June 19, 1934. E. E. ROBERTS 1,963,531

SCREW PROPELLER

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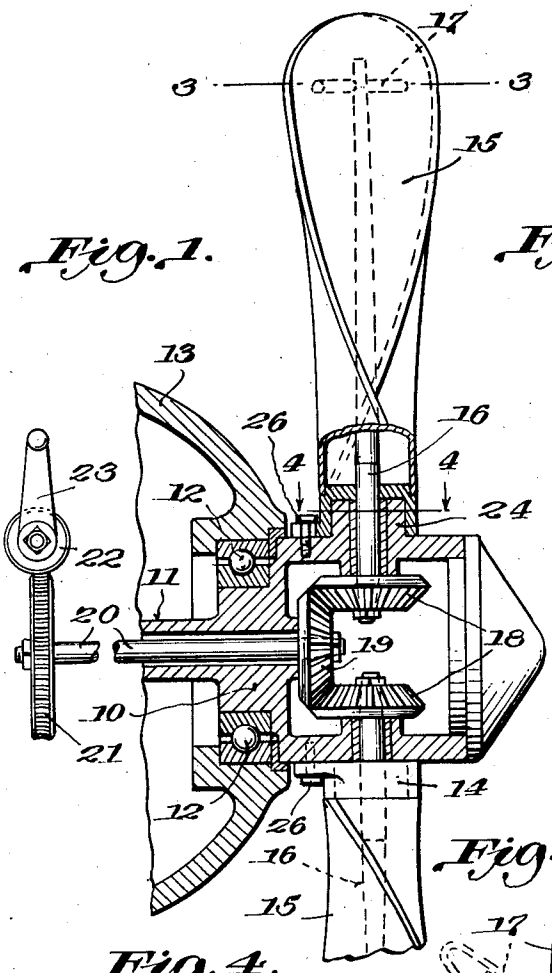


Fig. 1.

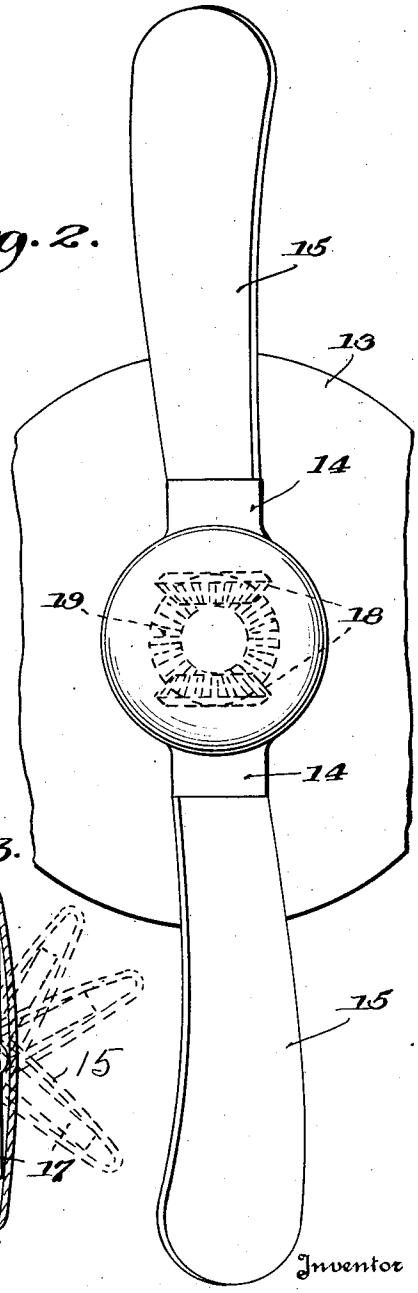


Fig. 2.

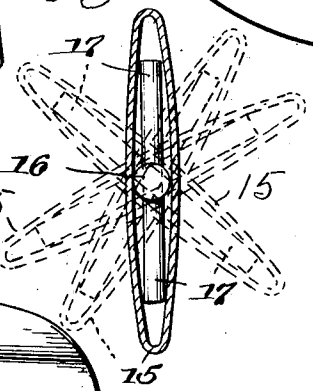


Fig. 3.

