SCIENTIFIC AMERICAN

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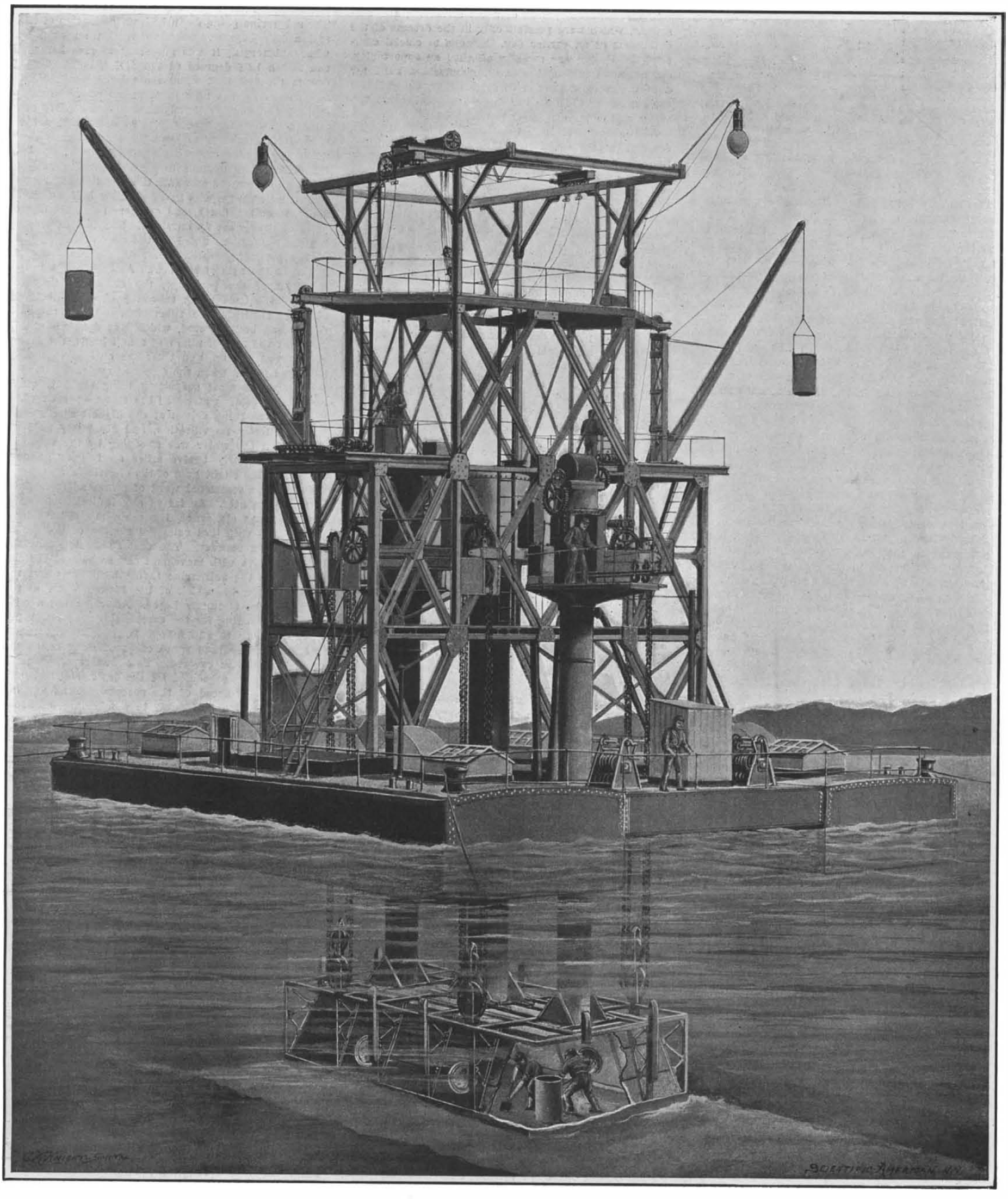
A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

Vol. CI.—No. 8. ESTABLISHED 1845.] NEW YORK, AUGUST 21, 1909. [10 CENTS A COPY $3.00 A YEAR.



Excavating apparatus for the German navy, consisting of a diving bell carried by pontoons from which it is entered and operated.

A NEW APPLICATION OF THE DIVING BELL.—[See page 127.]

SCIENTIFIC AMERICAN
ESTABLISHED 1845

MUNN & CO., Inc., - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York.
FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845) ..... $3.00 a year
Scientific American Supplement (established 1876) ..... 5.00 "
American Homes and Gardens ..... 3.00 "
Scientific American Export Edition (established 1878) ..... 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, AUGUST 21st, 1909.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

RACING YACHTS IN A GALE.

The recent run of seventy vessels of the New York Yacht Club from Martha's Vineyard around Cape Cod to Portland harbor afforded a supreme test of the seagoing qualities of the modern racing yacht. The distance was 152 miles. Not long after the start the wind began to freshen, and throughout the night, as the yachts fought their way along the coast of Cape Cod, it increased to what was probably a moderate gale. The fleet was so roughly handled that the majority of the boats were scattered during the afternoon and night, and the following morning found refuge in the various harbors from Vineyard Haven to Portland. Of those that completed the run, or rather race, for such it was, F. F. Brewster's 90-foot schooner "Elmina" went through without any mishap, covering the 152 miles in 22 hours, 36 minutes, and 38 seconds elapsed time. Equally meritorious was the performance of Cornelius Vanderbilt's sloop "Aurora," a vessel over 30 feet shorter than "Elmina" on the waterline, which covered the course in 26 hours, 11 minutes, and 21 seconds, beating Mr. W. E. Iselin's 90-foot yawl "Vigilant," the old "America" cup defender, by over 9 hours. The "Aurora" was navigated throughout by Mr. W. Butler Duncan, Jr., who says that the one-design Herreshoff yachts (the class consists of the "Aurora," "Istalena," and "Winsome") could hardly be surpassed in their weatherly qualities and were not in the least danger in the seaway. Nevertheless, the fact remains that a moderate summer gale sufficed to scatter this fleet of seventy vessels, completely disabling many of them, and driving the greater part of them to the shelter of the nearest harbor. The casualties comprised almost every kind of a disaster that can befall sails and spars, running and standing gear, from complete wreckage, as in the case of the "Eleanora," formerly the "Effort," whose mast went by the board, carrying bowsprit and everything above deck with it, to the breaking of the jaws of the gaff and the parting of blocks and the minor mishaps so well known to the racing yachtsman. The many casualties merely emphasize the fact, already well known to experienced yachtsmen and designers, that the enormous spars and big sail plan of the modern racing yacht are ill adapted for a thrash to windward in a heavy sea and wind. Although when a racing yacht is staggering along under her full press of canvas, the strains in spars, shrouds and stays run up to a very high figure, they evidently do not equal the more violent strains which occur under the sudden, snappy plunging and lurching of a vessel that is being driven under reduced canvas in a short and lively sea. The result of this experience of a summer's gale will be to bring the moderately sparred and more comfortable cruiser into greater favor with the average yachtsman.

PEARY AND THE NORTH POLE.

Public interest in the present attempt by Peary to reach the North Pole has been reawakened by the recent start of the schooner "Jeanie" from St. John's, Newfoundland, for Etah, west Greenland, for the purpose of getting into communication with the explorer, who has now been absent over twelve months on his present expedition to the North Pole. When Peary left in the "Roosevelt," about twelve months ago, he planned to push as far north as the ice would admit, and then establish winter quarters and make preparation for a dash by sled between March and June of the present year. If he were successful he planned to return to Etah with the ship, if possible, and if not, without it. If he failed to reach the Pole, it was his purpose, should another attempt seem to promise success, to remain in the North till the summer of 1910, and make another attempt in the early months of that year. If any disaster has befallen the "Roosevelt," the schooner will probably find Peary at Etah awaiting her arrival; and he will be there if he has succeeded in reaching and returning from the Pole. Should he have failed in his quest, he will still be far away to the north, and the schooner will bring back such dispatches and reports as he may have sent down. Possibly the vessel will also bring back Dr. F. A. Cooke, of Brooklyn, who went north two years ago and was landed at Etah to undertake a trip to the Pole with a single companion. The last word from him was sent back by a native when he was about to go out over the Arctic ice on his quest. If all goes well the return of the vessel may be looked for about October 1st, when some definite news of Peary's work may be expected.

TWENTY MILES UNDER THE SEA.

The rapid progress of the arts and sciences in these opening years of the twentieth century affords opportunity for the enjoyment of novel situations and sensations, which were possible only in the dreams of the enthusiast of an earlier day. Thanks to official courtesy, the Editor was recently afforded an opportunity, during the trials of the latest submarines built for our navy, to make a run of some twenty miles below the surface of the water in one of these always interesting and to-day extremely formidable craft.

A little removed from the long lines of battleships, destroyers, and auxiliaries, that were moored during the recent summer maneuvers in Provincetown Bay, was the converted hull of an old wooden sailing brig, the property of the Fore River Ship Building Company, which acted as "mother ship" to a group of submarines, recently constructed by that company, which had been brought to Provincetown for their official government tests. Selecting the "Stingray," one of the largest submarines, for the reason that her trials for the day were to be carried on entirely below the surface, we went aboard, and found ourselves on a narrow, flat deck, about five feet in width and sixty feet in length, which covers in the superstructure, a light construction of steel plating built upon the hull of the submarine proper, and perforated so as to allow a free entrance and exit of the water. A steel hand rope, carried in removable stanchions, surrounds this deck. Extending up through the center of the deck to a height of about five feet is a narrow elliptical tower, on top of which is the sighting hood or conning tower, pierced by several little glass-filled ports for observation. Just in front of the conning tower is a removable navigating bridge, used when the ship is at the surface. In front of this are the two tall tubes of the periscopes, which are in duplicate.

The ship was driven to the outside mile course by the electric motors, the gasoline engines which are used for propulsion on the surface in extended runs, being uncoupled. The first surprise of the day was the extraordinary smoothness of the motion, there being not the slightest vibration to indicate that the vessel was under way. As we approached the course, orders were given to dismantle the upper works and send everything below. The wire handrope around the deck was removed, the stanchions lifted from their sockets, the navigating bridge on the conning tower was knocked down, and all of this material, with the steering gear, compass, etc., was handed, piece by piece, through the manhole, until the ship was stripped clean for the dive. As soon as everybody had gone below, the manhole was closed, and the submarine was ready for her first run over the measured mile course. Below decks throughout the five hours below the surface we were struck with the purity and sweetness of the air, and the absence of any odor other than that of the last coat of paint which the interior had received. Forward, side by side, we noticed the two torpedo tubes. Aft, beyond a bulkhead, were the twin gasoline engines, and abaft of them the two motors, the former used for charging the batteries and for propulsion when the ship is at the surface, the latter being used exclusively for propulsion when the ship is submerged.

While making the trial runs, the steering is done by a man in the conning tower. Immediately below him, standing on the deck, is the lookout, with his eye at the periscope. Facing the side of the vessel, another man controls, by means of a handwheel, the diving rudder, and holds the vessel at its proper depth. At various stations were men with their hands upon the wheels and levers that regulate the ballast tanks for giving the proper submergence and trim to the vessel; aft were the engineers.

It will be remembered that when we went below, the submarine was floating at the depth for surface cruising. The first operation was to admit sufficient water into her tanks to sink the boat to the awash condition, and in sharp succession the commands came, "Fill the main ballast tank," "Fill the forward trimming tank," " Fill the after trimming tank." Immediately one could hear the rather ominous swish of the water, as it rushed into the vessel. Instinctively our eye followed the pointer on the large depth gage, which was fastened on the side of the submarine in front of the man who controls the diving rudder. The tanks were left open till a depth of five feet was registered. Then came the order to start the engines, which was shortly followed by the sharp word of command, "Dive." A few swift turns to the handwheel were followed by a curious dipping or lurching sensation, as the submarine, impelled by the downwardly-deflected rudder astern, changed from the horizontal to an inclination of about five degrees, and began to go down. The descent was shown at once on the depth gage, which moved quickly to indicate eight, ten, twelve, and ultimately fifteen feet, the depth at which the runs were to be made.

It should be explained here that the handling of the diving rudder is the most delicate operation, and the one requiring most skill and judgment, connected with the submarine. The rudder must not be put down too suddenly, or there may be too precipitate a plunge. At 9.5 knots, the speed at which the run was made, it took about five degrees of rudder to make the dive. The submarine going down had an inclination of three and a half degrees. To keep her on an even keel when submerged, it was necessary to give her about one and a half degrees of the diving helm. This is due to the fact that when the submerging tanks are filled, she does not take in sufficient water ballast to entirely sink her, but is adjusted with a reserve buoyancy of about 1,000 pounds. To correct this buoyancy, it is necessary to keep the helm slightly down when she is running. To reach the fifteen-foot depth takes from fifty seconds to a minute and a half, according to the speed at which the boat is being run.

The mile course was laid out about half a mile offshore, the start, finish, and quarters being marked by pairs of ranges set up on shore. The instant of passing the ranges was noted by the man at the eyepiece of the periscope, which was swung around at right angles to the axis of the boat. As each range passed the field of the periscope, the observer called out "Mark," the time being taken by observers both on shore and within the submarine. When the mile course had been covered, which was done under full power at the rate of nine and a half knots, the diving rudder was put up, and the same curious change of level was felt as when the dive was made.

Perhaps the most surprising thing about this five hours' trip below water was the fact that, even when the boat was being driven at the highest speed, there was practically no vibration, and absolutely no indication that the water was sweeping by the vessel at a speed of nearly twelve miles an hour. The only sound was the slight hum of the electric motors, punctuated by an occasional word of command from navigator or engineer. As far as any indication of sight or sound was concerned, the cabin might have been that of any ship that sails the surface of the sea in the orthodox manner. The first suggestion that the boat was alive with movement came when, at the end of the run, the submarine thrust her nose above the surface, when the swish of the broken water at the bow could be distinctly heard. After making a wide turn, and heading for the course, the rudder was put down; a dive to the fifteen feet depth was made, and, under a reduced speed of about eight knots, the course was again covered. This was repeated, until the twelve runs scheduled for the day's trial had been completed, the speed of the successive runs varying from nine and a half down to a minimum of about four knots. The engines were standardized by counting the revolutions corresponding to the various speeds.

A look through the eyepiece of the periscope, while we were submerged, removed the last doubt as to the ability of the submarine to "see." By means of a handwheel the periscope may be swept rapidly around the whole horizon; and so perfect is the reflection of the little mirrors, that we were able to pick out any particular battleship, yacht, or object on shore, with as much ease and as perfect visibility as if we had stood six or eight feet above the water, at the level of the object glass at the top of the periscope. The operator stated that in rough weather the wash of the waves keeps the glass clean and does not interfere with vision.

There can be no question that the submarine has at last "come into its own." Among the captains of the battleships and the line officers in general at Provincetown, there was noticeable a growing respect for these craft, due to the varied and accurate work which the flotilla had accomplished during the summer maneuvers. There has been a steady but slow growth in the speed of the submarine. Its control is now perfect, and its radius of action is being rapidly increased. Our largest boats have a radius of about one thousand miles; and two are under construction on the Pacific coast which will have a cruising radius of about three thousand miles. This means that the submarine is taking on full seagoing qualities. It must no longer be regarded as restricted to seacoast operation. The time is not far distant when an admiral searching for the enemy upon the high seas may include a submarine flotilla in his fleet. The profound significance of this fact upon strategy and tactics will be appreciated by every naval expert.

ENGINEERING.

The New York, New Haven & Hartford Railway Company are about to make tests of the comparative performance of electric and steam locomotives in freight service. To this end they have ordered two freight locomotives. One of these is to be equipped with side rods, and the other will be of the geared type.

Statistics of accidents on the railways of the United Kingdom for the year 1908 show that in accidents to trains, rolling stock, or permanent way, no passengers were killed, but 283 were injured; while of employees, 6 were killed and 164 injured. Accidents of a kind other than the foregoing included 102 passengers and 376 employees killed, and 2,240 passengers and 4,976 employees injured.

The "Alagoas," the seventh of ten torpedo-boat destroyers ordered by the Brazilian government, was successfully launched by Messrs. Yarrow & Co. of Glasgow on July 29th. Like her sister vessels she is 240 feet long by 23 feet 6 inches beam, and will be equipped with two doubel-ended Yarrow boilers of 4,000 horse-power capacity, supplying the two sets of 4-cylinder triple-expansion engines, refrigerating apparatus, and other auxiliaries.

In a recent paper W. E. Gray states that the manufacture of tin plates originated in Bohemia, hammered iron plates having been coated with tin in that country some time before the year 1600. Tinplate making was introduced into England from Saxony in 1665, and the first tinplate factory in France was established in 1714. Tin plates were first made on a commercial basis in the United States at Pittsburg in 1872.

According to "Railways" of Calcutta, the success of the monorail system in India for carrying freight and passengers is largely a question of finding a satisfactory type of carriage, and Mr. Brennan is now making experiments on short lengths of roads in India to determine this question. The monorail system is believed to possess great value, because of its simplicity and cheapness of construction, for military purposes on mountain roads. The result of the experimental work will be given in a forthcoming report.

The Jamaica Bay Improvement Commission will shortly make a survey for the bulkhead line, which will be built at about 2,000 feet from the westerly and northerly shore of the bay, and will extend from Barren Island to Three Mile Creek. The government will dredge a channel which will ultimately be 30 feet deep and 1,000 feet wide. The dredged material will be used to fill in the 1,250 acres between the bulkhead and the shore line. In the earlier stage of the operations it is proposed to dig the channel to a depth of 18 feet and a width of 500 feet.

