

Feb. 27, 1945.

H. A. BERLINER
PROPELLER BLADE
Filed Nov. 5, 1941

2,370,136

2 Sheets-Sheet 1

Fig. 1

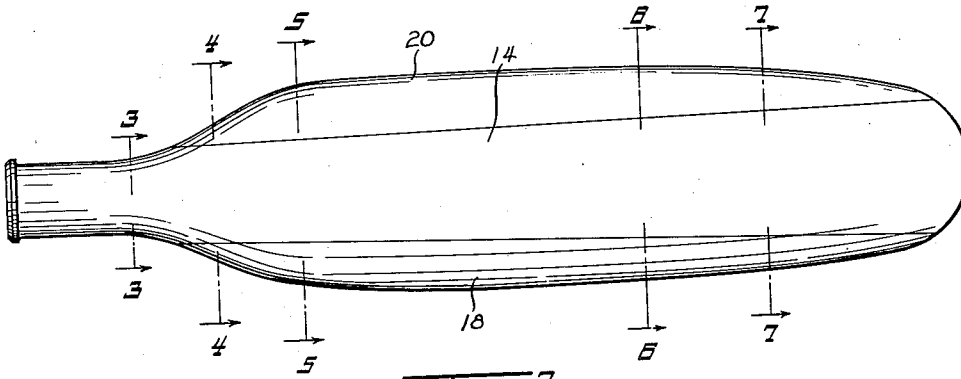
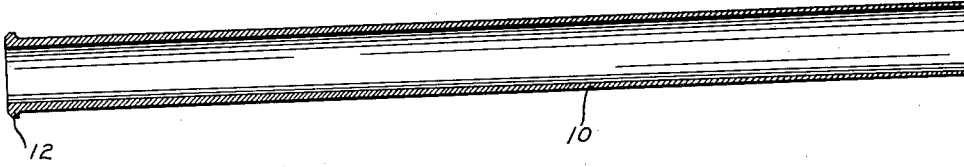


