the regulator carriage, and the bight is passed round the sheave.

The rails for the tension tracks are of steel, 50 lb. per yard, $4\frac{1}{2}$ in. deep; the heads being $2\frac{1}{8}$ in. broad.

(To be continued.)

DOUBLE-CUTTING PLANING MACHINE.

On page 161 we illustrate the most recent development of planing machine designed and made by Messrs. J. Buckton and Co., Limited, the well-known machine-tool makers of Leeds, and about which there are some points of interest. As will be seen by the illustration, the cutting on both strokes is secured by means of two tools set in opposite directions. In the machine illustrated it will be seen there are three tool-boxes, each with two cutters, two being set on the cross slide and one on the vertical slide. There are the usual self-acting feeds, which do not require explanation.

The usual arrangement for double cutting on the planing machine is by the "Jack-in-the-Box" device, but this has the defect of not being very steady at heavy cuts, and it is not often seen in operation, the quick return motion being preferred. It is not perhaps often realised how much power is absorbed by a quick return motion with a big planing machine; but the fact was very forcibly brought home to Mr. Wicksteed, the managing director of Messrs. Buckton's, by the application of an electric motor to driving one of these heavy tools. The delicate recording instruments that can be applied to electric motors showed that the idle return stroke demands double the power from the driving belt compared with that which is required during the cutting stroke; in other words, at a high return stroke speed the inertia of the table and work plus the friction is greater than is the inertia of the table and work plus the friction, and also including the resistance of the cut at the low cutting stroke speed. The larger and heavier the planing machine table, the more strongly does this apply, and when tables have a weight of 20 tons, or even 30 tons, as some made by Messrs. Buckton do, the detail is one of greater importance. It has been found that whereas in a machine requiring 20 horse-power to be transmitted through the belt for the cutting stroke, a belt capable of transmitting 80 horse-power is necessary for the quick return, that power being required temporarily on the idle stroke.

These considerations have led the firm to devote their attention to the design of a really convenient double-cutting tool box, and this is shown in the illustration. The machine is so constructed that by a slight change of gear it can be driven at the same speed on both strokes, therefore for plain work, where there is nothing to prevent the overrun of the tools, the work can be planed to great advantage without any idle return stroke, the tools cutting almost continuously. A self-acting feed takes place at each end of the stroke, so that if a feed of 20 cuts to the inch were in use, the tools would traverse $\frac{1}{10}$ in. when the table had completed one double stroke.

In addition to the saving of time that would be otherwise occupied by the idle stroke, there is in practice a further saving arising from the fact that the work of planing is divided between the edges of the two tools. It is obvious, therefore, that where two tools are used for a given surface to be planed, there will be less occasion to stop the operations to sharpen the cutting tool, as compared to the use of one tool only. When the tool has to be taken out to re-grind before the surface is all planed, a mark on the work may be the result, and an additional cut has to be taken so as to remove the inequality. There is still another point to which reference may be made in this connection. When the tool of a planing machine arrives at the end of its cut in a casting, the last particle or flake of metal, which consists of hard scale, is chipped off by the pressure of the tool, and thus leaves round the place a surface of cast iron free from scale, and therefore easily attacked by the tool without destroying the cutting edge. This fact alone is said to have a great influence on the time the tool will last without re-grinding, a fact which no mechanic will have difficulty in accepting.

The gear for driving is noticeably free from vibration and is very silent, virtues in a planing machine which need not be dwelt upon, whilst the massive table which may be used without disadvantage with this type of machine is also a matter which leads to excellence of surface produced. For driving the table the diagonal shaft system is used with worm and spur-wheel gear, as will be seen by the illustration. This form of gear is used both for driving the diagonal shaft and transmitting the power from the latter to the table. It is this device which contributes so largely to the steady running of the machine.

Perhaps a word may be said here as to the method of casting the worm pinions, which we saw when we visited these works. They are moulded in sand from patterns of the ordinary description. In place of having two boxes and removing the pattern by parting the mould, the sand is rammed all round the pattern at once. In order to withdraw the pattern, it is attached to a rod which projects vertically upwards, its top end being connected to a train of spur gearing similar in principle to the change wheels of a screw-cutting lathe. In this way the pattern is screwed out of the mould, being withdrawn and rotated at the proper speed, so as not to disturb the sand. In this way, the worms are cast in iron without the inequalities which are seen in similar pieces when the parting method is used to take out the pattern, a defect which is accountable for so much of the lost power notoriously present with cast worm pinions. The withdrawing machine has change wheels to suit different pitches of worm. These machines are manufactured by Messrs. Buckton and Co., and would certainly be a valuable addition to any foundry having a number of worm pinions to cast.

The planing machine illustrated can be run in the ordinary manner with quick return stroke if required, in which case the cutting stroke will be made at a speed of 20 ft. per minute, and the return stroke at three times the speed. Even when returning at this quick speed the machine is extremely quiet in its running, and the reversal takes place without knock.

THE JAPANESE BATTLESHIP "YASHIMA."

The Yashima is one of two large battleships which have been built in this country to the order of the Imperial Government of Japan. She has been built by Sir W. G. Armstrong and Co., from the designs of Mr. Philip Watts, the naval architect and general manager of the Elswick shipyard.

The Yashima was launched at the end of February, 1896, and at the time we gave a profile and a deck plan showing the general arrangement of the ship. We now publish views which illustrate very well the construction of the vessel, the engravings being from photographs taken during the progress of the work. Before referring to these it is necessary we should give a general description of the vessel, and in doing this we repeat, for convenience, some of the leading particulars contained in our former notice.

The Yashima is 400 ft. long on the water line, and 412 ft. over all; the ram extending beneath the water about 13 ft. The length between perpendiculars is 372 ft. The moulded breadth is 73 ft. 6 in., and the moulded depth 43 ft. $7\frac{1}{2}$ in., and the mean draught 26 ft. 3 in. The displacement at that draught will be about 12,320 tons. This includes normal coal of 700 tons, and all armament, stores, &c., in sea-going trim. There is, however, in addition to the 700 tons of normal coal, room in the bunkers for 500 tons more.

The armoured protection is very complete. All the armour-plates have been supplied by Messrs. Charles Cammell and Co., and are of steel treated by the Harvey process. On reference to Fig. 1, on the opposite page, which is reproduced from our former issue for convenience of reference, it will be seen that the arrangement consists of the now usual forward and after barbettes placed at the ends of the central citadel. The belt armour is 226 ft. long by 8 ft. deep, the thickness varying from 18 in. to 14 in., the immersion at normal draught being 5 ft., so that there is 3 ft. out of water. The protective or belt deck, which is flat amidships, stretches athwartships from the top edges of the armoured belt, and is therefore 3 ft. above the water line amidships, or so far fore and aft as the belt extends. Forward and aft of the citadel portion the protective deck is at a lower level, being somewhat below the water line and sloping at the sides. In Fig. 1 the levels of the protective deck are shown by the strong line over the citadel extending above the boilers and engine-rooms and round the barbettes. This deck covers, also, the shell-rooms and magazines beneath the two barbettes, and also the auxiliary machinery-room beneath the after barbette. Stores, engineers' workshop, and ammunition passages are placed in this part of the ship beneath the protective deck. The step-down of this deck at each end of the citadel is also shown in Fig. 1; the vertical part of the step being composed of armoured bulkheads which run square across from port to starboard, and join the ends of the belt. The forward bulkhead is 14 in. thick, and the after one 12 in. These armoured bulkheads are shown in Fig. 1 by the short black marks which indicate armour in section. From the illustration will also be seen the manner in which the armoured deck slopes down to strengthen the ram forward, and is carried aft horizontally—horizontally so far as the fore-and-aft sections are concerned—protecting the tiller and steering gear, torpedo-room, &c. Fig. 2, which is a deck plan, shows the position of the barbettes. The armoured bulkheads referred to, which extend vertically to the level of the lower edge of the barbettes, stretch square athwartships immediately forward and aft respectively of the barbettes.

Turning now to our other illustrations on pages 172 and 173, Fig. 3 shows the lower part of the midship framing and vertical keelplate towards the after part. Fig. 4 shows the framing of the forward barbette. In Figs. 5 and 6 there is seen the manner in which the frames are carried up to form the armour shelf. Fig. 7 is another view of the barbette framing, and Fig. 8 shows the steel casting which forms the heel of the ship.

