E. B. KNIGHT.

PROPELLER.

APPLICATION FILED FEB. 8, 1912.

1,098,156.

Patented May 26, 1914.

FIG. 1.

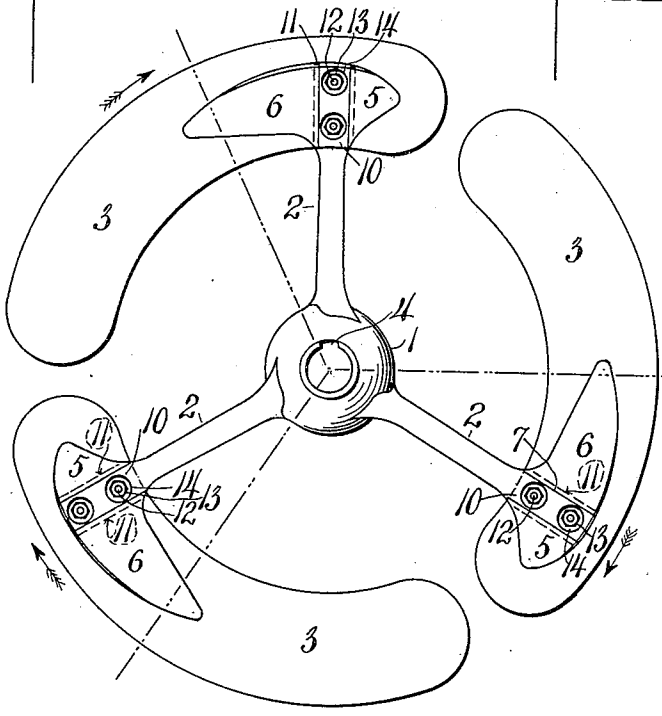



FIG. 2.

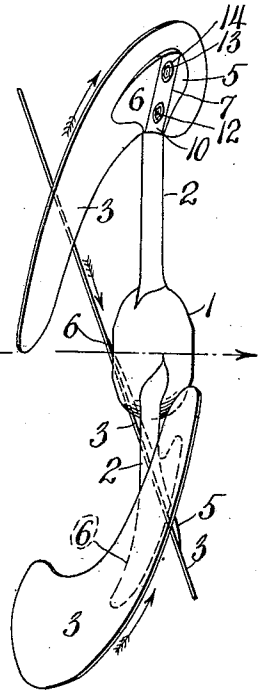



FIG. 3.

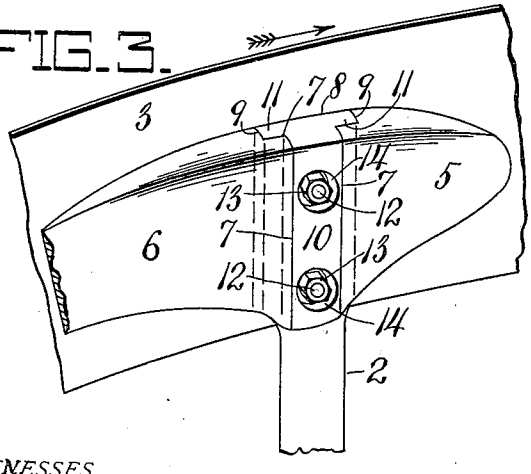
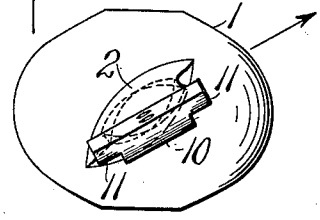



FIG. 4.




WITNESSES

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# UNITED STATES PATENT OFFICE.

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## PROPELLER.

1,098,156. Specification of Letters Patent. Patented May 26, 1914.

Application filed February 8, 1912. Serial No. 676,401.

*To all whom it may concern:*

Be it known that I, EDWARD B. KNIGHT, a citizen of the Dominion of Canada, residing at Meaford, in the Province of Ontario, Canada, have invented new and useful Improvements in Propellers, of which the following is a specification.

My invention relates particularly to ship propellers and the object of my invention is to produce a light weight propeller of superior design and efficiency.

While my invention contemplates the construction of a propeller with hub, arms and blades, either cast integral or constructed of several pieces joined into one article, I have chosen as my preferred form and shown in the accompanying drawings, which form a part of this specification, a propeller in which the hub and arms are one integral casting properly machined to fit separate individual blades. The number of arms and blades and proportionate width and length of the arms and blades may vary to suit the requirements of the service to which the propeller is to be put. In the present instance I have embodied my invention in a three-bladed propeller, which is the form most commonly used, of the style which contemplates an open space between the hub and the blades, the blades being joined to the hub by radial or approximately radial arms.

Figure 1 is a face view of the forward side of a propeller constructed in accord with my invention. Fig. 2 is an edge view of the same. Fig. 3 is a detail perspective view showing the manner of attaching an arm to a blade. Fig. 4 is a detail view looking toward the hub from the outer end of an arm.

1 is the hub, 2, 2, 2, the arms, and 3, 3, 3, the blades of my improved propeller, the hub 1 being provided with the usual key slot 4 for attachment to the driving shaft.

