Nov. 18, 1947. H. A. BERLINER 2,430,854

PROPELLER BLADE

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Fig. 1

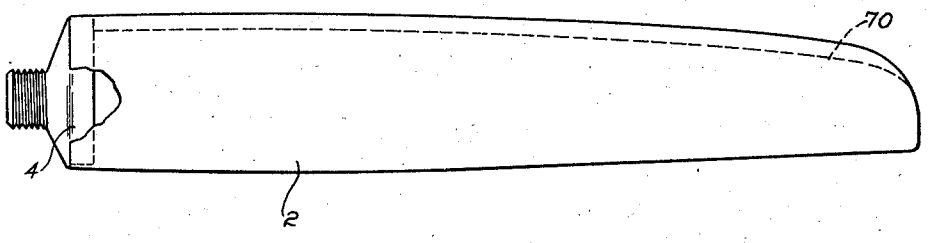


Fig. 2

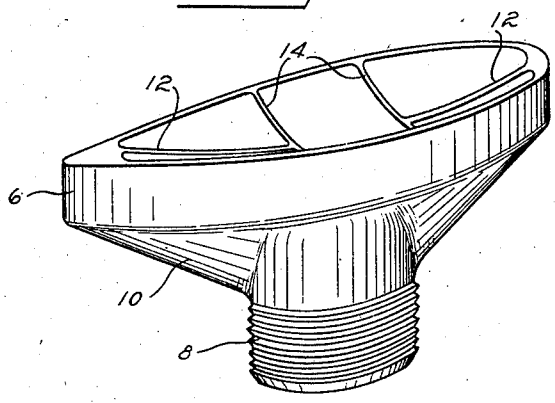


Fig. 3

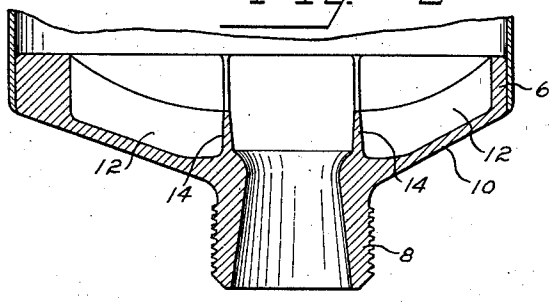
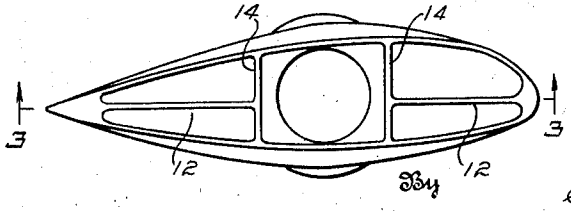


Fig. 4



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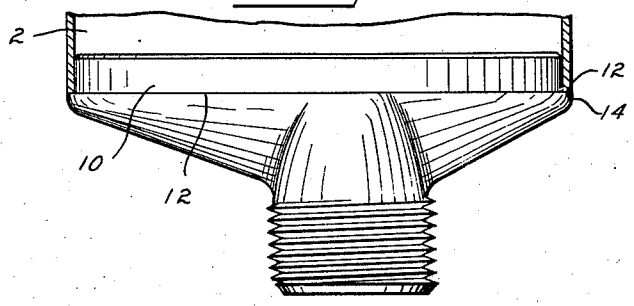
Attorneys