The work which has been done in the electrification of steam railroads has probably suffered from the lack of collaboration between the different railroads and interests that have been engaged in such work. Hence, it is gratifying to note that the New York Railway Club has appointed a special committee to take up the subject during the coming fall and winter, and report at the annual electrical meeting of the club in March next. They will collect data and make suggestions as to the direction in which further investigation should be made. Substantially the same action has been taken by the Maintenance-of-Way Association and the American Railway Association.

A new record for mining and shipping anthracite coal has recently been made by the Kingston Coal Company, of Wilkes-Barre, Pa. During the month of July, that company's breaker No. 2 shipped 91,000 gross tons of coal, which, as far as we can learn, beats the record of any in the United States. This breaker has been entirely rebuilt during the last six months without any stoppage of its machinery, improved springboard shakers being substituted for revolving screens, and mechanical pickers introduced to dispense with a large number of boys on the picking belts. The breaker worked twenty-four full working days of nine hours, the greatest number of mine cars dumped in one day being 1,641.

So vast are the crowds which are expected to gather during the forthcoming Hudson-Fulton Celebration, that the Executive Committee have made elaborate plans for the proper care of the health and convenience of the visitors. During the entire time of the celebration there will be open, twenty-four hours a day, a large number of emergency hospitals, provided with telephone connections. A number of physicians and 1,500 trained nurses have volunteered their services. During the three days of the land parades there will be established a temporary emergency hospital at every five blocks, with ambulances stationed at every ten blocks. During the two water events of the celebration, an innovation will be introduced in the form of ambulance launches, with nurses, doctors, and police officers in attendance.

ELECTRICITY.

In recent trials of the Pollak-Virag high-speed telegraph between Berlin and Königsberg, a distance of 430 miles, 2,800 distinctly recorded words were transmitted in five minutes.

So successful have been the experiments with the new Telefunken system of wireless transmission at the new 20-kilowatt station of the Austrian government at Pola on the Adriatic, that signals strong enough to be automatically printed on tape by the coherers were received at Norddeich on the North Sea, Copenhagen, and Berlin.

The wave forms of electric currents have been made visible by M. Abraham of Paris by means of an adaptation of the mirror galvanometer. Upon the mirror being set swinging horizontally by the current, the beam of light is thrown upon a revolving prism and a set of fixed mirrors in such a way that it is spread out in the vertical direction, so that the wave form of the current appears upon a screen.

The French government, which already had the monopoly of telegraph and telephone operations in France, has extended its legislation to include wireless telegraphy. No wireless telegraph or telephone apparatus may be set up on French territory or ships except where authorized by the state, and foreign vessels in French waters may not operate their apparatus in such a way as to conflict with government messages.

Wireless messages transmitted from the Glace Bay station in Canada have recently been picked up with some regularity by the Eiffel Tower receiving station in Paris, proving that transatlantic wireless communication is an accomplished fact. The Paris plant is in no way competing with commercial stations, being purely for military purposes, making no communication with places outside of France except the French African colonies.

The growing importance of the electric vehicle, hitherto somewhat overshadowed by the more showy successes of the gasoline car, is evinced by the fact that at the recent annual convention of the Society of Automobile Engineers in Chicago half the papers presented related to electrical subjects. Two of the papers referred to storage batteries and one to measurement of energy consumed by commercial vehicles, the most animated discussion of the meeting centering around the latter.

The notable successes of wireless telegraphy in procuring speedy assistance for ships in distress at sea in spite of fog and distance, best exemplified by the cases of the "Republic" and the "Ivernia," has caused an application for lower insurance rates for vessels equipped with wireless apparatus to be proposed for the international marine insurance congress at Baden next month. Success of the application should be mutually beneficial, both effecting a saving in insurance cost to shipowners using wireless and extending the use of the latter.

Upon the successful completion of tests now in progress of a 5,000-kilowatt unit, the New York Interborough Railway will install two more General Electric Curtis low-pressure turbines driving 3-phase 25-cycle 11,000-volt generators, each of 5,000 kilowatts capacity, operated by exhaust steam from existing reciprocating engines at the 59th Street power house. It is estimated that the turbines will take nearly as much power from the exhaust steam as the reciprocating engines do in expanding from 150 pounds pressure to atmosphere.

The Great Eastern Railway of England, with one of the largest termini in London and a great suburban traffic, has lost passengers at the rate of 25,000,000 per annum since the advent of the London County Council's electric tramways, and this in spite of a gradual reduction of its fares amounting in some cases to 40 per cent. The council tramways are a municipal undertaking, and while giving good service have been run hitherto at a loss, the deficit being paid out of the rates, so that the railway company, as a large ratepayer, is naturally aggrieved at having to contribute to the support of a successful rival.

The Public Service Commission, which has been considering the question of compulsory electrification of railways passing through the Adirondacks forest preserve, as a means of fire prevention in the latter, has rejected this remedy on account of its prohibitive cost. The additional cost of operation by electricity was estimated to be $1,156,470 a year more than the present cost of operation by steam locomotives, for the New York Central lines alone, that figure being reduced by only $100,000 if all the power were generated by water. This great expense is due to the very unfavorable conditions for electric service, the traffic consisting of a few heavy trains over comparatively long distances, whereas economical electrical operation requires a fairly uniform traffic composed of a large number of small trains at small intervals, as in the suburban service of large cities.

SCIENCE.

Capt. R. F. Scott, who recently returned after a thrilling attempt to reach the South Pole, in which he was nearly successful, has announced his intention of setting out on another Antarctic expedition early in 1910.

That the New York Aquarium is certainly meeting with public approval would follow from the remarkable attendance in July, 1909. During that month 528,266 persons passed through the turnstile—an average of 17,040 per day. Up to August 2d, 1909, the total attendance was 2,006,919.

It is announced that Lieut. Shackleton will lecture in the United States and Canada, in order to earn enough money to pay the heavy indebtedness which he incurred on his last Antarctic expedition. The announcement is astonishing, as it was generally supposed that Lieut. Shackleton had been aided by his government. It is stated that the expedition was financed by a small group of Americans who lost their all in the last financial crisis.

The Duke of the Abruzzi cables that he has ascended Mount Godwin-Austen, in the Himalayas, to a height of 24,600 feet. He failed by 3,665 feet in reaching the mountain's summit. We believe, that although he did not succeed in his ultimate object in ascending this lofty peak, he has broken all records for mountain climbing. The Duke had an advantage over the private individuals who were his rivals in the Himalayan field, in so far as the government of India furnished him with guides and porters. For all that, his hardships must have been tremendous. The Workmans have stated that climbing in the Swiss Alps is child's play compared with the feats of endurance which climbing in the Himalayas demands.

As aluminium is extensively employed in the manufacture of kitchen utensils it is important to know how it is affected by the foods which are brought into contact with it. For this purpose Fillinger boiled aluminium foil in fresh milk, sour milk, wine, mineral waters and 10 per cent solutions of various salts. The aluminium foil was weighed before and after the boiling, which was continued for half an hour. No appreciable loss of weight was produced by boiling in sweet milk, white or red wine, or solutions of sodium chloride, potassium iodide, sodium nitrate, potassium sulphate, and calcium nitrate, and only a very small loss was caused by sour milk. The aluminium was strongly attacked, however, by sodium bicarbonate, magnesium sulphate, calcium sulphate, and mineral waters.

Garrigon has tested the radio-activity of the hot springs of the Pyrenees by immersing in their waters a photographic film inclosed in a tube of aluminium. The film showed an impression after a longer or shorter immersion, while a second film, immersed in the same conditions, but inclosed in a tube of lead, remained unaffected. A very thin sheet of lead suffices to stop the radiations of radium, etc., which pass through comparatively thick sheets of aluminium. The following experiment, of similar character, is reported by an Italian scientific journal: A photographic plate, wrapped in paraffined paper (to exclude moisture) and then in black paper, was placed between two plates of iron 1/12 inch thick, which were coated with asphalt varnish. The iron plate next to the sensitive film had five perforations, about ½ inch in diameter. The whole apparatus was suspended for 15 hours over a spring, with the perforated plate lowermost. On being developed the photographic plate showed impressions of the five perforations. A control plate, treated in the same manner, but not exposed over the spring, showed no impression whatever.

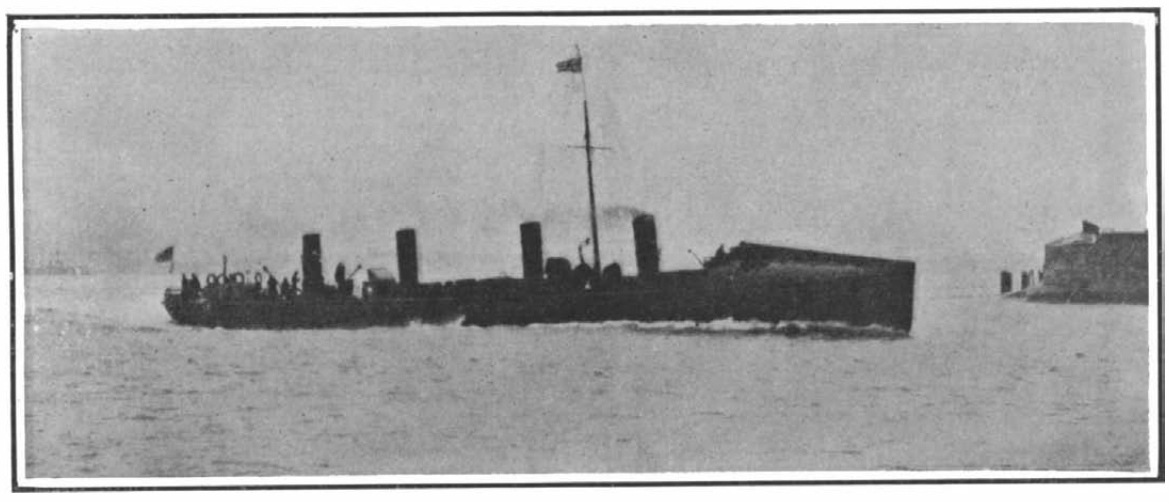
F. Robin has made a series of experiments on the hardness of steel at low temperature, using a falling ball 2/5 inch in diameter, which gave a blow of about three tons. The metals were in bars about two inches long and one inch square. They were placed in three refrigerating mixtures, producing temperatures of —4, —112, and —300 deg. F. The temperature —4 deg. F. was obtained by a mixture of ice and calcium chloride; the temperature —112 deg. F. by a mixture of carbon dioxide snow and 95 per cent alcohol. The lowest temperature, —300 deg. F., was obtained by a mixture of liquid oxygen and nitrogen containing a very large proportion of nitrogen. The experimenter finds, as Hadfield did, an increase in hardness of steel immersed in liquid air, but the increase is not progressive, the curve of hardness rising suddenly at —112 deg. F. and attaining a great height in liquid air. Cast antimony also increased greatly in hardness, but cooling had comparatively little effect upon aluminium, copper, lead, tin, nickel, and some other metals. Spring steel containing silicon shows little change. Chrome steel showed great variation, while tungsten steel, vanadium steel, molybdenum steel, and rapid-cutting steel gained little in hardness on being cooled to the lowest temperature. Quenched steels gained considerably in hardness.

TESTING A TORPEDO-BOAT DEFENSE.

BY AN EYEWITNESS.

A most realistic test of the value of a boom for the defense of harbors against the attack of torpedo craft has just been made by the British Admiralty. In 1904 the submarine mine fields which up to that date had been maintained at the entrance to the principal British naval ports were abolished, and at the same time the Brennan torpedo—a weapon operated and directed from the shore by means of endless steel wires—was also discarded. These changes were followed by the organization of submarine and torpedo flotillas for the local defense of the ports, and simultaneously a great deal of attention began to be paid to the question of boom defense.

The latest pattern in these obstructions adopted by the British Admiralty consists of a number—generally from 100 to 150—of balks of timber, each about ten feet long, tied together by four lines of strong steel hawsers. At intervals along its length, the boom is attached to pontoons which are themselves anchored to the bottom of the channel by heavy mooring chains. Each balk of timber is about a foot square in section, and is studded with a number of stout, curved steel spikes, four projecting from either end, and others being placed along the length of the balk at intervals of about three feet. The object of these spikes is to prevent the "jumping" of the boom—an incident which has occurred more than once in maneuvers. It is achieved by all movable weights—including the crew—being taken aft, thus lifting the bow of the vessel well out of water. Then, running at the boom at full speed, the nose would be pushed well over the edge of the boom, and the impetus of the vessel and the sudden rushing of the men forward again would in most cases prove sufficient to carry the ship safely across. A few years ago, however, a British torpedo vessel broke her back while trying to jump a boom.



Destroyer "Ferret" as she appeared when approaching the boom at 15 knots speed.

It was, of course, well understood that any vessel larger than a destroyer could easily break any boom yet devised. The British Admiralty, however, after much discussion, came to the conclusion that the only vessels likely to penetrate the outer line of British port defenses were destroyers and torpedo boats (including, of course, submarines), and it was therefore decided to put to a practical test the problem whether a vessel of one of these types could burst through a boom of the latest pattern.

A section of a boom of the latest design was therefore erected across a small creek in the upper reaches of Portsmouth harbor. In addition to the spikes already described, the boom was furnished with a three-inch wire hawser stretched about three feet above the balks, with the object of shearing the masts and funnels from any destroyer which might have the audacity to charge the boom, and to force it down on to the steel spikes. Five feet below the surface there was another hawser, designed to impede the progress of the ship and to foul its propellers.

The attack was intrusted to the torpedo-boat destroyer "Ferret," an obsolescent vessel of 280 tons, launched in 1893. Her engines are of 4,810 horsepower, the designed speed being 27 knots. For the purpose of the test she was strengthened by means of steel plates fixed to either side of the bow, but this was only done to give her a greater resemblance to the latest vessels of the destroyer class. Nominally her crew consisted of seventy men, but for the purpose of the trials a volunteer crew of ten was selected, Lieut. J. C. Hodgson being in command and Artificer Engineer J. Hawkesworth in charge of the engines. Before starting, the whole of the crew were directed to come on deck as soon as the vessel got within one hundred yards of the boom and to be ready to jump overboard, while a large number of tugs and launches were in the vicinity to pick up the expected pieces. These facts alone are sufficient evidence that the Admiralty officials did not expect the "Ferret" to get through, at any rate without considerable damage to herself.

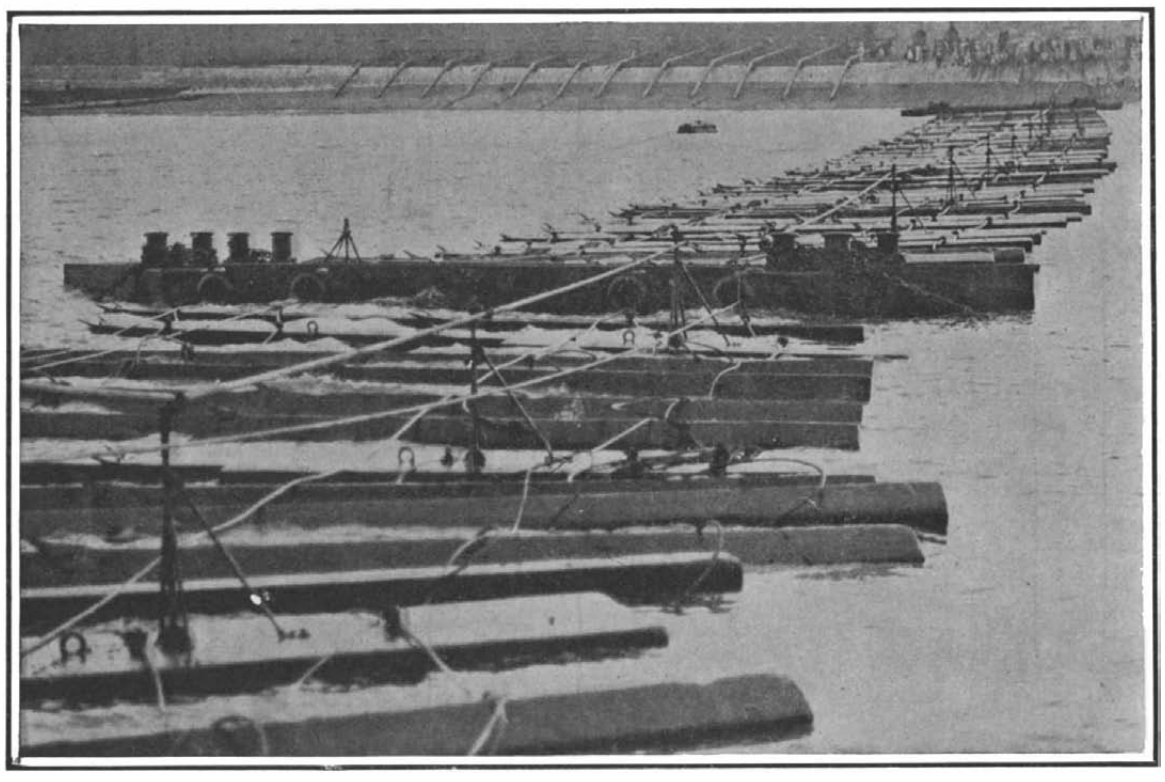
Of the trial itself there is little to say. It took place at five o'clock in the morning of July 28th. The "Ferret" left Portsmouth harbor, and, turning round, steamed toward the boom at about fifteen knots. The lieutenant and quartermaster stood on the bridge and at the wheel respectively, and steered a course direct for the center of the obstruction. When a hundred yards distant steam was shut off. The surrounding pinnaces and tugs closed in, the "Ferret" caught the boom between two balks—and went through it as easily as if it had been packthread. No shock whatever was felt on board. and everyone—engine-room staff and stokers included—remained at their posts, and were, in fact, unaware of the fact that the obstruction had been cleared. A glass of water left standing on the wardroom table was not even spilled.

The hawsers were cleanly cut, and the two halves of the boom swung round with the tide toward the shore.

