Sept. 6, 1932. W. W. EVERTS 1,875,998

PROPELLER

Filed May 22, 1931 2 Sheets-Sheet 1

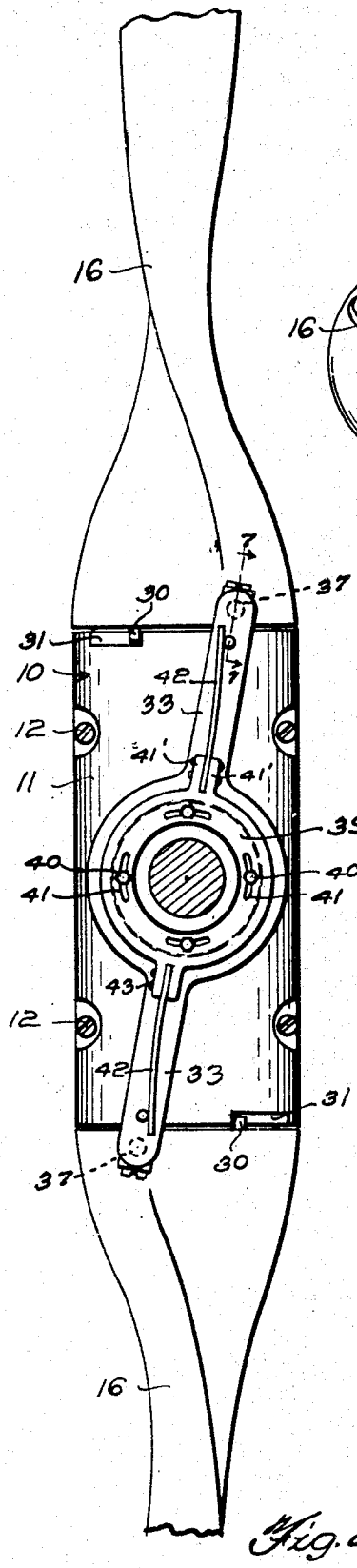


Fig. 2.

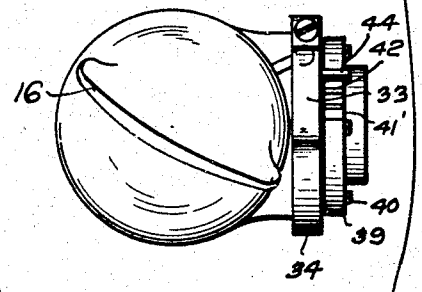


Fig. 3.

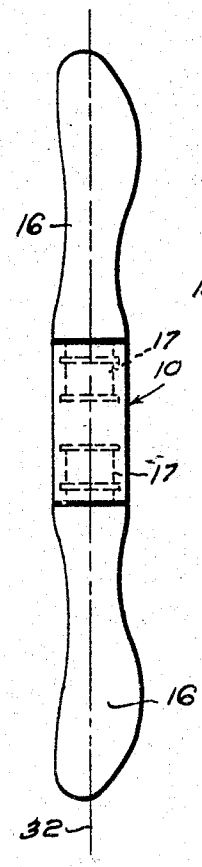


Fig. 4.

