Feb. 25, 1947. P. M. OLMAN 2,416,541

VARIABLE PITCH PROPELLER

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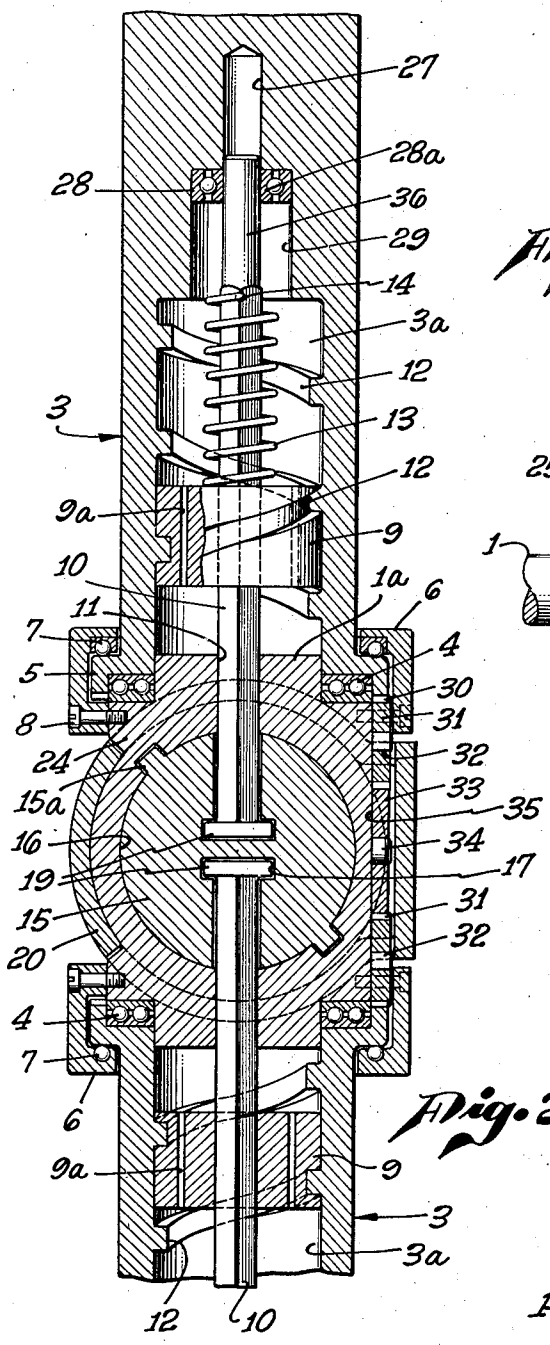


Fig. 2.

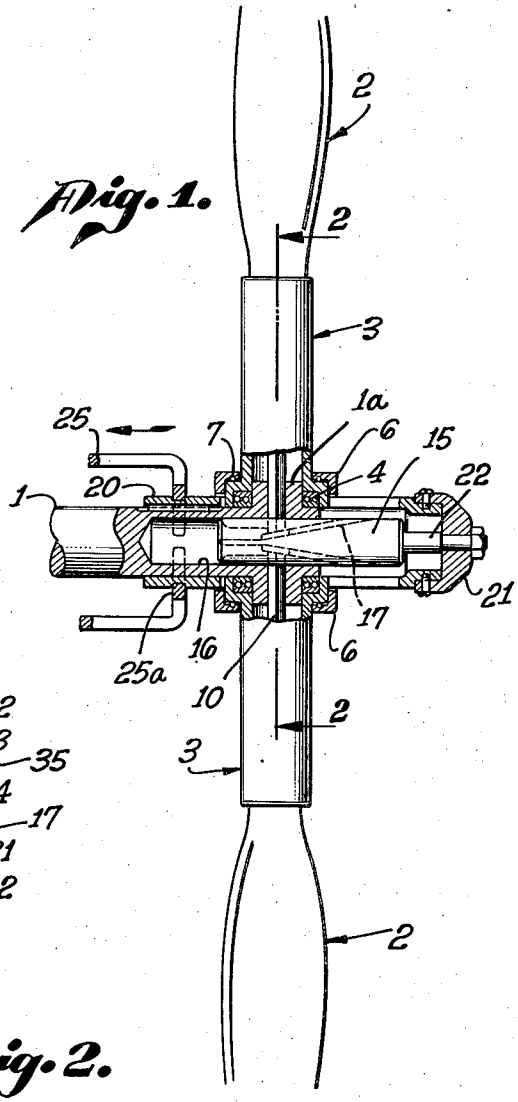


Fig. 1.

