TRANSPORTER BRIDGE ACROSS THE MANCHESTER SHIP CANAL.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The latest transporter bridge is now nearing completion across the Manchester ship canal in England, connecting Widnes and Runcorn on opposite banks of the river Mersey.

The structure when finished will be the largest of its type, as it will have a clear span of 1,000 feet. In design it is exactly the same as an ordinary stiffened suspension bridge, except that the approaches to the bridge are at a low level, and both vehicular and pedestrian traffic will be carried across the river in a car suspended from the bridge. The utilization of low-level approaches dispenses with the erection of costly high-level approaches, which are necessary to give admittance to the suspension bridges of the general type.

The idea of a transporter ferry bridge originated from Mr. Charles Smith, of Hartlepool (England), who suggested the construction of such a structure across the River Tees at Middlesborough over thirty years ago, but his suggestion never saw fruition.

The Runcorn and Widnes bridge, although similar in the main principles to that at Bizerta, is widely dissimilar in its general construction. The 1,000-foot span gives adequate clearance over both the river and the Manchester ship canal. The bridge is approached from both banks by an almost flat roadway at a suitable level, built between stone and concrete retaining walls right up to the water's edge. From this point over the foreshore to the base of the towers, the approach is carried upon steel elliptical girders resting upon cast-iron columns, supporting a corrugated steel flooring upon which is laid wood paving on a concrete bed. This section of the roadway is 35 feet wide between parapets with sidewalks 6 feet wide on either side.

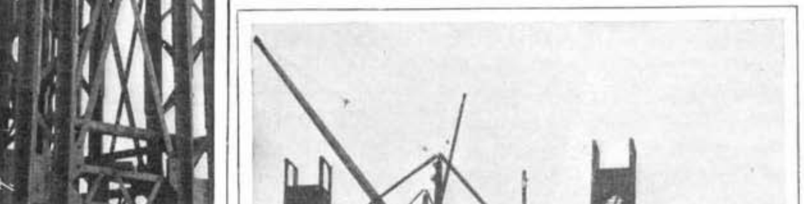
The towers which carry the cables and the stiffening girders are constructed throughout of steel, and rise to a height of 180 feet above high-water mark. There are four towers in all, two at either end, and each tower is firmly bolted to four cast-iron cylinders, each of 9 feet diameter. These caissons are firmly bolted to a solid rock foundation.

Each tower consists of four legs, 4 feet 10 inches wide at the base, tapering to a width of 2 feet 3 inches at the top, firmly and strongly braced together with strong horizontal and diagonal bracing. At the base of each tower the legs are 30 feet apart, narrowing to 6 feet 9 inches at the top landing, which is 10 feet 6 inches wide. Each pair of towers is 70 feet apart, and braced together with strong horizontal and diagonal frames. The saddles, on steel rollers, for carrying steel cables, are fixed at the top of each tower. The rollers are adapted for taking up the variations in the length of the cable due to the loads and climatic conditions.

There are two main steel cables. Each consists of nineteen steel ropes bound together, a rope being composed of 127 wires of 0.16 inch diameter, so that each cable is built of 2,413 wires. The total diameter of the cable is about 12 inches. The two cables represent a weight of 243 tons, and the wire is capable of withstanding a tensile strain of 95 tons per square inch. The interstices that are left between the wires of the ropes are filled during the process of manufacture with a bituminous compound. The ropes are laid in parallel, and when made up into the cable, the whole mass is covered with a layer of the same compound, and the whole is then incased in two layers of strong sail cloth saturated with bitumen.

The anchorages of the cable backstays are in the solid rock about 30 feet deep, with screw adjustments fixed between the anchorages and the backstays.

