

April 13, 1943.

C. S. WILLIAMS

2,316,482

VARIABLE PITCH PROPELLER

Filed Aug. 23, 1941

2 Sheets-Sheet 1

Fig. 1.

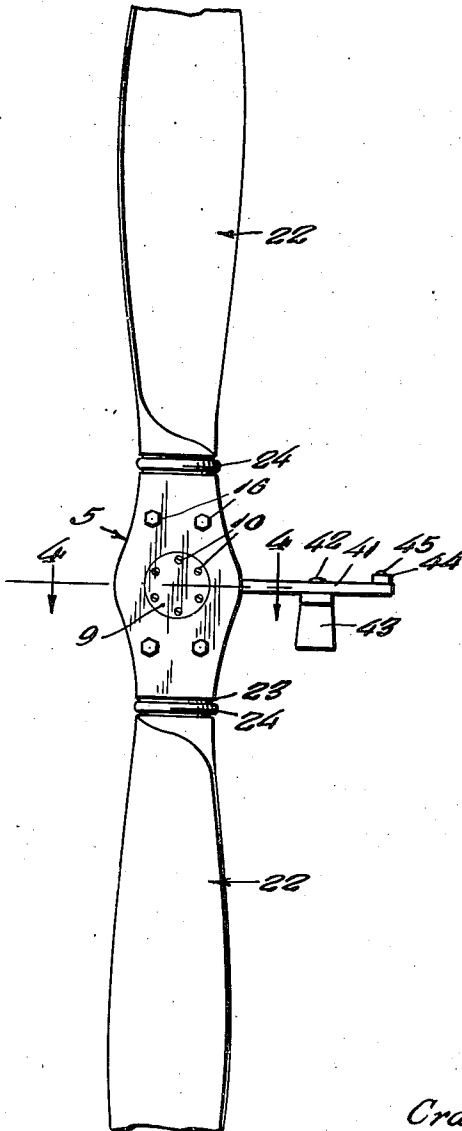


Fig. 2.

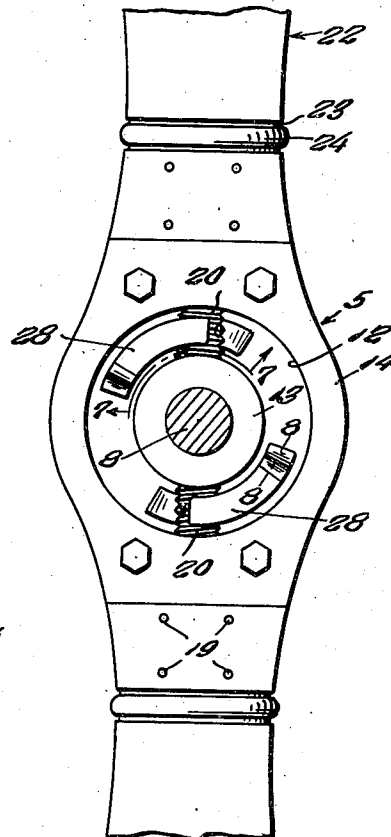
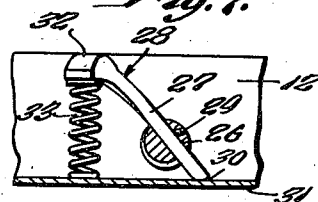


Fig. 7.