Dealing first with the barbette, the photograph from which our illustration, Fig. 4, was made was taken on the protective deck, the deck beams being shown in parts where the plating is not in place. The lower level of the protective deck forward of the barbette and outside the citadel is shown in the illustration, although the perspective is not very defined. The beams of the forward part of the deck above are also seen. In Fig. 7, on page 173, will be found an illustration, which also shows the framing of the same barbette on the other side, the photograph having been taken from forward and looking aft.

From the top of the thick belt, and, therefore, also from the top edge of the protective deck, up to the height of the main deck, there is armour 4 in. thick. These two strips, one on each side, do not extend quite as far as the thick belt, for whereas the latter reaches forward and aft respectively beyond the barbettes, the thinner belt ends at its junction with diagonal screens which spring from the barbettes and slope aft in the case of the forward part, and forward in the case of the after part. These screens therefore converge towards each other and thus shorten the side armour. The general disposition of the armour so far resembles that of the Royal Sovereign, and differs from that in the Majestic. In the latter vessel, it will be remembered, the protective deck is flat and a little above the water level, excepting where it approaches the sides of the ship, where it slopes down transversely so as to join the armoured belt at its lower edge, which is, of course, below the water level.

The arrangement of the barbette armour will be gathered from Fig. 1. The barbettes proper spring from the protective deck. The maximum thickness of the barbette armour is 14 in., this being used on the top part above the main deck. A large part of each barbette is, however, masked by the side armour, to which reference has already been made, and there the thickness may naturally be reduced. For instance, between the main deck and the protective deck, where the 4-in. belt is placed, the thickness is reduced to 9 in., and at the back of the screens it is 5 in. in the lower part. The guns of the main armament are protected by shields which, of course, revolve with them, and add quite an appreciable amount to the total weight of armour. The shields are 6 in. in front, but get thinner towards the rear, the ends being quite closed. This is substantially the same as the general arrangement of shields in the Majestic. It will be seen that each pair of guns is placed in what is vertically a light and shallow turret, the base of which is protected by the fixed barbette armour. There are four casemates on the main deck, in each of which a 6-in. quick-firing gun is mounted. The armour on these is 6 in. in the front and 2 in. at the back. The armour on the conning tower is 14 in. thick, and that on the director tower aft is 3 in. The coal stowage is so arranged as to give additional protection, the bunkers extending upwards to the protective deck and down to the stokehold plates. There is a passage immediately behind the armoured belt, being between it and the coal bunkers.

Excepting for the armour on the casemates, there is no protection for the sides above the main deck, as against raking fire there are the 4-in. armoured screens, and inboard there is the barbette armour. The main armament and the 6-in. guns are behind armour, the latter being in their 6-in. fronted casemates, and naturally the crews would be concentrated round their guns in action. Shells striking the thin sides would probably pass right through, but in the case of a shell entering and striking the barbette armour, it would be exploded, and the consequences might be extremely serious. There is not even the coal protection here which is so effective in muffling shell explosion. In the midship part below this deck there is 12 ft. thickness of coal. Of course all parts of the vessel cannot be protected, nor can fighting in an armourclad be rendered an occupation without risk; but it would seem that this is the weak point in the ship, though probably it is an inevitable weakness. Only a certain part of the displacement can be awarded to armour in a well-balanced design, and what may appear at first sight a feature of power, may prove to be, by the light of fuller knowledge, one of weakness. That is a point critics of warship design are apt to overlook or ignore. An extra gun might possibly be a better defence than a patch of armour.

All openings and hatches on the belt deck are protected by cofferdams, which are 3 ft. high, or 6 ft. above water level, and all these openings have armoured doors or armour bars to shut in action. The funnels, downcasts, air-shafts, &c., have armour bars at the level of the belt deck; in fact, the arrangements in this respect are in accordance with the best modern practice.

The main features of the armament were given in

THE JAPANESE BATTLESHIP "YASHIMA."

CONSTRUCTED BY SIR W. G. ARMSTRONG AND CO., LIMITED, ELSWICK.

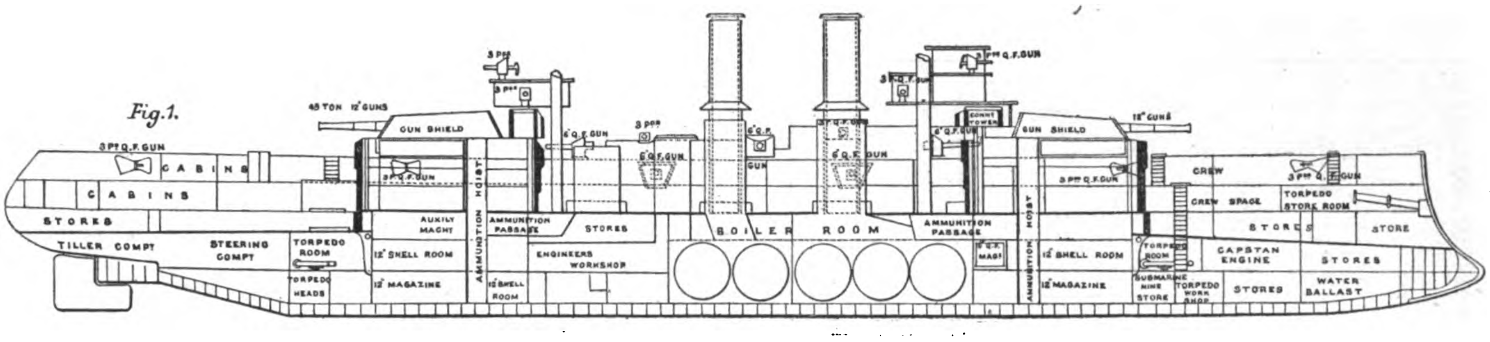


Fig. 1.

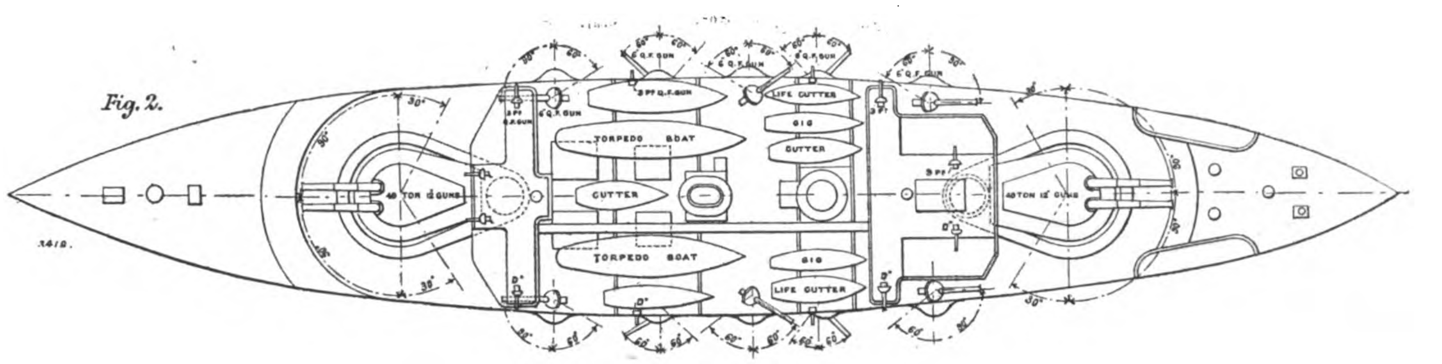


Fig. 2.

our previous notice.* There are two 12-in. 49-ton guns in each barbette, ten 6-in. quick-firing guns, and 24 lighter quick-firing guns.

