

IX.—*Account of the Gravesend Pier.*

By WILLIAM TIERNEY CLARK, F.R.S., M. Inst. C. E.

PREVIOUS to the introduction of steam packets on the River Thames, Gravesend was a place of resort for many persons from London in the summer months; the passage by the sailing packets, or tilt boats, as they were anciently called, presented an agreeable but uncertain conveyance. This transit was never attempted except with the tide, and frequently the passengers, being becalmed, were compelled to land at some place short of the vessel's destination, or to remain on board until the following tide; and it was not uncommon to be detained on the water throughout the night, especially when the journey commenced after mid-day. These sailing packets were of a burthen varying from 15 to 35 tons, and were capable of carrying from 60 to 100 passengers. A coach, called a tide coach, awaited the arrival and departure of the packets, for the convenience of those who resided at Rochester, or other places in the immediate vicinity of Gravesend. At the period referred to (1820) the population of Gravesend and the adjoining place, called Milton, was under 5000; and the visitors were chiefly of the lower classes of society. These packets either drew too much water, or it was considered inexpedient to allow them to lie alongside the jetty; and, consequently, in order to embark or disembark, the passenger had to hire a small boat or wherry to convey him between the shore and the packet, for which each person paid sixpence, although the distance would not exceed from ten to twenty yards, and although the same wherry would convey eight persons. The passage between Gravesend and London generally occupied from five to six hours, because, though a fair and fresh wind might have carried the vessel the whole distance in three hours, these favourable circumstances were invariably made the cause of delay in starting, in order to get a larger number of passengers, or, in the words of those days, "a good tide;" the whole object of the Captain (who was also generally part owner) being to reach the terminus by the time the tide was exhausted. When a steam vessel first came to Gravesend the attempt was made to lay her alongside the jetty, so that the passengers

might walk in and out; but this attack upon vested rights was so stoutly resisted by certain parties, that the owners of the packet soon made an unconditional surrender; and the watermen, seeing that their easy earnings had been placed in jeopardy, reduced their fare between the shore and packet to fourpence each person. The trip to and from Gravesend, however, being rendered certain by the steam packet, the resort to the place gradually increased, and at length, in the year 1830, in consequence of continued remonstrances by the visitors against being compelled to use the wherry boats, and a general demand for a pier, a public meeting of the inhabitants was called by the Mayor, to consider the propriety of erecting one. In the notice for convening the meeting, however, the Mayor thought it expedient to disclaim giving any judgment of his own, and to throw out a suggestion that, provided the pier should be built, compensation should be made to the watermen. The meeting was fully attended; but most of the persons who signed the requisition either were absent, or became at the moment opposed to the erection of a pier, and the measure was consequently condemned; for not more than four or five inhabitants were bold enough to declare their real sentiments, among whom was the then Town-clerk, who, for his temerity, was dragged from the Town Hall, and assaulted by the mob.

Notwithstanding this discouragement, a meeting of proprietors of the steam-packet companies was convened early in 1831, to express their opinion upon the utility of a pier; and although individual interest very much encouraged the hope of success, intimidation and prejudice prevailed to such an extent, that the steam-packet proprietors declared that a pier would be injurious to their establishment.

Public opinion, however, pressing closely, the municipal authorities of Gravesend, in 1832, applied to the legislature for authority to erect a pier. Perhaps a greater parliamentary contest on a subject of local improvement never occurred; nor were stronger feelings and interests ever called forth. The promoters of the Bill had opposed to them many of the inhabitants, as well as the watermen; who, with the mariners generally, declared the proposed plan to be impracticable, on account of the obstruction to the navigation, and as tending to impede the supplies for the London coal and fish-markets. The leading argument of the opponents of the plan was, that, as it was proposed to carry out the new pier to a considerable extent beyond the existing quay and jetty, the flow of the tide would be obstructed thereby in a much greater

degree than by the old jetty with its numerous arches. This was, however, met on the other side, by proof that there was a much greater extent of opposing surface in the old jetty than in the proposed pier, although the latter was to extend 40 feet beyond the lowest point of the jetty. Some of the authorities, also, connected with the conservancy of the Thames, took active measures of opposition; and, finally, at the close of the session, after powerful struggles and divisions in every stage, and an expenditure of a large sum of money, the Bill was lost in the House of Lords by a majority of one.

The struggle in Parliament, however, had called up the notice of the public, and even of the Ministry: and in consequence of some particular features in the report of the Lords' Committee, the Duke of Richmond, then one of the Cabinet, prevailed on their Lordships to recommit the Bill. But, after a second expensive struggle in the Committee, it met with a similar fate, and was consequently lost.

The contest, however, was not without its advantages, for, in the course of the investigation, the authorities of Gravesend became not only confirmed in the propriety of their conduct, but received so much public encouragement, that they determined, during the recess, to erect a temporary pier, and to shew to Parliament, in the ensuing session, not only the practicability of the proposed pier without injury to the navigation, but also the local as well as public benefit which would follow such a measure.

Accordingly a wooden pier was speedily constructed, and immediately produced such manifest advantages to the inhabitants, by more than doubling the resort to the town, that converts to such an improved landing were daily made, and those steam packets which did not use the pier had but few passengers. The watermen and their families (calculated at 1500 persons) were in the greatest excitement; and though they menaced several of the parties engaged in the pier, they refrained from acts of open violence, in the full conviction that Parliament or the Admiralty, in the following session, would either suppress the pier, or that, during the winter, one of those misfortunes (predicted by them) of ships striking against it and lives being lost, would effectually and for ever remove it. The expectations of many persons were greatly raised by the fact of the *United Kingdom*, of 400 tons burthen, being totally wrecked in the month of January 1833, at Northfleet, about two miles to the west of the pier, and being for three days carried by the tide up and down the river between Northfleet and the east end of Gravesend; but, contrary to all expect-

tation, the pier sustained no injury; and thus was the fact fully established that, so far as the ebb and flood tides were concerned, the pier projection was no impediment to the navigation.

In 1833, a Bill was again brought into Parliament, and again opposed; but at length, upon the Committee in the Commons passing the Bill, the watermen, aided by several of the inhabitants, proceeded in the night to destroy the pier, which they effectually did, after extinguishing the lights in the town, by cutting away with saws and hatchets, the piles that supported the platform. Such was the violence and menace used, that the civil authorities were utterly unable to put a stop to the destruction of property, or to preserve the peace of the town; and the presence of the military from Tilbury Fort, the Rifle Brigade from Chatham, and the Cobham Yeomanry were found necessary for several weeks, whilst the pier was repaired and order restored.

By this act of violence the opponents of the pier lost much of their Parliamentary support; and the Duke of Buccleuch, the Lords Salisbury, Strangford, Faversham, and Wynford, with many others who had opposed the Bill, now gave it their support, and ultimately the Act passed, in June 1833; and on the 29th of July of the following year, within 13 months afterwards, the present pier was opened to the public.

The advantages to Gravesend consequent on this event have been immense, and very far exceed the calculations upon which the claim for a pier were founded. The resident population is now more than 17,000, and in the summer season it exceeds 20,000. The buildings have increased in the like proportion, and the coaches between Rochester, Maidstone, &c. and Gravesend, attending the arrival and departure of the steam packets, average forty daily throughout the year.

The residents and visitors each month are found to be gradually increasing, whilst the latter are no longer confined to the mechanic and artisan, but they consist of all classes of society, and thus become a source of wealth and prosperity to Gravesend and the adjacent district of Milton, and afford great gratification to all who had to endure the labour and trouble of obtaining for the town its present pier; whilst the public, instead of paying sixpence each for the compulsory use of a small, inconvenient, not to say dangerous landing wherry, pay but threepence toll for a safe and commodious pier, which payment of toll is included in the fare of the steam-packets.

The following statement of the numbers of passengers landing and em-

barking at Gravesend for the last ten years, will prove the rapid and perhaps unparalleled increase, caused by the combined advantages offered by steam navigation and a commodious pier:—

1829	. .	122,880	} Before a pier was erected.
1830	. .	225,600	
1831	. .	237,600	
1832	}	. . 479,280	
1833			
1834	. .	313,896	
1835	. .	809,169	} Since the pier has been erected.
1836	. .	834,803	
1837	. .	784,763	
1838	. .	872,721*	
1839	. .	1,005,430*	

GENERAL DESCRIPTION OF THE PIER.

The nature of the communication betwixt the quay and the water, previous to the erection of the pier which forms the subject of the present communication, will be fully understood from the plans and sections (Plate I.) Stairs descended from the quay wall, and from the bottom of the stairs a jetty extended to the low-water line of spring tides, or to a distance of about 116 feet from the front of the quay wall. The pier extends to a distance of 161 feet from the front of the quay wall, at which distance there is a depth of about 6 feet at low-water spring tides, and of 27 feet at high-water spring tides.

The centre line of the pier is represented by the line A B b, and the nature of the site and the extent of the erection will be seen at once from the general plan and longitudinal section of the foundations (Plate I.) The ground upon which the pier was to be founded was very limited, and the existing quay was to form part of the new pier. Also a separate jetty and stairs were to be provided for the use of the watermen. The general arrangements by which these objects were effected, are shewn by the elevation and general plan of the quay and pier (Plate II.) The pier consists of two parts, the promenade and the T head. The promenade, or part of the pier between the T head and quay is

* These numbers for 1838 and 1839 may not be strictly correct, but they are derived from the best sources of information that could be obtained.

127 feet in length, and 39 feet 6 inches in breadth, and supported by four arches resting on columns, as will be described hereafter. The T head, so called from its shape, on the extreme or northern end of the pier, is 29 feet 7 inches in width, and 73 feet in frontage to the river. It is supported on eighteen cast-iron columns. The descent to the stairs for embarking and disembarking from the vessels, is in the centre of the extreme end of the pier (Plate III.)

Watermen's Causeway. The causeway at which the watermen land at all states of the tide is 111 feet 6 inches in length, and 12 feet 5 inches in breadth, supported on seven cast-iron frames resting on separate foundations, and on transverse bearing beams attached to the cast-iron columns which support the promenade, four of which are provided with bracketed flanches for this purpose. The ground being excavated to a sufficient depth to secure a good foundation, an entire course of 3-inch York paving-stone, well bedded in mortar, and set quite level, was laid, holes having been previously cut through the stones for receiving the hold-down bolts; upon this the brickwork was laid, capped with Bramley Fall stone, 18 inches wide and 12 inches thick, with holes for the hold-down bolts to secure the frames which support the causeway. The end of the causeway near the quay wall, and the steps up to the quay, are supported on three similar foundations of brickwork parallel to each other, the intermediate spaces being filled up with concrete (Plate I.)