There are two longitudinal stiffening girders suspended from the main cables, 18 feet deep, and placed 35 feet apart horizontally. The underside of the girders will be 82 feet above the high water of the river below, thus leaving plenty of clearance for the passage of the largest vessels underneath. In the center they will be hinged so as to minimize the stress arising from the deflection from temperature, the girders rising and falling as much as 2 feet 9 inches for a range of temperature of 60 deg. F. on each side of an average temperature of 60 deg. F. In order to allow for the longitudinal expansion and contraction, a unique arrangement has been adopted. The girders are fixed to vertical rockers, which furthermore carry the overhang of the girders when the car is in the dock at the towers.



The Towers in Course of Construction. The Top of a Tower. General View of Transporter Bridge Towers on Both Banks.

THE BUILDING OF AN ENGLISH TRANSPORTER BRIDGE.

The transporter car or ferry comprises a platform 55 feet in length by 24 feet beam, suspended by steel wire ropes from the trolley above. The ropes are so hung that they prevent either side or end oscillation of the car. The latter will be of sufficient dimensions to accommodate at one time four large two-horse wagons and 300 passengers. For the convenience of the latter, and to afford protection from the weather, there is a glazed shelter, with folding doors at either end and sides. On the top of the car will be placed the engineer's cabin, containing controlling levers and switchboard, so that he will have a complete uninterrupted view of the course, and the car at all times completely under his control. Reverse and forward gearing are to be provided, so that the car can be driven in either direction as desired at a moment's notice, or if the exigencies so demand it, the engineer can stop the car very quickly by means of the brakes. The time occupied in crossing from one side of the river to the other will be about 2¼ minutes, which is equivalent to a traveling speed of about 444½ feet per minute. Including time for unloading and loading, it is anticipated that nine or ten trips per hour will be made.

The car is to be propelled by electric traction. The rails upon which the trolley is to run are fixed upon the lower flange of the stiffening girders. The trolley is 77 feet in length, and is carried upon 32 wheels, 16 on each side. It is to be propelled by two electric motors each developing 35 brake horse-power. This is more power than will be necessary for actually driving the car; but the high power has been adopted to enable any sudden emergency, such as a strong head wind against a heavy load, to be coped with, and furthermore to effect economy in working. The motors are attached to a kind of bogie arrangement in the trolley, so that in event of large curvature of the bottom boom of the stiffening girders, arising either from temperature or load, the driving wheels will still be able to secure a firm grip upon the track metals. Automatic and hand brakes are provided, and it will be possible to bring the car to a standstill, even when traveling at full speed, within its own length.

The engineers for the work are Messrs. John J. Webster, M. I. C. E., of London, and John T. Wood, M. I. C. E., of Liverpool, to whom we are indebted for the accompanying illustrations. The total cost of the structure will approximate $650,000, which is about one-third of what a high-level suspension bridge would have cost.

A series of experiments have been conducted at St. Petersburg before a number of the court officials with a new cuirass invented by an Italian named Giorgiano, which it is claimed is impenetrable to revolver bullets, and resists steel onslaughts, such as are inflicted by a sword or bayonet. The breastplate is made of soft, elastic material, is about a centimeter in thickness and weighs four pounds. The experiment included the discharge of shots at eight planks, each an inch thick, and placed one on top of the other. The shots penetrated every plank. Then a sheet of steel, two inches in thickness, was pierced by the shots. Bullets were fired from a long-range heavy Russian cavalry revolver of the Nirwan type and a heavy American pattern revolver, respectively, but in each case the shots that were fired at the breastplate failed to penetrate or even dent the inner surface of the cuirass, remaining embedded. Even explosive bullets did not damage the breastplate. Experiments were also made with a steel bayonet, a Circassian dagger, and a sword of Damascus steel. The bayonet and the dagger broke without cutting the breastplate, while the saber simply made a dent on the outside of the fabric.

South Africa contributes about 95 per cent of the world's supply of diamonds, the trade being thus controlled by the De Beers Consolidated mines, which, in the year ending June 30, 1903, recovered 2,475,802 carats, valued at £5,241,173 ($25,507,042).