H. E. WEAVER.

VARIABLE PITCH PROPELLER.

APPLICATION FILED AUG. 14, 1918.

1,328,241.

Patented Jan. 13, 1920.

4 SHEETS—SHEET 1.

Fig -1-

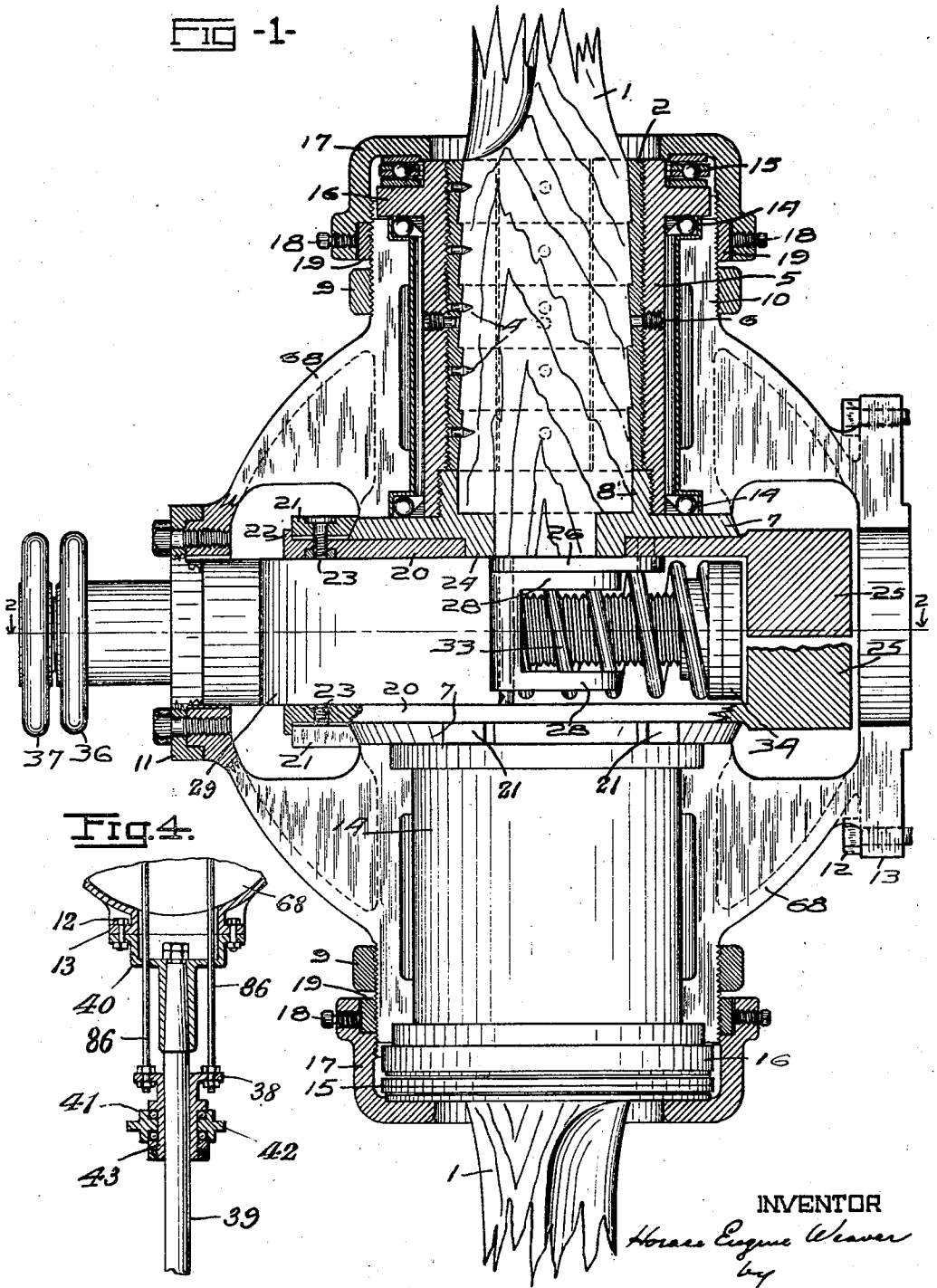


Fig. 4.