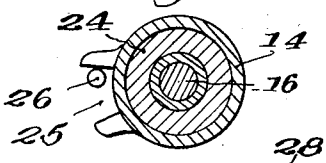


Fig. 4.

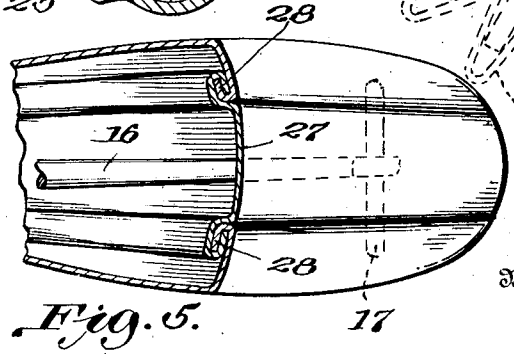


Fig. 5.

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SCREW PROPELLER

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7 Claims. (Cl. 170—163)

My invention relates to propellers and like devices of the screw type, the object of my invention being to provide such a member or element whether used for the propulsion of air-craft motor or other boats, fans, etc., that is to say, a rotating member having fluid-engaging blades set oblique to the axis of rotation, and which besides other advantages which will be appreciated by those skilled in the art has its blades capable of ready adjustment to change the pitch of the screw both in respect of blade angle and direction of the blades in the sense that their action may be reversed without changing the direction of revolution of the member.

My invention consists in whatever is described by or is included within the terms or scope of the appended claims.

In the drawing:—

Fig. 1 is a view of an embodiment of my invention for an airplane, parts being shown in side elevation and other parts in section;

Fig. 2 is a front view thereof;

Fig. 3 is a cross section of one of the propeller blades on the line 3—3 of Fig. 1, one position or adjustment being shown in full lines and several other positions in dotted lines;

Fig. 4 is a cross section on the line 4—4 of Fig. 1;

Fig. 5 is a detail view in perspective of a portion of a propeller blade made of elastic sheet metal.

A fundamental feature of my invention is the provision of propeller blades that are transversely flexible so that by a rotary motion on a radial or longitudinal axis with the inner end of the blade fixed, the blade may be twisted about such axis and thereby vary the pitch or inclination thereof so as to alter or modify the pitch to suit the requirements of the case. Another feature of my invention is the rotation of the blades on their longitudinal axes to reverse the directions of the blade edges to cause the propeller to act either by pull or thrust.

Blades having the necessary flexibility may be made of various materials such as rubber or other elastic material or thin sheet metal. When made of rubber for example, the blades will be made hollow for the accommodation and action of an internal twisting device which may take the form of a central radially extending rod or shaft having at its outer end a radial arm or arms. If made of metal, strips of steel having the required elasticity may be employed that are joined edge to edge on radial lines to form a hollow body for the reception and operation of a twisting device similar to that just mentioned in the case of blades made of rubber.

Describing in detail that embodiment of my invention shown in the drawing, the propeller comprises a hub, 10, secured to the forward end of a horizontal driving shaft, 11, the hub being journaled at one side in ball bearings, 12, in the front end of the fuselage or housing, 13. That portion of the hub projecting beyond the housing has at diametrically opposite sides blade bases 14, to which are fixedly secured the inner end of the respective propeller blades 15, and from which, of course, the blades extend radially outward diametrically opposite one another. The blades shown in Figs. 1 to 3 are of rubber, each being hollow and elliptical in cross section as shown in Fig. 3 and extending longitudinally of each blade centrally thereof is a shaft, 16, which passes through the base, 14, and reaches nearly to the outer end of the blade and near its outer end has a diametrically extending arm, 17, which extends along the major axes of the ellipse so that by rotating said shaft the blade will be subjected to a turning or twisting motion by the force applied near its outer end with the result that the angle and direction of the blade may be changed as indicated in the dotted lines in Fig. 3.

Various means may be employed to thus twist the blades and hold them in the desired twisted position. A simple and efficient contrivance for this purpose is to provide at the inner end of each twister shaft a bevel gear, 18, within the hub and to mesh therewith a single bevel gear, 19, on the end of a shaft, 20, which extends longitudinally through the center of the main shaft and which by worm gearing conveniently accessible for operation may be revolved to effect the turning and twisting rotation of the blade shafts. Thus on said shaft, 20, there may be a worm wheel, 21, with which meshes a worm, 22, on a shaft having a crank, 23, for rotating it. The worm gearing is advantageous because it holds the propeller blades in the twisted position to which they may be adjusted without the employment of any special holding device. Of course, the twisting action may be done otherwise than by hand and automatically acting means may be employed whose action, for example, will be dependent upon the speed of rotation of the propeller.

