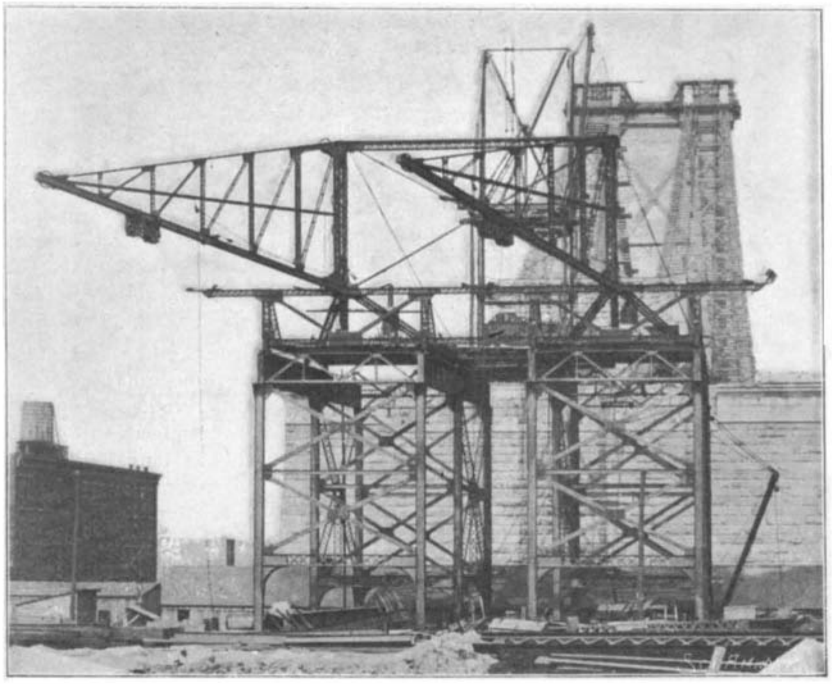
BUILDING THE APPROACHES OF THE NEW EAST RIVER BRIDGE.

The towers, cables and suspended roadway of the new East River Bridge are, of course, the most important part of that structure, and by virtue of their conspicuous position, are just now the most in the public eye; and yet it is a fact that, of the great elevated highway connecting Brooklyn with Manhattan, the portion which spans the East River is rivaled in extent and in the weight of materials that enter into it by the two great approaches by which the roadway is carried up from the street grade to the level of the tops of the anchorages. The approach on the New York side is 2,500 feet long, and calls for the delivery of no less than 12,000 tons of steel for its construction. The Brooklyn approach is 1,744 feet long, and the material in it will weigh 6,000 tons. Each of these structures would in itself be a notable work among the great bridge structures of the world, were they not eclipsed by the more daring and difficult suspended structure across the river.

On each side the approach consists of a massive viaduct 114 feet in width over all, with provision for travel on three separate decks or platforms. The lowest deck will carry the street railway tracks, of which there are four. This structure is carried upon four longitudinal rows of massive latticed columns, which are spaced 60 feet apart longitudinally. Every alternate pair of columns is braced to form an open tower construction. Upon the caps of the columns are four longitudinal lines of 62½-foot plate girders, and above the plate girders are placed the transverse floor-beams, which carry the street cars. These floor-beams are carried out beyond the columns to a distance of 13½ feet in the form of cantilever projections, which serve to carry the floor of the two roadways. Above the two inside lines of the girders above referred to, is constructed another viaduct with its columns spaced 22 feet 10 inches apart longitudinally, and above these columns are placed the floor-beams which carry the double-track elevated railway. This elevated railroad structure commences at the inshore end of the anchorages and descends on an easier grade than the platform for the street railway cars, which will have to be brought gradually down to the street surface on a three per cent grade. The elevated structure descends until it is at the proper elevation to connect with the elevated systems in Brooklyn and New York. Immediately below the elevated viaduct flooring, the supporting columns are strongly sway-braced, and beneath the sway-bracing is a platform for bicycles, the footwalks being carried at the level of the street-car tracks.