The "Ferret" could easily have proceeded into the dockyard under her own steam, but two tugs took charge of her, and later in the day she was docked. An examination showed that she was quite undamaged. The hawsers had made a dent in her bows, but no plates were started, and she was making no water. It is not believed that she was strained in the slightest degree, but this will not be definitely known until a thorough examination has been made.

The experience was practically a repetition of what occurred in 1885, when the torpedo-ram "Polyphemus" charged and broke a strong boom at Berehaven in Ireland. In that case, however, the attacking vessel was a craft of over 2,000 tons, and the boom was not so scientifically constructed as that tested at Portsmouth.

It is understood that the Admiralty intend to carry out a series of tests, with the object of discovering a really efficient obstruction for harbor mouths. It is suggested that a series of wire entanglements, placed one behind the other, will next be tried. As was to be expected, the result of the Portsmouth trial has already led to a demand for the reinstallment of the submarine mine defenses of British harbors.



The boom consisted of 12-inch by 12-inch logs, tied together with four lines of heavy steel cable. Three feet above and five feet below the boom were stretched two 3-inch steel cables. At the front end and along the sides of each log were sharp, forwardly-projecting steel spikes, The torpedo-boat destroyer struck the boom between two logs, cut the cables, and passed through unharmed.

Torpedo defense boom before the attack in Portsmouth harbor.

TORPEDO BOOM EXPERIMENT.

THE FIRST CROSS-COUNTRY FLIGHT OF THE AERONAUTIC SOCIETY'S BIPLANE.

As mentioned in our last issue, Mr. Charles F. Willard has been learning to fly the Curtiss biplane acquired recently by the Aeronautic Society. Last week, in the vicinity of Mineola, L. I., Mr. Willard made practice flights early in the morning almost daily. On the 14th instant he made a flight in the shape of the letter S of nearly five minutes' duration, in the course of which he traveled about three miles. The following morning, at 5:26 A. M., he started off as usual near the fair grounds at Mineola; but, instead of circling over the plain, he drove the machine above the fair grounds some three miles across country to Garden City. At this point he turned to the left and headed for the grounds of the Meadowbrook Hunt Club, passing over a group of men on their way to work, who waved their caps and cheered. From this point he flew toward Westbury, swerved to the south, and crossed the Motor Parkway, making several turns. He traveled to the outskirts of Hicksville, whence he directed his machine straight back to Mineola. Before reaching the starting point, however, something about the motor gave out, and the machine was forced to descend upon rather rough ground. The landing was made without damage, however. The machine was in the air over nineteen minutes, and covered a distance of about twelve miles. The height attained was about 150 feet. This is the second cross-country flight made in the United States by any aeroplane, the first one being that made by the Wright machine in its government test on the 30th ultimo. Mr. Willard traveled somewhat farther than did Orville Wright and Lieut. Foulois, though the ground over which he flew was much smoother and less dangerous in case the machine was obliged to alight. This flight surpasses any ever made by Mr. Curtiss himself, or by Messrs. McCurdy or Baldwin. In addition to being a cross-country flight, it is the longest flight yet made in the United States by any machine other than the Wright. It is probable that further exhibition flights will be made with this machine by Mr. Willard in the near future.

MR. CURTISS AT RHEIMS.

Mr. Glenn H. Curtiss arrived in France on the 12th instant with his aeroplane, which was packed in boxes. The machine was taken as personal baggage directly from Havre to Rheims, and after busying himself the following day with its erection, Mr. Curtiss announced that it was almost ready for trial. This will give him a full week in which to tune up the machine and prepare for the races, which start on August 22nd. There seems little doubt that Mr. Curtiss's new biplane will make an excellent showing against the two score machines with which he will have to compete.

THE TRIAL FLIGHT OF THE "BADDECK NO. 1."

"Baddeck No. 1," the new biplane with which Messrs. McCurdy and Baldwin are experimenting at Petewawa military camp in Canada, met with an accident when the first flight was attempted on August 13th. The machine reared suddenly in the air and

(*Concluded on page 127.*)

A RECORD CROSS-COUNTRY MOTOR-BOAT TRIP.

BY OUR SPECIAL CORRESPONDENT.

A river trip of 450 miles made in one day between dawn and dark would certainly be a record-breaking performance. Such a trip could hardly be made with the usual type of high-speed motor boat, as neither the engine nor the hull would be likely to stand 15 hours continuous running at a 30-mile clip. The annual French endurance race from Paris to the sea, in which a number of the fastest racers usually compete, is generally run in stages, so that it lasts several days and consists of a few spurts of several hours each. When these facts are considered, one can appreciate the bold undertaking of the Dean brothers, of Cincinnati, O., when they attempted to run their fast boat "Br'er Fox II." from Pittsburg to Cincinnati in one day. This boat had previously made the 1,554-mile trip from St. Louis to New Orleans at a speed of 29.8 miles an hour, and altogether had traveled over 3,000 miles at a speed of nearly 30 miles an hour.

The start was planned for Sunday, July 10th last; but on account of low water in the Ohio River, it was necessarily postponed. A demonstration was given the SCIENTIFIC AMERICAN representative of the speed of the boat, however, in a round trip to McKeesport, Pa., a town 20 miles distant. The running time was 39 minutes one way and 41 the other, which was against a slight current. This was an average of over 30 miles an hour. Fortunately, within the next three days there was some rain, and the water rose enough in the river to make possible the undertaking of the trip, although only with the running of considerable risk, as the following account shows: The start was made from the landing of the Pittsburg Launch Club on Wednesday evening, July 14th, at 7:09:25, with the intention of running through the six dams to Rochester, Pa., that night, in order to make an early start through the open river on Thursday morning, thus avoiding the loss of time in locking through these six locks. A storm came up after passing through dam No. 1, and the boat was forced to tie up for the night. Another start was made early Thursday morning, and dam No. 6, at Rochester, was reached at 9:25:10, the actual running time through the pools being at the rate of 25 miles per hour.

Below the pools the water was found to be so shallow that it was necessary to cut out four of the eight cylinders in order to reduce the speed of the engine to 500 R. P. M., or approximately half speed. Below Wellsville, O., the propeller struck the bottom of the river and was bent. It was decided to continue with the disabled propeller until deeper water was reached, as the extra propeller carried on the boat had been damaged on the trip up the river to Pittsburg. It was impossible to make any speed until Bellaire, O., a distance of 95 miles, was reached, although the engine performance was perfect. The boat grounded several times, causing a loss of considerable time, but fortunately little damage was done.

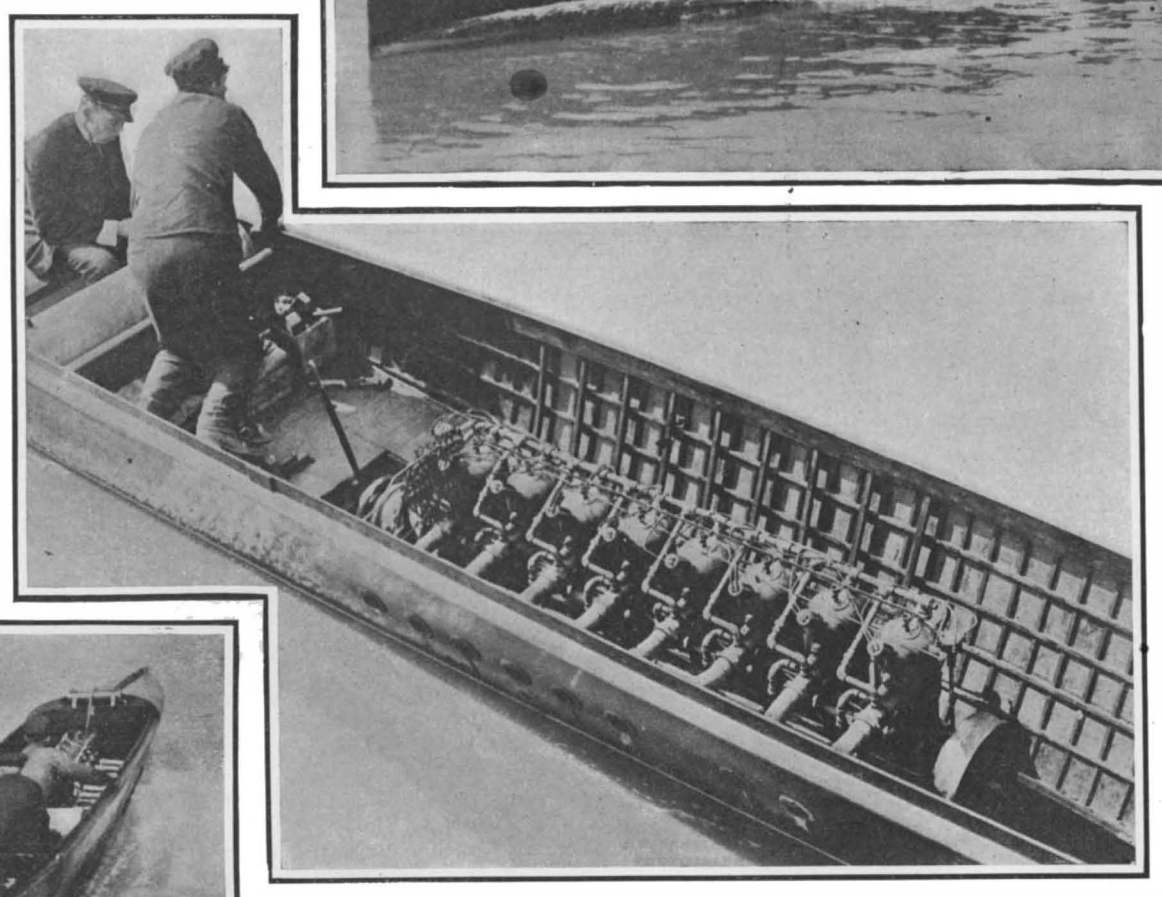
All eight cylinders were set working at Bellaire, but four were cut out again after going about two miles, and but four cylinders were used to Marietta, a distance of 171 miles. Sistersville, W. Va., was reached on Thursday evening at 6:49. The night was spent here, and a supply of gasoline and cylinder oil was taken aboard. Leaving Sistersville at 6:37:10 on Friday morning, a quick run was made to Petticoat Bar, 9 miles down the river. The propeller struck the bar while the boat was running nearly at full speed. Two blades were stripped from the wheel, and the boat was paddled to the bank, where the other propeller was put on. The shaft was bent slightly just in front of the propeller. The accident happened at 7 A. M., when all eight cylinders had been put on for a short time, as there appeared to be about three feet of water. The start was made from Petticoat Bar at 8:43:40, the engine running on four cylinders; and no further changes were made until Marietta was reached at 10:22:05, where there was considerably more water, owing to the Muskingum River flowing into the Ohio at that point.

Full speed was maintained until near Ravenswood, 218½ miles from Pittsburg, where a stop was made to replace the batteries. The boat is equipped with a magneto, but this had been disabled in the storm on Wednesday night, and was out of commission. From Ravenswood to Ironton, 106½ miles, the engine was run at full speed continuously, and not a single adjustment of any kind was made. Had it been possible to run at this rate of speed with the same amount of water down from Pittsburg, there is no doubt whatever that the run could have been made from that city to Cincinnati in one day. The performance of the engine on such high speed for such a distance is nothing short of remarkable, and is a triumph for the manufacturer of the two-cycle engine. No part of the engine heated up at any time, and not an explosion was missed. Vanceburg, Ky., was reached at 7:12 Friday evening. The boat was tied up for the night, and a supply of gasoline and cylinder oil was taken on. A fresh start was made at 7:22 on Saturday morning, and the run to Maysville, Ky., was made without stopping or slowing down the engine. The landing at Maysville was reached at 8:38:50, thus making the 30½ miles between those cities in 1:16:50, and this with a bent propeller and shaft. Such a performance by a badly disabled boat is truly remarkable, and particularly when it is taken into consideration that while the "Br'er Fox II." is designed to carry a crew of but two, she carried a crew of four on this trip, and 85 gallons of gasoline instead of the 30 gallons which are generally carried.

At Maysville a telegram was received from Cincinnati asking that the boat's arrival be planned and timed for one o'clock, as the launch clubs of that city had planned a reception at that hour. The boat was accordingly held at Maysville until 10:49, when the start was made for Cincinnati, 60 miles distant. The engine was then run without change of speed or adjustment until the Ohio River Launch Club was reached, where ten minutes were lost in taking on an extra can of gasoline, the supply having run short. Cincinnati was reached at 1:15:45, where the boat and occupants received a rousing reception from a large crowd. The run from Maysville to Cincinnati was made at the rate of 26.54 miles per hour, the fastest long run on the trip.

The actual running time for the trip from Pittsburg to Cincinnati was 21 hours, 35 minutes, and 25 seconds, which is a new record by water between these cities. This was at an average rate per hour of 21.25 miles, a most notable performance for a disabled boat in low water, where two-fifths of the entire distance was made under half power. At least ten per cent additional distance was covered on this trip, due to the necessity of crossing and recrossing the river in order to keep in the channel, maneuvering which would have been unnecessary had there been a sufficient stage of water to permit running straight ahead and cutting the bends and curves in the river. The crew on this trip was composed of M. B. Dean, captain; William Stevenson, engineer; James Rowley, pilot; and George D. Steele, representing the SCIENTIFIC AMERICAN. It is the intention of Mr. Dean, who is one of the owners of the "Br'er Fox II.," to make another attempt at a one-day trip from Pittsburg to Cincinnati this fall, when there will be a better stage of water in the Ohio River. With proper conditions, there is but little doubt of his accomplishing the remarkable feat. The second attempt will probably be made with another type of boat, as the Fox Company is installing its 8-cylinder motor in a hydroplane craft that it is thought will prove very speedy.

Side view of "Br'er Fox II." under way.



The 8-cylinder 2-cycle motor.

Rear view of "Br'er Fox II." traveling at high speed.

A RECORD MOTOR-BOAT TRIP FROM PITTSBURG TO CINCINNATI.

The "Br'er Fox II." was planned and assembled by Mr. A. G. Dean, one of her owners and also one of the officers of the Fox Reversible Gasoline Engine Company, of Newport, Ky. She is 40 feet in length, 4¼ feet beam, and draws about 26 inches of water. The hull is of rib and carvel construction, planked all over with ¼-inch white pine, and weighs, without engine and equipment, about 625 pounds. She is built on racing lines, and was designed and constructed by Wright brothers, of Newport, Ky.

The power equipment consists of a Fox motor rated at 56 to 65 horse-power. This engine is unique in that it has eight cylinders of the two-cycle type arranged in line above an 8-throw crankshaft. In appearance the motor is similar to the usual two-cycle engine, excepting that the cylinders are set farther apart to permit the use of wider bearings. The cylinders are all 5-inch bore by 5-inch stroke, and the base is a solid one-piece aluminium casting. The crankshaft is cut from a solid steel billet, and the throws are set to fire the cylinders 1, 5, 2, 6, 3, 7, 4, 8. At a speed of 800 R. P. M. this gives 6,400 piston oscillations per minute, and results in wonderfully steady and efficient power.

The one special feature of this motor is the design and location of an auxiliary fourth port, which is now being patented. Through this port air is drawn into the explosion chamber slightly in advance of the incoming charge of gas, and this injection of air accom-

plishes the double purpose of expelling the burned gas without waste of fuel, and leaving pure air in the explosion chamber instead of vitiated gas.

These fourth ports can all be operated together by means of a lever, and when opened, result in a marked increase in both power and speed. High-tension ignition by means of two distributors and two coils is employed. Lubrication is effectually accomplished by a force-feed system into the journals and by a spray taken by the incoming gas to the wrist-pins, connecting rods, and pistons. A clutch of the self-locking type is used, but no reversing gear is required, since the motor is readily reversible.

As is customary with boats of this type, the exhausts are open, and extend several feet above the sides of the boat. These exhausts are 2½ inches in diameter.

The motor drives a 22-inch diameter, 44-inch pitch wheel at from 750 to 800 R. P. M. with ease, and in short test runs has turned this wheel at from 810 to 825 R. P. M. in the Pittsburg pools, giving a speed in excess of 30 miles per hour in the slight current of those pools. On the run from Pittsburg down the Ohio to Cincinnati, the engine kept up a steady speed of from 750 to 775 R. P. M. without forcing, and maintained this speed for hours at a time without perceptible heating. This speed could be maintained easily for an entire day, or even more, were the stage of water sufficient to permit the boat to run at such speed in safety.

In the run to Cincinnati, four gasoline tanks were carried, two rear tubular tanks in the stern each having a capacity of 15 gallons; one 20-gallon tank under the seat; one 30-gallon tank in front of the seat; and one 5-gallon gravity feed tank directly over the 30-gallon tank, making a total capacity of 85 gallons for long runs. The tanks all feed into the 5-gallon gravity tank, a hand pressure pump forcing the contents of the lower ones to this gravity tank. Besides an individual carbureter for each cylinder, the transfer pipes of each pair of cylinders are connected to a second carbureter, so that there are no less than 12 carbureters used on the engine.

Based on rated power, the motor in the "Br'er Fox II." consumes approximately 1.4 pints of gasoline per horse-power hour, but the engine unquestionably delivers more than its rating, so that on actual wheel performance turning a 22-inch diameter, 44-inch pitch wheel 800 R. P. M., it is very close to a pint per horse-power hour.

The boat has a capacity of 14 gallons of cylinder oil in tanks. She is designed to carry two men averaging about 155 pounds each and 30 gallons, or about 240 pounds, of gasoline. On the trip from Pittsburg to Cincinnati she carried four men, whose combined weight was 670 pounds, and 85 gallons of gasoline, weighing approximately 600 pounds, or a total of 1,270 pounds, against 550 pounds, which is her estimated capacity when speeding.

The Current Supplement.

