with a pipe vise, and in its place the arrangement shown in the sketch will prove useful in holding bolts, rods and pipes



Holding Round Pieces in a Vise

from turning while threading them. Take a common monkey wrench, open the jaws sufficiently, and clamp the rod or pipe and wrench in the vise in such a way that the surface of the rod or pipe is forced against the corners of the wrench jaws. This is shown in Fig. 1. The way the wrench is put in the jaws of the vise is shown in Fig. 2. When the vise jaws are drawn together the rod or pipe cannot turn in either direction.—Contributed by A. W. Augestine, Stromsburg, Nebr.

Cleaning Automobiles Without Water

Owners of automobiles should know that the less water used about a machine the better. Any metal part (except brass) unpainted is liable to rust, and water is no friend of rubber tires. A greasy rag or waste cleans off dust quickly and leaves the surface bright. Mud dried on cannot be removed in this way, but the spots can be carefully soaked off with a damp sponge.

The addition of cadmium to soft solder composed of tin and lead, lowers its melting point and increases its strength.

Jig for Removing Valve Seats

Having occasion to frequently reseat brass valve seats in pumps, and finding it difficult to keep an edge on the wide cutter which is generally used for that purpose, I made a jig, the details of which are shown in Fig. 1, to remove the valve seats so that they could be faced off in a lathe.

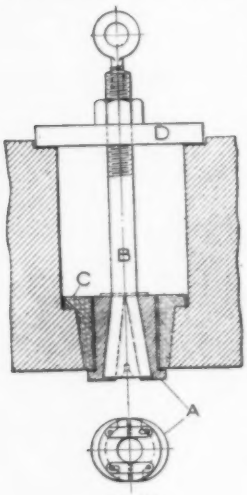


Fig. 1.

A bushing, A, has a tapered hole, and B is a bolt with the head turned to fit this hole, and the other end threaded for a nut. The bushing is cut in two lengthwise, and enough stock removed at the lower part to allow it to close sufficiently at the bottom to slip through the hole in the valve seat C. The two halves are held together by means of two small straps across the top as shown in the lower plan view. A bar D, with a hole in its center for the bolt stem to pass through, is placed over the valve chamber. After the nut is placed on the bolt an eye is screwed in the end of it to facilitate its handling. When a strain is put upon the nut and the bar tapped with a hammer the valve seat will readily pull out.

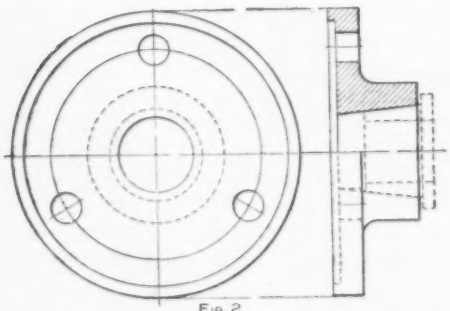
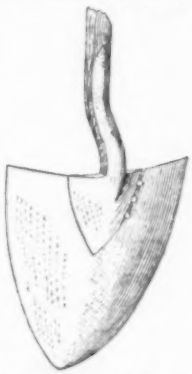


Fig. 2
Valve Jigs

I also made a jig as shown in Fig. 2 for holding the valve seats in the lathe for facing. The back is counterbored to fit over the driver faceplate of a lathe, and is bolted to it. The hole is bored to correspond to the taper of the valve seats so they will fit in place tightly. After facing off the seats they were removed by tapping them with a rod through the hollow spindle of the lathe.—Contributed by M. P. Chitterbuck, Chicago.

Repairing a Broken Shovel Blade

The lightest and best shovels often break where the handle is fastened to the blade, leaving a crack that makes the shovel useless. The break can be repaired easily by putting a rivet or two in the crack and hammering them down. A shovel can be made as strong as ever by repairing it in this manner. If rivets are not at hand cut a spike in two about ½ in. from the head. This will make a very good rivet.—Contributed by Peter J. Taft, Clovis, Calif.



How to Anneal Novo Steel Cutters

When milling cutters have been ground and reground until the teeth are entirely gone it is the usual practice, in most machine shops, to anneal the cutters and recut them, making them smaller but just as good as new. Much difficulty has been found in trying to anneal novo steel but the following method has proven very successful: Secure a cast-iron box, and a quantity of cast-iron chips, such as are found around a planer or shaper. Pack the novo cutters in the box, placing some of the cast-iron chips around the edge of the box and between each cutter. After the box is filled, seal it with fire clay and place in a hot furnace for five hours. If it is convenient to leave the

box in the furnace over night to cool, much better results will be obtained. In any case the box must not be opened until it is cold.—Contributed by Chas. E. Klink, Lemoyne, Pa.

How to Prevent a Scythe Handle From Turning

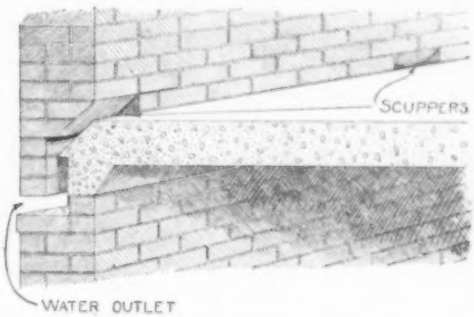
Place the handle in the desired position on the snath and screw it up as tight as possible. Drive a three-penny nail into the opposite side of the snath, leaving about ⅛ in. of the head projecting. Fasten one end of a wire to the nail and turn the other end up over the snath and around the handle, pulling it tight all the time, then bend

Handle Wired to Snath

it around and under the snath, then up and around the other side of the handle, and back to the nail again, where it is fastened securely. Drive the nail in to tighten it a little. This will hold the handle in place firmly and will not split the snath or blister the hands as where fence staples are driven in over the loop.—Contributed by B. Orlands Taylor.

Scuppers in Brick Walls

In case of a fire in a factory there is generally more damage done to the contents by water than by the fire. Especially is this true on concrete floors. Scupper openings should be made in walls carrying such floors to allow a free outlet for the surplus water to run away on the outside of the wall. This is necessary to protect the contents of the rooms below. The illustration shows the section of a brick wall and concrete floor through one of the scupper openings. The openings are formed with wood wedges which

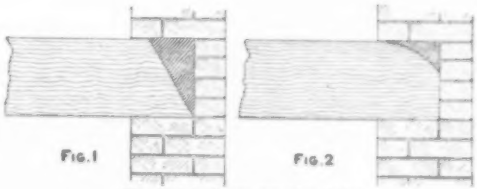


Scuppers to Drain a Cement Floor

are removed after the concrete has set. The rise at the end of the concrete prevents the cold air entering the building in the winter.—Contributed by Fred W. Hogloch, Akron, O.

Cutting the Ends of Joists

The ordinary way of cutting the ends of joists for entering a brick wall is shown in Fig. 1. If they are cut as shown in Fig. 2, they will be more effective and time will be saved in the cutting. The joists can be all laid without sawing them. The carpenter places his rule or compass on the lower edge of the joist at the intersection with the inside surface of the wall and describes an arc with a radius equal to the width of the joist. The corner of each joist is cut off on the line with a hand axe,

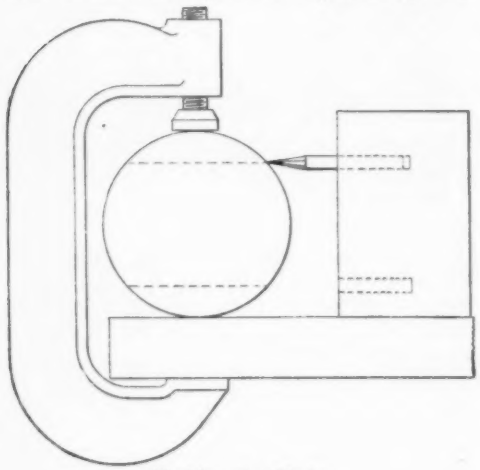


No Brick Rest on the Joist

making them rounding as shown. In case the building burns, the joists will fall without disturbing the wall as no bricks rest on the ends of the joists.—Contributed by E. C. Walker, Toronto, Canada.

How to Find Two Opposite Points on a Sphere

A simple method of finding two diametrically opposite points on a ball is shown in the accompanying sketch. The ball is clamped to a perfectly flat



Marking the Circles

surface, such as a faceplate or a marble table top, with an ordinary clamp. Secure a wooden block about the height of the ball and bore two holes in it, one near the top and the other near the bottom as shown. Fit a lead pencil in one of the holes and by moving the block about the ball trace a circle on its surface. Now place the pencil in the other hole and trace another circle in the same manner. The centers of these circles, which are easily found with a pair of dividers, are plainly the opposite ends of a diameter of the ball or sphere.—Contributed by C. W. Nieman, New York City.

How to Find a Sprinkler Leak

Not long ago an engineer had a sprinkler system extended into a new building in his plant. It was of the dry type with compressed air pumped into the pipes to hold back the water, says Practical Engineer. When completed they filled the system with air at 85 lb. and, behold, after two days there was only 35 lb., which same ought not to have happened for over six weeks.

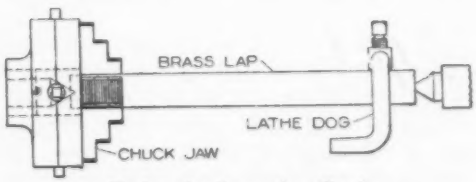
Soap lather treatment to the joints could give no hint of the location of that leak—but it was there just the same.

Our friend, the engineer, was a man of resources, and says he, "We'll chloroform the leak, and that'll put it to sleep so we can catch it napping easy." So he forthwith got 3 oz. of ether, poured it into the suction of the air pump that filled the sprinkler pipes and started the pump, in which case the ether went into the sprinkler pipes.

Foremen of the departments were warned to watch for the odor of ether, and report to the engineer. A day passed and no report; the ether wasn't yet working. But on the second afternoon word came that the leak was etherized and captured in a joint on the old system close to the new addition, caused probably by the strain when installing additional piping. So much for perseverance and using one's think tank. If you can't do a thing one way, do it two ways.

How to True Universal Chuck Jaws

A simple and inexpensive method of truing universal chuck jaws that have become badly worn and out of line, is shown in the accompanying sketch. Turn up a brass lap in the lathe so the centers will be perfectly true. Place this in the chuck and hold it between the lathe centers, as shown. It is to be kept from turning by a dog placed at the opposite end, and resting on the tool post support. Screw the jaws lightly against the lap, then apply oil and emery, and revolve the chuck.



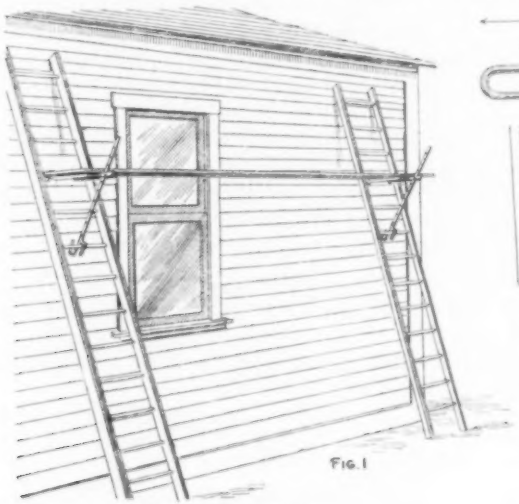
Truing the Jaws of a Chuck

The jaws will be ground perfectly true in a very short time by this method.—Contributed by J. Weaner, Plainfield, N. J.

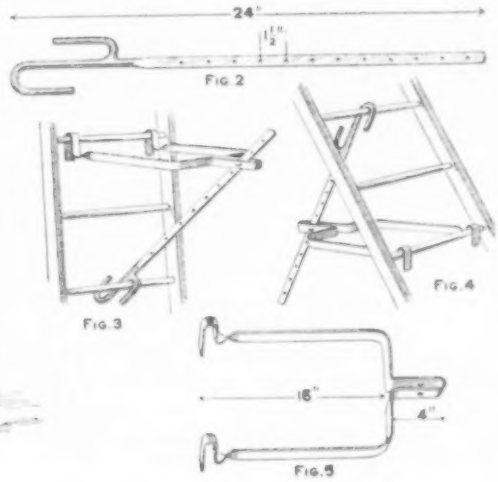
Ladder Attachments for Making a Scaffold

Painters who work on frame houses and do not have a swinging stage will find the ladder jacks shown in Fig. 1 a great help.

Each jack is made of ⅜-in. iron in two separate parts, the brace, Fig. 2, and the staging support, Fig. 5. These parts can be adjusted to any angle by taking out the bolt and raising or lowering the staging support to the desired position. The jacks are hooked on the rungs of the ladder as shown in Fig. 3. This is the usual position, but they can be reversed and used on the back of the ladders as shown in Fig. 4. For small places on the sides of buildings, sign work, etc., this jack will be found very useful.—Contributed by W. B. Smith, Guelph, Ontario.