Fig. 3, on page 172, shows the lower part of the midship framing and the vertical keel plate towards the after part. The structure of the double bottom may also be seen. The manner in which the frames are carried up to form the armour shelf, forming the chief structural distinction between naval and mercantile practice, is shown here, but perhaps better in Figs. 5 and 6. In all three of these illustrations the part of the framing at the back of the belt is shown, the large holes in the plates being placed where an armoured bolt will come, so that the latter may be hove up from the inside. Fig. 6, which is a view from forward looking aft, shows the double bottom and transverse bulkheads in the coal bunkers and machinery spaces. In the foreground is clearly seen the method of working the frames at the ends of the vessel. These are formed of Z-bars split towards the lower end, and thus made to form the angle and reverse angle bars at the top and bottom respectively of the floor-plate. The view is taken just forward of the part covered by the armoured belt, three of the beams for the protective deck forward of the citadel being in place. The change in construction from the citadel portion to the fore part of the ship is well shown here. Fig. 5 shows the detail of the midship part more plainly, and gives an excellent idea of the construction in this part. Fig. 8 is also an interesting picture, although it might be of advantage if there were a little less erecting timber included. The big steel casting which forms the heel of the ship, and which takes the suspended and balanced rudder, is well shown. The manner in which the ship is cut up aft is illustrated in Fig. 1, and should render her very handy and quick on her helm. Some of our own belted cruisers of seven or eight years ago had the "deadwood" removed somewhat, but their rudders were hung to a rudder-post and were unbalanced. The modern practice in the British Navy is to give cruisers a balanced rudder and to support it by a footstep bearing below, whilst the battleships have unbalanced rudders with an approximately horizontal keel right to the after end. The adoption of what may be called torpedo-boat practice for so powerful and heavy a vessel as these armourclads is a bold step on the part of the Japanese authorities. Mr. Watts has, however, had some experience with this form of rudder, and certainly the massive steel casting, with its broad and stiff flanges for the attachment of the plating and working it into the main structure, will provide enormous strength in this part, where it will undoubtedly be required. In Fig. 8 also will be seen the protective deck beams, together with part of the plating, in that part which comes in behind the after armoured bulkhead.

The legend speed of the Yashima with forced draught is 18½ knots, the air pressure being 1½ in. and the horse power 13,500 indicated. The natural draught speed is 16¾ knots, and the horse-power 10,000 indicated. The trials will take place very shortly, the vessel being almost ready.

For further details of this interesting vessel we must refer our readers to our former description of March 6, 1896. We shall, however, shortly publish illustrations of the main engines, which are by Messrs. Humphrys, Tennant, and Co., of Deptford, and shall then make reference to this part of the design.

* See Engineering, vol. lxii., page 310.

The Electric Light at Carlisle.—Mr. Wheatly, of Carlisle, speaking at an arts and crafts exhibition in Caldewgate, said that at a meeting of one of the town council committees, it had been practically decided to adopt the electric light for Carlisle.

Boston.—At the last quarterly meeting of the Boston Harbour Commissioners, the Mayor presented the annual report on the progress of the dock. He said the gross earnings of the dock in 1896 were 10,991*l.* 13s. 10d., being an increase of 2275*l.* 10s. 9d. on 1895. The expenditure for 1896 was 4425*l.* 17s. 11d., as against 3386*l.* 15s. in 1895. The estimated surplus harbour revenue, added to the gross earnings of the dock, made a total of 11,736*l.* 13s. 10d.; and, deducting expenses, 7310*l.* 15s. 11d. remained as the net earnings of the dock and harbour for 1896. Last year 88,652 tons of coal were shipped to Hamburg from Boston and King's Lynn; the corresponding shipments in 1895 were 79,474 tons.

Death of the President of the Pennsylvania Railroad.—Those who have taken any interest in American railroad development must have learned of the influence of Mr. George B. Roberts, who by sheer merit rose from the lowest to the highest rank, and who, for nearly twenty years, acted with conspicuous credit as president of the principal company in the States—the Pennsylvania Railroad. He has, however, been lately laid aside from his work, and succumbed on Saturday evening, the 30th ult., to the regret of a wide circle of friends. He began his association with the Pennsylvania Company 40 years ago in the humble capacity of a rod-man in the corps of civil engineers. His first position of importance was that of assistant engineer of the Allegheny Summit division, including the great tunnel on top of the mountain. He was employed for a decade in the construction of new railroads in Pennsylvania and New Jersey, including the North Pennsylvania, the Allantown, the Mahanoy, and Broad Top Mountain, and the West Jersey roads. In 1862 he was made assistant to the president, and thus early demonstrated the qualities that have since contributed to his elevation to the highest honours. He was elected fourth vice-president in 1869, and he proved such an invaluable aid to President Scott that he was promoted to the first vice-presidency in 1874. In the discharge of the duties of this office, he had charge of all engineering questions in relation to the extension and improvement of the various lines of the company, and exercised a general supervision through the comptroller of the accounts of the corporation. He was also the president's assistant in regard of all business connected with other lines leased or controlled by the Pennsylvania. In this he especially distinguished himself, and when Colonel Scott laid down the reins of power as president, in 1880, Mr. Roberts was chosen as successor. Since then Mr. Roberts more than justified the reputation he had previously earned. He was firm, just and exact in all his dealings, a skilful organiser, and a most successful manager.

NOTES FROM THE UNITED STATES.

Philadelphia, January 28.

The iron markets present no change, certainly no improvement. Buyers of material are waiting on the expected improvement. It was rather confidently believed that after the opening of the year the winter demand would set in. Apart from some activity in Bessemer pig, steel billets, and rods, there has been no activity to speak of. The production of pig iron at present limits is calculated to weaken the market if continued, but there has been no shading of prices as yet. Southern makers are meeting with encouraging home and foreign inquiries. Within seven months over 100,000 tons of American pig iron have been sold in Northern Alabama for foreign delivery. The industrial improvement in the South has helped the bar, sheet, and plate mills. Quite a demand is now in sight for all manner of finishing material. Throughout the northern States there is a fair volume of business, though prices are weak. There is a moderate demand for steel rails in the west, and very little movement elsewhere. All associations in the iron and steel industries have been putting forth vigorous efforts to prevent the drop of prices below certain agreed upon figures. This cannot be done. Steel rails will not sell freely until they are quoted at 22 dols., which is enough. Large quantities of merchant pipe have been asked for at Chicago and Pittsburgh. The Carnegies have booked orders for 15,000 tons. Pennsylvania mills have 28,000 tons of plate and structural iron orders in sight. Copper is in abundant supply at 12 cents. The general tendency in prices is downward rather than upward. The production of copper last year was 203,894 tons in the United States, of which 61.6 per cent. was exported. The production in 1895 was 171,197 tons, of which 37.8 per cent. was exported.

Hull and Barnsley Railway.—The declaration of a dividend at the rate of 2 per cent. per annum upon the ordinary stock of the Hull and Barnsley Railway and Dock Company has naturally had the effect of directing attention to the progress of the undertaking. The net revenue acquired for the last 10 years has been as follows: 1887, 72,839*l.*; 1888, 85,322*l.*; 1889, 98,281*l.*; 1890, 104,716*l.*; 1891, 122,925*l.*; 1892, 110,537*l.*; 1893, 84,433*l.*; 1894, 114,340*l.*; 1895, 131,402*l.*; and 1896, 158,473*l.*

The Wear.—The traffic committee of the River Wear Conservancy Commission reported recently that the number of vessels cleared from the port last year was 6545, registering 2,736,803 tons, on which the port dues amounted to 28,171*l.* As compared with the previous year, this showed an increase of 439 vessels, 169,807 tons, and 2332*l.* in port dues. The coal shipments from the Wear last year reached the large total of 4,406,853 tons, showing an increase of 180,474 tons over the preceding year. The imports from foreign ports and coastwise were 375,000, an increase of 70,000 tons. Mr. R. M. Hudson (vice-chairman) said it was gratifying to note that the transfer of Lord Durham's collieries to Sir J. Joicey and others had not been in any way detrimental to the trade of the port. On the contrary, the increased shipments of coal from the Lambton Collieries during the year amounted to 200,000 tons.

THE JAPANESE BATTLESHIP "YASHIMA."

CONSTRUCTED BY SIR W. G. ARMSTRONG AND CO., LIMITED, ELSWICK.

(*For Description, see Page* 170.)

