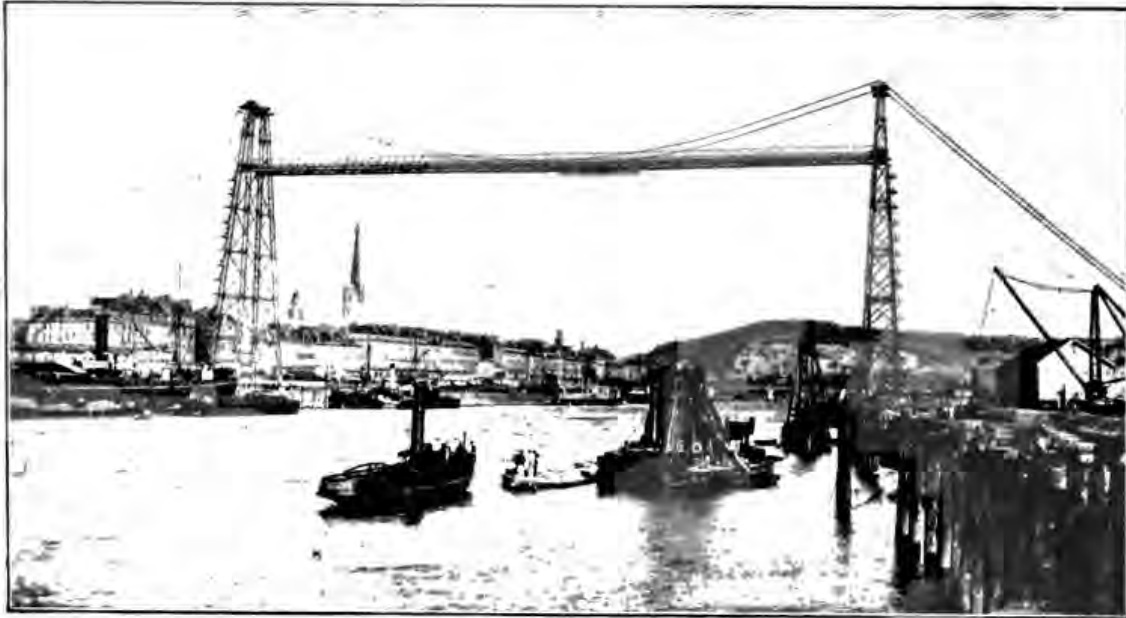


The Queerest Bridges in the World.

By HERBERT C. FYFE.



From a]

GENERAL VIEW OF THE FERRY BRIDGE AT ROUEN.

[Photograph.



HE engineer who is called upon to construct a bridge over a river has to take into consideration, before he decides on its ultimate form, the question as to whether or not there is much shipping in the waterway. If tall ships are in the habit of passing up and down stream it follows, as a natural consequence, that the bridge must be so built as to allow the vessels which use the river to come and go without hindrance.

The usual plan in such cases is to adopt one of the forms of "movable bridges." These may be divided into (1) Bascules, or drawbridges; (2) swing bridges; (3) traversing bridges; (4) lift bridges; (5) pontoon bridges.

In the present article it is not intended to enter into a discussion on the conditions under which these bridges should be employed, nor yet to describe severally their form and design, but simply to show how the problem, just enumerated, has been solved by the erection quite recently at Rouen of a bridge which does not come under either of these five heads.

