Dec. 28, 1948. H. H. ROBY 2,457,731

TWO POSITION PITCH-CHANGING MECHANISM

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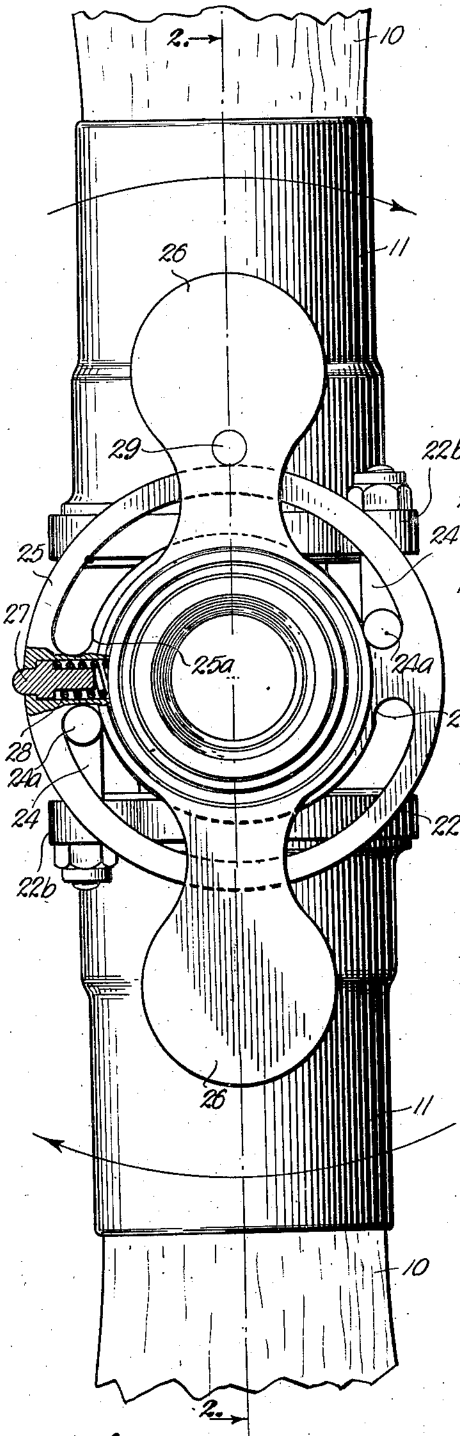

Fig. 1.

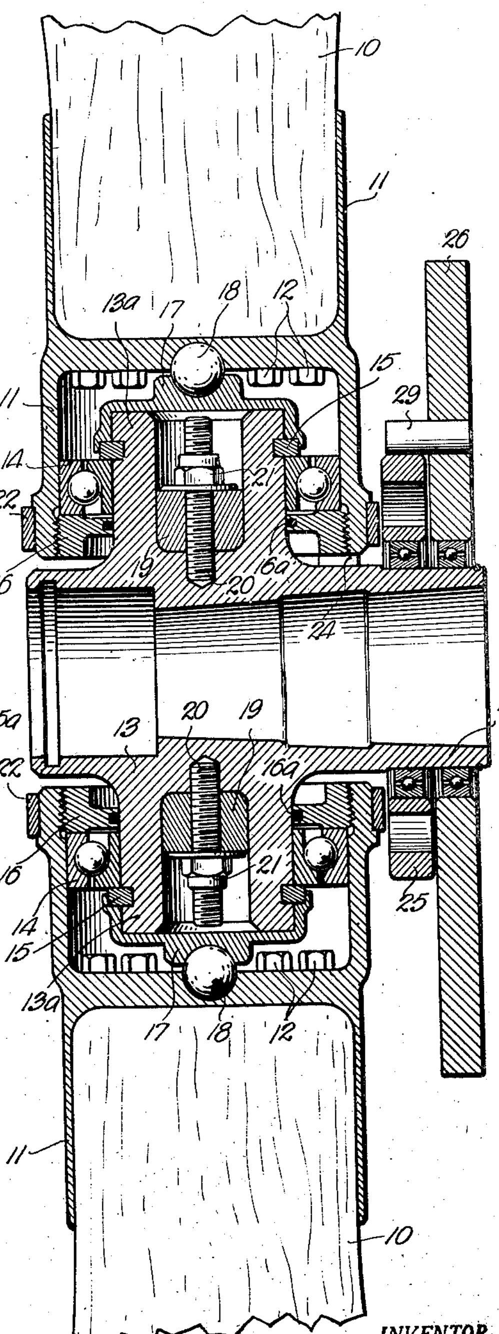

Fig. 2.