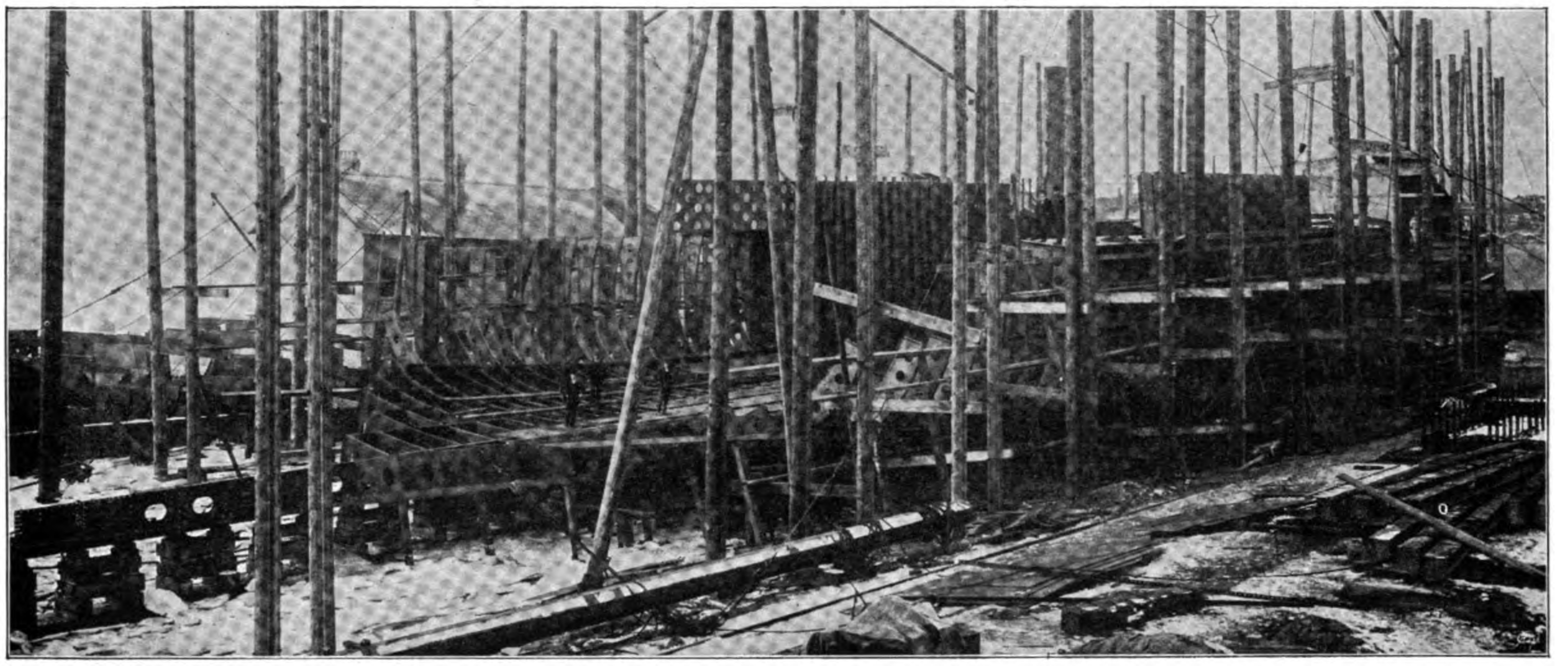


FIG. 3. LOWER MIDSHIP FRAMING AND VERTICAL KEEL PLATE.

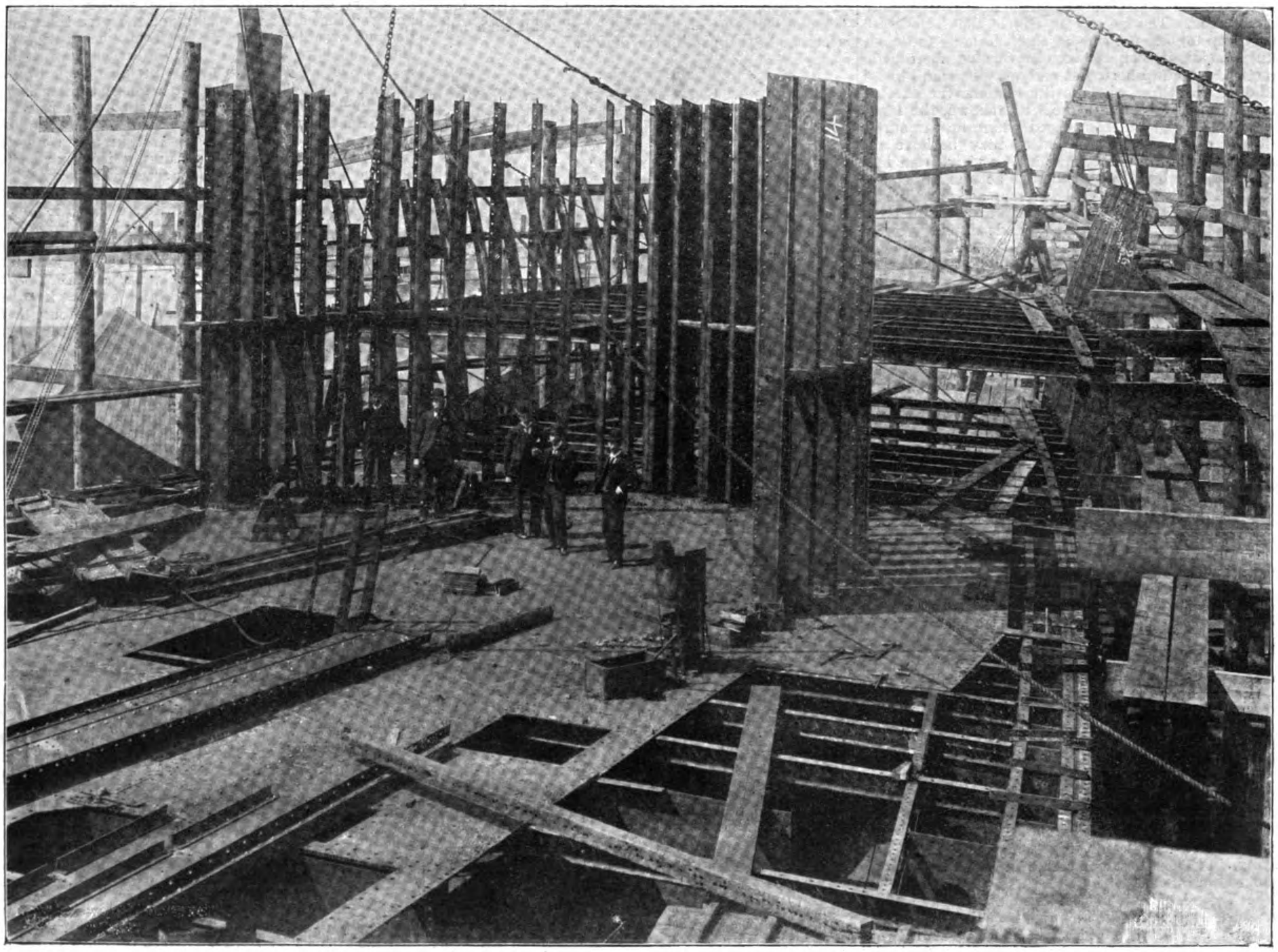


FIG. 4. PROTECTIVE DECK AND FRAMING OF FORWARD BARBETTE.

THE JAPANESE BATTLESHIP "YASHIMA."

CONSTRUCTED BY SIR W. G. ARMSTRONG AND CO., LIMITED, ELSWICK.

(*For Description, see Page* 170)

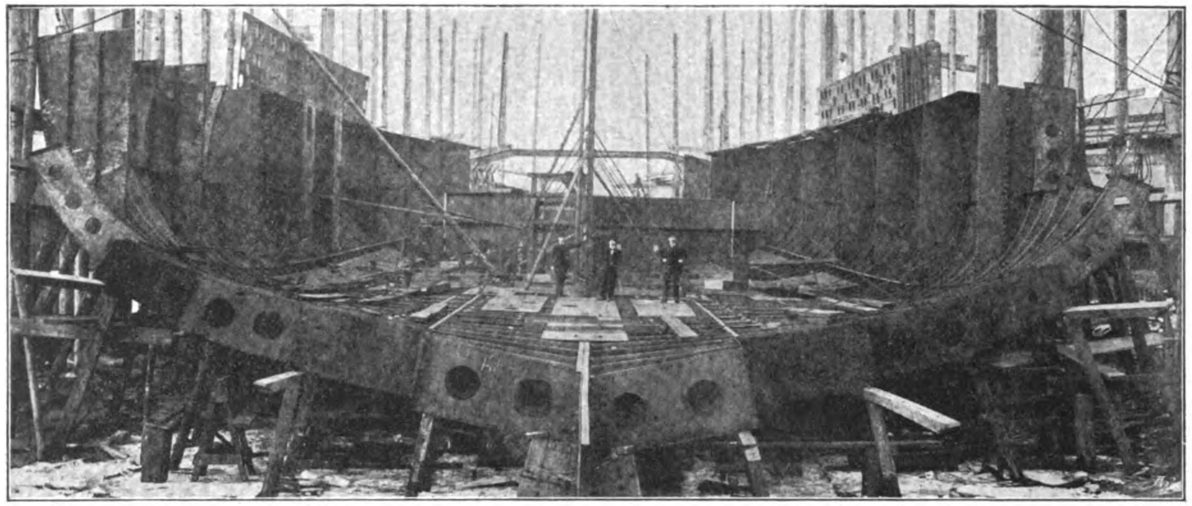


Fig. 5. Double Bottom Amidships.

