H. Vansittart.

Screw Propeller.

No. 89,712. Patented May 4, 1869.

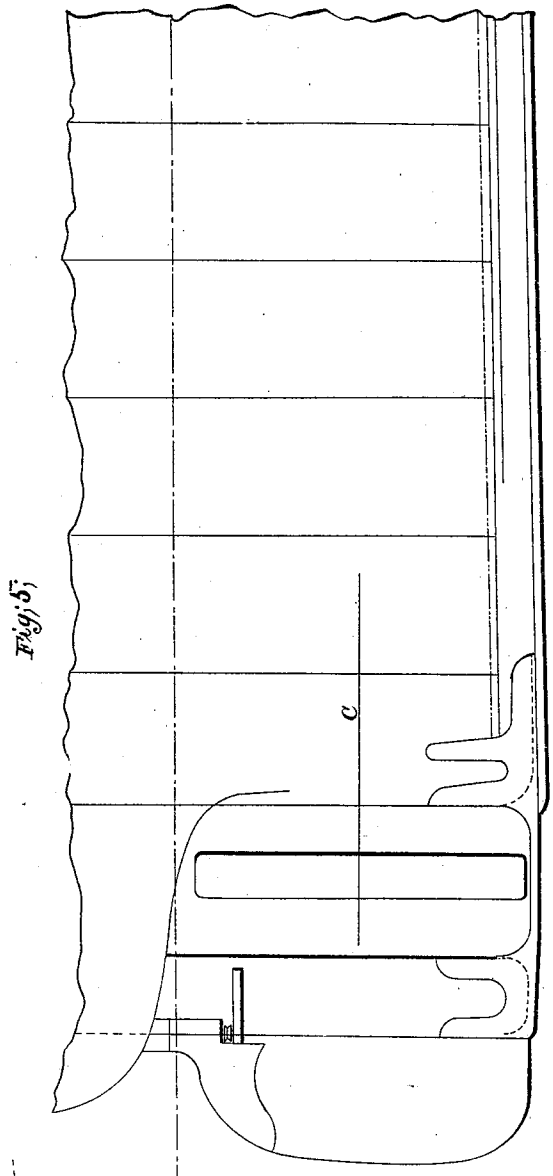

Fig. 5.

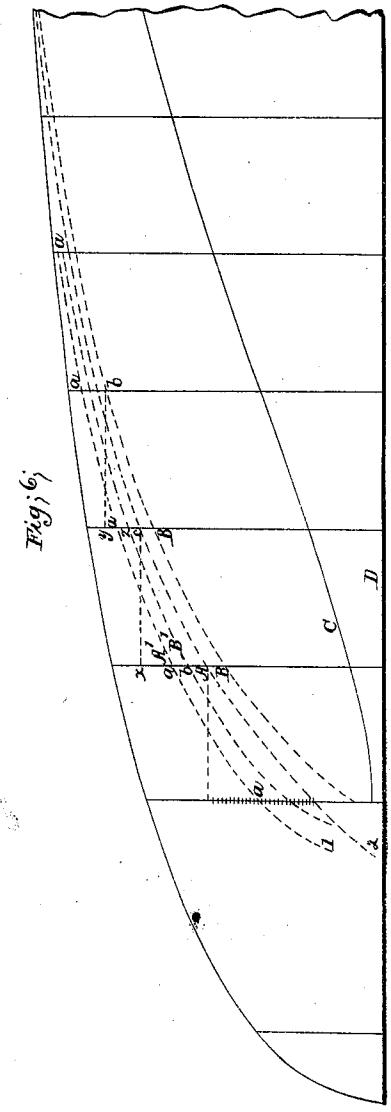

Fig. 6.

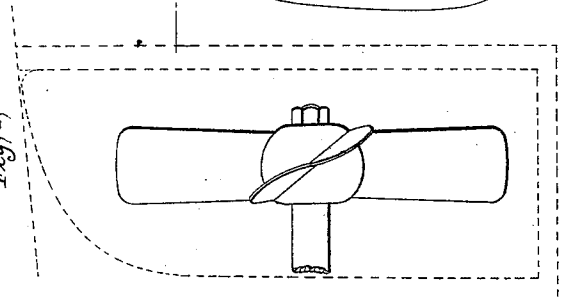

Fig. 1.