Our photograph shows an ingenious design of traveler by which the main portion of the viaduct up to the level of the street-car tracks is being erected. This traveler is seen in the foreground of the illustration with its two booms swung out over the adjoining foundations. Behind these, and standing upon the two interior lines of the columns, is a square timber tower which forms part of the derrick for erecting the elevated structure, this portion of the viaduct being built as the lower story is completed. The first traveler is a massive affair, weighing 70 tons. Its overhang is sufficient to enable it comfortably to cover one panel or 62½ feet of the viaduct. Its floor platform is 60 feet in length by 87 feet wide. At the front of the platform is a transverse riveted truss 10 feet in depth, and above this truss, at two of the panel points, rise the two extensions of the vertical posts which form the masts for two triangular booms, each 75 feet long and 30 feet in depth at the masts. The masts are tied together at the top by a horizontal latticed strut, and the top of each mast is also guyed back to the longitudinal sills of the traveler platform. The whole traveler is carried on a dozen double-flanged wheels, three beneath each longitudinal member of the platform. When the traveler is in operation, it is wedged up clear of the forward wheels, and the front transverse girder is thus given a solid bearing upon the completed portion of the viaduct. Each of the booms can swing through an arc of 180 deg. and upon the lower flange of each is a trolley which is capable of lifting a 20-ton load. With this traveler, the heavy material of the viaduct, including the longitudinal plate-girders and floor-beams, can be expeditiously lifted and swung into position, ready to be bolted up for the riveters.

The rear traveler which, as we have shown, follows along behind the front traveler as the first story of the viaduct is completed, consists of a tower 40 feet high with two boom derricks at the top, each of which swings a 54-foot boom. With this plant the bridge erecters are making good progress, and the indications are that the approaches will be complete by the time the great suspended span is ready for opening.