The cast-iron frames are firmly secured down to the brick and stone-work by four iron bolts, passing through the foundations, and the transverse beams are fitted endways between the columns, and screwed down to the flanches by 1-inch screw-bolts and nuts; longitudinal fenders of oak timber, 9 inches square, are fixed at the outside corners of the frames, and to the transverse pieces between the columns by 1-inch screw-bolts and nuts; between these longitudinal fenders are three cast-iron beams, each of which rests with one end on one half of the transverse beams between the columns, and is supported at the other end and at intermediate points on the frames, and securely fixed by dovetail keys. The whole is covered with 4-inch York paving.

Foundations of columns of Promenade. The promenade rests on cast-iron ribs forming four arches, supported by iron columns on brick and stone foundations (Plates I. & II.) The ground being excavated to a good and sound bottom, the entire surface of the excavation is laid with Bramley Fall rag-stone, dressed 9 inches in thickness, and no stone less than 4 feet square, set level in every direction, and well bedded in mortar. The stones are pierced with holes 4 inches square, for

receiving the hold-down bolts, each of which is provided with a cast-iron plate 15 inches square, well bedded to the under side of the stone. The brickwork being carried up to the proper height, is capped with two Bramley Fall stones, each 5 feet 9 inches square and 2 feet thick. Holes are also bored through these, the vertical spaces left in the brickwork being made to correspond with the holes in the lower stones, and great care was taken in setting out the holes and keeping the bolts in a perpendicular direction, and so wide as to correspond accurately with the centre of the bolt-holes in the bottom of the columns.

The sum to be expended by the Corporation on the new pier, was not sufficient to admit of the use of caissons or a coffer-dam, and the obstruction which they would have caused to the navigation was an additional objection to their use. Recourse was consequently had to a more simple mode, which has proved from experience equally advantageous and far less expensive, and which, it is believed, was never before practised. The complete success of the method, and the great advantages which may attend its adoption in particular cases, will be seen from the following account.

Foundations of
T head. The columns of the T head are supported on fifty-four cast-iron piles, each column being supported on three piles. The stratum into which the piles are driven, consists chiefly of chalk, and as it was of the greatest importance that this part of the work should be executed with accuracy, in order that the centres of the piles, when driven, should correspond with the centre of the holes in the flanches at the bottom of the columns, the following precautions were adopted. A large platform of whole timbers was formed in length, breadth, and dimensions, as shewn in the plan (Plate I.), and well secured by 1-inch screw-bolts and nuts. Upon this, was accurately set out the distances between the centre of each column forming the T head of the pier. Plates of cast-iron $1\frac{1}{2}$ inch thick, eighteen in number, and each having three circular holes, $17\frac{1}{2}$ inches diameter, called guide-plates, were then screwed down in their proper situations upon the platform; the centres of the holes in each plate being adjusted so as to correspond exactly with the centre of the site for each pile.

The platform was then floated out and secured by moorings in its proper place, at the level of low-water spring tides, until four piles were driven, one at each corner, for securing it more permanently.

This being done, a cast-iron shell was introduced perpendicularly into one of the three holes of the guide-plates, and driven through the mud into the chalk below. An auger was then inserted, varying from nine to ten inches in

diameter, according to the density of the chalk, and the boring was proceeded with to within one foot of the length of the pile intended to be used. The depth of the boring varied according to the length of the piles, and other circumstances; the pile was then introduced through the shell into the bored hole, and driven down to within two or three feet of the top of the shell, when the shell was drawn up, and the pile driven down by means of a hard wooden dolly, made to fit the top of the piles, and upon which the monkey of the pile-engine acted. The greater portion of the piles for the T head were driven in this manner under water, in consequence of the prevailing wind during the months of February, March, and April, being easterly, which prevented the tide ebbing out to its usual extent, so that the platform and piles were seldom seen except when the wind shifted to the west, and oftentimes when it did it was for so short a period, that little could be done before the return of the flood. Under these circumstances, as it was evident that if favourable winds were waited for much time would be lost, it was determined to remove the platform. This having been removed, a wooden cylinder, 9 feet diameter, and 9 feet long, was made of 3-inch deal battens, firmly keyed and hooped together, the lower end being shaped like a sheet pile, and shod with iron. This cylinder was lowered over one set of three piles, and loaded sufficiently to cause it to sink through the soft mud of the shore, when it was driven into the hard ground. The water was then pumped out, and the mud removed low enough to enable the workmen to reduce the heads of the piles to a uniform level by chipping, so that the bases of the columns were fitted down to the tops of the piles metal and metal, and this operation was repeated as often as required. But the piles were found to have been driven with such accuracy, that not more than six required chipping, and the greatest variation did not exceed $\frac{3}{4}$ of an inch.

Adjusting Plate
and Columns. When the pile heads of each set were adjusted, a cast-iron plate, connecting the three piles together, called the adjusting plate, was firmly keyed on immediately below the top of the piles (Plate IV.) The columns were then fitted down to the adjusting plate by $2\frac{1}{2}$ -inch screw-bolts through flanches at the bottom. The holes in these flanches were a little elongated, so as to allow of the columns being slightly shifted and fixed in their true position (Plate IV.) Upon the columns rest the deep bearing-beams which support the superstructure. These bearing-beams are screwed together at the corners by $1\frac{1}{2}$ -inch screw bolts, and fastened by bracket flanches to the capitals of the

columns; on their upper sides are flanches on which the flooring of the T head is laid. The columns of the T head are tied together at about one-third of their height, by timbers fastened to bracketted flanches on the columns. On these timbers are supported the frames for the stairs in the T head. The details of the adjusting Plate, the columns, the deep bearing-pieces, and the stairs, are fully shewn in the accompanying Plates.

Arches of Promenade. Upon each of the columns of the promenade rests a cast-iron rib 40 feet in length; each arch is composed of two of these ribs, secured together at the centre by $1\frac{1}{2}$ -inch screw bolts and nuts. The whole structure consists of four such arches, kept apart at their proper distances by means of distance pieces (Plate VI.), nicely fitted to the ribs, and secured by $1\frac{1}{2}$ -inch screw bolts. The ends of the ribs next the quay are secured by means of a square flanchèd piece built into the wall, and by hold-down bolts; four horizontal and vertical holes being made through the springing of the land arch, for this purpose. The ribs at the other end of the promenade, form part of the T head, as well as one-half of the arch, and are secured to the columns and deep bearing-beams. The different portions of the iron-work of the arches, and superstructure of the T head, were fitted together in a temporary manner at the iron-foundry, and when it came to be fixed upon the columns, scarcely any chipping was found necessary; indeed, many of the holes in the capitals of the columns were drilled from the dimensions of the working drawings, and found to correspond with the holes in the flanches of the deep open beams.

Floorings, Stairs, and Superstructure. The top edge of the arches of the deep bearing-beams of the T head being perfectly level, the wooden flooring-beams were laid on the flanches, and screwed down by 1-inch screw bolts. The stairs of the T head are supported in iron frames resting on the two pieces fixed to the flanches on the columns. Oak steps are laid on the flanches of these frames, and screwed down with $\frac{5}{8}$ -inch counter-sunk bolts and screws. The bottom and top of these iron frames are secured to their respective bearing-timbers, and to the side of the columns.

The promenade and T head are surrounded by a cast-iron fence, the small pillars of which are half an inch in thickness, and the longer pedestals $\frac{5}{8}$ ths of an inch, all having flanches at the bottom for fixing them perpendicularly and true, one with the other, in every direction, by means of $\frac{3}{4}$ -inch screw bolts and nuts. Through the small pillars are cast 3 holes 3 inches deep, and $\frac{5}{8}$ ths of an inch wide, to admit the horizontal fence-bars of wrought-iron to

pass at the back of the diagonal braces, which, as well as the handrail, are of Memel timber. The awnings at the east and west ends of the T heads, are supported by six ornamental columns, each an entire casting $\frac{7}{8}$ ths of an inch thick, and screwed down by eight $1\frac{1}{8}$ -inch screw bolts and nuts.

The bearing-timbers forming part of the cornice round the exterior and interior of the T head, and on each side of the promenade, over the arches to the quay wall, are .6 inches deep and 12 inches wide. These timbers are secured to the cast-iron work with $\frac{7}{8}$ -inch screw bolts and nuts passing through the cast-iron flanches for fixing the cornice. From the centre of the T head to the termination of the promenade, run longitudinally five bearing-timbers, secured nine inches into the quay wall, and to their respective flanches by $\frac{7}{8}$ screw bolts and nuts. The whole area of the promenade, and of the T head, is then covered with 4-inch Memel plank, in proper lengths for breaking joint; a plank at every ten feet apart extending the entire width of the promenade.

The framing of the roofs of the awnings and the turrets are shewn in the drawing (Plate VI.); the acroteria forming the ornaments or tiles at the top of the cornice are of cast-iron, and firmly screwed to the cornice. The roofs of the awnings and turrets are covered with copper 16 oz. to the foot.

Lighthouse. Long after the plans had been matured, and the castings made, it was determined to have a cast-iron column to exhibit a night-light (Plate III.) This column is situated at the centre of the pier on the line of juncture of the promenade with the T head. It is 30 feet in height, 3 feet in diameter at the bottom, and 2 feet 6 inches diameter at the top. It has a staircase in the centre, and was cast in three pieces. The lantern is glazed with red glass, and lighted by gas.

DESCRIPTION OF THE PLATES.

PLATE I.

A general plan of the approaches and site previous to the erection of the pier, shewing the town-wall and quay; the stairs and bridge, or jetty, leading down to the river; quoting the distances from the town and quay wall, and the depths of water at different points, at low-water of spring-tides.

Sections on different lines of the plan, shewing the levels and depths of soil and water with reference to low-water spring-tides.

Scales, shewing the rise of the tide at Gravesend pier, and at the entrance lock of the Thames and Medway Canal.

A general plan of the foundations of the new Pier; shewing the foundations next to the quay-wall, and the bolt-holes for fastening the frame-work to carry the steps leading from the watermen's causeway to the quay. Also the seven other foundations for the iron framings which support the causeway. On the first foundation wall is shewn in section the iron framing; the others only shew the bolt-holes. The foundations of the columns of the promenade. The frame-work for fixing the piles, the guide-plates being shewn on one half, and the piles on the other half. The longitudinal section of the foundations, and a section of the columns and piles, and the temporary frame-work.

PLATE II.

Side elevation and general plan of the pier.

Side and end elevation, and plan and dimensions of the half ribs which form the tie with the quay-wall. This is bolted down to the foundation-plate in the quay-wall by vertical and horizontal bolts (*see* p. 253), the former of which is shewn at the end of the flanch in the elevation.

