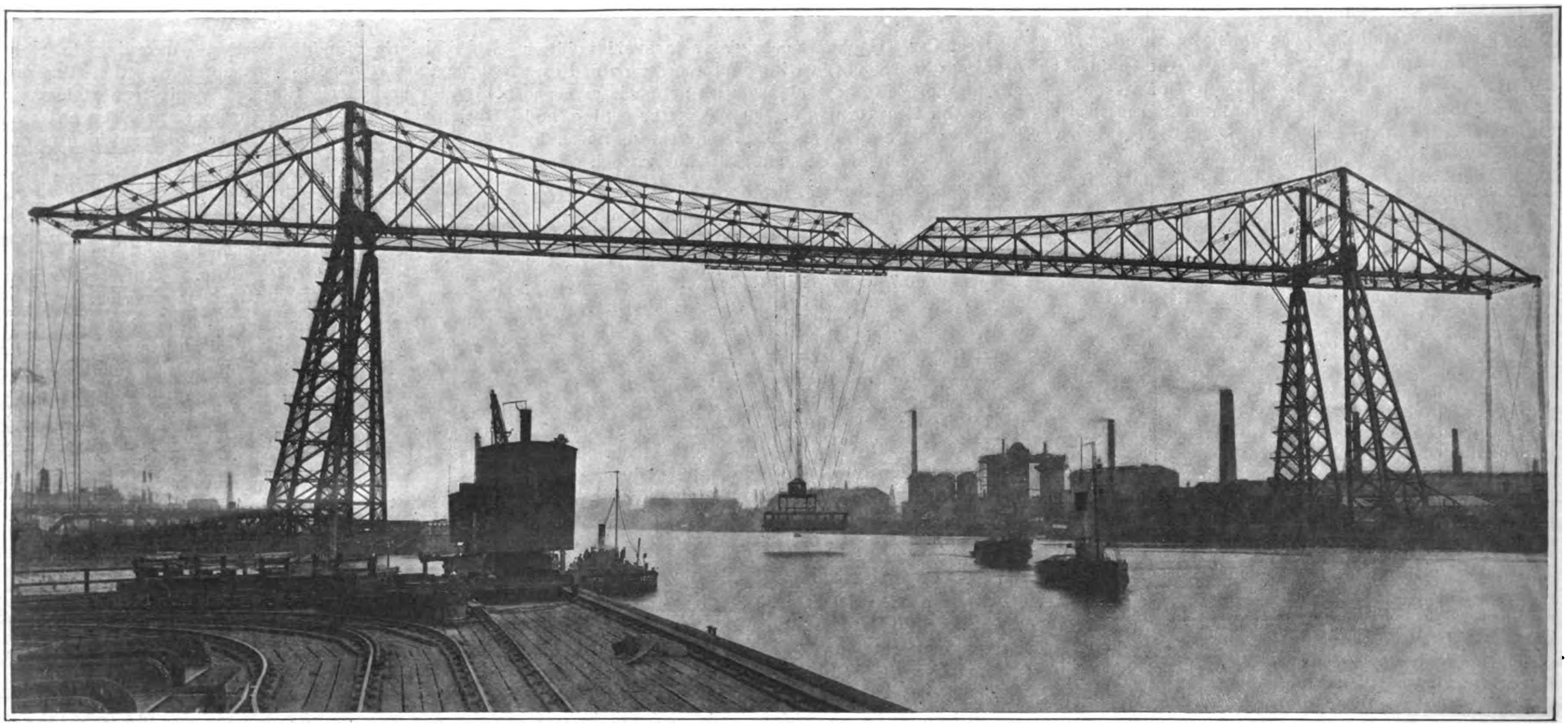


The suspended passenger car traveling across the River Tees.