The Scaffold in Use



Parts to Make the Jack

Bending Castings

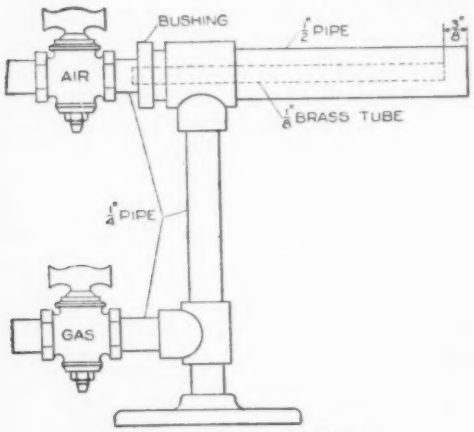
Anyone who has had anything to do with metals knows that castings of iron or steel, or the various yellow metal compositions, possess one characteristic in common—that of brittleness. Under great strain they bend but little and when pushed to the breaking point give little warning before a fracture. This property of brittleness prevents a piece that has been cast crooked from being straightened. The result is that innumerable castings are discarded annually. Heating and hammering the casting does not help the matter. It is possible, however, to straighten or bend castings when hot by use of the slower and more cautious method of weighting. Take, for instance, the case of a plate that has been warped in casting and which should be straight. This plate could be heated red hot, laid on another flat surface convex side up and a weight placed on the "hump." By giving the proper amount of weight the casting can be slowly and surely straightened. It may be convenient in some cases to fasten down one end of a casting leaving an overhanging end to which a weight is suspended by a wire.

The same results could be secured by the use of a press where pressure is applied by an adjusting screw which is set up slightly as the casting changes its form. I have used these methods with unfailing success on iron and steel castings and have saved time and money by avoiding delay in getting new castings.—Contributed by Donald A. Hampson, Middletown, N. Y.

¶ Never run cutters backward in a milling machine.

A Blowpipe Made of Pipe Fittings

A blowpipe that can be made entirely of pipe fittings, which can be screwed together in a very short time,

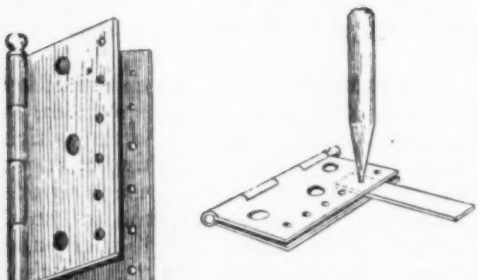


Made Entirely of Pipe Fittings

is shown in the accompanying sketch. By adjusting the air and gas cocks, a needle point flame or a powerful blast may be readily obtained with sufficient heat for light brazing. One advantage of this torch is that it cannot be blown out no matter how small the amount of gas nor how powerful the blast of air.—Contributed by S. W. Morrison, Baltimore, Md.

A Tool for Punching Holes in Springs

Take an ordinary hinge, 1½ by 3 in., close it and drill five or six holes about $\frac{5}{16}$ in. from the edge. Start with a $\frac{1}{16}$-

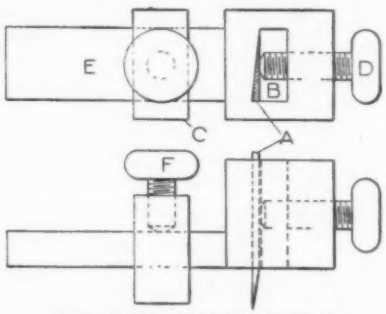


Punching Holes in Springs

in. hole first, then $\frac{3}{32}$, ⅛, and so on, until you have the sizes you wish. Secure or make a punch to fit each hole drilled. Countersink the top part of the holes just a little. Mark the spring where you want the hole and put it between the hinge, close the wings and adjust the spring so the mark will appear in the hole. Take the right sized punch and drive it through the hole and spring. The punch will cut a smooth round hole without cracking the spring.—Contributed by Rud R. Karich, Brooklyn, N. Y.

A Belt Lace Cutter

A simple attachment for a pocket knife blade which converts it into a belt lace cutter is shown in the accompanying sketch. The knife blade, A is held fast in the slot B by means of the setscrew D. The circular collar C is made to slide along the arm E and regulates the width of the lace to be cut. It is locked in place by the setscrew F. This cutter has proved to be superior to



Lace Cutter Attached to Knife

many of the patent cutters now on the market.—Contributed by H. W. Brooks, Shafter, Texas.

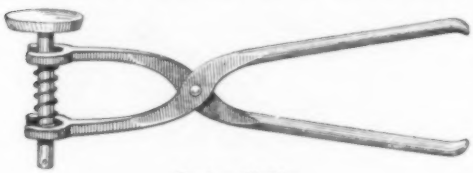
Removing Chatter Marks

Work taken from a machine with chatter marks on it will not be found perfectly true. When turning a piece in a lathe it sometimes seems impossible to remove the marks from the metal with a tool and with each succeeding cut the tool makes grooves in the same place. When the tool used has been ground with the top rake slanting to the right, change the rake to the left and it will remove the marks,

as the cutting edge will strike the lines of the chatter at right angles to the old marks, thus cutting through them instead of following the lines. In turning slender pieces the chattering can be stopped by increasing the feed a little more than usual.

Tool for Removing and Replacing Valve Springs

Removing and replacing valve springs on gasoline engines to regrind leaky valves is a very aggravating job on most all engines where a proper tool is lacking. Several different types of valve spring lifters have been invented and placed on the market. However, it can be readily seen that the tool illustrated can be applied to most any valve where the spring is accessible. They are made similar to a blacksmith's tongs and should be about 14 in. long, forged from $\frac{7}{16}$-in. round stock. The forked ends should have a U-shaped opening of about $\frac{1}{2}$ in. The tip ends should be tapering to permit it being pushed between the coils of the spring easily. This tool can be quickly made and it will be found valuable to those



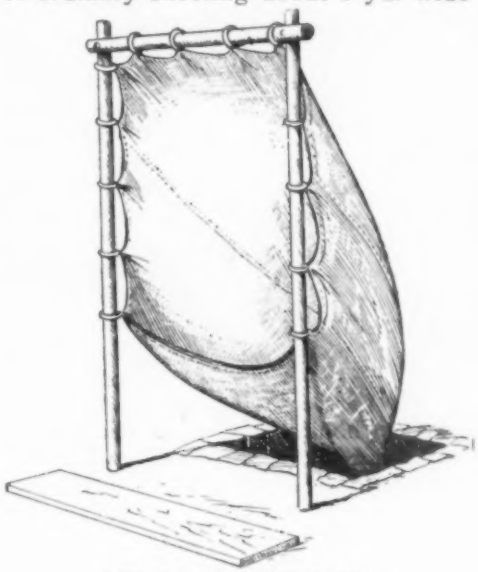
Spring Holder

who have occasion to repair automobiles.—Contributed by L. A. Cuson, Detroit, Mich.

Supplying Fresh Air to Well Diggers

In localities where firedamp exists underground, it is a difficult and dangerous undertaking to dig a well as the digger often loses his life by entering the deadly gas, which, being heavier than air, is found at the bottom of the well. If firedamp is suspected, a lighted candle may be lowered to the bottom of the well and if the gas is present the candle will be extinguished.

A method of furnishing fresh air to the person who is working down in the well is shown in the accompanying sketch. An air collecting sheet, a piece of ordinary sheeting about 2 yd. wide



Forcing Fresh Air into a Well

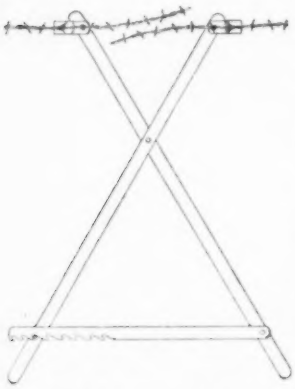
and 3 yd. long, is fastened to the posts. A pipe, 6 or 7 in. in diameter, is made of the same cloth with an enlarged funnel-shaped end which is sewed to the bottom end of the air-collecting sheet. Hoops are placed in the cloth pipe at suitable distances to keep the pipe open for the free passage of air. The edges of the air sheet should be reinforced so it will stand the pressure of the wind. The end of the cloth pipe should hang near the digger's head.—Contributed by A. M. Bryan, Corsicana, Texas.

How to Repair a Sagging Door

Doors frequently sag to such an extent that the latch will not engage with the mortise in the jamb. This annoying defect may be corrected by placing an object, such as a file tang, vertically between the outside edges of the wings on the lower hinge and closing the door easily, but firmly. This will spring the lower hinge sufficiently to raise the door so as to accomplish the result desired.—Contributed by C. W. Nieman, New York City.

Splicing a Wire Fence

This device shown in the accompanying sketch is very handy for holding the wire of a fence while making a splice. It is made of two hard wood sticks or bars of metal, 3 or 4 ft. long, which are bolted together as in making a pair of tongs. Two small clips are bolted at the shorter ends of the bars. These are made like a hook to hold the wire. After placing the end of the wires in the clips they are pulled together in the same manner as closing the tongs. The bars are held together while making the splice by a crosspiece fastened to one bar and notched to fit a pin in the other bar.—Contributed by W. C. Parker, Olaf, Iowa.



A Potato Paring Knife

When the "eyes" of potatoes are deeply indented, the housewife has considerable trouble to pare them evenly. The ordinary paring knife has a pointed blade, and to clean the "eyes" the point has to be circled around the eye-pit.

The illustration shows how a wide knife blade may be ground down so as to leave a triangular "eye-cutter" near the butt of the blade. After a potato is pared the knife is held crossways in

Eye-Cleaning Paring Knife

the hand and the spur of the blade set in each eye and twisted back and forth or revolved. The eyes are thus pared out evenly and with much saving of the edible part of the potato.—Contributed by Thaleon Blake, Sidney, O.

A Lawn Weeder

This new weeder shown in Fig. 1 makes a useful addition to lawn and garden tools. It is very simple and effective for removing dandelions and other weeds that are usually found in lawns. The instrument is grasped firmly in both hands and the point A, Fig. 2, is driven into the ground just behind the objectionable weed. The lever B is then pulled, thus bringing the second blade, C, to close on the first. The root of the weed is now firmly held in the grasp of both blades and by removing the instrument from the ground the entire weed comes with it. By releasing the lever B the spring

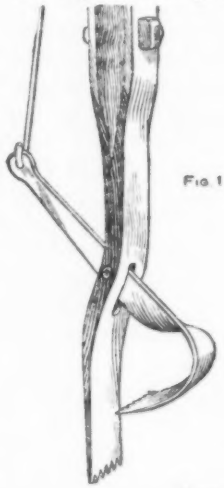


Fig. 1

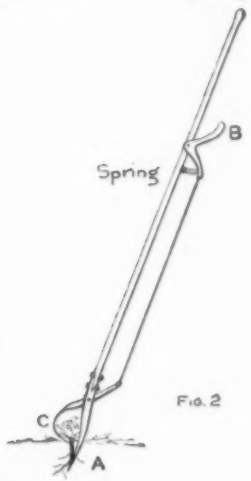


Fig. 2

Uprooting Weeds

causes the blade to open, the weed drops out and the instrument is ready for another.—Contributed by W. B. Lipphard, Buffalo, N. Y.

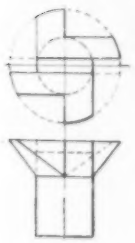
Protecting Steel Work with Cement Paste

The most efficient, durable and economical coating for steel girders in viaducts or overhead crossings to protect the steel from the corrosive action of locomotive gases is a cement paste mixed in proportion of 12 lb. pure red lead, 32 lb. Portland cement, 4 lb. linseed oil and 2 lb. drier. This mixture should make a paste like putty, and if too soft, cement and red lead are

to be added; and if too heavy, oil and drier are to be added. The iron or steel surface to be coated should be as clean of rust and foreign matter as it can be made, using either sand blast, steel brush, chisel, or sandpaper, for this purpose, according to the amount and hardness of the foreign matter to be removed. Apply one heavy coat of red lead and allow the same to set. Apply one heavy coat of Japan drier. Put the paste on this drier while it is wet. Do not allow the drier to become dry before applying the paste. The paste should be put on about 1/8 in. thick, rubbed with a trowel and pressed around rivet heads and angle flanges by hand. Cover over the paste with one coat of red lead. This last coat adds a great deal to the life of the coating, as it retards the hardening effect of the atmosphere on the paste.

Screw Head Used for a Countersink

A countersink will not cut the wood on a bevel to fit the various screw heads as the different sizes do not have the same bevel on the under side of the heads. Where the screw head is wanted to be flush with the wood and a neat fit is desired, make a temporary countersink from one of the screws. This is done by cutting the screw in two above the threads and filing the head, as shown in the illustration, to make a cutting edge. Use a brace and a screwdriver bit to turn the screw cutter in countersinking the holes. Turn the cutter down until the head is flush and it will make the exact bevel, cutting a perfect and smooth hole.—Contributed by C. L. Wall, Lawrence, Kansas.