Elevation of the half rib, forming part of T head. At A, B, C, are the distance pieces, the details of which are given in Plate V. At A is shewn the union of two ribs at the centre, the bolts passing through the transverse pieces. At D is the end of the deep-bearing beam of the T head.

Elevation of a half rib and column of the promenade, shewing the bolts of the distance pieces.

PLATE III.

The river front.

PLATE IV.

Details of the columns, piles, guide plates and adjusting plates, with the dimensions.

Details of the deep-bearing beams, forming the T head. The situation of these in the plan of the structure is shewn by A, B, C, in Plate VI.

Details of the steps at T head. The columns on the plan of the steps, marked *e*, *d*, *g*, *k*, are those referred to by the same letters in Plates V. and VI.

PLATE V.

Details of the distance pieces, the situations of which are shewn by the letters A, B, C, Plate II.

Details of caps of columns and deep-bearing beams of T head. The columns *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *k*, are those shewn by the same letters in the plan on Plate VI. The column *k* being the lamp column, Plate III. The column *i* is not shewn on the plan Plate VI. but is one of the columns of the promenade, these being all alike. The columns in the other half of the T head occupy the same relative positions as those here described.

PLATE VI.

Elevation of the awnings, or pavilions and turrets, and details of the wood-work of the superstructure.

Plan of T head; one half shewing the manner of fastening the iron bearing beams to the caps of the columns, and the other half the plan of the timbers of the floor resting upon the iron beams. A, B, C, are the positions of the bearing-pieces, the details of which are shewn on Plate IV.; and *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *k*, the positions of the columns, the details of which are given in Plate V.

GRAVESEND PIER.

W. TIERNEY CLARK.

RISE OF TIDE AS TAKEN AT GRAVESEND PIER,
18th February 1832.

High Water Mark	17 th February.	18 th Feb ^y 1832.
20.0	2 O'Clock	17 Minutes
20.3	2	1
18.9	1	48
16.8	1	33
14.8	1	18
13.7	1	2
12.0	12	37
10.5	12	12
8.10	11	50
7.4	11	30
5.6	11	10
4.2	10	58
2.6	10	30

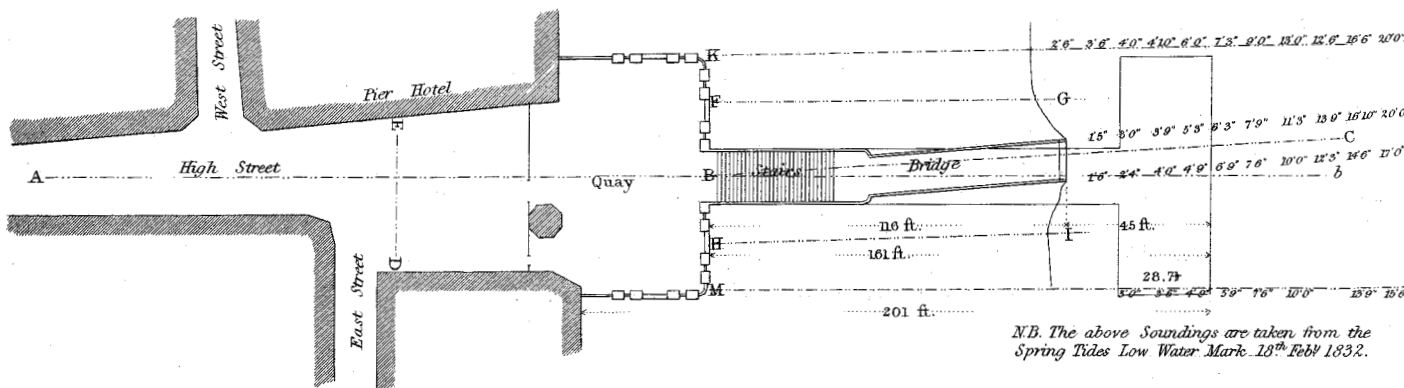
Low Water Mark 18 Feb^y 1832.

N.B. The above Soundings are taken from the Spring Tides Low Water Mark 18th Feb^y 1832.

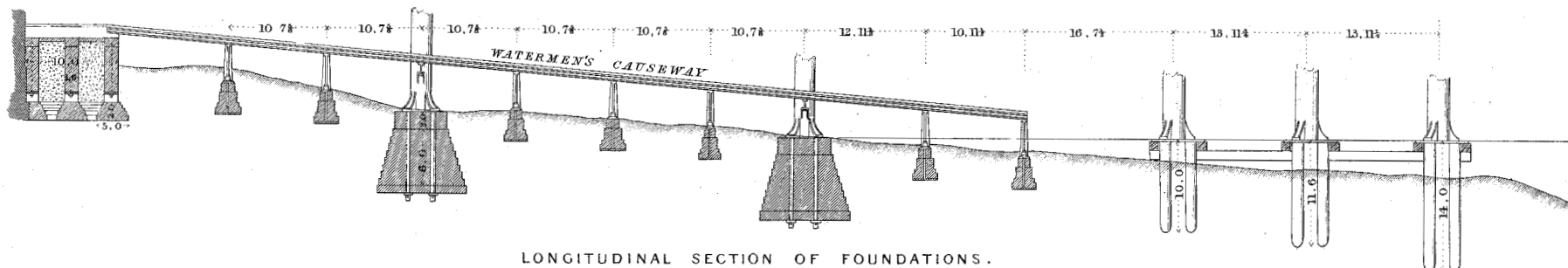
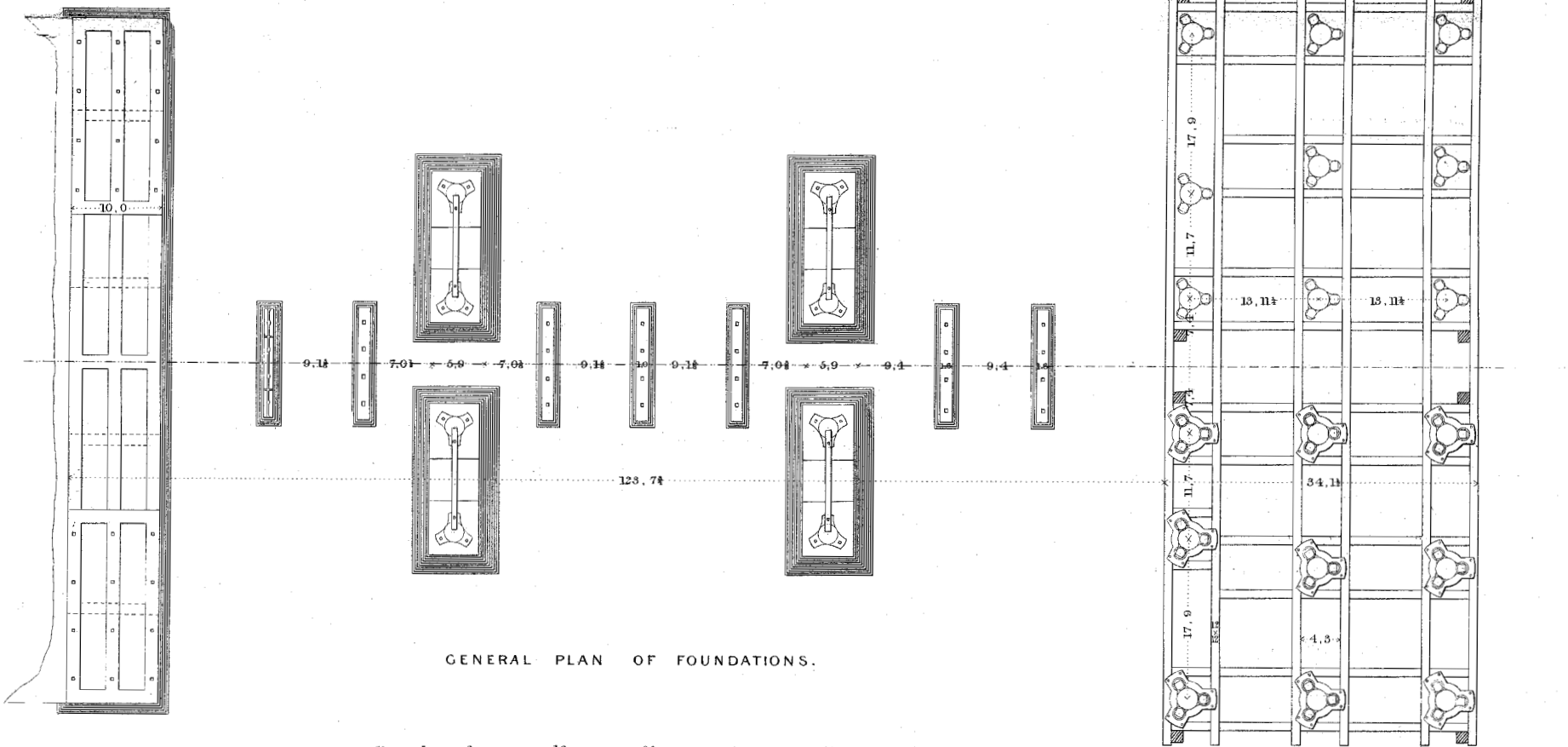
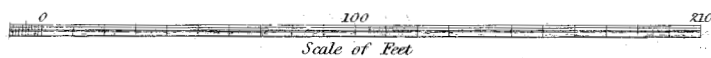
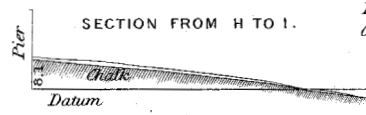
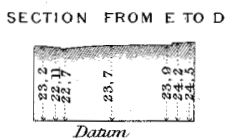
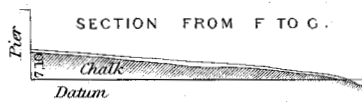
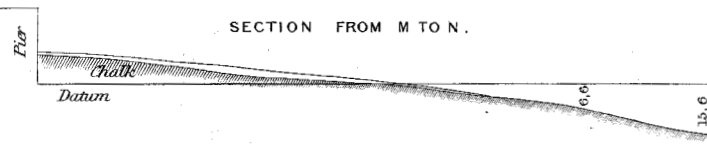
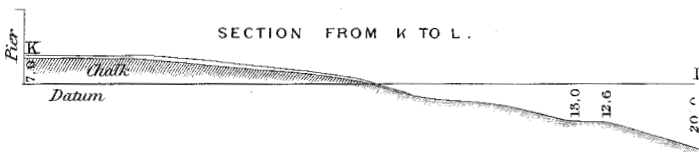
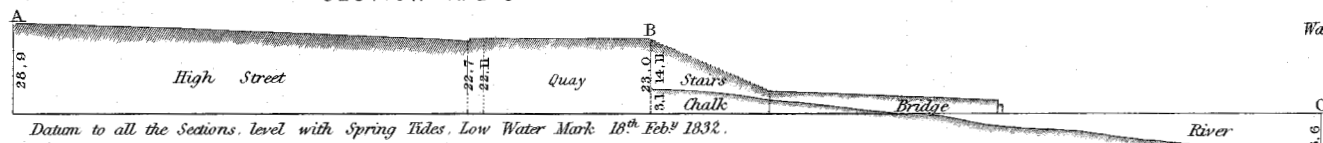
RISE OF TIDE AS TAKEN OUTSIDE THE ENTRANCE LOCK TO THE THAMES AND MEDWAY CANAL,
17th February 1832.