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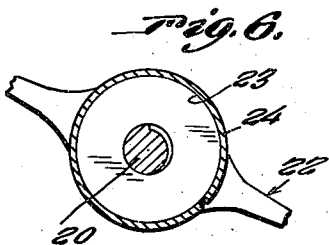
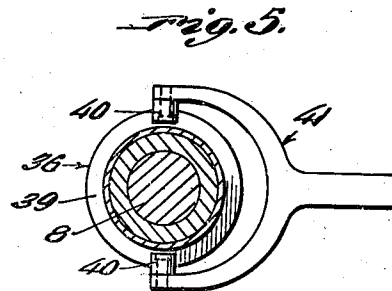
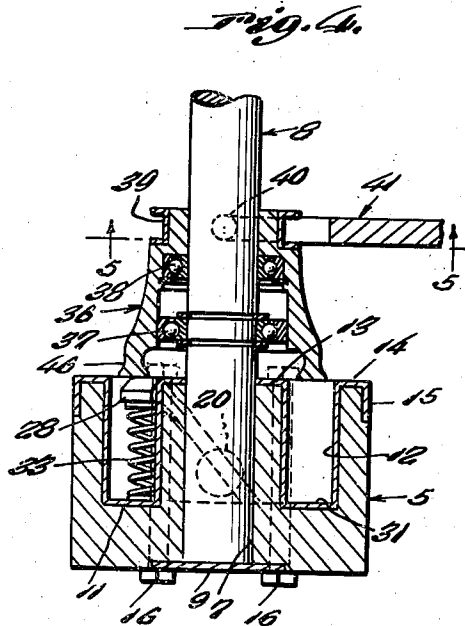
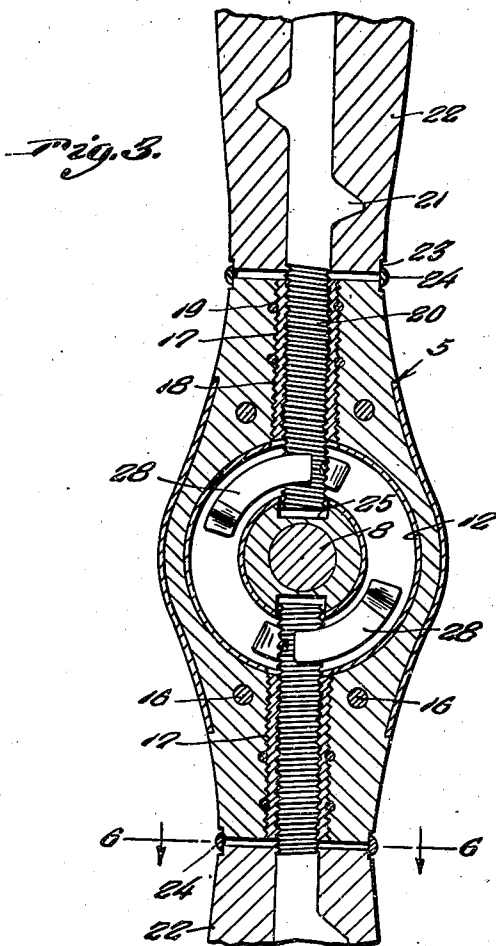
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VARIABLE PITCH PROPELLER

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2 Sheets-Sheet 2



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VARIABLE PITCH PROPELLER

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N. C.

Application August 23, 1941, Serial No. 408,088

7 Claims. (Cl. 170-163)

My invention relates to improvements in variable pitch propellers, especially as adapted to aircraft, and the primary object of my invention is to provide a simplified and more efficient arrangement of this character which is especially suited to the construction of propellers having non-metallic hubs and blades.

Other important objects and advantages of my invention will be apparent from a reading of the following description taken in connection with the appended drawings, wherein for purposes of illustration I have shown a preferred embodiment of my invention.

In the drawings:

Figure 1 is a general fragmentary front elevational view of the embodiment.

Figure 2 is an enlarged fragmentary rear elevational view with the propeller shaft in section.

Figure 3 is a vertical longitudinal sectional view taken through Figure 2.

Figure 4 is an enlarged fragmentary horizontal sectional view taken through Figure 1 along the line 4-4 and looking in the direction of the arrows.

Figure 5 is a fragmentary horizontal sectional view taken through Figure 4 along the line 5-5 and looking in the direction of the arrows.

Figure 6 is a horizontal sectional view taken through Figure 3 along the line 6-6 and looking in the direction of the arrows.

Figure 7 is a fragmentary sectional view taken along the line 7-7 of Figure 2 and looking in the direction of the arrows.

Figure 8 is a fragmentary sectional view taken through Figure 2 along the line 8-8.

Referring in detail to the drawings, the numeral 5 generally designates the hub of the present propeller, which may have a generally conventional shape and contour and be formed of a block of non-metallic material, such as wood or plastic, and having the transverse cross section illustrated in Figure 4 of the drawings.

The hub is characterized by an axial opening 7 receiving the propeller shaft 8, the front end of the opening 7 being closed by a plate 9 secured by screws 10, with the end of the propeller shaft abutting the plate 9 as indicated in Figure 4 of the drawings.

Concentrically surrounding the propeller shaft 8 is the deep and relatively wide annular chamber 11 which is lined and reinforced by a metal channel 12 which is coextensive with the walls and the bottom of the chamber 11 and has continuous inner and outer lateral flanges 13 and 14, respectively, the inner flange 13 overlying the

back surface of the propeller hub around the propeller shaft, while the outer flange 14 is coextensive with the area of the rear face of the hub which lies outwardly from the chamber 11.