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PROPELLER BLADE

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Fig. 5



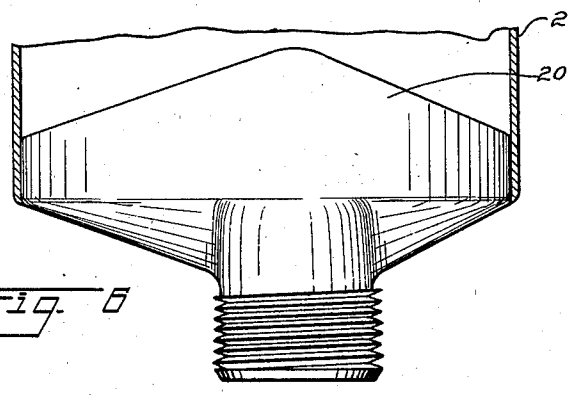


Fig. 6

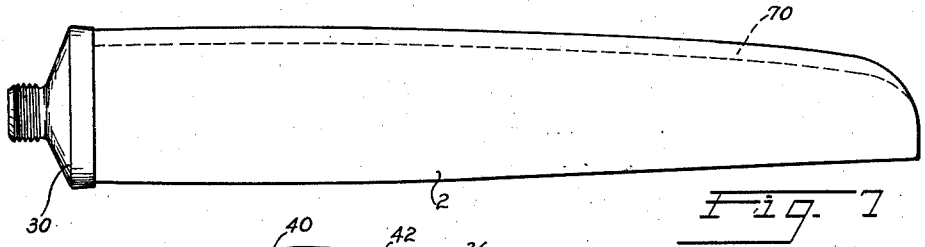


Fig. 7

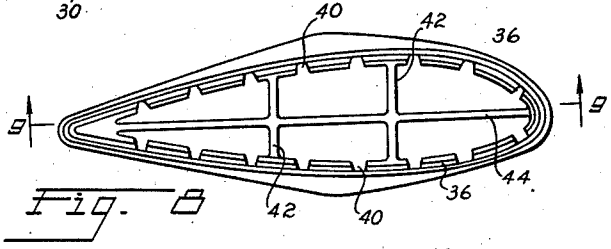


Fig. 8

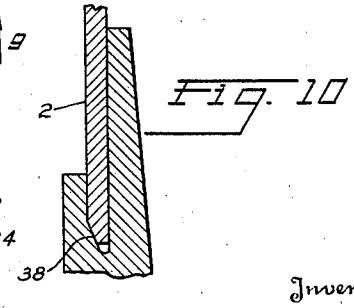


Fig. 10

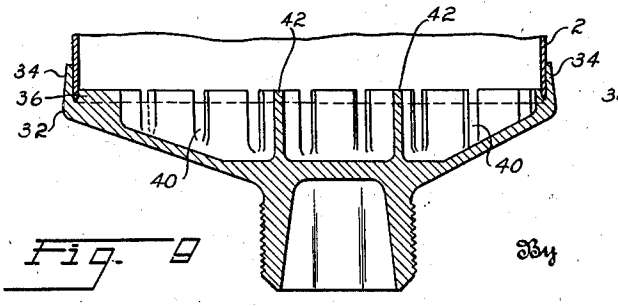


Fig. 9

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Fig. 11

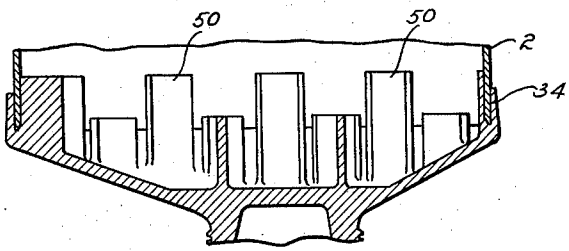


Fig. 12

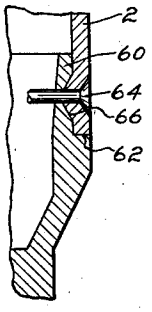


Fig. 13

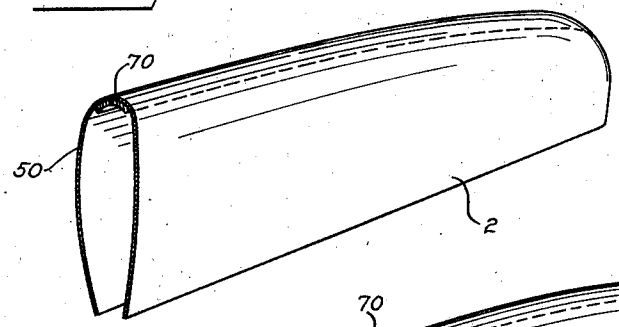


Fig. 14

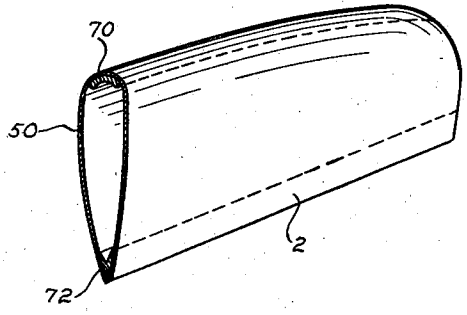
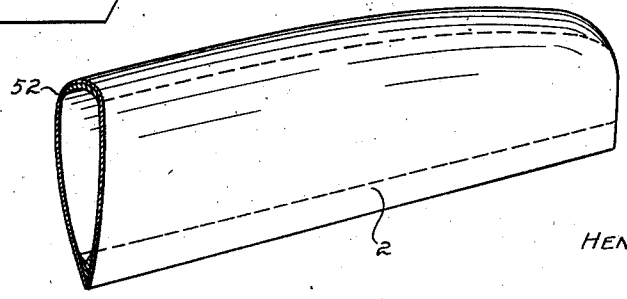


Fig. 15



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Patented Nov. 18, 1947

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UNITED STATES PATENT OFFICE

2,430,854

PROPELLER BLADE

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Application June 13, 1945, Serial No. 599,176

4 Claims. (Cl. 170—159)

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This invention relates to propeller blades and, more particularly, to hollow metal propeller blades.