Wall Top of Quoin Level with Gravesend Pier.	West Side of Lock Gate	
23.0	2 O'Clock	0 Minutes
20.9	1	32
20.0	1	15
18.0	1	1
17.0	12	49
16.0	12	94
15.0	12	19
14.0	12	4
13.0	11	53
12.0	11	87
11.0	11	17
10.0	11	3
9.0	10	50
8.0	10	40
7.0	10	30
6.0	10	15

New Sill, entrance 1.6 to Canal Lock.
Old Sill, at D^o 1 Inch above Low Water Mark.
17th Feb^y 1832.



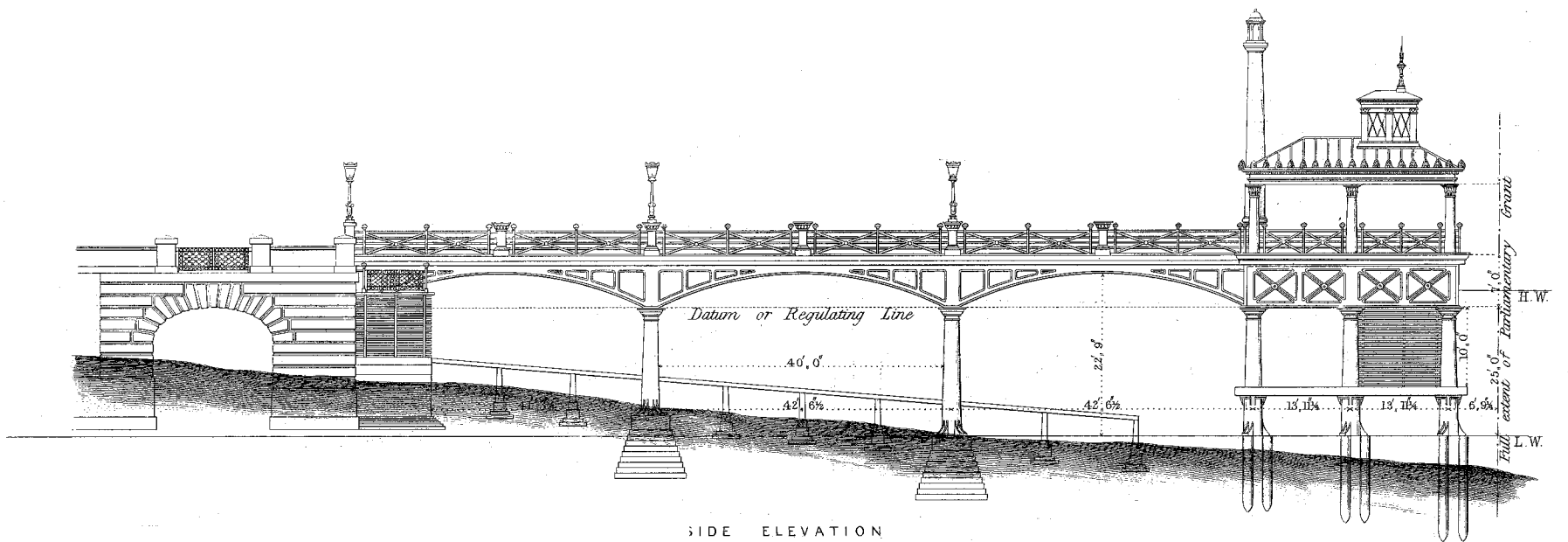
SECTION A. B. C.



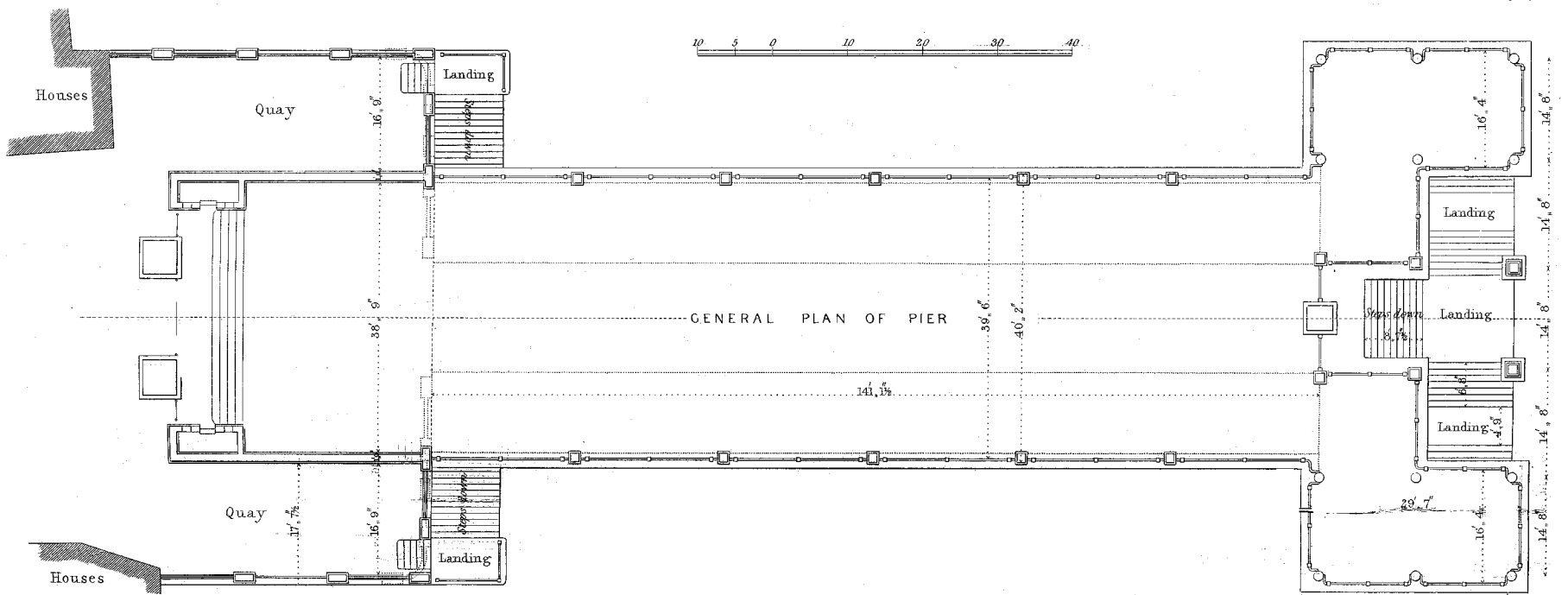
Reduced from the original drawings by Fred. Ramble.

GRAVESEND PIER.

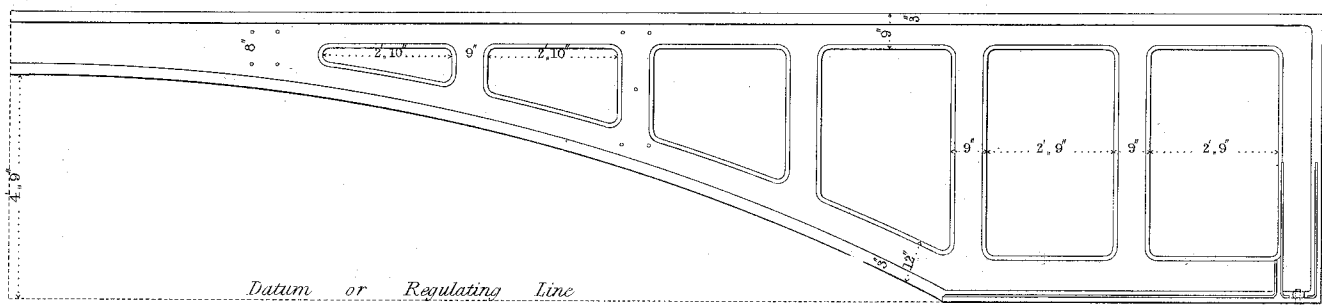
TIERNEY CLARK



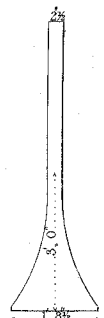
SIDE ELEVATION



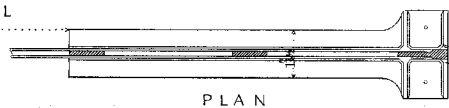
GENERAL PLAN OF PIER



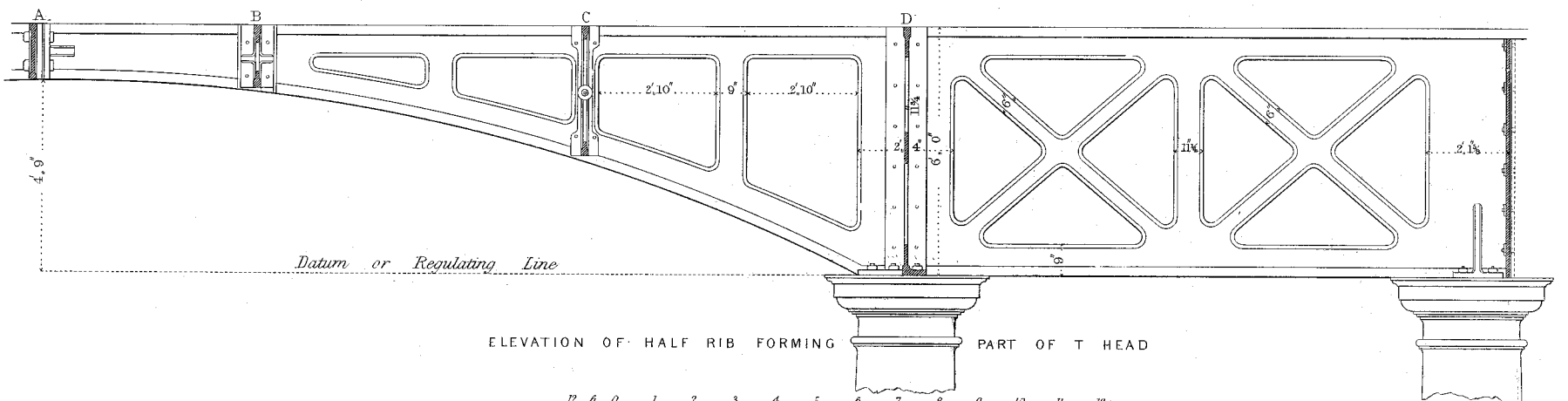
ELEVATION OF HALF RIB GOING INTO QUAY WALL



