(Model.)

2 Sheets—Sheet 1.

J. E. T. BARTLETT.

PROPELLER WHEEL.

No. 384,498. Patented June 12, 1888.

Fig. 1.

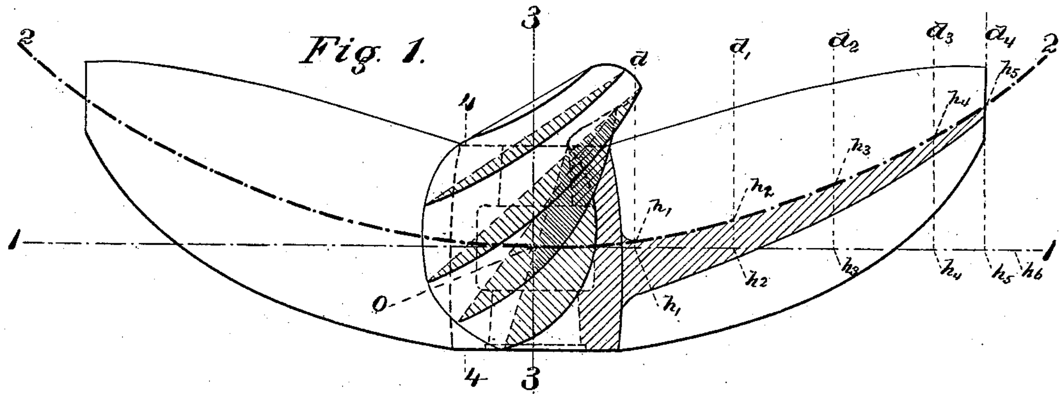
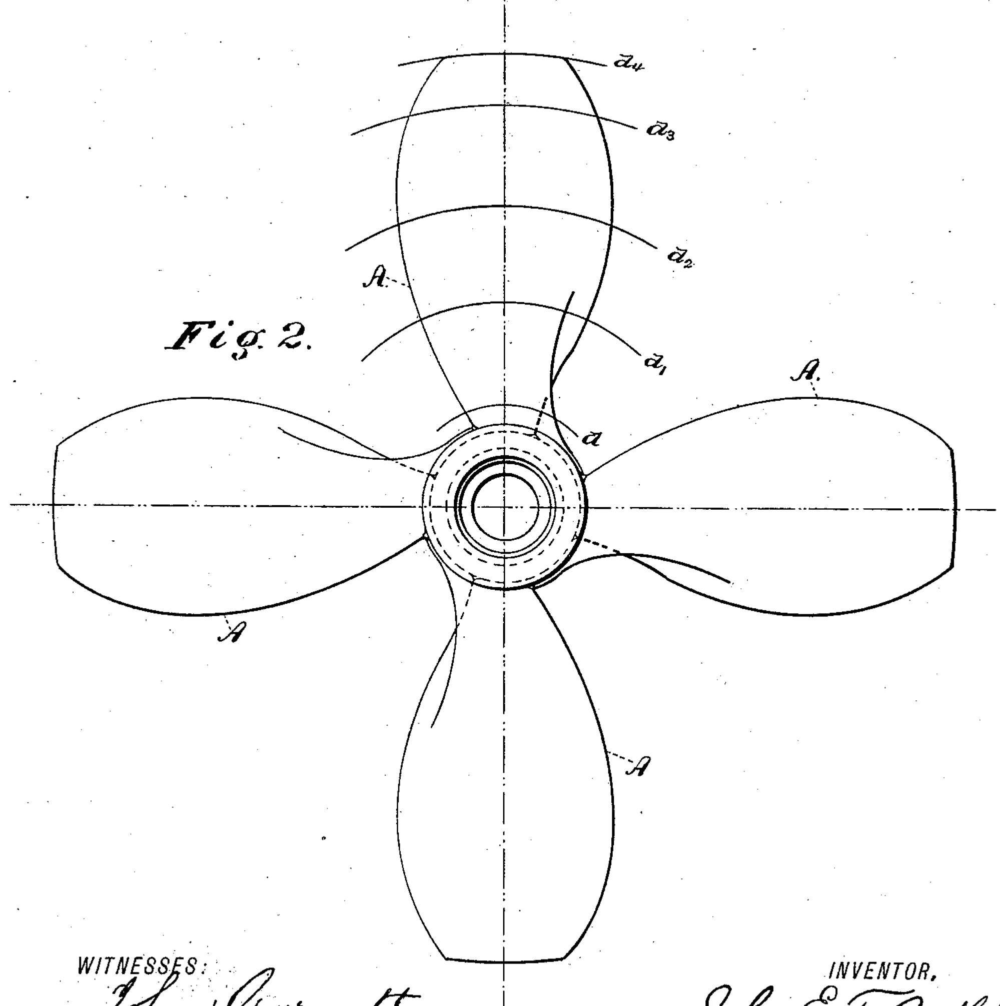