The flange 14 has a laterally directed rim portion which engages in a conforming groove in the side of the hub as indicated in Figure 4 of the drawings. Pairs of bolts 16 are laterally spaced at opposite ends of the hub 5 and pass through the outer flange 14 and through the hub to secure the channel 12 assembled to the hub and to assist the channel 12 in providing the necessary reinforcement and increase in rigidity of the hub.

Axially aligned bores 17 extend through the tapered ends of the hub 5 as far as the chamber 11. In the case of a non-metallic material hub these bores are lined with threaded bushings 18 which are both exteriorly and interiorly threaded and are locked in place by sets of pins 19 passing through the hub as indicated in Figures 2 and 3.

Threaded into the bushings 18 are the propeller blade shafts 20, the outer end portions of which are provided with anchoring projections 21 which are embedded in the wooden or other non-metallic material blades 22. Both the inner ends of the propeller blades and the outer ends of the opposed portions of the hub are square cut and relatively closely spaced as indicated in Figure 3 of the drawings, and peripherally grooved as indicated by the numeral 23 to accommodate a broken spring ring 24 which has its outer surface curved, the purpose of the ring being to provide streamlining at this point and eliminate an annular air pocket which would otherwise exist.

The inner ends of the threaded shafts 20 of the propeller blades extend across the channel 12 through openings provided in the outer wall of the channel and in the inner wall of the channel as indicated in Figure 3 of the drawings, the terminals of the threaded portions 20 entering sockets 25 formed in the hub body and close to the propeller shaft. In one position of pitch of the blades 22 the terminal ends of the threaded portion 29 are slightly spaced from the ends of the sockets 25 as illustrated in Figure 3 of the drawings, whereas in another angle of the propeller blades the terminal ends abut the ends of the sockets and lock thereagainst, so that further feathering or changing of the pitch of the blades is positively prevented.

The inner end portions of the threaded propeller blade shafts 20 have formed therein eccentrically located diagonal slots 26 to receive the

plain rectangular cross section portion 27 of the corresponding cam levers 28 which are locked in place by means of set screws 29 or other suitable locking means, in the diagonal position illustrated in Figure 7 of the drawings. The lower end of the lever 28 is rounded as indicated by the numeral 30 for abutment with the floor 31 of the channel 12, while the longer upper end portion of the lever 28 is enlarged and provided on its top with a relatively large rounded cam surface 32. Under the resultant head is mounted a vertical helical expanding spring 33 which is anchored to the bottom 31 of the channel and has its upper end seated in a cup-shaped retainer 34 secured as indicated by the numeral 35 to the bottom of the upper end portion of the lever 28 as indicated in Figure 8 of the drawings. The springs 33 are of sufficient strength and rigidity to hold the cam levers 28 in the raised position with the rounded terminal 30 engaged with the floor 31 of the channel 12, and to return the levers, and hence the propeller blade shafts, to initial position after operation of the levers 28 by the exertion of pressure on the cam surfaces 32 thereof in a manner to be described. As seen in Figures 2 and 3 the levers 32 conform in curvature to the curvature of the channel 12 and are spaced at their inner and outer sides from the corresponding walls of the channel.

Means for operating the levers 28 comprises a tapered shell 36 which has longitudinally spaced internal bearings 37 and 38, respectively, mounting the same concentrically and rotatably on the propeller shaft 8 behind the hub 5, as illustrated in Figure 4 of the drawings. The bearing arrangement is such that the shell 36 can slide on the bearing 37 toward and away from the hub, while the bearing 38 is fixed to the shell 36 but slidable on the propeller shaft 8 toward and away from the hub. On the rear extremity of the shell 36 is a grooved portion 39 into the opposite sides of which project roller pins 40 on the yoke 41 which has a lever portion pivoted at 42 on a suitable bracket 43, the lever portion being operated by a drag link or connecting rod 44 pivoted at 45 to the free end of the lever portion of the yoke. The connecting rod 44 extends to the cockpit (not shown) of the aircraft, from which its operation is manually controlled for varying the pitch of the blades 22, through manipulating the shell 36 toward the hub 5 from the initial position illustrated in Figure 4 of the drawings, so as to engage the continuous annulus with the cam surfaces 32 of the levers 28, so as to depress the spring supported ends of the levers 28 and thereby rotate the propeller blade shafts 20 to the desired degree in accordance with the manipulation of the shifting yoke 41 under the control of the pilot. As is to be inferred, the propeller shaft 8 is suitably pinned or keyed in the hub 5. It is also to be observed that the shell 36 is comparatively free to turn on the shaft 8 except when strongly frictionally engaged with the cam levers in which condition the shell 36 rotates with the propeller shaft 8 and the hub.