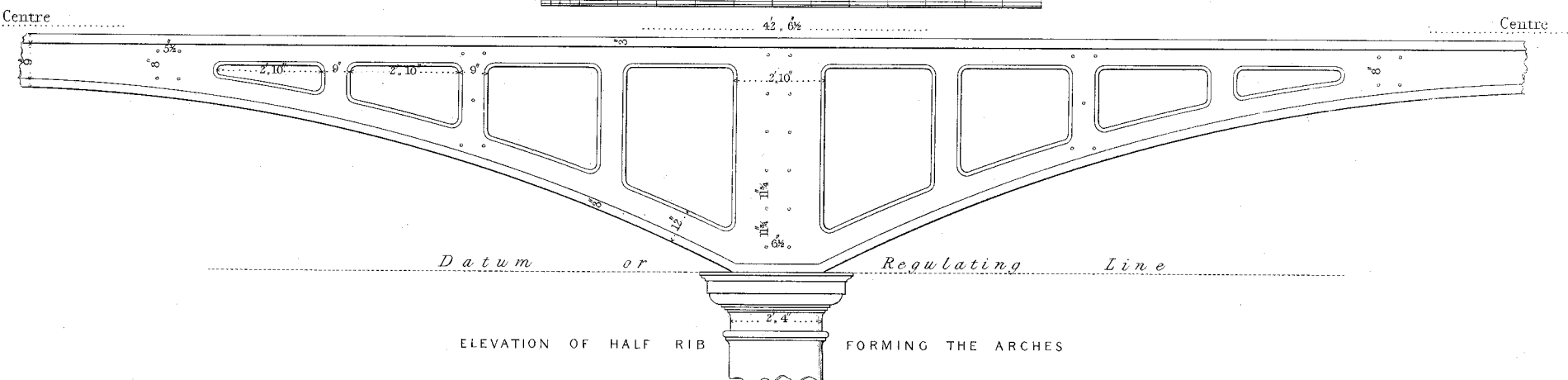
ELEVATION OF END



PLAN

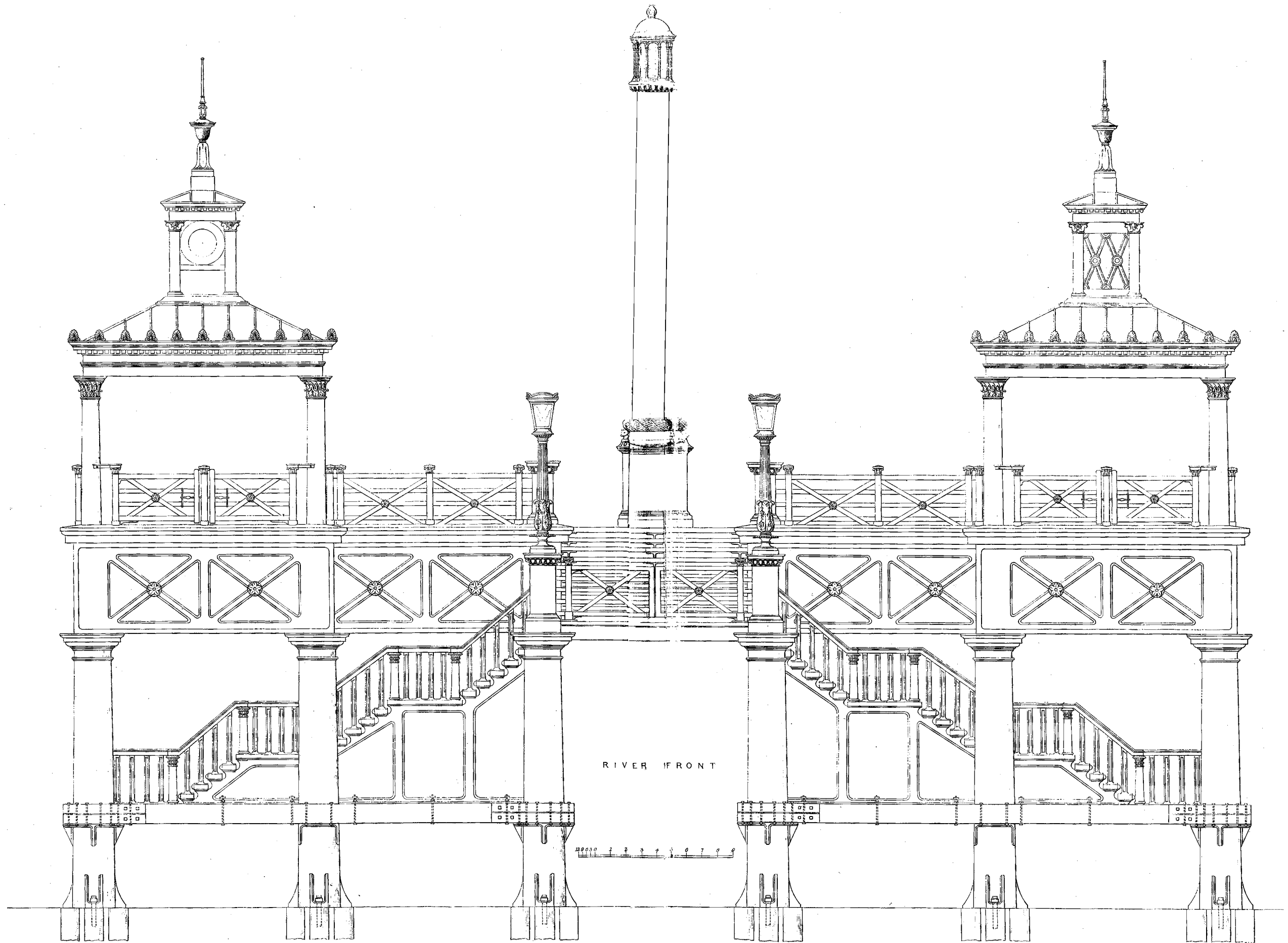


ELEVATION OF HALF RIB FORMING PART OF T HEAD



ELEVATION OF HALF RIB FORMING THE ARCHES

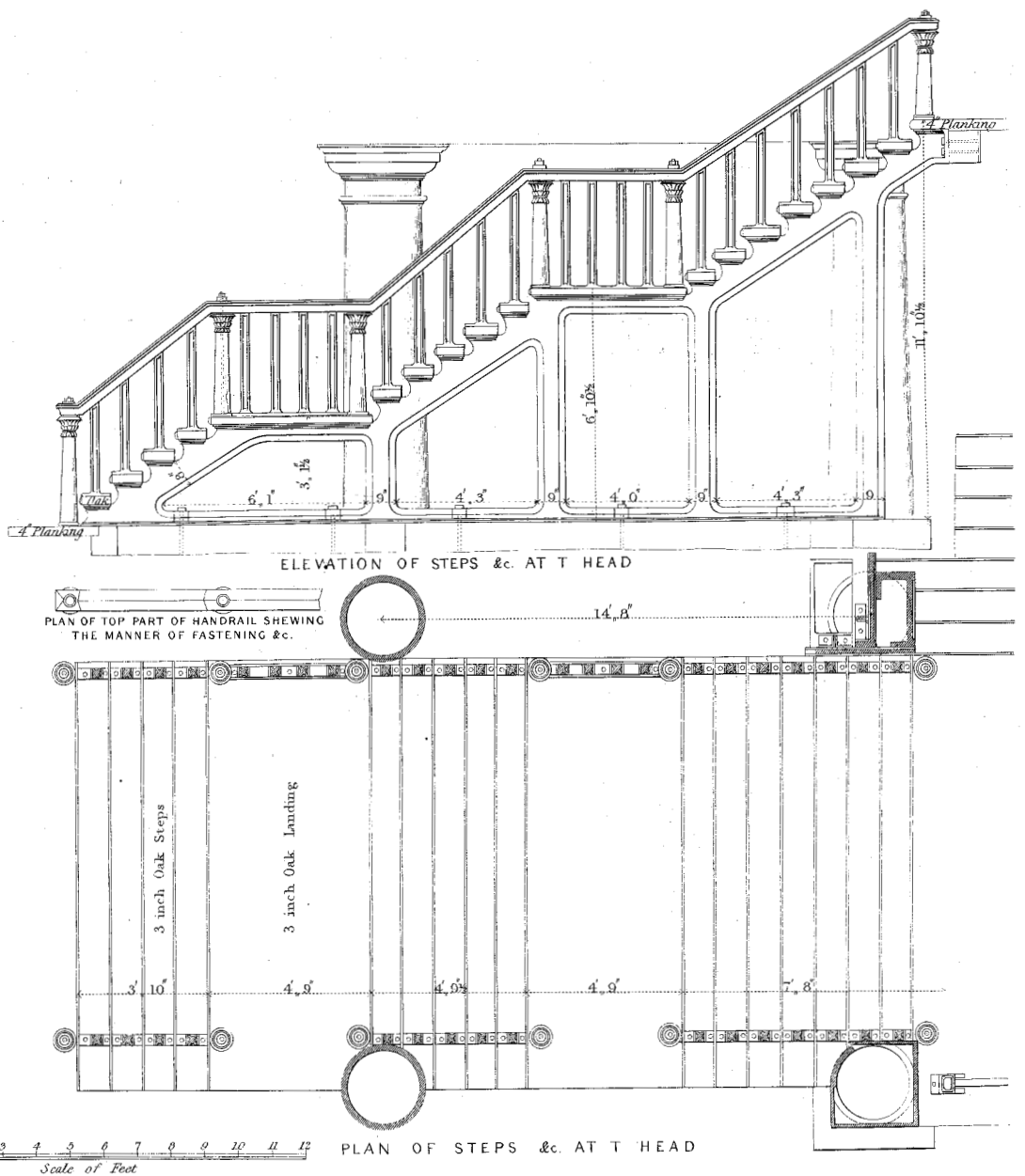
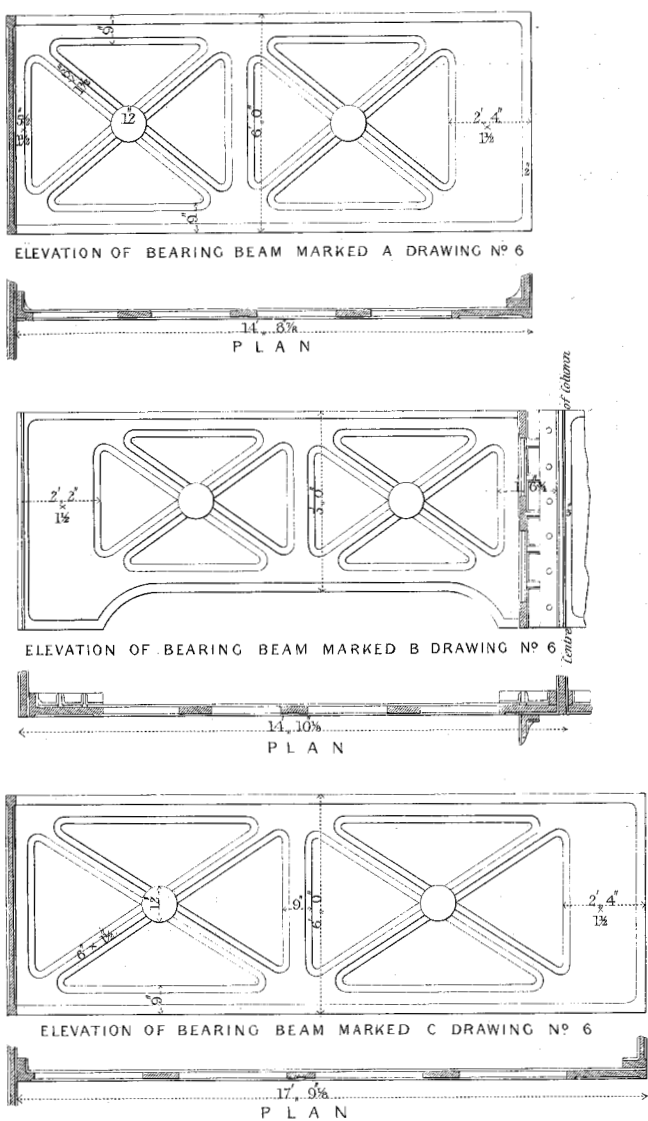