Home-Made Wagon Tire Shrinker

Many small blacksmith shops do not have a regular tire shrinker as the cost is too great for the amount of work done on such a machine. These blacksmiths have occasion to shrink a few tires. The work can be done by using two steel clamps and an old rasp. The

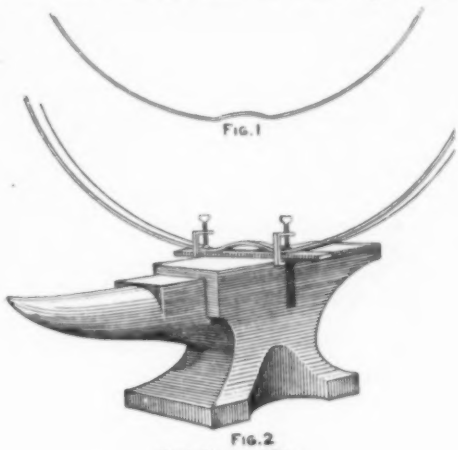


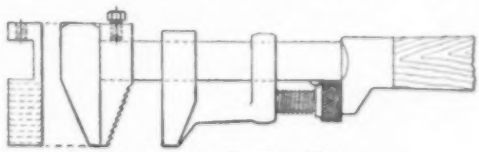
FIG. 1

FIG. 2
Shrinking a Tire

tire is first bent as shown in Fig. 1, then heated to almost a welding heat and clamped to the rasp as shown in Fig. 2. The rasp and tire are placed on an anvil and the bend hammered down. This usually upsets the tire sufficiently to make it a tight fit on the wheel. If one shrinking is not sufficient, a second bend can be made and hammered down in another place.—Contributed by F. M. James, Dewey, Montana.

A Detachable Jaw for a Monkey Wrench

The accompanying sketch shows a detachable jaw which, when applied to an ordinary monkey wrench, converts it into a first-class pipe wrench. It is best to make it of soft machine steel and then caseharden, as it is liable to break in the yoke if made of tool steel.



Jaw for Turning Pipe

It is held in place by means of a small set screw as shown.—Contributed by A. D. Johnson, Philadelphia, Pa.

A Pipe-Bending Tool

When putting in piping it is often necessary to make bends, turns, etc., other than those possible with elbows

Bending a Pipe

and tees. If a very slight indentation is not objectionable, a bend can be made with a tool, as shown in the accompanying sketch. A tool for bending small pipe can be made from a 3-ft. piece of 1¼-in. pipe with a tee screwed on one end. A bend is made by grasping the pipe in the left hand and with the right inserting the pipe to be bent as far in the tee as the end of the intended curve and pressing down. Pull the pipe out for successive bends until the desired curvature is obtained. This tool is very handy for conduit work on lighting circuits and is better for making a bend than a vise.—Contributed by Donald A. Hampson, Middletown, New York.

Pasting Labels on Tin

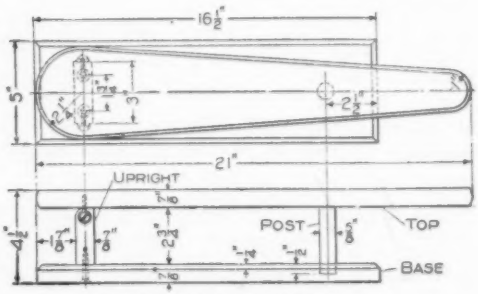
The reason that labels will curl off from metal surfaces is because the paste will contract in drying. If this shrinkage can be eliminated, the labels will stick on tin plate as well as any other surface. A correspondent of the Modern Painter has solved this problem by applying a coat of pure glycerine to the back of the label before pasting. The paper absorbs enough glycerine to prevent contraction, yet permits the necessary drying of the adhesive. Keep a convenient supply of glycerine in a wide-mouthed bottle and when required for use, tilt until the glycerine will run into the neck, then return the bottle to the vertical position. It will be found that enough glycerine to moisten the tip of a finger remains within reach. Apply with the finger to the back of the label and immediately paste over it as usual.

Sleeve and Shirt Waist Ironing-Board

The ironing-board shown in the illustration has two advantages over the kind with a fixed top. First, the top can be raised to a vertical position and the sleeve slipped over easily, and second, the top is more rigid as it is supported by an upright post.

The board is easily made from round stock, or the different pieces can be purchased from a mill, planed and cut to the size. The base is ⅞ in. thick, 5 in. wide and 16½ in. long. The edges are given a ¼-in. bevel to add to the appearance. The upright is fastened to the base with two 1¾-in. wood screws. The post is set into a ⅝-in. hole, bored ½ in. deep in the base.

The top is cut in the shape shown, and the edges made round so the cloth covering can be easily applied. The top piece must be covered with several



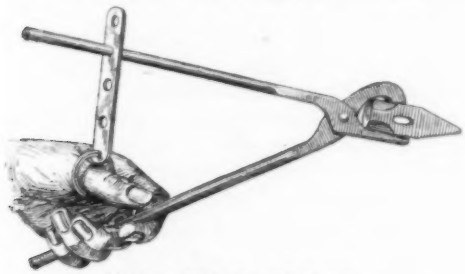
Detail of the Ironing-Board

thicknesses of cloth. Into the under side of this top board two screw eyes (preferably brass) are turned in a little over 3 in. apart, so as to clear the edges of the upright. Round-headed

brass screws are cut into the upright through the screw eyes, thus forming a hinge. This permits the top being turned back to receive the sleeve of the garment.—Contributed by Allison P. Ball, Worcester, Mass.

Adjustable Handle Link for Blacksmiths' Tongs

Some blacksmiths cannot afford to have a full line of tongs and the device shown in the illustration was designed to be used where the handles of the tongs spread beyond the grasp of the workman's hand in holding various kinds of work in the jaws. It is made of a piece of flat iron, ¼ by 1 in. and 6 in. long. Drill a ⅜-in. hole in one end and insert a ring about 1½ in.

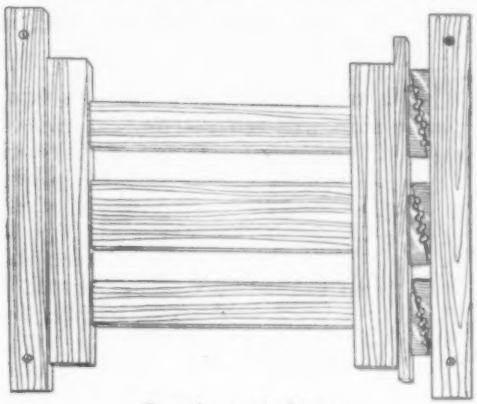


Holding Wide-Spread Handles

inside diameter. Beginning at the other end, drill four holes, each slightly smaller than the handle of the tongs. File the handle tapering so as to make a wedge fit when it is put in a hole. This will keep the device from coming loose when the tongs are thrown down. —Contributed by M. Kakara, Streator, Illinois.

Quoins Used for Cabinet Maker's Clamps

In making up pieces of furniture, for instance, gluing a table top together, gluing up a piece of panel work or anything of this kind, instead of having to buy the large and expensive cabinetmaker's clamps, I made use of three pairs of printer's quoins as shown in the sketch. Two pieces of wood are screwed to the bench or floor with ample room between them for the work, and the quoins are used in a manner similar to that in which they are used

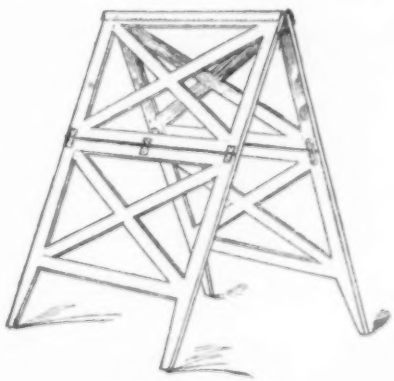


Clamping with Quoins

in the page or job press forms.—Contributed by H. M. Heyde, Houston, Texas.

Tapestry Display Rack

The show rack shown in the accompanying sketch was originally designed to be used by a traveling salesman for displaying heavy tapestry samples. It is so constructed as to fold to the trunk size and 2 in. thick, says the Upholsterer. The frame and braces are made of light wood mortised and set in so the entire rack will



Rack Ready for Use

have a smooth surface. This rack is not only a handy thing for the traveling salesman, but can be used to advantage on the salesroom floor as well.

Preventing Disturbance on Telephone Lines

By F. H. Tillotson

Explanation of Cross Talk and Other Disturbances and How They Are Overcome

As a usual thing the average telephone man will tell you that if two or more toll lines parallel one another, or if the telephone lines are in close proximity to power circuits, noise disturbances will be the result, the remedy being transpositions. But how many of these same men can explain to you why we have such disturbances or how transpositions remedy the same? The following explanation of line disturbances is offered in order that the work may be better understood.

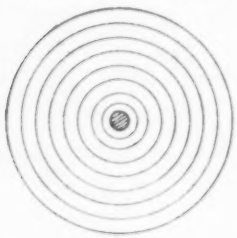


Fig. 1

Let us first consider a current flowing in a conductor. Around this conductor will be lines of force which compose the magnetic field. This is shown in Fig. 1, the conductor shown in cross section and the lines of force being closed circles. The strength of the field of force around the wire will of course depend upon the strength of the current flowing in the wire. If this current is constant and always in the same direction, then the field remains constant, but if the current is a changing one, then the field of force will change with it.

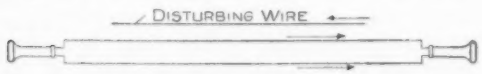


Fig. 2—Metallic Circuit

Fig. 3—Induction on Grounded Circuits

Let us suppose that a telephone circuit is so near a wire carrying a varying current as to be cut by the varying magnetic field. If the telephone circuit is metallic and both sides equidistant from the disturbing wire, and also in electrical balance, then the currents induced in each side will neutralize each other and no noise will result. Such a condition is shown in Fig. 2, the arrows showing the direction the currents flow at any given instant.

If the disturbing wire is nearer one side than the other, then the induced current in the nearest side will be the greater, hence they will not neutralize each other at the receivers and noise will result. In the case, however, of a grounded circuit, as shown in Fig. 3, you will notice there is no chance of neutralizing the effect of the induced current. It has a continuous path through both receivers to the ground, therefore a noise will be produced in both. If in any case the disturbing wire is another telephone circuit the conversation will be reproduced in the second circuit giving what is known as cross talk. This is most common in grounded lines.

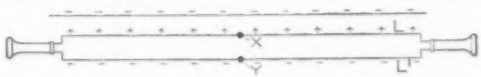


Fig. 4—Induction on Metallic Circuit

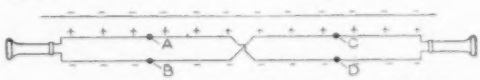


Fig. 5—Effect of Transposition on Induction

Now let us take the case of the metallic circuit in which the two sides are not equidistant from the disturbing wire as in Fig. 4. Let the side L of the circuit be nearest to the disturbing wire. At a certain instant the charge on the disturbing wire is negative. The side L will then have a positive charge and L^1 a negative charge. It has also been found that the points X and Y are neutral and if receiver is connected to them no noise will be heard. Now the positive charge on

the disturbing wire, which follows the negative charge will cause this negative charge to flow from Y to X through both receivers until L is negatively and L^1 positively charged, and so on for each change in the charge on the disturbing wire. Thus we see that as the charges on the disturbing wire vary we have alternating currents flowing through the circuit which produce noises in the receivers.

If we now transpose the lines as in Fig. 5 we will reduce the noise in the receivers but not entirely eliminate it. X and Y are no longer neutral points, as each half of each side has neutral points at A and B, and C and D. The charges now have four paths, instead of two, to the more remote portions of the circuit. Theoretically an infinite number of transpositions would be required to entirely eliminate induction,

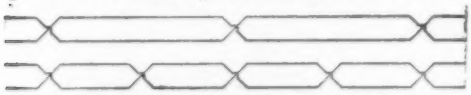


Fig. 6—Transpositions on Two Parallel Circuits

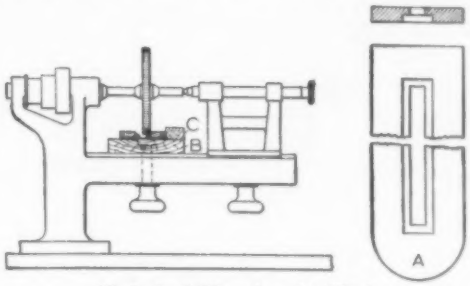
but practice has shown that in long lines transpositions at every ¼ or ½ miles are sufficient.

In making transpositions on parallel circuits care must be taken to see that such transpositions are so arranged that the circuits are always transposed against one another, thus avoiding bringing them back into the same inductive relation as at the start. For instance in two parallel circuits one should be transposed twice as often as the other as shown in Fig. 6. The use of twisted pairs of insulated wires for cables, inside wiring, and to some extent for outside work, accomplishes the transposition of circuits quite thoroughly. Every twist of the wire amounts to a complete transposition. This is the method employed in the construction of cables to overcome cross talk.

¶A good varnish for electric terminals is made of sealing wax dissolved in gasoline. To prevent brittleness add a little linseed oil.

Planing on a Lathe

The accompanying sketch shows how I rigged up my small lathe to cut a long slot in the strip of sheet brass

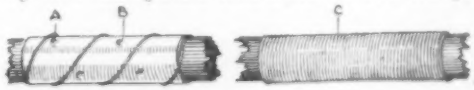


Method of Mounting the Work

shown at A, as I had a small lathe and some metal-cutting circular saws, but no planer. Removing the tool rest, I placed a pine board, B, across the ways and fastened it down with the tool rest clamping-pin. I carefully laid out the slots in the brass piece, then placed it in the proper position on the board B and fed it slowly against the rapidly revolving saw. Small strips of hard cardboard, placed under the brass strip served to regulate the depth of the cuts. In this manner I cut my slots smoothly and accurately without the aid of a planer.—Contributed by Thos. F. Williams, New Bethlehem, Pennsylvania.

