D. W. TAYLOR.

SCREW PROPELLER.

APPLICATION FILED SEPT. 28, 1910.

1,068,946. **Patented July 29, 1913.**

Fig. 1.

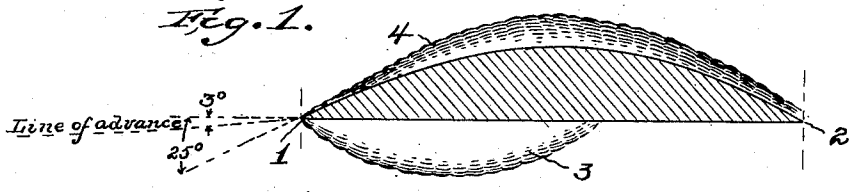


Fig. 2.

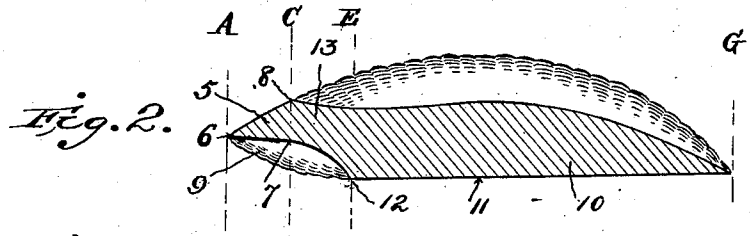


Fig. 3.

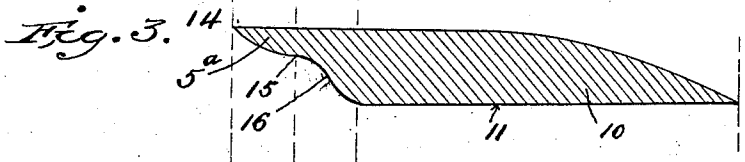


Fig. 4.

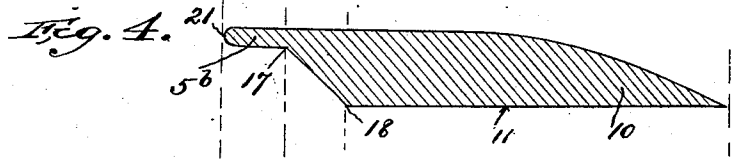


Fig. 5.

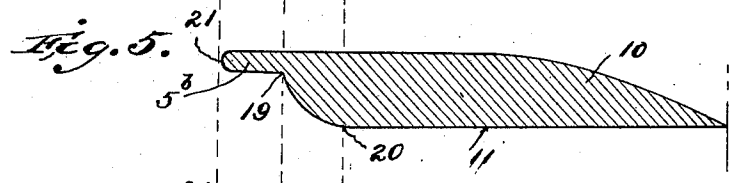


Fig. 6.

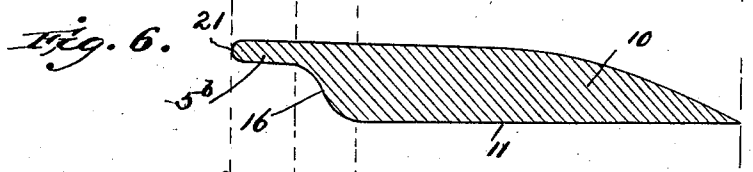
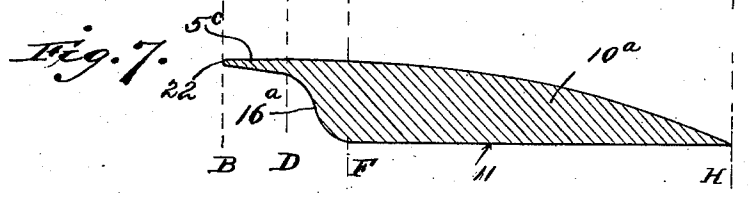


Fig. 7.



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SCREW-PROPELLER.

1,068,946. Specification of Letters Patent. Patented July 29, 1913.

Application filed September 28, 1910. Serial No. 584,328.