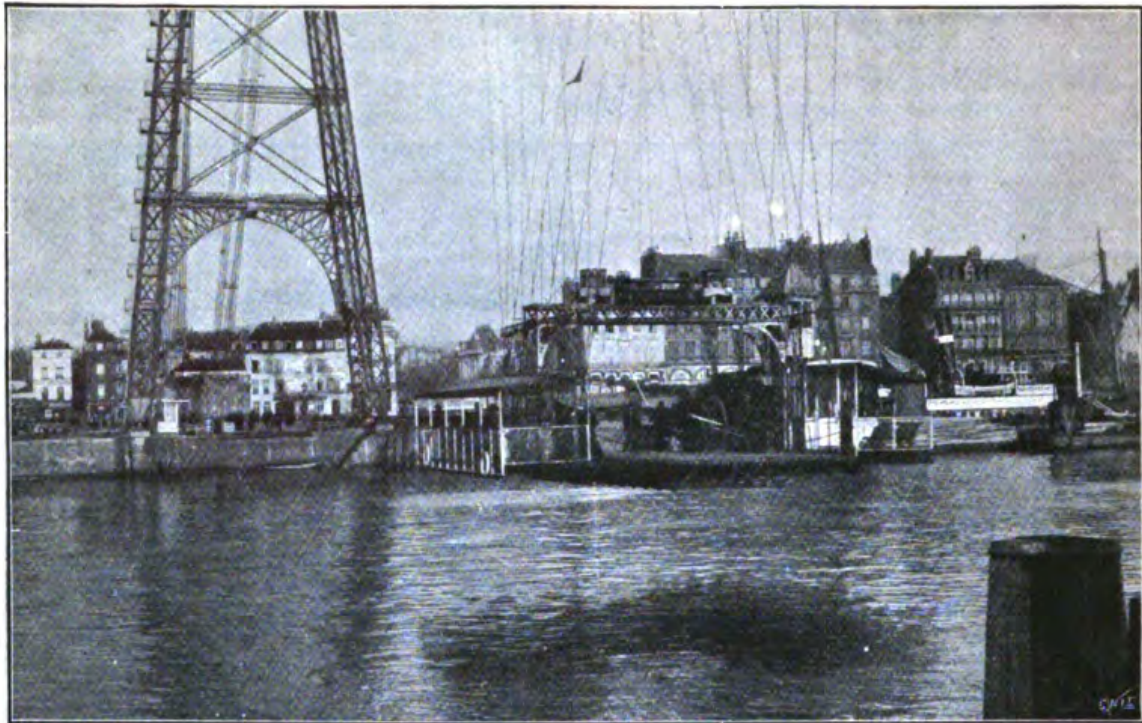
The title that has been chosen for this article, "The Queerest Bridges in the World," will not be considered an ill-chosen one when the photographs, here reproduced, are studied. Nowhere in Great Britain or America do there exist ferry bridges such as

these about to be described, and, therefore, the subject should be one of especial interest both to the engineering world and the general public.

Every Britisher has heard of the Tower Bridge, and is proud of this fine structure. The manner in which the bascules are raised and lowered is too well known to need description, but it may be mentioned that a "ferry bridge" would be of little use here owing to the large amount of traffic from the Middlesex to the Surrey shores. Where the traffic is not nearly so great it is probable that, given certain conditions, the ferry bridge is the cheapest and most efficient attainable.

In the case of the town of Rouen the problem to be solved was the conveyance of traffic and foot-passengers from one side of the river to the other, without interfering with the passage of ships. Inland towns, such as Bordeaux, Nantes, Caen, and Rouen, are considered as maritime ports; the last-mentioned has developed very considerably in recent years, and now carries on a large trade by means of the waterway. Factories and docks have been built, and the tonnage of the port, which, not long ago, was but 900,000 tons, has now attained to 2,000,000 tons.

Many schemes had been proposed for the crossing of the river below the Boie l'Dieu Bridge. Most engineers favoured a swing



From a]

THE CAR IN TRANSIT.

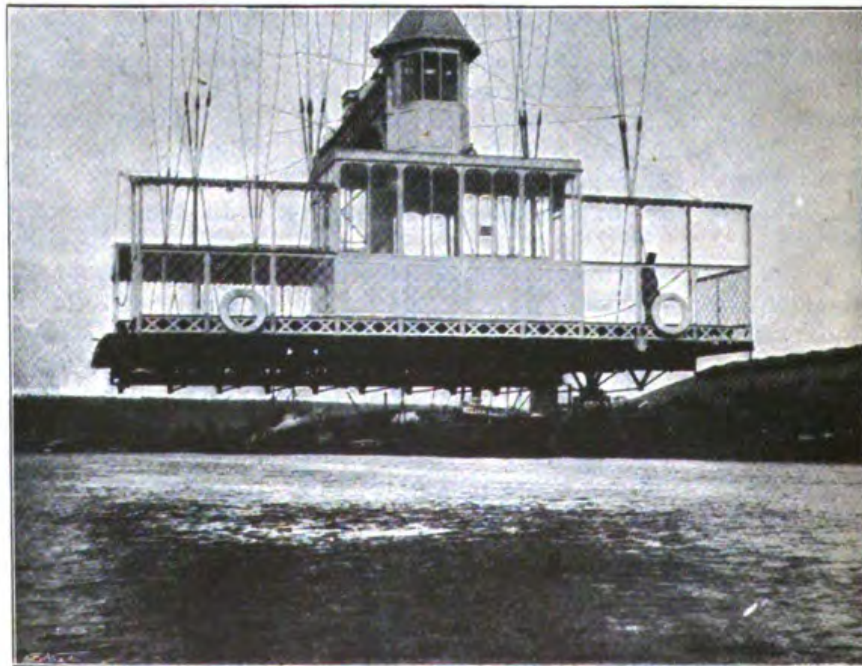
[Photograph.

