

March 5, 1861.

GEORGE PARKER BIDDER, President,  
in the Chair.

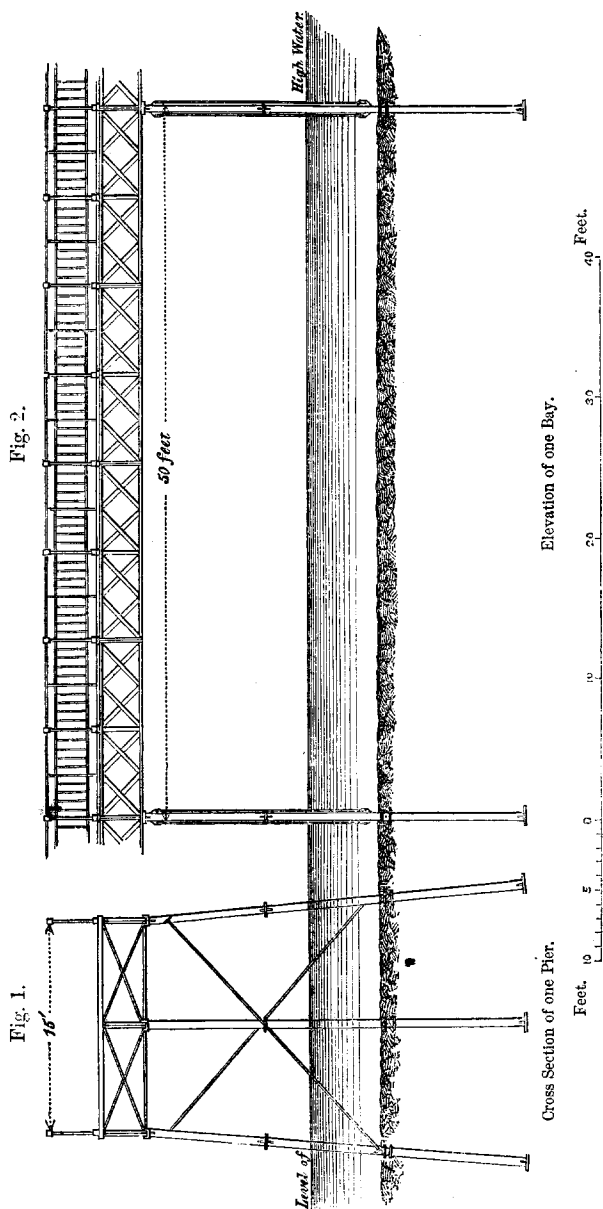
The following Candidates were balloted for and duly elected :—  
DAVID HUGHES JONES, as a Member; WILLIAM ATCHISON, JAMES  
SAMUEL COOKE, BENJAMIN PAYNE COXON, EDWARD MAGDALEN  
JOSEPH DELANEY, JOHN COCKBURN FRANCIS LEE, ROBERT  
CHARLES MAY, HENRY WYNDHAM SICH, JOSEPH SPIERS, GEORGE  
TAYLOR, and EDWARD TYER, as Associates.

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No. 1,033.—“Description of the Pier at Southport, Lancashire.”  
By HENRY HOOPER, Assoc. Inst. C.E.

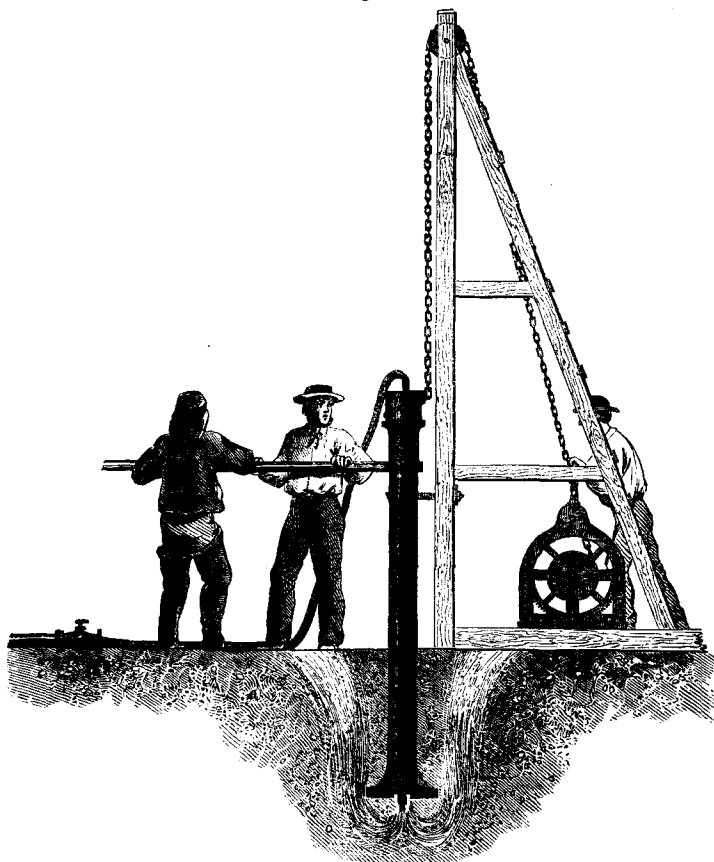
THIS pier originated with the residents of the town, who had long experienced the want of facility of access to the shore, at low water. From its great length, it has also been found of material assistance, in enabling boats to be launched for the relief of vessels passing to and from the port of Liverpool, which were, not unfrequently, driven on the sandbanks at the mouth of the River Ribble. Of the various applications of wrought and cast iron to permanent structures, in no case, probably, has a more satisfactory result been obtained, by a small outlay, than in the construction of works of a similar character to that now to be described.