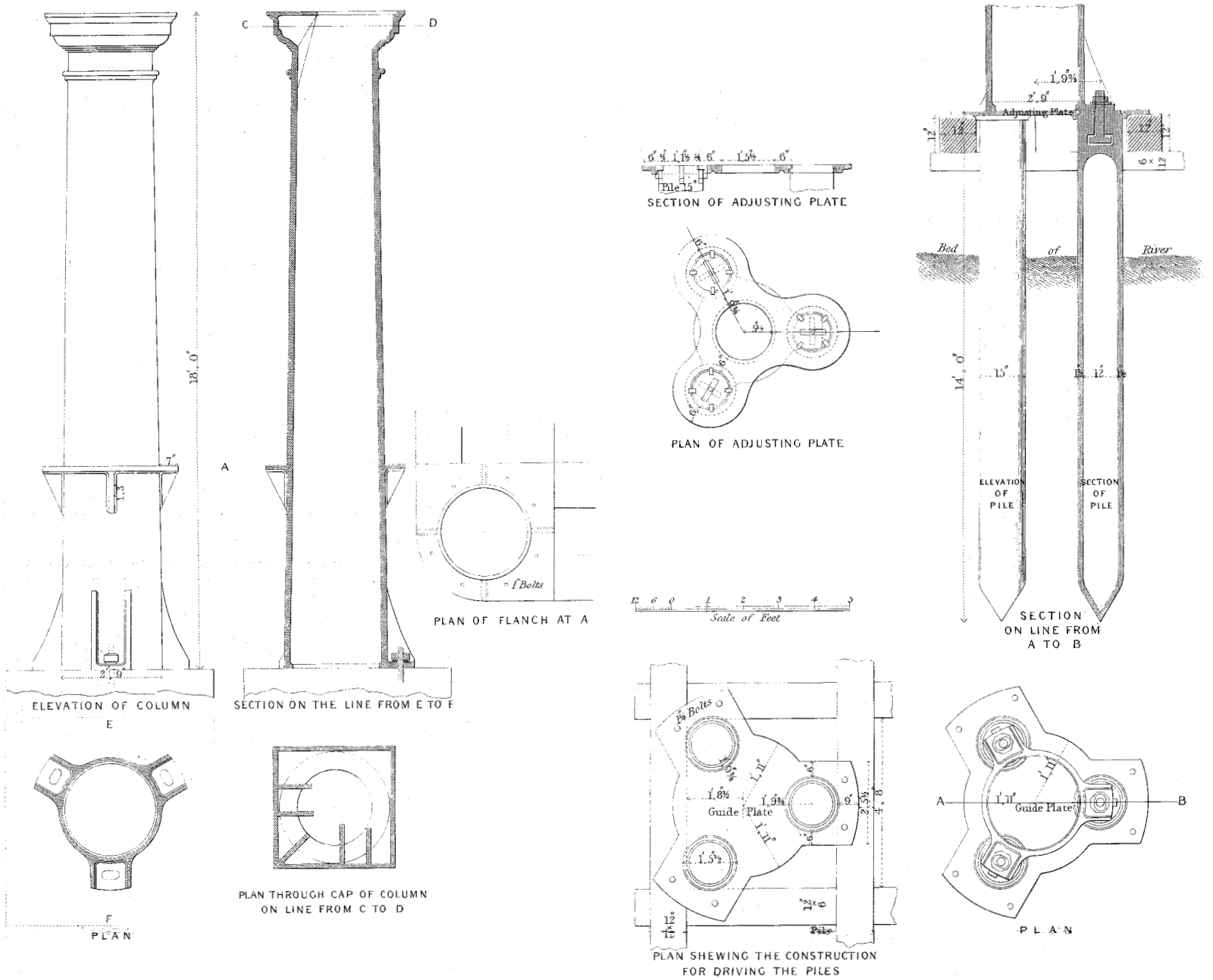
GRAVESEND PIER.
TIERNEY CLARK.



Reproduced from the original drawing by Fred. Rumble.

GRAVESEND PIER.

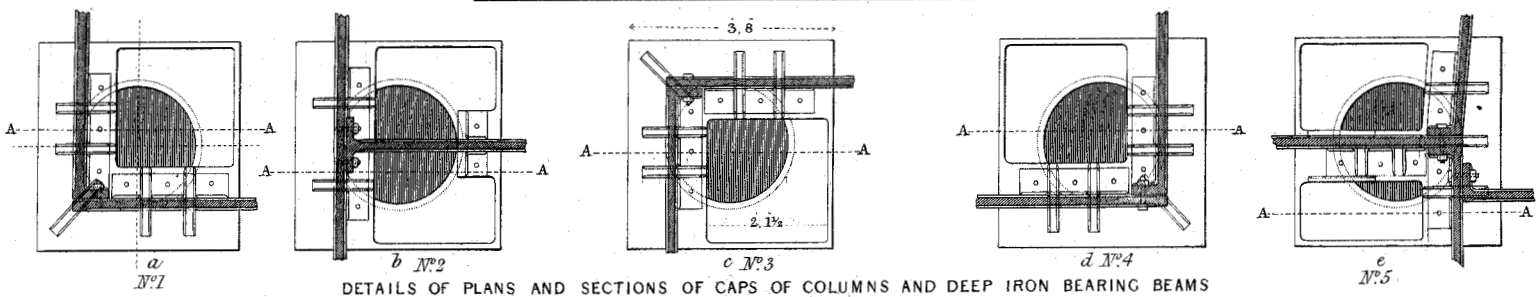
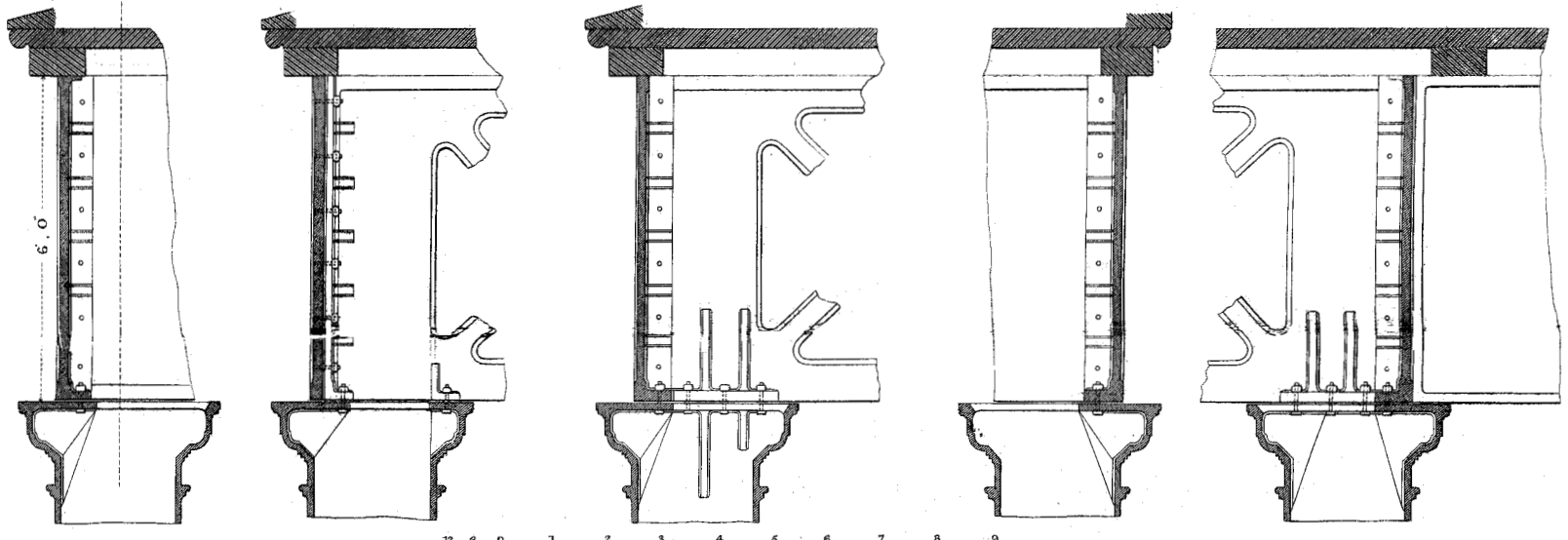
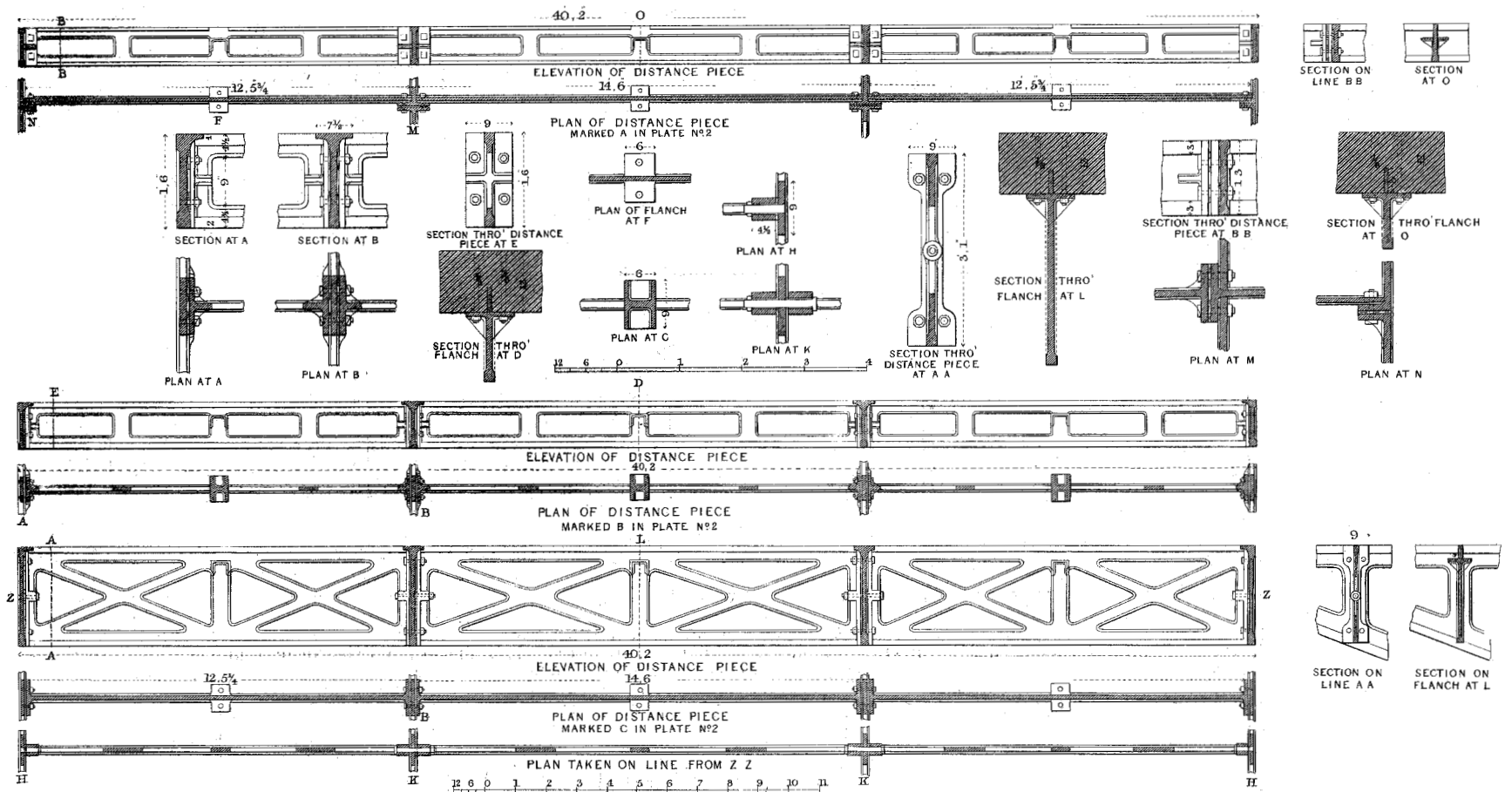
W. TIERNEY CLARK.