Each blade is rounded or tapered at its ends to cut the water with as little disturbance as possible, the precise design of the tapering being immaterial. The blade is also preferably so shaped that its outer and inner edges are arcs of circles having the shaft axis as center. Each blade is plane on both sides with the exception of a pair of bosses 5 and 6 on the forward face of the propeller, each boss being tapered or faired down to the surface of the blade to offer as little retardation to the passing water as possible. In using the word "plane" in connection with the blades, I intend to convey the impression that the blade is flat, not curved, on both sides and of unvarying thickness, except for a beveling or rounding of the edges to make a smooth finish, as the word is commonly understood in experimental ship and propeller contour work. The bosses 5 and 6 are each provided with undercut adjacent edges 7 providing a socket 8 with side extensions 9 for the reception of the outer end 10 of one of the arms 2, the projecting reduced edges 11 of the end of the arm fitting in the side extensions 9 and the arm being secured to the blade by suitable permanent fastenings such as rivets or by removable fastenings such as bolts 12 and nuts 13, the ends of the bolts and the nuts being preferably countersunk in the blade 3 and in the arm 10 to shield the fastenings from injury from passing objects and to present a fairer surface, or a surface free from projections, to the passing water. The countersink holes 14 may be filled up with putty or soft metal to present a better appearance.

Each of the arms 3 is approximately elliptical in cross section for the greater part of its length, its outer end being bent to an angle corresponding to the angular plane in which the blade is to be positioned, and twisted to a position so that the major transverse axis of the arm is parallel with the set or angular position of the blade, and is shaped to fit the sockets formed by the bosses on the blade. The inner end of each arm is enlarged and faired into the lines of the hub, the major transverse axis of the arm for the greater part of its length and where it joins to the hub having an angle of inclination toward the forward direction slightly greater than that of the blade and of the arm where it joins to the blade.

I find it also preferable to incline the outer ends of the arms slightly forward as, owing to the forward tip of the forward part of the blade, with relation to a perpendicular to the axis of the shaft, at the point on the blade where it is desirable that the arms and blades be secured together, which point is approximately one-fourth the length of the blade distant from the front end of the blade, the arms would not lie flat to the blade otherwise, and at the same time this inclining permits the forward end of the blade to project forward of the hub as desired for economy in space. This inclination however may vary, it being desirable

that the inclination together with the angle to which the blades are set be sufficient to force the water directly back, rather than to spread or focus the current of passing water.

My invention thus provides a propeller having arms offering a minimum of resistance to the passing water and blades presenting flat or plane pressure surfaces to the water and also easily removable for repair or substitution in case of accident.

By using, with flat or plane blades, arms constructed with their outer ends inclined slightly forward, in accord with my invention, the blades at their fore ends incline in a radial direction, that is, from inner to outer edges, slightly forward with respect to a line perpendicular to the shaft axis and passing radially through that part of the blades, and at their rear ends incline slightly backward with respect to a line perpendicular to the shaft axis and passing radially through that part of the blades, and at an intermediate point, depending on the angle to which the arms and blades have been set, but preferably about one-third the length of the blade from the fore end, the blades are coincident with a similar line perpendicular to the shaft axis and passing radially through that part of the blades. This forward inclination, perpendicularity and backward inclination gives a twist in rotation which tends to receive the water freely and deliver the water with acceleration. It is recognized that the water on the rear face of the blades is all under compression when the blades are in motion but there is a comparative tendency toward compression toward the rear ends of the blades owing to the backward inclination of the blades at the rear ends, that serves to slightly accelerate the water.

An important feature of propellers with blades spaced away from the hub is the leaving of a large open space through which water which is not being acted on by the blades may pass freely so that the advantage gained by the increased diameter of the circles of revolution is not lost by the drag of a body of "dead" water surrounding the hub.

I am aware of the patent to Hulbert No. 199550, but in said patent the blades are not flat or plane according to my meaning of the word and the inclination of the blades and ends of the arms is backward instead of forward. For several years I have been experimenting along a line involving the mounting of a plane blade spaced at a distance from the hub and attached thereto by an arm connected near the forward end of the blade in such a way as to give results superior to propellers of helicoidal form, the advantages of spaced blades being already determined, attaching by an arm near its forward end favoring flexibility of the blade as an insurance against fracture under too great pressure, a plane blade favoring economical production and replacement, and a free entrance and pressure exit of water conducing to economical operation.

I have tested a propeller constructed in accord with my invention in comparison with propellers of standard makes and found mine to give increased speed and to operate with less commotion or disturbance of the water. This I attribute to the combination of features, some of which are old in the art and others of which I believe to be new.

Having thus described my invention the following is what I claim as new therein and desire to secure by Letters Patent:

1. A propeller of the character described, comprising a hub, arms elliptical in cross section and plane blades; each arm, where it is adjacent the blade to which it is joined, having its major transverse axis coincident with the angular plane of the blade, and each arm, for the remainder of its length and also where it is joined to the hub, having its major transverse axis extending in a direction at an angle to the angular plane of the blade, the angle between the plane of the blade and the direction of the major transverse axis constantly increasing as the hub is approached.

2. A propeller of the character described, comprising a hub, arms and plane blades; the arms and hub being integral and the blades being fitted to the arms with a mortise and tenon joint and secured thereto.

3. A propeller of the character described, comprising a hub, arms elliptical in cross section and having their major transverse axis angularly inclined with relation to the shaft axis, and blades, plane on both sides except for faired arm socket bosses, fitted to the ends of the arms with a mortise and tenon joint and secured thereto.

4. A propeller arm approximately elliptical in cross section; the major transverse axis throughout the greater portion of the length of the arm when the arm is in place being angularly inclined with relation to the hub axis and the arm having a blade receiving outer end forwardly bent or inclined with relation to the main portion of the arm and set at an angle slightly greater than the main portion of the arm with relation to the hub axis.

EDWARD B. KNIGHT.

Witnesses:
WALTER ALLEN,
WALTER ELLWOOD ALLEN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."