# AUTOMATIC HEATING AND VENTILATING FREIGHT CAR AT THE COLUMBIAN EXPOSITION.

CONSTRUCTED BY THE EASTMAN CAR COMPANY BOSTON AND CHICAGO.

(*For Description, see Page 269.*)

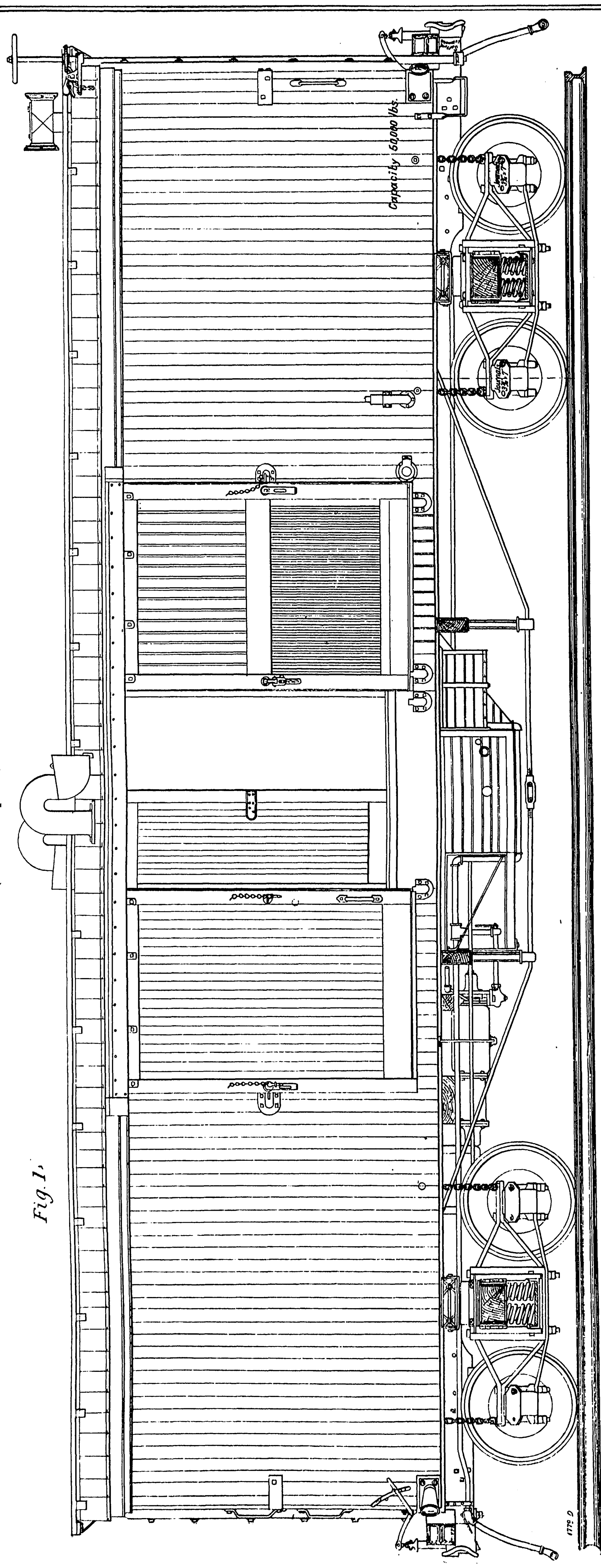


*Fig. 1.*

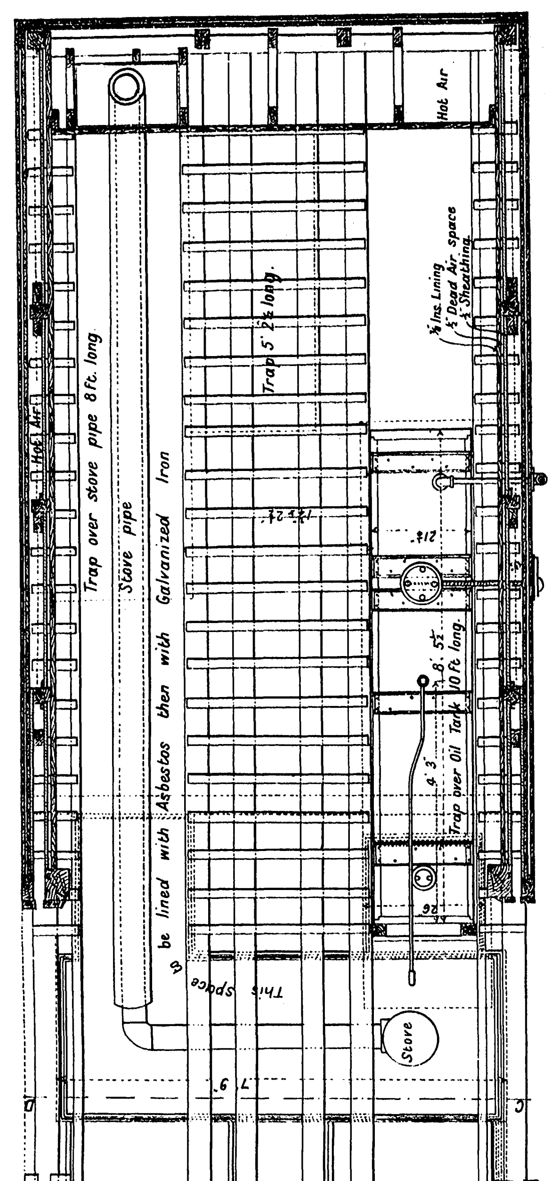