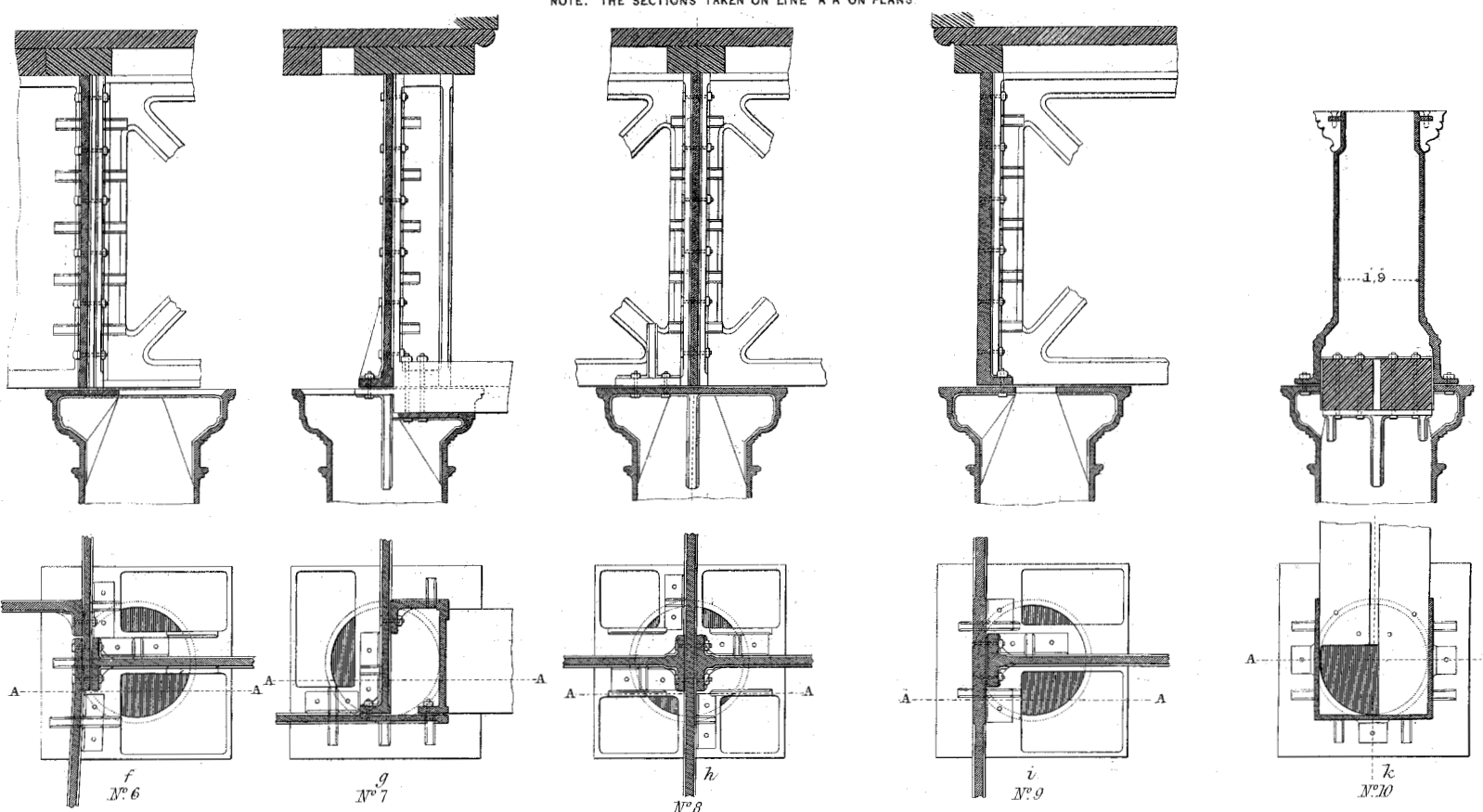
Reduced from the original drawings by Fred. Kumble.

GRAVESEND PIER.

W. TIERNEY CLARK.



DETAILS OF PLANS AND SECTIONS OF CAPS OF COLUMNS AND DEEP IRON BEARING BEAMS OF T HEAD, SHEWING FLANGES & BRACKETS WITH FASTENINGS AND MODE OF SECURING TIMBERS OF LANDING.
NOTE. THE SECTIONS TAKEN ON LINE A A ON PLANS.

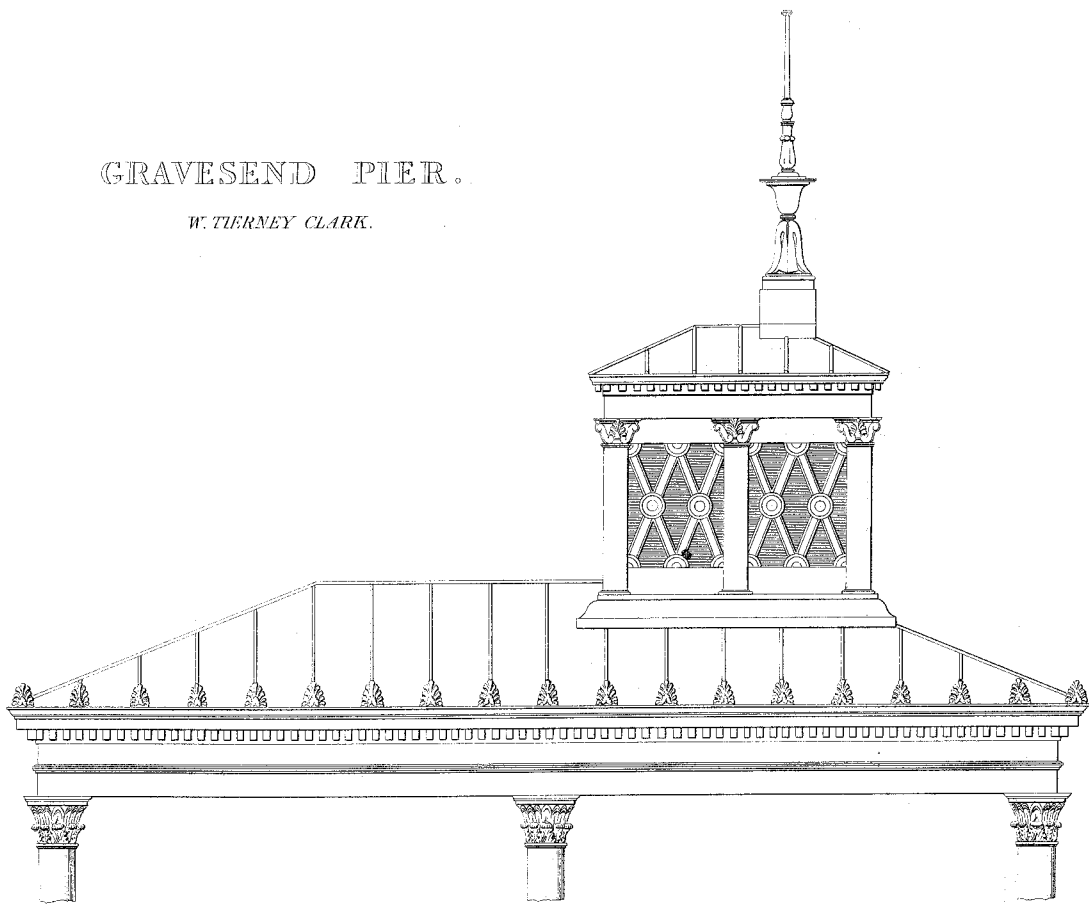


Reduced from the original drawings by Fred^lc Runble

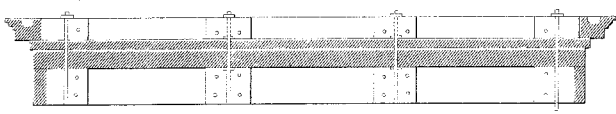
J.W. Lowry sculp.