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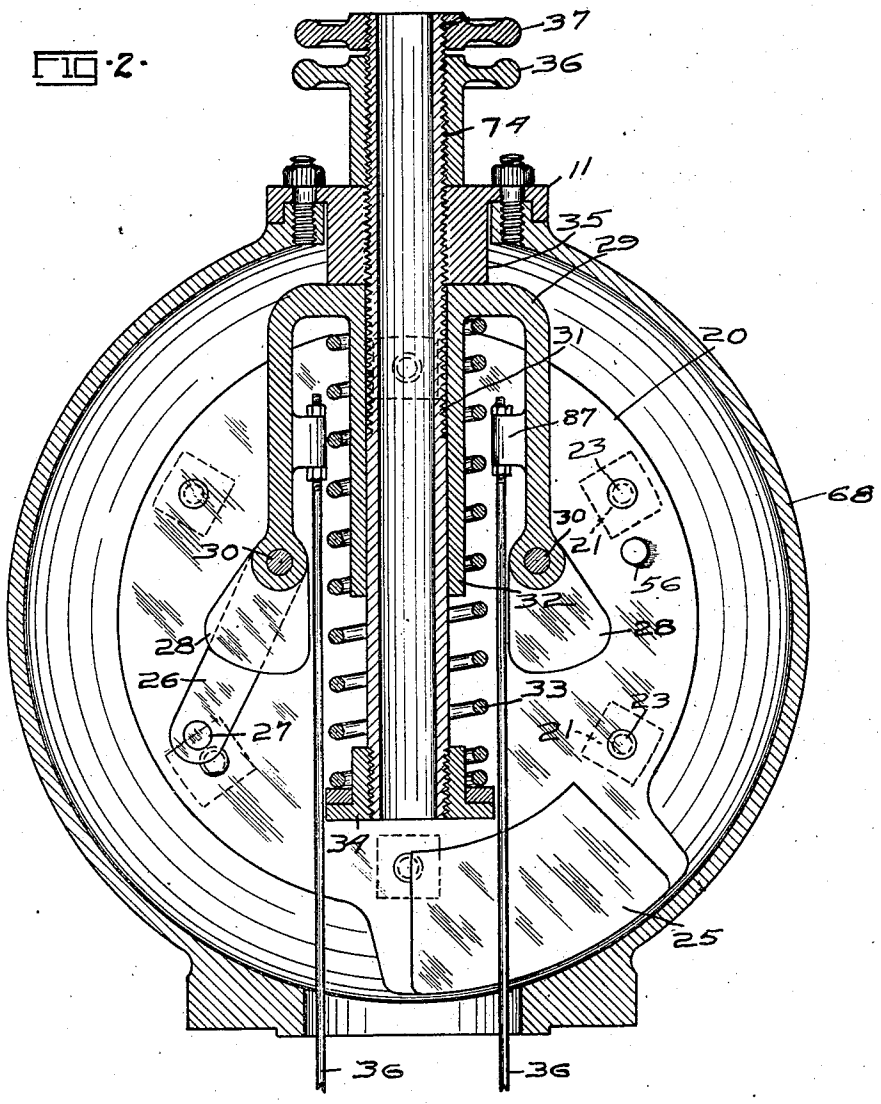
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4 SHEETS—SHEET 2.

FIG. 2.



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4 SHEETS—SHEET 3.

Fig. 3.

