July 28, 1931. H. H. HARDIN 1,816,730

AIRPLANE PROPELLER

Filed June 10, 1930

Fig. 1.

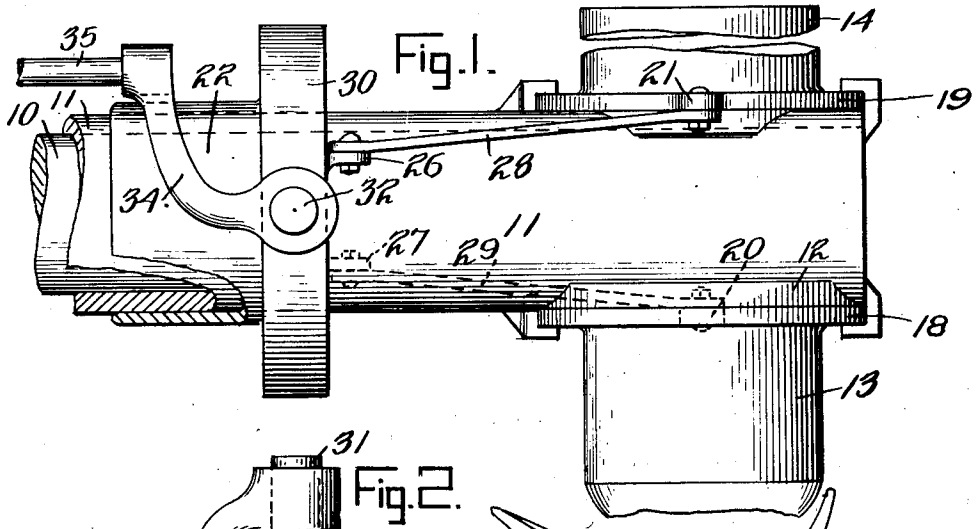


Fig. 2.

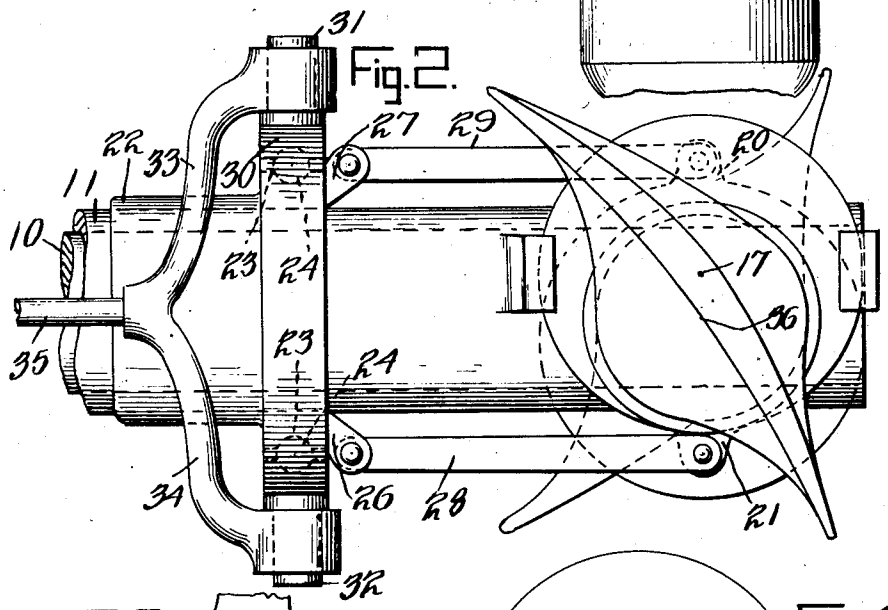


Fig. 3.

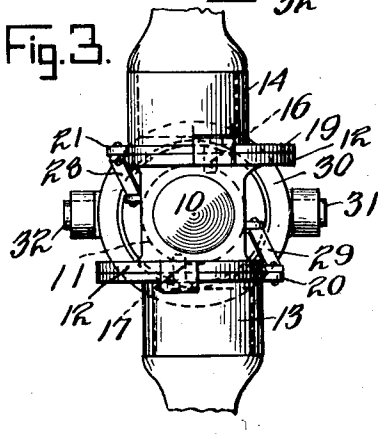
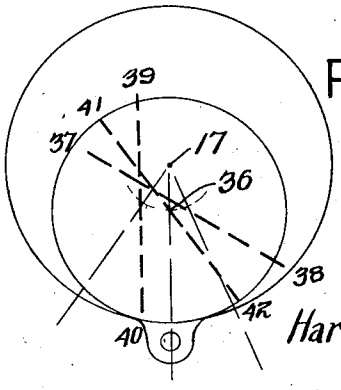


Fig. 4.



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1,816,730

UNITED STATES PATENT OFFICE

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AIRPLANE PROPELLER

Application filed June 10, 1930. Serial No. 460,251.

This invention relates to reversible propellers and an object of the invention is to provide a propeller blade in which the pitch of the blades may be changed easily and quickly by the operator.

A further object is to provide an adjustable propeller without complicated gearing, racks or pinions.

A further general object therefore is to provide a new and improved propeller which may be simply, yet reliably adjusted.