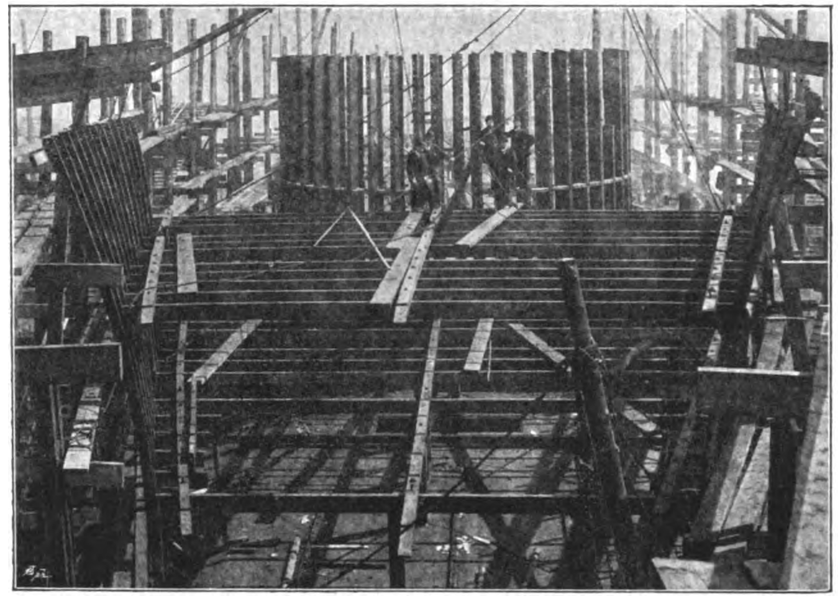


Fig. 7. Protective Deck Beams and Framing of Forward Barbette.

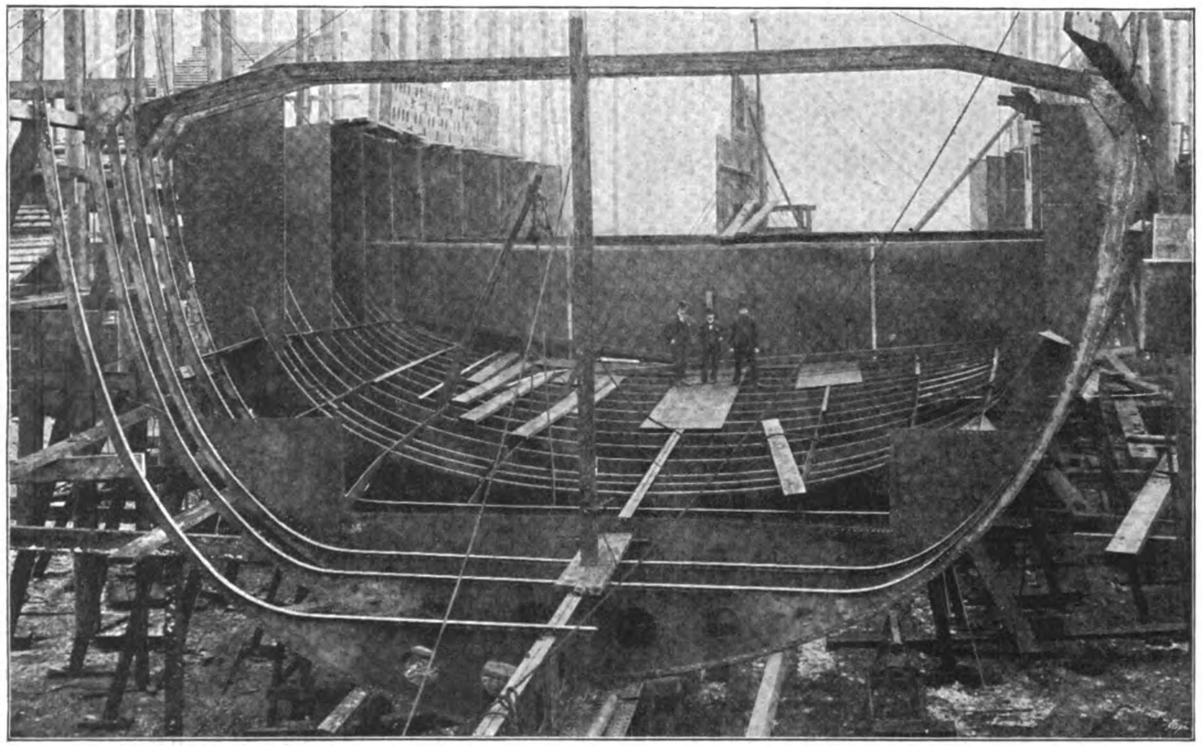


Fig. 6. Bottom Construction and Transverse Bulkhead Forward.

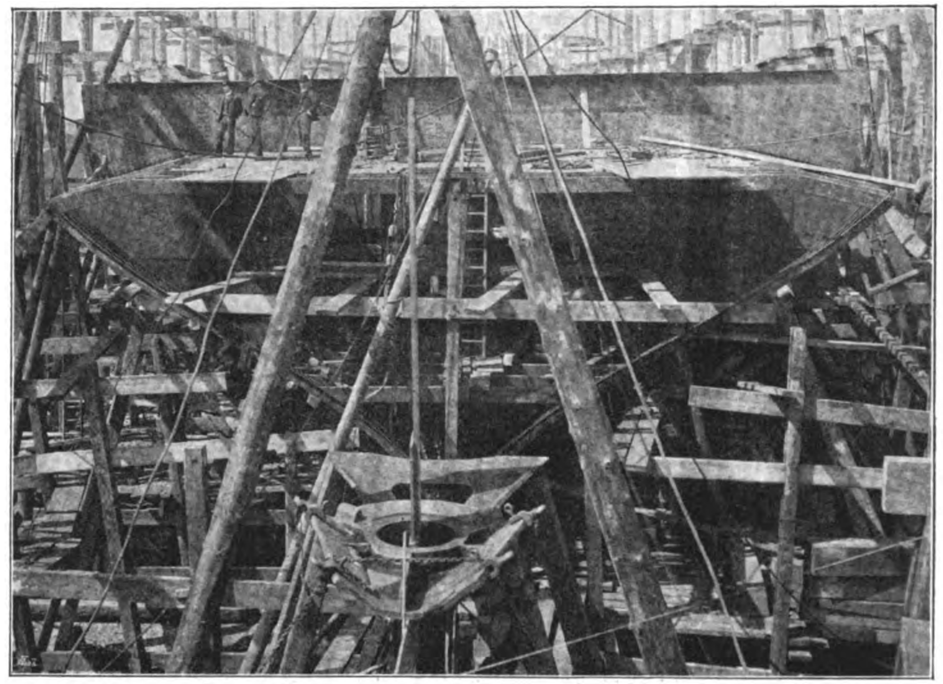


Fig. 8. Stern Casting in Position.

THE LAUNCH OF THE JAPANESE BATTLESHIP "YASHIMA."

CONSTRUCTED BY SIR W. G. ARMSTRONG AND CO., LIMITED, ELSWICK.

(*For Notice, see Page* 239.)

TWIN-SCREW ENGINES OF THE J

CONSTRUCTED BY MESSRS. HUMPHRYS, TENN

(For Notic

Fig. 7.