bridge, but the Chamber of Commerce decided against a bridge of this kind, for the reason that it caused no little delay to those who wished to cross the river; that it was expensive and cumbersome; and, finally, that if it met with any accident, it would entirely block the passage of shipping. Various forms of bridges, such as those which have been mentioned above, were considered, but the design which found most favour in the eyes of the authorities was the one which eventually was put into execution.

The photographs here reproduced will give the reader a good idea of the "ferry bridge." So far as we are aware, there exist but three of this class in the world. One is the new one at Rouen, over the River Seine; the second is over the River Nervion, in Spain, at the town of Portugaleté; while the third is at Bizerta, in Tunis. The last two examples had given such ex-

cellent results that the ferry bridge was finally adopted for the port of Rouen.

This is the first ferry bridge, or "Pont Transbordeur," as the French call it, which has been built in France, and it is already beginning to give great satisfaction. We understand a fourth ferry bridge is to be built over the Scheldt at Antwerp, and doubtless more examples of this kind of



From a]

SIDE VIEW OF THE CAR.

[Photograph.



THE ENTRANCE TO THE ROUEN BRIDGE.
From a Photograph.

bridge will be constructed, as occasion requires. The engineer of the Rouen bridge is M. Arnodin, of Château Neuf-sur-Loire, who has made a speciality of this kind of work. The Rouen Chamber of Commerce voted 600,000f. for its construction.

On each side of the River Seine, at a distance of 150 mètres below the Boië l'Dieu Bridge, two great skeleton towers, with steel framework, have been erected. Between these two supports, almost at the top of each, there has been hung a kind of suspension bridge, consisting of a horizontal platform held up by cables stretched from the tops of the pillars. In this kind of bridge it is necessary for the elevated platform to be sufficiently high to allow the tallest ships which use the river to pass easily underneath it.

In the Rouen "Transbordeur" the height is 51 mètres, and this has been found ample for the purpose. The platform is not intended for traffic of any kind: its function is

to support the special form of car designed for the transport of passengers, carts, and vehicles of all kinds. In order to effect this four lines of rails are laid down, upon which run sixty small wheels in pairs. To these wheels are fixed thirty steel vertical cables, which are fastened to the car, which is situated at the exact height over the river of the roads on each side of the quay. In order that the tension produced by the weight of the platform and of the car may not be too great a strain on the two upright supports, these are braced by means of cables to massive pieces of masonry placed some little distance behind each tower.