Southport is situated thirty-seven miles north-west of Manchester, and twenty miles north of Liverpool, overlooking the Irish Channel, a little to the south of the mouth of the River Ribble. The pier commences at about the centre of, and is at right angles to, the line of promenade facing the sea, and it forms a continuation of Nevill Street. It is constructed on an extensive tract of sands reaching to low water, a distance of nearly a mile, the pier itself being 1,200 yards in length. The superstructure is supported upon a series of piers, (Figs. 1 and 2, page 293,) each formed by three cast-iron columns, 7 inches in external diameter, and  $5\frac{3}{4}$  inches in internal diameter, and each column, or pile, is in three lengths. The lower joint, at the top of the pile, is of the socket form, 8 inches deep, and made good, round the column, with iron cement. The two upper lengths are connected by a flange joint, turned in the lathe, and accurately fitted. The upper lengths of the columns have cast-iron bearing-plates, 1 foot 2 inches by  $6\frac{1}{2}$  inches, to receive the ends of the girders, with four holes, each 1 inch in diameter, to receive bolts for securing the girders, the holes being cast oval to allow for expansion, or contraction. The piles proper, or lowest



lengths of the columns, are cast in lengths of 8 feet and 10 feet, and are sunk into the sand, to the depth of 7 feet and 9 feet respectively. They were provided with circular discs, 1 foot 6 inches in diameter, to form a bearing surface; and, a small hole being left in the centre, a wrought-iron tube, 2 inches in diameter, was passed down the inside of the pile, and forced about 4 inches into the sand, a connection being made, by means of a flexible hose, between the top of the tube and a temporary pipe connected with the water com-

Fig. 3.



Mode of Sinking the Piles.

pany's mains, and extended as the sinking of the piles proceeded. (Fig. 3.) A pressure of water of about 50 lbs. per inch was thus obtained, and this was found to be sufficient to force the sand from

under the disc. Each disc was provided, on the lower side, with cutters, which, on an alternating motion being given to the pile, loosened the sand. The piles were gradually lowered, and guided by a small ordinary piling machine. When the pressure of water had been removed about five minutes, the piles settled down to so firm a bearing, that when tested with a load of 12 tons each, no signs of settlement could be perceived. The piers are braced transversely by means of diagonal tie rods,  $1\frac{1}{4}$  inch in diameter, extending from the level of the sands to the under side of the girders, and crossing at and being bolted to the flange joint of the middle column. To break the continuity of the whole structure, and to give stability in the direction of its length, double piers are introduced at three points, thus giving an opportunity of projecting angle-iron brackets, to support seats, clear of the general width of the footway.

The superstructure is 15 feet wide on the footway between the handrails, and it consists of a triple row of longitudinal lattice girders, 50 feet in length and 3 feet in depth, having a bearing, in the clear, of 48 feet 10 inches. The footway is formed of spruce deals, 7 inches by 3 inches in section, laid transversely with spaces of 1 inch for the passage of the wind from the under side, and to prevent the lodgment of water on the upper surface. Each plank is bolted down to the girders by six cup-headed bolts,  $\frac{3}{8}$ ths of an inch in diameter, the two ends beyond the outside girders being finished with a half-round nosing piece, 3 inches deep. The centre girder having to perform double the duty of each of the outside girders, extra strength was given to it, by the addition of top and bottom plates.