The opening article of the current Supplement, No. 1755, is devoted to a discussion of the wonderful Frankfort Aeronautical Exposition, which has been opened with such success in Germany. Excellent views of the exhibits accompany the text. Mr. E. F. Lake's exhaustive and instructive article on the oxhydric process of cutting metals is continued. Mr. Newton Wright explains how the size of gas and oil engine cylinders may be determined. It is a curious fact that many of the marbles employed by the Romans, Greeks, and even Egyptians, are those most highly valued by the architects and builders at the present time. Marbles and other decorative stones from the identical localities which were sought by the ancients with so much care are now to be seen in most fine modern buildings in London and other cities. This whole subject of ancient marbles and ancient marble quarries constitutes the subject of an article by Mary W. Porter. O. Bechstein contributes a wonderfully instructive article on kieselgur and its uses. The experimental evidence in support of the atomic hypothesis is set forth by R. Ehrenfeld. Maria Parloa's monograph on canning and preserving fruit is continued. Interesting electrical notes are those entitled "How to Join Electric Wires," and "The Egner-Holmstrom Telephone Apparatus." It is sometimes necessary when designing buildings or other works to construct models in order to explain intricate points more clearly than can be shown in drawings. How this is done, Mr. Stanley C. Bailey explains. Improved deep-sea sounding apparatus is described by Capt. E. Moll. A report of the Sixth Conference of the International Commission of Meteorology is published. A calendar good from 1753 to 1952 is not the least interesting feature of this issue.

From the returns compiled by Lloyd's Register of Shipping, it appears that, excluding warships, there were 308 vessels of 745,705 tons gross under construction in the United Kingdom at the close of the quarter ended June 30th, 1909.

Correspondence.

THE NUMBER OF OUR ANCESTORS.

To the Editor of the Scientific American:

The difficulty that some of your correspondents have with the ancestral puzzle is in disregarding the marriage and intermarriage of distant relatives. Thus if one of B's grandparents on his mother's side was cousin to one of his grandparents on his father's side, B would have only 14 great-great-grandparents. The one divergent series would be extinguished and the number of his ancestors in any one generation would be $2^n - 2^{n-4}$. If, instead, two of his eight great-grandparents were cousins the formula would be for any generation $2^n - 2^{n-5}$. If there were two sets of cousins among his great-grandparents the formula would be $2^n - 2(2^{n-5})$, etc.

When we consider that our ancestors for hundreds and thousands of years lived in small and more or less isolated villages and communities and that families of as many as ten or twelve children were not uncommon, we can see that could we trace all lines of descent of any one person we would find them constantly running into each other and merging into common ancestors. Thus in the fifteenth generation we might trace descent from two parents through any one or through all of their twelve children. And if the blood of these children had commingled at other times in the line of descent, as it must at least in an isolated community, two persons in the fifteenth generation might represent a hundred or even several thousand of B's theoretical ancestors.

Nora Springs, Iowa. W. A. Eckles.

THUNDERSTORMS.

To the Editor of the Scientific American:

The explanation of thunderstorms ordinarily given is that clouds are formed of minute particles of moisture, each having an electric charge on its surface. These particles agglomerate in drops of rain, and their electric charges spread over the surface of the drops with a resulting greater electric density, because the surface of a drop is much less in extent than the aggregate of the surfaces of all the particles of which it is made; the increase in surface being proportional to the square of the diameter, when the increase in volume is proportional to the cube of the diameter. For instance, the electric potential (depending on the electric density on its surface) of a drop of rain ⅛ of an inch in diameter will be 125 volts, if it is formed of particles 1/1,000 inch in diameter whose potential is one volt.

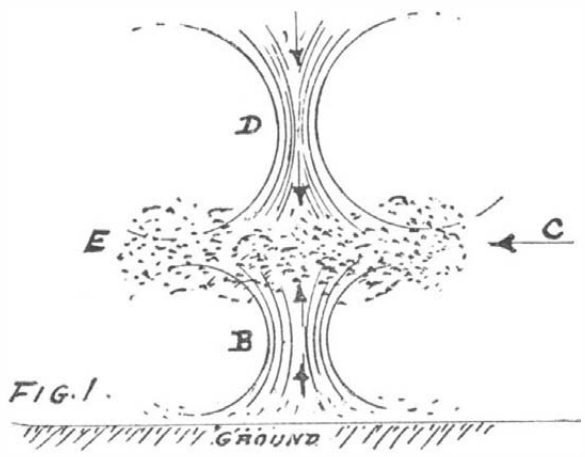


FIG. 1.

The drops of rain in a cloud being separated by air acting as a dielectric, electrify each other by influence; the resulting influence at the center of the cloud being an enormous electrostatic strain, which is relieved by lightning.

This simple explanation is that generally given in the lecture room, but is not sufficient to explain the thunderstorms without rain frequent on the Western plains in hot dry weather. The writer has observed many in northwest Texas. One day at noon I was resting in my house, when I was startled by a sudden clap of thunder, followed by others. I had not seen a sign of a cloud a few minutes before when coming home. Stepping out doors, I saw toward the zenith a very thin yellowish cloud somewhat broken, from which emerged the thundering. No lightning could be seen, the glare of the sun through that misty cloud being too intense. From its rapid motion and the distinctness of the claps of thunder, I judged that it could not be very high. This phenomenon lasted about three minutes and vanished.

The appearance of that cloud was unusual for a dry thunderstorm. Ordinarily, in such occurrences there are several scattered small white clouds, embryo cumuli in shape but diaphane, they look "dry," and do not cast any appreciable shadow on the ground. They appear and vanish with more or less sharp thunders, seemingly at a high elevation. No lightning can be seen because of the sunshine through them. These electric discharges begin about noon, to last until about two hours before sunset. During the day there are occasional flushes of breeze, but no continuous wind in a certain direction.

This condition of weather may last without rain for two or three weeks, and is generally followed by a stubborn drought, with a smoky appearance of the sky and very little or no dew in the morning. The absence of rain, the small size of the clouds, and their diaphane, evanescent appearance, indicate that other agencies besides those mentioned in the lecture room are active for the presence of electric potentials widely differing in a dry thunderstorm.

Observations have shown that the electric potential of the air increases with the distance from the ground. Now suppose that a portion of the upper atmosphere be brought near a portion of the nether atmosphere within a medium like mist, where electrification by influence can take place; the requisites for an electric discharge are present, and apply to dry thunderstorms. They occur when atmospheric conditions are favorable for causing local ascending currents of warm air with a small quantity of aqueous vapor to an elevation where they meet a cold current, whose cooling effects contract the hot air and condense the vapor it contains, creating a vacuum that sucks the air from the highly electrified upper atmosphere, as shown in Fig. 1, where *B* is a warm ascending current, *C* is the initial cooling current (which has disappeared), *D* is the descending current, and *E* the cloud formed by the condensation of the vapor in the ascending current *B*.

From the absence of rumbling thunder the electric discharges seem to be confined within each separate cloud, and originate mainly from differences of potential brought from different strata in the atmosphere.

The ordinary thunderstorms with rain happen also when atmospheric conditions cause ascending currents of warm air containing aqueous vapor. There is low barometer and a preceding period of calm high temperature; the clouds are cumuli and pile very high up, especially for hailstorms.

When rain is brought by a wind that has been blowing for a few hours or days in the same direction, the clouds are of the nimbus class; they overcast the whole sky, and though the drops of rain may be large, there is no appreciable thunder and lightning, the electric potential being too uniformly distributed throughout the cloud.

Pittsfield, Mass. Henry Getaz.

THE EFFECT OF POLAR CURRENTS ON GULF STREAM PLANKTON.

To the Editor of the Scientific American:

It was announced some time ago that very interesting communications were to be published shortly from the pen of Prof. Frithjof Nansen and assistants upon the most recent results of the investigations which have been carried on for a series of years with a view to ascertaining the influence which the water in the polar currents has upon the water in the Gulf Stream in the way of creating very favorable conditions of existence in the latter for plankton and higher marine life.

The results may be shortly summed up thus: From the investigations carried on during the "Fram's" voyage across the north polar basin it has been proved conclusively that in the polar water which is protected by a thick layer of ice from the influence of light, accumulate matters which have a fertilizing effect upon the vegetable life in the open sea and which in the cold, dark polar water are not used. The polar basin is like a large tract of fallow land in which fertilizing matters accumulate without being used.

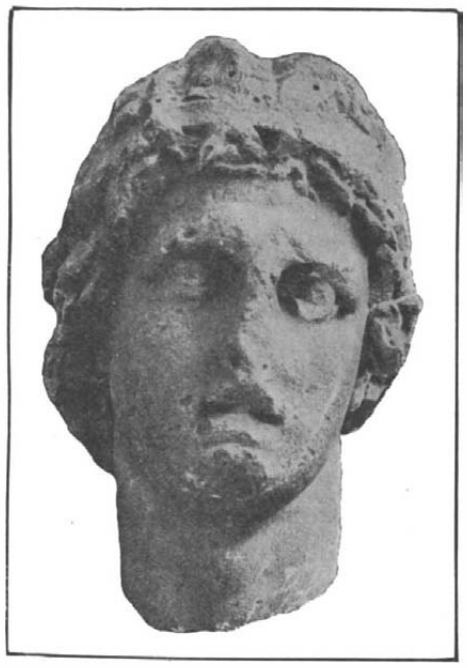
The warm water in the Gulf Stream, on the contrary, when reaching the northern part of the Atlantic is desert water, so to say. It has been used up and contains only scanty means of subsistence for any animal life.

The more polar water that sets in and mixes with the warm water in the Gulf Stream, the more luxuriant seems to be the growth of plankton and higher marine life. It is the cause of colder summers in northern Europe, but the fisheries seem to be better in proportion.

The results of these investigations, of which only a short summary is just published in the press, will be issued in book form, and seem to open up prospects of our being able to foretell good or poor fisheries and to explain many interesting phenomena which seem to be dependent upon the temperature in the northern part of the Gulf Stream.

Christiania, Norway. J. A. Mörch.

Rubber Substitute.—According to a foreign patented process, a substance resembling rubber or gutta percha is produced by mixing gelatine, bichromate of potash, and glycerine, and molding the mass obtained. The components are used in an anhydrous state to retard the working of the bichromate of potash on the gelatine; by heating, the chemical effect may be increased or reduced.



THE EXCAVATIONS AT DELOS

BY THE

PARIS CORRESPONDENT

OF THE

SCIENTIFIC AMERICAN

In 1903 excavations in the island of Delos were begun on an extensive scale, owing to the liberality of the Duc de Loubat, who decided to make an annual gift to the enterprise of $10,000, in order that the work could be carried on in a manner which is justified by the great importance of the site. The work is carried on by the French School of Athens, and M. Homolle, whose connection with the excavations at Delphi we have already had occasion to note, directed the first part of the enterprise. Since then it has been carried on by his successor, M. Holleaux, and various archæologists of the French School. Because of the great number of discoveries which have been made at Delos, the archæological world is much indebted to the action which the Duc de Loubat took in aiding the excavation work.

From an early period, going back to the eighth century B. C., Delos was a center of the worship of Apollo, who had a celebrated sanctuary on the island. After passing through many political vicissitudes, Delos was completely ravaged by the army of Mithridates. Its most flourishing period appears to have been in the third century B. C.

Since Delos was a religious as well as a commercial center, it is but natural that we should find remains both of various temples and also of extensive buildings such as storehouses and wharves. In general, we may liken the site of Delos to Pompeii, because it is covered with remains of public and private buildings. But naturally it is far superior to Pompeii in the artistic character of the structures and other remains; for here is represented a flourishing period of Greek art. For this reason the excavations at Delos are of especial interest, and the remains have a high artistic value. On the one hand we have specimens of sculpture which belong to the principal epochs. There are also extensive remains of architectural forms, columns, etc. Not the least in importance are the fragments of mural decorations which are found in various places. While these are not in so good a state of preservation as those of Pompeii, they give a clear idea of the decorative borders, friezes, and large wall paintings that adorned the larger dwelling houses of Delos. Mosaics of brilliant colors are also found, and some of these are in a good state of preservation.

The excavation work is carried on with a view to clearing as much as possible the streets and edifices of the site. In the quarter of the port, very extensive wharves have been disclosed, as well as large quays and storehouses, evidences of considerable commercial activity. It is evident from their extent that Delos was one of the most important commercial ports of the archipelago.

As regards the work which has been undertaken at Delos since 1903, the year when the Duc de Loubat came to the aid of the enterprise, it is one of the most considerable to be carried out in Greece, so far as the amount of material i. concerned. This is no less than 50,000 cubic yards of earth annually. As the various walls were brought to light they were consolidated to keep them together and efforts were made to preserve the stucco decorations and mural paintings. The appearance of the paintings, mosaics, and various decorative *motifs* is shown in a collection of water-color drawings which were made on the spot by two artists belonging to the expedition.

Among the points which have been explored up to the present are the sacred inclosures in which was the leading sanctuary of Delos, also the quarter of the Theater. Near the inclosure is the sacred lake, a small body of water. One of the most remarkable finds is a tomb belonging to the Mycenæan epoch, to which we may assign a date between the twelfth and the fifteenth century B. C. Thus we remark the great antiquity of the early remains of Delos, showing that it flourished at even this remote period. On this spot were found fragments of pottery which are of value in the study of this epoch. A great terrace or esplanade was uncovered near the sanctuary. Here were found five colossal lions which were set up in a range and spaced at equal distances apart along the terrace. One of our engravings shows the appearance of this site, and another one represents one of the lions, showing the considerable size and also the great antiquity of the specimens. They rank in date after the above-mentioned tomb, and from their archaic character we may place them in the seventh century B. C. M. Salomon Reinach, however, considers that the group of lions may have been offered to the sanctuary by Croesus, King of Lydia, fabled for his riches. He bases his theory on the fact that Herodotus states that Croesus had offered a massive gold lion to the temple of Delphi having a weight of ten talents, the lion being the ancestral sign of the king's family. It is possible, therefore, that the group at Delos may have come from the same source, and this would place them in the sixth century.

Coming to the remains of a later epoch, we find a street which led from the theater to the sanctuary, a very narrow street, only five feet wide. It was bordered with small houses and shops, and must have been much frequented.

As to the general character of the excavations at Delos as they appear at the present time, one of the accompanying views will give a good idea of the extent of the work. It will be observed that it covers a very wide area. Like modern buildings in some countries the dwellings of Delos consist of a central court surrounded by a portico with columns, opening into which were the various rooms of the building. Some of the columns in this and other structures of a like character are in a good state of preservation, and the walls in some cases are high. The remains slightly resemble the dwelling houses at Pompeii. One of the dwellings, which has a considerable interest, is similar to the above and is known as the "villa of Cleopatra." Here the portico is upheld by high Doric columns. There were found here the statues of the owners of the villa, Dioscourides and his wife Cleopatra (who has, of course, no relation to the Queen of Egypt). The latter statue, which is shown here, is in a good state of preservation, although the head is unfortunately missing. An inscription on the statue relates that Cleopatra, native of the town of Myrrhinonte in Attica, executed the statue of her husband, which is the accompanying one, and that he himself had offered two silver tripods to the temple of Apollo. As the inscription bears the name of the archon Timarchos, we are able to fix the date of the statue in the second century B. C. The draped statue retains some of the characteristics of the grand epoch in its treatment.

A NEW APPLICATION OF THE DIVING BELL.

BY THE GERMAN CORRESPONDENT OF THE SCIENTIFIC AMERICAN

A remarkable diving bell or portable caisson has recently been constructed for the German Navy Department for use in the deepening of the harbor of its naval base at Tsingtau. The remarkable features are not so much those of the bell itself, but of its connection with the imposing structure above water shown in our frontispiece, the whole making a complete and self-contained unit for excavating to a maximum depth of 15 meters below water level.

Two pontoons, each 16.5 meters long, 5.6 meters wide, and 2.2 meters deep, are rigidly braced together bow and stern, forming between them a well into which the diving bell may be completely withdrawn from the water. Upon the deck of the joined pontoons is erected the superstructure, from which the diving bell is suspended and operated, consisting principally of conventional I-beams and angles.

The diving bell is built of sheet iron, externally braced, and is 10 meters long, 5 meters wide, and 2½ meters high. Extending upward from the top of it are three telescopic shafts, two for the hoisting of the excavated material, each 80 centimeters in diameter, through which a bucket of 1 ton capacity can pass, and one of 1 meter diameter for the workmen. Each of these is provided with such an "air lock" as is now familiar in connection with tunnel and foundation work in New York and elsewhere, in which, as workmen enter, the air pressure is gradually raised from that of the atmosphere to that required to exclude water and mud from the interior of the caisson, being similarly reduced for those ascending from work. The air locks of the spoil shafts are identical, but the air may be compressed or exhausted much more rapidly in the hoisting of buckets of excavated material, the gradual change of pressure being necessary in the case of men only as a precaution against caisson disease.

The bell is suspended by four sets of chain tackle, one at each corner, which are mounted on opposite ends of two shafts on the operating platform of the superstructure, driven simultaneously by an electric motor when it is desired to raise or lower the bell.

Higher platforms carry two cranes, which receive the buckets of excavated material from the top of the spoil shafts and deliver them into scows alongside or however desired, the cranes also being electrically driven, as are the winches inside the spoil shaft for hoisting the buckets from the interior of the bell. One man on the platform at the top of each of the latter can hoist the bucket with the winch, detach it, and hook it onto the crane, and *vice versa*, and also raise and lower the bell as desired. Two more operators for the cranes above are required.

On the deck are three compressors supplying the necessary air pressure to the interior of the bell, power for the whole equipment being supplied from a stationary plant on shore. Both the superstructure and the interior of the bell are electrically lighted, and communication is maintained between them and from either to the shore by telephone. Quarters for the crew are provided in the interior of the pontoons.

