Nov. 2, 1937. L. KAISER 2,098,100

PROPELLER

Filed Nov. 13, 1933 2 Sheets-Sheet 1

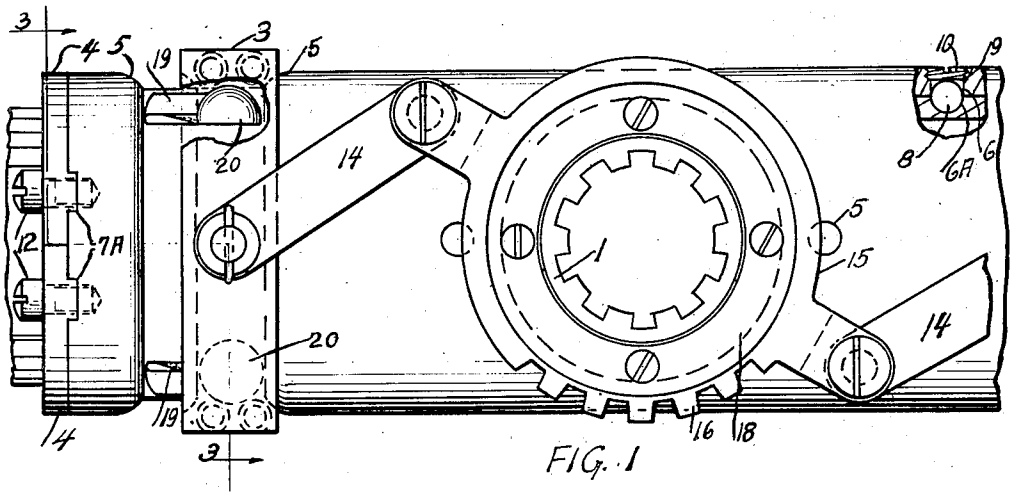


FIG. 1

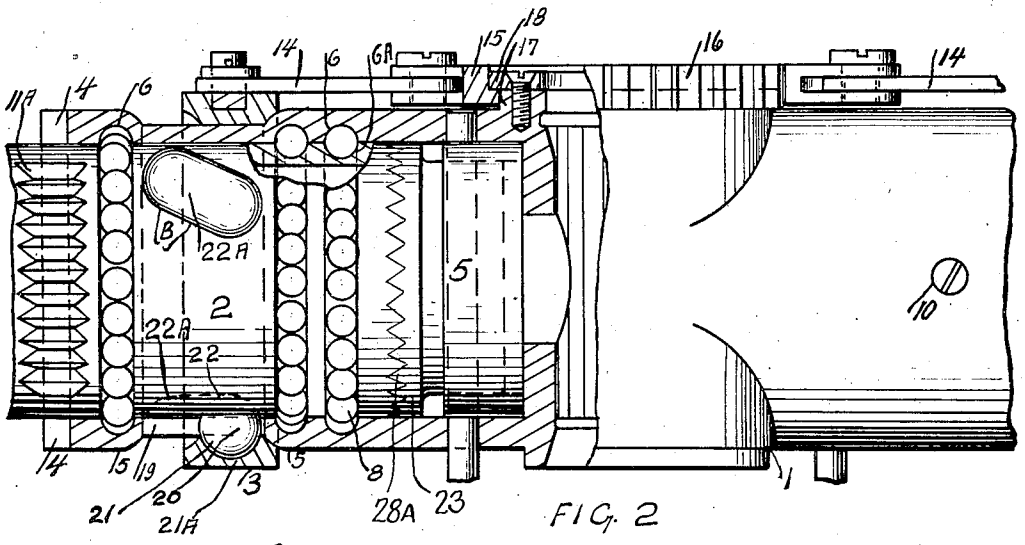


FIG. 2

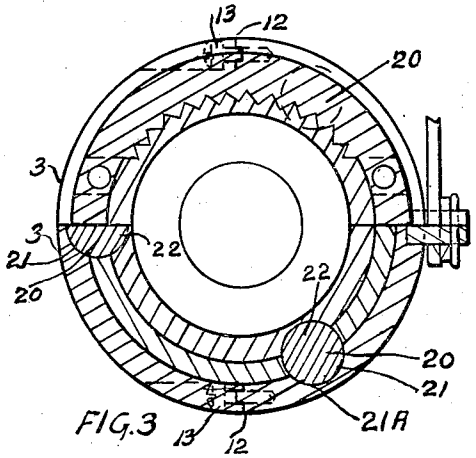


FIG. 3

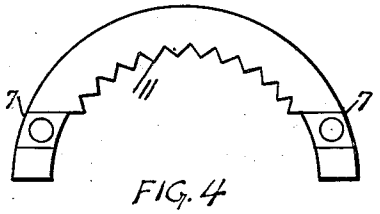


FIG. 4

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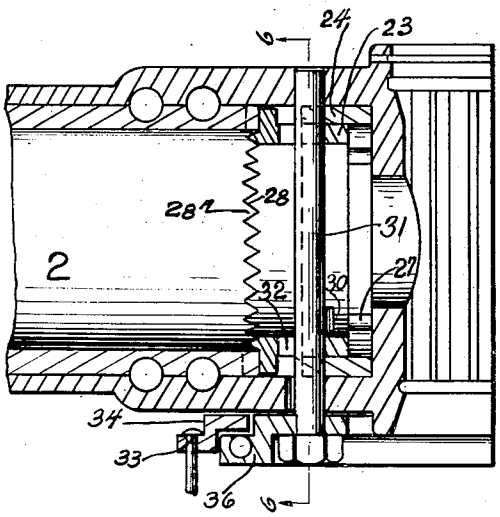


FIG. 5.

