A.D. 1868, 18*th* SEPTEMBER. N° 2877.

Screw Propellers.

LETTERS PATENT to Henrietta Vansittart, of Richmond, in the County of Surrey, for the Invention of "IMPROVEMENTS IN THE CONSTRUCTION OF SCREW PROPELLERS."

Sealed the 22nd December 1868, and dated the 18th September 1868.

PROVISIONAL SPECIFICATION left by the said Henrietta Vansittart at the Office of the Commissioners of Patents, with her Petition, on the 18th September 1868.

I, HENRIETTA VANSITTART, of Richmond, in the County of Surrey, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN THE CONSTRUCTION OF SCREW PROPELLERS," to be as follows:—

The object of this Invention is to construct screw propellers such as those described in the Specification of Lowe and Harris's Patent dated 10th Oct^{r}. 1862, No. 2735, in such a manner as to suit vessels of various lines.

In the Specification of Lowe and Harris's Patent just referred to a clear and detailed description is given of the mode of constructing screw propellers with oppositely curved blades or vanes, but although pro-

pellers of this kind are generally effective (due consideration having been given in their construction to the general character of the vessel to which they are to be applied, such for instance as the tonnage, the required speed, the length and breadth of the vessel, and the propelling power) yet it has been found that every propeller should be constructed upon certain rules depending for their data not only upon the tonnage but also on the lines of the vessel and the speed it is intended to propel her at, for it has been found by experience that the same propeller would not give an equally good result on two vessels of the same tonnage but different lines. A propeller constructed specially for either vessel would give a very bad result on the other for which it was not specially made.

In forming the pattern of a Lowe's screw propeller according to my Invention the blade should be divided endwise into 4 equal parts or portions, as set forth in Lowe and Harris's Specification above referred to, and the two middle portions (except where they blend with the two end portions) are to be pitched to such an angle as will correspond with the intended speed of the vessel through the water. This is their best and true effective pitch which shows no slip. The leading edge of the propeller blade must coincide with the angle of curvature and of departure of the water at the stern part of the vessel. The following edge is to be exactly the same as the leading edge of the propeller, so that both sides are to be of equal power in going ahead and in backing. The middle and edge curves are to blend with each other in a manner which can only be described as forming the true line of beauty. The twist on each blade from the periphery to the boss will be that due to a true screw, that is to say, the relative pitches or angles at the periphery and at the boss are to be the same as of the blades of a true screw.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Henrietta Vansittart in the Great Seal Patent Office on the 18th March 1869.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, HENRIETTA VANSITTART, of Richmond, in the County of Surrey, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Eighteenth day of September, in the year of our Lord One thousand eight hundred and sixty-eight, in the

thirty-second year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Henrietta Vansittart, Her special licence that I, the said Henrietta Vansittart, my executors, administrators, and assigns, or such others as I, the said Henrietta Vansittart, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN THE CONSTRUCTION OF SCREW PROPELLERS," upon the condition (amongst others) that I, the said Henrietta Vansittart, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Henrietta Vansittart, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being had to the Drawing hereunto annexed, and to the letters and figures marked thereon (that is to say) :—

The object of this Invention is to construct screw propellers such as those described in the Specification of Lowe and Harris's Patent, dated Tenth October, One thousand eight hundred and sixty-two, No. 2735, in such a manner as to suit vessels of various lines and form or configuration and for deep or shallow draught.

In the Specification of Lowe and Harris's Patent just referred to a clear and detailed description is given of the mode of constructing screw propellers having blades or vanes with their edges oppositely curved. Although propellers of this kind are generally effective, due consideration having been given in their construction to the general character of the vessel to which they are to be applied, such for instance as the tonnage, the required speed, the length and breadth of the vessel, and the propelling power, &c.) yet it has been found that every propeller should be constructed upon certain rules depending for their data not only upon the tonnage but also on the lines and configuration of the vessel

and the speed at which it is intended to propel her, for it has been found by experience that the same propeller would not give an equally good result on two vessels of the same tonnage but of different lines. A propeller constructed specially for either vessel would give a very bad result on the other for which it was not specially made.