*Fig. 2.*

# AUTOMATIC HEATING AND VENTILATING FREIGHT CAR AT THE COLUMBIAN EXPOSITION.

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*Fig. 3.*

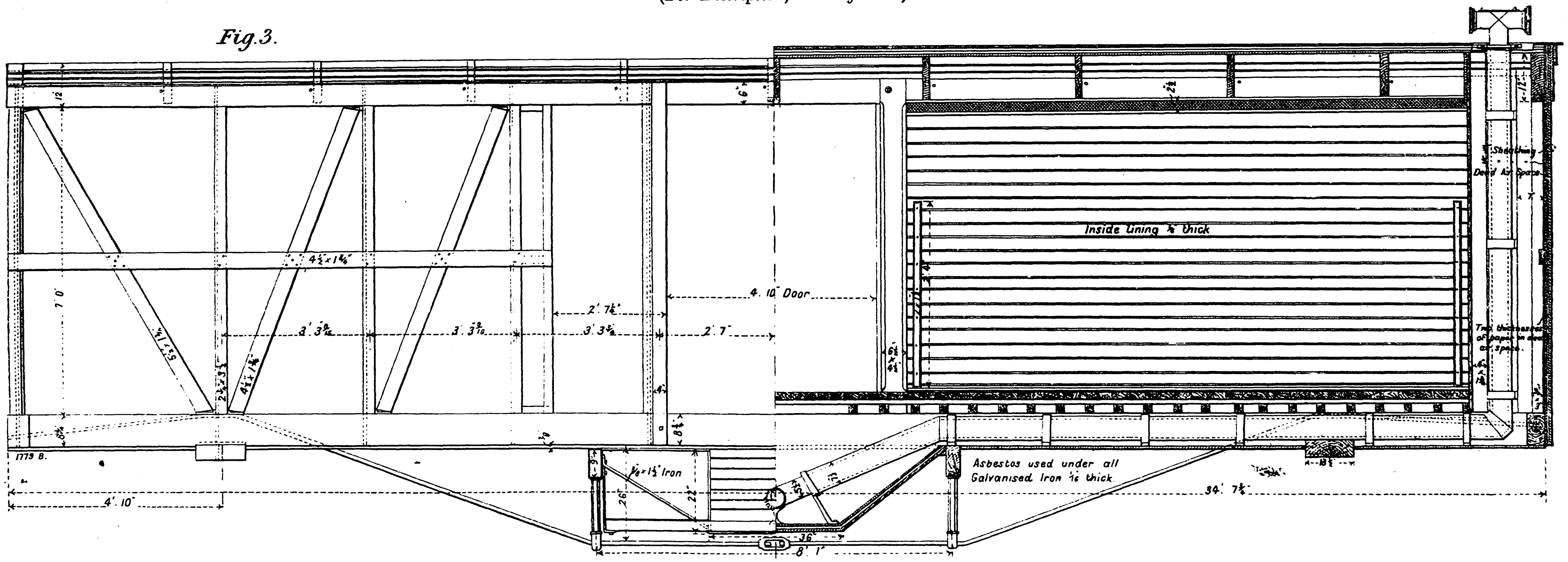
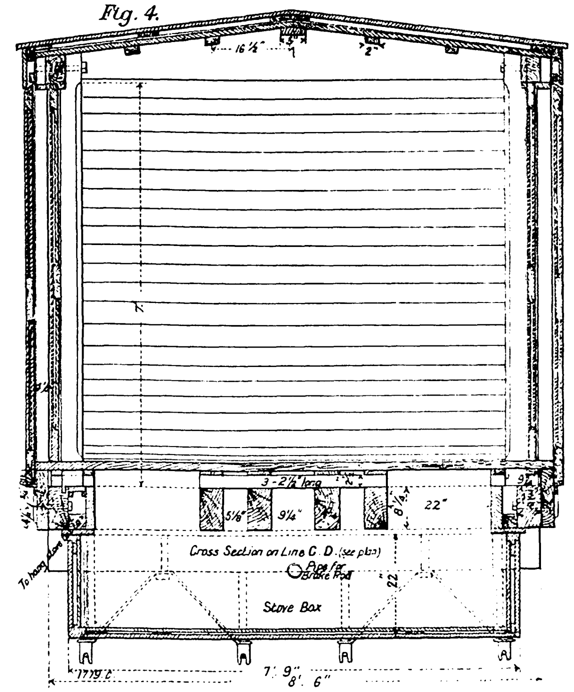



