in continuity of the old outfall. The manholes at both ends were then opened, the temporary timber stoppers were removed, the new outfall was then ready for the passage of the sewage.

The cost of the steel tube, which was constructed under contract by Messrs. Clayton, Son & Co., Limited, of Leeds, was £1,358, and the cost of launching, floating and laying was £592, a total cost of £1,950, or at the rate of £9 15s. per lineal yard.

Fig. 1 shows a plan and section of the new outfall tube sewer.

Fig. 2 shows the cross-section of the sewer as laid on the cradles for a length of 86 ft. seaward of the end of the old outlet.

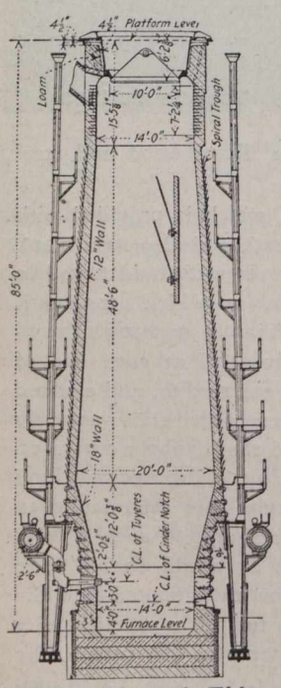
Fig. 3 shows the tube afloat, dropping down into its position on the receding tide.

The tube was manufactured and delivered on the foreshore at Blackpool by Messrs. Clayton, Son & Co., Limited, of Leeds, and the launching, floating and laying has been carried out departmentally under the author's assistant, Mr. H. Banks.

A NEW THIN-LINED BLAST FURNACE.

The construction of a blast furnace of the new thin-lined water-cooled type, which has recently been put in operation, is described in the Cleveland Iron Trade Review. This furnace was built for the Eastern Steel Co.—formerly Warwich Iron & Steel Co.—at Pottstown, Penn., by F. C. Roberts & Co., of Philadelphia. It is the third of a group of furnaces owned by the company, and is arranged to be used with the stoves and power equipment of either No. 1 or No. 2 stacks.

The stack is 85 x 20 ft. The framework, including the columns, is of wrought steel. The top platform, charging apparatus, etc., are supported independently of the furnace shell by columns resting upon the main columns which support the furnace. Platforms are provided at various levels so that all parts of the furnace casing may be readily accessible. The lower portions of the furnace columns are enclosed in cast-iron casings filled with concrete. The in-wall is cooled by water carried and distributed by a spiral trough of the Roberts type. The waste water from the tuyeres and bosh-plates is delivered by different points in the spiral trough by an electrically driven pump. This trough is connected to the furnace shell by top bolts, which do not pass through the shell, thereby avoiding the possibility of water entering the furnace around the bolts. A washer is provided around each bolt and between the trough and the shell. As a result, there is an opening between the bottom of the spiral trough and the shell which is continuous, except for the interference of the bolts.



Section Through Thin-Lined Blast Furnace.

At the lower end of the spiral trough the water is discharged into a horizontal trough which in turn is connected to the drainage system. The construction and operation of the spiral trough is such that while some of the water circulates around the spiral a large quantity passes through the openings at the bottom to the courses of the spiral trough below and continues its flow to the horizontal trough at the lower end of the spiral. In passing from one course of the spiral to that underneath, the water is in immediate contact with the furnace shell, thereby forming a thin film over all of the plates. The effect of a well-distributed spray is thereby secured with the additional advantages that the side of the spiral trough prevents the wind from interfering with the distribution of the water.

The bosh is enclosed entirely in a wrought steel casing having openings for the insertion of the bosh-plates. The construction is of the Farrell-Roberts type. The bosh-plates are held securely in position by angles on the inside and outside of the steel casing, the former angles being above and the latter below the bosh-plates. The steel casing enclosing the bosh extends downwards to a point below the top of the hearth jacket and is provided with openings for the tuyeres, cinder notch and the run of bosh-plates below the tuyeres. The hearth jacket is made of wrought steel plates which enclose a series of water-cooled cast-iron plates. Tht furnace mantel is simple in construction and a continuous wrought iron casing is provided which extends from the top of the hearth jacket to the top of the furnace. The hopper is supported by an annular ring, the construction being such that the leakage of gas around the furnace top is rendered impossible. The furnace is equipped with 10 tuyeres and two cinder notches.

The brickwork of the stock line is protected by Cook high-carbon steel plates. The downcomer is connected to the furnace top by four branches equally spaced around the furnace, each connection being provided with a vertical pipe extending 22 feet above the furnace platform and is equipped with a Roberts relief valve. In the event of a slip these valves permit the escape of gas, but prevent the discharge of ore, coke, etc. The furnace charging apparatus is of the Roberts skip hoist design connecting below with the stock transfer system, which supplies all the furnaces.

This stack has now been in operation about two months, with results entirely satisfactory.

REPAIR OF FOUNDATIONS.

The underpinning of Winchester Cathedral, England, has been necessary on account of the serious settlement and displacement of some of the walls, cracking of masonry and distortion of arches. The original foundations have footings on timber grillages resting about 10 ft. below the surface on a 3 to 7-ft. stratum of peat underlaid by water-bearing gravel with pockets of silt between it and the peat in some places. Small pits were sunk outside the footings and from them drifts about 4½ ft. wide and 20 ft. long were tunneled diagonally under the wide footings. They were kept dry by centrifugal pumps down to a depth of about 18 in. above the silt when they were allowed to fill and the remainder of the excavation down to the gravel was dug by divers in water about 10 ft. deep. Bags of cement were carefully laid on the bottom under water and cut open. When set the formed a solid floor sealing the bottom of the tunnel and enabling the latter to be pumped out and the work continued in the dry with mass concrete and cast concrete blocks built up to within 3 ft. of the overhead wall which was connected to the new footing with brick work.