The design of the superstructure permits of continuous operation being carried on independently of the varying height of the pontoons due to rise and fall of tides.

THE FIRST CROSS-COUNTRY FLIGHT OF THE AERONAUTIC SOCIETY'S BIPLANE.

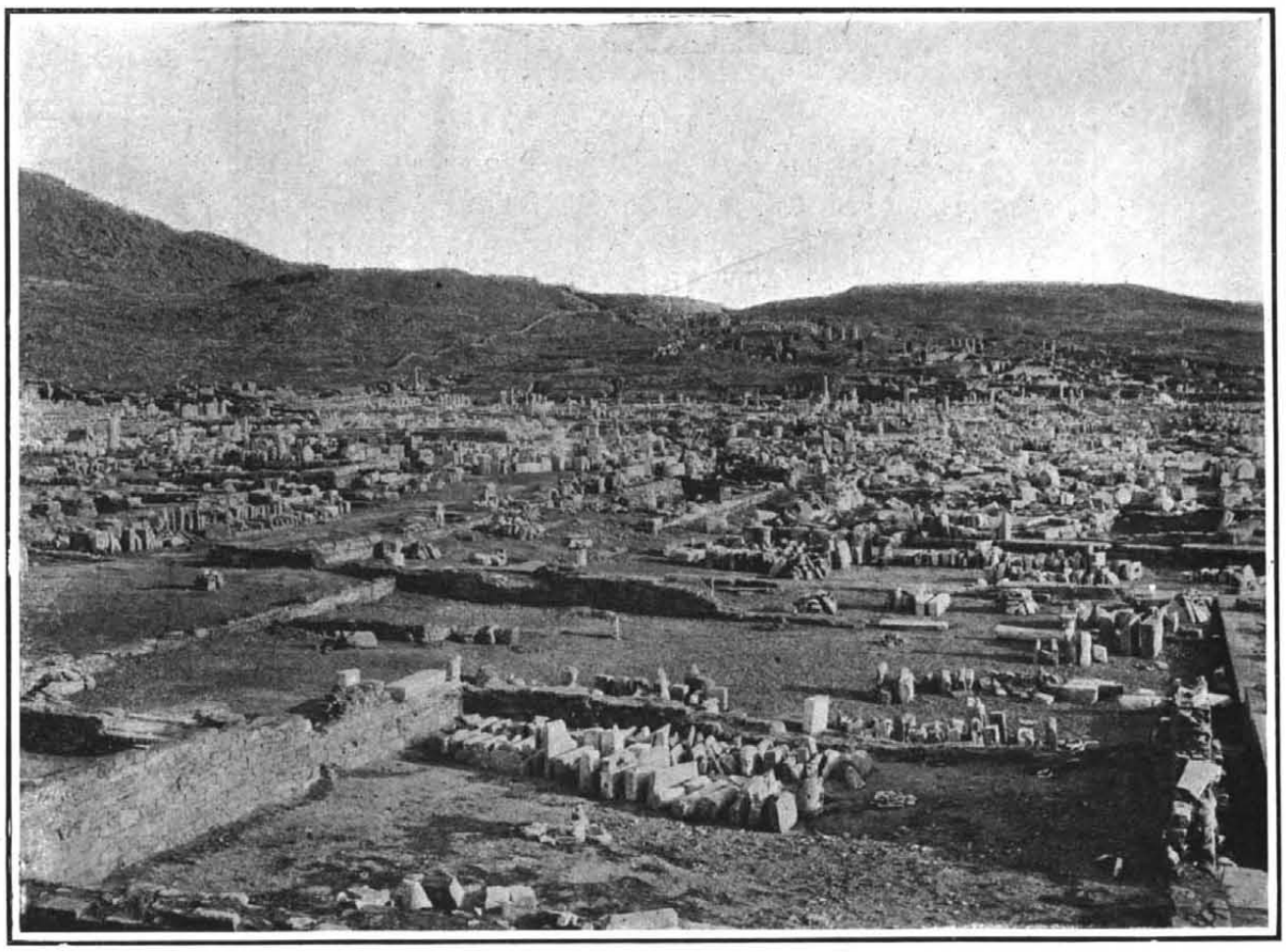
(*Concluded from page 124.*)

fell backward, breaking the rudder and propeller and damaging the running gear. Mr. McCurdy, the aviator, was unhurt, and the engine was not damaged. The accident is said to have been due to the engine being placed too far to the rear. The machine will be repaired in about a week, when further flights will be attempted.

M. SOMMER'S RECORD FLIGHT.

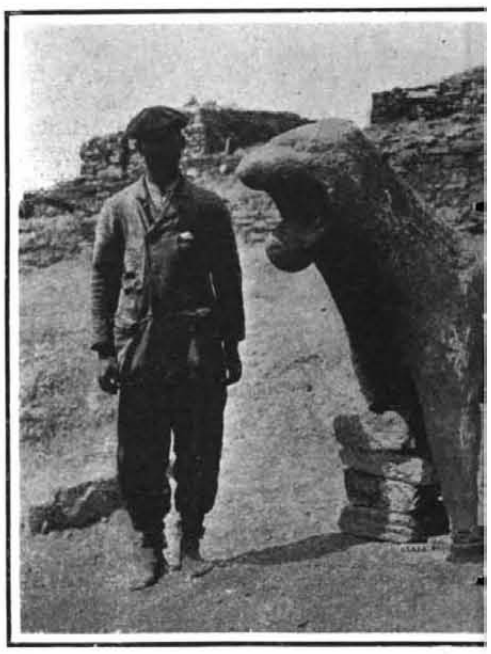
The record endurance flight of 2 hours and 27¼ minutes in France, mentioned in our last issue, was wrongly attributed to M. Gaudart. This flight was made by M. Roger Sommer with a Farman-type biplane, and although unofficial, it is probably the longest ever made with an aeroplane.

In an article appearing in the American Machinist on annealing high-speed steel, the author states experiments have been carried on looking to electrical annealing and to bright annealing by immersion in a bath of fusible metallic salts, somewhat after the manner of the barium-chloride process for hardening. Moderately successful results have in some cases been obtained; but the methods are not as yet sufficiently developed for commercial use. The two methods have also been combined, with results apparently good, the salts bath being heated by the passage through it of a low-tension electric current.



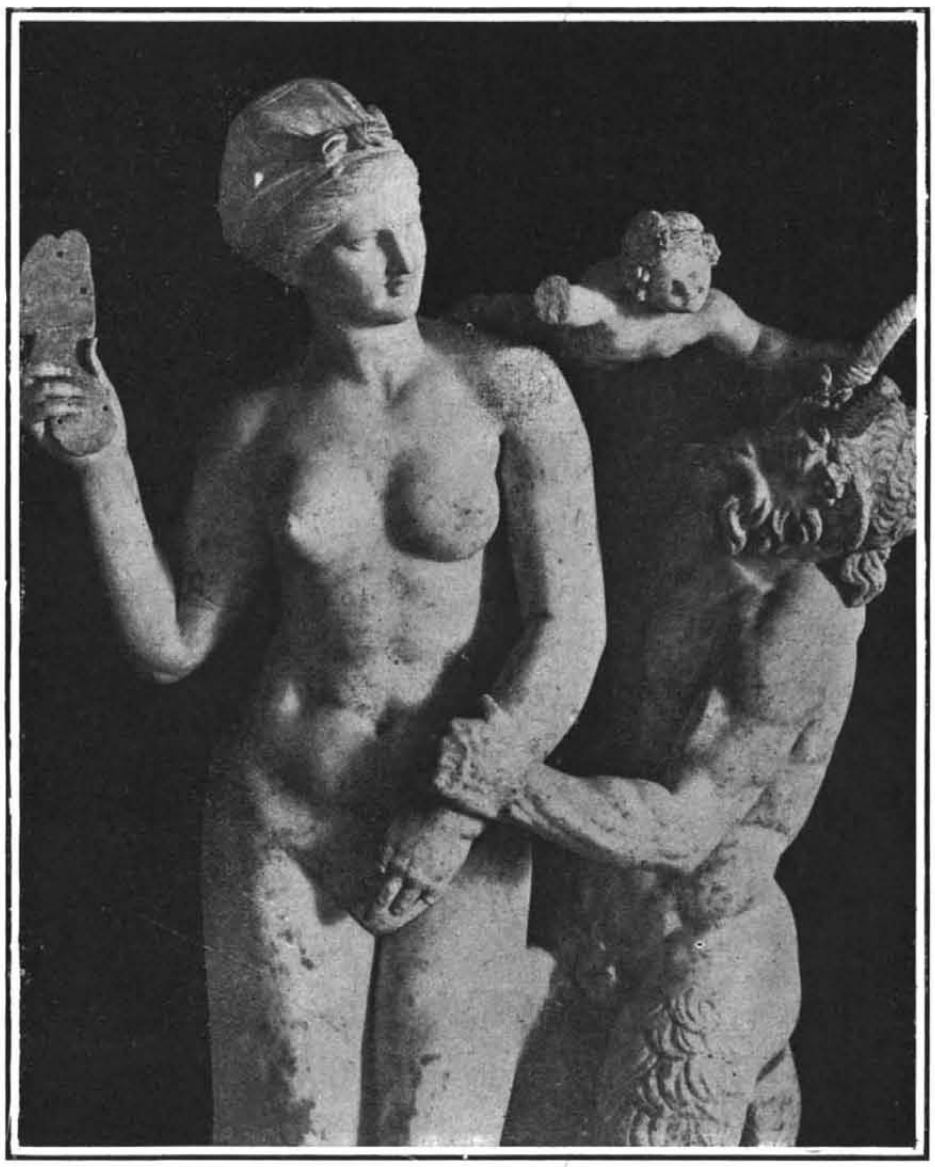
The central portion of the sanctuary.

Hellenistic

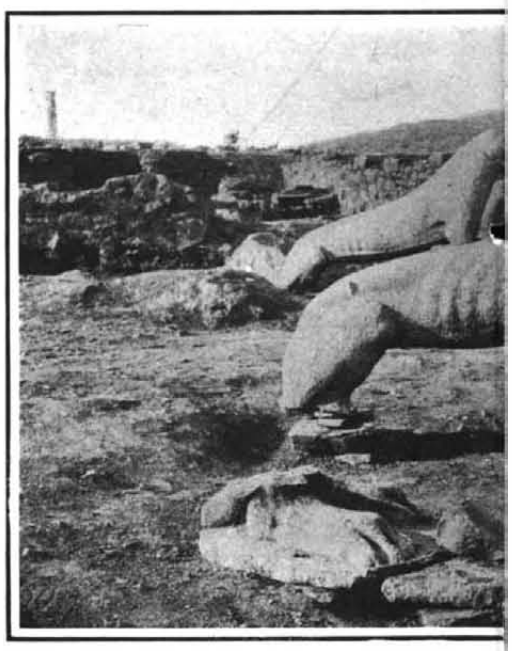


One of the lions—possibl

Statue of Cleopatra.

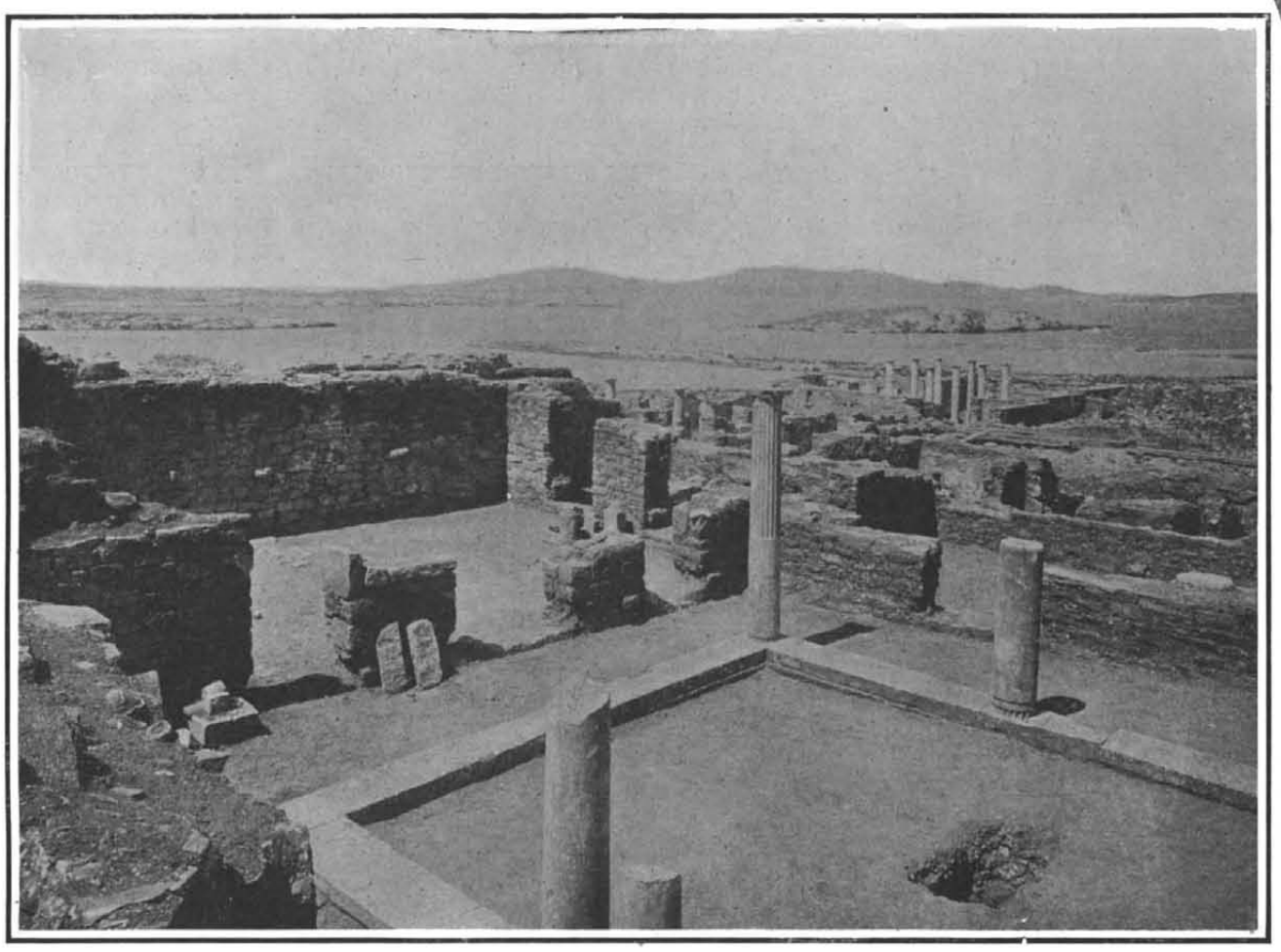


Group representing Aphrodite, Pan, and Eros (2 B. C.)

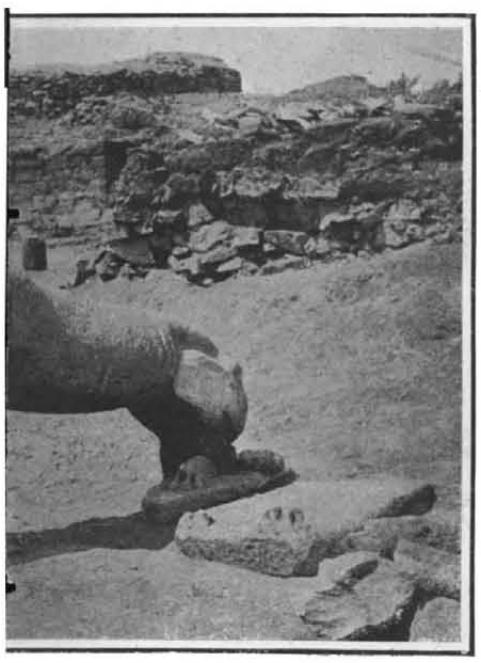


The terrace

bas-relief.

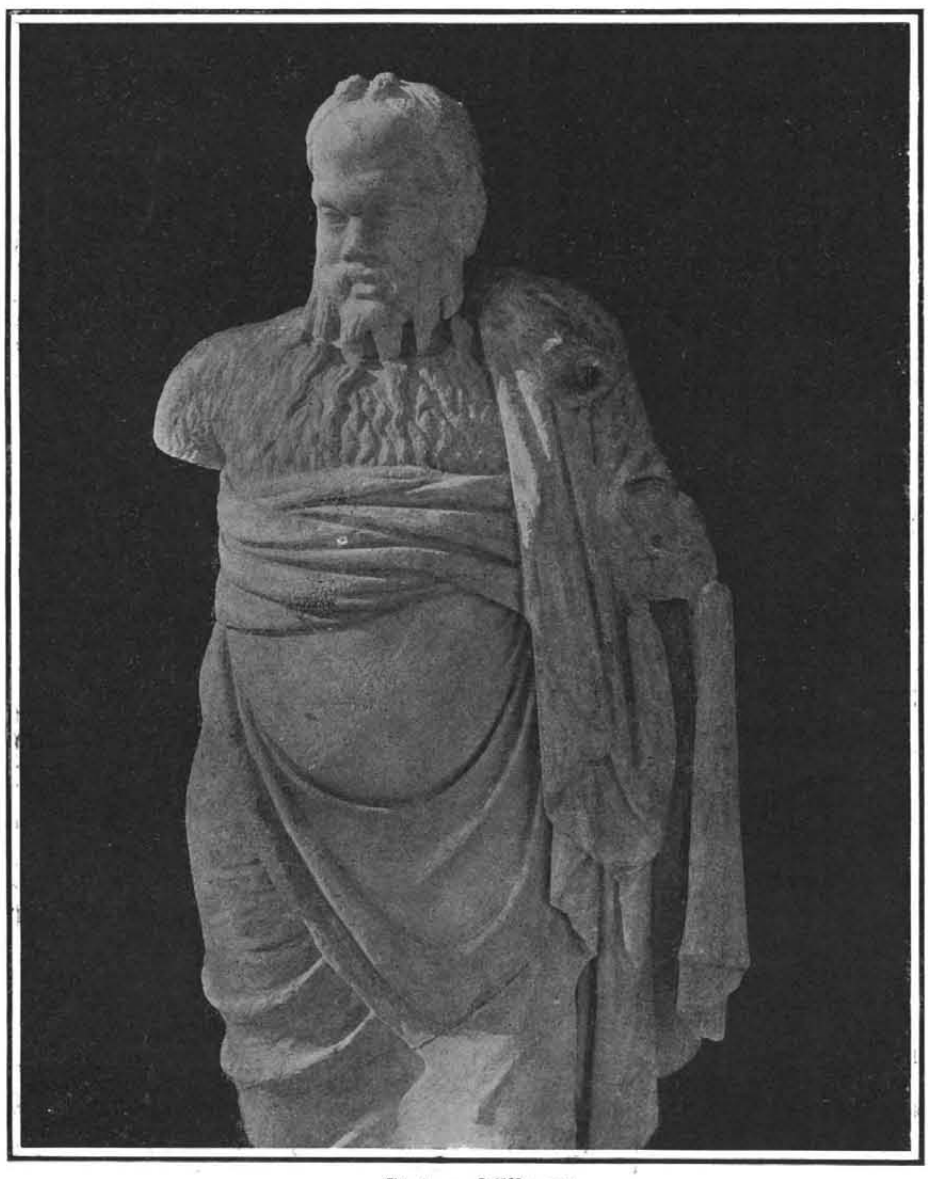


A house in the quarter of the theater.



y dedicated by Croesus.

of lions.