PETER MICHAEL OLMAN,
INVENTOR.

BY Robert W. Fulwider
ATTORNEY.

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Fig. 4.

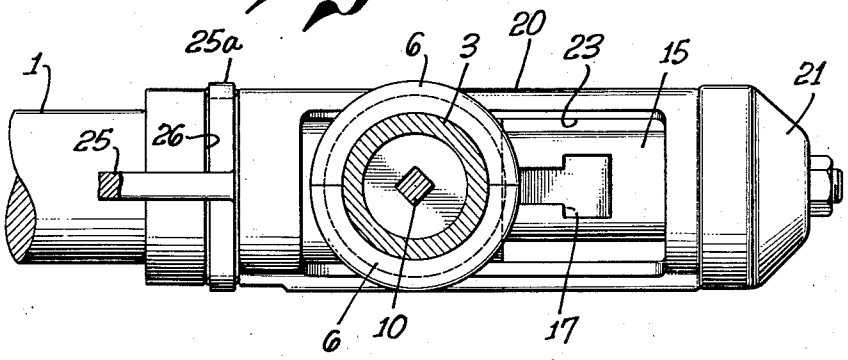
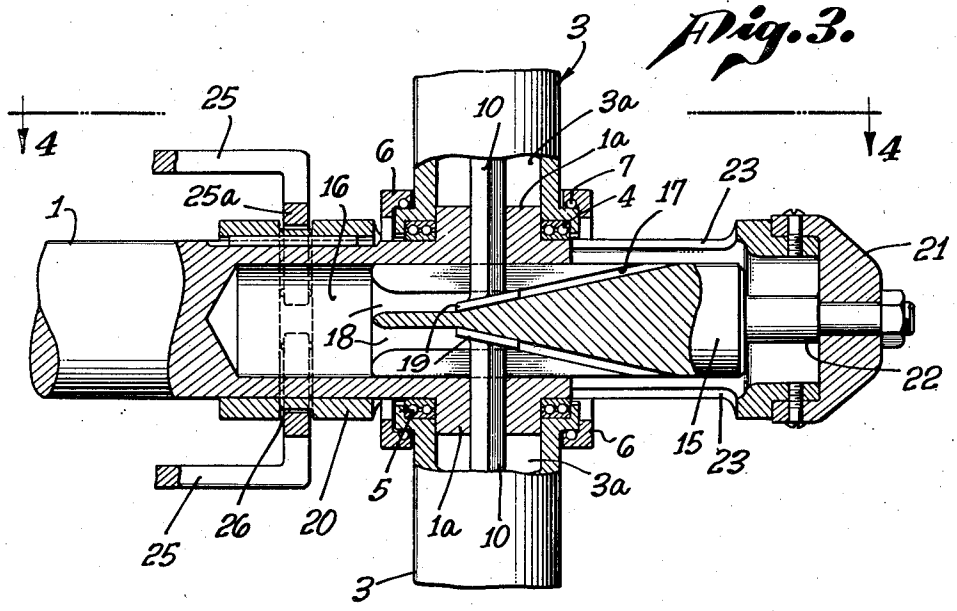


Fig. 3.



PETER MICHAEL OLMAN,
INVENTOR.

BY Robert W. Fulwider
ATTORNEY.

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VARIABLE PITCH PROPELLER

Peter Michael Olman, Los Angeles, Calif.

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12 Claims. (Cl. 170—162)

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This invention relates to propellers and is particularly adapted for use in the construction of propellers for aircraft, although features of the invention may be employed in the construction of propellers for other uses.

A motor driving a propeller should preferably rotate uniformly at the speed for which it is designed, as ordinarily that is the speed at which the motor operates most economically and gives the most efficient performance. The energy absorbed by a rotating propeller having radial blades, depends largely upon the pitch of the blades, and of course, the power required by the propeller to drive it at a given speed increases proportionally with increase of pitch of the blades.

An object of this invention is to provide a propeller having features of construction that will enable the blades to adjust their pitch automatically to the speed of rotation, so that if the motor tends to rotate at an abnormally high rate of speed the pitch of the blades will automatically be increased, and vice versa.

Another object of the invention is to provide a construction for the propeller that will enable the pitch of the blades to adapt itself automatically to the density of the air at the flying level of the aircraft, so that although the air at a higher elevation is more rarefied, the pitch of the propeller blades will automatically be increased to meet this condition. This of course operates to keep the motor turning at a uniform speed.

A further object of the invention is to provide a construction in which centrifugal weights are housed in the shanks of the propeller blades, for automatically varying the pitch of the blades, in order to accomplish the general purposes of the invention.