How to Repair a Broken Buggy Whip

Secure a piece of tin about 2 in. long, and wide enough to reach around the whip at the place where it is broken. Roll the tin on the whip and hold it temporarily in place with a few strands of wire as shown at A in the illustration. Punch a few holes, B, in the tin with a nail, so the rough burr made by the nail point will hold in the whip.

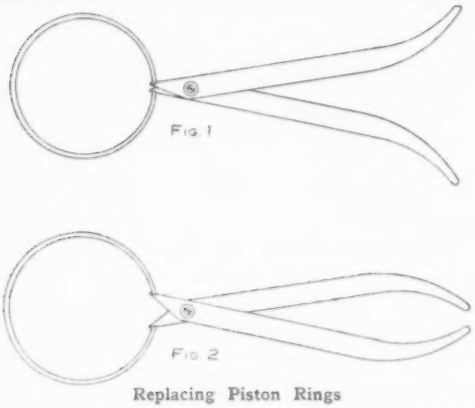


Binding the Break

Remove the wire and wind some shoemaker's thread around the tin as shown at C.—Contributed by Henry Larsen, Waupaca, Wis.

Tool for Removing Piston Rings

A very simple combination tool for the use of those manufacturing or repairing automobile and small gas engines can be made as shown herewith.



Replacing Piston Rings

The tool is made of two 1/16-in. strips of steel cut as shown in the sketch and fastened together with a screw and thumb-nut. By tightening the nut it can also be used as an inside or outside caliper. Figure 1 shows the tool in position for spreading the ring; Fig. 2, ready to slip on or off the piston.—Contributed by J. O. Brouillet, Tarrytown, N. Y.

A Substitute Paint Brush

How often does one want to paint several small articles with different colored paints and possesses only one brush, making it necessary to thoroughly clean the brush each time. I have found the following method very satisfactory:

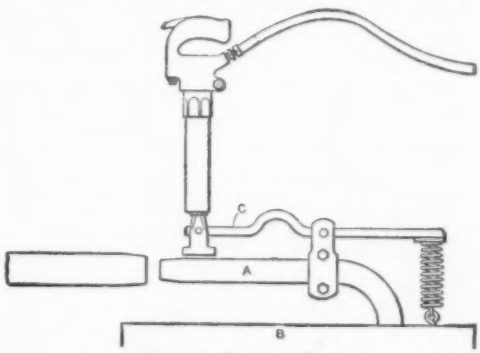
Procure flat sticks, each about ⅛ in. thick and 8 in. long, and tie a strip of muslin, say 2 in. wide, on one end of each stick as shown in the illustration. Wind the cloth around several times,

Temporary Brush Made of Cloth

tying it with thread so as to let the goods extend over the end of the stick 1 in. or more, then trim with scissors sufficient to give it the proper stiffness. This makes a fairly good brush. The broader the stick the broader the brush. The stick can be used over and over again as the brush part can be taken off and replaced with new cloth—Contributed by G. F. Orphal, New York City.

Pneumatic Flue Welder

An inexpensive flue-welding device that was designed to handle a large repair job that came in unexpectedly is shown in the accompanying illustration. It consists of a mandrel, A, which is attached to a cast-iron block, B, and a pneumatic hammer (equipped with a swage), which is mounted on a lever, C. As the illustration shows, this arm is fulcrumed to a bracket on the mandrel and is spring supported. The ends of the long pieces were first scarfed by



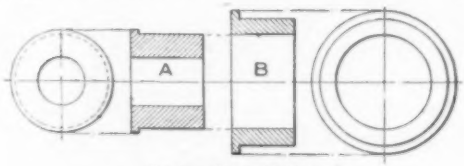
Welding Ends on Flues

lowering the back end of the tube until it was about 6 in. below the level of the mandrel. This gave a taper of approximately ¼ in. to the inch. After all the long pieces were scarfed, short pieces about 8 in. long were placed in the furnace and heated on one end so that they could be drawn to a feather edge. This was also done under the pneumatic hammer. After all the flues were scarfed and the short ends made ready for welding, the horse upon which the outer ends of the flues had rested, was raised to bring the work level with the mandrel. All short pieces were then put on the flues while hot so they would

shrink tightly in place, thus insuring a good clean weld by preventing any dirt from getting between the surfaces to be welded. After all flues were treated in this way, the furnace was cleaned, and the welding done at a speed which would make many of the costly flue-welding machines hustle to keep up.—Machinery.

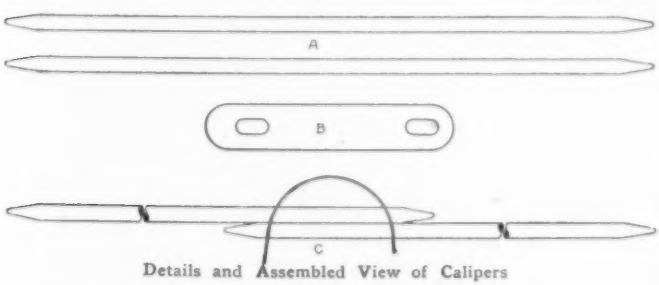
Sizing Collars for a Lathe Center-Rest

Where a great many shafts of different diameters are to be cut off in the lathe by using the center-rest, a set of collars as shown in the accompanying sketch, will prove very handy. The large one, B, is intended to be kept in the center-rest permanently. A set of small collars, A, should be made to fit the different sizes of shafting, and the outside diameter of these



Center Rest Collars

should be turned to fit the hole in the large collar. They should have a flange on them as shown, to prevent them from shoving through. Considerable time can be saved by their use as the center-rest need not be adjusted each time a different sized shaft is to be cut off.—Contributed by F. E. Randall, Pearl River, N. Y.

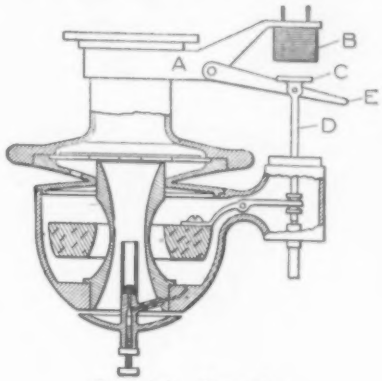


Details and Assembled View of Calipers

¶A piece of wire solder makes a good temporary spline for the draftsman.

A Magnetic Primer for Carburetors

A gasoline engine carburetor with a magnetic primer attachment is shown



Primed by Magnetism

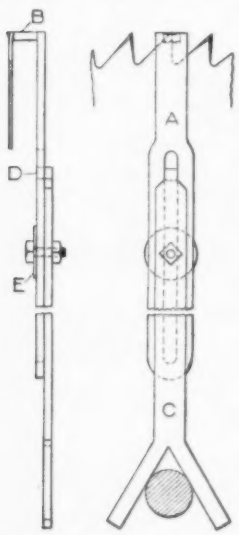
in the accompanying sketch. The supporting arm A fastens about the carburetor and holds the magnet B. When the current is applied, the plate C is drawn to the magnet, thus working the rod D. The lever E can also be worked by hand if desired.—Contributed by Leo. Beauchamp, East Hartford, Conn.

How to Make Inside Calipers for Large Work

It often happens that a machinist has use for a larger pair of inside calipers, especially on large engine and marine work, than is usually carried by the ordinary mechanic. A pair can be made in a few minutes that will do the work as well as the regular kind. Secure two ¼-in. tool steel rods of the proper length and point them as shown at A in the accompanying sketch. Then get a piece of spring steel about ¾-in. wide, 1/32-in. thick, and 4 in. long and cut ¼ by ½-in. slots in it as shown at B. When assembled as at C the caliper will be found to be adjustable, and sensitive enough for any class of work.—Contributed by J. R. Weaner, Plainfield, N. J.

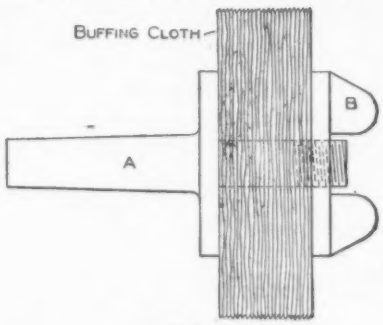
A Home-Made Circular Saw Jointer

The accompanying sketch shows the design of an adjustable circular saw jointer which will be found a very handy tool by saw filers. It can be easily made by a blacksmith out of a couple pieces of scrap iron. The dimensions can be varied to suit the size of the saws it is to be used upon, but the following size will be about right for most of them. The piece A is made of ¼ by 1-in. iron stock about 22 in. long. Split it and form a slot about ⅜ in. wide as shown in the drawing. Weld a piece of steel, B, to the top end and after it is bent temper it very hard. The piece C is of the same size stock and is about 15 in. long. It should be split at the lower end and two prongs formed, each about 4 in. long. The top is bent to form a lug, D, which slides in the slot of the piece A. A $\frac{5}{16}$-in. hole for the ¼-in. bolt should be drilled through the bar about 4 in. from the top. A washer, E, is placed under the head of the bolt to keep it from slipping through the slot. To use the tool place the forked end against the saw axle and adjust the length of the jointer to the radius of the saw. By running the teeth under the lug B the long teeth can be found and filed off.



Making a Keen Edge on Tools

The device shown in the accompanying sketch will prove handy for putting a keen edge on woodworkers' tools. It consists of a shank, A, tapered to fit in a lathe head stock spindle and a wing nut, B, threaded to screw on the opposite end of the shank as shown. Place several layers of buffing cloth on the threaded end of the shank and clamp them securely with the wing nut. Place it in the lathe center and while revolving it rapidly, apply some razorine or plater's crocus to the edge of the cloth. After tools such as gouges, chisels, etc., have been sharpened on the grindstone and rubbed slightly on an oilstone, touch them to this buffer first on one side, then on the other, and a much keener edge will be produced than could be obtained in any other way. For gouges this device is especially handy on account of their round edges. An emery-wheel spindle can be used to hold the buffing cloth if you happen to have one.—Contributed by J. C. Hansen, Chicago.



The Buffer

How to Prevent Highly Polished Metal Surfaces from Rusting

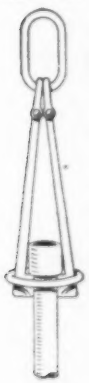
Take 1 oz. of pure beeswax and after cutting it up fine, place the pieces in a quart bottle and fill with naphtha or benzine. Cork tightly and after allowing it to stand for 24 hours or more, carefully draw off the clear solution into another bottle and it will then be ready for use. Take a small sponge and cover the article or surface you wish to protect as lightly as possible with the solution and then allow the parts coated to stand for 30 minutes or more so as to give time for the benzine to evaporate, after which polish with soft paper, clean waste or chamois skin.

Repairing a Split Water Pipe

The pipe connecting my pump and well passes through the basement, and on wash day a split was found in the pipe and no water could be pumped. The split was in the pipe at a place close to the wall and in the corner of the basement where soldering it up was out of the question. An old inner tube of a bicycle was found in a woodshed and I wrapped a piece of this tightly around the pipe covering the split and for 5 in. on each side, stretching the rubber as tight as possible, then wrapped the rubber with small copper wire. The leak has given no trouble for over a year.—Contributed by L. E. U., St. Charles, Ill.

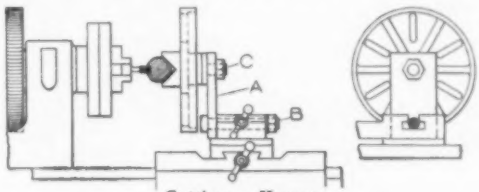
A Tool for Pulling Pipe

The pump repairman repeatedly has use for some kind of pipe pulling device. I have used various kinds, but never handled a safer and better tool than the one I designed myself. This tool I made from two pieces of 1⅛-in. square iron about 20 in. long, shaped on one end of each so as to fit around the pipe under a coupling. The other ends of the two pieces are drilled and each fitted with a clevis and both clevises connected with a link. Another link is made just large enough to slip over both pieces of iron and hold them close together on the pipe. Several sizes of links should be made to adjust the jaws to the various sizes of pipes.—Contributed by H. Toeffer, Mt. Carroll, Ill.



A Milling Attachment for a Lathe

The accompanying sketch shows how I rigged up a milling attachment for my small lathe. With this device I can cut keyways in small shafting and do all sorts of light milling. I fastened a piece of steel, A, to the compound rest with a bolt, B, as large as would lay in the T-slot. I drilled a hole in this plate on the lathe spindle center-line, and into this I fastened a stud C. This stud has a shoulder which fits against the plate. Threads were cut on the opposite end to take the regular lathe faceplate which also screwed up against the shoulder. By bolting the work to the faceplate, which in turn was fastened to the compound rest as shown, and using different styles and sizes of end mills I could do a great many different kinds of milling jobs. Several adjustments could be made by changing the compound rest to different angles.—Contributed by C. L. Bryan, Corinth, Mass.



Cutting a Keyway

Home-Made Towel Rack

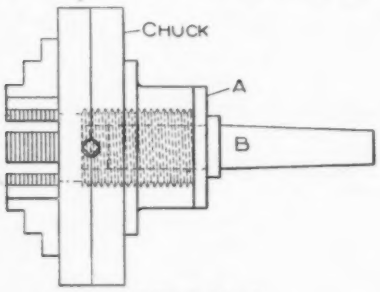
It is very convenient to have plenty of towel racks in the bathroom, but they are not often supplied on account of the first cost. Illustrated herewith is a towel rack that can be made at home and is inexpensive. The rack consists of two door stops and a round stick ½ in. in diameter. A ½-in. hole is bored in the side of each stop to receive the ends of the round stick. The holes should be bored about half way through the stop. Set the stops at the proper distance apart and turn them into the wall. The round stick is placed in the holes as shown in the illustration.—Contributed by J. C. Englehart, Richmond Hill, N. Y.

