J. B. WARD.

Screw-Propeller.

No. 226,466. Patented April 13, 1880.

Fig. 1.

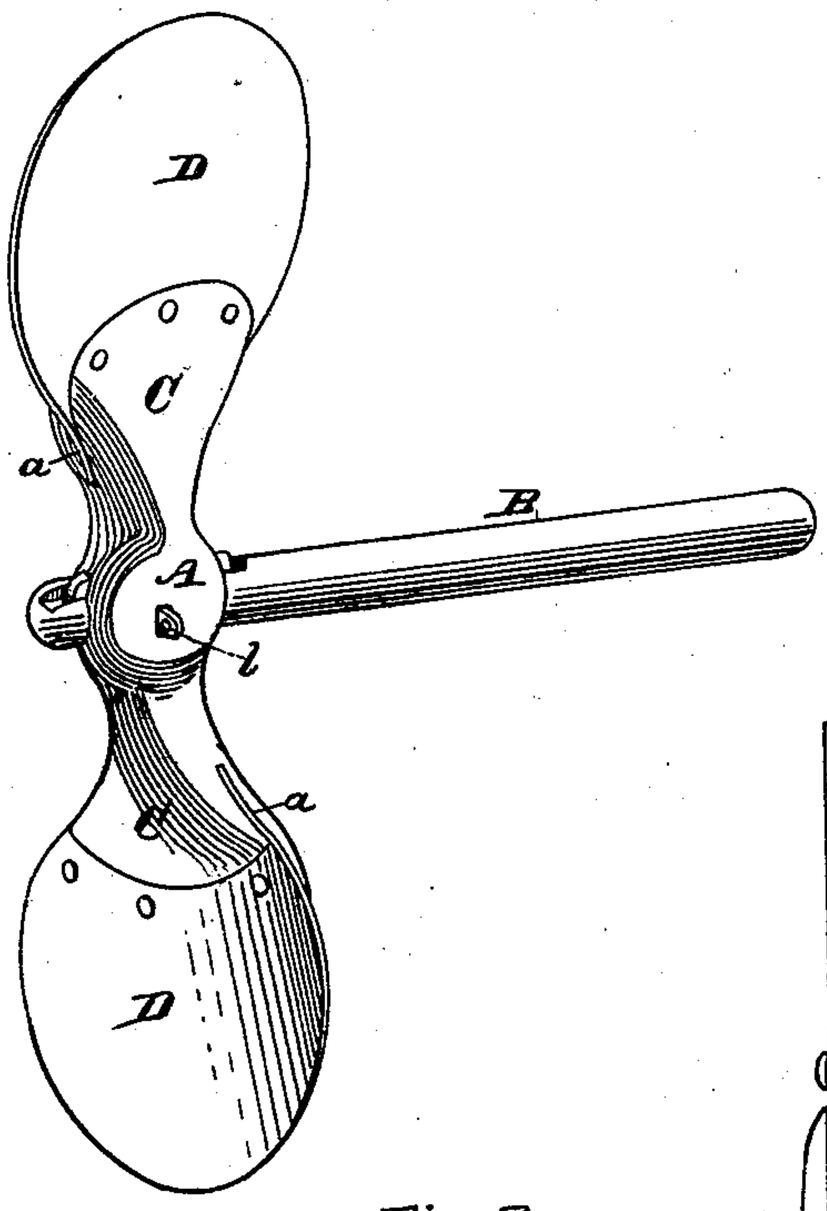


Fig. 2.

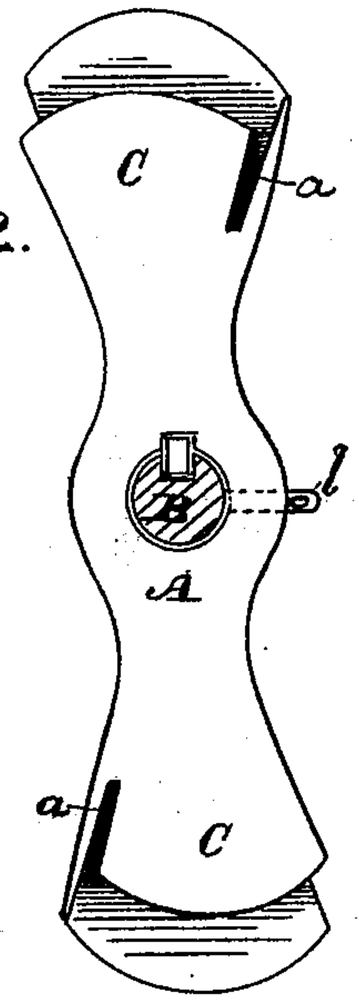


Fig. 3.