Other objects and advantages will become apparent as the description proceeds.

Referring to the accompanying drawings, which are made a part hereof and on which similar reference characters indicate similar parts,

Figure 1 is a side view partly in section of the device of my invention,

Figure 2 a plan view of the same,

Figure 3 an end view of the propeller as shown in Figure 2, looking from the right and being on a reduced scale, and

Figure 4 a diagrammatic illustration of the several positions taken by the propeller during adjustment.

In the drawings numeral 10 indicates the drive shaft from the engine upon which shaft the propeller is mounted. This propeller consists of a sleeve 11 which is mounted on the drive shaft 10 and keyed thereto to rotate with the shaft. The forward end of the sleeve 11 is provided with a pair of integral flanges 12. Propeller blades 13 and 14 are secured upon the flanges 12 by means of lugs 43 and pins or bolts 15 and 16 about which latter they are adjustable on the flanges. Means for causing this adjustment is as follows:

The blades preferably have at their inner ends flanged hubs 18 and 19, these hubs each being provided with lugs 20 and 21. Neatly fitting but axially sliding upon the sleeve 11 is a collar 22. This collar has an annular groove 23 which forms the inside race for bearings 24. At the forward side of the collar are lugs 26 and 27. Links 28 and 29 connect the lugs 26 and 27 with the lugs 21 and 20 respectively. A ring 30 surrounds the forward end of the collar 22 and forms the outer race for the bearings 24. This ring is provided with short stub spindles 31 and 32 at opposite sides to which are attached the ends 33 and 34 of an operating lever 35.

As previously described the propeller blades are pivoted on pins 16 and 17. As shown in Figure 2 and shown diagrammatically in Figure 4 these pins are eccentric with respect to the axis of the blades. When the propeller blades are moved on these pivoted pins therefore they do not rotate in a complete circle or the arc of a complete circle but rather the axis of the blade will move about the pivots 16 and 17. As shown in Figure 2, for example, when this propeller is adjusted on its center 17 the axis of the blade indicated at 36 will move in an arc having 17 as its center. When the adjusting lever 35 is pushed forward the propeller 13 will lie substantially in the line 37—38 shown in Figure 4. When the adjusting lever is moved to the left, the face of the propeller may assume the position shown in lines 39—40 of Fig. 4. Line 41—42 indicates a position intermediate the two positions just mentioned.

A, B and C indicate the axis of the main drive shaft 10, the pivot point of the blades and the axis of the propeller blades, respectively.

From the foregoing description the operation of my device should be apparent.

Just a word concerning the effect created by the adjustment should be given. At normal atmospheric pressure and in a relatively calm wind the propeller blades will be set at a pitch which has been predetermined by the engineer. At normal speeds this will be the pitch which will give the best possible

pulling effect by the engine. At high speeds, however, this given pitch of the blade will not produce the highest efficiency on the part of the engine. During flight the blades of an engine travel in a spiral. At high speeds with the blades having the same pitch as they had at low speeds there will be a lost motion of the blade. At such high speeds therefore it is desirable that the pitch of the blade be increased so as to create the proper push or pull against the air. Not only is this necessary at high speeds but it is necessary in different wind velocities for the same effect is present when going against the wind as is found in flying at very high speeds. It is necessary to tilt the blades to correspond to the velocity of the wind in order to realize the highest efficiency on the part of the engine. The density of the air is another factor to be taken into account. The density of the atmosphere at sea level is quite different from that at an elevation of several thousand feet and at high altitudes the air becomes very rare. When flying at high altitudes therefore it becomes necessary to tilt the blades again in order to enable them to operate at a maximum pulling efficiency. By the use of my invention adjustment for all of these occasions may be instantly made.

With adjusting mechanism for propeller blades now in use gears, pinions and racks are used; while these may be sufficiently reliable for marine propeller blades they are entirely too hazardous for airplane construction since they easily get out of order. With my construction there are no gears to get out of order and all of the parts may be rigidly and thus reliably secured together with relatively little danger of their breaking or getting out of order.

It will be obvious to those skilled in the art that various changes may be made in my device without departing from the spirit of the invention, and therefore I do not limit myself to what is shown in the drawings and described in the specification, but only as indicated by the appended claims.

Having thus fully described my said invention, what I claim as new and desire to secure by Letters Patent, is:

1. A reversible propeller comprising the combination with a propeller shaft of a sleeve mounted thereon and rotatable therewith, the forward end of the sleeve being provided with opposite integral flanges, propeller blades pivotally attached to said flanges, said blades being pivoted at points eccentric of their axes, a collar slidable on said sleeve, a ring within said collar and secured to move axially therewith but to rotate in the collar, and links connecting said ring and ears on said propeller blades, substantially as set forth.

2. A reversible propeller comprising the combination with a propeller shaft of a sleeve having opposite integral flanges thereon, propeller blades having integral hubs pivoted on said flanges, said blades being pivoted eccentric of their axes, lugs on said blades, links to pivot the blades, the axes of the blades moving about the pivot point, substantially as set forth.

In witness whereof, I have hereunto set my hand at Washington, District of Columbia, this tenth day of June, A. D. nineteen hundred and thirty.

HARVEY H. HARDIN.