Towel Rack

CA cocoanut may be easily broken by making two holes in the shell, extracting the milk, applying air pressure by blowing in the holes and quickly throwing it to the floor.

A Revolving Tail-Stock Chuck

The details of a revolving tail-stock chuck are shown in the accompanying sketch. The bushing A is threaded to screw into a chuck, preferably a uni-



Tail-Stock Chuck

versal chuck, and is bored out to fit on a spindle, B, which has a tapered end that fits in the tail stock of a lathe in place of the ordinary center. This revolving chuck will be found a very useful lathe attachment for holding large pipes while they are being threaded or cut in two. It can be used for steadying castings while a place is being turned on them for the steady rest, preparatory to boring. It takes the place of the cone-shaped pipe center and can be used where the ordinary pipe center is useless, as it will center by either inside or outside within its limits, and it also does not require end thrust to hold it in position.—Contributed by J. N. Thomas, Burlington, Wis.

Substitute Hook Latch Staple

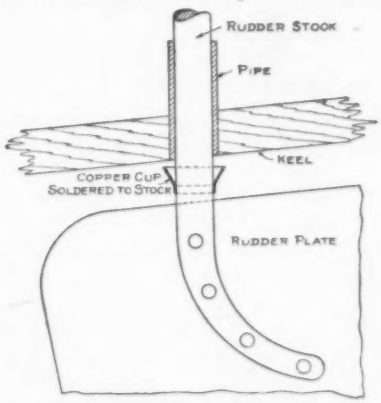
When putting a hook latch on a door it may be impossible to use a staple on account of danger of splitting the wood or the wood being too hard to drive a staple in without bending it out of shape. The illustration shows how to make a substitute for a staple that can be easily fastened to a door jamb without spoiling or splitting the wood. It is made of a strap of iron ½ in. wide and about 4 in. long. Draw out one end in the shape of a rod and bend it up in the form of an eye. Drill two holes for screws. This will make it possible to fasten both hook and eye with screws. —Contributed by W. C. Parker, Kanowha, Iowa.

Thin Chilled Edges and Scale Ruin Files

A thin chilled edge with a scale on castings will ruin a new file as the strain comes wholly on a few teeth and breaks them, says Motorcycle Review This scale should be removed by pickling in a solution consisting of two parts of water to one of sulphuric acid, and the surfaces which have become chilled should be ground off before applying the file. If it is impossible or impracticable to remove the scale by pickling, an old file that has been used until it is too dull for narrow steel work may be employed; the teeth will not be broken by the hard scale.

How to Prevent Leaky Rudder Ports

A great many motorboat owners are bothered more or less by water coming



Prevents Port from Leaking

into the boat through the rudder port. It is often caused by the propeller forcing water up through the pipe when the boat is running, says a correspondent of Motor Boat. A simple, inexpensive and effective way to stop the leak is to solder a small piece of copper on the rudder post just below the rudder port as shown in the accompanying illustration.

AMATEUR MECHANICS

How to Make Paper Balloons

A paper balloon may be well made, but if it does not have the right shape it will not make a very high ascent. Balloons made spherical or designed after the regular aeronaut's hot-air balloon are the best kind to make. Those having an odd or unusual shape will not make good ascensions, and in most cases the paper will catch fire from the torch and burn before they have flown very far. The following description is for making a tissue paper balloon about 6 ft. high.

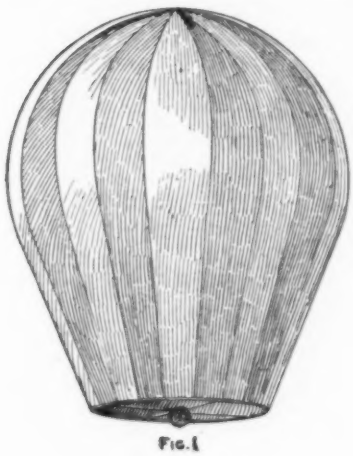
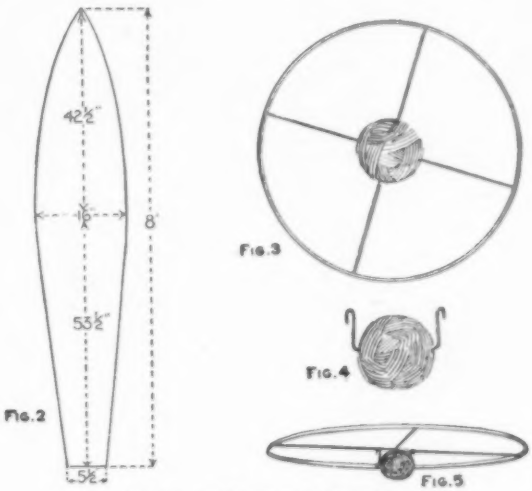


FIG. 1

Paper Balloon



Pattern and Parts to Make Balloon

The paper may be selected in several colors, and the gores cut from these pasted in alternately will produce a pretty array of colors when the balloon is on its flight. The shape of a good balloon is shown in Fig. 1. The gores for a 6-ft. balloon should be about 8 ft. long or about one-third longer than the height of the balloon. The widest part of each gore is 16 in. The widest place should be 53½ in. from the bottom end or a little over half way from the bottom to the top. The bottom of the gore is one-third the width of the widest point. The dimensions and shape of each gore is shown in Fig. 2.

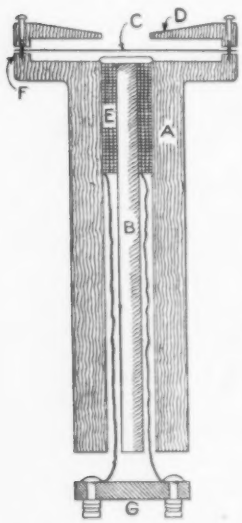
The balloon is made up of 13 gores pasted together, using about ½-in. lap on their edges. Any good paste will do—one that is made up of flour and water well cooked will serve the purpose. If the gores have been put together right the pointed ends will close up the top entirely and the wider bottom ends will leave an opening about 20 in. in diameter. A light wood hoop having the same diameter as the opening is pasted to the bottom end of the gores. Two cross wires are fastened to the hoop as shown in Fig. 3. These are to hold the wick ball (Fig. 4) so it will hang as shown in Fig. 5. The wick ball is made by winding wicking around a wire having the ends bent into hooks as shown.

The balloon is filled with heat in a manner similar to that used with the

ordinary cloth balloon. A small trench or fireplace is made of brick having a chimney over which the mouth of the paper balloon is placed. Use fuel that will make heat with very little smoke. Hold the balloon so it will not catch fire from the flames coming out of the chimney. Have some alcohol ready to pour on the wick ball, saturating it thoroughly. When the balloon is well filled carry it away from the fireplace, attach the wick ball to the cross wires and light it. Then let the balloon go.—Contributed by R. E. Staunton, Rochester, N. Y.

Home-Made Telephone Receiver

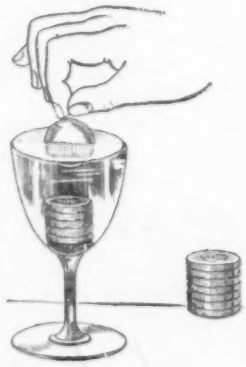
The receiver illustrated herewith is to be used in connection with the transmitter heretofore described. The body of the receiver, A, is made of a large wooden ribbon spool. One end is removed entirely, the other sawed in two on the line C and a flange, F, is cut on the wood 1/8 in. wide and 1/16 in. deep. A flange of the same size is made on the end D that was sawed off, and the outside part tapered toward the hole as shown. The magnet is made of a 30-penny nail, B, cut to the length of the spool, and a coil of wire wound on the head end. The coil is 1 in. long, made up of four layers of No. 22 gauge copper magnet wire, allowing the ends to extend out about 6 in. The nail with the coil is then put in the hole of the spool as shown. The diaphragm C, which is the essential part of the instrument, should be made as carefully as possible from ferrotype tin, commonly called tintype tin. The diaphragm is placed between the flanges on the spool and the end D that was sawed off. The end piece and diaphragm are both fastened to the spool with two or three slender wood screws as shown.



A small wooden or fiber end, G, is fitted with two binding-posts which are connected to the ends of the wire left projecting from the magnet winding. The binding-posts are attached to the line and a trial given. The proper distance must be found between the diaphragm and the head of the nail. This can be accomplished by moving the nail and magnet in the hole of the spool. When the distance is found to produce the right sound, the nail and magnet can be made fast by filling the open space with melted sealing wax. The end, G, is now fastened to the end of the spool, and the receiver is ready for use.—Contributed by Austin Mettler, North Bend, Oregon.

Dropping Coins in a Glass Full of Water

Take a glass and fill it to the brim with water, taking care that the surface of the water is raised a little above the edge of the glass, but not running over. Place a number of nickels or dimes on the table near the glass and ask your spectators how many coins can be put in the water without making it overflow. No doubt the reply will be that the water will run over before two coins are dropped in. But it is possible to put in ten or twelve of them. With a great deal of care the coins may be made to fall without disturbing the water, the surface of which will become more and more convex before the water overflows.



Wood-Working Lessons for Beginners

By Ira S. Griffith

CHAPTER IV

Sawing with Handsaws

In using the handsaws the most advantageous position is obtained by placing the board which is to be sawed upon a pair of "horses" or trestles.

Whether ripping—cutting parallel to the grain—or crosscutting, the manner of starting the cut or kerf and guiding the saw throughout the operation is the same.

Figure 14 shows clearly the position of the hands when starting the kerf.

Fig. 14—Guiding the Saw with Left Thumb

The index finger of the right hand extends along the side of the handle to assist in guiding the saw. The thumb of the left hand rests upon the board at the place where the cut is to be made. With the right hand the saw blade is pressed lightly against this thumb and thus assists in setting the saw at the desired point.

Begin with short, light, easy strokes, holding up on the saw so that it shall take small "bites" at first. Gradually increase the length of the stroke until the full arm stroke is obtained. Avoid short, jerky strokes and undue pressure. Time is lost thereby, the saw cannot be properly guided, and the work is made unnecessarily laborious. Figures 15 and 16 show the proper position to assume. The saw will cut

Fig. 15—Correct Angle of Saw

best when held at an angle of about 50 or 60 deg. with the board. Stand so as to give the arm free and easy movement, keeping the eye, hand and saw in one and the same plane, Fig. 16.

If the saw should fail to follow the line, a slight and continued twist with the hand that holds the saw handle, as the sawing proceeds, will soon cause the cutting edge to work its way back to the line. This twisting must be care-

Fig. 16—Saw, Wrist and Elbow in One Plane

fully done or the blade will bind and kink.

When nearing the finish of a cut, lessen the length of the stroke and hold

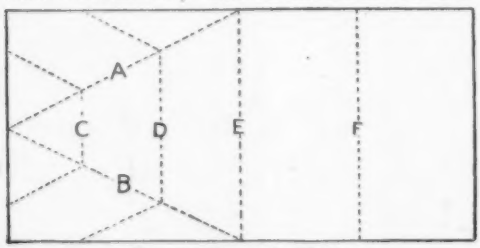
Fig. 17—Holding Overhanging Piece

up on the saw so that little weight rests upon the wood; at the same time, if crosscutting, reach over the saw and take hold of the overhanging piece, Fig. 17.

Where it is desired to cut out a small piece from a long board, always ripsaw first, then crosscut to meet this kerf, leaving on the board all but just what is wanted for present use. There are two reasons for this, first, economy; second, there is always danger of splitting off the piece when making the second cut if the crosscutting is done first.

How to Send Coins by Mail

Sending coins by mail is not as a rule advisable, but sometimes it be-

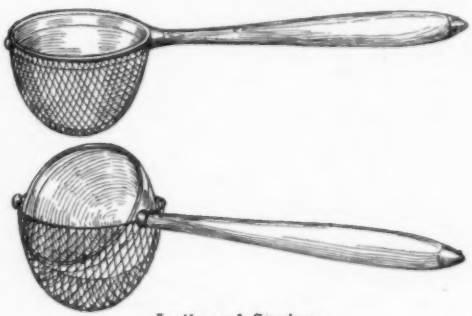


How the Paper Is Folded

comes necessary, and usually a regular coin mailer is not available. A very simple and secure way to wrap a coin or coins for mailing is as follows: Procure a piece of heavy paper, nearly as wide as the envelope is long, and about 12 in. long. Fold on the dotted lines shown by A and B in the sketch, and slip the coin in the pocket thus formed. Fold together on lines C, D, E and F, making the last two folds wide enough to fit snugly in the envelope. This method holds the coin in the center of the envelope where it cannot work around and cut through the edges.—Contributed by O. J. Thompson, Petersburg, Ill.

Combined Ladle and Strainer

When using a strainer in connection with a ladle the operation requires both hands. A convenient article where a ladle and strainer are needed is to swing a cup-shaped strainer under the bowl of a ladle as shown in the illustration. The strainer can be held in



Ladle and Strainer

place with small bands that fit loosely over the handle, and a small tip soldered to the ladle. These will allow the ladle to be turned, leaving the strainer always in position. A large sized ladle, equipped with a strainer, is just the thing for painters to dip and strain paint, while a small one is of great assistance to the housewife for dipping and straining soups, jellies, etc.—Contributed by W. A. Jaquythe, Richmond, Cal.