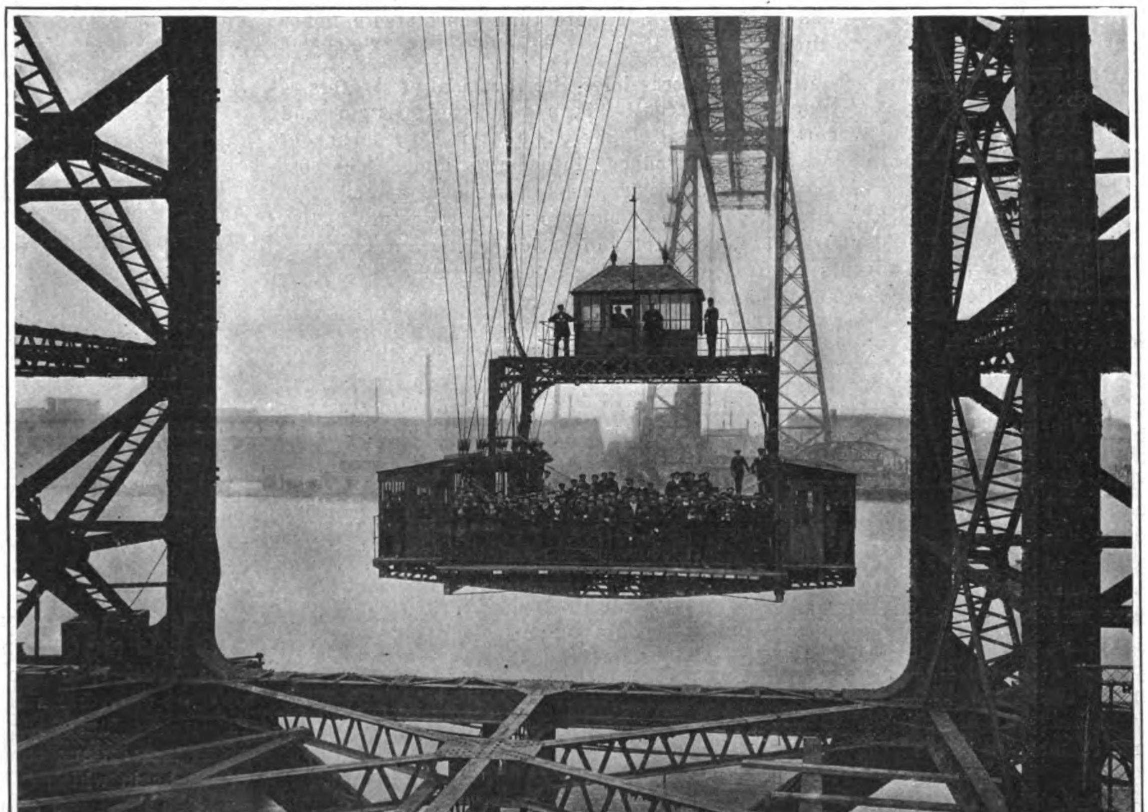
Novel Transportation Bridge in Great Britain

A Suspended Ferry

By F. C. Coleman

A NEW transporter bridge, which has been under construction for the past three years over the River Tees, one of the great industrial waterways of North-Eastern England, was formally opened for traffic by H. R. H. Prince Arthur of Connaught on October 17th. Hitherto communication between the thriving town of Middlesbrough and the industrial area on the north side of the river has been maintained by means of a municipal ferryboat service, but, during recent years, this method of transport has proved both inadequate and inconvenient. Consideration has been given at various times to projects for a tunnel under the river, a suspension bridge, an ordinary swing bridge and also a rolling lift bridge. In the case of a busy river like the Tees, it is essential that any means adopted for accommodating the cross traffic should interfere as little as possible with the conduct of the up-and-down stream traffic, and if no other objections existed there would be no doubt but that a tunnel or high-level bridge would have afforded the best means for attaining this end. But both the tunnel and the high-level bridge, independently of high cost, would have involved the difficulties of approaches and in the case of a high-level bridge, this would, in a flat district like that of Middlesbrough, form a practically insurmountable obstacle, so long as the bridge was utilized by the traffic passing over it in the ordinary way. Accordingly, in 1906, the Middlesbrough Corporation decided to replace the ferries by a transporter bridge.