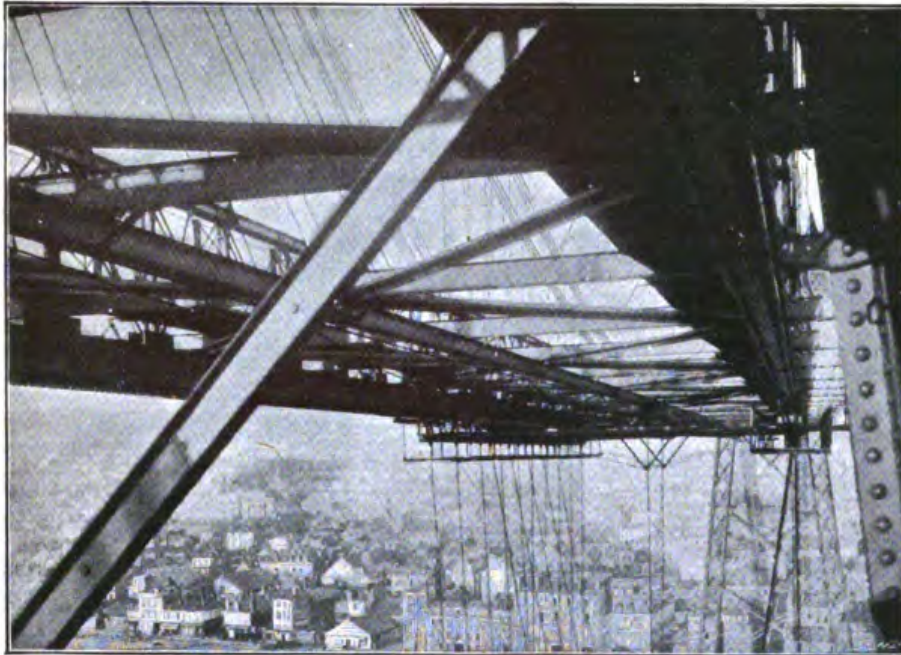
The car is 11 mètres in length and 13 mètres broad; the central portion is meant for vehicles—it is 8 mètres broad, and can accommodate a number of carts, etc., horse-riders, and cyclists. On each side are spaces intended for foot-



From a

THE ROUEN BRIDGE FROM ABOVE.

[Photograph.]



From a] THE ROUEN BRIDGE FROM BELOW.

[Photograph.

passengers: the right-hand side is covered in and is reserved for first-class pedestrians; that on the left is protected by an awning, and is intended for the commoner folk. The car alone weighs 20 tons, and the rolling apparatus on the elevated platform has the same weight. When full to the maximum of vehicles and foot-passengers the car carries a burden of 65 tons—thus a total weight of 105 tons has to be transported from one side of the river to the other.

The works for the installation of the ferry bridge at Rouen were commenced in April, 1898, and have been completed now some weeks. The rapid way in which the work has been carried out is in some measure due to the electrical machinery which has been available.

At Rouen electricity can be supplied in almost any quantity, and the cost of current is cheap. On both banks very powerful electric cranes were erected, and these served

By way of special precaution, all the pieces in the supporting arrangement have been doubled, so that if one should from any reason break the car could still continue to run while it was being repaired. There seems to be no possibility of the wheels on the elevated platform running off the rails, and, indeed, there is very little chance of anything going wrong with the structure.