Hollow metal propeller blades are well-known and widely used and have numerous advantages over other types of blades. Such blades may be formed in many ways, one of these being by the formation of separate root and blade parts which are joined to form the finished blade. Among other serious difficulties encountered in the manufacture of blades of this specific type has been the provision of a strong and efficient but simple connection between the root and blade and the construction of a blade having a root portion of minimum size and weight but also having sufficient blade rigidity and strength to withstand heavy loads.

It has been the principal object of this invention, which is achieved by the blade disclosed herein, to provide a strong and light blade having the required rigidity and strength, which may be simply manufactured and easily assembled.

Other objects and features of novelty of the invention will be made apparent by the following description and the annexed drawings which, it will be understood, are only illustrative of the invention and impose no limitation thereon not imposed by the appended claims.

Referring to the drawings, in which similar reference numerals refer to like parts,

Fig. 1 is a side elevational view of a blade according to this invention, having parts thereof broken away;

Fig. 2 is a perspective view of the adapter part of the blade of Fig. 1;

Fig. 3 is a sectional view taken on line 3—3 of Fig. 4;

Fig. 4 is an outer end view of the adapter part of the blade of Fig. 1;

Figs. 5 and 6 are views showing two modified adapters according to my invention;

Fig. 7 is a side elevational view of a modified form of blade according to the invention;

Fig. 8 is an outer end view of an adapter part for use with the blade of Fig. 7;

Fig. 9 is a sectional view taken on line 9—9 of Fig. 8;

Fig. 10 is an enlarged view of parts of the adapter shown in Figs. 8 and 9, showing particularly the connection between the blade wall and the adapter;

Fig. 11 is a view similar to Fig. 9 showing a modified form of the adapter of Fig. 9;

Fig. 12 is an enlarged view showing one means for attaching the blade wall to the adapter, and

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Figs. 13, 14 and 15 are partial views of the blade part of a propeller showing the means provided by the invention for strengthening and stiffening the edges thereof.

A propeller blade formed according to my invention is disclosed in Fig. 1 of the drawings and comprises a blade part 2 and a root, or adapter, part 4. The blade is of airfoil shape at each cross-section thereof and is hollow, being formed of sheet metal which, in a preferred method of manufacture illustrated in Figs. 13 and 14, is bent or stretched about a form having the shape of the leading edge part of the blade, the free edges being then shaped and connected to form the trailing edge part. The root or adapter part of the blade comprises a metallic member having a part 6 which is of airfoil shape in cross-section and of substantial area, a part 8 of circular cross-section and reduced size which is screw-threaded or otherwise formed for attachment within the propeller hub, and an intermediate part 10 of tapering form. The adapter 4 is preferably hollow and the parts 6, 10 thereof are provided with internal reinforcing webs 12, 14.

The open, inner end of the part 2 of the blade closely surrounds the airfoil-shaped part 6 of the adapter and is rigidly attached thereto by brazing, welding, riveting or otherwise, thus forming a light-weight and strong blade.

In a modified form of the invention, which is disclosed in Fig. 5, the blade part 2 is attached to the adapter over only a part of the surface of the peripheral wall of the airfoil-shaped part thereof, and the part of the wall which contacts the blade part is set inwardly of the rest of such peripheral wall, as at 10 in Fig. 5, forming a step 12 on which the end wall of the blade part 2 seats. The parts are preferably so dimensioned that the outer surface of the blade part 2 is flush with that of the part of the peripheral wall which is not inset.

A further modification of the adapter part of the blade provided by the invention is disclosed in Fig. 6. In this embodiment the side walls of the part of the adapter to which the blade part 2 is attached are extended toward the blade part 2 beyond the leading and trailing edge parts of the adapter to provide additional areas of contact between the blade and adapter parts, whereby brazing, welding or other connecting means may be provided over a larger area. Such extended parts are shown at 20 in Fig. 6.