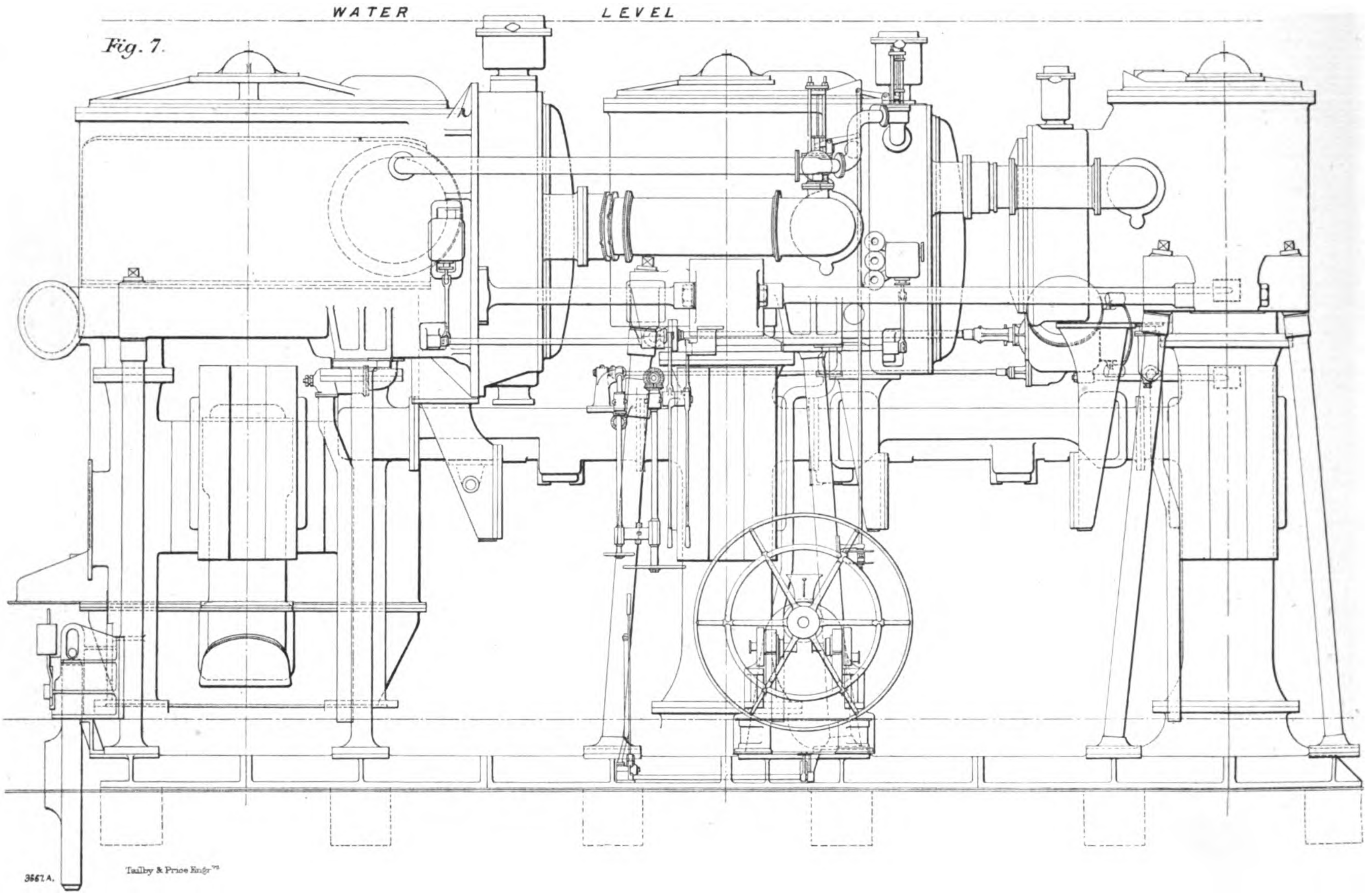
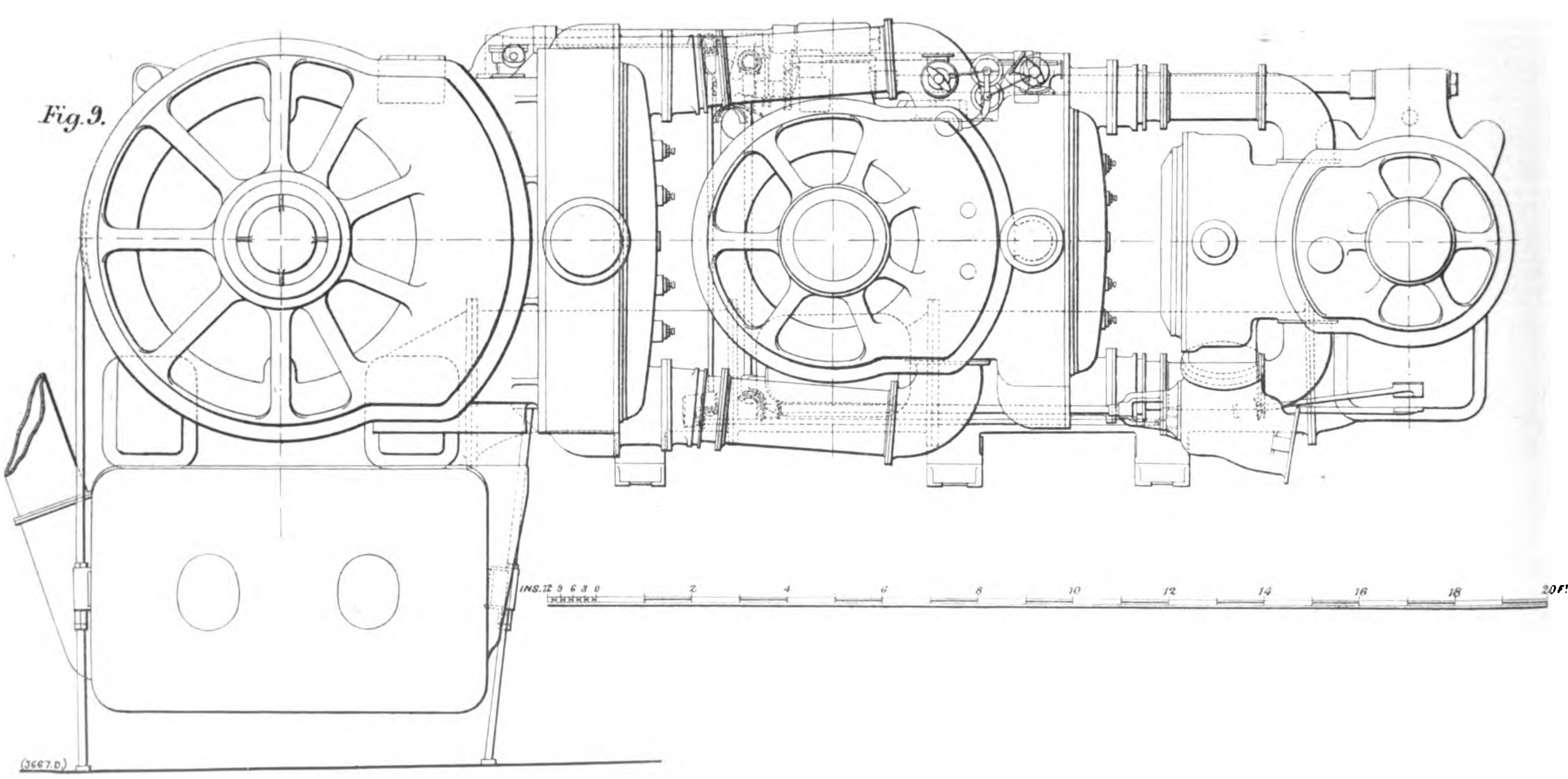


Fig. 9.



PANESE BATTLESHIP "YASHIMA."

T, AND CO., LIMITED, ENGINEERS, LONDON.

Page 239.)

