

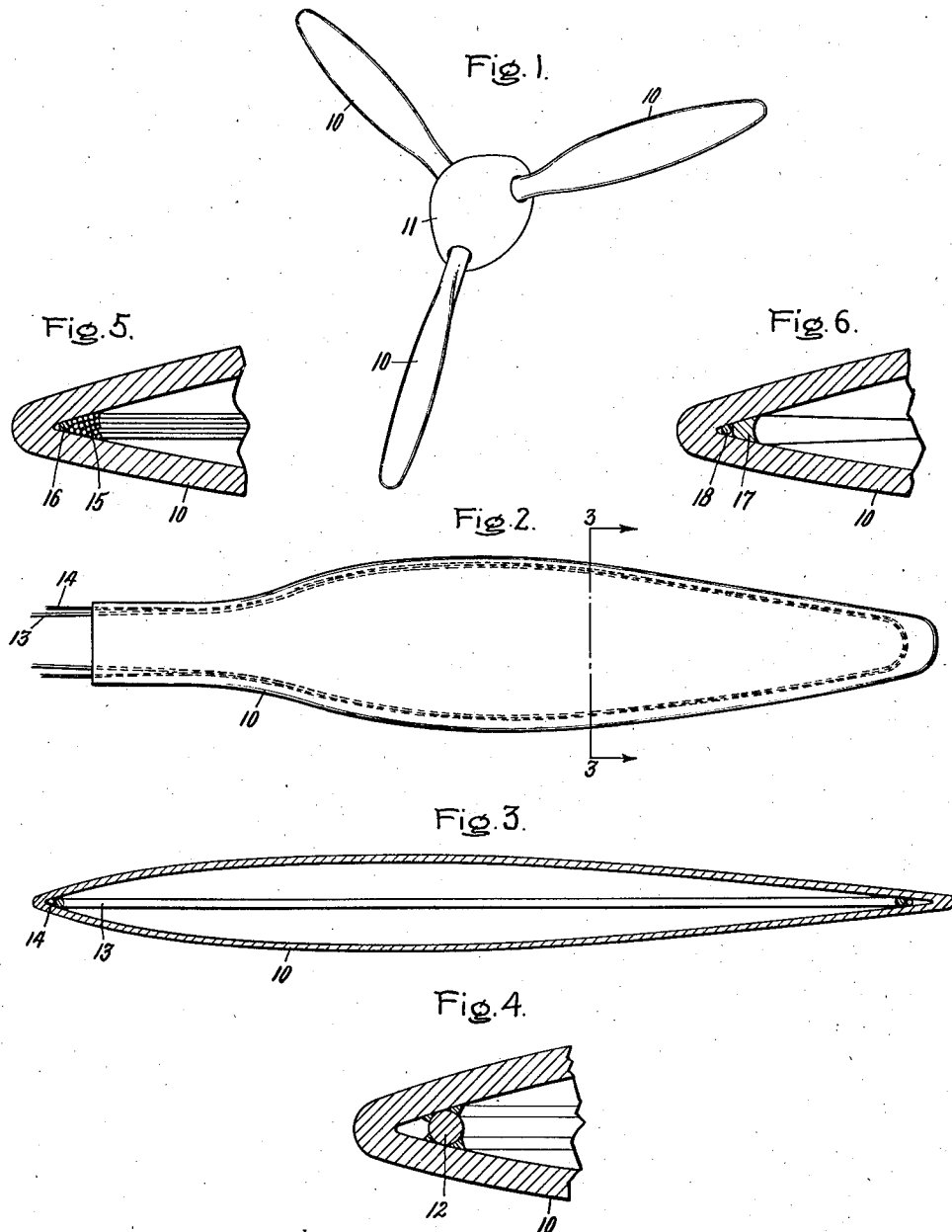
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METHOD OF MAKING HOLLOW PROPELLERS

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METHOD OF MAKING HOLLOW
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1 Claim. (Cl. 29—156.8)

The present invention relates to hollow propellers as are used for propelling aircraft. More particularly, the invention relates to the kind of propellers made from steel tubing by a forming process. Such propellers have blades air-foil-shaped in section with a pitch varying from the root to the tip. The edge portions of the blades are subject to considerable forces during operation and therefore reinforcing means near the edges inside the hollow blades must be provided to preclude failure due to excessive stresses along the edge portions. At present it is the practice to produce such reinforcing means in the form of fillets from copper cast into the edge portions of the blade. The process of casting the reinforcing fillets or strips is ordinarily carried out in a number of successive steps during each of which an amount of copper is cast into a portion only of the hollow edge. This succession of steps heretofore has been found necessary properly to distribute the melted reinforcing material over the entire length of the edge. The present method is especially cumbersome in regard to modern propeller blades with considerable variation of the pitch from the root to the tip.