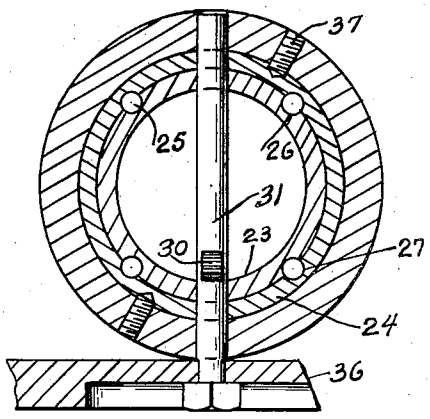


FIG. 6.

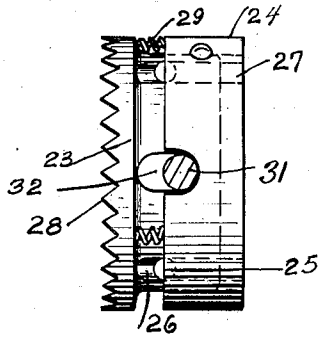


FIG. 8.

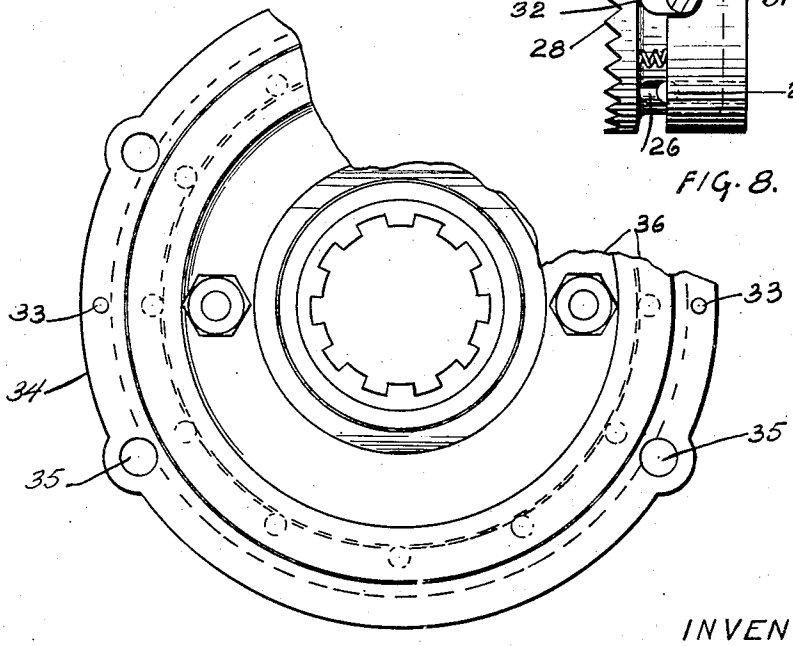


FIG. 7.

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Patented Nov. 2, 1937 2,098,100

UNITED STATES PATENT OFFICE

2,098,100

PROPELLER

Lawrence Kaiser, Milwaukee, Wis.

Application November 13, 1933, Serial No. 698,026

2 Claims. (Cl. 170—162)

This invention relates to variable pitch propellers primarily for air-craft use.

An object of the present invention is to provide simple and improved mounting means for the propeller blades which will adequately sustain the centrifugal forces as well as the air loads imposed thereon, which will permit free pitch-varying adjustment of the blades, and which will permit prompt and independent removal of individual blades for replacement or repair.

Another object is to provide simple and improved means for regulating and controlling the pitch of the blades.

Another object is to provide simple and effective means for securely locking the blades in any desired position of pitch-varying adjustment.

Other more specific objects and advantages will appear, expressed or implied, from the following description of an illustrative embodiment of the present invention.

The present application is a continuation in part of my abandoned application S. N. 641,858 filed Nov. 9, 1932.

In the accompanying drawings:—

Figure 1 is a fragmentary front elevation of a propeller hub equipped with blade mounting and control means constructed in accordance with the present invention.

Fig. 2 is a top elevation, partly in longitudinal section, of the device shown in Fig. 1.

Fig. 3 is a transverse sectional view taken substantially along the line 3—3 of Fig. 1.

Fig. 4 is a side elevation of one of the blade locking elements shown.

Fig. 5 is a sectional view illustrating particularly the blade locking clutch shown in elevation in Fig. 2.

Fig. 6 is a sectional view taken substantially along the line 6—6 of Fig. 5.

Fig. 7 is a view in elevation of the clutch control mechanism partly shown in section in Fig. 5.

Fig. 8 is a view in elevation of the clutch.