In forming the pattern of a Lowe's screw propeller according to my Invention the blade should be divided endwise into three or four equal parts or portions according to the velocity intended to be given to the periphery of the propeller. The middle portion or portions (except where they blend with the two end portions) are to be pitched to such an angle as will correspond with the intended speed of the vessel through the water. This is their best and true effective pitch which shews no slip. The blades may be set at any desired angle on their boss and for convenience they may be cast with the boss or separately therefrom and fixed or secured therein in any convenient manner. It is preferred to make the boss in the form of a truncated sphere or barrel. The propeller may be constructed with two or more blades, and these blades may taper either to or from the boss, or they may be made with edges the planes of which are parallel.

In the accompanying Drawing Fig. 1 shews in side elevation a two-bladed propeller constructed according to my Invention and adapted to the stern of a vessel. The blades *a*, *a*, are cast in one with the boss *b*, which is solid and of nearly a spherical form or a truncated sphere. The blades in this instance taper slightly laterally outwards from the boss as shewn by the dotted lines which represent them in a vertical position. In thickness they also have a slight taper towards the boss to ensure sufficient strength to the blades at their root. The amount and character of convexity which is given to the opposite faces of the blades will be clearly seen by inspecting the Figure.

Screw propellers formed of a true screw or its segments have heretofore been constructed on the hypothesis that water is a solid, and that the best way of obtaining propelling power or resistance from it is to cut a direct screw passage through it in such a manner as shall offer the least resistance to the motion of the blades and shall divide the water by the least possible distance; experience has however demonstrated that the above theory is incorrect, and has served to prove conclusively that water ought not to be thus treated, but should be considered as a subtle fluid capable of finding its way into hollows and

curves in the blades of the propeller even when these are in rapid motion. It has been found (in respect to the curves of these blades) that the proper angle of the edge or entering part of the blade is difficult to determine and at the same time is all important to the proper action of the propeller. Careful experiments have shewn that the best or proper angle for the leading edges of the blades varies according to the angle or curve of the water lines of the after part or run of the vessel and also varies with and according to the velocity of the vessel through the water. The velocity of the vessel therefore as well as the curvature of the water lines determines an invisible line which indicates the points and angle at which the water closes in after the vessel has passed through it or at which the water recedes frem the vessel while the latter is in motion, or in other words as the vessel moves forward the disturbed water will leave the sides of the vessel in a curved line which will vary according to the lines of the vessel and its velocity. All these considerations must be the guides to the engineer in deciding on the proper angle for the leading and following curved edges of the propeller blades, more especially the outer edges of the blades. The pitch of the middle or centre portions of these blades must be determined on other and quite distinct conditions, viz^{t}. the length of stroke of the pistons, the number of revolutions per minute, and the horse power employed, as well as the intended velocity of the vessel through the water. The mode of determining these points is well known and need not be detailed here as it forms no part of my present improvements. In order to arrive at the proper angle for the outer edges of the propeller the blade should be divided on its outer edge or end into say four equal parts or portions, and the two middle portions (except where they blend with the two end portions) are to be pitched to such an angle as will correspond with the intended speed of the vessel through the water. The manner of obtaining this angle is well known to engineers and forms no part of my present Invention. The outer or entering edges of the blades are curved round to coincide with the invisible line above mentioned as being formed or produced from the lines of the vessel and the calculated speed.

The way in which this line is produced or obtained will be understood by reference to Figures 5 and 6, which are diagrams representing the lines of a steam vessel to be fitted with a screw propeller; Fig. 5 is a side elevation, and Fig. 6 is a plan, shewing the lines of a vessel