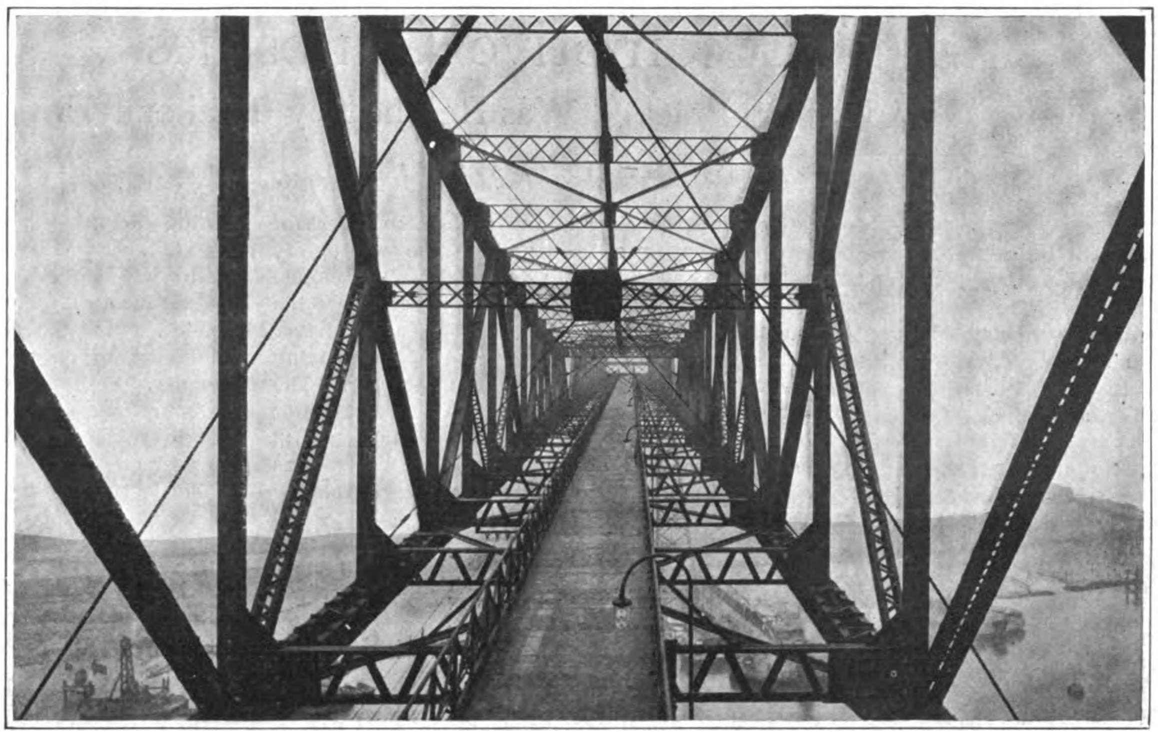
The Tees transporter bridge consists of two groups of piers erected on either bank of the river on masonry foundations and connected by a pair of lattice-type girders of 570 feet span with depths varying from 65 feet over the towers to 21 feet at the centers. The underside of these girders is 160 feet above high-water mark. The girders on the lower flange each carry two lines of rails and are placed at a distance of 35 feet from center to center. On the four lines of rails there is supported a traveling platform from which a traveling car, 44 feet by 39 feet, is suspended. This car is provided with passenger cabins on each side, and its floor is level with the roadway on each side of the river. Accommodation will be found for about 600 passengers and six road vehicles. As the upper platform travels across the high-level girders the car is carried across the river between the landing places, the hauling to and fro of the traveling platform being effected by an endless ropeway. The ends of this rope are fixed on a winch placed on the south side of the river and driven by two 60 H. P. Westinghouse motors. The journey from shore to shore will be accomplished in less than two minutes. The working of the car will, generally be controlled from the pilot house placed on the top of the passenger cabin on the suspended platform, but in case of emergency it can also be worked from the winch house, distant about 150 feet from the main tower of the bridge on the Middlesbrough side of the river. One motor will, it is anticipated, be more than sufficient to propel the car, even in the most severe gale.



Passenger car approaching the Middlesbrough side.

The main girders are of the braced cantilever type and the extremities of the main span are anchored and secured to concrete anchorage blocks on each bank of the river by 16 wire ropes embedded in concrete, each rope being capable of withstanding a breaking strain of 300 tons. Owing to the unfavorable strata the main towers on the Port Clarence side have been distanced 130 feet from the shore and approach is therefore made by a lattice girder bridge. On the Port Clarence side the foundations were carried down to 90 feet below high water of spring tide, and on the Middlesbrough side to a depth of 70 feet. The caisson foundations are filled up solidly with concrete, and 10,000 cubic yards of concrete were used in these foundations and in the retaining walls supporting the same. After the caissons had been sunk and the steel towers sunk, the erection of the main girders proceeded simultaneously toward the land arm and over the river on the cantilever system. As the steel arms from each side of the river approached one another careful measurements as to levels and line had to be taken from time to time so as to insure an exact meeting in the center. As soon as they were within 100 feet of one another, exact dimensions were taken and after due allowance had been made for the proper measurements the closing lengths of the steel work that were required to fill in the gap were completed at the contractors' works and forwarded to the site. Aided by favorable weather conditions, the 100 feet of closing lengths was erected in position in sixteen hours, the work coming together perfectly as to line and level. The temperature at the time of closing was 53 deg. Fahr. The height of the towers above high water is about 250 feet, so that the bulk of this work was carried out at a height of about 200 feet.