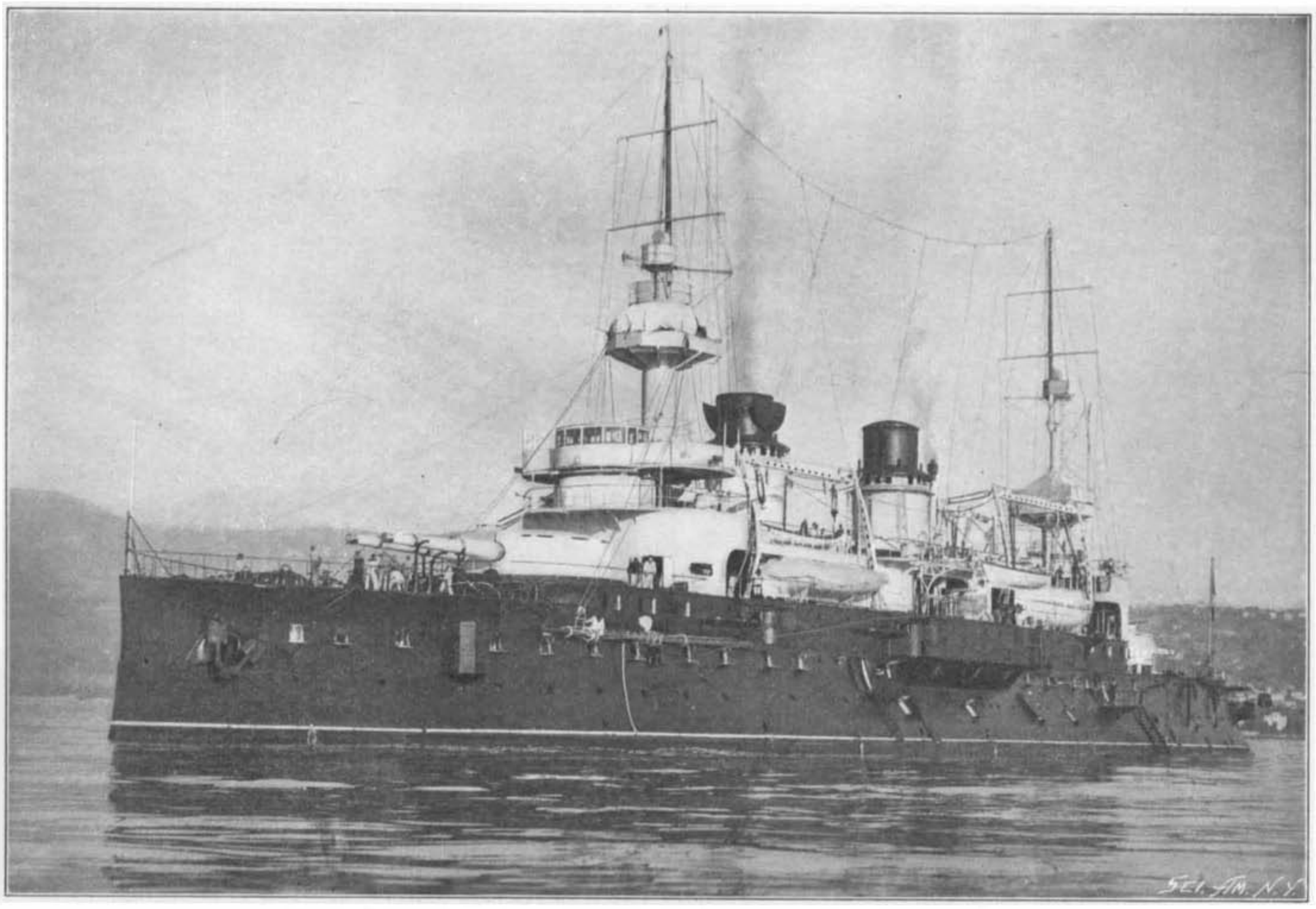


SEVENTY-TON TRAVELER ERECTING THE BROOKLYN APPROACH TO THE NEW EAST RIVER BRIDGE.

FRENCH FIRST-CLASS BATTLESHIP "CHARLEMAGNE"

Among the powerful ships of the French Mediterranean fleet which has gathered in the Levant to enforce the demands of the Republic upon the Sultan of Turkey, the latest and most powerful are the three identical first-class battleships "Gaulois," "Charlemagne" and "St. Louis." The "Charlemagne," which was launched in 1895, embodies several features which, while they have appeared in earlier vessels of other navies, are new in the French navy. The most novel of these is the method of mounting the main battery. In the battleships of the "Carnot" and "Charles Martel" type, which immediately preceded the "Charlemagne," the four heavy guns of the main battery are carried in four separate turrets, on what is known as the quadrilateral plan, two of them being carried on the center line, one forward and one aft, and one on either beam amidships. This was a popular arrangement in vessels built during the eighties, and though it was abandoned in other navies, it has remained longer in favor among the French. In the "Charlemagne," "St. Louis" and "Gaulois," the main battery has been placed in two main positions, one forward and one aft, as in our own "Kentucky" and "Alabama," and the secondary battery has been gathered within a central citadel which is covered with a complete wall of vertical armor. By making this change France has at last fallen in line with the other nations, and adopted a plan which seems likely to be permanent. The "Charlemagne" has a displacement of 11,275 tons on a maximum draft of 27 feet 6 inches. She is characterized by a lofty freeboard and her midship section shows the curious "tumble-home" (a survival of the days of the wooden three-decker), of which we have a solitary example in our own navy in the "Brooklyn." The tumble-home sides allow a concentration of fire parallel with the keel of the ship, and it has the further advantage of bringing the weights well inboard, and thereby contributing to stability. It has a serious drawback, however, in the fact that the living quarters of the crew are considerably curtailed.

The protection of the hull of the "Charlemagne" embodies some novel structural features. Immediately at the water-line is a continuous belt, which is 6 feet 6 inches in depth, and tapers from a maximum thickness of 15¾ inches amidships to 3 inches at stem and stern. Above this belt is another which is 3 feet in depth, and 3 inches in thickness. Immediately at the top of the main belt is a 3½-inch armored deck, and at the bottom of the belt, below the water-line, is an armored deck which is 1½ inches in thickness. From the top of the 3-inch belt up to the level of the main deck, there is no armor protection, except around the ammunition hoists leading to the 12-inch guns. The secondary battery, which is located within the superstructure amidship, is protected by 3 inches of armor, while the 12-inch guns are protected within turrets of 15¾-inch armor. The obviously weak point in the armor plan is the unprotected space between the main deck and the armored deck, for it would be possible for an enemy to send high-explosive shells through the sides of the vessel and explode them immediately beneath the guns of the secondary battery. The damage wrought by such shells in the recent trials of the "Belleisle" show that a few well-placed shells of this character



NEW FRENCH BATTLESHIP "CHARLEMAGNE," NOW IN THE LEVANT.