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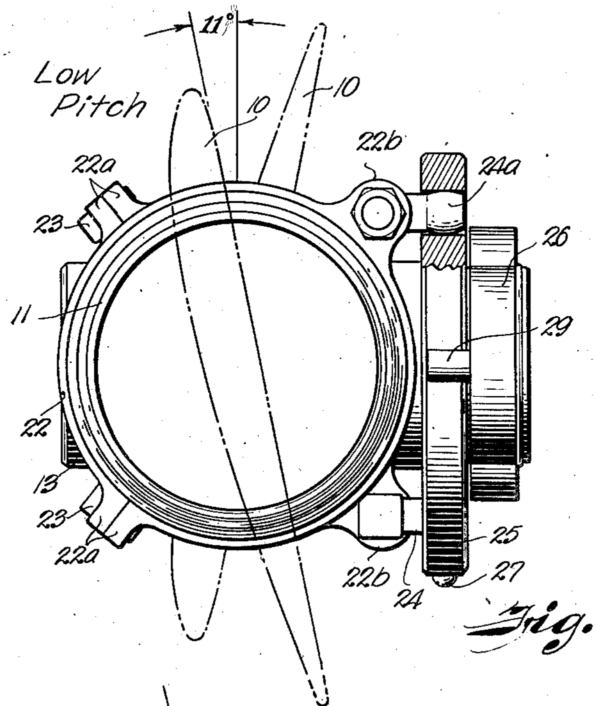

Fig. 3.

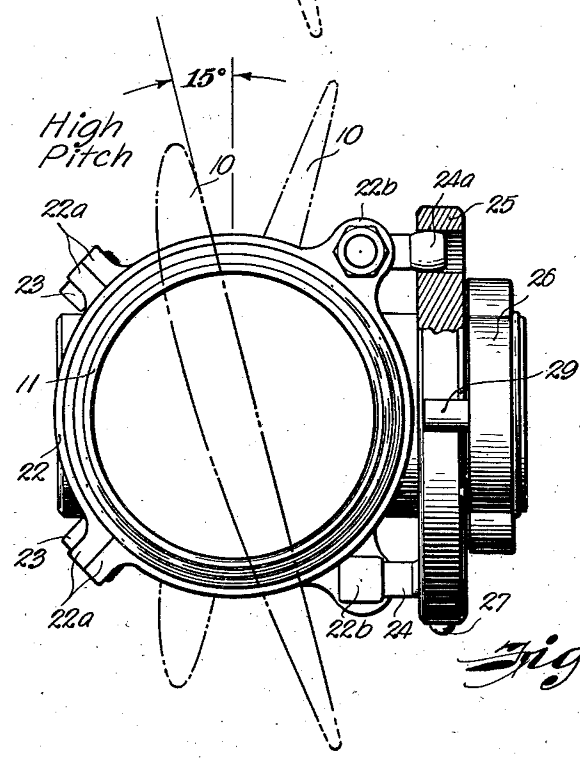

Fig. 4.

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TWO POSITION PITCH-CHANGING MECHANISM

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Application October 13, 1945, Serial No. 622,180

3 Claims. (Cl. 170—162)

This invention relates to improvements in a two position pitch-changing mechanism and refers more particularly to an automatic pitch-changing device for controllable pitch propellers for airplanes. In the operation of an airplane it is important at all items to have the advantage of maximum power of the engine. This is particularly essential when the plane is taking off. Many different types of pitch-changers have been devised, actuated manually, hydraulically and electrically. For small planes the weight of most of these devices is prohibitive and the expense of such manual devices whose weight is not excessive for some applications is objectionable. Many pilots, particularly those operating small planes, would prefer an automatic pitch-changing mechanism which does not require adjustment when their attention is needed elsewhere.

Among the objects of the invention is to provide a simple, inexpensive, automatic pitch-changing mechanism operable with sudden increase of rotative speed of the propeller to adjust the blades in a low pitch position and with the decrease of the rotative speed to automatically move the blades to a high pitch position.

Another object of the invention is to provide a pitch-changing device particularly adapted to small planes and low horsepower motors which delivers the maximum horsepower of the engine when the plane takes off or while it is being air borne by adjustment of the propeller blades in a low pitch position.

A further object is to provide a pitch-changing mechanism adapted to automatically adjust the propeller blade pitch to a high pitch position when the engine speed is decreased after take-off to a cruising speed.

Other and further objects will appear from the following description.

In the accompanying drawings which form a part of the instant specification and are to be read in conjunction therewith, and in which like reference numerals indicate like parts in the various views,

Fig. 1 is a rear view of a two blade propeller hub assembly embodying the invention with the blades broken away,

Fig. 2 is a central section of the device shown in Fig. 1,

Fig. 3 is a top plan of the propeller shown in Fig. 1 with the blades adjusted in a low pitch position and with parts of the pitch-changing mechanism broken away, and

Fig. 4 is a similar view to Fig. 3 with the blades adjusted in a high pitch position.

Referring to the drawings, at **10** are shown the propeller blades broken away in Figs. 1 and 2. The hub ends of the blades are pressed into sleeves **11** and rigidly affixed thereto by lag screws, the heads of which are shown at **12**.