which it is intended to propel at the assumed speed of thirteen knots per hour. Let the blue line A in Fig. 6 indicate the water line or line of flotation. The red line B is a horizontal line coincident with the top of the propeller when placed on end. The lower red line C is another horizontal line, but coincident or parallel with the axis of the propeller shaft, which is indicated by the straight black line D. In order to ascertain the line described by the water on leaving the vessel (when it is going at the speed of thirteen knots per hour) proceed as follows:— From the intersection of the water line A with an ordinate as at *c*, draw *c*, *x*, parallel to the centre line D of the vessel, then bisect A, *x*, as at *a* and use this as one point. Repeat this operation at every intersection of the ordinates with the water line A and a series of points *a*, *a*, *a*, will be formed. On uniting these points as indicated by the blue dotted line A^1 a curved line will be produced, which will be the line described by the water on leaving the sides of the vessel. An analogous line from the red line B may be obtained in the same manner, taking *d*, *y*, as the parallel lines from ordinate to ordinate bisecting B, *y*, as at *z*, and proceeding as in the former instance and as indicated by the dotted red line B^1. It has been found that the water on leaving the vessel in the line A^1 curves round sharply towards the boss of the propeller, and therefore when the exact angle or curve from the last ordinate to the boss is ascertained, the entering angle or edge of the propeller blades must be brought just within as shewn at 1, 1, which in Fig. 6 represents the edge of the propeller. By this means the water in motion beyond the line A^1 will be carried or brought behind the leading edge of the propeller, which will thus be caused to act more efficiently than ordinary screw propellers. If it be desired to adapt the Invention to vessels intended to be propelled at a greater or less speed than thirteen knots per hour (which I propose to adopt as my standard speed) I produce the line A^1 in the manner already explained as for a speed of thirteen knots per hour, and I divide the space on the ordinates from the water line A to the points *a*, *a*, *a*, on A^1 into thirteen parts, and if the vessel is to be propelled at say sixteen knots I mark off three divisions of the scale above the points *a*, *a*, *a*, and on joining these I shall obtain the line described by the water on leaving the sides of the vessel when she is proceeding at a velocity of sixteen knots per hour. If on the contrary I intend to propel the vessel at the rate of say ten knots per hour, I mark off three degrees

of the scale below the points *a*, *a*, *a*, on all the ordinates and proceed as before to produce a line equivalent to the line A^1 in Fig. 6, but corresponding to the speed of only ten knots per hour.

In certain cases where it may be considered desirable to increase the area of the propeller to prevent slip or reduce its amount, and improve the grip of the blades, I construct the after edge of each blade of the propellers with an additional portion slightly curved forward. This additional width may be cast with the blade as shewn at Fig 2, the part *p* below the dotted line 2 and colored blue being the added portion, or the added portion may be rivetted on to an existing blade as shewn at p^1 in Fig. 3. The pitch of this additional length will be decreasing until its after edge will be the same or nearly the same pitch as the middle portion of the blade. Constructing the after edges of the blades with an additional width will be particularly applicable to vessels of shallow draught where sufficient diameter of propeller cannot be obtained or when the propeller cannot be fully immersed. When the propeller with these additions is in motion ahead there will be less rush of water past the after edges of the blades, and the backing or power to quickly check the velocity of the vessel will be increased by the finer pitch of the additional after edge and by the increased area of the propeller.

Fig. 4 represents another form of blade adapted to a cylindrical boss to which the blades are secured by flanges and bolts which are fitted to slotted or oblong holes in the flange so as to admit of adjusting the position or altering the pitch of the blades. It will be seen that the blades near the boss are extended laterally to obtain a finer entrance near the boss and to give propelling power to this part of the blade. The upper blade is shewn in side elevation; the lower blade is shewn as developed or laid out flat and not in propelling position.

When a screw propeller is constructed on the principles herein set forth a very decided increase of grip on the water, and consequently an increase of propelling power, will be obtained with great steadiness of action and absence of vibration.

Having now described my Invention of "Improvements in the Construction of Screw Propellers," and having explained the manner of carrying the same into effect, I claim as the Invention secured to me by Letters Patent as aforesaid, forming the outer edges of the blades

of a screw propeller in the manner herein set forth, that is with compound curves obtained or generated from the lines or configuration of the vessel to which the propeller is to be adapted as herein set forth.

In witness whereof, I, the said Henrietta Vansittart, have hereunto set my hand and seal, the Seventeenth day of March, in the year of our Lord One thousand eight hundred and sixty-nine.