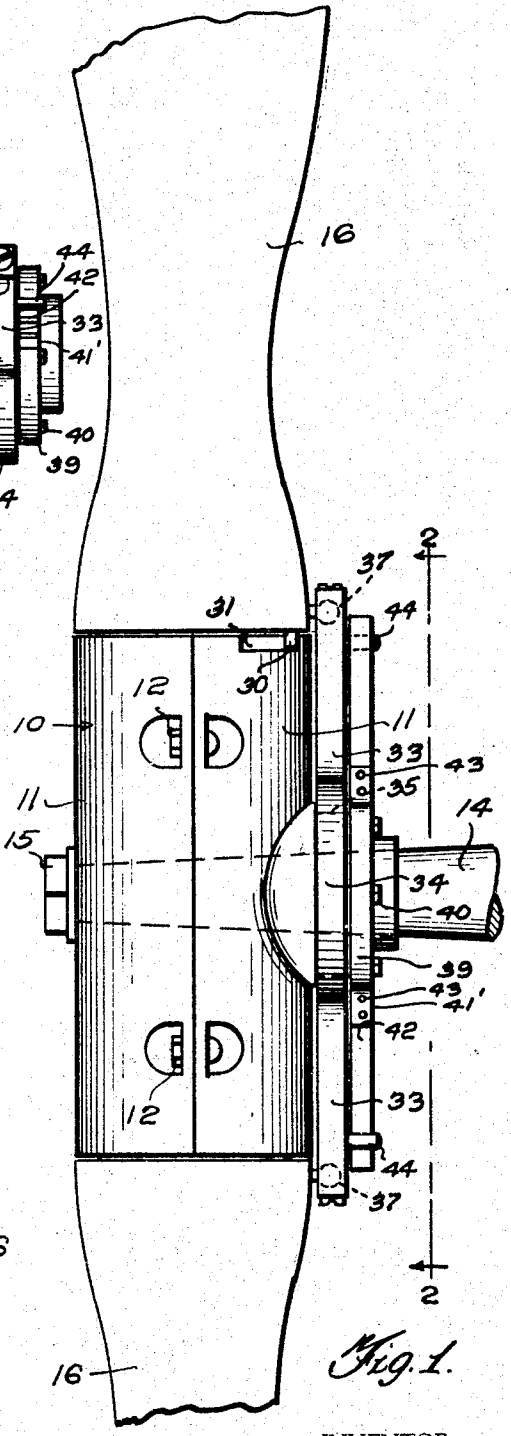


Fig. 1.

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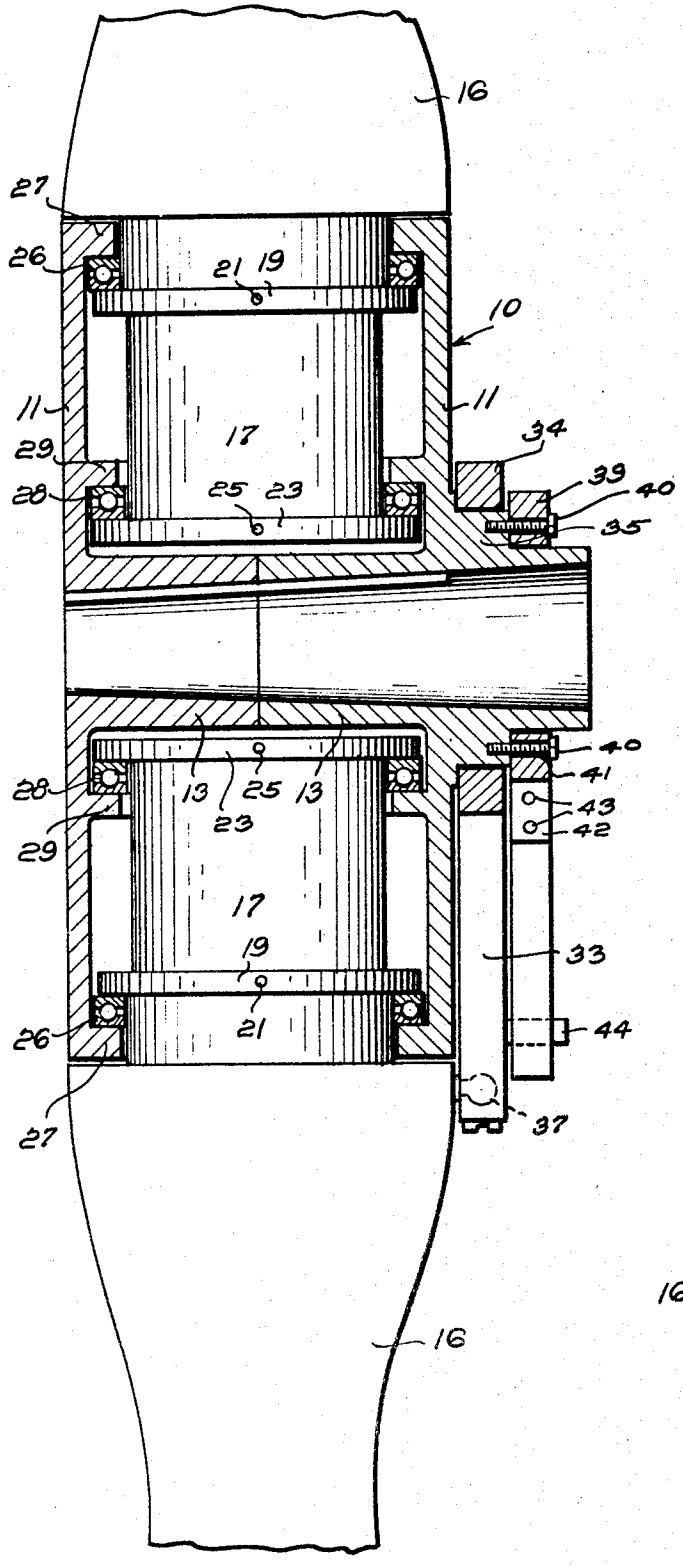