It is also an object of my invention to provide an organization of parts that is capable of being set to adapt the propeller for running at different selected speeds.

Additional objects of the invention will appear from the following specification and the accompanying drawing, in which:

Fig. 1 is a plan view illustrating my invention as applied to a two-bladed propeller; in this view the outer ends of the blades are broken away, and the propeller shank and propeller hub are also broken away and shown in section.

Fig. 2 is an enlarged vertical section taken in the plane of the line 2—2 in Fig. 1.

Fig. 3 is a view similar to Fig. 1, but showing only the inner ends of the blade shanks; this

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view is also upon a larger scale and shows in section and more in detail the parts that enable the propeller to be set to run at certain predetermined speeds.

Fig. 4 is a section taken in the plane of the line 4—4 in Fig. 3 further illustrating the preferred construction for the controlling parts associated with the propeller hub.

In practicing the invention, I provide a propeller shaft 1, at or near the end of which I mount the blades 2. In the present instance, there are two radially-extending blades located diametrically opposite to each other, but of course three or more blades may be employed if desired. Each blade is formed with a tubular shank 3 that carries the blade body, and each blade body is formed with pitch in the usual manner. The inner ends of the shanks 3 are mounted for rotation on their longitudinal axes, which are preferably located perpendicular to the axis of the propeller shaft.

The base of each tubular shank is swiveled on a neck of a stub-pintle 1—*a* that projects laterally from the propeller shaft 1 around which is located an inner bearing 4, preferably formed as an anti-friction bearing such as a roller bearing, or a duplex ball bearing such as illustrated. Each shank is formed at its inner end with an annular shoulder 5 over which is secured a retainer, preferably consisting of a collar 6 with a roller bearing 7 or a plurality of such bearings to take the outward thrust of the blades. These retainer collars 6 may, if desired, be threaded onto circular bosses located at the propeller hub in accordance with common practice, or they may be secured at their inboard edges to the hub by means of a plurality of bolts or machine screws such as the screws 8 illustrated in Fig. 2.

Each propeller shank 3 houses a centrifugal governor means that preferably includes a centrifugal weight or block 9, that resembles a piston head in form, and which is capable of moving in or out in the chamber 3*a* of shank 3 depending upon the action of centrifugal force. The heads 9 are prevented from rotation about their own axes during their axial movement in the shank chamber 3*a*, and to this end, I prefer to provide an arbor 10, coaxial with each shank, that extends out through a central guide opening 11 in the head 9. These arbors are constructed so that the heads 9 are nonrotatable thereon, and for this purpose a feathered or splined connection may be employed, or the arbors may be of angular form in cross-section, for example,

octagonal, hexagonal or of square form as shown in the drawing for the purpose of illustration.

The outer surface of each centrifugal head has a substantially helical screw thread connection 12 with the inner wall of the shank 3, and by reason of this connection, the outward or inward movement of each head 9 will cause an adjusting rotation of the shank 3 which will vary the pitch of its propeller blade.

As the weights 9 travel outwardly, they meet with increasing but yielding resistance, preferably occasioned by coil springs 13 coaxial on the arbors 10, with the inner end of each spring thrusting against the head 9. In the present instance, the outer end of each spring is attached to the outer portion of each arbor, preferably by forming a radical spur on its outer end that is received in a drill hole or socket 14 in the arbor. The strength and position of the springs 13 are correlated with the heads 9 so that the blades will assume the proper pitch for normal engine speeds. If the motor tends to rotate at a higher speed than normal, the increased centrifugal force available will force the heads 9 outwardly, against the action of the springs 13, beyond their normal position. This outward movement of heads 9 will rotate the shanks 3, thereby increasing the propeller bite. This in turn will slow down the engine to its normal speed. Even slight variations in motor speed will start this cycle of operations, thus giving continuous instantaneous adjustment. The springs are also proportioned so that when the motor stops, the heads 9 will be forced inwardly to their extreme base position, in which position the blades will be completely feathered.

The inner ends of the arbors 10 are preferably mounted so that they can be adjusted in or out to different extents to change the amount of normal compression in the springs 13, thereby enabling the springs to be "set" to adapt them for different engine speeds. Counterbores 29 are provided to accommodate the outer ends of the springs when the arbors are moved outwardly. This adapts the propeller for use with different makes or types of engines, and also affords an adjustment for adapting the propeller for normal flying at any desired elevation. The adjustment is preferably accomplished by means of a cam 15 keyed as at 15a against rotation, and mounted to slide in the chamber 16 that is formed at the forward end of the shaft 1. This cam may have the general form of a plug or long piston (see Fig. 3) and is preferably provided with undercut cam slots 17. Each of these slots has a gateway or mouth 18 which is wide enough in a radial direction to permit inclined T heads 19 carried by the arbors to slip into them when the cam is slipped into the forward end of the chamber 16 when assembling these parts. The cam slots preferably diverge or incline outwardly toward the periphery of the cam.

