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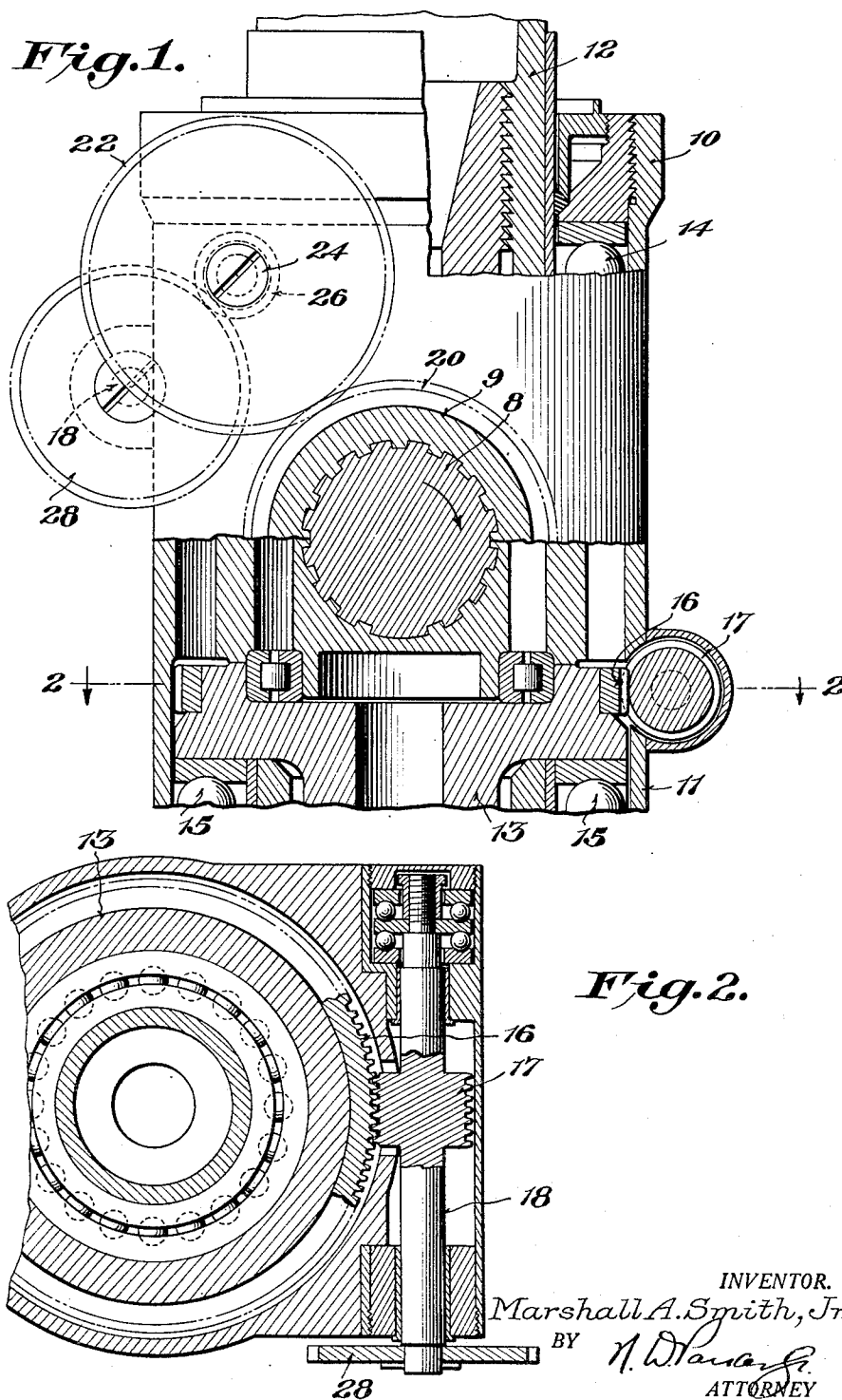
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2,140,722

VARIABLE PITCH PROPELLER

Filed June 30, 1932

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Fig. 3.