Statue of Silenus.

Terra-cotta heating pan.

DISCOVERIES AT DELOS.

CONJUNCTIONS OF THE PLANETS.

BY PROF. FREDERIC R. HONEY, TRINITY COLLEGE.

The purpose of this article is to treat of only that part of the general subject of planetary configuration which relates to a comparison of the planets when they have the same right ascension; i. e., when they are on the same celestial meridian.

Six conjunctions of the planets occur during the latter half of the present year. One illustration is a plot of the orbits of the terrestrial planets, showing the positions of the earth and of the planets at each conjunction. The other shows the apparent diameters and phases magnified. In order to compare the figures, they are all drawn to the same scale. The apparent distance between the planets at each conjunction, however, cannot be represented on this scale, because the figures would be separated by a measurement which would fall beyond the limits of the drawing; but the distance seen, by the naked eye, is given in the text. The date of conjunction is Washington mean time.

CONJUNCTION OF MERCURY AND NEPTUNE.

July 23d. 0h. The distance between the planets is a little more than twice the moon's diameter, which subtends an angle of about ½ deg. Neptune's diameter is nearly eleven and one-half times the diameter of Mercury (= 34800/3030). At this date Neptune's distance from the earth was about thirty-one times the mean distance between the earth and the sun (= 30.9 × 92.9 million miles); while Mercury's distance was only one and one-fifth times this unit (= 1.195 × 92.9 million miles). The apparent diameter of a planet is proportioned to its true diameter, and inversely as its distance from the earth. The result of a simple computation shows that Mercury subtended a very much larger angle than Neptune.

The plot shows that the planets are morning stars, and that Mercury's phase is gibbous. In this and in the illustrations which follow, the arrow drawn with the full line shows the direction of the planet as seen from the sun; and that drawn with the dash line as it is seen from the earth. On account of the great distance to Neptune, the convergence of these visual rays is scarcely perceptible in the drawing.

CONJUNCTION OF VENUS AND JUPITER.

August 11d. 14h. Jupiter and Venus are evening stars. The former is daily receding farther from the earth, and will be in conjunction with the sun on September 17th, after which date Jupiter will be morning star. Venus presents the gibbous phase; and at the time of conjunction, the relative diameters of the planets appear as shown in the illustration. The computations for these figures are similar to those which have been explained. The great difference between the equatorial and polar diameters of Jupiter are apparent. The planets are separated by a distance equal to two-fifths of the moon's diameter.

CONJUNCTION OF MERCURY AND JUPITER.

August 24d. 19h. The planets are evening stars, and are at a distance apart equal to one and a third times the moon's diameter. Mercury shows the gibbous phase, the dark edge being opposite from that shown on July 23rd.

CONJUNCTION OF VENUS AND URANUS.

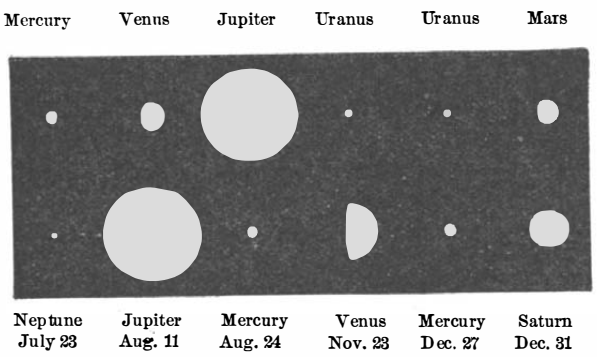
November 23d. 8h. The planets are evening stars, and may be seen a long time after sunset. Venus is rapidly approaching the earth, and as a consequence the planet's diameter is increasing. An inspection of the plot shows that a little more than one-half of the illuminated surface is visible. Venus will soon present the half-moon phase, which will be succeeded by the crescent phase, when she will be the most beautiful object in the evening sky. The planets are separated by a distance equal to about five times the moon's diameter.

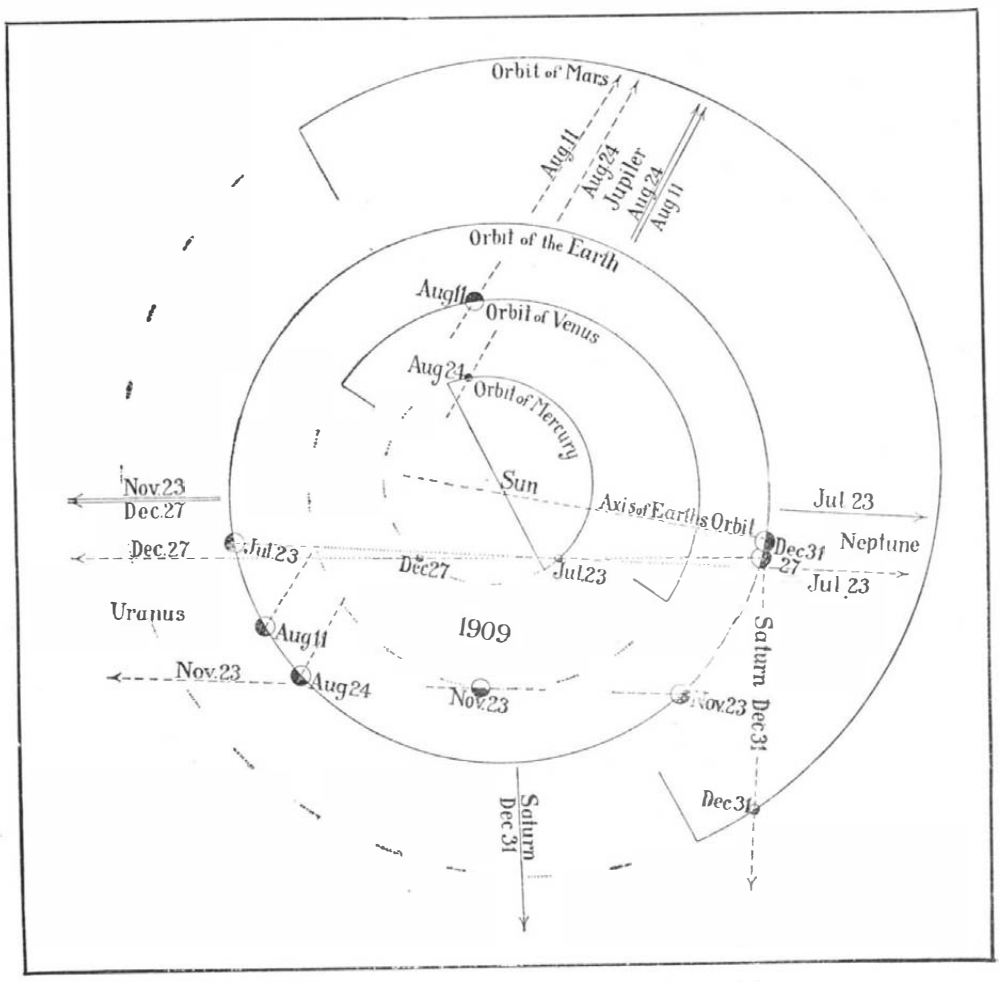
CONJUNCTION OF MERCURY AND URANUS.

December 27d. 15h. The planets are evening stars. Mercury shows the same phase as that of August 24th; and since the distances from the earth are very nearly equal, the apparent diameters are equal. The diameter of Uranus is about ten and a half times that of Mercury; but its distance from the earth reduces its apparent diameter to that shown in the figure. The distance separating the planets is equal to about three and a half times the moon's diameter.

CONJUNCTION OF MARS AND SATURN.

December 31d. 2h. Again the planets are evening stars. Mars shows the gibbous phase, and his distance from the earth is about equal to that between the earth and the sun. The apparent distance between the two planets is nearly six and a half times the moon's diameter. The great difference between the equatorial and polar diameters of Saturn is very apparent. Although Jupiter's diameter is scarcely one and three-sixteenths times that of Saturn, the diameter of the latter is very much reduced on account of its greater distance from the earth.





CONJUNCTIONS OF THE PLANETS IN 1909.

An American Exposition in Berlin in 1910.

What promises to be a unique event in international commerce will take place under distinguished auspices in Germany's capital next year.

In a recently erected permanent exposition building known as the Exposition Palace near the Zoological Gardens, in the best section of Berlin, an exposition of American products exclusively, among which tools and machinery will form an important part, will be held during the months of April, May, and June, under the patronage of Prince Henry of Prussia.

This exposition is designed to stimulate and strengthen our trade with Germany, a trade the importance of which may be gaged from the statement that Germany bought nearly $277,000,000 worth of goods from the United States in 1908 and is America's second-best customer. Prominent men on both sides of the Atlantic will co-operate to make the undertaking a success.

The exposition commends itself particularly because of the fact that there will be no drudgery connected with it for the exhibitors. The space rental will include all incidentals, such as the decoration of the booths, foundations for the exhibits and carpeting, janitor service, the storing of the packing material, protection, insurance, etc. The large steamship companies have granted substantial freight reductions, and exhibits will be admitted into Germany free of customs duty.

Some of the most prominent manufacturers in the United States are signatories to an invitation to participate in the exposition. For the exhibitors' convenience an office has been established in the Hudson Terminal Building, New York city.

The "Parahyba," the sixth of the ten destroyers ordered by the Brazilian government from Yarrow & Co., Limited, of Scotstoun, ran an official full-speed trial a few days ago on the Skelmorlie mile. She attained a speed of 27.29 knots.

Poisonous Honey.

BY PROF. KARL SAJO.

Illness, and even death, are sometimes caused by eating natural honey, free from all adulterations. The writer is not aware that any fatal cases of poisoning have occurred in Europe. They are reported exclusively from America and Asia. Almost all cases are caused by the use of honey derived from the flowers of plants of the Alpine rose and heath families (*Rhodoraceæ* and *Ericaceæ*). The matter is somewhat puzzling, because cases of severe poisoning are very rare. For example, the American cases, which are attributed to *Kalmaia angustifolia* and *K. latifolia*, are only two in number, although these plants are common in America. Even in Europe, illness is sometimes produced by eating honey. I have myself witnessed several mild cases, one of which appears to throw some light upon the subject. Some children, who were watching their teacher cleaning honeycomb, asked him the nature of the dark and acrid paste with which some of the cells were filled. The teacher explained that this was bee bread. The children asked if it was fit to eat, and the teacher carelessly answered, "yes." The children ate the bee bread freely, despite its unpleasant taste, and all became extremely ill.

The reader doubtless knows that bees fill certain cells partly with pollen, which is necessary food for the development of the young bees, as it contains albumenoids, while honey contains only carbohydrates. This pollen is known as bee bread. It is usually stored in certain special groups of cells, which can be easily separated from the honey cells. Sometimes, however, the bee keeper, to his disgust, finds in the honeycomb, intermingled with the honey cells, many cells which contain pollen. Often the lower part of a cell is filled with pollen, and the upper part with honey. In the case above cited, the poisoning was evidently due to the pollen, for persons who ate the honey from which the bee bread had been removed experienced no ill effects. I know, from personal experience, that the eating of honeycomb which contains bee bread often produces unpleasant symptoms and loss of appetite.

Several possibilities suggest themselves. The pollen may be naturally poisonous, for many pollen grains contain toxines, as was proved by Prof. Dunbar in his investigation of the cause of hay fever. It is possible, also, that the pollen stored in the cells may become decomposed, and thus produce disease germs and poisonous substances. If the bees wish to preserve their stores of pollen, which are not usually protected by large additions of honey, they are obliged to add large quantities of a secretion containing formic acid, and it is not impossible that, in this operation, large doses of the alkaline poison of their stings may also be added.

In view of these facts, it appears probable that the cases of poisoning attributed to honey are really caused by pollen. If this is true, the frequency of such cases should be diminished by modern methods of bee keeping, in which a compartment of the hive is reserved exclusively for honey, and the bee bread is almost entirely deposited in cells attached to the broodcomb, in another compartment. Furthermore, honey is now seldom pressed from the comb, but is almost entirely extracted by centrifugal separators, in which the semi-liquid honey flows out of the cells, leaving the more solid bee bread behind. In the case of honey in the comb, the presence of bee bread cells is easily detected by inspection or by the taste, and a little care in removing them will prevent any evil consequences.—Translated from Prometheus.

Washable Water-Color Paint.

Washable painting in water colors can be executed by mixing the pigments with plaster, a fusible salt, a suitable glaze, and an acidulated solution of gelatine. The paste thus formed is applied like paint and, after it is dry, is hardened by heating the painted objects. The following proportions and method are recommended:

Ten parts of glue are dissolved in 100 parts of hot water containing a little acetic or other acid. After this solution has cooled it is rubbed up with 5 parts of plaster, 5 parts of soda, potash or borax, 30 parts of lead oxide or zinc white, and the necessary quantity of the water color pigment desired. The coating, when dry, is heated by means of an alcohol or other smokeless flame. The finished coating resembles enamel. It is not affected by rain or heat and may be lacquered without difficulty.

A NOVEL SOLUTION OF THE PROBLEM OF TELEPHOTOGRAPHY.

BY DR. ALFRED GRADENWITZ.

Many inventions have recently appeared for the telegraphic transmission of handwriting, drawings, and photographs. Ingenious though they be, nearly all of these devices have never passed the experimental stage, which circumstance is partly due to the extraordinary sensitiveness and complicated construction of the mechanism employed. The main difficulty met with in solving this interesting problem, however, lies in the means of obtaining and maintaining a perfect agreement between the working of the transmitting and receiving stations. In fact, an accurate reproduction cannot be obtained except by causing identical parts of the original and reproduced pictures to pass at equal times in front of a given point. On the other hand, the two picture rollers should perform their respective motions in equal intervals of time.

These difficulties, it is claimed, are successfully overcome by the "teleautocopist," an apparatus recently invented by Laurent Sémat and constructed by F. Ducretet and E. Roger of Paris. Moreover, the machine is well adapted for the transmission of musical notes, shorthand records, prints and—a matter of especial importance for the criminal police—sketches or anthropometrical data.

The roller used at the transmitting station has a larger diameter than the receiving roller. A motor which requires no superintendence is used to actuate both. Different in diameter and accordingly different in peripheral area, the rollers, nevertheless, reproduce a picture exactly the size of the original.

On the smaller roller of the transmitter (represented in Fig. 1) is wound a metal foil on which the picture to be transmitted is drawn or printed. The style which touches this foil serves to throw into the circuit the current impulses that will reproduce the picture. Whenever a conducting portion of the metal foil is struck, the circuit is closed, and on passing over an ink-coated portion the circuit is opened.

On the larger roller (at the receiving station, similar to Fig. 1) is wound a sheet of carbon paper and upon this, a sheet of ordinary paper. Assuming the difference in the peripheral areas of the two rollers to be ⅛, the reproduction of the original picture on the larger roller will take up only ⅞ of its peripheral area. The peripheral speeds of the two rollers are chosen at the opposite ratio of their peripheral areas; that is, the smaller roller performs a full revolution in ⅞ of the time of revolution of the larger one. Again, the first-named roller, after completing one revolution, is stopped and is not started again until the other roller has moved on through the disengaged eighth of its peripheral area. The process is repeated with each revolution. When starting from a given point, the two rollers are accordingly seen to pass in front of the style, at equal times through equal lengths of their peripheral area; the longitudinal displacement is identical on the two rollers in the reproduction of original dimensions. In order, however, to reproduce in a magnified or reduced size, the relative diameters and displacements of the rollers are proportionately altered.

Besides the advantages afforded by the simplicity and perfection of synchronism, the Sémat apparatus dispenses with any selenium cells and photographic views, all operations being performed in full daylight, merely by means of mechanical devices. No special knowledge is required for adjusting the apparatus, which is readily connected with any ordinary telegraph or telephone line.

The speed of transmission is easily raised to five minutes in the case of pictures measuring 7 x 12 centimeters.

The inventor, who is an official of the Egyptian railways, has recently made some successful experiments on this apparatus, at the Khedival Palace at Cairo, when the telephotographic record reproduced herewith was obtained. The apparatus was then installed at the annual exhibition of the French Physical Society and there demonstrated.