The cam 15 can be shifted at will to any desired position by shifting the sleeve 20 forward or back in the shaft 1, because the forward head 21 of the sleeve 20 is secured to the cam, by means of a shouldered pintle 22 and its nut.

The sleeve 20 has diametrical oppositely located clearance slots 23 through which the stub-pintles 1—a and their enlarged bosses 24 (see Fig. 2) project. The sleeve is slid into place over the front end of the shaft and its position is controlled by two opposed links or draw bars 25, the ends of which terminate respectively in arcuate yokes 25a that lie in a circumferential groove 26 in the sleeve. The rear ends of these draw bars extend into the interior of the aircraft's body (not illustrated) where they are connected up to means for exerting force upon them to shift them at will.

If desired, in order to guide and steady the outer ends of the arbors 10, they are formed respectively with round tail ends or necks 36 (see Fig. 2) that can slide and rotate in a corresponding guide bore 27 in the outer portion of the shank 3, and if desired, a ball bearing 28 may be provided in the counterbore 29 shown at this point. Of course, the neck 26 slides freely through the inner ring 28a of the bearing 28.

The centrifugal heads 9 are preferably provided with vents 9a which give communication for free flow of fluid between the ends of each chamber 3a in which these heads shift in or out.

When greater motor speeds than normal are desired as when the plane is taking off, the cam 15 is pulled back, thus moving the arbors 10 and their springs 13 outwardly to thereby permit the heads 9 to move farther out for a given motor speed.

In order to insure that the blades will be always in the same phase of pitch the inner ends of the shanks 3 may be formed with gear teeth 30 that mesh with idler pinions 31 rotatably mounted on studs 32, and meshing on their inner edges with a large gear 33 between them, mounted on a center stud 34. These studs may all be mounted on a flat seat or face 35 on the side of the shaft 1.

If desired, the cam 15 may be set with respect to the pitch phase of the blades, so that movement of the cam beyond a certain point will reverse the pitch of each blade to give a braking effect tending to reduce the speed of the aircraft very promptly.

The embodiment of the invention described above is of course only one of the many forms this invention may take, and it is to be understood that I do not mean to be restricted to the details shown, but intend that my invention shall be accorded the full scope of the appended claims.

I claim:

1. A propeller having automatic pitch control including: a rotatable propeller hub; blades with shanks mounted for rotation on their own axes and extending in a radial direction from the hub; centrifugally controlled means including a weight guided to travel in and out along a radial line from the axis of the hub; an arbor corresponding to each blade extending outwardly from the propeller hub on the axis of the shank, passing through the weight for that blade; each arbor and its corresponding weight having correlated form enabling the arbor to prevent rotation of the weights on the axis of each shank; each weight and each blade having a thread connection between the same operating to effect an adjusting rotation of each blade on the axis of its shank to alter its pitch; means for yieldingly resisting the outward movement of the weights under the action of the centrifugal force; and means for drawing said arbors inward to increase the resistance of said yieldingly resistant means.

2. A propeller including a propeller shaft; a plurality of blades, each having a shank mounted on the propeller shaft for rotation on the axis of the shank; a centrifugally controlled weight in each shank operating to move out under the action of the centrifugal force; means actuated by the in and out movement of the weight to effect a rotational adjustment of the shank to alter the

pitch of each blade; resistance means for yieldingly resisting the outward movement of each weight; and means including a cam mounted in the propeller shaft for adjusting the resisting force of said resistance means.

3. A propeller including a propeller shaft; a plurality of blades, each having a shank mounted on the propeller shaft for rotation on the axis of the shank; a centrifugally controlled weight in each shank operating to move out under the action of the centrifugal force; means actuated by the in and out movement of the weight to effect a rotational adjustment of the shank to alter the pitch of each blade; an arbor in each shank extending outward past the weight; a coil spring thrusting against each weight and connected to the arbor; and a cam guided to move longitudinally of the propeller shaft and connected with the inner ends of the arbors for adjusting the same in or out in the shanks to alter the resisting force of the springs and thereby adapt the same for different speeds of rotation of the propeller shaft.