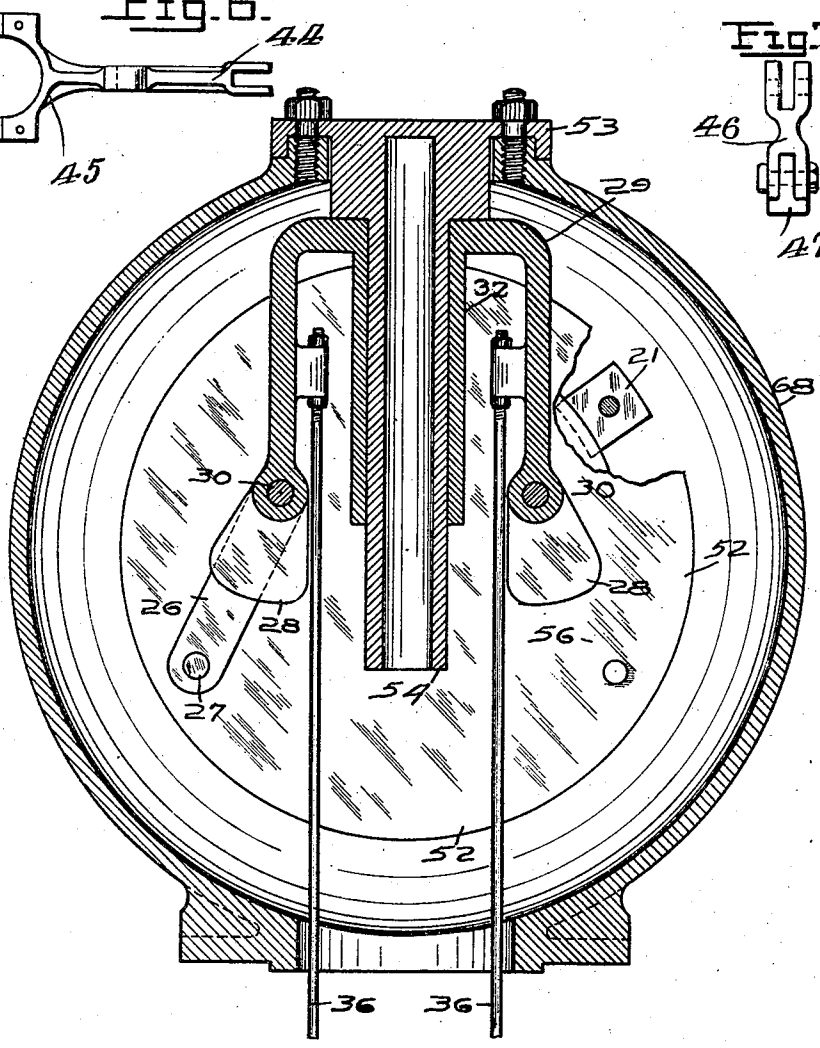
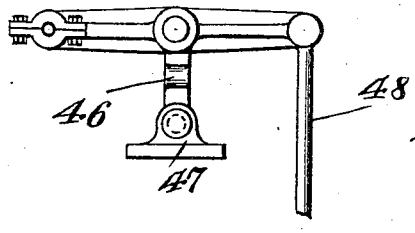


Fig. 6.

Fig. 7.

Fig. 5.



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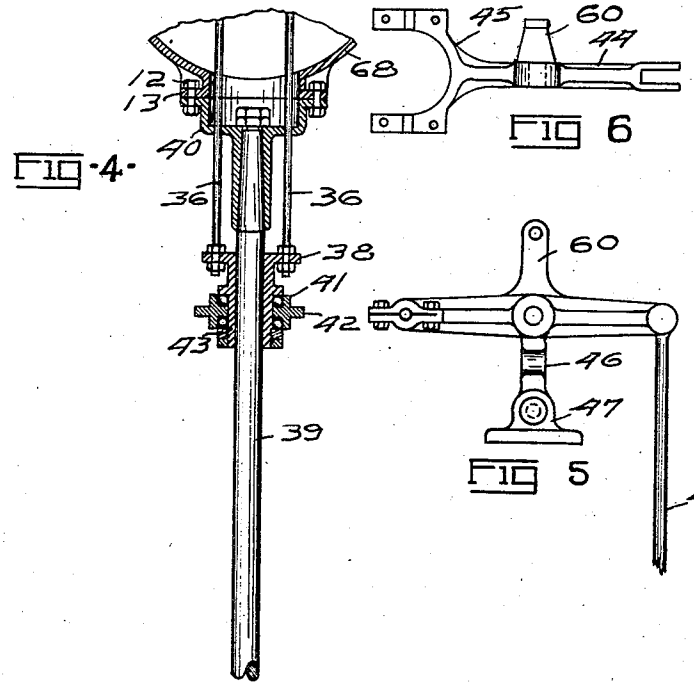


FIG. 4.

FIG 6

FIG 5

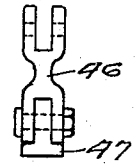


FIG 7

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UNITED STATES PATENT OFFICE.

HORACE EUGENE WEAVER, OF BRYAN, OHIO.

VARIABLE-PITCH PROPELLER.

1,328,241. Specification of Letters Patent. Patented Jan. 13, 1920.

Application filed August 14, 1918. Serial No. 249,807

To all whom it may concern:

Be it known that I, HORACE EUGENE WEAVER, a citizen of the United States, and a resident of Bryan, in the county of Williams and State of Ohio, have invented a certain new and useful Variable-Pitch Propeller; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference, marked thereon, which form a part of this specification.