Fig. 2.



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(Model.)

2 Sheets—Sheet 2.

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PROPELLER WHEEL.

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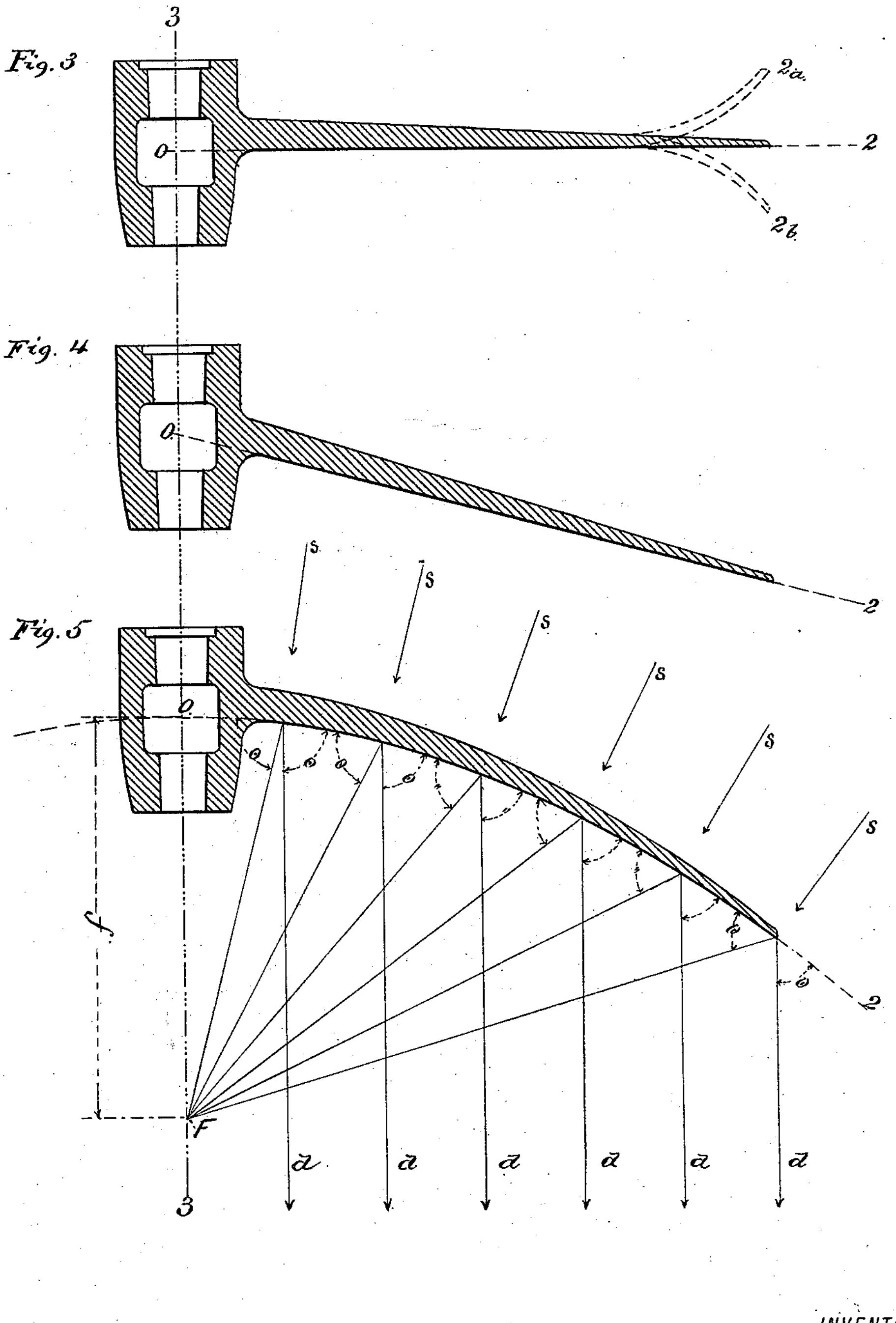
Fig. 3