Although I have shown and described herein a preferred embodiment of my invention, it is to be definitely understood that I do not wish to limit the application of the invention thereto, except as may be required by the scope of the subjoined claims.

Having described the invention, what is claimed as new is:

1. A variable pitch propeller comprising a propeller shaft, a hub fixed thereon one side of said

hub being formed with an annular groove, radial blade shafts having portions journaled in said hub and extending into said groove, cam levers on the said portions within said groove, spring means holding said cam levers and their blade shafts in initial position and arranged to return the cam levers and blade shafts to initial position after operation, a shell rotatably and slidably mounted on said propeller shaft, said shell having a substantially continuous annular surface engageable with said cam levers to tilt said levers and thereby vary the pitch of said blade shafts, and means for operating said shell in directions toward and away from said cam levers.

2. A variable pitch propeller comprising a propeller shaft, a non-metallic hub fixed on said propeller shaft, one side of said hub being formed with an annular groove, an annular metal channel seated in and lining said groove to reinforce the hub, said channel having stiffening flanges secured on the said side of the hub, radial blade shafts journaled through radial openings formed through said hub and the walls of said channel, cam levers secured to the blade shafts within said channel, spring means holding said cam levers and the blade shafts in initial position and active to return said cam levers and blade shafts toward initial position after operation, and means arranged to push against portions of said cam levers to tilt them and correspondingly rotate the blade shafts out of initial position.

3. A variable pitch propeller according to claim 2 wherein said radial openings in the hub are lined with metal bushings in which the blade shafts turn.

4. A variable pitch propeller according to claim 2 wherein said radial openings in the hub are lined with metal bushings in which the blade shafts turn, said bushings and said blade shafts being threadedly engaged.

5. A variable pitch propeller comprising a propeller shaft, a non-metallic hub fixed on said propeller shaft, one side of said hub being formed with an annular groove, an annular metal channel seated in and lining said groove to reinforce the hub, said channel having stiffening flanges secured on the said side of the hub, radial blade shafts journaled through radial openings formed through said hub and the walls of said channel, cam levers secured to the blade shafts within said channel, spring means holding said cam levers and the blade shafts in initial position and active to return said cam levers and blade shafts toward initial position after operation, and means arranged to push against portions of said cam levers to tilt them and correspondingly rotate the blade shafts out of initial position, said cam levers having on one end a terminal portion movably bearing upon the bottom of said channel and a cam head on the opposite end located in the mouth of the channel.

6. A variable pitch propeller comprising a propeller shaft, a non-metallic hub fixed on said propeller shaft, one side of said hub being formed with an annular groove, an annular metal channel seated in and lining said groove to reinforce the hub, said channel, having stiffening flanges secured on the said side of the hub, radial blade shafts journaled through radial openings formed through said hub and the walls of said channel, cam levers secured to the blade shafts within said channel, spring means holding said cam levers and the blade shafts in initial position and active to return said cam levers and

blade shafts toward initial position after operation, and means arranged to push against portions of said cam levers to tilt them and correspondingly rotate the blade shafts out of initial position, said cam levers having on one end a terminal portion movably bearing upon the bottom of said channel and a cam head on the opposite end located in the mouth of the channel, said cam levers curving in conformance with the curvature of said channel.

7. A variable pitch propeller comprising a propeller shaft, a non-metallic hub fixed on said propeller shaft, one side of said hub being formed with an annular groove, an annular metal channel seated in and lining said groove to reinforce the hub, said channel having stiffening flanges secured on the said side of the hub, radial blade shafts journaled through radial openings formed

through said hub and the walls of said channel, cam levers secured to the blade shafts within said channel, spring means holding said cam levers and the blade shafts in initial position and active to return said cam levers and blade shafts toward initial position after operation, and means arranged to push against portions of said cam levers to tilt them and correspondingly rotate the blade shafts out of initial position, said cam levers having on one end a terminal portion movably bearing upon the bottom of said channel and a cam head on the opposite end located in the mouth of the channel, said cam levers curving in conformance with the curvature of said channel, and having their sides spaced from the side walls of the channel.

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