Spiral stairways on one of the two towers of each abutment afford access to the main platform of the bridge and this passageway is specially illustrated in one of the photographs. The total length of the bridge and approach span is 850 feet, the length of each cantilever girder overhanging on the landward side of the towers is 140 feet, and the extreme height of the bridge above high water to the top of the center of the towers (i. e., to the top of the main posts of the cantilever girders) is 225 feet. The base girders, on which the towers are built, have a length of 98 feet, a depth of 16 feet, and a weight of 163 tons. The total amount of steelwork in the bridge is 2,600 tons and there are 600 tons of steelwork in the caisson foundations. The total cost of the works and approaches, including buildings and all auxiliary work in connection with the structure, is estimated to be about $408,660.



The boulevard across the main girder of the bridge, reached by spiral stairways in the towers.

The Rabbit Problem in Australia

RABBITS are well known to be the curse of Australia; notwithstanding the fact that, according to the view of the commonwealth meterorologist, Mr. H. A. Hunt, the burrows of these animals, by keeping the ground broken up, make it more retentive of rainfall—a philosophical consideration that strongly suggests Mark Tapley. Latterly, the Australians have been trying with considerable success to turn their curse into a blessing by marketing their surplus rabbits (dressed) in European countries.

The Most Powerful European Express Engine

An Important French Locomotive Development

THE Chemin de Fer du Nord has recently introduced into service, huge "Baltic" type, four-cylinder compound superheater locomotives for operating the Nord Express, connecting Paris with Brussels, Berlin, the Baltic seaboard and St. Petersburg. This international express service ranks as the fastest train service in the world, and, with 400 tons coach load, the French engine attains 75 miles per hour, developing in the cylinders about 2,000 horse-power.

Two engines of the "Baltic" wheel arrangement have been built by the Chemin de Fer du Nord for comparative working, the only difference being that the first engine, 3.1101, is fitted with ordinary locomotive firebox and boiler, while the later engine, 3.1102, has a marine pattern water-tube firebox. This firebox was designed by the Nord company's engineers, although actually constructed at the Creusot Works of the Schneider Company. Both engines are fitted with apparatus for highly-superheated steam, and the cylinders in each engine are identical. Instead of constructing the ordinary type boiler for saturated steam and placing a water-tube boiler for superheated steam over a simple engine, the same system of compounding is here employed in both engines.