Fig. 4

Fig. 5



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JOHN E. T. BARTLETT, OF NEW YORK, N. Y.

PROPELLER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 384,498, dated June 12, 1888.

Application filed October 28, 1887. Serial No. 253,661. (Model.)

To all whom it may concern:

Be it known that I, JOHN E. T. BARTLETT, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented a new and useful Form of Propeller-Wheel, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

My invention relates to an improvement in the shape of the propelling-surface of the blades of propeller-wheels used in propelling vessels through or on the water; and the objects of my improvement are, first, to control the flow of water driven astern by the propeller, giving it a direction parallel to the axis of the driving-shaft and opposite to the motion of the vessel; second, to prevent the water being raised by the centrifugal force generated by the angular velocity of the propeller; third, to gain length of blade with given diameter, and thereby decrease the frictional resistance to be overcome by the engine in rotating the propeller at a given angular velocity, this resistance increasing as the square of the distance from the axis of the propeller; and, fourth, to eliminate the local surface disturbance and currents caused by the dispersion of the water in any other form of propeller-wheel, and as the flow of water is parallel to the longitudinal axis of the shaft the banks are not washed away nor the bottom scoured by this form of propeller in navigating narrow or shallow water-ways, such as canals. I attain these objects by constructing the propelling-surface of the blades of the propeller, which may have as many blades as the fancy of the designer may desire—usually from two to four—of the form illustrated in the accompanying drawings, in which—

Figure 1 is a plan or top view of the propeller, showing a longitudinal section of the blade on the right and projected sections at the diameter $d\ d_1\ d_2\ d_3$, and the characterizing curve 2 0 2, forming the principal feature of my invention. Fig. 2 is a front elevation of the propeller, looking aft. Fig. 3 is a cross-section through the propeller-shaft and the blade of the common form of screw-propeller, the blade being of such a nature that if it were turned on its axis, having at the same time a motion of translation equal to the desired pitch, a true pitch-wheel having a helicoidal surface precisely analogous to the Archimedean screw would be generated. Fig. 4 is a similar section through that form of propeller commonly known as the "centrifugal propeller," which is formed on an oblique generatrix. Fig. 5 is a section of my improved form of propeller-blade, and shows that a plane passed through the axis of the propeller-shaft will intersect the blade in a parabolic curve.

Similar symbols refer to similar parts throughout the specification and accompanying drawings.

The base-line of abscissæ 1 0 1, for determining the curve 2 0 2, is assumed to pass through the center line, 3 3, of the shaft midway of the length of the propeller-hub 4 4. The ordinates $h\ h_1\ h_2\ h_3$, and so on for as many ordinates equidistant from each other as may be necessary to determine the curve to the required degree of accuracy, are calculated, using the variable quantity d as one of the values in the formula, said variable quantity being equal to twice the distance of the point at which it may be desired to erect the ordinate from the axis of the propeller, using the parabolic formula

$$h=\frac{d^2}{x\,f},$$

in which formula h equals the ordinate h—h, h—h, and so on for the different values of d^2. The curve 2 0 2, drawn through these points, is a parabola.