This invention relates to means for producing a variable pitch in propeller-blades used on aeroplanes. In the use of aeroplanes it is desirable in starting to have the propeller-blades so positioned that they will have a small pitch and when the machines have raised from the ground, to then increase the pitch. The amount of the increase of pitch, is, however, varied according to the speed that it is desired to have the plane make. The object of this invention is to provide in connection with such a means, a means whereby a change in the pitch of the propeller-blades is accomplished automatically by the speed of the engine and in conjunction therewith to provide a means whereby the pitch may be further varied by the operation of the pilot. In this connection I have provided a means whereby the control may be performed entirely by the pilot. A further object of this invention is to provide a means whereby the pitch of the plurality of propellers may be controlled both automatically and manually. Further objects and advantages of the invention will appear from the description and from the drawings.

The invention may be contained in different forms of aeroplane construction. I have selected one such form of construction for the purposes of illustration and shall describe the aeroplane selected hereinafter. The construction selected is illustrated in the accompanying drawings.

Figure 1 of the drawings illustrates a sectional view taken through the hub of the propeller. Fig. 2 illustrates a sectional view taken on line 2, 2 indicated in Fig. 1. Fig. 3 is a similar view to that shown in Fig. 2 of a modified form of construction. Fig. 4 illustrates part of a connecting means whereby the variable pitch of the propeller-blades may be controlled manually. Fig. 5 illustrates a side view of the lever forming a part of the connecting means shown in Fig. 4. Fig. 6 illustrates a top view of the lever shown in Fig. 5. Fig. 7 illustrates a movable fulcrum also shown in Fig. 5.

1, Fig. 1, indicates the propeller-blades which are shown broken in order that a large view of the hub may be presented. The propeller-blades 1 are secured in sleeves 2. The ends of the propeller-blades secured by the sleeves 2 are provided with a plurality of cone or frustumal shaped surfaces, the larger diameters of which are located nearer to the inner end of the propeller-blades than the smaller diameters. The sleeve 2 in each case is formed of three longitudinally cut segments the inner surfaces of which when placed together form a binding means for securely locking the propeller-blades in position. When the segments of the sleeve are placed together the sleeve will have a plurality of female surfaces that correspond to the surfaces formed on the inner end of the blade. Each of the segments are provided with a plurality of pin holes through which pins 4 may be driven into the propeller-blade. The sleeve 2 is threaded on its outer side and is threaded into a sleeve 5 having a female tapered threaded surface so that when the blade and the sleeve 2 is threaded into the sleeve 5, the tapered thread of the sleeve 5 will tightly clamp the propeller-blade and thus securely hold a propeller-blade in position. The sleeve 2 is locked from rotation within the sleeve 5 by means of threaded pins 6 that thread into sleeve 5 and extend through holes formed in sleeve 2.

The blade 1 being provided with frustumal surfaces each of which have the larger diameter located near the inner end of the blade than the smaller diameter is located, provides a means whereby splitting off of the wood will be prevented owing to the large centrifugal force to which the blade is subjected when in use. If the inner end of the propeller-blades were so formed that the position of the diameters of their frustumal surfaces were reversed the outward pull of the blade would tend to cause the shoulders to cut or splinter the blade angularly. In the form shown any movement of the blade 1 that might possibly occur relative to the sleeve 2 would operate to squeeze the inner end of the blade tighter. This would compress the wood and increase its resistance to

the squeezing action to which the wood may be subjected, by reason of the increased density that would occur owing to the compression of the wood. Also the multiple tapered parts permit more sharply inclined tapered portions over a considerable area than if a single taper was provided over the same area.

The inner end of the blade is stepped into the plate 7, and the sleeve 5 is threaded on to a flange 8 formed on the plate 7. The blade, its connecting sleeves and the plate 7 are secured in the hub of the propeller.

The hub is provided with two semi-spherical members 68 which are secured together by means of rings 9 which are threaded on to tapered ends 10 of the semi-spherical members 68. The spherical members are also secured in position by means of the collar 11 which is bolted to the spherical members. The spherical members are also secured by means of bolts 12 that pass through flanges 13 and thread into a flange 40 located on the engine shaft. This not only operates to hold the spherical members 68 together but also to hold the hub in position on the engine shaft.