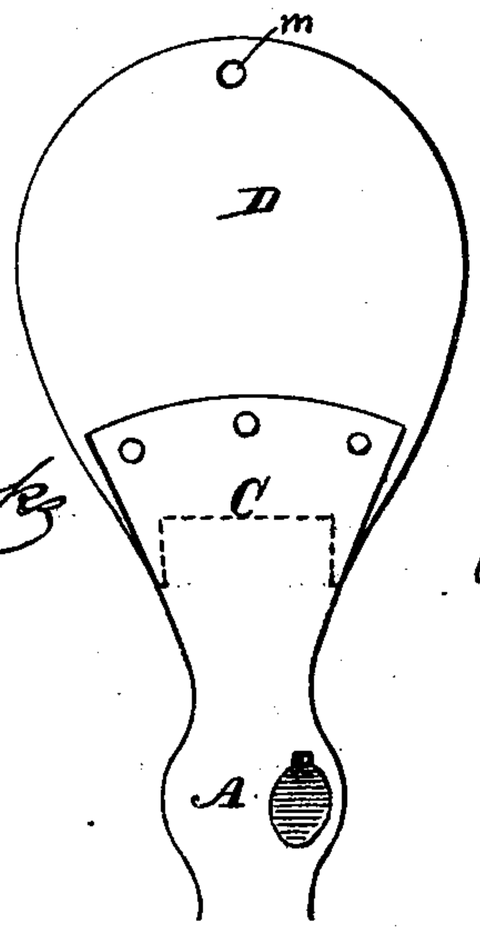
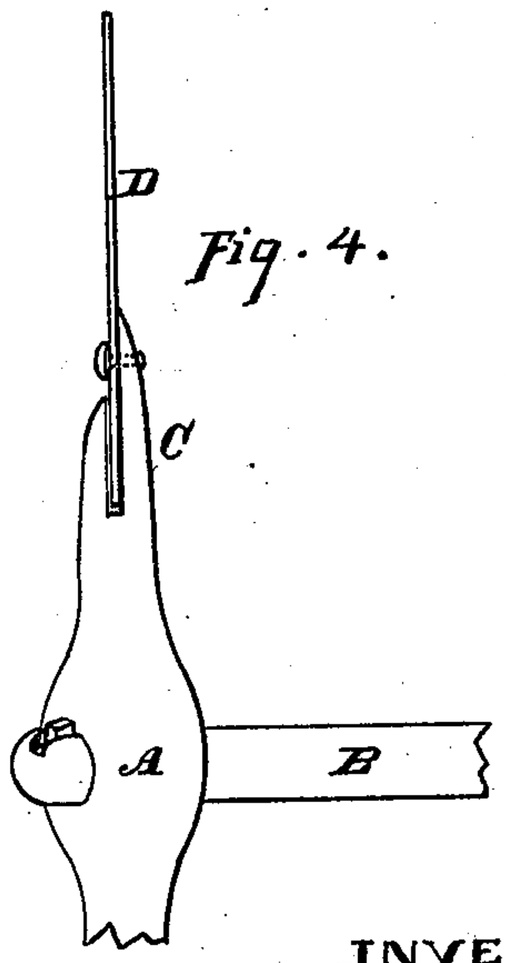


Fig. 4.



WITNESSES.

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UNITED STATES PATENT OFFICE.

JOHN B. WARD, OF SAN FRANCISCO, CALIFORNIA.

SCREW-PROPELLER.

SPECIFICATION forming part of Letters Patent No. 226,466, dated April 13, 1880.

Application filed September 26, 1879.

To all whom it may concern:

Be it known that I, JOHN B. WARD, of the city and county of San Francisco, and State of California, have invented an Improvement in Propellers; and I hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to certain improvements in propellers; and it consists in the employment of a peculiarly-formed elastic blade, which is united to the hub, upon which are formed flanges upon the arc of a circle, so as to give the greatest strength at this point. These blades are formed circular, but are with a straight-line face, similar to those shown in Letters Patent No. 216,244, issued to me June 3, 1879, and of a substance of an elastic nature, the outer edge being in the arc of a circle, so as to increase the efficiency of the blade.

This form gives the greatest area with the least circumference, and hence the greatest strength for a given surface of gripe.