Displacement, 11,275 tons. **Speed,** 18.1 knots. **Maximum Coal Supply,** 1,100 tons. **Armor:** Belt, 15¾ inches; gun positions, 15¾ inches; deck, 3½ inches. **Armament:** Four 12-inch, ten 5.5-inch rapid-fire, eight 4-inch rapid-fire, sixteen 3-pounders, 18 smaller guns. **Torpedo tubes,** 4. **Complement,** 631. **Date,** 1900.

would be sufficient to put the secondary battery entirely out of action.

The 12-inch guns, which weigh 46 tons apiece, are of a modern and very powerful type, although they are not equal to the new 40-caliber 12-inch guns now building for the United States navy. They fire a 644-pound projectile with a muzzle velocity of 2,625 foot-seconds, and a muzzle energy of 30,750 foot-tons, the muzzle penetration being 37.3 inches of iron. The United States navy 12-inch gun fires an 850-pound projectile with a muzzle velocity and energy of 2,854 foot-seconds and 47,994 foot-tons, and it has the added advantage that, owing to the greater weight of the projectile, the velocity and energy will not fall off nearly so rapidly as they will in the case of the lighter 644-pound projectile of the French gun. The secondary battery of the "Charlemagne" consists of ten 5.5-inch rapid-fire guns which are contained, five of them within the central citadel on the main deck, and five of them behind shields which are mounted in broadside in the open on the superstructure deck. These guns are light as compared with the 6-inch guns which obtain favor in our own and the British navy. They fire a 66-pound projectile with a velocity of 2,625 foot-seconds, and an energy of 3,100 foot-tons. Our 50-caliber 6-inch gun, on the other hand, sixteen of which will be found in the secondary battery of the battleship "Maine" fires 100-pound projectiles with an initial velocity of 3,000 foot-seconds and an initial energy of 6,240 foot-tons. The comparative lightness of the secondary battery of the "Charlemagne" is, however, somewhat compensated for by a battery of eight 4-inch rapid-fire guns, which is carried on the bridges and superstructure at a height of 35 to 40 feet above the water line. There are also sixteen 3-pounders, ten 1-pounders and eight machine guns. The "Charlemagne" is driven by engines of 14,500 indicated horse power, which gave her on her official trial a speed of 18.1 knots per hour. She can carry a maximum coal supply of 1,100 tons, which is small compared with that of our battleships, and she has a complement of officers and men of 631. She has four torpedo-tube discharges, of which two are submerged.

Efforts to Save the Gutta-Percha Tree.

The scientists in France are now engaged upon the problem of acclimatizing the *Isonandra gutta*, the tree which produces gutta-percha, indispensable to the construction of submarine cables.

It seems that no other product known at present replaces the gutta-percha found in the forests of the Malay Peninsula and in certain districts in Malacca. Inferior qualities have not the requisite durability for submarine use.

The plantations in the above-mentioned districts have been so ruinously exploited by the natives, who uproot full-grown trees and cut young plants before they come to maturity, that it is feared there will be a shortage in the supply of this quality of gutta-percha in the course of fifteen years, unless means are taken to protect the forests or to propagate the plants elsewhere.

The following figures will give some idea of the rapid increase in the export of the gum: In 1845, Europe imported only 9,000 kilogrammes (19,841 pounds) of gutta-percha; in 1857, when the Singapore supply was exhausted, the Malay Archipelago exported more than 240,000 kilogrammes (529,104 pounds); in 1879, Sumatran exportations exceeded 135,000 kilogrammes (299,621 pounds), and Borneo exported 1,300,000 kilogrammes (2,863,900 pounds). In order to attain these figures, it is estimated that the natives must have sacrificed more than 5,000,000 trees.

Expeditions sent out by France, England and Holland to discover the botanical origin of the precious gum and to increase its production, have reached the same conclusion. As it is almost impossible to find a full-grown gutta-percha-producing tree, the situation will be extremely grave if urgent measures are not taken.

The British government has posted placards for the protection of the trees, with no effect. Holland has planted trees, but in insufficient number and of inferior species.

Productive species have, however, been found in the Malay forests extending between the rivers of Pahang, Patani, and Perat. They have been transplanted into Reunion and Madagascar, and if they thrive there will be less danger of a dearth in the supply of gum required for submarine cables.