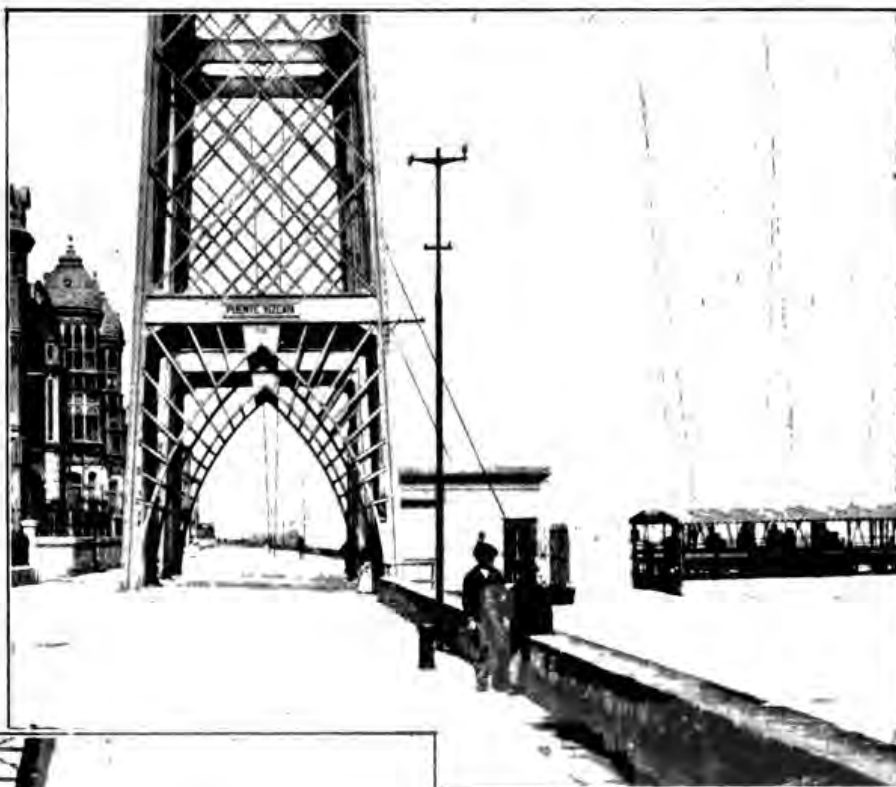


GENERAL VIEW OF THE PORTUGUESE FERRY BRIDGE OVER THE NERVION.

From a Photo. by Hauser & Menet, Madrid.

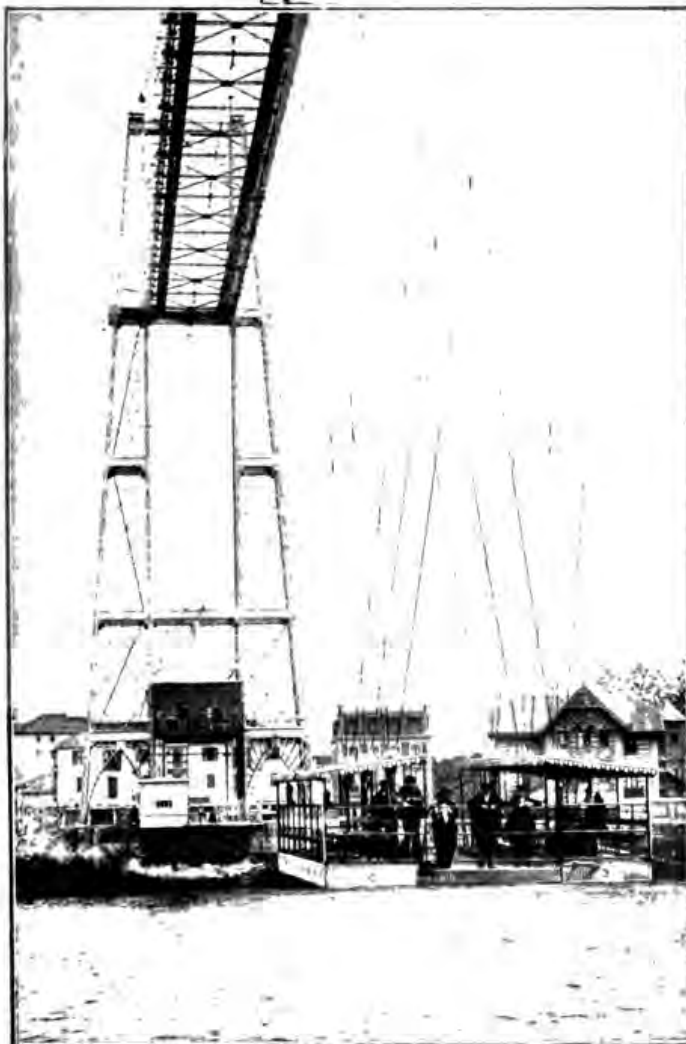
for the installation of the different parts required for the pillars. The car is moved across the river by electricity, and the "driver" is located in a little tower over the first-class compartment. The cost of transport is 5c. second class and 10c. first class; empty carriages 25c., and full ones 40c.

Over the River Nervion, between Portugaleté and Las Arenas, there was built in the year 1893, by Mr.



THE ENTRANCE TO THE BRIDGE OVER THE NERVION.

From a Photo. by Hauser & Menet, Madrid.