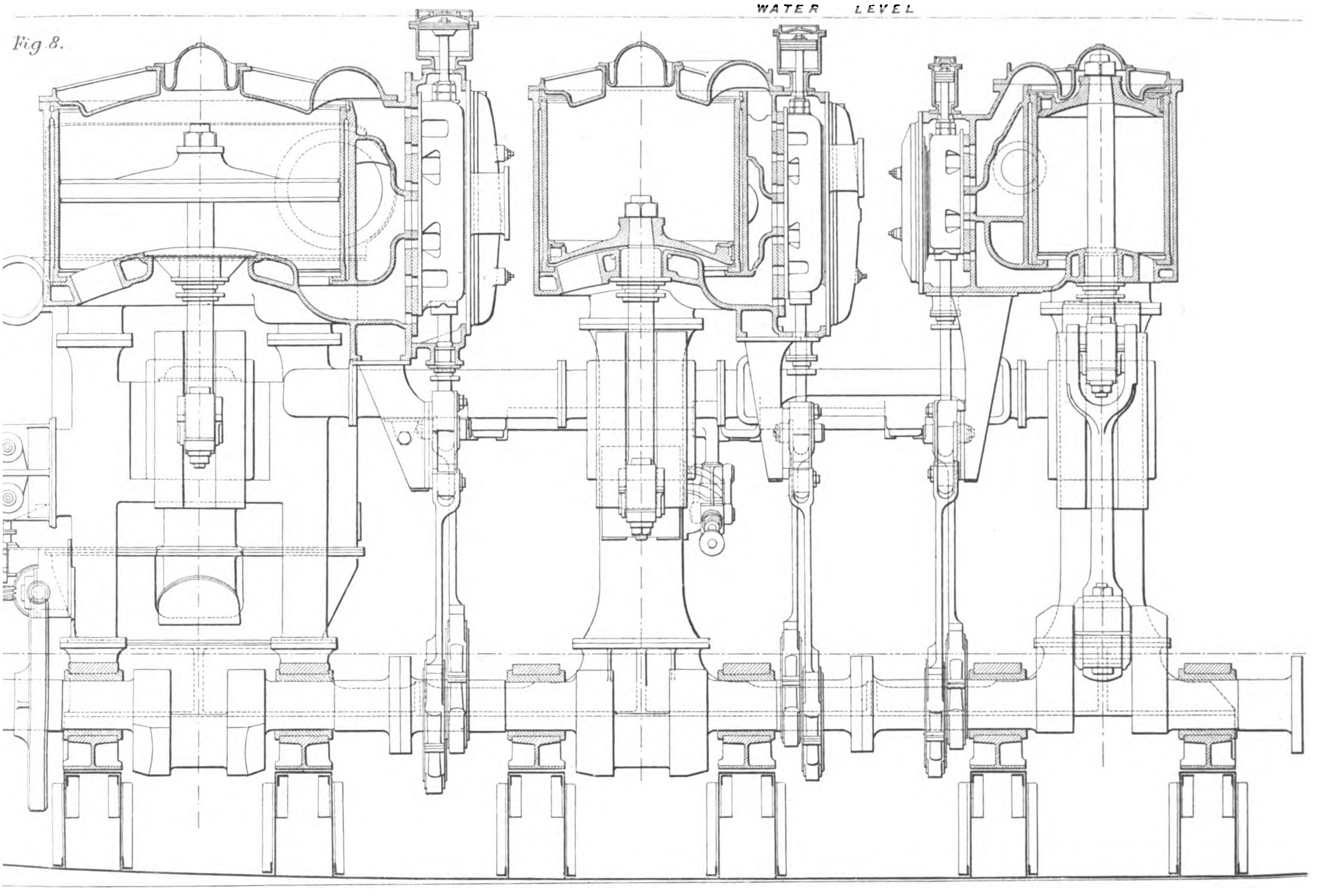
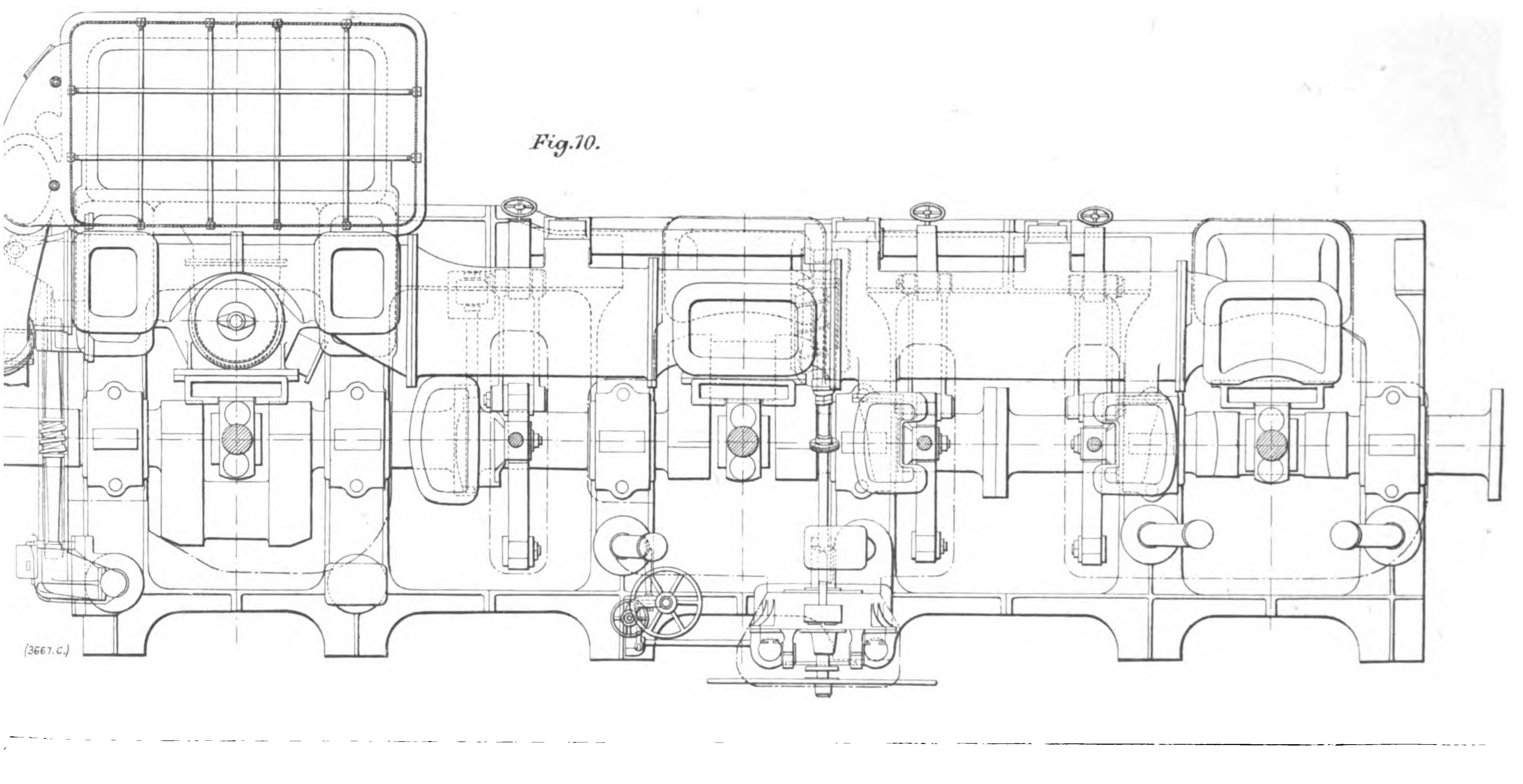


Fig. 8.

Fig. 10.



TWIN-SCREW ENGINES OF THE JAPANESE BATTLESHIP "YASHIMA."

CONSTRUCTED BY MESSRS. HUMPHRYS, TENNANT, AND CO. LIMITED, ENGINEERS, LONDON.

Fig. 13.