Referring to the drawings, if a plane be passed through the axis of the shaft of a propeller of my construction intersecting the driving-surface of either of its blades A A A A, then will the intersection of said plane and driving-surface of the blades form a parabolic curve, 2 0 2, and the driving-surface will be a parabolic surface generated by the revolution of a semi-parabola, 0 2, whose vertex is 0, around the longitudinal axis 0 3, having at the same time a motion of translation, positive or negative, in the direction 0 3, equal to the required pitch of the propeller.

Referring to Fig. 5, it will be seen that the curve of the blade therein shown is a parabola having its vertex situated at 0, its focus at F. The focal distance is represented by f. The lines $s\ s$ indicate the flow of water to the wheel, partaking as it does of the contour of the run of the ship, as is actually the case in practice. After the particles of water have passed behind the blades, the directional force of the wheel will drive it in one of two directions—viz., it will be reflected parallel to the shaft-axis. Why? Because water being incompressible it cannot be forced at F, and as the reflecting-surface must drive it one way or the other it must follow the lines *d d*. The wheel, taking water perpendicularly to its feeding-edge, will draw from the larger area facing the wheel, and said area being in the same ratio as the square of the length of the curved directrix is to the square of the actual radius of the wheel, the diameter of the wheel being the smaller diameter of a frustum of a cone whose elements are parabolas, or what may be called a "conic paraboloid." The water behind the wheel will be compressed, or, more strictly speaking, the air in the water which flows to the propeller is compressed, so that the wheel works in solid water, thus correcting any tendency to race, racing being a term used to represent the tendency of propeller-wheels to slip ahead of the water with variable speed, owing to the existence of air in the water; hence a wheel of my construction causes less vibration than the other forms, because it works on solid water.

The driving-surface of this design of propeller will act on the same principle as sound and light reflectors constructed on the same principle; hence the water driven astern must necessarily be driven in a stream parallel to the longitudinal axis of the propeller-shaft. Any particle of fluid passing behind the leading edge A of the propeller-blade will be forced back by the advancing surface of the propeller, and the superposed particles being prevented following or flowing off the blades by the reflecting-surface. Before said particle can acquire centrifugal force from contact with a rotating surface of high velocity it will have been left behind by the advancing propeller. Having no tendency to rise to the surface, it will be reflected parallel to the axis of the shaft, as the least resistance is in the direction of the wake of the vessel.

The increase in length of blades is clearly shown on the right-hand blade, Fig. 1, and the length gained is the difference in length of the curved line 0 2 and the straight line 0 1, the length of the curve extending to the point h_6 a distance $h_5 - h_6$ beyond the diameter of the propeller, and as the frictional horse-power required to rotate a propeller is equal to the surface-pressure multiplied by the square of the velocity the velocity will be greater as the diameter is increased. Therefore a wheel of the same blade area can be obtained with less diameter and equal length of blade in this construction, and will require less power to rotate it at a given angular velocity than a straight blade of equal length.

The propelling-surfaces of propellers of my peculiar construction prevent the water flowing off radially or tangentially; hence there are no waves on the surface caused by the rotation of the propeller, and as the water is but slightly agitated there is no tendency to wash away banks or scour the bottom of water-ways of small sectional area, and my experiments have always shown a wake of as little commotion as is made by the passage of a vessel under sail; hence I believe this design of propeller is particularly adapted to steam-navigation on canals.

I am aware that many designs of propellers have been made with curved blades of different forms having names given them from some fancied resemblance they may have to wings of birds and objects. I therefore do not claim curved blades as so constructed; but

What I desire to claim is—

The herein-described propeller-blades curved in the line of a parabolic generatrix to form a driving-surface, consisting of a helicoidal parabolic surface of revolution, and so combined with the propeller-shaft that a plane passed through the axis of the shaft will intersect the driving-surface of each blade in a parabola, substantially as described.

JOHN E. T. BARTLETT.

Witnesses:

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