*Fig. 4.*




speaker approved of filtration, provided nature was given time for the purification and not hurried.

This interesting session was then closed by reading by title the following: "Possibility of Increasing the Water Supply from the Soil for Purposes of Irrigation and of Augmenting the Flow of Rivers," by G. H. O. Volger, Germany, and "On the Distribution of Water in the City of Mexico," by L. Salazar, Mexico. The meeting then adjourned.

The next meetings to be considered in this Congress were those of the American Society of Mechanical Engineers.

About 300 assembled on Tuesday, August 1, at the Art Palace. President Eckley B. Coxe was in the chair, and presided with his usual grace and suavity of manner.

The first matter of interest was the report of the Committee on a Standard System of Tests of Materials. As the conference of engineers in Berlin was so recent, Mr. Henning, chairman, simply presented an account of the conferences held in Europe for the purpose of establishing uniform methods of testing materials, and it was suggested that the society memorialise the United States Government to send duly accredited representatives to the conferences abroad to further the movement of establishing international standards of tests. After this he read a paper by Professor Debray, chief engineer of Ponts et Chaussées, in France, on the desirability of a general adoption by all countries of a uniform method for the tests of materials of construction. Resolutions presented by Chairman Henning's committee in favour of international standards of tests were then adopted.

Professor Martens, of Berlin, spoke in German in support of the movement to secure uniformity in the methods of testing. He said that the origin of the movement in Germany was due to a proposition emanating from Professor Egleston of this country in 1884. His remarks were translated by President Coxe, who adds a knowledge of German to his other accomplishments. A motion was then adopting requesting the American Society of Mechanical Engineers to take charge of this subject.

The report of the Committee on a Standard Method of Conducting Locomotive Tests was presented by the chairman, Mr. William Forsyth. The principal feature of this report was the shop tests for locomotives as practised at Purdue University. The apparatus is arranged with the driving wheels of the locomotive resting upon wheels that are part of a dynamometer. In this way certain points could be better determined than by a road test; but the committee thought the road test should supplement the other.