The propeller selected for illustration comprises a one-piece hub 1, internally splined for mounting upon a propeller shaft in the usual manner, and having a plurality of hollow sleeve-like members radiating therefrom for receiving and supporting the shanks 2 of the individual propeller blades.

The interior of each sleeve-like member is provided with a plurality of annular grooves 6, spaced longitudinally therein and mating, respectively, with similarly formed annular grooves 6A provided in the propeller shank 2, so as to form continuous raceways for sets of balls 8 confined therein. The balls 8 coact with the grooves to securely hold each blade against longitudinal displacement and to adequately support the same against the air loads imposed thereon. The balls however permit each propeller blade to turn freely about its longitudinal axis in a manner to vary the pitch of the blade.

The balls 8 are admitted to the grooves through external ports, one of which is shown at 9 in Fig. 1 communicating with a groove 6, the ports being normally closed by plugs 10 screwed or otherwise removably fixed therein. Whenever it is desired to remove one of the propeller blades, it is a simple matter to release the same by removing the plugs 10 and permitting the balls 8 to discharge by gravity through the ports 9.

In the propeller shown, the pitch of each blade is regulated and controlled primarily by a ring 3 surrounding a reduced portion of the blade holder and axially movable thereon toward and from the central hub 1. Annular shoulders 5 at the ends of the reduced portion limit the movement of each ring. A plurality of balls 20, seated in sockets 21 formed internally of each ring, project through longitudinal guide slots 19 in the blade supporting member, and engage inclined cam grooves 22 in the blade shank 2, so that the shank 2 rotates in its support in response to axial movement of the ring 3.

To facilitate assembly, the ring 3 is divided, as at 12, to form two half sections, releasably but securely fixed together by appropriate means, such as screws 13.

The arrangement is such that, during rotation of the propeller, the control ring 3 of each blade is urged outwardly by centrifugal force, and the balls 20, reacting to this outward thrust and coacting with the cam grooves 22, urge each blade to rotate in such direction as to vary the pitch thereof. The blades are so formed that the air load thereon urges them to rotate in the opposite direction, with the result that the pitch varies in accordance with changes in the rotative speed of the propeller.

In order to synchronize and coordinate the pitch of the blades, suitable mechanical connections are preferably provided between the individual control rings 3. In this instance a link 14, connected with each ring 3, is also connected with a center ring 15, freely rotatable upon the front end 18 of the propeller hub 1. The ring 15 is retained on the hub by suitable means, such as a ring 18 releasably secured to the end of the hub. The ring 15 is shown provided with gear

teeth 16 through which it may be actuated or controlled, if desired.

Under some conditions of operation it may be desired to securely lock the blades in any position of adjustment, and for this purpose I have shown a two-part locking ring 4 for each blade, having internal teeth 11 for interlocking engagement with grooves 11A formed in the shank 2 of each blade. Each ring 4 is secured to the end of the blade support preferably by screws 12 and locked thereto by lugs 7 which engage within notches 7A formed in the blade support.

An alternative form of blade locking means is shown in Figs. 2 and 5 to 8. It comprises a clutch ring 23 having clutch teeth 28 for interlocking engagement with mating teeth 28A formed in the inner end of a blade shank 2. The ring 23 is mounted for axial adjustment within a ring 24 anchored by pins 37 within the blade support. Balls 25 engaged in mating grooves 26 in the rings 23 and 24 securely hold the clutch ring 23 against rotation. The clutch ring 23 is yieldably retained in advanced position with its teeth 28 engaged with the blade teeth 28A by appropriate means such as springs 29.

Each clutch ring 23 is operated and controlled by a rod 31 which extends through slots 32, formed in the clutch, and into a control collar 36 at the rear end of the propeller hub. The collar 36 rotates with, but is axially movable with respect to the hub 1. A non-rotating control ring 34, loosely engaged behind the collar 36 is provided with control rods 33 by which the ring 34 and collar 36 may be actuated to shift the rod 31 lengthwise. The rod 31 is provided with a cam lug 30 which, when the rod 31 is thus shifted, reacts against the rear end of slot 32 in a direction to withdraw the clutch teeth 28 from teeth 28A and thus render each propeller blade free to rotate and thus change its pitch.

The rods 33, ring 34, and collar 36 connected in the manner described makes possible a distant control of the clutch 23 while the propeller is in motion.

Various changes may be made in the embodiment of the invention hereinabove specifically described without departing from or sacrificing the advantages of the invention as defined in the appended claims.

I claim:—

1. In a propeller the combination of a hub, hollow members projecting therefrom, a propeller blade rotatably mounted in each of said members, a ring encircling each of said members and movable axially thereof, a slot in each of said members, a non-parallel groove in each of said blades, and a ball engaged in said slot and groove and movable with said ring to rotate the associated blade.

2. In a propeller the combination of a hub, hollow members projecting therefrom, a propeller blade having a supporting shank rotatably mounted in each of said members, a clutch within each of said members, said clutch including a toothed element normally engaged with the associated shank to lock the same against rotation and movable axially thereof to release the latter, and control means extending from said propeller for operating said clutch elements to thereby release the shank.

LAWRENCE KAISER.