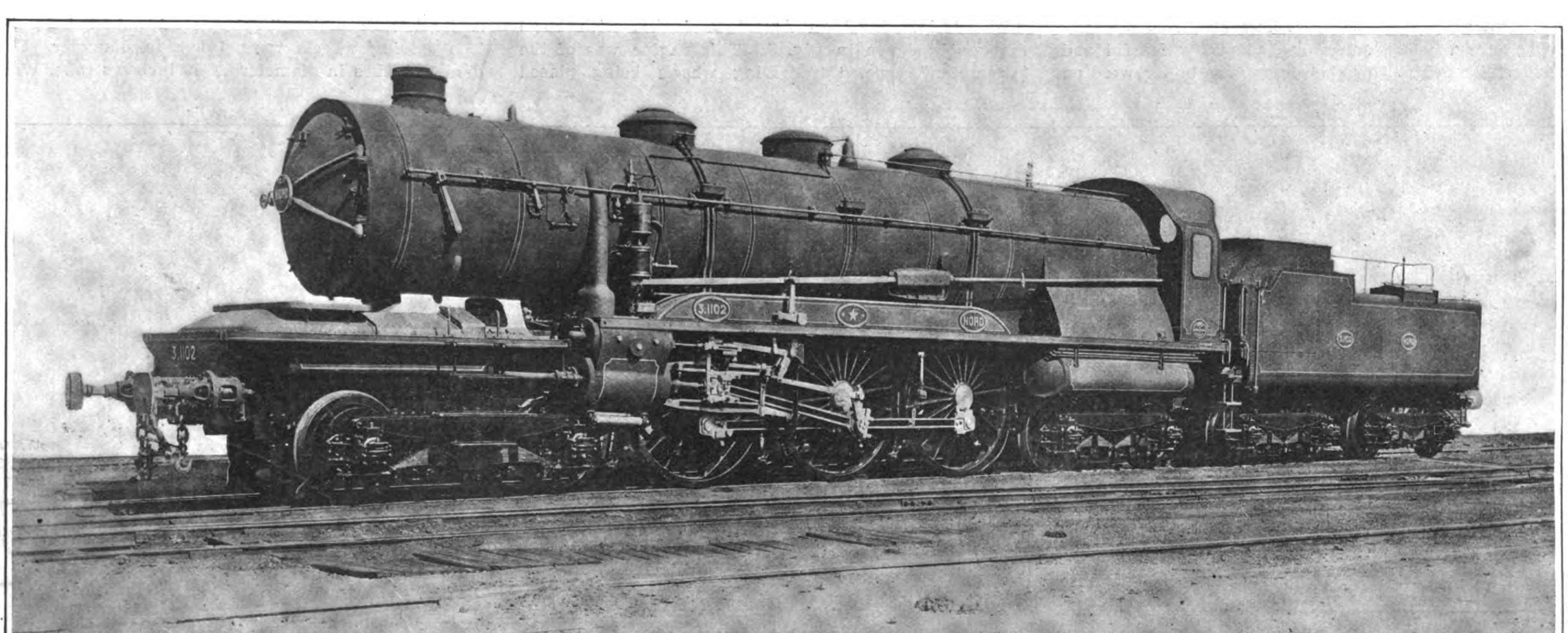
The previous largest engines in Europe are the "Pacific" type, class 10, of the Belgian State Railways, which have four cylinders, each 500 millimeters by 660 millimeters (19.68 x 25.98 inches). The new Nord engines have, however, two high-pressure cylinders, 440 millimeters (17.32 inches) by 640 millimeters (25.19 inches) and two low-pressure cylinders 620 millimeters (24.41 inches) by 730 millimeters (28.74 inches). Further, while the steam pressure in the Belgian engines is 200 pounds per square inch, the French engines carry a pressure of 227.5 pounds per square inch with direct admission from the boiler to all the cylinders whenever it is found desirable for starting.

These French engines, although very much more powerful in starting effort than the Belgian locomotives, are of the same weight, loaded and empty, as the latter, but the boilers of the Nord engines have 23 per cent more heating surface.

The chief interest in these new locomotives is the novel solution of the cylinder problem, which has, for years past, been an obstacle in the design of very powerful locomotives, the difficulty occurring when specially large cylinders are necessary, either for low-pressure saturated steam, superheated steam, or extra low pressures in one-half of a compound engine. The high-pressure cylinders are mounted outside the frames and drive on the center pair of the three sets of coupled wheels with cranks set at 90 degrees apart. The low-pressure cylinders are inside the frames and drive on the forward pair of coupled cylinders. The cranks in this case are also set at right angles to one another and each high-pressure is at 180 degrees from its corresponding low-pressure crank. One of the low-pressure cylinders is set in advance of the other, so as to get the centers of the piston rods close together. Although intended for cylinders working at 80 pounds maximum pressure, this device is applicable to any system of engine with such modification as may be desirable. The driving wheels have a diameter of 6 feet 8¼ inches and the bogie wheels a diameter of 3 feet 4½ inches. The firebox grate is 8.56 feet in length and 5.3 feet in width and the grate area is 46 square feet. The total heating surface amounts to 4,394.93 square feet, to which the water-tubes and firebox contribute 1,097.95 square feet, and the smoke tubes 2,629.6 square feet, while the superheater surface is 667.38 square feet. The boiler barrel has a diameter of 6 feet 2¾ inches. The water capacity is 1,886 gallons, and the steam capacity 690.8 gallons. The tractive force of these locomotives working compound, is 32,429 pounds, and simple 42,834 pounds.

An interesting innovation is the adoption of mechanical stokers. On the Northern Railway the express engines are served with "smalls" and "tout-venant" which, to avoid choking the fire and evolving heavy smoke, must be laid on thinly and with great frequency. Opening the fire-door frequently is injurious to the tube plate and tends to lower the temperature of the steam in the superheating pipes. With mechanical stokers these and other objections disappear, the fuel in fine powdery form may be blown into the fire-box with suitable tuyères.

In running order, the engine weighs 102 tons, of which 24 tons is on the leading bogie, 54 tons on the coupled wheels and 24 tons on the trailing bogie. The tender is of the standard Nord 8-wheels type and weighs 56½ tons, so that in working order these "Baltic" locomotives have a total weight on rails of 158½ tons.



Baltic type four-cylinder compound superheater locomotive for the "Nord Express."