Professor Lanza inquired as to the probable error likely to occur in determining the amount of water in a boiler at the conclusion of the test by observing the height by the water glass, as he thought the error might be quite large, and also as to the advisability of using two indicators in engine testing in place of one indicator with long pipe connections.

## AUTOMATIC HEATING AND VENTILATING FREIGHT CAR.

NOT only do many parts of the United States suffer from an extreme range of climate, varying from Arctic cold to tropical heat, but the country is so vast that a railway journey may begin in one extreme, and end a few days later in the other. The passenger takes this as a matter of course; the human frame will bear very violent changes of temperature without much ill effect. But it is not the same with many varieties of food. Most perishable articles rapidly decay under excessive heat, and if they are to be transported for long distances in hot weather they must be artificially cooled. Hence there has arisen in America the refrigerator car, in which beef and fish can be carried for thousands of miles without suffering any injury. So perfect is the system that meat can be delivered in New York in better condition if it be dressed in the western plains than if the beast be carried alive and slaughtered immediately at the journey's end. All this we in England can readily understand, although the necessity for refrigerator cars has not yet grown sufficiently urgent here to lead to their introduction. But it will be news to many of our readers that heated cars are provided in the States for certain products. Early fruits and vegetables grown in the warm climate of Florida cannot bear exposure without injury to the freezing atmosphere of the north. If they are packed in the ordinary way, and despatched by train, the chances are that they will be frozen and spoilt in transit, to the great detriment of their quality. To meet this difficulty, the Eastman Car Company, of Boston and Chicago, construct automatic heating and ventilating freight cars, and are now showing them in the Columbian Exposition. As will be seen from the illustration on pages 262 and 263, the heat is furnished by a stove (Fig. 2) fed with petroleum from a tank. This stove is below the level of the car floor (Fig. 4), and delivers its products of combustion into a stovepipe fitted between the frames, and finally rising above the car roof (Fig. 3), where it ends in a cowl. The stovepipe is inclosed within a second pipe, and the channel containing it is lined with asbestos and galvanised iron. The temperature is regulated by a thermostat comprising a Bourdon tube filled with kerosene oil. The whole car has double walls, separated by a space for hot air, and each wall is hollow to prevent conduction of heat through it. At the end of the car there is a wide space for the distribution of the warm air. The car is carried on two four-wheel trucks, and has a capacity of 50,000 lb.

## HEAVY PLATE SHEARS FOR CLYDEBRIDGE STEEL WORKS.

THE two engravings on page 266 illustrate a very powerful set of plate shears made by Messrs. Craig and Donald, of Johnstone, N.B., suitable for large steel works where the heaviest class of plates are rolled. The blades in this machine are 9 ft. 6 in. long, and the standards have 37 in. depth of gap, so that a plate 6 ft. wide and of any length may be cut into two pieces of 3 ft. wide. There is a clear distance between the standards of 6 ft. 6 in. The machine is driven by two 20-in. cylinder engines, and as there are no flywheels the apron carrying the top blade can be stopped at any point by shutting off the steam where required, so that a long plate may with safety be passed between the standards and cut across at any part. This arrangement is also advantageous in cutting a rectangular plate of any length into two tapered plates suitable for scarphing in the case of shell plating. The plate is cut diagonally from the lower corner on the one end to the upper corner on the other. The great depth of gap provides for very wide plates of this description being dealt with. From shipbuilders, &c., tapered or scarphed plates are often called for, and in most plate mills, where the facilities for shearing are not as described above, a great waste is incurred through having to shear each plate from a rectangular plate instead of rolling the plate double the width of the broadest end of the tapered plate and cutting two tapered plates from it. The saving in the production of such plates becomes a matter of great importance when much work of the kind requires to be done. This machine cuts with great ease a $1\frac{1}{2}$-in. steel plate of the full length that the blades will admit, but is sufficiently powerful to cut up to $1\frac{3}{4}$-in. steel plate. The gearing is all of Siemens-Martin cast steel, and is very massive. The total weight of the machine is about 90 tons. One of these machines, as described, was recently put down for the Clydebridge Steel Company, near Glasgow, and has proved a thorough success.