4. A propeller according to claim 3 in which the cam is formed with cam slots operatively connected with the inner ends of the arbors for adjusting the same in or out.

5. A propeller according to claim 3 in which the cam is formed with cam slots operatively connected to the inner ends of the arbors for adjusting the same in and out; and including a sleeve guided to shift longitudinally on the propeller shaft and connected to the cam for actuating the same.

6. A propeller according to claim 3 in which a sleeve is mounted to slide longitudinally on the shaft, attached at its outer end to the cam, and having longitudinal slots corresponding to the several blades, the inner ends of the shanks being attached to the shaft through said longitudinal slots.

7. A propeller having automatic pitch control including: a rotatable propeller hub; blades with shanks mounted for rotation on their own axes and extending in a radial direction from the hub; centrifugally controlled means including a weight guided to travel in and out along a radial line from the axis of the hub; an arbor corresponding to each blade extending outwardly from the propeller hub on the axis of the shank, passing through the weight for that blade; each arbor and its corresponding weight having correlated form enabling the arbor to prevent rotation of the weights on the axes of the shanks; each weight and each blade having a thread connection between the same operating to effect an adjusting rotation of each blade on the axis of its shank to alter its pitch; a coil spring associated with each arbor and having its outer end connected to its corresponding arbor and its inner end pressing against the outer side of its corresponding weight to thereby yieldingly resist the outward travel of the weight; and means mounted in the hub for drawing the arbors inward to increase the resistance of said springs to the outward travel of the governor weights, thereby adapting the blades for a relatively high speed of rotation of the propeller shaft.

8. A propeller including a propeller shaft; a plurality of blades, each having a shank mounted on the propeller shaft for rotation on the axis of the shank; a centrifugally controlled weight in each shank operating to move out under the action of the centrifugal force; means actuated by the in and out movement of the weight to

effect a rotational adjustment of the shank to alter the pitch of each blade; means for resisting the outward movement of each weight; means including a cam mounted in the propeller shaft for adjusting said resisting force; a sleeve mounted to slide longitudinally on said shaft and attached to said cam to move the same; and means for sliding said sleeve to operate said cam.

9. A propeller including a propeller shaft; a plurality of blades, each having a shank mounted on the propeller shaft for rotation on the axis of the shank; a centrifugally controlled weight in each shank operating to move out under the action of the centrifugal force; means actuated by the in and out movement of the weight to effect a rotational adjustment of the shank to alter the pitch of each blade; an arbor in each shank extending outward past the weight; means associated with the arbors for yieldingly resisting the outward movement of each weight; and a cam guided to move longitudinally of the propeller shaft and connected with the inner ends of the arbors for adjusting the same in or out in the shanks to alter the resisting force of said yielding means and thereby adapt the same for different speeds of rotation of the propeller shaft.

10. A propeller according to claim 9 in which the cam is formed with cam slots operatively connected with the inner ends of the arbors for adjusting the same in or out.

11. A propeller according to claim 9 in which the cam is formed with cam slots operatively connected to the inner ends of the arbors for adjusting the same in and out; and including a sleeve guided to shift longitudinally on the propeller shaft and connected to the cam for actuating the same.

12. A propeller according to claim 9 in which a sleeve is mounted to slide longitudinally on the shaft, attached at its outer end to the cam, and having longitudinal slots corresponding to the several blades, the inner ends of the shanks being attached to the shaft through said longitudinal slots.

PETER MICHAEL OLMAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,449,685	Luther et al.	Mar. 27, 1923
2,237,030	Gathmann	Apr. 1, 1941
2,275,361	Godfrey	Mar. 3, 1942
1,648,837	Anderson	Nov. 8, 1927
1,979,616	Haidle	Nov. 6, 1934
2,307,102	Blanchard	Jan. 5, 1943
1,328,241	Weaver	Jan. 13, 1920
2,054,947	Riddle	Sept. 22, 1936
2,125,222	Evans	July 26, 1938
1,833,403	Newton	Nov. 24, 1931
1,837,568	Moody	Dec. 22, 1931
2,177,535	Platt	Oct. 24, 1939
2,284,521	Insua	May 26, 1942
1,405,643	Weaver	Feb. 7, 1922
2,013,647	Bace	Sept. 10, 1935
2,257,126	Rindfleisch	Sept. 30, 1941

FOREIGN PATENTS

Number	Country	Date
629,361	German	Apr. 29, 1936
630,650	France	Dec. 6, 1927
215,941	British	May 22, 1924
14,635	British	1910