HENRIETTA VANSITTART. (L.S.)

LONDON:
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Printers to the Queen's most Excellent Majesty. 1869.

A.D.1868. SEP.18. Nº 2877.
VAN SITTART'S SPECIFICATION.

FIG.1.

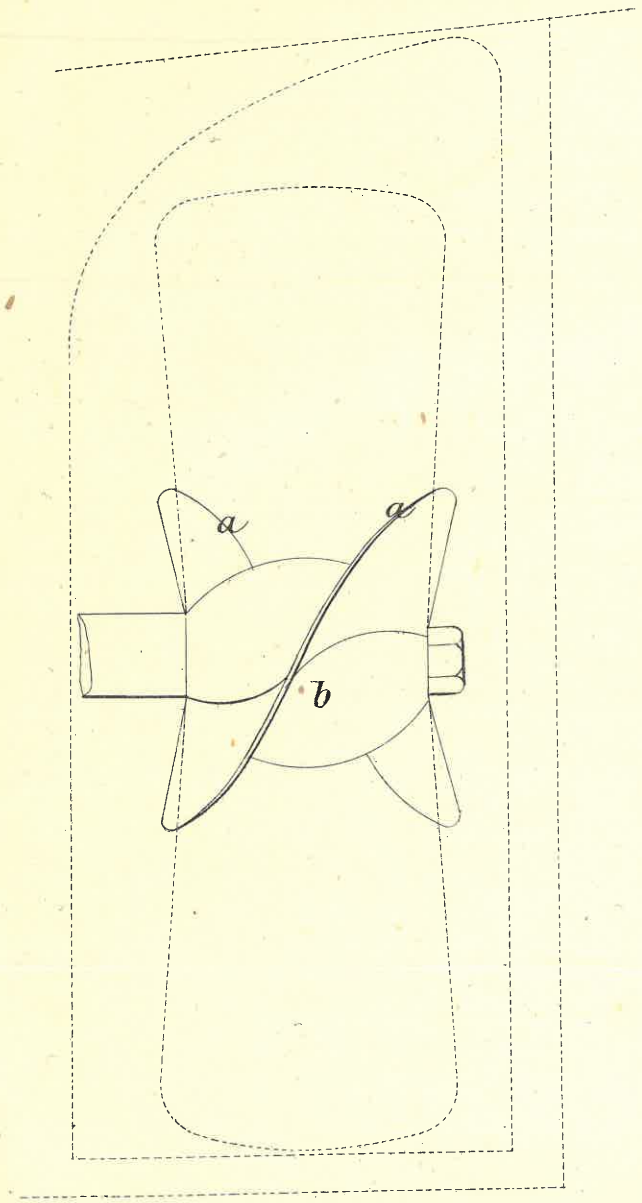

FIG.4.

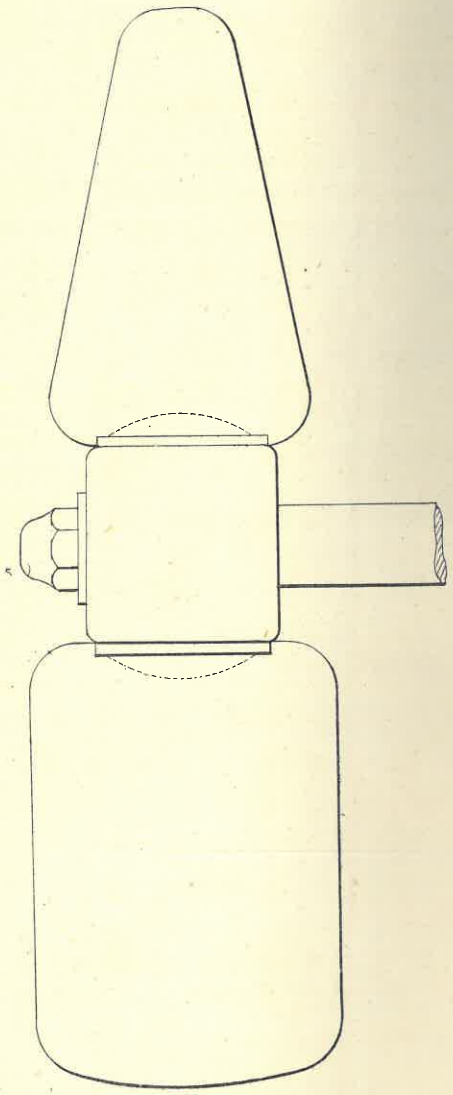

FIG.2.

