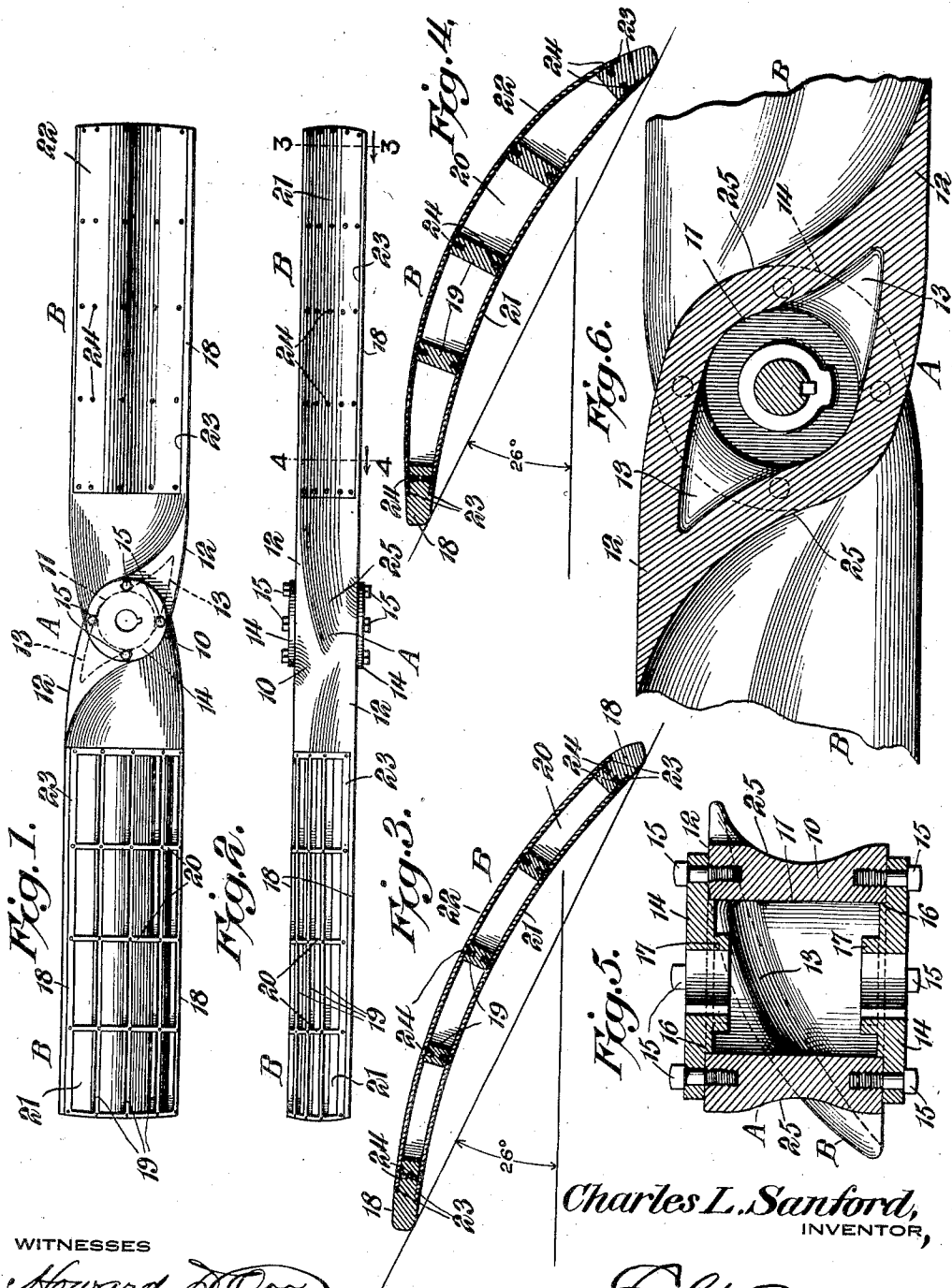


C. L. SANFORD.
PROPELLER.

APPLICATION FILED JULY 18, 1917.

1,357,348.

Patented Nov. 2, 1920.



WITNESSES

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PROPELLER.

1,357,348.

Specification of Letters Patent.

Patented Nov. 2, 1920.

Application filed July 18, 1917. Serial No. 181,345.

To all whom it may concern:

Be it known that I, CHARLES L. SANFORD, a citizen of the United States, residing at Washington, in the county of Washington and State of Pennsylvania, have invented a new and useful Improvement in Propellers, of which the following is a specification.

The invention relates to a propeller, and more particularly to the class of air propellers for use with aeroplanes or other air craft.

The primary object of the invention is the provision of a propeller of this character wherein the blades will be prevented from warping when cast, and the weight of the propeller will be reduced to a minimum, yet the same will possess maximum rigidity and strength.

Another object of the invention is the provision of a propeller of this character wherein the blades are novel in form to assure the proper disposition of their surfaces for the action of the impact sides upon air currents to assure maximum driving power, the hub for the blades being of a contour to form an air screw to assure minimum resistance in the operation of the propeller.

A further object of the invention is the provision of a propeller of this character which is extremely simple in construction, thoroughly reliable and efficient in its purpose, strong, durable and inexpensive in manufacture.

There are various other objects and advantages of this invention besides the above all of which will be hereinafter more fully or particularly brought out in the following specific description of the present preferred embodiment of the invention, the same being illustrated in the accompanying drawing, wherein:—

Figure 1 is a top plan view of a propeller constructed in accordance with the invention shown with one of the impact surface blades removed.

Fig. 2 is an edge elevation with one of the surface blades removed.

Fig. 3 is an enlarged sectional view on the line 3—3 of Fig. 2, looking in the direction of the arrow.