A driving spider **13** is fixedly mounted upon the propeller shaft of the airplane, not shown. Extending radially from spider **13** are shanks **13*a*** upon which are mounted roller bearings **14** which carry the blade retention sleeves **11**. Bearings **14** set into a machined portion of the sleeves and are held in place by the lock rings **15** fitting in grooves in the shanks and retaining nuts **16** screwed into internal threads at the end of retention sleeves **11**. Seal rings **16*a*** inside the retaining nuts abut against the shanks and seal the spaces beneath the blades where the bearings are located. Pressed onto the ends of the shanks **13** and abutting lock rings **15** are caps **17**. These caps are recessed to receive ball bearings **18** which serve as bearing pivots for the blade assemblies during the pitch-changing operation. The skirts of the caps overlap the lock rings and prevent displacement.

Within a cavity in each of the shanks is a lead weight **19** held in place by a threaded stud upon which is screwed a holding nut **21**. On the hub ends of the sleeves **11** are affixed clamping rings **22** held in place by bolts **23** which are screwed into threaded ears **22*a*** shown in Figs. 3 and 4. Attached to separate ears **22*b*** of the clamping rings are lugs **24** whose outturned pin extensions **24*a*** slide in semicircular cam slots in the circular ring or pitch-changing member **25**. The pitch-changing member or cam ring **25** is rotatably mounted on the sleeve portion of spider **13**, as shown in Fig. 2. Outside of the cam ring and also freely rotatable upon the sleeve of the spider are fly weights **26**. In a well formed in the cam ring is a pin **27** resiliently cushioned by coil spring **28** serving as a stop for a pin **29** extending from the rear of one of the fly weights and permitting passage of the pin when the fly weights have considerable rotative inertia.

The operation of the mechanism is more or less obvious from the description. When the engine is started and the propeller is rotated in a clockwise direction as shown by the arrow in Fig. 1, the starting inertia of the fly weights freely mounted on the propeller shaft spider will be at a slower speed than the propeller. The pins **24*a*** on the lugs **24** will seek the positions shown in full lines in Fig. 1. In this position the propeller blades are moved to low pitch and pin **27** rotating with the cam ring will contact with pin **29** and gradually increase the rotative speed of the fly weights until the pins rest in abutment and the fly weights rotate with the cam ring. The low pitch adjustment of the propeller blades will continue so long as the propeller is rotated at high speed and maximum power is desired.

After the take-off and the plane is in the air and when the engine speed is reduced to its cruising rate, the propeller speed is reduced with the engine speed but the rotative speed of the fly weights does not immediately respond to the reduction in speed of the propeller. This causes the fly weights to overrun the speed of the cam ring and propeller, moving rotating pin **29** around the periphery of the cam ring to abutment on the opposite side of stop **27**. This rotates the cam ring through an arc corresponding to the length of the cam slots while the pins **24**a sliding in the cam slots move through a like arc shifting the pitch of the blades from the low pitch position shown in Fig. 3 to the high pitch position shown in Fig. 4. Slight depressions **25***a* on the inner surface of the cam slots at the high pitch end hold the propeller in high pitch position through the centrifugal twisting moment and air loads of the blade, allowing for minor throttle settings and small inertia changes in the fly weights.

If the inertia of the fly weights is too great, whether speed is being increased or decreased, stop pin **27** is depressed allowing the fly weights to over-run the cam and propeller speed or rotate at a slower speed than the cam and propeller sleeve until speed of the fly weights is either reduced or increased to more nearly correspond to the speed of the propeller at which time the stop and fly weight pin engage when the fly weights and propeller rotate together.

The lead weights **19** in the cavities of the shanks may be varied to statically balance the propeller blade.

Thus it will be seen that the pitch-changing mechanism operates automatically to shift the blades into low pitch position when maximum power of the engine is needed and the rotative speed of the propeller is rapidly increased. With reduction of engine speed the mechanism automatically operates to shift the propeller blades from low to high pitch thus providing high propeller efficiency under all operating conditions of the plane. When making a landing, if the field has been misjudged or an obstacle appears and there is need for an emergency take-off or the use of the engine's maximum power, sudden increase of engine speed by opening the throttle will automatically shift the propeller to low pitch position.

From the foregoing it will be seen that the invention is well adapted to attain the objects hereinbefore set forth together with other ad-

vantages which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. A two position pitch-changing mechanism for a controllable pitch propeller whose hub assembly includes a blade-supporting spider mounted on the propeller shaft, radial shanks on the spider and mountings on the hub ends of the blades axially rotatable on said shanks, a fly weight assembly freely rotatable with respect to the propeller shaft, a pitch changer plate also rotatable with respect to the propeller shaft and said plate having arcuate cam slots permitting movement of said changer through an arc corresponding to the range of the pitch change of the blades, separate blade actuating means slidable in the slots of the pitch changer and each connected to a blade mounting, contacting members on the fly weight assembly and pitch changer plate operable with increase and decrease in the rotative speed of the propeller to shift the pitch changer.

2. A pitch-changing mechanism as in claim 1 in which the contacting members on the fly weight assembly and pitch changer plate comprise stationary and retractible contacting abutments on the fly weights and pitch changer.

3. A pitch-changing mechanism as in claim 1 having depressions formed in the ends of the cam slots whereby shifting of the slidable means due to minor speed changes and small inertia changes of the fly weight assembly is retarded.

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