Fig. 2

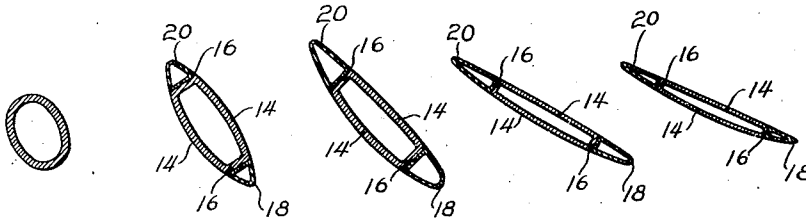


Fig. 3 Fig. 4 Fig. 5 Fig. 6 Fig. 7

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Fig. 8

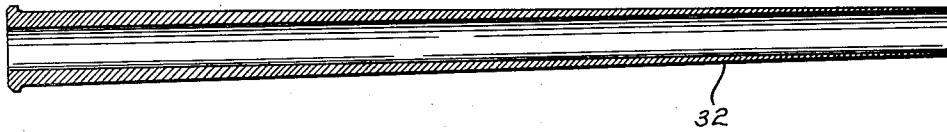


Fig. 9

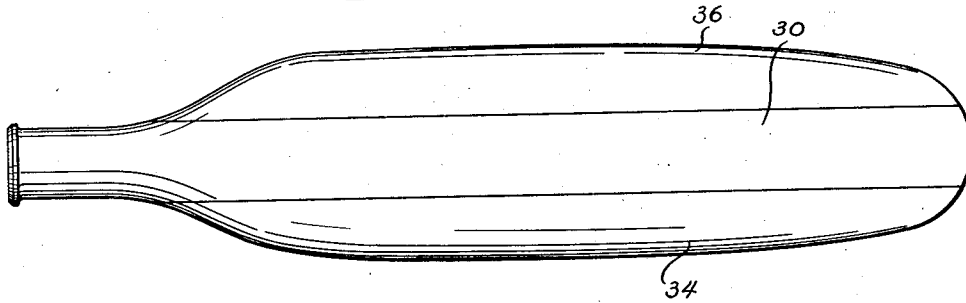


Fig. 10

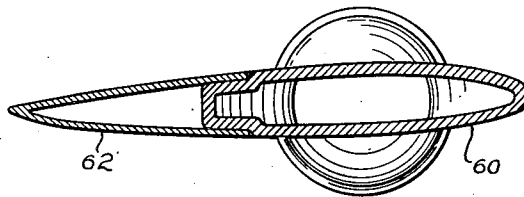
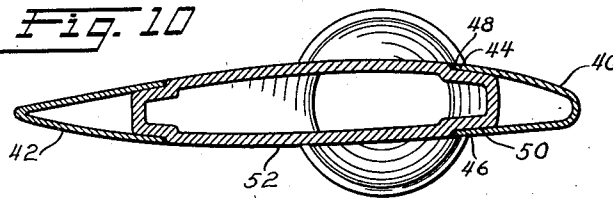


Fig. 11

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UNITED STATES PATENT OFFICE

2,370,136

PROPELLER BLADE

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Application November 5, 1941, Serial No. 417,951

1 Claim. (Cl. 170-159)

This invention relates to propeller blades and, more particularly, to hollow, metallic blades of a type particularly adapted for use in aircraft.

The principal object of the invention is to provide a hollow, metallic propeller blade having internal reinforcing members, which blade is formed by the simple operations of deforming and attaching together a plurality of metal tubes or sheet metal members to provide elongated parts which extend longitudinally of the blade. In carrying out this simplified manner of construction any one of a number of combinations of tubular and sheet metal sections and parts may be used, and the blade may be formed of two or more of such sections and parts.

According to one important feature of the invention, the several sections of the blade are formed of hollow tubes rigidly secured together longitudinally of the blade and shaped to give the blade the desired cross-sectional configuration. According to another feature of the invention, one or more of the longitudinal sections of the blade is formed of a hollow tube, while one or more of the other longitudinal sectional parts of the blade may be formed of sheet metal or other suitable material attached to the tubular section or sections, all of the parts being properly shaped to provide the desired cross-sectional shape.

In a preferred form of the invention the blade is formed by a central, longitudinal tubular section having other longitudinal tubular sectional parts attached to the side walls thereof to form the leading and trailing edge portions of the blade. However, the invention contemplates that the blade may be formed of a lesser or greater number of longitudinal sectional parts and that bent sheet metal parts may take the place of the deformed tubular parts contemplated in the preferred embodiment.

Another principal object of the invention is to provide a blade which is very simple and inexpensive in construction, and yet is strong and has the desired airflow shape throughout.

The above and other objects, features of novelty and advantages of the invention will be apparent from the following description when read in connection with the accompanying drawings, in which

Fig. 1 is a longitudinal section through one form of tube used in forming a section of the blade;

Fig. 2 is a plan view of a completed blade formed from the tube of Fig. 1 and from other parts;

Figs. 3 to 7 are sections on the lines 3-3, 4-4, 5-5, 6-6, 7-7 respectively, of Fig. 2;

Fig. 8 is a longitudinal section through a second form of tube used in forming a blade in accordance with the invention;

Fig. 9 is a plan view of a completed blade formed from the tube of Fig. 8 and from other parts;

Fig. 10 is a cross-sectional view of a blade formed in accordance with the invention and showing a modified construction, and

Fig. 11 is a view, similar to Fig. 10, showing a further modification of the invention.

The main body portion of the blade is formed from a hollow metal tube of substantially constant external diameter throughout its length, as shown in section in Fig. 1, and indicated at 10. Adjacent one end the tube is formed with an annular shoulder 12, by which it may be secured in place in a hub. It will be noted that the walls of the tube taper in thickness from the hub end toward the outer end, being substantially thinner at the outer end than at the hub.

In forming the blade, the tube 10 is flattened throughout the portion thereof removed from the shoulder 12 to provide upper and lower faces 14, which are relatively wide and which are connected by narrower edges 16. As shown, the edges 16 are substantially straight and flat, and become narrower toward the outer end of the blade, while the faces 14 become wider. It will also be noted from the sections shown in Figs. 4 to 7 that the pitch or angle of the faces 14 changes progressively throughout the length of the blade.