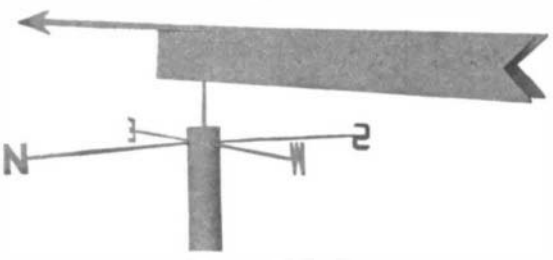
The employment of automobiles by the German army during the recent maneuvers proved a conspicuous success. Seventeen motor cars of various designs were requisitioned, and the military authorities intend to favor their more extensive utilization for the generals in command and their aides-de-camps. The steam lorries used for the transportation of ammunition and the commisariat did not prove so satisfactory, but this is probably due to the bad state of the roads and the unusually severe tests to which they were submitted.

A FEW METEOROLOGICAL INSTRUMENTS.

BY GEORGE M. HOPKINS.

In previous articles of this series a few meteorological instruments of simple construction have been illustrated and described, but the collection would be incomplete without a weather vane, a wind pressure gage, and a rain gage. These instruments do not possess a great deal of novelty, but they are of considerable importance to the amateur observer.

The weather vane hardly needs explanation to make it understood. In the top of a stout pole is inserted

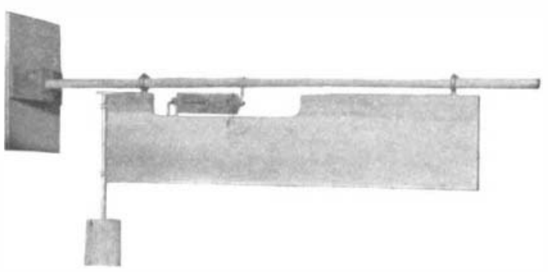


WEATHER VANE.

a $\frac{1}{4}$-inch rod which is bluntly pointed at its upper end. On this is placed a vane consisting of a wedge-shaped piece of hardwood with a hole through it, a piece of hoop iron being fastened over the hole and resting on the upper end of the blunt-pointed rod.

To opposite sides of the wedge are secured pieces of $\frac{1}{4}$-inch board 4 inches wide and 20 inches long. These pieces are let into the faces of the wedge so as to form continuous surfaces. The boards diverge so that their free ends are about $2\frac{1}{2}$ inches apart. This construction insures steadiness.

The thin end of the wedge has an arrow-headed arm projecting from it to indicate the direction of the wind. In the sides of the pole, near the upper end, are inserted four $\frac{1}{4}$-inch rods arranged at 90 deg. with each other, and in slots sawed in the ends of the rods are riveted letters which indicate the points of

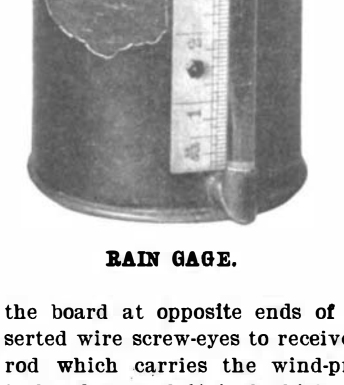


WIND PRESSURE GAGE.

compass, N., S., E. and W. These, in connection with the arrow-headed arm, enable the observer to tell which way the wind blows.

When we find the weather vane pointing toward the west we look for clear weather, and as a rule we are not disappointed; but when the vane indicates that the wind is blowing from the east, a storm is expected. When it blows from the north, cool weather may be looked for; and when it blows from the south, it hardly ever fails to bring sultry days in summer and thaws in winter.

The construction of a wind pressure gage is as simple as that of the ordinary windmill, which every boy knows how to make. A wind vane 6 inches wide and 24 inches long is made of a $\frac{7}{8}$-inch board, on the edge of which is secured a piece of band iron which projects over the end of the board about $1\frac{1}{2}$ inches. In the end of the board are inserted two screw-eyes for receiving the rod upon which the vane swings. The upper end of the rod is pointed bluntly, so that the piece of band iron which rests upon it allows the vane to swing freely in any direction.



RAIN GAGE.

The middle portion of the board is cut away from the upper edge to admit of placing a spring scale for the measurement of the wind pressure. In the upper edge of the board at opposite ends of the scale-notch are inserted wire screw-eyes to receive the horizontal wooden rod which carries the wind-pressure board, 8 by 9 inches long and $\frac{1}{4}$ inch thick.