Fig. 4 is a view similar to Fig. 3 taken on the line 4—4 of Fig. 2, looking in the direction of the arrow.

Fig. 5 is a vertical transverse sectional view taken through the hub of the propeller.

Fig. 6 is an enlarged fragmentary horizontal sectional view through the propeller taken longitudinally thereof.

Similar reference characters indicate corresponding parts in the several views in the drawing.

Referring to the drawing in detail, A designates generally the hub and B each blade of the propeller, the details of which will be hereinafter fully described.

The hub A and the blades B are integrally formed with each other, and preferably made from aluminum cast, or otherwise, into the desired shape and construction. The hub A is formed with the central circular portion 10 which provides a circular chamber 11 for receiving the motor shaft, shown in Fig. 6, the chamber 11 being of considerably greater diameter than the cross sectional diameter of the motor shaft and constituting a cooling space concentrically of said shaft. Extending from diametrically opposite points on the portion 10 are the reversely twisted arms or shanks 12 connecting the blades B with the hub, and these arms or shanks 12 are hollowed at 13, which spaces communicate with the space 11 and coact therewith for cooling purposes to avoid the warping of the blades B when the propeller is being cast. The opposite ends of the portion 10 of the hub carry removable hub end disks or plates 14, which are detachably fastened in place through the medium of screws 15, although the same may be otherwise fastened if found desirable. The disks or plates 14 are centrally apertured to receive the motor shaft and, at the inner sides thereof, are thickened to form internal circular shoulders 16 for snugly engaging in the space 11 of the portion 10 of the hub to prevent the displacement of the disks or plates 14 when fastened thereon. Concentrically of the apertures in the disks or plates 14 on the thickened inner sides thereof are bosses 17 which augment

the bearing surface of the disks or plates 14 for the motor shaft and also provide for the keying or otherwise fastening of the shaft in the plates, as will be clearly apparent.

Each blade B is of skeleton formation having an outer marginal frame 18 and inner spaced longitudinally and transversely disposed parallel webs 19 and 20, respectively, while fastened to opposite sides are the surface plates 21 and 22, respectively, the frame 18 being formed with a counterseat 23 in each side thereof for accommodating the surface plates so that its outer surface will be flush with the exposed surface of the frame, the plates 21 and 22 being detachably fastened in the counterseats 23 preferably by means of screws 24, although the same may be otherwise fastened, if desirable.

The blades B gradually taper from their inner to the outer ends thereof, and this is effected by the impact surfaces which are formed by the plates 21 of uniform shape from the outer ends of said blades to within a short distance from the hub of the propeller, while the opposite faces of said blades, formed by the plates 22, gradually rise from the extreme outer end of said blades to the hub so as to materially reinforce the propeller. This is clearly shown by a comparison of Figs. 3 and 4.

The external contour of the portion 10 of the hub A where it joins the shanks or arms 12 presents surfaces 25 forming an air screw, as is clearly illustrated in Figs. 1, 2 and 5 of the drawing, for coöperation with the impact surfaces of the blades B to afford the least possible resistance to the propeller.

Each blade B is shaped in cross section so that the propelling or impact surface thereof has its front edge at an angle of approximately 26° out of the plane of the rear edge and is curved in cross section gradually to a given radius, as is clearly illustrated in Figs. 3 and 4 of the drawing.

The formation of the webs 19 and 20 in the frame 18, which together constitute the skeleton form of the supporting portion of the blade, assures maximum rigidity to said blade in all directions with a minimum of weight in material. Owing to the hollowing of the hub A, and the shanks or arms 12 in contradistinction to making the same solid, weight is reduced and cooling of the hub with the adjoining portions is brought about to thus avoid the usual warping of the blades or any portions of the propeller attended by the cooling of castings when the metal is of too uneven bulk.

From the foregoing it is thought that the

construction and manner of operation of the invention will be clearly understood and, therefore, a more extended explanation has been omitted.

What is claimed is:—

1. In a propeller, a hub having a central cooling chamber, the outer wall of said hub being shaped to provide an air screw, hub end disks detachably held to the hub and providing bearings, and blades formed integrally with the hub, said blades being of skeleton formation and carrying facing plates.

2. In a propeller, a hub having a relatively large cooling chamber, disks detachably held to the ends of the hub and providing bearings, blades formed integrally with the hub, said blades being of skeleton formation consisting of a marginal frame and longitudinal and transverse ribs, and facing plates detachably secured upon the blades on opposite sides.

3. In a propeller, a hub, a plurality of blades, the plane determined by the front and rear edges of each blade making an angle approximating 26° with a plane perpendicular to the axis of rotation, the impact surface of the blade being of uniform curvature from the tip inwardly, the opposite surface of the blade having a uniformly increasing curvature from the tip inwardly.

4. A propeller comprising a hub, blades integral therewith, end plates detachably secured to the hub, and a shoulder on each plate to engage in the hub to prevent lateral displacement of said plate.

5. A propeller comprising a hub, blades integral therewith, end plates detachably secured to the hub, a shoulder on each plate to engage in the hub to prevent lateral displacement of said plate and a reinforcement on each plate for the securing keying of the same to a motor shaft.

6. A propeller comprising a hollow hub having shanks, skeleton blades integral with the shanks, and facing plates secured to opposite sides of the blades.

7. A propeller comprising a hollow hub having shanks, skeleton blades integral with the shanks, and facing plates secured to opposite sides of the blades, the external surfaces of the hub and shanks being shaped to form an air screw.

In testimony that I claim the foregoing as my own, and have hereto affixed my signature in the presence of two witnesses.

CHARLES L. SANFORD.

Witnesses:

JOHN H. SIGGERS,
DAVID R. WAGNER.