The blade is completed by a pair of tubular hollow edge structures secured to the edges 16 by welding or brazing, and extending substantially throughout the flattened portion of the tube. One such structure, indicated at 18, is so shaped as to form the leading edge of the blade, and the other structure 20 is shaped to form the trailing edge of the blade. As is shown in Figs. 4 to 7, the contour of the blade formed by the main tube 10 and the leading and trailing edge structures is such as to provide a desired airflow shape at all points in the length of the blade.

The leading and trailing edge members 18 and 20 may be formed by shaping sheet metal to a tubular shape, as shown in Figs. 4 to 7, or may be formed by deforming a tube to the desired shape, in the same manner as the center section of the blade is formed from the tube 10.

A tube of decreasing outer diameter, as shown in Fig. 8, may be used in place of the tube of

substantially constant outer diameter shown in Fig. 1, in which case a blade having a center section of substantially constant width throughout its length will be provided. Such a blade is illustrated in Fig. 9, in which the center section 30, which is of substantially constant width throughout its length, has been formed from the tube 32 of Fig. 8. Leading and trailing edge portions 34 and 36, respectively, which may be formed in any desired manner such as those taught in this application, are attached to the side edge portions of the central section.

In Figs. 4 to 7 the leading and trailing edge portions of the blade are shown as formed of tubular parts deformed to the desired shape and attached to the opposite side edge portions of the central section. In Fig. 10 of the drawings there are disclosed modified forms of leading and trailing edge members and a modified form of attachment thereof to the central section. In this embodiment, the leading and trailing edge portions 40, 42 are formed of sheet metal bent to the desired airflow shape. The free longitudinal edge portions of each of these is caused to overlap the adjacent portions of the upper and lower surfaces of the central section and are set into depressions therein. Thus, the free edges 44, 46 of the leading edge member 40 are received within depressions 48, 50 in the upper and lower faces of the central section 52, which extend along the edges of the central section and the depth of which is made equal to the thickness of the material of the leading edge member in order to provide a smooth outer surface. The depressions 48, 50 are of sufficient extent laterally of the blade to receive enough of the edge portions 44, 46 to permit a secure attachment by brazing, welding, riveting or otherwise. The trailing edge portion 42 may, if desired, be formed in the same manner as leading edge portion 40 and may be attached to the center section in the described manner, all as illustrated in Fig. 10.

Each of the embodiments hereinbefore described includes three sections. If desired, a lesser or greater number may be provided without

departing from the spirit or scope of the invention. Thus, in Fig. 11 a two-part blade is disclosed, having a main section 60 providing the leading edge portion and the greater part of the center of the blade, and a trailing edge section 62 which, in Fig. 11, is shown as formed and attached to main section 60 in the manner illustrated in Fig. 10. Obviously, the trailing edge section 62 may be formed and attached to the main section in the manner illustrated in Figs. 4 to 7.

It will be seen that by using any of the constructions described and illustrated, or which may obviously occur to those skilled in the art as variations within the scope of the invention, a multi-part blade of proper airflow shape will be provided, and will have internal reinforcing members increasing its strength.

After the blade is completed as described, the surface may be finished in any desired manner and the blade is then ready for use.

While a number of embodiments of the invention have been shown and described in detail, it will be understood that various other changes may be made and that the described embodiments are illustrative only and are not intended to limit the scope of the invention, reference being had for this purpose to the appended claim.

What is claimed is:

A propeller blade comprising a hollow metallic tube of integral section formed at one end for connection to a hub and being flattened to form relatively wide faces of increasing width extending from the hub end of the blade to the outer end thereof and which are connected by relatively narrow side walls, a hollow metallic tube rigidly attached to each side wall substantially throughout the longitudinal extent thereof, the three tubes being of closed cross-sectional shapes and reinforcing and stiffening each other and having such cross-sectional shapes that at each point along the length of the blade the three cross sectional shapes combine to provide a desired airfoil shape of the propeller.

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