THE CUNARD STEAMER "LUCANIA."—The Cunard steamer Lucania has been redocked at Birkenhead in consequence of her taking a list when floating out of dry dock, and beyond the abrasion of a few feet of her paint at the turn of the bilge amidships, not the slightest appearance of damage has been found. The Cunard Company, being thus satisfied of the perfect condition of the vessel, have arranged to take her over from the builders as soon as she undocks. There is, therefore, nothing whatever to prevent her sailing to-morrow as already arranged.

## LOCOMOTIVES AT THE COLUMBIAN EXPOSITION.

ON page 274 we publish perspective views of three of the eleven locomotives that form the magnificent exhibit of the Brooks Locomotive Works, Dunkirk, in the State of New York. They are all of normal gauge, and form part of an order to be delivered to an American railway company after the close of the Exhibition. As we propose to publish detailed drawings of one of the simple, and one of the compound Brooks engines exhibited, we shall content ourselves this week by adding a Table of some of the leading dimensions of the three engines of which we give illustrations. Of these Fig. 1 is a ten-wheeled passenger engine; Fig. 2 a six-wheeled switching or yard locomotive; and Fig. 3 is an engine of the "Mogul" type.

*Principal Dimensions of Three Locomotives Exhibited at the Columbian Exposition by the Brooks Locomotive Works, Dunkirk, New York. (See page 274.)*