GRAVESEND PIER.

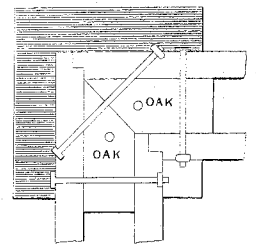
W. TERNEY CLARK.



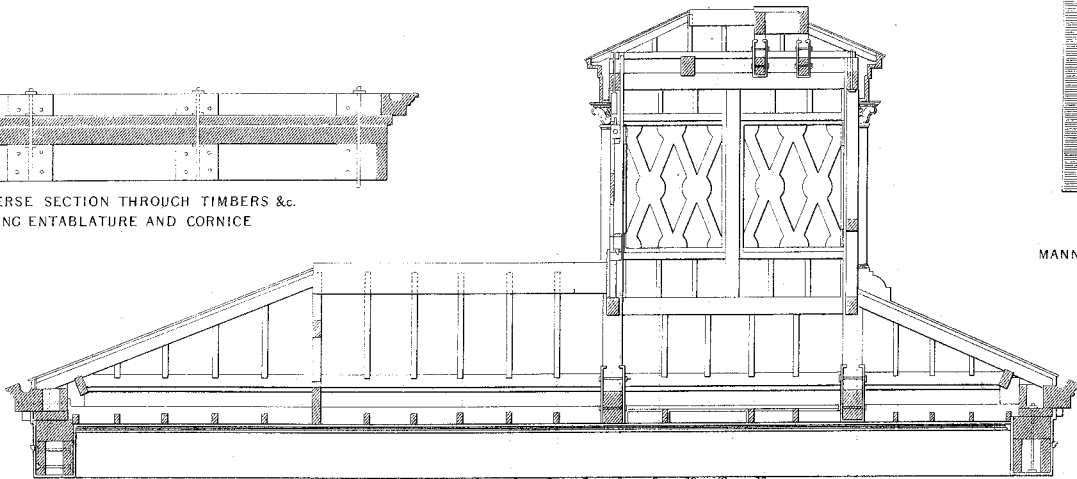
ELEVATION OF AWNING AND TURRET



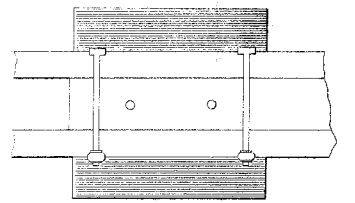
TRANSVERSE SECTION THROUGH TIMBERS &c. FORMING ENTABLATURE AND CORNICE



MANNER OF SECURING THE TIMBERS AT THE ANGLES

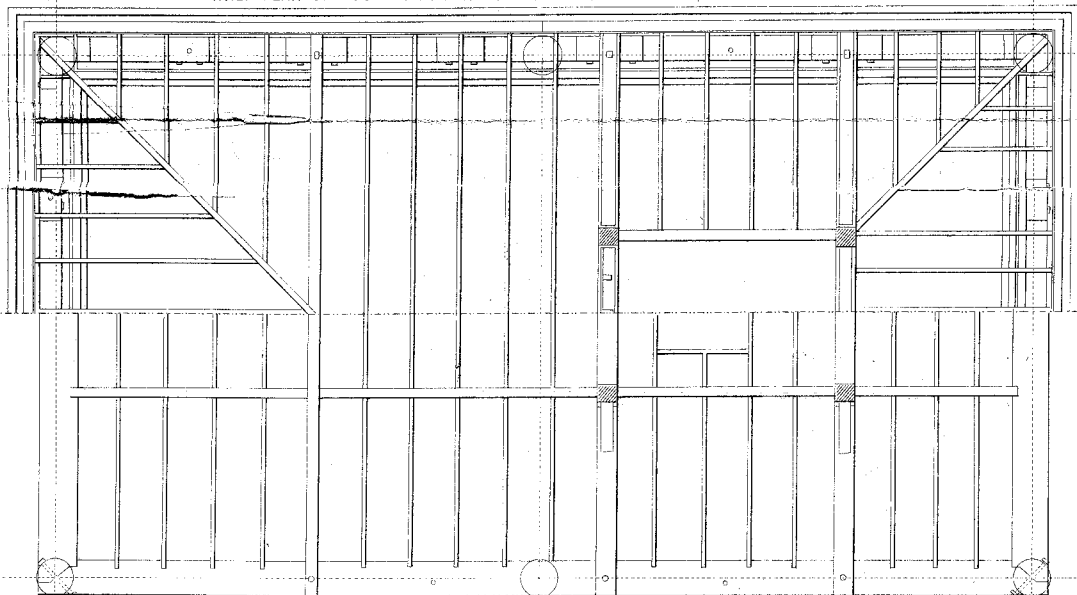


LONGITUDINAL SECTION THROUGH AWNING AND TURRET

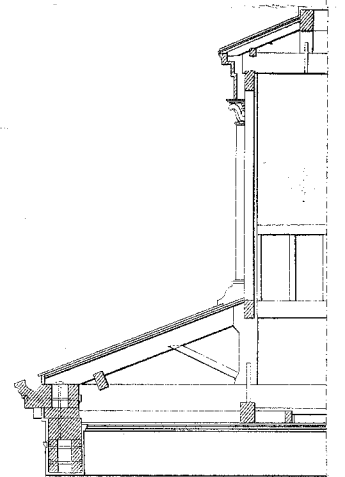


HALF PLAN OF ROOF TO AWNING SHEWING RAFTERS PURLIN AND PRINCIPALS

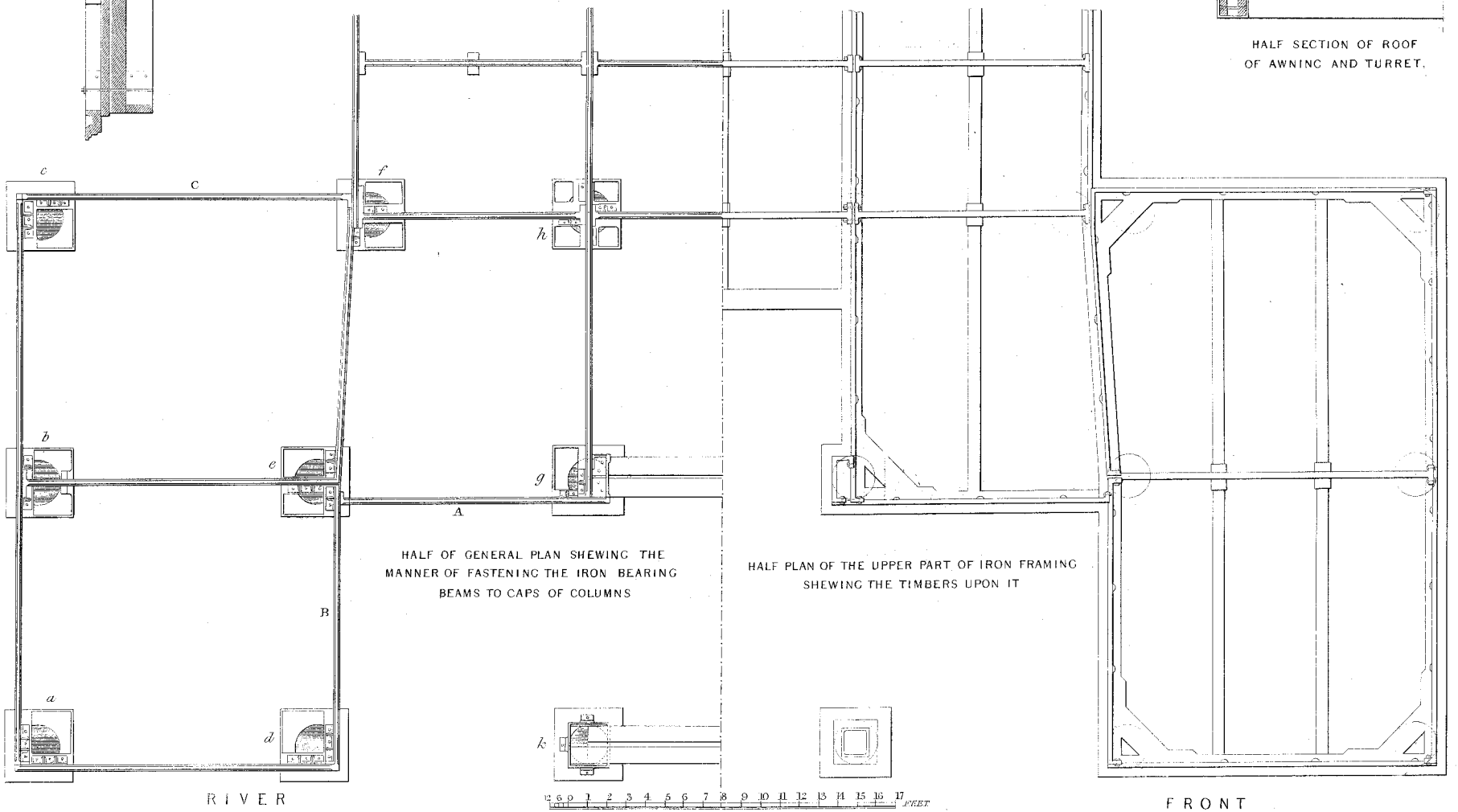
LONGITUDINAL SECTION THROUGH TIMBERS FORMING ENTABLATURE AND CORNICE &c.



HALF PLAN OF CEILING JOIST WITH BINDERS AND TYEBEAMS &c.



HALF SECTION OF ROOF OF AWNING AND TURRET.



HALF OF GENERAL PLAN SHEWING THE MANNER OF FASTENING THE IRON BEARING BEAMS TO CAPS OF COLUMNS

HALF PLAN OF THE UPPER PART OF IRON FRAMING SHEWING THE TIMBERS UPON IT

RIVER

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 FEET

FRONT