¶Sheet metal placed between two boards in the jaws of a vise and clamped tightly, can be sawed easily with a hacksaw.

How to Make a Wireless Telegraph Set—Part I

By Arthur Moore

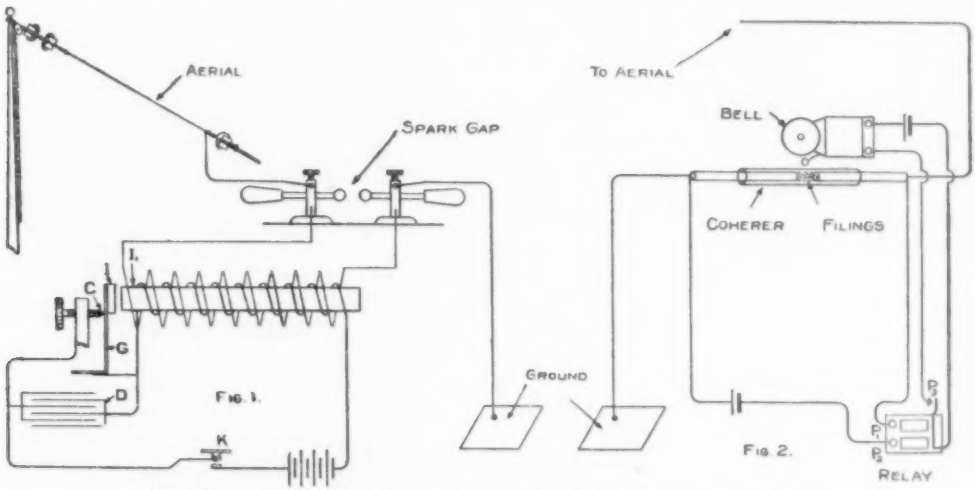
The Necessary Parts

There is no field of electrical experimenting that has received more attention from the amateur in the last few years, than that of wireless telegraphy. A great many persons have the impression that one must be an electrical engineer in order to construct and operate successfully a wireless telegraph set. Such an impression is not well grounded. The following description of a small wireless set will not only be useful to those who wish to experiment along this particular line, but it will be a great aid in making clear the elementary principles upon which wireless telegraphy is based. A set suitable for transmitting four or five miles in the open country can be easily constructed by a boy of ordinary ability at a small cost. The information gained by constructing a small set would be a great help to those who intend building larger outfits later.

Before explaining the construction of the various parts in detail, it might be well to give a general description of them and explain their functions and operation. You will need the following parts to complete the equipment for a single station, that can both send and receive a message: A spark coil that is capable of producing a spark from 1 to 1½ in. long, telegraph key, 150 or 200-ohm relay, common vibrating electric bell, aerial conductors, coherer and spark gap.

The spark coil is used to produce a very high voltage current from a source of electrical energy of low voltage, such as dry cells, and consists of two windings about an iron core.

The source of electrical energy is connected in series with one of these windings, which is called the "primary." The terminals of the other winding are connected to the spark gap as shown in Fig. 1. This second winding is called the "secondary." There will be produced in the secondary winding an electromotive force when there is a change of current in the primary. If the primary circuit is then made and broken by placing the telegraph key in circuit with it, there will be an electromotive force set up in the secondary for each make and break in the primary due to the operation of the key. The value of the induced electromotive force



General Diagram of a Complete Sending and Receiving Wireless Telegraph

in the secondary will depend upon the ratio of primary and secondary turns and the rapidity of the "making and breaking" of the primary circuit which can be greatly increased by placing in the circuit a current "breaker," or interrupter as it is more usually termed. The construction of the interrupter is indicated in Fig. 1. When the key, K, is closed the iron core, I_1, becomes magnetized, due to the current in the primary, and as a result attracts the iron armature, I, which is normally held away from the core by the spring G. The movement of the armature I toward the core I_1 results in the contact at C being broken and the current in the primary winding dropping to zero. The iron core loses its magnetism and the armature again returns to its normal position completing the circuit at C and again going through the same operation. With this interrupter in circuit as shown in Fig. 1, there will be a number of makes and breaks in the primary when the key is closed only for a short time and hence a much greater electromotive force set up in the secondary.

There is quite an arc formed at the contact C when the circuit is broken, due to the inductance of the primary winding. The condenser D is connected directly across the gap and reduces to a great extent the tendency for the arc to form, and as a result the decay of the primary current is a great deal more rapid, hence a greater electromotive force is set up in the secondary, and it will be continuous as long as the key is closed.

One terminal of the spark gap is well grounded and the other terminal is connected to the aerial as indicated in Fig. 1. The aerial may be made from a piece of No. 14 gauge copper wire that has one end fastened to the top of a 60 or 70-ft. pole by means of two knob insulators. One of these knobs can be tied to a rope that runs in a small pulley on the top of the pole, one end of the aerial is fastened to the other insulator or knob and the two knobs are then connected by a link of wire. The aerial should be run off at an angle to the pole to prevent them touching, and it should be well insulated where it is led into the building. If it is possible the pole carrying the aerial should be placed on the top of a building. This will give much better results. A good ground connection can be made by soldering a No. 14 gauge wire to a metal plate and burying it at a depth of 5 or 6 ft. in moist earth. The sending end is now complete. The details in construction and adjustment will be taken up later.

The coherer is the most important part of the receiving set. Branly was the first to discover that a quantity of iron filings when brought within the influence of a high frequency discharge, such as that from an induction coil or Leyden jar, will cling together, or cohere as it is termed, thus lowering the resistance of the quantity of iron filings as a whole, and a current from a battery will more easily flow through them when they are in coherence than when they are not. These filings are usually placed in a glass tube between two metal terminals. One of these terminals is connected to the aerial and the other is grounded when the station is used in receiving, as shown in Fig. 2.

A battery of low voltage and the relays are connected across the terminals of the coherer as shown in Fig. 2. The adjustment of the coherer and the relay is such that there is not sufficient current through the relay to operate it when the filings are not cohered. When, however, the coherer is acted upon by a high frequency discharge the filings will cohere, thus reducing the resistance of the relay circuit and increasing the current through the relay, which will operate it if the proper adjustment has been made.

This relay in Fig. 2 can be made to close a second local circuit consisting of a battery of a few dry cells and an ordinary vibrating bell, which serves to give an audible signal. The relay consists of two magnet coils connected in series and their outside terminals

connected to the posts P_1 and P_2, Fig. 2. There is a soft iron armature that is delicately balanced on two pivots, near the ends of the cores of these two coils. These two iron cores become sufficiently magnetized, due to a very small current in the coils to attract the armature, which is normally held away from them a very small distance by a weak coil spring. The armature closes the second circuit by coming in contact with the point P_3.

When the iron filings are once cohered they will not return to their original condition if they are removed from the influence of the high frequency discharge, and as a result the bell would continue to ring even though the coherer was not being acted upon by any discharge. To overcome this objectionable feature the filings must be decohered, which can be done by allowing the tapper of the electric bell to strike lightly against the glass tube of the coherer. The receiving station is now complete and the operation of such a set can be traced as follows: The telegraph key at the sending end is pressed, allowing a current to flow through the primary winding and start the vibrator in operation. At each make and break of the primary circuit due to the vibrator there will be a high voltage induced in the secondary which is sufficient to break down the air gap between the terminals of the spark gap and as a result a high frequency current will flow in the secondary circuit. This high frequency current oscillates up and down the aerial and is supposed to set up a similar motion in the ether existing in the air and the ground. This wave motion is sent out in all directions and any receiving station that is within its influence receives a small portion of the total energy sent out. As a result a very high frequency current flows through the coherer, thus reducing its resistance and operating the relay and closing the local circuit which starts the bell in operation. The bell will continue to ring as long as the wave continues to come in, which is determined by the time the telegraph key at the sending end is closed, and as a result the dots and dashes of the code can be easily distinguished.

(To be continued)

A Cork Extractor

The device shown in the sketch is for removing a cork or stopper from a bottle whether full or empty where the cork has been pushed inside. A wire about No. 14 gauge is bent as shown at B, Fig. 1, to fit the index finger and the other end filed to a point C, and turned in a spiral D, so the point will be on top. Insert this tool in the bottle as shown in Fig. 2 and place the end D under the cork and pull up. The cork will come out easily.—Contributed by Maurice Baudier, New Orleans, La.

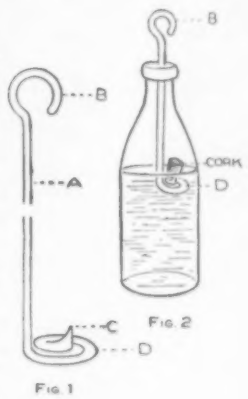


Fig. 1 Fig. 2

Center of Gravity Experiment

This experiment consists of suspending a pail of water from a stick placed upon a table as shown in the accompanying sketch. In order to accomplish this experiment, which seems impossible, it is necessary to place a stick, A, of sufficient length, between the end of the stick on the table and the bottom of the pail. This makes the center of gravity somewhere near the middle of the stick on the table, thus holding the pail as shown.

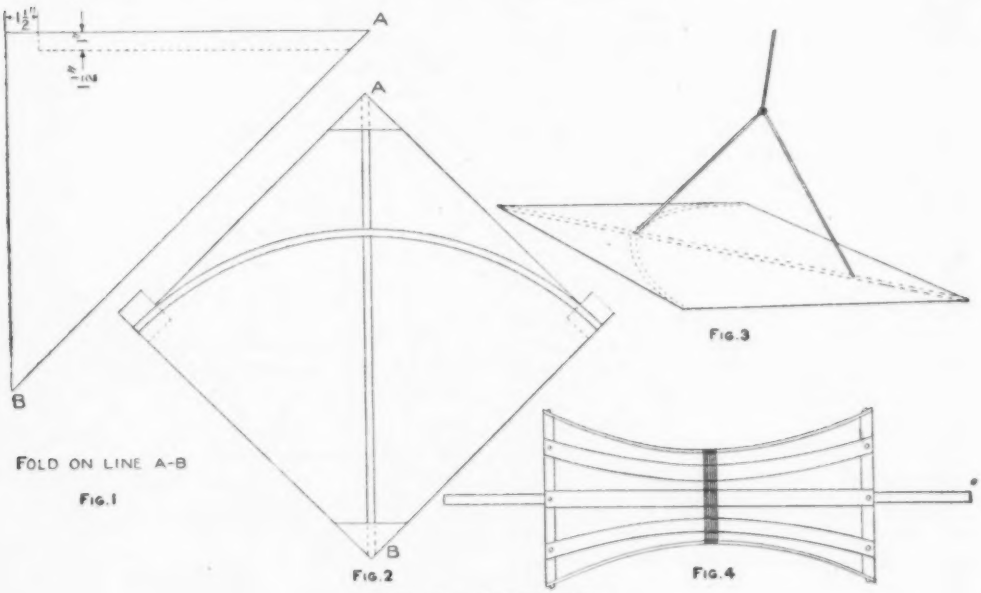
How to Make and Fly a Chinese Kite

The Chinese boy is not satisfied with simply holding the end of a kite string and running up and down the block or field trying to raise a heavy paper kite with a half pound of rags for a tail. He makes a kite as light as possible without any tail which has the peculiar property of being able to move in every direction. Sometimes an expert can make one of these kites travel across the wind for several hundred feet; in fact, I have seen boys a full block apart bring their kites together and engage in a combat until one of their kites floated away with a broken string, or was punctured by the swift dives of the other, and sent to earth, a wreck.

The Chinese boy makes his kite as follows:

From a sheet of thin but tough tissue paper about 20 in. square, which he folds and cuts along the dotted line, as shown in Fig. 1, he gets a perfectly square kite having all the properties of a good flyer, light and strong. He shapes two pieces of bamboo, one for the backbone and one for the bow. The backbone is flat, ¼ by $\frac{3}{32}$ in. and 18 in. long. This he smears along one side with common boiled rice. Boiled rice is one of the best adhesives for use on paper that can be obtained and the Chinese have used it for centuries while we are just waking up to the fact that it makes fine photo paste. Having placed the backbone in position, paste two triangular pieces of paper over the ends of the stick to prevent tearing. The bow is now bent, and the lugs extending from the sides of the square paper are bent over the ends of the bow and pasted down. If the rice is quite dry or mealy it can be smeared on and will dry almost immediately, therefore no strings are needed to hold the bow bent while the paste dries.

After the sticks are in position the kite will appear as shown in Fig. 2. The dotted lines show the lugs bent over the ends of the bow and pasted down. Figure 3 shows how the band is put on and how the kite is balanced. This is the most important part and cannot be explained very well. This must be done by experimenting and it is enough to say that the kite must



Parts of a Chinese Kite

balance perfectly. The string is fastened by a slip-knot to the band and moved back and forth until the kite flies properly, then it is securely fastened.