| — | Fig. 1. | Fig. 2. | Fig. 3. |
|---|---|---|---|
| *Engine.* | | | |
| Total weight in working order .. .. .. lb. | 138,000 | 114,000 | 118 000 |
| Weight on driving wheels ,, | 111,000 | 114,000 | 102,000 |
| ,, truck wheels ,, | 27,000 | — | 16,000 |
| Total length of wheel base .. | 25 ft. | 10 ft. 8 in. | 21 ft. 6 in. |
| Rigid wheel base .. .. | 14 ft. 6 in. | 10 ,, 8 ,, | 14 ft. |
| *Cylinders, &c.* | | | |
| Diameter of cylinders in. | 19 | 19 | 19 |
| Stroke of piston .. ,, | 26 | 26 | 24 |
| Kind of piston packing | Metallic, by C. C. Jerome, Chicago | Same | Same |
| Diameter of piston-rod in. | $3\frac{1}{2}$ | $3\frac{1}{2}$ | — |
| Size of steam ports .. ,, | $1\frac{5}{8} \times 18\frac{1}{2}$ | $1\frac{5}{8} \times 18\frac{1}{2}$ | $1\frac{5}{8} \times 18\frac{1}{2}$ |
| ,, exhaust ports ,, | $3 \times 18\frac{1}{2}$ | $3 \times 18\frac{1}{2}$ | $3 \times 18\frac{1}{2}$ |
| *Wheels, &c.* | | | |
| Diameter of driving wheels in. | 72 | 49 | 55 |
| ,, truck wheels ,, | 33 | — | 30 |
| ,, driving axle journal .. .. .. in. | 8 | 8 | 8 |
| Diameter of truck axle journal .. .. in. | $5\frac{1}{4}$ | — | $5\frac{1}{4}$ |
| Diameter of main crankpin journals .. .. in. | $6\frac{1}{4}$ | $6\frac{1}{4}$ | $6\frac{1}{4}$ |
| Diameter of coupling-rod journals .. .. in. | $5\frac{1}{2}$ and $4\frac{1}{2}$ | $5\frac{1}{2}$ and 5 | $5\frac{1}{2}$ |
| Length of driving springs ,, | 36 | 36 | 36 |
| *Boiler.* | | | |
| Description of boiler.. | Belpaire type, by Wellman Iron and Steel Company, Thurlow, Pa. | Same | Same |
| Inside diameter .. in. | 60 | 58 | 58 |
| Material of barrel of boiler .. | Steel | Steel | Steel |
| Thickness of plates .. in. | $\frac{1}{2}$ to $\frac{5}{8}$ | $\frac{1}{2}$ to $\frac{5}{8}$ | $\frac{1}{2}$ to $\frac{5}{8}$ |
| Material of tubes .. | No. 11 B.W.G., by Duquesne Tube Works Company, Pittsburg | Same | Same |
| Number ,, .. .. | 202 | 180 | 212 |
| Diameter ,, .. in. | $2\frac{1}{4}$ | $2\frac{1}{4}$ | 2 |
| Distance between centre of tubes .. .. .. in. | $3\frac{1}{16}$ | $3\frac{1}{8}$ | $2\frac{13}{16}$ |
| Length of tubes .. .. | 13 ft. 10 in. | 11 ft. 1 in. | 11 ft. 1 in. |
| ,, firebox .. in. | 114 | 98 | 98 |
| Width of ,, .. ,, | 32 | 32 | 32 |
| ,, water spaces round firebox .. .. in. | $3\frac{1}{2}$ to 4 | $3\frac{1}{2}$ | $3\frac{1}{2}$ |
| Material of outer firebox sheet .. .. .. . | Steel | Steel | Steel |
| Thickness of plates in firebox sheet .. .. .. in. | $\frac{1}{2}$ to $\frac{5}{8}$ | $\frac{1}{2}$ to $\frac{5}{8}$ | $\frac{1}{2}$ |
| Material of inside of firebox | Steel | Steel | Steel |
| Thickness of plate in firebox .. .. .. in. | $\frac{3}{8}$ | $\frac{5}{16}$ and $\frac{3}{8}$ | $\frac{5}{16}$ and $\frac{3}{8}$ |
| Thickness of tubeplates (firebox) .. .. .. in. | | $\frac{1}{2}$ | $\frac{1}{2}$ |
| Thickness of tubeplates (smokebox) .. .. in. | $\frac{5}{8}$ | $\frac{5}{8}$ | $\frac{5}{8}$ |
| Size and number of crown plate stays .. .. .. | 220 at 1 in. | 190 at 1 in. | 190 at 1 in. |
| Working pressure .. lb. | 180 | 180 | 180 |
| Grate surface .. sq. ft. | 25.3 | 21.7 | 21.7 |
| Firebox heating surface ,, | 152 | 144 | 134 |
| Tube ,, ,, ,, | 1646 | 1136 | 1232 |
| Total ,, ,, ,, | 1798 | 1280 | 1366 |
| *Tender.* | | | |
| Weight of tender empty lb. | 35,400 | 34,000 | 35,400 |
| ,, ,, full ,, | 84,600 | 69,730 | 84,600 |
| Number of wheels .. .. | Eight | Eight | Eight |
| Diameter ,, .. in. | 33 | 33 | 33 |
| Total wheel base .. . | — | 10 ft. 6 in. | — |
| Diameter and length of journals .. .. .. | — | — | — |
| Water capacity .. gals. | 4000 | 3100 | 4000 |
| Fuel capacity .. .. tons | 8 | 5 | 8 |

## 7-TON TRAVELLING JIB CRANE.

THE 7-ton travelling jib crane which we illustrate on page 270 was constructed by the Yale and Towne Manufacturing Company, Stamford, Conn., U.S.A., and is now on view at Chicago Exposition. It has a radius of 21 ft., and is designed to run on lines of 7-ft. gauge. The jib can be raised and lowered by means of a separate drum driven by a worm and wormwheel, the wire rope running round a snatch block. The main drum is driven by spurwheel and pinion, and is fitted with a powerful brake capable of sustaining the full load. The cylinders are arranged at each side of the framing, the valves being driven by a cross-shaft from eccentrics situated near the centre of the crankshaft. The turning motion is operated from a rear shaft driven from the crankshaft through an intermediate shaft. On this rear shaft are two bevel wheels, either of which can be driven through a friction clutch. These wheels gear with a third bevel wheel on a short vertical shaft, from which motion is conveyed through spurwheels to a second vertical shaft carrying a pinion gearing with the large spur ring cast on the baseplate. The travelling wheels are worked by a vertical shaft passing down the crane-post, and gearing with a fore-and-aft shaft on the level of the axles. The vertical shaft is driven through the intermediary of a second short vertical shaft from a bevel wheel on the intermediate shaft. The boiler is 4 ft. in diameter by 6 ft. 5 in. high. It will be noticed that all the handles are conveniently grouped together.