While I prefer that the blade part 2 be attached to the adapter exteriorly thereof, as shown in Figs. 1 to 6 and described hereinbefore, the invention also provides a blade in which the end of part 2

is positioned and connected within the adapter. Such a blade is disclosed in Fig. 7 and comprises an adapter part 30 which receives, surrounds and is attached to the open inner end of the blade part 2.

One form which the root or adapter 30 may take is disclosed in Figs. 8, 9 and 10. This adapter is generally similar in shape to that of Figs. 2, 3 and 4. The outer, airfoil-shaped part 32 of the adapter comprises the peripheral wall 34 and a second wall 36 which is spaced inwardly of peripheral wall 34, is of less height than the outer peripheral wall and extends parallel thereto throughout its length. The width of the space between the two walls is of the order of the thickness of the metal sheet of the blade part 2 in order that the same may be received therebetween, and such space is sufficiently deep to receive a substantial part of the edge of the blade part 2. The lower part of the outer surface of the inner wall 36 is flared toward the outer wall, as shown at 38 in Fig. 10, in order to permit the blade part 2 to be wedged between the walls and therefore be more securely held. The inner wall is preferably non-continuous, being interrupted by a plurality of openings 40 which extend below the bottom of the space between the two walls. Lateral internal ribs 42 and a longitudinal internal rib 44 are provided to strengthen the adapter part.

In a modified form of the adapter of Figs. 8, 9 and 10, which is disclosed in Fig. 11, a plurality of the spaced parts forming the inner wall 36 are extended outwardly, as shown at 50, beyond the outer or upper surface of the outer wall 34 and provide additional surfaces abutting the inner surface of the blade part 2 and to which the blade part may be brazed or otherwise attached. These extending parts also increase the stiffness of the blade part of the propeller.

In a further embodiment of the invention the blade part is attached to the adapter part by riveting. A structure embodying this means of fastening is disclosed in Fig. 12, in which are shown the wall 60 having a step 62 formed in the outer surface thereof within which the inner end of the blade part 2 is received, the blade part 2 and wall 60 being connected by rivets 64. These rivets may extend through the entire blade, thereby attaching the blade part to each side of the adapter or, alternatively, each rivet may be of the blind type. The outer wall of adapter part 60 is countersunk about the rivet holes therein, as shown at 66, and the metal of the blade part 2 is drawn into these countersinks in order to more firmly attach the blade parts together.

Means are provided by the invention for stiffening and strengthening the leading edge or the trailing edge, or both, of the blade part of the propeller. Such means comprise stiffening means

70 attached to the leading edge part of the blade part 2 and similar means 72 attached to the trailing edge part internally thereof, and either or both extending throughout all or a part of the length of the blade part. As shown in Figs. 13 and 14, this stiffening and strengthening means may comprise a metal strip welded, brazed or otherwise attached to the blade part prior to completion thereof. Alternatively, and as shown in Fig. 15, each stiffening and strengthening means may be provided by a metal fillet which may be deposited in molten state.

While I have described and illustrated several embodiments of my invention, it will be apparent to those skilled in the art that further embodiments, as well as modifications of those disclosed, may be made without departing in any way from the spirit or scope of the invention.

What is claimed is:

1. A propeller blade comprising a hollow blade part and a separate adapter part, said adapter part comprising an integral structure having a substantially cylindrical portion for attachment within a hub and a substantially hollow portion of airfoil section having two radially-spaced walls extending axially of the blade and between which the open end of the hollow blade part is received and fastened.

2. A propeller blade according to claim 1, in which the adjacent faces of the two walls converge at their inner ends to provide a restricted recess for the reception of the end wall of the hollow blade part.

3. A propeller blade according to claim 1, in which the inner wall is formed of a plurality of spaced sections.

4. A propeller blade according to claim 3, in which some of the spaced sections of the inner wall extend axially of the blade beyond others.

HENRY A. BERLINER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,414,742	Leitner	May 2, 1922
1,438,838	Leitner	Dec. 12, 1922
1,875,454	Havill	Sept. 6, 1932
2,231,888	Couch	Feb. 18, 1941
2,336,012	Hackethal	Dec. 7, 1943
2,380,683	Carol	July 31, 1945

FOREIGN PATENTS

Number	Country	Date
221,906	Great Britain	Sept. 25, 1924
281,357	Italy	Jan. 10, 1931
360,952	Germany	Oct. 9, 1922
491,155	Great Britain	Aug. 26, 1938