FIG.3.

The filed drawing is partly colored.

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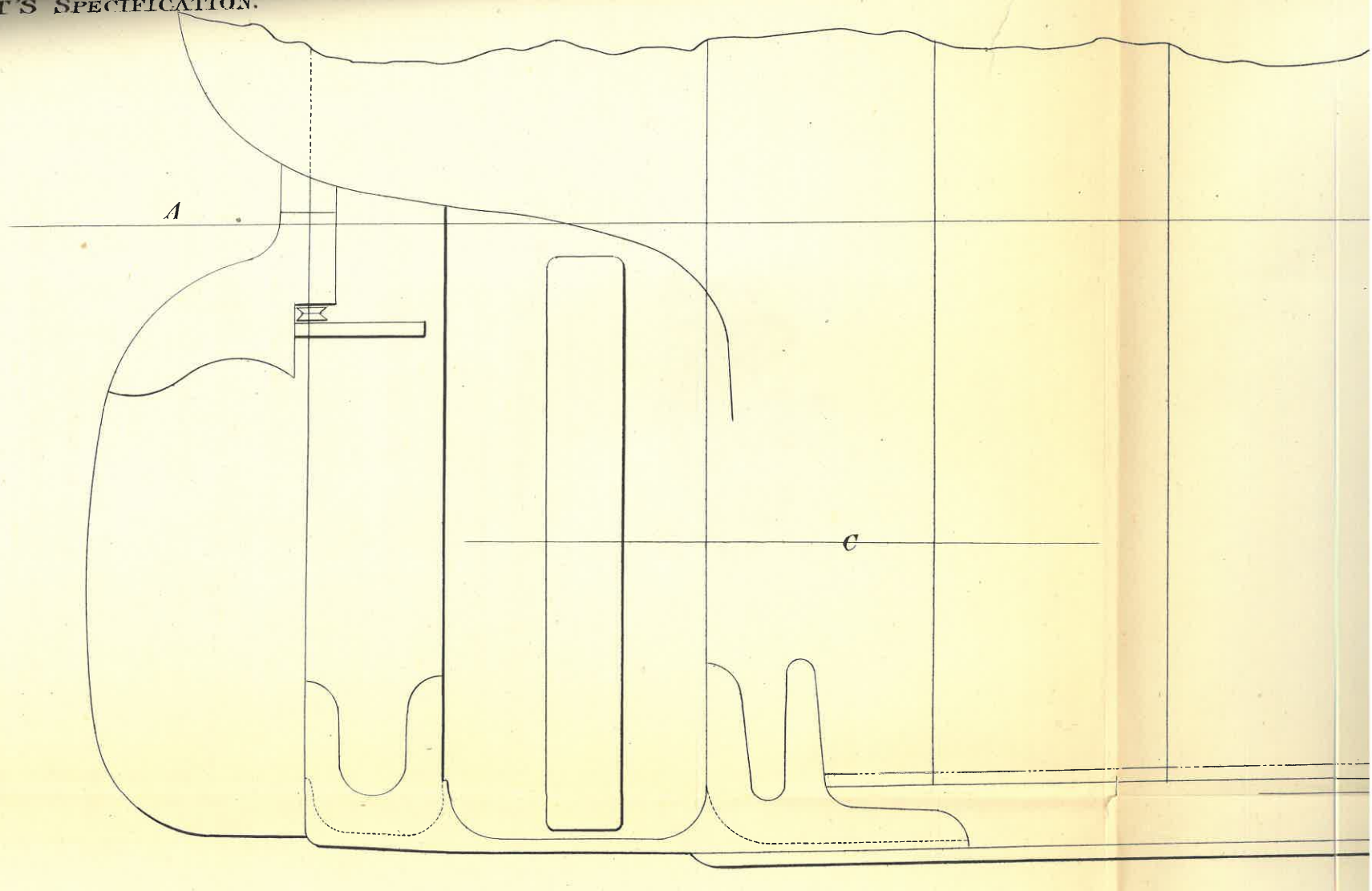