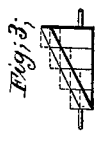

Fig. 3.

Fig. 4.

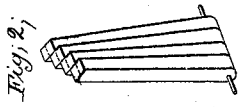

Fig. 2.

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HENRIETTA VANSITTART, OF RICHMOND, ENGLAND.

Letters Patent No. 89,712, *dated May* 4, 1869.

IMPROVED METHOD OF CONSTRUCTION FOR SCREW-PROPELLERS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, HENRIETTA VANSITTART, of Richmond, in the county of Surrey, in England, have invented a new and useful Improvement in the Construction of Screw-Propellers; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

The object of this invention is to economize the power required in driving steam-propellers for ships or other vessels.

This is effected by so modifying the form of the blades of screw-propellers, as to cause them to act more effectually on the water, and to prevent them from "churning," or uselessly stirring the water near the centre of motion.

In carrying out the invention, the blades of the propeller are so shaped, that when viewed in edge view, and in cross-section, instead of forming portions of the thread of a screw, they will present a compound curved line, curling in opposite directions from the centre to the edges.

The blades may be set at any desired angle on their boss, and, for convenience, they may be cast with the boss, which, by preference, is made 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.

In the accompanying drawing—

Figure 1 shows, in side elevation, a four-bladed propeller constructed according to my invention, and adapted to the stern of a vessel;

Figures 2, 3, and 4, illustrate the method of forming the curvatures of the blades; and

Figures 5 and 6 represent diagrams, in plan and section, of a vessel, illustrating the method of obtaining the pitch of the said curves.

Similar letters of reference indicate corresponding parts.

The blades *a a* are cast in one with the boss *b*, which is solid, and, by preference, of nearly a spherical form, or a truncated sphere.

The blades, in this instance, taper slightly laterally outward from the boss. In thickness, they also have a slight taper toward the boss, to insure 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.

The manner in which I obtain the right curvature for blades of different sizes and proportions, and for vessels of various kinds, is the following:

Take the extreme breadth of blade required, and let that measurement be divided into four parts.

The measurements thus obtained are to be used for forming four cubes of wood, of a length equal or somewhat superior to the length of the blade required.

These long cubes are placed on a rod, as shown in the perspective view, fig. 2.

These cubes are set side by side, and so arranged that the upper or free end of the leading cube will be in advance of the adjoining cube, to the extent of one-half its width, and so on throughout the series.

Having secured the cubes in this position, the projecting angles are cut away, and the cubes trimmed down until an even surface is obtained, as shown at fig. 3.

The opposite faces of the blade are then hollowed out, as shown at fig. 4, and I thus produce the curved transverse line, curling in opposite directions, as shown in the propeller-blades, fig. 1.

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 shown 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-line, determines an invisible line, which indicates the points and angle at which the water recedes from 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 portion of these blades must be determined on other and quite distinct conditions, viz, 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.

In order to arrive at the proper angle for the outer edges of the propellers, the blade should be divided, on its outer edge or end, into 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 figs. 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, showing 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.

The lower red line 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′, 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′.

It has been found that the water, on leaving the vessel in the line A′, curves round sharply toward 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 shown at 1 1, which, in fig. 6, represents the edge of the propeller.

By this means, the water in motion beyond the line A′ 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′ 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′, 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 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′ in fig. 6, but corresponding to the speed of ten knots per hour.

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

Having thus described my invention,

I claim as new, and desire to secure by Letters Patent—

The method of determining the form or inclination of the outer edges of the blades of a screw-propeller, relative to the form or speed of the vessel to which it is attached, as herein described.

In witness whereof, I, the said HENRIETTA VANSITTART, have hereunto set my hand and seal, the 24th day of November, in the year of our Lord 1868.

HENRIETTA VANSITTART. [L. S.]

Witnesses:

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