To all whom it may concern:

Be it known that I, DAVID WATSON TAYLOR, a citizen of the United States of America, of the United States Navy, have invented certain new and useful Improvements in Screw-Propellers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to screw propellers and has for its object the construction of a screw propeller which although it does not prevent cavitation at the face of the blade, is of such construction as to permit cavities to form at the face of the blade, but materially reduces their harmful action, and in some cases nullifies it.

Referring to the drawings, in which like parts are similarly designated Figure 1 is a developed section of a propeller blade of the usual ogival type showing approximately the relation of the cavities thereto when in action. Figs. 2–7 are developed sections of propeller blades similar to Fig. 1, illustrating various forms of my invention.

In the operation of screw-propellers at high speeds there frequently appears at the blades the phenomenon known as cavitation, the nature and cause of which are set forth in my application Serial No. 517,179, filed September 10, 1909.

Fig. 1 represents a developed section of the usual ogival type of propeller blade, *i. e.*, a propeller blade whose developed section has a straight line at the face and a convex curve at the back extending from the leading edge 1 to the following edge 2. This figure shows cavitation occurring over the face at 3 and over the back at 4. The slip angle is indicated as 3° and the angle between the face of the blade and its back at the leading edge as 25°. In operation at a sufficiently high speed such a blade splits the water with the formation of vacuous cavities somewhat as indicated at 3 and 4, 4 being the cavity over the back of the blade, principally over the following portion of the back, and 3 being the cavity over the leading portion of the face of the blade. Cavities at the back of the blade such as 4 are helpful rather than harmful to efficiency, but if the speed of the leading edge 1 of the blade through the water is made so great that cavities, such as 3, extend over a large portion of the blade face, the efficiency of the propeller is materially reduced.

For the purpose of illustration I have shown my invention as incorporated in a propeller blade whose following portion is of the usual ogival type.

Fig. 2 shows the blade whose leading portion 5 between the lines A—B and C—D is also of the ogival type, that is substantially identical with the leading portion of Fig. 1, the developed section of the blade having a straight face at this leading portion from 6 to 7 and a curved back from 6 to 8. The cavity 9 resulting from this leading portion 5 will be very much the same as the cavity 3 in Fig. 1, but by setting back the following portion 10 say between lines E—F and G—H, as indicated in Fig. 2, so that the face 11 of this following portion is tangent, or virtually so, to the line 6—12 bounding the cavity on the water side, at the point 12 where said line 6—12 is naturally parallel to the face of the blade, then the face 11 of the following portion of the blade is enabled to act on the solid water, and cavitation on the face of the blade is restricted to the portion between the lines A—B and E—F.

It is necessary in practice to connect the leading portion 5 of the blade to the following portion 10, there being an intermediate portion 13 between the lines C—D and E—F for this purpose. This intermediate portion 13 may be of any convenient form adapted to give the necessary strength. The shape of the leading portion of the blade may be varied materially within limits, but it is advisable to adopt a type such that cavitation is not naturally great. Fig. 3 shows a developed section of a propeller blade in which the leading portion 5^a is similar to the leading portion 5 of Fig. 2, but reversed. In this figure the arc 14—15 of the face of the leading portion 5^a is preferably connected to the straight face of the following portion 10 by a curve, tangent to said arc and to the straight face 11, and that has a point of inflection as at 16 or of zero curvature. It may, however, be a straight line, as the straight line 17—18, Fig. 4, a hollow or concave curve as at 7—12, Fig. 2, or even a rounding curve as 19—20, Fig. 5,

that meets the leading portion at an angle and is tangent to the face of the following portion of the blade.

In Figs. 3–7 the straight back of the leading portion is tangent to the curve of the back of the following portion.

In Figs. 4, 5 and 6 the leading portion 5^b has a rounded leading edge, and the leading portion is made of uniform thickness, that is the face and back of the leading portion show in developed section as straight parallel lines connected at the leading edge by the rounded edge 5^b.