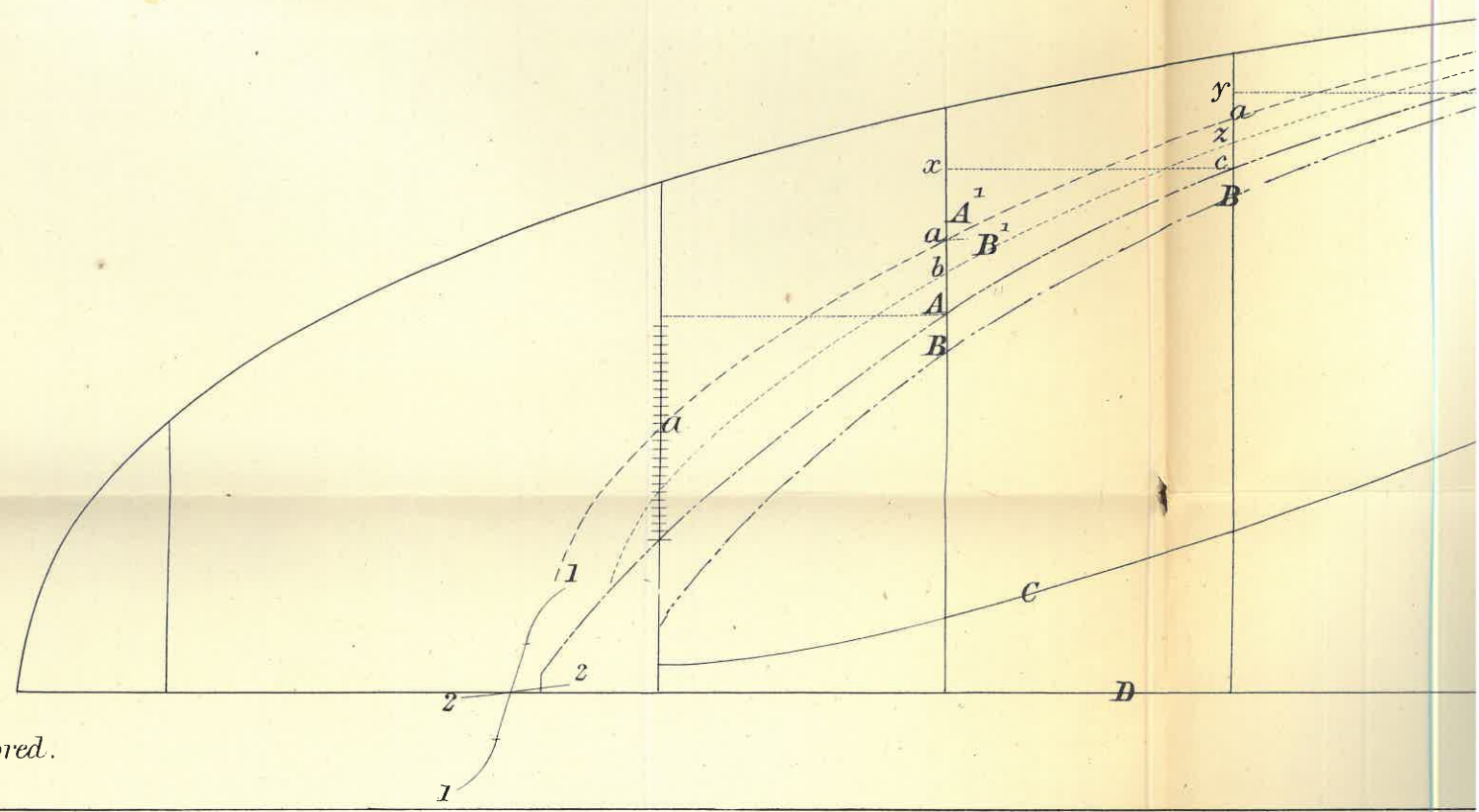

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FIG. 5.