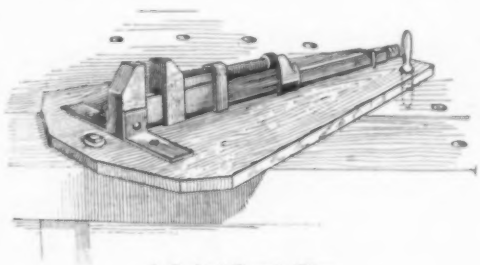
A reel is next made. Two ends—the bottoms of two small peach baskets will do—are fastened to a dowel stick or broom handle, if nothing better is at hand. These ends are placed about 14 in. apart and strips nailed between them as shown in Fig. 4, and the centers drawn in and bound with a string. The kite string used is generally a heavy packing thread. This is run through a thin flour or rice paste until it is thoroughly coated, then it is run through a quantity of crushed glass. The glass should be beaten up fine and run through a fine sieve to make it about the same as No. 2 emery. The particles should be extremely sharp and full of splinters. These particles adhere to the pasted string and when dry are so sharp that it cannot be handled without scratching the fingers, therefore the kite is flown entirely from the reel. To wind the string upon the reel, all that is necessary is to lay one end of the reel stick in the bend of the left arm and twirl the other end between the fingers of the right hand.

A Chinese boy will be flying a gaily colored little kite from the roof of a house (if it be in one of the large cities where they have flat-roofed houses) and a second boy will appear on the roof of another house perhaps 200 ft. away. Both have large reels full of string, often several hundred yards of it. The first hundred feet or so is glass-covered string, the balance common packing thread, or glass-covered string. As soon as the second boy has his kite aloft, he begins maneuvering to drive it across the wind and over to the first kite. First, he pays out a large amount of string, then as the kite wabbles to one side with its nose pointing toward the first kite, he tightens his line and commences a steady quick pull. If properly done his kite crosses over to the other and above it. The string is now payed out until the second kite is hanging over the first one's line. The wind now tends to take the second kite back to its parallel and in so doing makes a turn about the first kite's string. If the second kite is close enough, the first tries to spear him by swift dives. The second boy in the meantime is see-sawing his string and presently the first kite's string is cut and it drifts away.

It is not considered sport to haul the other fellow's kite down as might be done and therefore a very interesting battle is often witnessed when the experts clash their kites.—Contributed by S. C. Bunker, Brooklyn, N. Y.

Home-Made Vise

An ordinary monkey wrench that has been discarded is used in making this vise. The wrench is supported by two L-shaped pieces of iron, fastened with



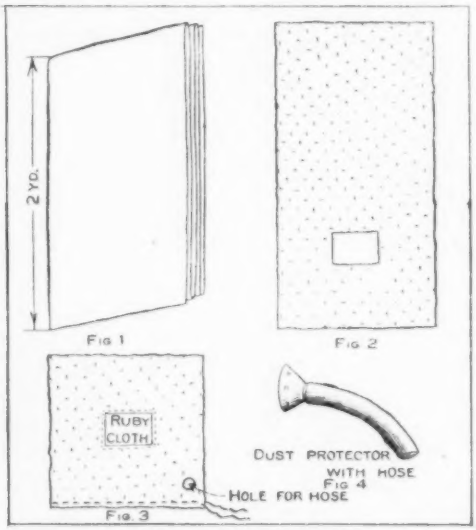
A Swivel Bench Vise

a rivet through the end jaw, and these in turn are bolted or screwed to the bench. The handle end is held down with a staple. The inside jaw is used in clamping and is operated with the thumb screw of the wrench. Two holes bored through the thumb piece will greatly facilitate setting up the jaws tightly by using a small rod in the holes as a lever.

The vise may be made into a swing vise if the wrench is mounted on a board which is swung on a bolt at one end and held with a pin at the other as shown in the illustration. Various holes bored in the bench on an arc will permit the board to be set at any angle. —Contributed by Harry S. Moody, Newburyport, Mass.

Home-Made Changing Bag for Plate Holders

A good bag for changing plates and loading plate holders and one that the operator can see well to work in can



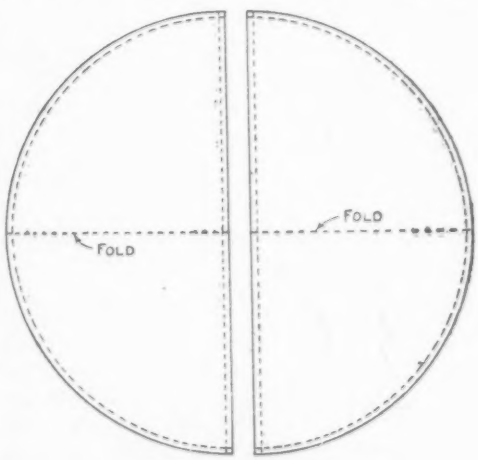
Made of Black Cambric

be made by anyone on a sewing machine. Ten yards of black cambric or other black cloth and a little ruby fabric will be required. Take the cambric and fold it into 2-yd. lengths (Fig. 1) which will make five layers of cloth, tack or fasten the layers together so they will not slip and cut an 8-in. square hole in the middle of one half (Fig. 2) and sew the ruby fabric over the opening. Be sure and make the seam light-tight and have enough layers of ruby fabric so no white light can get in. Fold the cloth up so it will be 1 yd. square (Fig. 3) and sew up the edges to make a bag with one side open. Put a drawstring in the edge of the cloth around the open side and the bag is complete ready for use.

Take the holders and plate boxes in the lap and put the bag over the head and down around the body, then draw the string up tight. A bag made up in this manner is for use only for a short time. If it is necessary to do considerable work at a time, then a dust protector, such as mill men use, must be attached to a 3-ft. length of 2-in. rubber hose and the hose run through a hole in the bag. This will make it possible to work in the bag as long as you wish.—Contributed by Earl R. Hastings, Corinth, Vt.

Home-Made Asbestos Table Pads

Asbestos table pads to prevent the marring of polished table tops from heated dishes can be easily made at home much cheaper than they can be bought. Procure a sheet of asbestos from a plumbing shop and cut it in the shape of the top of your table. If the table is round, make the pad as shown in the illustration, cutting the circular piece into quarters. Cut four pieces of canton flannel, each the size of half the table top. Two of the asbestos pieces are used to make one-half of the pad. Place the two pieces with their edges together so they will form half a circle disk and cover both sides with a piece of the flannel and pin them in place. A binding of white cotton tape is then basted around the edges to hold all the pieces together until they are stitched on a sewing machine. A line of machine stitching is made all around the outside and through the middle be-



Pads Made of Asbestos

tween where the edges of the asbestos sheets join together. This will form a hinge so the two quarters may be folded for putting away. Make the

other half circular disk in the same way. If leaves are wanted in extending the table, any number of pads can be made to cover them in the same manner with the hinge in the middle of each pad. The flannel is used with the nap side out so it will make the pad soft and noiseless. This kind of a pad furnishes perfect protection to the table from any heat or moisture.—Contributed by H. E. Wharton, Oakland, Calif.

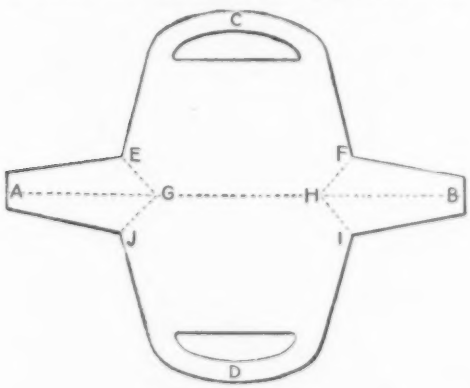
How to Make a Ladies' Handbag

To make this bag, get a piece of Russian calf modeling leather. A shade of brown is the best as it does not soil easily and does not require coloring, which spoils the leather effect.

The dimensions of the full sized bag are: from A to B, 17½ in.; from C to D, 16¼ in.; from E to F, 9¼ in.; G to H, 6¼ in., and E to G, 2¼ in.

Enlarge the accompanying pattern to the given dimensions, trace this or some other appropriate design on it, and then cut the leather the size of the pattern.

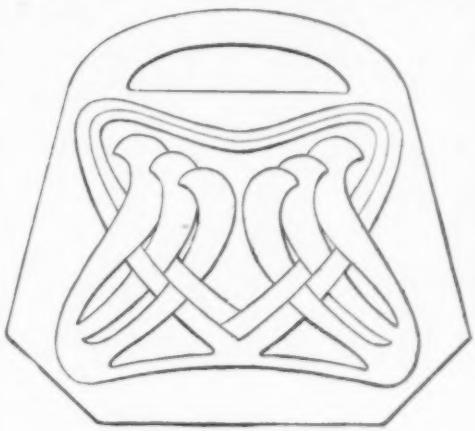
Use a sponge to dampen the leather on the rough side, not so damp that the water will come through to the right side when working, but damp enough to allow the design to be well impressed



Pattern

on the leather. Use a smooth, non-absorbent surface to lay the leather on while at work.

Now lay the pattern on the right side of the leather and with the smallest end of the leather tool or a sharp, hard pencil, trace the design carefully on the leather. Moisten the leather as



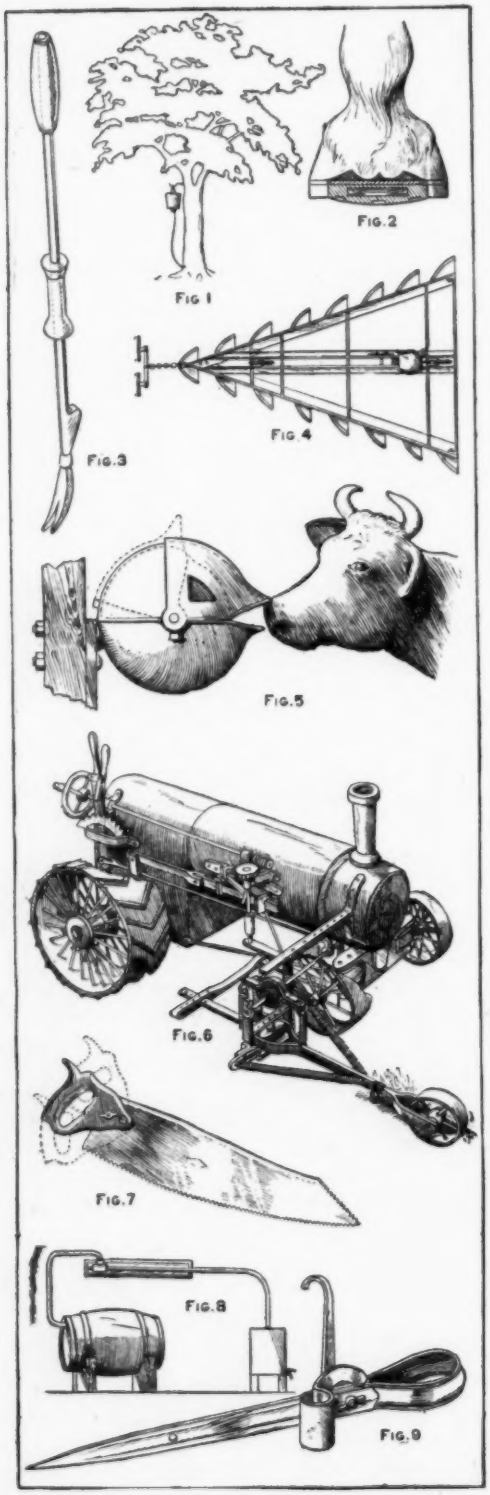
Design on the Leather

often as necessary to keep it sufficiently moist to work well. Trace the openings for the handles, also lines A-G, H-B, and E-G, G-J, and corresponding lines on the other side.

Remove pattern and trace the design directly on leather with the round point of tool, until it is made distinct and in marked contrast to the rest of the leather. Do not make sharp marks but round the edges of the lines nicely, with the rounded sides of the tools.

To complete the bag, get something with which to make a lining. A piece of oozed leather is the most satisfactory. Cut it the same size as the bag, place both together and with a leather punch, make holes all around the edge of the bag about ½ in. apart. Cut out the leather for the handle openings. Care should be taken not to cut the holes too near the edge of the bag lest the lacing pull out. Now cut narrow thongs, about ⅛ in. wide, and lace through the holes, lacing the sides of the end pieces in with the sides of the bag. Crease the lines A-G and B-H inward for ends of bag.

¶ The claw of a hammer can be used for removing the insulation on copper wire, if not more than 1 in. is taken off at a time.



INTERESTING IDEAS

METHOD OF COLORING GROWING WOOD—Staining wood after it has been sawed, planed, and converted into woodwork or furniture is a most ordinary procedure, but the staining of the wood while the tree it composes is alive and growing is a departure from old methods. Figure 1 shows a device by which coloring matter is injected into the tissues of the tree in such manner that it will be distributed by the natural circulation of the sap, thus effecting a substantial change in the color of the tissues with which it comes in contact.

SPRING SHOES FOR HORSES—The growing popularity of rubber spring heels for human feet has resulted in a somewhat similar idea being adopted for horses, although in the latter instance the resiliency of the rubber heel-pad is reinforced by a spring. The rubber pad, as shown by Fig. 2, is in the form of a cross bar, with the spring in a chamber between it and the top of the shoe.

NEW TYPE OF BOX-OPENER—Figure 3 shows an improved type of packing-box opener. The force that drives the toes under the head of the nail is gained by striking downward upon the heel with the spool-shaped hammer that slides upon the shank.

BRUSH-CUTTING MACHINE—The device shown by Fig. 4 is a brush-cutter composed of a V-shaped frame, provided with outwardly projecting cutting blades. The driver occupies the seat near the back of the frame. The device cuts a swath through the brush as wide as the rear end of the frame.