Fig. 5.

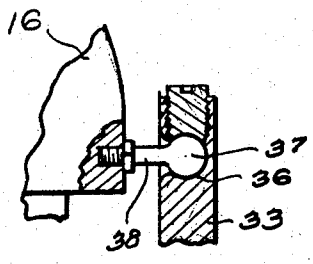


Fig. 7.

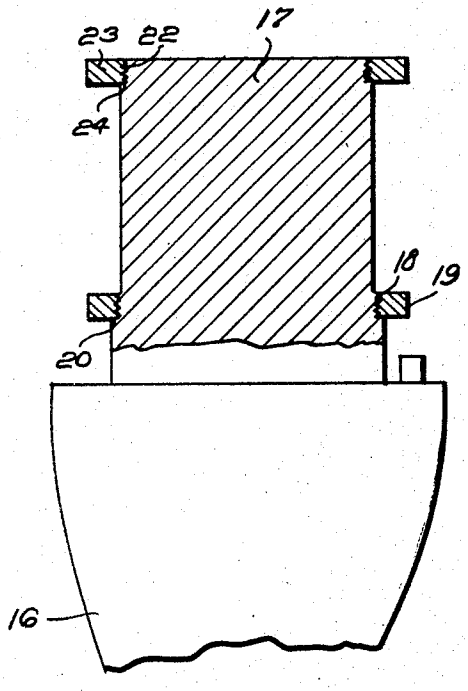


Fig. 6.

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Patented Sept. 6, 1932 1,875,998

UNITED STATES PATENT OFFICE

WALTER W. EVERTS, OF SAN ANTONIO, TEXAS, ASSIGNOR TO EVERTS PROPELLER COMPANY, A CORPORATION OF TEXAS

PROPELLER

Application filed May 22, 1931. Serial No. 539,337.

My invention relates to improvements in propellers.

In accordance with my invention, I provide a propeller having blades which are adjustable to vary their pitch. The construction is such that the adjustment of the blades is effected automatically by the change in pressure or density of the fluid medium in which the propeller is operated. The propeller is intended for use upon vehicles traveling within the air, such as airplanes, dirigibles, or the like, and is also intended for use upon vehicles traveling upon or within water, such as ships, submarines, or the like. The action of the propeller, with respect to adjusting the pitch of its blades, is wholly automatic, and the means controlling such automatic operation is so constructed that it is not preceptibly affected by changes in temperature. The propeller is of simple construction and the several parts of the organization are arranged in a compact manner.

In the accompanying drawings forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a side elevation of a propeller embodying my invention,

Figure 2 is a similar view taken at a right angle to Figure 1, upon line 2—2 of Figure 1,

Figure 3 is an end elevation of the propeller,

Figure 4 is a side elevation of the propeller, parts omitted, and illustrating the shape or construction of the blades.