In Fig. 7 I have shown the leading portion 5^c as tapering toward a thin leading edge rounded at 22. The face of the leading portion is connected to the straight face 11 of the following portion 10^a by a compound curve having a point of inflection at 16^a or of zero curvature, said curve being tangent to both face surfaces.

In Figs. 3–7 the straight back of the leading portion is tangent to the curve of the back of the ogival type following portion, although this is not absolutely necessary, as is shown in Fig. 2.

It will be observed that, as indicated in Fig. 2, my novel construction of blade may tend to increase cavitation over the back of the blade, but, as already pointed out, cavities over the back of the blade are an aid to efficiency.

In all of the figures illustrating my invention it will be observed that the following portion of the blade is set back axially with reference to the leading portion and that the face of the following portion of the blade is preferably tangential to the boundary of the cavity formed at the face of the leading portion.

I claim—

1. A propeller blade having its following portion of ogival type set back with reference to its leading portion and the faces of the leading and following portions connected by a curve having a point of zero inflection.

2. A propeller blade having its following portion of ogival type set back with reference to its leading portion and the faces of the leading and following portions connected by a curve having a point of zero inflection, the face of the following portion being substantially tangential to the boundary of the cavity formed by said leading portion.

3. A propeller blade whose developed section has a following portion set back with respect to its leading portion, the leading portion having a straight back tangential to the curve of the back of the following portion and the faces of the leading and following portions connected by a curve having a point of inflection or of zero curvature.

4. A propeller blade whose developed section has a following portion set back with respect to its leading portion, the leading portion having a straight back tangential to the curve of the back of the following portion, the faces of the leading and following portions connected by a curve having a point of inflection or of zero curvature and the face of the following portion being substantially tangential to said curve.

5. A propeller blade whose developed section has a following portion of ogival type set back with respect to its leading portion, the leading portion having a straight back tangential to the curve of the back of the following portion, the faces of the leading and following portions connected by a curve having a point of inflection or of zero curvature and the face of the following portion being substantially tangential to the boundary of the cavities formed by said leading portion when in action.

6. A propeller blade whose developed section has its following portion set back with reference to a tapered leading portion and the driving faces of the leading and following portions connected by a curve having a point of zero inflection.

7. A propeller blade whose developed section has its following portion of ogival type set back with reference to a tapered leading portion and the driving faces of the leading and following portions connected by a curve having a point of zero inflection.

8. A propeller blade whose developed section has its following portion set back with reference to a tapered leading portion and the driving faces of the leading and following portions connected by a curve tangent to said faces and having a point of zero inflection.

9. A propeller blade whose developed section has its following portion set back with reference to a tapered leading portion, said leading portion having a straight face and back, the face of the leading portion connected to the face of the following portion by a curve having a point of zero inflection.

10. A propeller blade whose developed section has its following portion of ogival type set back with reference to a tapered leading portion, said leading portion having a straight face and back, the face of the leading portion connected to the face of the following portion by a curve having a point of zero inflection.

11. A propeller blade whose developed section has its following portion set back with reference to a tapered leading portion having a straight face and back connected by a rounded leading edge and the faces of the leading and following portions connected by a curve having a point of zero inflection.

12. A propeller blade whose developed section has its following portion set back

with reference to a tapered leading portion having a straight face and back connected by a rounded leading edge and the faces of the leading and following portions connected by a curve tangent to said faces and having a point of zero inflection.

13. A propeller blade whose developed section has its following portion of ogival type set back with reference to a tapered leading portion having a straight face and back connected by a rounded leading edge and the faces of the leading and following portions connected by a curve having a point of zero inflection.

14. A propeller blade whose developed section has its following portion of ogival type set back with reference to a tapered leading portion having a straight face and back connected by a rounded leading edge and the straight faces of the leading and following portions connected by a curve tangent to said faces having a point of zero inflection, and the straight face of the following portion substantially tangent to the boundary of the cavities formed by said leading portion when in action.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

DAVID WATSON TAYLOR.

Witnesses:
HENRY ORTH, Jr.,
MAY ELLIS.

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