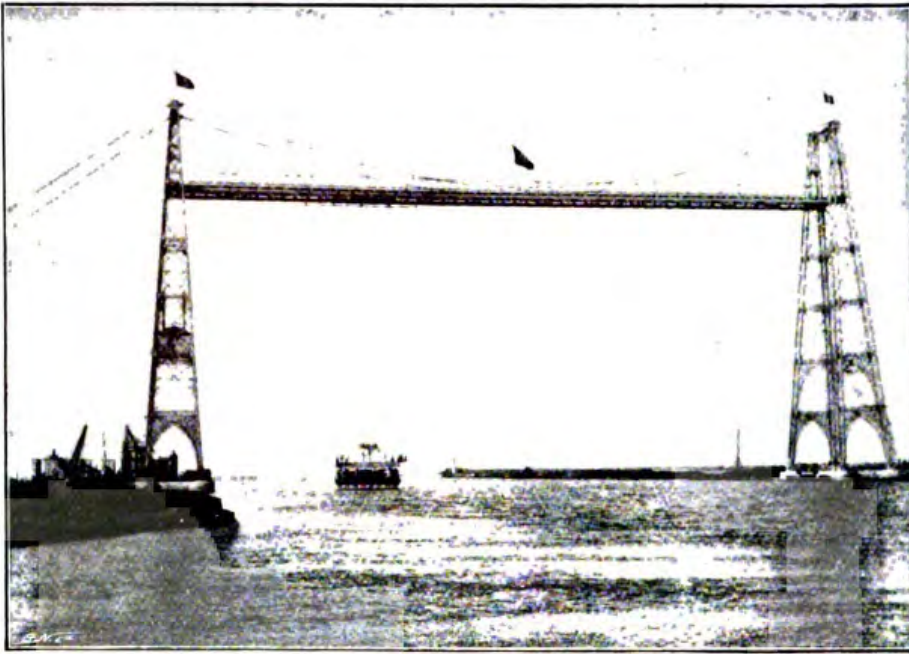
THE CAR CROSSING THE NERVION.

From a Photo. by Hauser & Menet, Madrid.

Palacio, of Bilbao, a "Puente Vizcaya," or "puente trasbordador," which resembles in character the Rouen Transbordeur. Two massive double piers, 240ft. in height, stand on stone platforms close to the edge of the river, and support a light iron bridge, 530ft. long and 150ft. above the water.

From the bridge hangs a car, to which the Spaniards have given the term "Flying Ferry." This runs some 16ft. above the water, being propelled by an engine in the lower part of the east pier. It can accommodate 200 persons, and makes the crossing of the river in one minute. The first-class fare is 10c.; the second, 5c. The car is suspended in much the same way as is the ferry of the Rouen bridge, and, as will be seen from the photographs, the stability of the upper bridge is increased by wire cables passing over the tops of the piers and embedded in the ground beyond. The cost of the "Puente Vizcaya" was 800,000f. (£32,000).

Our last example of the ferry bridge is the one at Bizerta, and



From a]

GENERAL VIEW OF THE FERRY BRIDGE AT BIZERTA.

[Photograph.

for particulars of this we are indebted to a recent number of the German periodical, *Für Alle Welt*. On the coast of Algiers lies the very old town of Bizerta, the Hippo Zanitus of the Romans. For centuries it dragged out the miserable existence of a fishing harbour that was gradually filling up, and could never hope to attain importance of any kind. But since the year 1886 the strategical importance of this point has been better understood, and the French Government decided to appropriate a certain sum of money to be used chiefly for the construction of piers that would protect the harbour from being entirely filled with sand. The result of this first work was so very favourable that operations were begun in earnest with the view of making Bizerta a first-class harbour for war and commercial purposes.

To-day the outer harbour can accommodate the largest ocean steamers and war vessels; the outer harbour is connected with the inner harbour by a

canal, which is 203ft. wide, and through which ships with a draught of 24ft. 7in. can pass. The inner harbour is a lake which has been dredged out. The change in the level of the sea at ebb and flood tide causes a current, which, although it does not interfere with the passage of ships, renders the crossing of the canal in boats a difficult and dangerous process.

In order to overcome this difficulty, a ferry bridge of the kind we have been describing has been built. This consists of an iron frame 148ft. high, which is formed of two pillars, one on each bank, and a connecting bridge. The car is suspended, as in the other two instances, from the high-level bridge, and is propelled backwards and forwards by an engine located on land.



From a]

THE CAR CROSSING THE CANAL AT BIZERTA.

[Photograph.