The board is stiffened by a cleat on the back, which is bored to receive the rod. A screw hook is inserted in the rod, and another is inserted in the upper edge of the vane for receiving, respectively, the eye and hook of the scale. The spring scale is adjusted so as to hold the thin board a little more than the length of the slot in the spring-scale away from the pivot of the vane when the wind is light or nil. When the wind blows the vane keeps the instrument headed toward the wind, and the scale indicates the pressure on a half square foot, so that the reading must be multiplied by 2 to secure a correct pressure.

The rod should be inserted in a rigid post and must be exactly vertical.

When the wind blows strong from any direction curiosity is aroused as to the pressure it is exerting. This may be ascertained by observing the wind pressure gage; $1\frac{1}{8}$ pounds pressure shows that the wind is blowing 15 miles per hour; $4\frac{1}{2}$ pounds pressure per square foot represents a velocity of 30 miles per hour; 18 pounds pressure indicates a velocity of 60 miles an hour; and 50 pounds pressure is registered during a tornado and shows a speed of 100 miles an hour. In calculating the pressure as indicated by this gage it must be remembered that the board which offers resistance to the wind has only a half square foot area.

The amount of rain falling in a given time can be ascertained approximately by placing any kind of vessel having parallel sides out of doors in an open place where it may receive all the rain, and then measuring the depth of the water after the rain by means of a small stick plunged into it; the depth being registered by the wet portion of the stick. This method, however, is crude and open to objections; some of the water will spatter over, some will be lost by evaporation, and some will be displaced by the stick.

If the observer is really in earnest he should make, or have made, a copper vessel like the one shown in the illustration. It is 4 inches in diameter and 6 inches high, with the bottom set in 1 inch so as to receive the copper tube, which is bent twice at right angles, with its inner end inserted in the recessed bottom and its outer end extended up outside the vessel, and even with the bottom to receive a $\frac{3}{8}$-inch glass tube, which is cemented therein with a cement consisting of white lead paint and litharge formed into a soft putty.

The glass tube is 7 inches long, and furnishes a ready means of ascertaining the depth of water in the vessel when viewed in connection with the scale of inches attached to the vessel.

In the top of the vessel is inserted a funnel $3\frac{1}{2}$ inches long, with a cylindrical portion at the top 2 inches deep. The upper and lower edges of the main vessel are wired to give them rigidity, but the cylindrical top of the funnel is not wired.

A rubber band may be stretched around the funnel at the junction of the cylindrical and conical portions to prevent waste by evaporation at this point. To insure accuracy the copper pipe which holds the glass tube should be filled with water before the observation begins.

When the gage is used in a windy place it should be clamped to some fixed object by three screws engaging the wire rim at the bottom of the vessel.

Successful Balloon Trip Across the Channel.

M. Georges Latruffe has lately made a balloon trip across the Channel, starting from Dunkerque, on the 22d of September. After a six hours' voyage, the aeronaut, who was mounted on a balloon of 1,000 cubic yards, succeeded in making a landing on the English coast at Southminster without accident. The trip was accomplished safely, but not without some difficulty. During the voyage the balloon was carried by an east wind which took it as far as Clayton. Then it encountered a northwest wind which brought it to the mouth of the Thames, where the landing took place. The distance in a straight line from Dunkerque to Clayton is 105 miles, and if the distance from Clayton to the landing point is added, this makes a total voyage of over 150 miles. Again, the distance in a straight line from starting to landing points is 90 miles. The French aeronauts have crossed the Channel on several occasions, but the successful attempts have been rare, on the whole. The first trial was made in 1785 with a Montgolfier constructed by Pilatre de Rozier, but he lost his life in the attempt. François l'Hoste tried to cross in 1883, and succeeded only after a number of unsuccessful attempts, in which he was picked up in the sea by boatmen. A monument has been erected at Boulogne-sur-Mer to commemorate this first crossing, on the 9th of September, 1883. L'Hoste crossed again from Boulogne during the following year, and in July, 1886, crossed a third time from Cherbourg, with Joseph Mangot. His balloon was provided on this trip with sails, guide-ropes, floaters and a cone-anchor for slackening the speed. The descent took place near London, where the aeronauts were received by Mr. Lefebre, president of the Balloon Society. It was also in 1886 that M. Henri Herné made his successful trip from Boulogne to Yarmouth, and demonstrated the value of his steering and floating apparatus.