Figure 5 is a side elevation of the propeller, upon an enlarged scale, parts broken away and parts shown in central longitudinal section,

Figure 6 is a side elevation of one of the propeller blades, parts broken away and parts in section,

Figure 7 is a detail section taken on line 7—7 of Figure 2.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 10 designates a tubular hub member, having a cylindrical bore, and shown as exteriorly cylindrical, while the invention is, in no sense, restricted to this precise shape, as the shape may be modified to produce stream-line effects, if desired. The tubular hub member 10 is, preferably, formed in semi-cylindrical hub sections 11, rigidly connected by any suitable means, such as bolts 12, although these sections may be welded or, otherwise, secured together. The hub sections 11 are provided, centrally thereof, with sleeve sections 13, which register with each other when the hub sections 11 are assembled. These sleeve sections form a sleeve for the reception of a rotary shaft 14, of a prime mover, such as an internal combustion engine, steam engine, or electric motor. These parts may be keyed together, and the bores of the sleeve section 13 are, preferably, tapered forwardly to conform with the taper of the shaft 14, which may be provided at its forward end with a nut 15.

The numeral 16 designates propeller blades provided at their inner ends with cylindrical shanks 17, preferably formed integral therewith, and these shanks are rotatably mounted within the ends of the tubular hub member 10, as clearly shown in Figure 5. Each shank 17, Figure 6, is provided, near its outer end, with a screw-threaded portion 18, for engaging with an internally screw-threaded end-thrust ring 19, adapted to be clamped or jammed against a shoulder 20. This end-thrust ring may also be held against rotation when properly screwed up, by one or more set screws 21. The shank 17 is slightly reduced in diameter inwardly of the screw-threaded portion 20, to permit of the end-thrust ring 19 being inserted in place, and, at its inner end, the shank is further reduced in diameter and is screw-threaded at 22, for receiving an internally screw-threaded end-thrust ring 23, adapted to be clamped or jammed against a shoulder 24. This end-thrust ring 23 may also be held against improper turning movement by one or more set screws 25, or the like. The invention is, in no sense, restricted to the precise manner of rigidly mounting the end-thrust rings 19 and 23 upon the

cylindrical shank 19, as any suitable means may be employed for this purpose.

The numeral 26 designates a combined lateral and end-thrust ball bearing unit, surrounding the outer enlarged end portion of the shank 17, and confined between the end-thrust ring 19 and an end-thrust ring 27, preferably formed integral with the hub member 10. The combined lateral and end-thrust ball bearing unit 28 surrounds the inner end portion of the shank, and is confined between the end-thrust ring 23 and an end-thrust ring 29, preferably, formed integral with the hub member 10. It is thus seen that each blade 16 is capable of turning upon its longitudinal axis, within limits, with relation to the tubular hub member 10. Each blade 16 is provided adjacent to its shank 17, with a stop element or pin 30, rigidly secured thereto by any suitable means, and arranged within a circumferentially extending groove 31, formed in the hub section 11. This pin is arranged to engage the end walls of the groove, thereby limiting the relative turning movement of the blade upon its longitudinal axis. The turning movement of the blade upon its longitudinal axis is effected for the purpose of varying the pitch of the blade. As clearly shown in Figure 4, the longitudinal axis of each blade 16, and of its shank 17 and hub member 10, is represented by a line 32. The blade turns upon this longitudinal axis 32. The blade is so shaped that the area of that portion of the blade arranged upon the trailing side of the longitudinal axis 32 is greater than the area of the blade arranged upon the leading side of the axis 32. These surfaces are, therefore, unbalanced, with the larger surface or area upon the trailing side of the axis 32. As a result of these unbalanced areas, pressure acting upon the propeller will effect an automatic turning of the blade upon its longitudinal axis, as will be more fully explained.