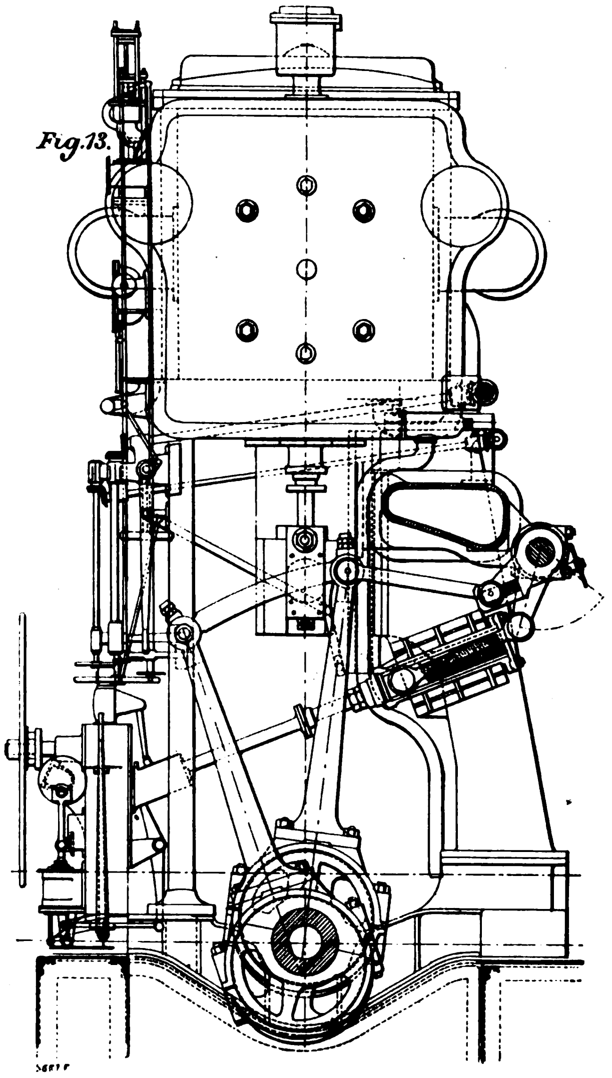
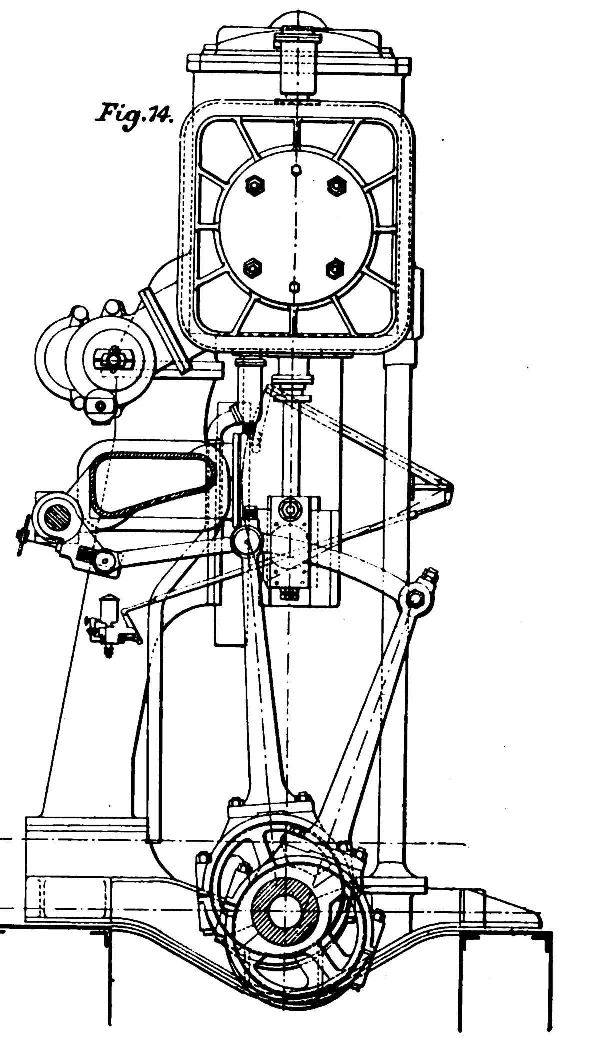


Fig. 14.



IN our two-page plate of last week we published four views of the engines of the battleship Yashima, built at Elswick by Sir W. G. Armstrong and Co., and engined by Messrs. Humphrys, Tennant, and Co., of Deptford. We give above and in the two-page plate of the present issue, the remaining views illustrating these engines. Fig. 11 is a general perspective view of one set of engines. This engraving has been prepared from a photograph taken as the engines were standing in the shops on the erecting blocks. Fig. 12 is a cross-section of the engine room showing both sets of engines in position, one engine being in section. Figs. 13 and 14 are end elevations, one showing the high and the other the low pressure engines.

The engines are of the three-stage compound, vertical, direct-acting, three-crank type. They have cylinders, 40 in., 59 in., and 88 in. in diameter, by 3 ft. 9 in. stroke. The general design is well shown in the illustrations in the present and last week's issue. The specified power is 13,500 indicated horse-power, the revolutions 120 per minute, and the steam pressure 155 lb. to the square inch. The cylinders are carried on castings of the usual type at the back, and have turned columns in front, each engine standing independently, the cylinders being separate castings. The whole is carried on a steel framing attached to the ship. The cylinders are jacketed, the required pressures being regulated by reducing valves, the drains being hand regulated. The covers are of cast steel. The pistons are of cast steel, and are secured to their rods by cone and nut in the usual way, the ends being solid with the rod. Spring packing is used. The slide valves are all flat valves, having balance pistons at the top taking the steam pressure of the corresponding steam chest. The high-pressure valve is double-ported, while the intermediate and low-pressure valves are triple-ported. All valves have an equilibrium ring at the back for relieving the face pressure, the ring being set up by springs in the usual way. There are separate faces to the slide surfaces of the cylinders, these being secured by screws. The slide valve gear is the ordinary link motion, fitted with solid link and sector. The valve spindle is screwed into a square sector block, means being provided for adjustment to take up wear. The vertical motion is controlled by a solid casting which projects downwards from the cylinder and acts as a guide. The eccentric rods are attached to the straps by bolts, as shown. The reversing engine is placed on the front as shown in Fig. 11. Means are provided for varying the cut-off in the different cylinders independently, by means of levers fitted with adjustable screws acting on the drag link. In this way the expansion can be altered so as to get a proper distribution of power within any cylinder according to the work being done and the method of running. The arrangement is shown in Fig. 14.

The crankshafts of the two sets of engines are each in three parts, the cranks being placed at equal angles. The cranks are of hollow forged steel. The air pumps are carried on the back frame casting of each low-pressure engine, and worked directly from the piston by means of a rod, which passes through a stuffing-box in the bottom cover. The stroke of the air pump bucket is, therefore, the same as that of the engine itself. The arrangement is generally adopted by Messrs. Humphrys, Tennant, and Co., for this class of engine; and though it was common with the old horizontal engines of warships, it is quite unusual with vertical engines. It makes, however, a very snug arrangement and takes up less room, allowing a freer passage at the back than when side levers are used. It also saves weight, and reduces the working parts. That it is an efficient arrangement is proved by the excellent vacuum this firm gets on its engine trials. The pump has foot and bucket valves and head valves as usual. All rubbing surfaces are of white metal, excepting the top end of the connecting-rod.

There is a rectangular surface condenser for each set of engines. These are placed behind the low-pressure cylinders, and contain collectively 13,500 square feet of cooling surface. There are also two auxiliary condensers, one in each engine-room. They are cylindrical in form, and each one has its own separate air pump and circulating pump. The larger steam pipes are of steel, and are either welded or solid drawn.

The boilers are of the ordinary return-tube type, and are 10 in number. They will be placed in four boiler-rooms separated by athwartship and fore-and-aft bulkheads. The two forward stokeholds will have three boilers, and each after one two boilers. The boilers are all single-ended, and will be placed back to back. The length of each will be 9 ft. 7¼ in., and the diameter 15 ft. 3 in. There will be four Purves furnaces to each boiler, and each pair of furnaces will have a combustion chamber in common, so there will be two combustion chambers in each boiler. The boilers will be run by forced draught on the closed stokehold system. There will be eight fans below the protective deck. The tube ends will be fitted with Humphrys' patent tube connection, which has been found to give admirable results, and has been in use since it was first practically tried on the Royal Sovereign. Special machinery has been laid down for making this fitting, and a large number have been turned out. There is an auxiliary boiler on the deck above. It is 9 ft. 5 in. long and 10 ft. 3 in. in diameter.

The propellers are of gun-metal and are three-bladed.

The trials of the Yashima are expected to be run shortly, and are being looked forward to by the designers of warships, as this Japanese battleship undoubtedly affords a most interesting example of warship design.

NEW ENGINE SHED AT CREWE.

WE illustrate on the opposite page the new "through and through" engine shed which has recently been erected at the south end of Crewe Station, and which is intended by its designer, Mr. F. Webb, to accommodate 60 standard tender engines. The shed in question will be used principally for the "turnback" engines arriving at Crewe with goods trains from either the north or south. These will pass into the shed at one end as they come off work, and, after cleaning, will come out at the other end for the return journey. An excellent idea of the internal appearance of the shed will be obtained on reference to Fig. 2, which brings out its huge proportions in a perhaps more striking way than the external view, Fig. 1. The length is 272 ft. 7 in., whilst the breadth is 184 ft. 1 in. All the ironwork is made to template and to standard patterns, so that any part will fit any similar shed, many of smaller dimensions having been erected at different points of the company's lines. The arrangement of tracks is well shown in Fig. 3.

ARGENTINA.—Last year 164,208 immigrants entered the Argentine Republic. Of this total 162,674 were labourers and immigrants of the poorer class.