The propeller-blade in each case is supported in suitable ball-bearings 14 located intermediate the sleeve 5 and the hub. Ball-bearings 15 are also provided to maintain the end thrust of the propeller-blades and is located intermediate a flange 16 formed on the sleeve 5 and a collar 17. The collar 17 is threaded on to the tapered end of the spherical hub and is also provided with blocks 19 set in notches formed in the collar 17. Threaded pins or bolts 18 extend through the collar 17 and press against the plugs 19 to force the plugs 19 against the spherical hub.

Rotation of each propeller-blade along its longitudinal axis, that is, about the axis of the sleeves 2 and 5 may be accomplished automatically, as hereinafter described, or may be manually operated by the pilot. A plate 20 is secured to the plate 7 by means of locking members 21 that have beveled edges that press against a bevel edge formed on the plate 7. The plate 20 is provided with a flange 22 against which one edge of each locking member 21 may butt when the locking member 21 is pulled toward the plate 20 by the threaded pin 23 which threads into the plate 20. The plates 7 and consequently the propellers may be adjusted relative to the plate 20 by rotation of the plates 7 relative to the plate 20, and locked in their adjusted positions. The plates 7 have a flange or inwardly extending part 24 that sets into an opening formed in the center of the plate 20 to center the plates. The plates 20 are provided with enlarged or weighted portions 25 which extend inwardly toward the plates on which they are located. The weighted portions are located side by side and on opposite sides of the axis of the hub. In the view shown in Fig. 1 a broken view of the lower plate 20 is shown in order that the weighted portion of the lower plate may be shown. A link member 26 is connected to each plate 20 by means of a pin 27 which is located near the periphery of the plate 20, and about sixty degrees measured angularly from the center of the weighted portion 25. The links 26 which are connected to the plates 20 at their remaining ends of the links are connected to a yoke 29. The yoke 29 is provided with shelves 28 which are located on one side of each of the links 26 so as to hold the links 26 against the inner surface of the plates 20, and so as to prevent any movement of the links at right angles to the axes of the pins connecting the links to the plates 20 and to the yokes 29, and yet permits free lateral or rotated movements of the links 26. The shelves 28 are located at the four corners of the yoke.

Inasmuch as the weighted portions 25 are located on opposite sides of the axis of rotation of the hub, the weighted portions tend to rotate the plates 20 in a direction that will cause the weighted portions 25 to separate. This will cause the pins 27 to move circularly toward each other. Inasmuch as the links 26 are connected to the yoke 29 by means of the pins 30 they both operate to pull the yoke 29 toward the engine, that is, toward the weighted portions of the plates 20.

The yoke 29 is located on a barrel or rod 31. The yoke 29 is provided with a sleeve portion 32 which guides the yoke 29 in its movement along the barrel 31. A spring 33 is located intermediate the yoke 29 and a flange collar 34 that is threaded on to one end of the barrel 31. The barrel 31 at its outward end is provided with an extended threaded portion 74. The collar 11 is provided with a female thread located in an inwardly extending flange 35 and into which the barrel 31 is threaded. The barrel 31 is passed up through the collar 11 until the spring 33 is placed under the desired compression to properly balance the action of the weighted portions 25 of the plates 20. A threaded sleeve 36 is threaded on to the threaded portion 74 and operates to lock the barrel 31 in the position that it may be placed in adjusting the compression of the spring 33. A head 37 may be located in the upper end of the barrel 31 and keyed thereto by a suitable pin. This permits ready adjustment of the barrel 31 and consequently, of the spring 33 after the hub has been assembled. In the adjusting operation, the sleeve 36 is released and the collar 27 is rotated which rotates the barrel 31 and, when the proper adjustment is made, the sleeve 36 is turned so that its

end will abut the collar 11. This operates to yieldingly hold the yoke 29 against the inner end of the flange 35. Until movement is compelled by the centrifugal action of the weighted portions 25 of the plates 20.

It will thus be seen that rotation of the blades about their longitudinal axes is accomplished by the rate of rotation of the blades about the axis of the shaft connected to the engine and by which they are propelled. The blades are so adjusted in the hub by the adjustment of the plates 7 that the pitch of the blades will be increased by the increased speed of the engine shaft or the shaft connected to the engine which propels the blades.