The blades 16 are twisted or have a normal pitch, in opposite direction, as is customary, and in varying the pitch of these blades, they turn upon their longitudinal axes in opposite directions with relation to each other. Means are provided to positively connect the blades so that they turn in unison. This connecting means embodies lever arms 33, which are rigidly connected with a supporting member or ring 34, and this supporting member is pivotally mounted upon a cylidrical boss 35, formed in sections, which are integral with the hub sections 11. This cylindrical boss 35 is concentric with the axis of rotation of the hub member 10. The lever arms are provided, at their outer ends, with spherically curved sockets 36, for receiving balls 37 rigidly secured to pins 38, which are rigidly attached to the inner ends of the blades 16. The lever arms and supporting element 34, therefore, constitute a pivoted lever, the outer ends of which are pivotally connected with the inner ends of the blades, upon opposite sides of the pivot of the lever, the arrangement being such that the blades are caused to turn upon their longitudinal axes, in unison, and in opposite directions. A stationary ring or collar 39 is mounted upon the end of the boss 35, and attached thereto by adjustable clamping bolts 40, engaging within the screw-threaded openings formed in the end of the boss 35. These bolts extend through elongated slots 41, formed in the ring 39, whereby the ring may be circumferentially adjusted with respect to the boss and clamped thereto in a selected adjusted position. The stationary ring 39 is provided, at diametrically opposite points, with pairs of radial lugs 41', receiving therebetween radial leaf-springs 42, rigidly attached to these lugs by bolts or rivets 43. The leaf-springs 42 engage behind pins 44, rigidly attached to the lever arms 33, near their outer ends. The leaf-springs 42 being attached to the stationary ring 39, do not rotate, and their function is to oppose the turning movement of the lever arms 33. In this action, the leaf-springs have a sliding engagement with the pins 44. This is an important feature of the invention. In operating an airplane, temperatures in which the airplane is driven may vary rapidly. This variation in temperature will cause an expansion or contraction of the leaf-springs 42, but since they have slidable engagement with the pins 44, such expansion or contraction will not perceptibly vary the resistance offered by the springs. If coil springs were employed in a propeller for regulating the turning movement of the blades, the expansion or contraction of such coil springs, due to changes in temperature, would materially affect the resistance which they would offer with respect to the turning movements of the blades.

The operation of the propeller is as follows:

The ring 39 is circumferentially adjusted and set to produce the minimum pitch of the propeller blades when driven at a selected R. P. M., at sea-level atmospheric pressure or at any other selected atmospheric pressure. When the propeller is stationary, the leaf-springs 42, acting through the lever arms 33 and associated elements, hold the propeller blades at the maximum pitch. When the engine is started, and the propeller rotated, turning counter-clockwise, as is customary, with airplane propellers, the resistance upon the surfaces of the propeller blades increases as the speed increases, until a selected maximum speed of rotation is obtained, such as 2,000 R. P. M. As the speed increases, the pressure acting upon the unbalanced surfaces of the blades gradually cause these blades to turn upon their longitudinal axes, and

when the maximum selected speed is reached, the blades have turned upon their longitudinal axes to reach positions whereby they will have the minimum or suitable pitch for the selected R. P. M., at the starting or selected altitude. When the airplane rises, the atmospheric pressure or the resistance of the air gradually decreases. In order that the propeller may have a constant pulling or driving force at the selected R. P. M. the springs overcome the unbalanced forces upon the blades, as the air pressure gradually decreases upon the rotating blades, due to the accent of the airplane, such springs then turning the blades upon their longitudinal axes in an opposite direction, for gradually increasing the pitch of the blades, so that the maximum or desired pitch is maintained for the elevation at which the airplane is flying. It is, thus, seen that means are provided whereby the blades are turned upon their longitudinal axes by the variance in the resistance of the air to the rotating propeller, to automatically regulate the pitch of the blades in proportion to the variation in atmospheric pressure.

When the propeller has been shown and described as intended to rotate counter-clockwise, it is obvious that, by a slight modification, it may be rotated clockwise, and the invention is, in no sense, restricted to constructing the propeller for rotation in either direction.