It further relates to certain details of construction in the matter of the point of junction of the blade and hub-flange, as is more fully described in the accompanying drawings, in which—

Figure 1 is side elevation. Fig. 2 is a front view. Fig. 3 is a side view of one of the blades. Fig. 4 is a perspective view looking on the edge of one of the blades.

The curved-line faced propeller in its rotation breaks off the head of the resisting water-column at the instant that it gives the thrust, thus throwing the water into an inefficient foam up to the line of the edge resistance. The reaction of the water-column upon the propeller, which is the cause of the forward movement of the vessel, is not then effective for that purpose until its solid end or head has passed through the space of foam before mentioned. Then it meets at an angle the curved line of the advancing propeller, and gives the unpleasant intermittent jar to the vessel, engine, and machinery. This, with the diminution of its effective force, owing to the advance of the vessel, causes the loss known as the "slip." These objections I have overcome by constructing my improved propeller in a peculiar form, in which the blades are elastic.

The hub A may be cast or wrought, as desired, and is keyed onto the shaft B in the usual manner.

Projecting from the hub are the flanges C, as many separate flanges being formed as there are blades to the propeller. The edges of these flanges are formed in the arc of a circle, preferably of half the diameter of the blade D. Slots *a* are made in the edges of the flanges, into which may be inserted the blades D, the flange reaching out to the point of semi-radius of the blade, being secured by bolts, as shown.

It will be seen that both parts of the flanges are not of equal size. That portion on the inside or nearest the vessel is broader than the other, giving a bearing out to the semi-radius of the blade, while the outer part of the flange is considerably shorter. This construction is necessary, in view of the fact that if both parts of the flange were of equal size, when the blade is bent back from the pressure of the thrust the two parts of the flanges would be separated; as it is the inner part gives a broad bearing to the semi-radius of the blade where the strength is required. Moreover, the core or slot in the flange does not have to be made so deep to receive the blade. These flanges on the hub are turned to the pitch required for the blade.

The blades are formed of elastic steel without any curves or hollows, a perfectly flat surface being presented to the water. This straight-line faced elastic propeller-blade in its rotation makes a clean cut in the resisting water-column, thus avoiding the slip. The end of the blade is formed in the arc of a circle, as shown, for greater efficiency. Being of steel or other elastic substance, it may be made thin and light, and will not be broken by any ordinary blow. Moreover, it is much simpler of construction than those which are cast. If the blades are made circular they may be turned around in the flanges after being used so much that their elasticity is impaired.

The form and proportions shown give the maximum strength with minimum weight, and the maximum effective straight-line face area of blade-thrust with the necessary strength of flange and gripe. The edge resistance is very slight in proportion to the area of blade, and the liability of breakage from strain or concussion is lessened. In case any one of

the blades becomes injured at any time that single blade may be removed and replaced without disturbing the other blades or removing the hub from the shaft, as is usually necessary with cast-iron propellers. This form combines all the advantages of straight-line face with the strength of curved-line propellers, while the elastic blade avoids the jar on engine and machinery.

The curved-line propeller-blade in ordinary use breaks the head of the resisting water-column, throwing it into foam and producing the slip. The straight-line faced elastic propeller makes a clean cut on the head of the resisting water-column and produces no foam. The reaction of the water-column is instantaneous, continuous, and effective, the propeller-blade receiving the reactive effect of the resisting water-column on the same surface that gave the original thrust; hence there is no slip, but, on the contrary, the reactive effect of the elastic blade, when its modulus of elasticity is properly adjusted in reference to the resistance to be overcome, will cause the vessel to overrun the distance usually allowed to the pitch of the propeller. As a wheel is a continuous lever, so is this propeller a continuous even wedge or inclined plane, giving great efficiency.

An eyebolt, *l*, is screwed into the hub, so as to lift the propeller out when it is necessary. If only one blade is to be lifted out a hole is made near the edge of the blade, in which fits a screw-plate, *m*. By removing this screw-plate a hook may be inserted in the hole and the blade lifted out from between the flanges.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

The flanges C, cast on the hub A, said flanges being formed with the slot *a*, and larger on one side than the other, the large side being the semi-radius of the blade, in combination with the removable circular straight-line faced blade D, whereby a broad bearing is given to the propeller-blade at its most effective point, substantially as herein described.

In witness whereof I have hereunto set my hand.

JOHN B. WARD.

Witnesses:
CHAS. G. YALE,
FRANK A. BROOKS.