The mechanism for obtaining accurate synchronism comprises an armature which arrests a peg fixed to the transmission roller as long as its electromagnet is excited. At the receiving station is installed an interrupter, which opens the current each time it is struck by a cam rigidly connected with the roller.

As the speed of rotation of the (smaller) transmission roller is higher than that of the (larger) receiving roller, the former, after each revolution, is arrested by the armature striking the peg until the large roller (which turns at a correspondingly lower speed), by interrupting the circuit, allows the electromagnet to relieve its armature and accordingly the stop.

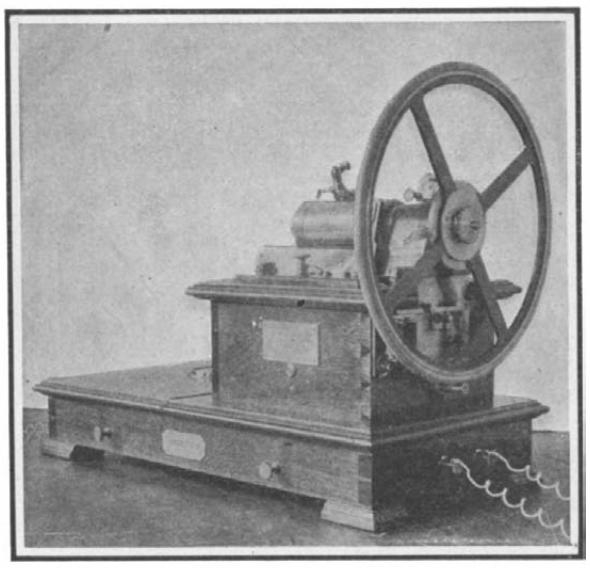


Fig. 1.—View of the transmitting apparatus, identical in appearance with the receiving apparatus.

Fig. 2.—The Egyptian Khedival insignia transmitted by the teleautocopist.

Fig. 3.—Portrait of Arago transmitted by the teleautocopist.

A NOVEL SOLUTION OF THE PROBLEM OF TELEPHOTOGRAPHY.

Cement from Blast-Furnace Slag.

Cement is made from blast-furnace slag by various methods. Among the newer processes are the following:

Canaris Process.—The slag is granulated in a milk of lime made from freshly-slaked lime in a vessel provided with a stirrer. Two parts by weight of anhydrous lime (CaO) are employed for each 100 parts of slag.

Collosseus Process.—Slag in the fused state is treated with solutions of salts of calcium, magnesium, or aluminium. The action is twofold. The physical structure of the slag is altered and chemical changes are effected by which the injurious ingredients, especially sulphur, are made harmless and even conducive to proper setting and hardening.

Muller Process.—For certain purposes it is advantageous to substitute salts of barium or strontium for the salts of calcium, etc.

Grau Process.—A jet of dry superheated steam is projected upon fused slag in such a manner that the slag falls in the state of powder and forms a pile which is allowed to cool slowly in order to prolong the effect of the heat and steam.

The new process of Dr. Ekenberg for converting raw peat into fuel is based on the fact that after the peat has been heated in the presence of water to 150 deg. C. about 90 per cent of the water in the peat, which ordinarily cannot be separated by mechanical means, can be removed by moderate pressure. By then applying a small amount of artificial heat, a fuel free from water can be obtained.

Soaps for Removing Spots.

Many soaps sold as spot-removers are ordinary cocoanut oil soaps, and remove only the spots which are prepared for the purpose by the vender. For example, spots made by daubing cotton goods with a mixture of tar and acid can be removed with pure water, and completely disappear when washed with ordinary soap. True spot-removing soaps contain ox gall and turpentine, which can be detected by their characteristic and powerful odors, even if the soaps are scented.

A good spot-removing soap may be made by mixing 20 parts by weight of good hard white soap, in very small pieces, with 8 parts of water and 12 parts of ox gall. The mixture is allowed to stand over night and is then heated gently until solution is complete. The heating is continued a little longer, in order to evaporate some of the water, and ½ part of oil of turpentine and ¼ part of benzine are stirred in, after the vessel has been removed from the fire. The still liquid soap is then colored with a little ultramarine green, dissolved in ammonia, and is poured into molds, which are at once covered.

The following process is also recommended, but it requires some care, as the soap is easily separated by agitation, especially if the ox gall is not fresh. In a vessel heated on a water bath, 28 parts by weight of cocoanut oil are thoroughly incorporated with 5 parts of talc or fuller's earth, 1/10 part of brilliant green and 1/50 part of ultramarine green. The mixture is allowed to cool to 90 deg. F.; 14 parts by weight of lye of a strength of 38 Baumé are then added and, after saponification is completed, 5 parts of ox gall are stirred in. If any separation takes place, the vessel is closely covered and heated on the water bath until the mixture becomes uniform. Finally ¼ part of turpentine and about 8 parts of benzine are added and the soap is poured into molds.

Natural Synthesis.

In an address to the chemical congress recently held in London, Prof. Paterno, of Rome, called attention to the evolution which is taking place in the synthetical processes employed in the commercial production of organic chemical compounds. There is a tendency to substitute, for the crude, tedious, and complex methods hitherto used, processes of an entirely different character, in which the desired chemical changes are effected at ordinary temperatures, without the employment of violent reagents. As chemical science develops it allows an approximation to the ideally perfect methods of synthesis by which nature produces vast quantities of compounds in infinite variety. Duclaux has wittily rallied those chemists of to-day whose ambition and efforts are wholly directed to the comparatively easy production of new compounds, even if these compounds serve no other purpose than to enlarge dictionaries of chemistry. Manufacturing chemists will assuredly discover and utilize new and more natural methods of synthesis. The researches of the past half century in connection with ferments, microbes, toxines, diastases, catalyzers and the colloidal state of matter have indicated very interesting possible applications of these agencies to the processes of technology. Some of these agencies have long been known. Many kinds of fermentation, for example, have been utilized from time immemorial, but the mechanism of their action was unknown. Now that it is better understood it is safe to predict that the practical employment of that action in chemical synthesis will soon follow. Very important applications of this newly acquired knowledge of biological chemistry have already been made. Yeast, which only converts sugar into alcohol and carbon dioxide, has been, to some extent, displaced by mold fungi, which also convert starch into sugar. Agricultural experiments have demonstrated the great fertilizing power of infinitesimal quantities of catalyzers, and a new and valuable method of saponification has been devised by Dr. Nicloux.

Electrical illumination will be a great feature of the Hudson-Fulton Celebration from September 25th to October 9th. Over a million incandescent lamps, 10,000 arc lamps, and searchlights aggregating 1,800,000 candle-power will be used in addition to the regular lighting of the city in New York alone, not to mention the illumination of the Jersey shore and numerous special advertising signs.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

GARMENT-RACK.—FANNIE WOLF, New York, N. Y. This invention relates to improvements in garment racks, and more particularly to the means employed for supporting the hangers and permitting of their rotation, to expose the garment to view from all sides. The invention involves features of construction substantially the same as certain of the modified forms illustrated in a prior application filed by F. Wolf.

Electrical Devices.

INSULATOR FOR THIRD RAILS.—L. STEINBERGER, New York, N. Y. Among the many objects of this invention may be named the provision of means whereby a movable portion of the insulator may be connected with the rail and so arranged as to turn relatively to a stationary portion of the insulator; the means for securing the insulator to a separate base, thus enabling the operator to handle the entire device as a single unit; and mechanism for taking up pounding action otherwise taking place between insulator and base, owing to the alternate depression and rebounding of a cross tie when a train passes over it.

CIRCUIT-CLOSER.—O. M. TUSTISON, Bainbridge, Ind. The main purpose here is to provide a closer which can be operated only by a special key, and which, therefore, is not capable of being operated by any one other than the possessor of the key. The actuating member is held securely in place while it is in use, thereby rendering it impossible for a separation of the circuit closing contacts.

CONTROLLER.—H. SMITH, Suffern, N. Y. The more particular object of this inventor is to provide a type of controller in which there is a revoluble drum carrying resistance windings upon its periphery, these windings being adapted to dip into a body of free mercury and being movable at will by aid of the drum for the purpose of varying the ohmic resistance of the windings.

Of Interest to Farmers.

STALK-CUTTING ATTACHMENT FOR VEHICLES.—R. B. HUMAN, Chickasha, Okla. The cutting attachment is complete in itself, in combination with cultivator disks, and which can be expeditiously applied to the forward or rear axles of an ordinary farm wagon, or to a similar vehicle, and provide means for lowering and raising the cutter and cultivator disks.

BEET-PLOW.—L. BRENNEIS, Oxnard, Cal. An object of this inventor is to provide a plow with bell crank levers pivoted to the frame, the levers having treadles on one set of terminals with a yoke pivoted to the frame, the yoke having a pin which engages the draft bar to shift it.

Of General Interest.

ANIMAL-TRAP.—G. J. MILLER, Marco, Mont. When the jaws are sprung, and the animal is caught beneath either one, if not instantly killed or disabled, he naturally seeks to escape by crawling out under the jaw. To prevent escape in this manner, each end of the body of the trap is provided with a fang, which will ordinarily pierce the skin or body of the animal when the trap is sprung, which prevents his movement in any direction.

DISAPPEARING TABLE.—G. H. WITTHAUS, New York, N. Y. This table is adapted for use in launches, yachts, apartments, automobiles, and railway cars. One object of the invention is to provide means whereby a removable section of a floor may be utilized as a table, reclining couch, bench, or a settee. Articulated members support the floor section, which may be received within a pit below the surface of the floor.

Machines and Mechanical Devices.

FLYING-MACHINE.—P. V. WADLEIGH, Needles, Cal. The invention relates especially to machines of the aeroplane type. The machine is provided with mechanism for raising the same to the desired elevation, and having independently operated propellers for advancing the machine. The invention resides in the construction of the lifting and propelling mechanism, and in the guiding mechanism.

WELTING-MACHINE.—J. LARSEN, Vestergade 11, Copenhagen, Denmark. The invention relates to means for handling welts in welting machines and in other forms of machines for sewing leather, the more particular object being to provide means whereby the welt is fed step by step into a position favorable for enabling it to be pierced by the needle.

VALVE.—A. PAUL, New York, N. Y. The more particular object of this inventor is to produce an efficient type of valve suitable for use in connection with liquids or gases, and especially adapted for handling illuminating gas. The invention comprises details of construction whereby the closure of the valve is rendered positive and the general efficiency of the valve is greatly increased.

WIRE-FRAME MACHINE.—A. PIASER and H. COHN, New York, N. Y. One object of the invention is to provide a machine which is capable of a plurality of adjustments to permit frames of widely different forms to be fashioned thereon, and which can be operated to release a frame after the latter is formed without destroying or altering the form of the frame.

SPEED-CONTROLLING DEVICE.—C. E. PALMER, Spokane, Wash. The device requires very little attention and is connected to a revolving part of the device to be controlled, with a view to cause the device to run at all times at a sure, steady, even speed, although the power or the load may increase or diminish instantly or gradually.

FLYING-MACHINE.—M. B. SELLERS, Baltimore, Md. The weight of this machine is supported by the air impinging on one or more surfaces, inclined at a small angle of incidence and in motion relative to the air, whether this motion is produced by movement of air or by gravity, or by propelled mechanism. When by gravity, the machine is known as a gliding machine, but it is equally suitable as a power-driven machine.

CONCRETE-MIXER.—W. D. CLOUGH, E. S. CLOUGH, and J. G. CLOUGH, Quincy, Ill. The invention has reference to machinery for working concrete and the like, the more particular purpose being to produce a concrete mixer especially adapted for continuously admixing concrete in successive charges of limited volume, The machine is to a great extent self-cleaning and is not liable to do any pounding.

REGULATOR FOR THE FLOW AND LEVEL OF LIQUIDS.—P. SUTHERLAND, La Luz, New Mex. The invention is particularly useful in devices used in irrigating channels, mining ditches and other water supply conduits. It provides a regulator which is absolutely automatic in operation, and which can be adjusted to operate and control the liquid body at different levels and at different rates of flow.

LATHE-HEAD.—G. F. FISHER, Torreon, Mexico. More particularly the improvement relates to the means employed for driving the chuck or face plate at any one of a plurality of different speeds. The intention is to provide means whereby the ordinary belt-driven lathe having a cone pulley may be converted into an all-gear lathe.

ROAD-MACHINE.—M. M. SICKLER, Pala, Cal. The supporting wheels are operated by gearing, particularly worm gearing, instead of by chains, and the various supporting wheels can be independently operated for steering the machine, and the bed may be raised or lowered, thereby achieving results on a hillside not ordinarily obtainable since the machine can be practically level upon a decided slope.

COUPON CUTTER AND COUNTER.—E. H. BARTOW, New York, N. Y. This device may be set to accommodate coupons of various sizes, and is adapted to sever or shear rapidly and evenly. The device has a visible dial upon which is registered each coupon as cut, and by means of which all the coupons may be gathered as cut, in a removable receptacle.

TYPE-WRITER RIBBON-SPOOL.—J. F. O'CONNOR, New York, N. Y. This improved typewriter ribbon spool is provided with a cast hub to which the flanges are riveted, thus permitting quick, convenient and accurate assembling of the parts without the aid of skilled labor, and thereby reducing the cost of manufacturing to a minimum.

Pertaining to Vehicles.

TIRE-ARMOR.—W. J. BELYEA, Port Huron, Mich. The invention relates particularly to improvements in a guard armor or protector for rubber tires of automobiles, although it may be used on rubber tires of other vehicles, the object being to provide an armor that may be readily placed over a tire and absolutely protect the same from wear or abrasion, and also enable the use of a brake directly to the tread of the wheel.

LOCK FOR CYCLES.—J. M. BARRETT, Fostoria, Ohio. The invention comprehends a lock mounted upon the framework of a bicycle and provided with a movable bolt adapted to project through the sprocket wheel, the bolt being so arranged that when in its normal position the bicycle cannot be used, the bolt being withdrawn from the sprocket wheel by aid of a key carried by the operator.

TRANSMISSION APPARATUS.—J. O. FORKER, New York, N. Y. The object of this inventor is to provide a mechanism whereby the rear or driving wheels of a motor vehicle can be placed thereon without in any way altering the motor vehicle, and the power from the driving of such wheels will be applied to a power transmission member such as a belt pulley.

LUGGAGE-CARRIER.—L. E. DRAPER, Santa Cruz, Cal. One of the objects in this invention is to provide an adjustable luggage carrier adapted to be mounted on a vehicle, for carrying trunks, bags, or other receptacles, secure against accidental displacement or loss, the carrier when not in use being adapted to be folded together.

ARMORED TIRE.—S. T. MOSER, Huntdale, N. C. The improvement is in that class of tires which are armored and in which an air tube of the usual design is contained within the outer tube. The aim is to provide a tire and means for protecting the air tube from puncture and also to provide means for preventing "skidding" or slipping of the wheel and further to increase the traction and prolong the life of the tire.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

TO AND FRO THE KEY TO LONDON. London: Simpkin, Marshall, Hamilton, Kent & Co., 1909. 12mo; pp. 343. Price, 6d.

Few people are aware of the many and valuable facilities of communication which await them in London, practically at their very doors, in the shape of the general public conveyances, and fewer still know how to completely avail themselves of these facilities so as to reach any part of the British metropolis with the greatest dispatch and comfort. The present volume is published with the object of enabling them to make full use of these advantages. Great strides have been made in the past year in effecting rapid transit in London, and the guide before us enables the best advantage to be taken of the opportunities afforded. The work of compiling a book of this nature is colossal, and the publishers can be congratulated on the production of a unique book.

LIFE IN THE NAVY. By Thomas Beyer. Chicago: Laird & Lee, 1909. 16mo.; 246 pp. Price, 25 cents.

This book is published by special authority of the United States Navy Department, and is indorsed by ex-President Roosevelt, Admiral Dewey, and Rear-Admiral Evans. It contains a vast fund of useful information which will prove of value to all who are in any way interested in the subject.

CATALOGUE OF A LOAN EXHIBITION OF RARE VIEWS OF OLD NEW YORK. New York: Lloyd Title Insurance and Trust Company, 1909. 12mo.; 53 pages; illustrated.

We are indebted to Mr. J. H. Jordan, the compiler, for this excellent monograph on the prints which were exhibited a few months ago at 160 Broadway, New York city. The idea of the exhibition was a most novel one and the exhibition attracted wide attention. The quality of the prints was of the very highest, and many of them were practically unique. The present volume is beautifully illustrated, and with a number of half-tone engravings showing the prints *in situ*. The book is beautifully printed on French deckle-edge paper. The present catalogue will be warmly welcomed by all collectors.

HOW TO COOK VEGETABLES. By Olive Green. New York: G. P. Putnam's Sons, 1909. 16mo.; 644 pages. Price, $1.

No more unique or welcome aid to a brain-fagged housewife can be imagined than this little series of handbooks in their plaid gingham covers, comprising such a large number of tried recipes. The book is beautifully printed on light-weight paper, and it is really a delight to handle it. There are directions for cooking asparagus in 45 different ways, beans 95 ways, cabbage 105 ways, celery 32 ways, chestnuts 19 ways, corn 87 ways, mushrooms 95 ways, although mushrooms are not really vegetable, but fungi. There are 20 ways of cooking the toothsome okra. There are 336 ways to cook potatoes, which is certainly a most remarkable showing. There are 100 ways to cook tomatoes, and 46 different ways to cook turnips. There are besides dozens of formulæ for what might be termed minor vegetables. The other volumes of the series deal with "What to Have for Breakfast," "Every-Day Luncheons," "How to Cook Shell Fish," and "How to Cook Fish." The series is worthy of a large sale.

THE EXPLORATION OF EGYPT AND THE OLD TESTAMENT. By J. Garrow Duncan, B.D. New York: Fleming H. Revell Company, 1909. 12mo.; 248 pages. Price, $1.50 net.