The scantling of iron used in the girders was as follows:—

#### Outside and Inside Girders:—

	Inch.	Inch.	Inch.
The two angle-irons at the top and bottom, each . . . . .	$3\frac{1}{2}$	by 3	by $\frac{3}{8}$
The vertical T-irons . . . . .	4	by $2\frac{1}{2}$	by $\frac{3}{8}$
The lattice bars, at the ends . . . . .	$2\frac{1}{2}$	by $\frac{1}{2}$	
Ditto, at the middle . . . . .	$2\frac{1}{4}$	by $\frac{1}{2}$	

#### Inside Girders:—

The top plate of the middle girder . . . . .	9	by $\frac{1}{4}$
The bottom ditto . . . . .	$6\frac{1}{2}$	by $\frac{3}{8}$

The weight of wrought iron in one bay of the pier, or in a span of 50 feet, is 4 tons, 5 cwt., 4 lbs.

The weight of cast iron in each bay of the pier, is 1 ton, 17 cwt., 3 lbs.

		Cwt.	Qrs.	Lbs.
The weights of the 8-feet piles are	.	3	2	12
Ditto	10-feet ditto	4	1	7

The second bay from the shore end was tested by a load of 35 tons, equally distributed, when the mean deflection of the three girders, in twenty-four hours, was  $1\frac{1}{2}$  inch, and there was a permanent set of half an inch, on the load being removed.

The pitch of the rivets used between the plates and the angle-irons, was 5 inches. Each set of girders was stiffened transversely at each end, and in the middle, by diagonal bracing of angle-iron, with a T-iron purlin at the foot, 4 inches by  $2\frac{1}{2}$  inches and  $\frac{3}{4}$ ths of an inch thick, the purlin alone being used in the two intermediate spaces. The bracing and the purlins were riveted to the girders, by rivets  $\frac{5}{8}$ ths of an inch in diameter. At the sea end of the pier, there is an oblong platform, 100 feet long and 32 feet wide, at right angles to the line of footway. Two light staircases, 5 feet wide, with open cast-iron treads 11 inches wide, and risers 7 inches deep, supported on wrought-iron raking lattice girders 2 feet 6 inches in depth, securely braced, afford access to the sands at low water, and to boats at other states of the tide.

The hand-rail is formed by cast-iron hollow standards, tapering upwards from 3 inches to  $2\frac{1}{2}$  inches in external diameter, the thickness of metal being  $\frac{3}{8}$ ths of an inch. They are bolted to the girders at intervals of 6 feet 3 inches, from centre to centre, with four bolts, each  $\frac{1}{2}$  an inch in diameter. The spaces are filled in with light wrought-iron flakes, consisting of two horizontal bars,  $1\frac{1}{8}$ th inch by  $\frac{5}{16}$ ths of an inch in section, and vertical rods of round iron,  $\frac{3}{8}$ ths of an inch in diameter, placed at intervals of 6 inches. The top rail is formed of T-iron 2 inches by 2 inches by  $\frac{1}{4}$ th of an inch thick, surmounted by a rounded capping of red deal, 4 inches by  $1\frac{1}{2}$  inch in section, screwed on the under side of the top web of the T-iron.

The whole of the cast-iron work in the columns and piles was boiled, for one hour, in a composition of tar and asphalte; and the wrought-iron work and cast-iron standards for the hand-rail were painted with one coat of red lead, when put together, and with two coats of stone colour, when erected. The deals forming the footway were dipped in boiling coal tar, and well sanded on the surface.

The advantages claimed for this mode of construction are :—  
1st. Great economy in the first cost, especially in sinking the piles. By taking advantage of the pressure of water supplied by the water company, the cost was reduced to four pence halfpenny per foot; whereas in the case of the viaducts over the Rivers

Leven and Kent, in Morecambe Bay,<sup>1</sup> two pontoons were used, each supplied with a donkey engine of 2 H.P. to afford the necessary pressure of water, and the cost amounted to two shillings and sixpence per foot.

2nd. The very small resistance offered by any of its parts to the action of the wind and waves, from which cause not the slightest vibration is felt, while works in the vicinity, of a much heavier character, have been destroyed.

3rd. Similarity of parts, thus reducing the cost of manufacture to a minimum.

4th. The expeditious manner of obtaining a solid foundation ;—an important point in tidal work. All the piles, to the number of two hundred and thirty-seven, were sunk in six weeks, being at the rate of between six and seven in twenty-four hours.

The estimated cost of the pier was £10,400. It has been completed for £9,319, being at the rate of £7. 15s. 4d. per lineal yard, including a toll house, two registering turnstiles for ingress and egress, one pair of foot gates 9 feet wide, the formation of approaches from the promenade, and the enlarged platform at the sea end.

The design was furnished by Mr. Brunlees, (M. Inst. C.E.,) and the superintendence of the construction was intrusted to the Author, as Resident Engineer ; Messrs. Galloway, of Manchester, were the Contractors.

The Paper is illustrated by a series of diagrams, from which the woodcuts, (Figs. 1 to 3,) have been compiled.

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<sup>1</sup> *Vide* Minutes of Proceedings Inst. C.E., vol. xvii. p. 442.