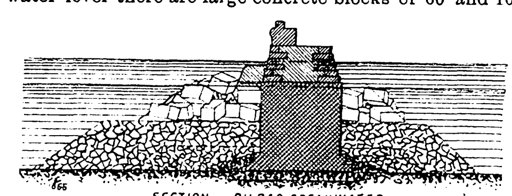
## HARBOUR WORKS.

TO THE EDITOR OF ENGINEERING.

SIR,—In your issue of the 25th ult. you illustrate and describe the Bilbao breakwater works at present in course of construction. Those members of the engineering profession who devote themselves more especially to marine works must, like myself, be exceedingly pleased to find such a detailed and well illustrated description of these important works, showing fully the design, the method of execution, the plant employed, and the cost of the undertaking.

On looking at the section of the breakwater, Fig. 2, on page 230 of your last week's issue, I was astonished at the immense amount of material which is being swallowed up in this work. Per metre in length of the breakwater there is no less than 860 cubic metres of material (excluding the parapet), and yet the total height from foundation to top (parapet excluded) is only 21 metres, so that were all the material put into the form of a rectangular cross-section of the height given (21 metres) it would have a width of not less than 41 metres.

The design is the ordinary composite arrangement of assorted rubble from the foundation up to 6 metres below low-water level; from thence up to 1 metre above low-water level there are large concrete blocks of 60 and 100



SECTION OF BILBAO BREAKWATER

tons weight, with rubble filled in between their interstices, and from this level to the top it is concrete in mass faced with 10-ton concrete blocks.

As you are well aware, I have lifted up my voice time after time against the continuance of this unsightly, unreliable, unscientific, and extravagant system of construction, and I think I shall be rendering a service to the engineering profession in pointing out the defects of this class of work whenever an opportunity presents itself.

The accompanying figure shows a section of the Bilbao breakwater (taken from your last week's issue), and on this section I have shown, by means of the central portion etched crosswise, the section of monolithic work which would be ample for the under-water portion of the structure, instead of the immense mass of loose rubble and huge concrete blocks, as actually constructed. The central monolithic portion I have shown would be built of blocks of moderate weight, say 9 to 12 tons, and cemented together by neat Portland cement grouted into a solid mass, founded on the top of a grouted rubble and shingle base below the level of the sea bottom, and extending well beyond the width of the breakwater. The triangular portions on each side of the breakwater above the foundation would be of loose rubble to guard against undermining action, should there be any at this depth, which I think hardly likely.

I might point out that the St. Helier's breakwater, Jersey, which I carried out, is somewhat higher from foundation to cope than the Bilbao one, and the width of the under-water portion, shown on the accompanying figure (13 metres), is that which I adopted at Jersey, and with the most successful results. I might further remark that the St. Helier's breakwater, like that of Bilbao, is exposed to the Atlantic, so that in this respect the circumstances are further comparable.

Now to deal with the details of the construction of the Bilbao work. For handling and depositing the 60 and 100 ton blocks, expensive block-making plant, powerful travellers, and special depositing barges are necessary, and likewise barges for depositing the rubble; all of which is in addition to the ordinary plant for constructing the monolithic superstructure on top of the 100-ton blocks.

It is worthy of notice that this superstructure, which is subject to the full force of the waves, is faced with blocks of only 10 tons weight, whilst the engineers for the work have deemed it necessary to have blocks of 60 to 100 tons weight below low water, where there will be less force of the sea to be resisted. I do not call in question in the slightest degree the adoption of the 10-ton blocks in the one case and the 60 to 100 ton blocks in the other, because the circumstances are different.

The 10-ton blocks are all cemented together and to the concrete hearting, thus forming a solid mass, whilst the 60 to 100 ton blocks have each to depend on their own weight for resistance to displacement.

What I do find fault with is the monolithic work commencing only above low-water level. Had the monolithic work been commenced at the foundation, then the whole structure, not merely the facing, but likewise the hearting,