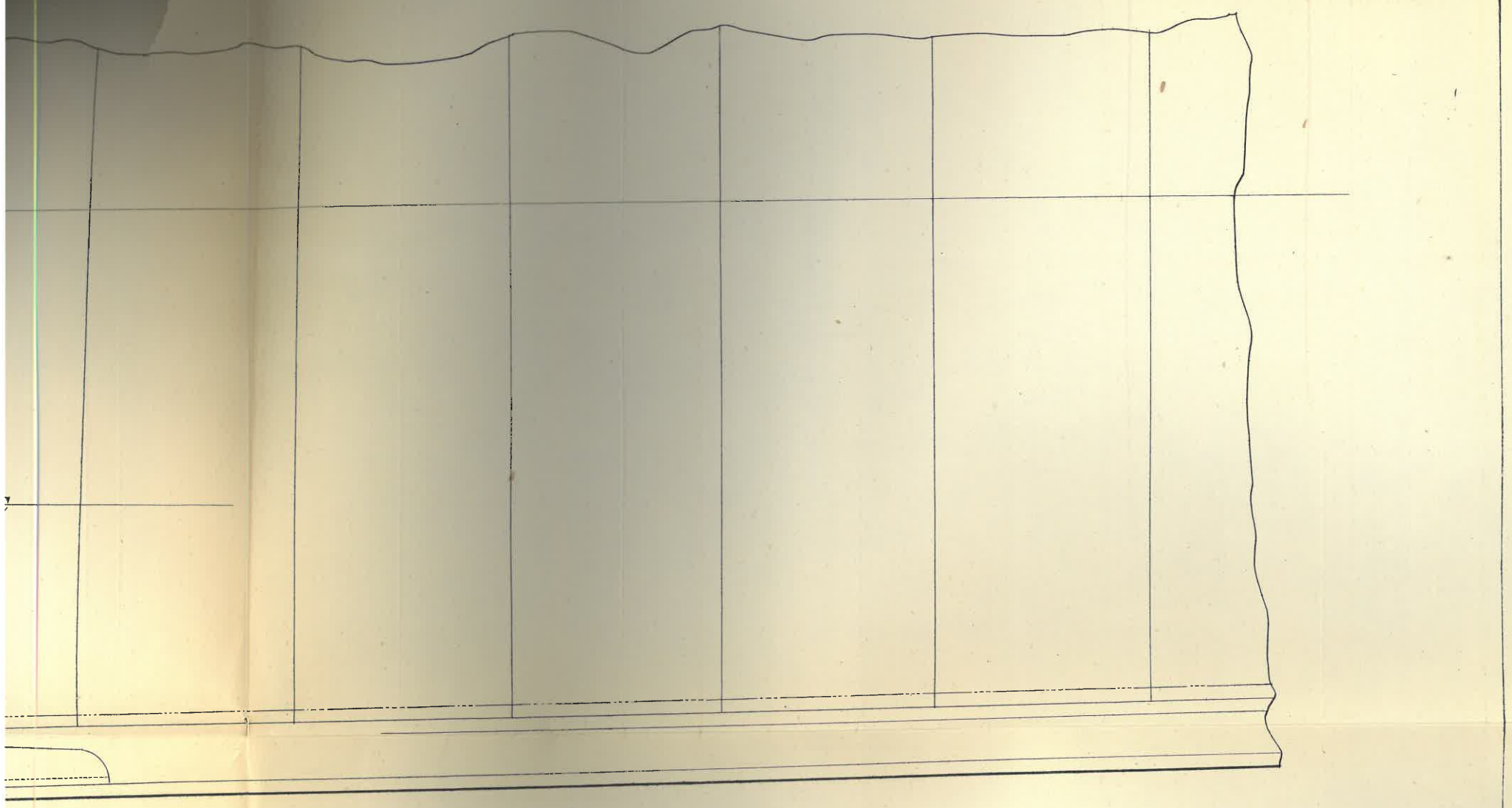
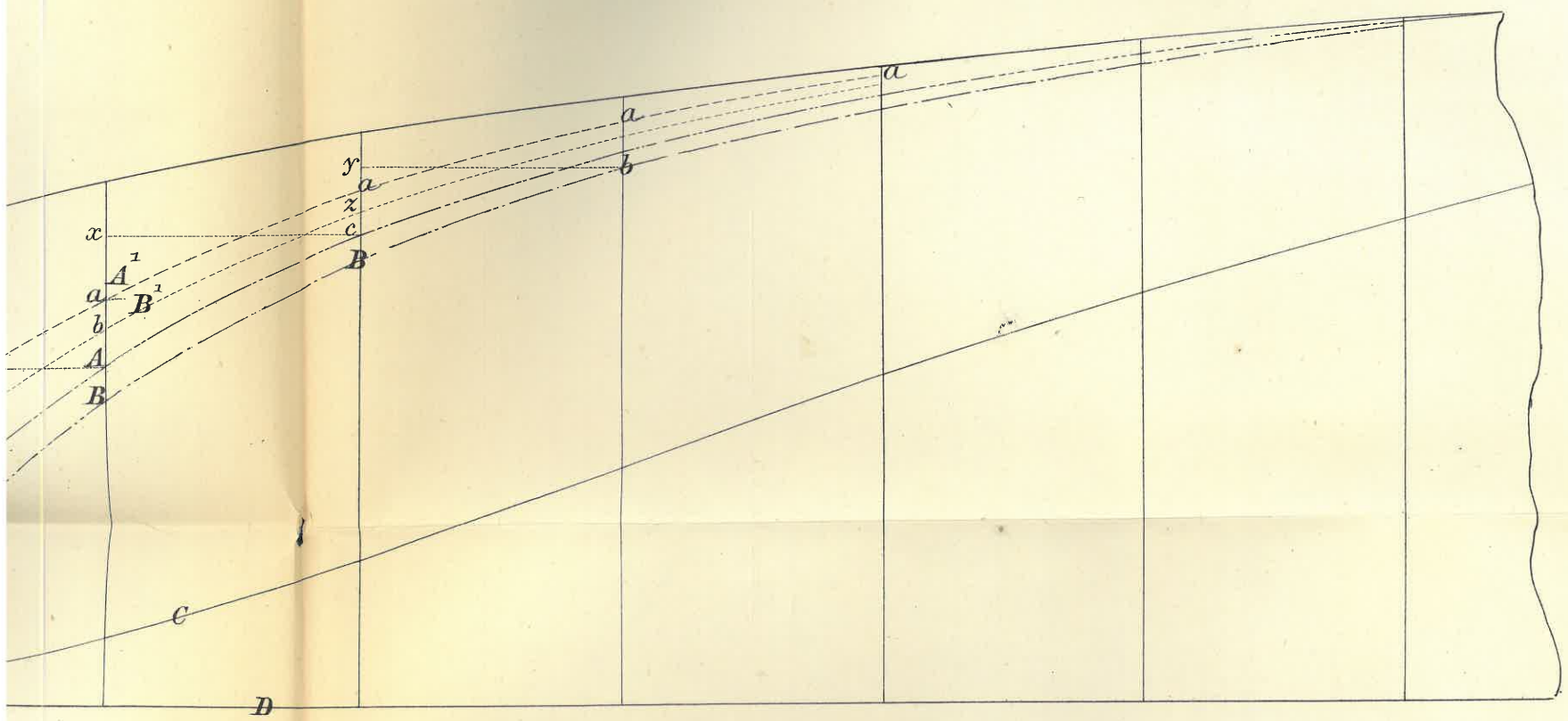


FIG. 6.



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s to the Queen's most Excellent Majesty. 1869.