I have provided means whereby the automatic controlling device may be used either in connection with an engine having a right hand or an engine having a left hand rotation, or when a tractor propeller or a push propeller is used. These different conditions may be met by the proper connection between the ends of the yoke 29 with the plates 20. In the form of the construction shown in Figs. 1 and 2 the connecting links are made at the edges of the yoke when the propeller is used as a tractor. If on the other hand the connection were such that the pitch of the plates were to be controlled by a left hand engine or if the propeller is a push propeller the plates 20 would be connected with the other corners of the yoke and the weighted portions 25 would be placed on the other side of the axis of the drive shaft. I have thus provided a wrist pin 56 for pivotally securing and connecting the link 26 with a portion of the plates 20 located on the opposite side of the diameter of the plate that passes through the center of the weighted portion than that on which the pin 27 is located as shown in the connection made in the illustrations of Fig. 2. The other corners of the yoke being thus provided with the shelves 28 and the ends of the pintles extending beyond the corner the links can be connected to either pair of opposite corners.

The blades moreover may be manually varied in their pitch relation by means of rods 86 that are connected to the yoke 29, the yoke 29 being provided with inwardly extending lugs 84 to which threaded ends of the rods 86 may be secured by means of suitable nuts located on opposite sides of the lugs. The rods 86 may be connected to a flange of a sleeve 38, which is made slidably movable along the shaft 39. The shaft 39 which is connected to the hub by means of the bolts 12 and the flanged cup 40 operates to drive the propeller-blades when the shaft is rotated. The sleeve 38 is provided with a ball-bearing member 41 having pins 42. The ball-bearing member 41 is secured by suitable nuts 43 which are threaded on to one end of the sleeve 38. The ball-bearing member 41 is connected to a lever 44 having a yoke 45. The pins 42 extend through the sides of the yoke 45 and consequently when the lever 44 is moved about its pivot the sleeve 38 will be shifted which will shift the rods 36 and consequently move the plates 20 and 7 and thus change the pitch of the propeller-blades.

The lever 44 is supported on an arm 46 which is mounted on a suitable part of the fuselage of the aeroplane by means of bracket 47. The link or arm 46 permits lateral movements of the lever 44 which permits the sleeve 38 to move along the shaft 39 without binding. A rod 48 is connected to the end of the lever 44 and may be operated by a suitable manually operated means.

If desired the automatic control of the pitch of the blades may be eliminated and the weighted portions 25 may be omitted. Also the counteracting spring 33 and the means for adjusting the spring may likewise be omitted. The arrangement for manually controlling the pitch of the blades as distinct from automatic and manually controlling them is illustrated in Fig. 3 wherein the barrel 31 forms a part of the collar 11. In the form shown in Fig. 3 the barrel 54 and the flange 53 takes the place of the collar 11 in the form illustrated in Figs. 1 and 2. The yoke 29 slides along the barrel 54 in the same manner that it slides along the barrel 31 in the form shown in Figs. 1 and 2. The yoke 29 is connected to the plates 52 by the links 26 in the same manner that the yoke 29 is connected to the plates 20 in the form shown in Figs. 1 and 2.

The same results can be obtained by merely substituting the plates 52 in place of the plates 20 and releasing the tension of the springs 33 except so far as it may be desirable to hold the connecting rods and parts that connect the yoke 39 with the manually operated means through the rod 48.

I claim:—

1. In a variable pitch propeller, a plurality of blades, a weighted member associated with each blade, means for inter-connecting the weighted member with its associated blade for right or left hand engine rotation or for a tractor or push propeller.

2. In a variable pitch propeller, a hub, a pair of blades connected to the hub, a plate located in the hub and having a weighted segment and secured to each blade at right angles to the axis of the blade, the said plates located in parallel relation, means for connecting the plates together and a yielding member for resisting the rotation of the plates by reason of the centrifugal action of the weighted segments.

3. In a variable pitch propeller, a hub, a pair of blades connected to the hub, a plate located in the hub and having a weighted segment and secured to each blade

at right angles to the axis of the blade, the said plates located in parallel relation, means for connecting the plates together and a yielding member for resisting the rotation of the plates by reason of the centrifugal action of the weighted segments, a manual means connected to the yielding member for manually causing rotation of the plates.

4. In a variable pitch propeller, a hub, a pair of blades, a pair of plates connected to the blades and located in the hub and having weighted segments located on opposite sides of the axis of the hubs and in parallel relation to each other, a yoke located between the plates, links connected to the arms of the yokes and the plates, the link connecting each plate being located on the side of the axis of the hub opposite to that on which the weight of that plate is located, a spring member for yieldingly resisting the movement of the yoke by the centrifugal action of the weighted portions of the plates.

In testimony whereof, I have hereunto signed my name to this specification.

HORACE EUGENE WEAVER.