The blade base, 14, is mounted on a radial boss, 24, on the hub, so that it may rotate through a limited extent on an axis concentric with the twisting shaft axis and to limit its rotation it has in its periphery a segment shape notch, 25, between the ends of which is situated a pin or stud

26, fixed to the hub and in contact with which the end walls of said notch strike. This provision is made to allow limited rotary movement of the blades bodily when the blades are to be reversed in a direction to cause them to act either by pull or thrust. Such rotation of the blades is effected through the operating shaft, 20, and is preliminary to any change of pitch by twisting the blades themselves. The shaft 20 through the bevel gear connections with each of the shafts 16, by the action of the radial arm 17, on the blades will result in bodily turning the blades when they are to be reversed to the limited extent the notch 25 and stud 26 permit and following stoppage by the latter, continued rotation of the shaft 20 through the gear connections described will result in the desired twist.

In Fig. 5, I show the flexible blades made of strips, 27, of steel which extend longitudinally of the blade and which at their edges are joined by lap joints, 28, which extend longitudinally of the blade and thus a metal construction is provided which results in the hollow blade with enough flexibility for the twisting action. Of course, other metal than steel may be employed.

A propeller embodying my invention permits the twisting and rotary motions of the blades on their longitudinal axes to be effected while the propeller is rotating in service and, of course, also when it is not rotating.

As I have already indicated, while I consider the construction shown in the drawing and described in detail to be a most desirable one yet my invention may be embodied in structures that differ therefrom in the form, relative arrangement and location of parts and in other respects and my invention may be embodied in constructions which will not utilize all of the features and advantages my invention, but only some of them. The scope of my invention is to be determined by the language and legal meaning of the appended claims.

What I claim is:—

1. A screw propeller having a blade that is twistable in a direction perpendicular to the longitudinal axis of the blade and means comprising a single element substantially concentric with the longitudinal axis of the blade to twist the blade on such axis the blade having an interior space within which the twisting means is located, said twisting means acting on an interior surface of the blade.

2. A screw propeller having a blade that is twistable in a direction perpendicular to the longitudinal axis of the blade, means to twist the blade on such axes and a blade-carrying member to which the blade is connected at its inner end from which the blade radiates and means to restrain turning of the blade at such inner end when the twisting means is operated.

3. A screw propeller having a blade that is twistable in a direction perpendicular to the longitudinal axis of the blade, means to twist the blade on such axis and a blade-carrying member to which the blade is connected at its inner end from which the blade radiates and means to restrain turning of such inner end when the twisting means is operated comprising a part mounted for turning and means to restrict the turning of said part.

4. A screw propeller having a blade that is flexible in a direction perpendicular to its longitudinal axis, a driving member and means from which the blade radiates and means at the inner end of the blade and said driving member constituting a rotatable connection for rotation of the blade on its longitudinal axis and means acting on the inner end of the blade to limit rotation thereof.

5. A screw propeller having a hollow blade, a driving member, means from which the blade radiates and means connecting the inner end of the blade and said driving member constituting a rotatable connection for rotation of the blade on its longitudinal axis, the blade being twistable perpendicular to its longitudinal axis and means for turning the blade and twisting it about its longitudinal axis comprising a shaft within the hollow blade with a blade surface-engaging portion towards the outer ends of the blade eccentric to the shaft axis.

6. A screw propeller having a hollow blade a driving member from which the blade extends radially, said blade being flexible in a direction crosswise of its longitudinal axis and blade-twisting means comprising a radially extending shaft reaching to the outer end of the blade and having a blade wall engaging member that extends radially from the blade shaft.

7. A screw propeller having a hollow blade, a driving member from which the blade extends radially, said blade being twistable in a direction crosswise of its longitudinal axis and means to twist the blade on its longitudinal axis comprising a shaft within the blade and having a blade wall engaging member that extends radially from the shaft.

ERVIN EDWIN ROBERTS.