It is to be understood that the form of my invention herewith shown and described is to be taken as the preferred example of the same, but that various changes in the arrangement of parts, shape and size, may be resorted to without departing from the spirit of my invention, or the scope of the subjoined claims.

Having thus described my invention, what I claim is:

1. A propeller comprising a hub member, blades pivotally mounted upon the hub member and having axes upon which they turn with relation to the hub member, each blade having unbalanced areas upon opposite sides of its turning axis so that it is automatically turned upon such axis by fluid pressure acting upon such blade, a lever pivotally mounted exteriorly upon the hub member and connected with the blades so that they turn in unison, and resilient means to oppose the swinging movement of the lever upon its pivot in one direction.

2. A propeller comprising a hub member, blades pivotally mounted upon the hub member to turn upon generally radial axes with relation to the hub member, each blade having unbalanced areas upon opposite sides of its turning axis, a lever pivotally mounted upon the hub member and connected with the blades so that they turn in unison, and leaf-spring means having a fixed attachment to the hub member and extending longitudinally of the lever and serving to oppose the swinging movement of the lever upon its pivot in one direction.

3. A propeller comprising a hub member, blades pivotally mounted upon the hub member to turn upon generally radial axes with relation to the hub member, a lever pivotally mounted upon the hub member and connected with the blades so that they turn in unison, and leaf-spring means having a fixed attachment to the hub member and extending longitudinally of the lever and opposing the swinging movements of the ends of the lever in the same direction.

4. A propeller comprising a hub member, blades pivotally mounted upon the hub member to turn upon generally radial axes with relation to the hub member, each blade having unbalanced areas upon opposite sides of its turning axis, a lever pivotally mounted upon the hub member and connected with the blades so that they turn in unison, said lever having engaging parts, and leaf-spring means attached to the hub member and disposed to engage with the engaging parts of the lever, the arrangement being such that the leaf-spring means is capable of moving longitudinally with relation to the engaging parts when it varies its length due to changes in temperature.

5. A propeller comprising a hub member, blades pivotally mounted upon the hub member to turn upon their longitudinal axes with relation thereto, each blade having unbalanced areas upon opposite sides of its turning axis, a lever pivotally mounted upon the hub member and connected with the blades so that they turn in unison, said lever having engaging parts, leaf-spring means disposed to engage with said engaging parts, the arrangement being such that the leaf-spring means is capable of moving longitudinally with relation to the engaging parts when its length is varied due to changes in temperature, and adjustable means attaching the leaf-spring means to the hub and for regulating the tension of said leaf-spring means.

6. A propeller comprising a hub member, blades pivotally mounted upon the hub member in a manner to vary their pitch, a lever pivotally mounted upon the hub member and connected with the blades so that they turn in unison, a support member, means for pivotally mounting the support member upon the hub and for locking the same to the hub in a selected adjusted position, and leaf-springs mounted upon the support member and coacting with the lever to oppose its turning movement in one direction.

7. A propeller comprising a hub member, blades pivotally mounted upon the hub member in a manner to permit the same to turn for varying their pitch upon the change in air pressure, means connecting the blades so that

they turn in unison for varying their pitch, and means to oppose the pitch varying turning movement of one propeller including a spring and a coacting member with which the spring has slidable engagement, the arrangement being such that the action of the spring is not perceptibly changed due to a variance in its length caused by changes in temperature.

8. A propeller comprising a hub member, blades pivotally mounted upon the hub member to turn upon generally radial axes, each blade having unbalanced areas upon opposite sides of its turning axis, means connecting the blades so that they turn in unison upon their axes, and means to oppose the turning movement of one blade upon its turning axis including a leaf-spring and a coacting member with which the leaf-spring has slidable engagement, the arrangement being such that the action of the leaf-spring is not perceptibly altered due to the change in length of the leaf-spring caused by changes in temperature.

In testimony whereof I affix my signature.

WALTER W. EVERTS.