SALT-FEEDING RECEPTACLE FOR STOCK—The salt receptacle shown in Fig. 5 is designed for use in a field or corral. It affords free access to the stock for obtaining the requisite amount of salt, and at the same time protects the salt from the elements and prevents waste. The opening is protected by a hood which the animal shoves open by putting his nose under it and lifting upward. When the nose is withdrawn from the opening thus made, the hood drops down again by its own weight. A sufficient opening is always left to expose the salt and attract the stock.

AUTOMATIC STEERING DEVICE FOR TRACTION ENGINES—The device attached to the front of the traction engine shown in Fig. 6 is an automatic steering device for use in plowing. It is often difficult to steer an absolutely straight course when pulling an 8 or 12-furrow series of plows behind, but the wheel of this automatic steering device makes this possible by running in the last furrow made.

NEW CUT-OUT SAW—Figure 7 illustrates a saw specially designed for cutting through flat surfaces, such as floors, without the usual preliminary boring. It can be used for cut-outs in flooring or siding, for joist or sill splicing, and in various ways as a housing saw for millwrights, plumbers, ship carpenters, etc. Its distinctive features are its double-toothed point, extra deep belly, and adjustable handle.

APPARATUS FOR RECOVERING ALCOHOL FROM THE LINING OF BARRELS—One of the departments of a liquor concern in Cincinnati is devoted to the recovering of the alcohol that has been absorbed by the wood of the barrels used for the handling of the liquid. One method of recovering the absorbed spirit is shown in Fig. 8. Under the cradle on which the barrels are placed is a pipe connected to a dry-heat radiating device. This is inserted in a hole in the under side of the barrel, and an outlet pipe in the barrel head near the top. The hot air forced into the barrel causes the alcohol to ooze from the wood in the form of vapor. This leaves the barrel through the outlet pipe, which is provided with a condenser.

MINER'S CANDLESTICK—Figure 9 is a candlestick made to meet the various demands of miners. It either may be carried by the handle, jabbed into a crack, or hung up by its hook. The hanger, when not required, can be loosened and pushed back to lie alongside the handle. The candle socket may also be set at any angle.

IN RECENT PATENTS

TOE-THIMBLE AS HOSE PROTECTOR—The thimble-like cap on the end of the big toe in this drawing (Fig. 10) is the idea of a St. Louis inventor, who believes it will keep the toe-nail from cutting through the stocking.

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LIFTER FOR HOT PANS—Figure 11 is a device by which pans may be lifted from the stove without danger of burning the hands. The lower part is slipped under the pan, the clutch-rod is dropped until its hooked outer end engages with the rim, and the pan is removed without danger of upsetting its hot contents or being burned by its hot surface.

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ALARM WATCH—This alarm watch (Fig. 12) has for its chief purpose the reminding of its wearer that something is to be done at a certain time. If, for instance, the wearer of the watch is to meet a person at a certain time, or buy a certain thing before returning home, he sets the watch for a certain time. The alarm, of course, does not tell him who he is to meet or what he must buy, but it reminds him that there is some certain thing to be done, and he usually recalls the rest of it.

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ABDOMINAL FAT-REDUCING APPARATUS—To rock a person back and forth on his stomach, in the same way a cradle is rocked, seems a very heroic method of reducing abdominal fat, yet this device (Fig. 13) was recently patented for such a person.

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SIMPLE METHOD OF MAKING SILHOUETTES—The making of silhouettes is made simple by means of the device shown in Fig. 14. It consists of a set of panels attached to the back of a chair at the proper height, one panel being translucent to receive the shadow, and the other holding the paper while being marked. The person of whom the silhouette is to be made takes his or her position in the chair, and a lamp or candle is placed on a table a few feet away. A pantograph attached to the back of the panels makes it possible to reproduce on the paper the outline of the shadow thrown on the translucent panel.

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PACKING EXTRACTING BIT—Figure 15 is a bit designed for extracting packing from glands of engines, pumps, air compressors, or refrigerating machines. It is said to draw out packing from positions in stuffing boxes where a rigid packing tool cannot even be turned.

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A CARTRIDGE FOR SHOT GUNS—The curious looking cartridge shown in Fig. 16 is for use in an English gun that can shoot either shot or bullets. The cone-shaped bullet in this paper shell is made of brass, but can be made of lead with a hollow front, for use on soft-skinned game when a maximum of expansion is required. The muzzle velocity of the bullet is 1,200 ft. per second, and is claimed to be efficient at 300 yd. The same gun will plant more than 200 small shot in a 30-in. circle at 40 yd.

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BUCKET-CART FOR HANDLING OF CONCRETE—The main feature of this bucket-cart for the handling of wet concrete (Fig. 17) is its self-releasing leg. It swings free either forward or backward when the cart is being wheeled or dumped, and becomes fixed and rigid when the cart is stood upon it. The leg consists of a strong bar, hung by a bolt in a lug bracket. The bolt hole in the bar is slotted and the top end of the bar extending above the bolt is notched. When the cart is standing, with its leg vertical, the bolt bears against the bottom of the slotted hole and the notched top engages a projection inside the lug bracket. This holds the leg rigid until the cart is raised for wheeling, at which the leg drops by its own weight the full length of the slotted hole, and swings free.

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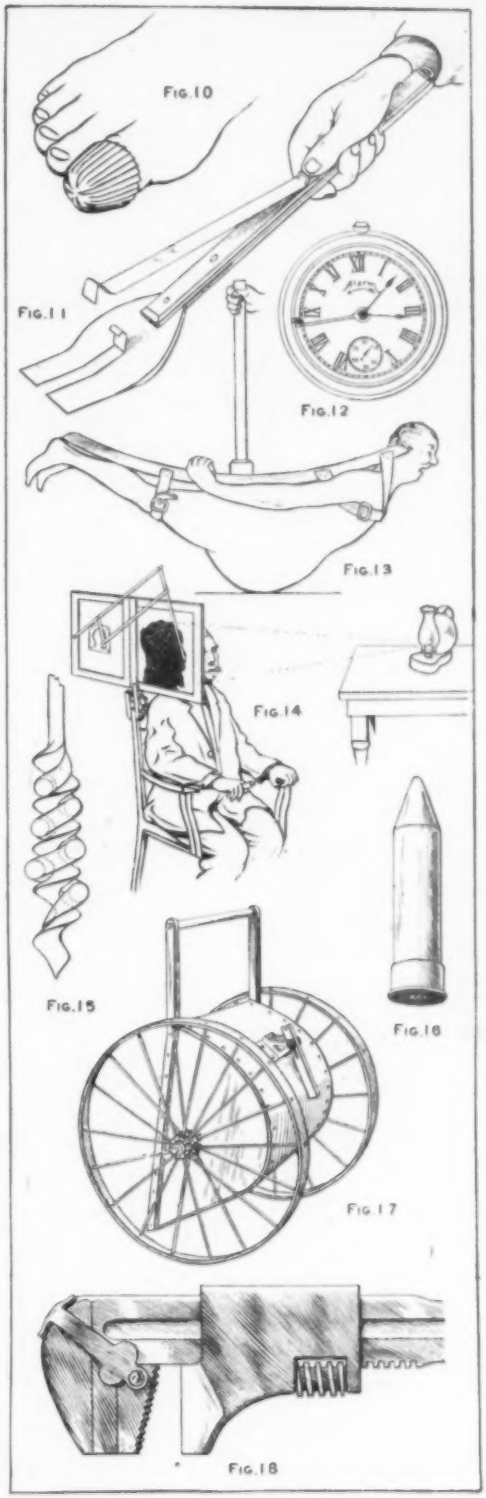
PIPE-WRENCH ATTACHMENT FOR AUTO WRENCH—The small attachment shown in connection with the automobile wrench in Fig. 18 transforms it from a nut wrench into a pipe wrench.



IT was in a railroad car. A one-legged passenger entered and seated himself. Another passenger eyed the newcomer for some minutes, and then, leaning forward, remarked:

"Only one leg, I see."

"Yes."

"Soldier?"

"No."

"Sawmill?"

"No."

"Dynamite?"

"No."

"Railroad?"

"No."

"Steeplechase?"

"No."

"Orange peel?"

"No."

The questioner lit a clay pipe, and twisted uneasily in his seat. Then he said:

"Fine day?"

"Yes."

"My good man, don't think me rude, but how did you lose that leg?"

"I dreamt one night that I was a dog, and bit it off."

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Two old settlers sat smoking in their cabin far away in the backwoods. No woman's hand had ever desecrated that sanctum, and grime reigned supreme and triumphant. The conversation veered round from state politics to cooking.

"Yaas," said the elder of the two, with a drawl. "I did get one o' them there cookbooks wunst, but I could never do nothin' with it."

"How was that?" inquired the other. "What was the hitch?"

"Waal," was the answer, "every one o' them receipts begun in the same way with the same words. Every-one of 'em started off with 'Take a clean dish'—and I never got no further."

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Suddenly a white form appeared at a window. All about leaped the mad flames. A portion of the wall had caved in, and it was too hot for the firemen to go up after the man. anyway. But see, a noble hero dashes under the ropes, makes his way to the elevator, and shoots up to the leventy-leventh floor, where the lonely form is still standing. Within about eight and one-half minutes he comes tearing out of the building with the life he has saved besides his own. Just then the entire building and the man who held the mort-gage on it collapsed.

About seventy-five thousand people rushed over to the hero—the man who at the risk of his own life and without the aid of a brass band went to the res-cue of one lone man.

"'Twas, indeed, noble of you," the people cried, with one voice. "Why did you do it?"

"Vell," said the hero, "I hat to. He owes me two tollars."

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"A joker was accosted the other day by a man who stammered badly. 'Can you tell me where I can get some g-g-g-g-good c-c-c-carpet t-t-t-tacks?' he asked.

"'Yes, certainly,' replied the inveterate joker. 'You turn down this street to your left, then turn again to your left and then go straight ahead, and you'll find a hardware store where you'll be sure to get them.'

"The stammerer continued on his way and the joker bolted down the street and tackled the hardware man first.

"'Have you any g-g-g-g-good t-t-t-t-tin-t-tacks?'

"'Yes, sir,' said the obliging man, producing his best after some rummaging.

"'Are you sure th-th-these are g-g-g-good ones?'

"'Yes. The best that are made.'

"'Are th-th-the heads st-st-st-strong?'

"'Yes, sir.'

"'Have they g-g-g-g-got s-s-s-s-sharp p-p-p-points?'

"'Certainly.'

"'Well, p-p-p-please s-s-s-sit on them t-t-t-till I get back, will you?' he said, making a dash for the door.

"'Presently the unlucky stammerer arrived, and, entering, asked innocently: 'Have you any g-g-good t-t-tin t-t-t-tacks?'———

"When he recovered he asked, in a somewhat dazed fashion, whether the house had fallen on him, or if it was simply an explosion."—American Artisan.

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A teacher was examining his class, and he said: "I will give a quarter to any boy that can tell what nothing is." A small boy at the back of the class put up his hand. "Well, Willie, and what would you say it is?" "Please, teacher, it is a bung hole with-out a barrel round it." Willie got the quarter.

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A teacher was explaining to her class of little girls some of the mysteries of the navy. She said: "The principal of this school is like the captain of a ship and the teachers may be looked upon as the blue-jackets, or sailors. Now children, who owns the navy of Uncle Sam?" Nobody answered. To carry her simile further the teacher asked, "Who owns this school?" The hand of a little girl in the back row went up. "Well, Hattie," said the teacher, "who does own this school?" With eyes sparkling with the inward assurance that she was about to hit the center of the target, Hattie answered: "The janitor."—The Bluejacket.

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Her—Richard! Why on earth are you cutting your pie with a knife?

Him—Because, darling—now, understand, I'm not finding any fault, for I know that these little over-sights will occur—because you forgot to give me a can-opener.

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A sympathetic old German gentleman was leisurely strolling past a city fire house, when he was moved by the tears of the captain. Stopping to offer con-solation, he said:

"Say, for what you grief?"

"Oh," replied the captain, with a fresh gush of tears, "my poor father is dead. If he had lived just one more day he would have been chief of the whole fire department; just think."

"Do not so bad feel," said the friendly old German, patting the fellow on the shoulder, "maybe he is a fire chief now."

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The office boy using the telephone for the first time in his life, and not knowing how to use it, was told that when the bell rang, he was to answer it.

When he heard it ring, he picked up the receiver and shouted, "Hello! Who's there?"

The answer came back, "I'm one hundred and five."

"Go on," said the boy. "It's time you were dead."

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The electrical study craze is now bearing fruit.

"Are you a conductor?" asked a lad of a street-car attendant.

"I am," replied the courteous official.

"What is your name?"

"My name is Wood."

"Oh that can't be," said the boy, "for wood is a non-conductor!"

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"I see you have a new automobile," said Wiggs, enviously.

"Yes," responded Biggs, as he slowed up the ma-chine near the sidewalk, "and it's a beauty. Every-thing works like clockwork."

"That's good."

"The tires are puncture-proof."

"Better still."

"And she goes like the wind."

"Gee whiz! Wish I owned one."

"By the way, are you fond of riding?"

"Am I fond of riding? Well, I should say so."

"Well, here's a street-car transfer I just found. I won't need it, and you can ride home on it."—Chicago News.