The object of my invention is to provide an improved method of manufacturing impellers, more particularly of producing the reinforcing means near the hollow edge portions thereof whereby the aforementioned difficulties are substantially eliminated.

Another object of my invention is to provide a method of making an improved propeller blade structure in which the weight of the reinforced edge portions is kept at a minimum. This is accomplished in accordance with my invention by the provision of a reinforcing strip made from resilient flexible steel united with the hollow edge portions by a brazing process.

During the method of manufacture a strip in the form of a round or otherwise suitably shaped wire is inserted into the hollow blade together with another strip of copper, and the blade with the copper and steel strips inserted in the edge portions is placed into a brazing furnace to effect brazing of the steel strips to opposite sides of the hollow edge portion.

For a better understanding of what I believe to be novel and my invention, attention is directed to the following description and the claim appended thereto in connection with the accompanying drawing.

In the drawing Fig. 1 illustrates a propeller according to my invention; Fig. 2 shows a propeller blade during the process of manufacture accord-

ing to my invention; Fig. 3 is an enlarged section along line 3—3 of Fig. 2; Fig. 4 is an enlarged edge portion of the blade shown in Figs. 2 and 3 upon completion of the process according to my invention; and Figs. 5 and 6 illustrate sectional views of modifications of my invention.

The propeller in Fig. 1 has three blades 10 with inner end portions or roots secured to a support or hub 11. The blades are of conventional shape, the root portion is essentially cylindrical, and the blade tapers gradually outward up to a certain point from which it gradually tapers inward to assume a leaf shape, as indicated in Fig. 2. In cross section the blade is air-foil-shaped, as shown in Fig. 3. The pitch, that is, the angle between the horizontal center-line of the section in Fig. 3 and the plane of rotation, varies gradually from the root towards the tip. This complicated shape is attained by subjecting a hollow tube to a forming process. The opposite walls of the tip portion upon completion of the forming process are united by a fusion process, such as stitch-welding.

During operation, different parts of the propeller are subject to different stresses. These stresses are especially great with regard to portions slightly spaced from the inner edge and considerably spaced from the center of the blade when viewed in Fig. 3. In order to carry the load acting on these portions a propeller blade according to my invention is reinforced by a strip 12 (Fig. 4) of steel rigidly secured to opposite walls of the propeller blade near its edge by a brazing process.

During the process of forming the reinforcing strip 12 a steel wire 13 is inserted into the hollow blade body in the form of a loop (Fig. 2). The resiliency of the wire material forces the wire into the hollow edge portion. Together with the wire suitable brazing material is inserted into the body. This material is preferably in the form of a copper wire 14 (Fig. 2) of a cross section smaller than that of the steel wire 13 and placed into the edge of the blade body. The blade body with the steel and copper wires is then placed into a brazing furnace and subject to high temperature at which the copper is melted to effect a strong bond between the blade and the inserted steel wire, as shown in Fig. 4. In certain instances it may be desirable to use a plurality of thin steel wires 15 together with a single strip or wire of copper 16 (Fig. 5) in place of the single wires 13, 14 respectively in Figs. 2 and 3. In other instances (Fig. 6) a steel wire 17 to be inserted into the hollow edge portion of a blade may be shaped so

that its opposite sides conform to the shape of the inner surfaces of the blade body. The cross sectional area of the wires 17 may vary along the edge of the blade (Fig. 6) so as to provide for different reinforcement as may be required for different edge portions of a blade. The copper wire 18 used in Fig. 6 is likewise shaped to conform to the edge of the blade and in certain instances it may be desirable to secure the copper wire 18 to the steel wire 17 prior to their insertion into the blade.

Thus, with my invention I have provided an improved propeller blade structure and method of making the same. The fillet or reinforcing strip is united to the edge portions of a propeller blade by a brazing process in a single step.

Having described the method according to my invention, together with the apparatus for carrying out the method, I wish to have it understood that changes may be made in both the apparatus

and the method without departing from the spirit of my invention and the scope of the appended claim.

What I claim as new and desire to secure by Letters Patent of the United States is:

The method of making a propeller blade which comprises forming a blade body airfoil-shaped in section and with varying pitch along its length, placing into the hollow body a loop of flexible steel strip and a loop of copper strip each extending along the entire length of and in close proximity to the inner edge of the body, the flexibility of the steel strip forcing opposite portions of the loop into the hollow edge portions of the blade, and subjecting the body with the two strips therein to a brazing operation integrally to unite in a single step the steel strip and the walls of the body near the inner edge thereof.

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