The present work is a summary of the results obtained by explorations in Egypt up to the present time, with a full account of those bearing on the New Testament. Many years of exploration in Egypt under the direction of Mr. Flinders Petrie have abundantly qualified Dr. Duncan to write on this interesting subject. Many readers will feel grateful to him for explaining the processes of exploration. His general plan of writing is at once popular and accurate. He speaks as an explorer on Joseph's granaries, the route of the Exodus, the treasure city of the Rameses and unearths many singular facts about them. The illustrations and drawings add a great deal to the vividness of the story, combining to give a book that has long been needed for the average reader.

ITALIAN HIGHWAYS AND BY-WAYS FROM A MOTOR CAR. By Francis Miltoun. Boston: L. C. Page & Co., 1909. 12mo.; pp. 380. Price, $3.

A delightful book, sumptuously printed and appropriately bound. The author is in love with his Italy, and makes a most entertaining book of it. He has visited many of the out-of-the-way places with which the peninsula is filled. The illustrations are particularly interesting and appropriate.

THE GEOLOGY OF THE CITY OF NEW YORK. By L. P. Gratacap. New York: Henry Holt & Co., 1909. 8vo.; 232 pages. Price, $2.50.

This is the third revised and enlarged edition, and is accompanied with 65 illustrations and 4 maps. There is no one better fitted to treat of this subject than Prof. Gratacap, whose long connection with the American Museum of Natural History has given him exceptional opportunities for the study of valuable material at first hand. The book is excellently made, and is well illustrated by half-tone engravings and diagrams. The facts presented and the statements have been brought together from many sources and have been classified. The book will certainly tend to develop and complete a correct geological conception of Greater New York. Mr. Gratacap is to be congratulated upon a highly successful scientific book.

GAS ENGINE THEORY AND DESIGN. By A. C. Mehrtens, M.E. New York: John Wiley & Sons, 1909. 12mo.; pp. 256. Price, $2.50.

It has been the aim of the author to prepare a book for all who are interested in gas engines—students, draughtsmen, engineers, as well as the men who operate gas engines of any kind, and wish to become better acquainted with the theory and the *why* of many things. The book should be of special interest to the technical student, and was, in fact, first prepared for the engineering classes at the Michigan Agricultural College, since no suitable textbook could be found. The reading matter throughout has been arranged carefully and with a definite object in view. The large number of figures illustrating the text have been made as simple as possible. It has also been the aim of the author to make the treatment clear and concise, and for this reason every paragraph should be studied—not merely read over.

AN HISTORICAL REVIEW OF WATERWAYS AND CANAL CONSTRUCTION IN NEW YORK STATE. By Henry Whalen Hill, LL.D. Buffalo: Buffalo Historical Society, 1908. 8vo.; 549 pages.

The present volume is a critical study dealing with various phases of the history of New York State waterways. Nothing of the character of the present work has been written before. The book, which is beautifully bound, is filled with papers and documents of all kinds. It is a most voluminous compendium of valuable facts which are particularly interesting at the present time when the subject of internal waterway construction in the Empire State is of paramount importance. The Hon. Mr. Hill is to be congratulated on the completion of so laborious a work.

THE LURE OF THE LAND. By Edith Loring Fullerton. New York: Long Island Railroad Company, 1909. 8vo.; 160 pages.

The present attractive work is a history of a market garden and dairy plot which were developed within eight months upon a most unfertile section of Long Island. The section was so bad that it was designated as "scrub oak waste." This work was carried on by the Long Island Railroad Company at Experiment Station No. 1. The author has also written a most valuable book entitled "How To Make A Vegetable Garden." Mr. and Mrs. Fullerton are well known as promoters of agriculture along the latest scientific lines. The book contains a graphic description of the work from the time when the underbrush was cleared and the stumps dynamited until the farm was in its full fruition and they were shipping "home hampers" to the city containing an assortment of fresh vegetables picked before daylight and delivered before dinner. The book is charmingly illustrated and describes the method of procedure which could be utilized in almost any territory. Tables and figures prove that agriculture is far from being either a profitless or dry occupation, with a celery crop at $330 to $1,000 per acre, Brussels sprouts at $500, asparagus at $550, gooseberries at $900, quinces at $1,500; and other attractive crops may be grown at similar profits.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending August 3, 1909,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Air governor, automatic, L. W. Baker..... 930,120
Amalgamator, R. Luckenbach..... 930,299
Ammonia gas from ammonia liquors, obtaining purified, C. M. Stine..... 929,726
Amusement apparatus, L. Collis..... 929,753
Anchor hook, guy clamp, and stretcher, G. F. Swortfiger..... 929,996
Animal fat product and making same, J. H. Filbert..... 929,926
Annunciator drop, B. W. Sweet..... 930,324
Antirattling device, J. J. Halladay..... 930,072
Arch, fire brick, E. P. Stevens..... 929,724
Atomizer for paint or the like, R. Reich.... 930,087
Automatic switch and signal, H. F. Roach.. 929,880
Automobile lever lock, D. N. Nester..... 929,783
Automobiles, gear changing mechanism for, F. Beemer..... 930,029
Axle coupling, reversible car, M. Markarian 929,771
Back pedaling coaster brake, F. S. Ellett .. 929,663
Bale identifying means, W. L. McCarty.... 929,691
Baling press, automatic, R. E. Rahm..... 930,083
Barrels, manufacture, O. Schubert..... 929,715
Bat making machine, D. Haynes..... 930,285
Bearing, W. P. Rodman..... 930,232
Bearing, antifriction, H. Hess..... 929,762, 929,851
Bed or box couch, H. J. Jacobs..... 929,855
Bed spring, adjustable, S. R. Hunt, Jr..... 929,853
Bell, selective ringing magneto, B. W. Sweet..... 929,995
Belt for transmitting power, C. F. Gray.... 929,760
Billiard cue cutter, G. L. Lyman..... 929,681
Binder, J. D. Stow..... 929,893
Board. See Game board.
Bolster, F. H. Davol, Jr..... 930,051
Bolt anchor, expansion, H. W. Pleister.... 929,979

Legal Notices

Book forming mechanism, J. Bengough..... 929,652
Bottle, E. F. Berg 930,133
Bottle capping machine, H. S. Brewington, 930,144, 930,145
Bottle holder, milk, V. C. Getty 930,281
Box. See Cigarette and tobacco box.
Box lid holder, C. W. Ufford 930,245
Bracket device, H. S. Mills 930,209
Brake, R. E. Rudolph..... 930,234
Brake lever, J. & W. Connell 930,045
Brickmaking machine, O. G. Diefendorf.... 930,053
Bromisovaleric ester of the borneols, M. Dohrn 930,054
Brush, C. R. Uhlmann 929,731
Brush, dustless, F. S. Hunt 929,670
Brush, electric needle spray bath, H. Hertzberg 929,947
Brushes, mounting for bottle washing, A. N. Davis 930,049
Buckle, harness, J. E. Rempel 929,709
Buggy top raising and lowering attachment, W. P. Warren 929,806
Bung, faucet, F. Fink 929,928
Butter making machine, R. Williams 929,908
Cabinet, biscuit. C. A. Salzman..... 930,089
Cabinet, panel board, F. B. Adam..... 929,812
Calculating machine, A. Monachimoff..... 930,211
Camera, F. A. Anthony 929,648
Camera back, T. W. Ingersoll 929,671
Camphor, making, C. Glaser, reissue..... 13,001
Candy machine, J. Smith 930,099
Car body head frame, railway, C. M. Evans. 930,277
Car brace, W. I. Taylor 929,998
Car coupling, N. F. Resseguie 929,879
Car draw bar mechanism, C. M. Evans.... 930,278
Car fender, P. A. Faust 930,062
Car frame, H. M. Pflager 929,705
Car indicator, E. Schupp 930,318
Car, street, C. B. Price, reissue..... 13,003
Car tank, C. N. Stevens..... 930,101
Cars, cooling attachment for stock, B. L. Stimmel 929,725
Cars from self-dumping mining cages, automatic device for releasing empty, Brasche & Doelz 929,751
Carbonating machine equalizer, S. H. Bither 930,033
Carbonator, L. M. Keeler 980,189
Carton closing and sealing mechanism, W. S. Scales 930,090
Cartridge, loaded, G. Meadows 929,866
Cask cleaning and pitching apparatus, P. Seifert 929,793
Caster, I. L. Leasure 930,199
Caster retaining device, D. A. Maccualg.... 929,964
Casting apparatus, stereotype, H. F. Bechman 929,747
Casting metal ingots, J. F. Monnot..... 928,688
Cement cistern mold, N. Bronhard..... 929,825
Centering mold, J. E. Moody 930,308
Chain conduit, Monrath & Mottlau..... 929,968
Chaplet, W J. McCarroll 930,080
Chart suspension device, C. S. Jenkins.... 929,672
Check device, manifolding scales, E. Z. Lewis 929,959
Chuck, A. P. Kern 930,075
Chuck, C. E. Brooks 930,147
Chuck, sub, C. E. Brooks 930,146
Churn, J. F. Torbett 929,900
Cigarette and tobacco box, C. Campus..... 930,154
Cigars, lid supporting display box for, A. G. Jaeger 929,856
Circuit breaker, H. W. Cheney..... 930,155
Clamping or binding mechanism, W. J. Wright 930,258
Cleaning apparatus, cleaner head for vacuum, F. S. Blackall..... 930,134
Cleaning device, Bayless & Hein 929,746
Clock case and calendar holder, sheet metal, W. H. Hall 929,940
Closets and urinals, nidus for aerobic bacteria applicable to, E. L. Short..... 930,319
Closure and spout, non-explosive, W. H. McNutt 929,974
Clothes marker, Weaver & Martin..... 930,005
Clothes pin, F. H. Perry 929,703
Clutch member, E. M. Cook 930,270
Coal handling apparatus, A. C. Stewart.... 929,993
Coating machines, article holder for liquid, Beausejour & Drubel 930,129
Coffee pot, M. Davidson 929,754
Coin wrapper, E. W. Jennings 930,291
Collar, H. S. Kennedy 930,191
Collar, set, I. W. Exley 930,169
Collar stuffing machine, horse, J. C. Collett 930,043
Comb, E. O. Kohn 930,195
Combination lock, R. E. Runkle..... 929,712
Combination lock, J. J. Murphy 930,079
Combination or keyless lock, O. M. Farrand. 929,924
Combustion motor, G. Enrice 930,056
Commutator brush, F. W. Garrett..... 930,067
Compartment can, E. Eckart 929,842
Concentrating table, H. D. McLeod 930,218
Concrete culverts, method and apparatus for making, H. Noah 929,694
Concrete form, permanent, M. D. Murray.. 929,969
Concrete girder frames, crossover for, E. N. & R. E. Spaulding..... 929,890
Concrete, mortar, and the like, apparatus for making, L. M. Reed..... 930,084
Concrete or cementitious compounds, apparatus for making, L. M. Reed..... 930,086
Concrete or cementitious compounds, making, L. M. Reed..... 930,085
Concrete post, reinforced, J. H. Carpenter.. 930,040
Concrete reinforcing frames and product thereof, manufacturing, P. E. & R. L. Bertin 929,748
Concrete wall mold, reinforced, G. W. Stevens 930,102
Cooker, fireless, Marsh & Thompson..... 930,204
Cooking utensil, G. C. Port..... 930,223
Coop or crate, folding, A. Farmer..... 930,170
Core drill, M. J. McLoughlin..... 929,780
Corn cutter and crusher, J. S. Bloom..... 930,137
Corn sheller, G. Wandscheer..... 929,735
Corrugating machine, E. R. Stasch..... 929,722
Corset, G. Pfeil..... 929,704
Corset, C. E. Woodworth..... 930,015
Corset stay stiffener, H. M. McCormick.... 930,217
Cotton chopper, P. Joiner..... 930,184
Coupling. See Car coupling.
Coupling, H. A. Dulinsky..... 930,162
Coupling ring for corrugated culverts, G. W. Storms 930,103
Cover releasing means, C. G. Miner..... 930,306
Cradle, C. L. Finch..... 929,927
Crate, J. I. McClung..... 930,216
Crate, folding, G. W. M. Smith..... 929,718
Crate or box, collapisble, J. S. Strassel..... 929,894
Crib, O. F. Seifert..... 929,792
Cuff, thumb, H. E. Wood..... 929,910
Culinary utensil, J. H. Collins..... 929,917
Cultivator, R. S. Wells..... 930,109
Cultivator, D. J. Ellis..... 930,332
Curtain fixture, P. Drinkaus, Sr..... 929,923
Curtain rod, J. N. Henry..... 930,288
Curtain stretcher, H. E. Southworth..... 929,991
Dam, high service, R. Griswold..... 929,667
Damper actuator, J. W. Barton..... 930,126
Dead centers, device for overcoming, L. F. Dahl 929,919
Dental engine, O. H. & A. F. Pieper..... 930,082
Disinfecting composition, A. W. Lyda, et al. 929,963
Display rack, H. J. Schlegel..... 929,714
Display rack, J. E. Taylor..... 929,897
Displaying lace, cabinet for, W. J. Snyder. 929,889
Distillation, treating wood during, H. W. Doughty 930,274
Ditching machine, Van Buren & Krupp.... 929,732
Door, J. P. Sjoberg..... 929,888
Door fender, W. H. Terrell..... 930,105
Doors, antisagging device for, C. Lehman... 929,958
Dough raiser, S. Rasmussen..... 929,983
Draft rigging, bumper beam, E. C. Washburn 930,247, 930,248
Drain or similar pipe, E. Harpham..929,941, 929,942
Drilling apparatus, W. F. Bossert..... 929,822
Dumping device, automatic skip or bucket, T. O. Werner..... 930,253
Dynamite heater, A. H. Vannauker..... 929,902
Dynamite, machine for packing gelatin, T. W. Bacchus 929,815
Dynamo regulator, S. D. Field..... 929,758
Dynamometer, E. E. Sweet..... 929,803
Easel for desk calendars, cards, and other articles, W. H. Hall..... 929,939
Eaves gutter or trough, Mills & Taylor..... 929,684
Egg washer, T. Thompson..... 929,804
Electric arcs, production of long stable, Schonherr & Hessberger..... 930,238
Electric heater, Trewhella & Holley..... 929,901
Electric machine brush holder, dynamo, F. W. Garrett 930,068
Electric machines, brush holder for dynamo, J. W. Webster.....930,006, 930,007
Electrical conductors, current leak indicator for, R. S. Masson..... 929,773
Electrical energy, system of distributing, P. H. Thomas..... 930,325
Electrical instrument for pyrogravure and surgical purposes, L. Mandarelli..... 930,203
Electrical measuring instrument, D. C. Jackson 929,854
Electromagnet, D. J. Hauss..... 930,177
Electromagnetic apparatus for actuating mechanisms, S. H. Hoggson..... 929,763
Elevator, A. C. Newton..... 929,870
Elevator, E. C. Porter..... 930,224
Elevator automatic stopping and locking device, J. P. O'Donnell..... 929,872
Engine, L. W. Noyes..... 929,695
Engine starting jack, G. A. Bull..... 929,828
Engraving machine, V. L. Ourdan..... 929,700
Expander and flanger, Pfluger & Christensen 929,706
Eyeglasses, mounting for, C. L. Merry..... 929,966
Feed water into steam boilers, means for introducing, C. W. Seddon..... 929,716
Ferrule, husking, A. S. Lyddon..... 930,300
Fertilizer distributer, E. C. Smith..... 930,098
Fiber, soaking sheet, I. W. Masball..... 930,205
Filter, A. Endler..... 930,167
Fire escape apparatus, J. C. F. Sprankle.. 929,721
Fire extinguisher, J. O. Banning..... 930,123
Fire extinguishing apparatus, J. O. Banning 930,122
Firearm, J. Maudry..... 930,305
Firearms, etc., safety device for, P. Mauser 930,206
Fireproof structure, C. W. Denny..... 930,160
Fish hook, J. L. Chesser..... 929,914
Fishing reel, Meisselbach & Catucci..... 929,867
Flour, obtaining starch and gluten from wheat, F. A. V. Klopfer..... 929,861
Fluid distributing system, D. M. Hosford.. 929,852
Fluids, rate regulating device for, F. N. Connet 930,158
Flushing mechanism, P. H. McNeill..... 929,693
Fly screen, exit, W. Bagwell..... 929,816
Fruit and lard press, Becker & Ondrizek... 930,130
Fruit and vegetable mill, J. Koerner..... 930,194
Fruit picker, R. P. Andersen..... 929,647
Funnel, L. E. Edmunds..... 930,165
Furnace. See Ore roasting furnace.
Furnace, W. M. Page..... 929,701
Furnace water back, T. Thornburg..... 929,899
Gage and measuring instrument, J. R. Coe. 930,330
Game apparatus, B. P. Hanft..... 9 0,176
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If there is any scientific, mechanical, or engineering subject on which special information is desired, some papers will be found in this catalogue, in which it is fully discussed by competent authority.

A few of the many valuable articles on the making of experimental apparatus at home are given in the following list:

ELECTRIC LIGHTING FOR AMATEURS. The article tells how a small and simple experimental installation can be set up at home. Scientific American Supplement 1551.

AN ELECTRIC CHIME AND HOW IT MAY BE CONSTRUCTED AT HOME, is described in Scientific American Supplement 1566.

THE CONSTRUCTION OF AN ELECTRIC THERMOSTAT is explained in Scientific American Supplement 1566.

HOW TO MAKE A 100-MILE WIRELESS TELEGRAPH OUTFIT is told by A. Frederick Collins in Scientific American Supplement 1605.

A SIMPLE TRANSFORMER FOR AMATEUR'S USE is so plainly described in Scientific American Supplement 1572 that anyone can make it.

A ⅛-H.-P. ALTERNATING CURRENT DYNAMO. Scientific American Supplement 1558.

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