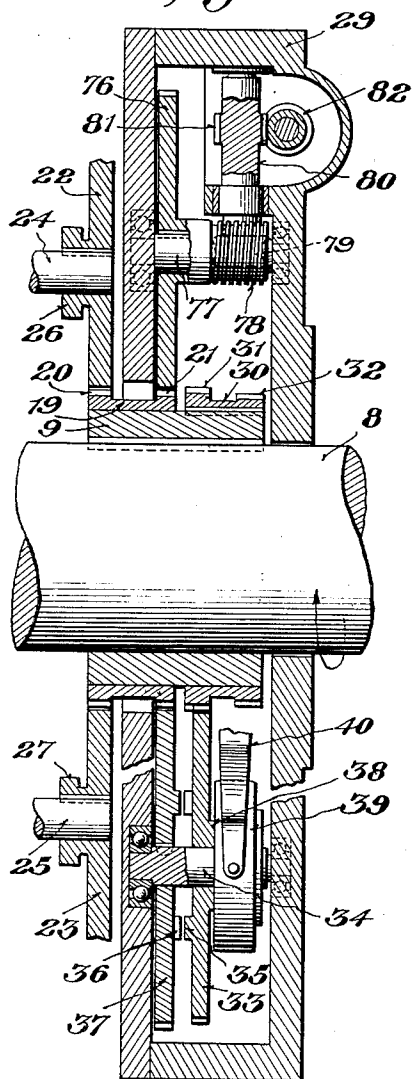
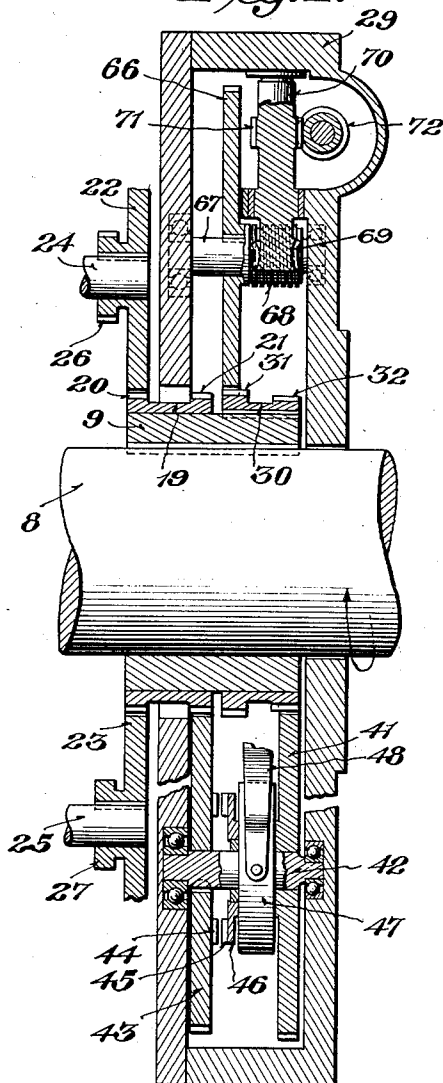


Fig. 4.



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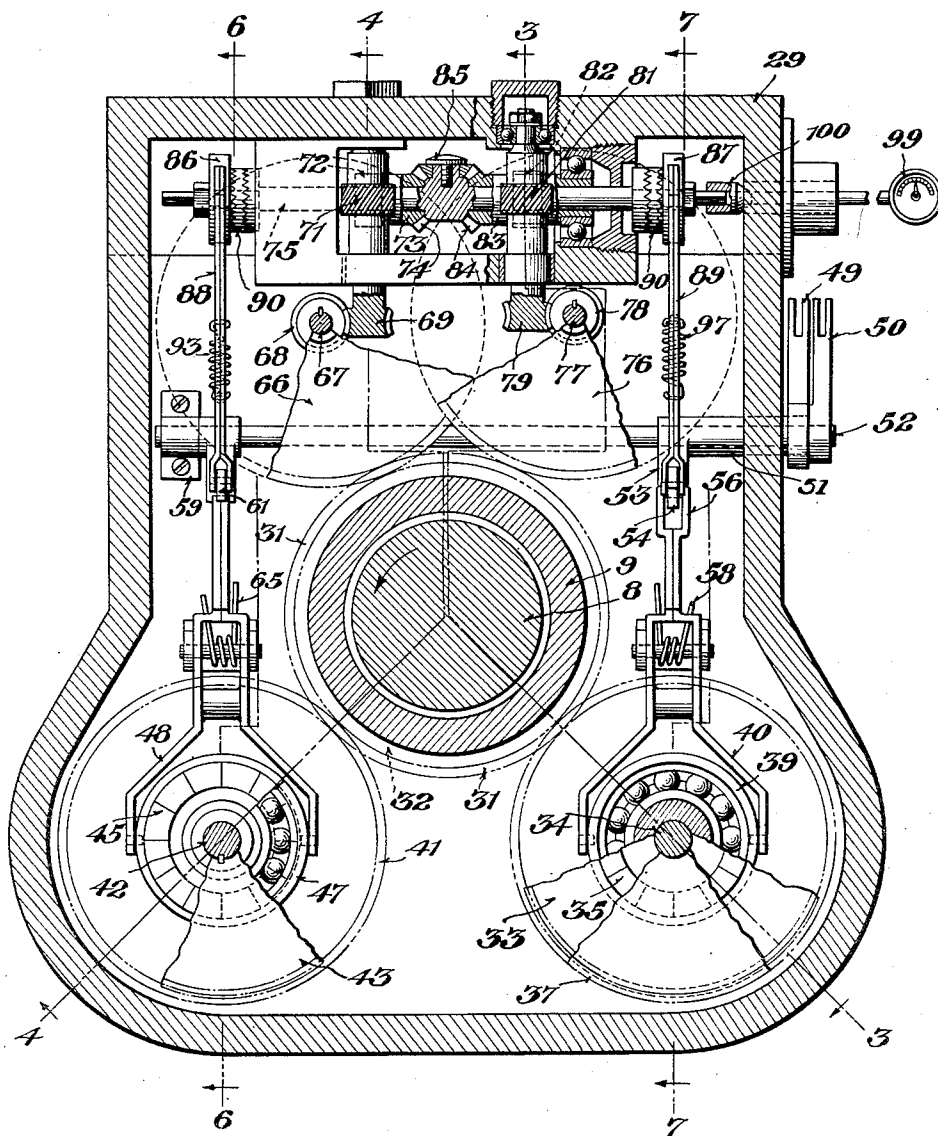
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Fig. 5.



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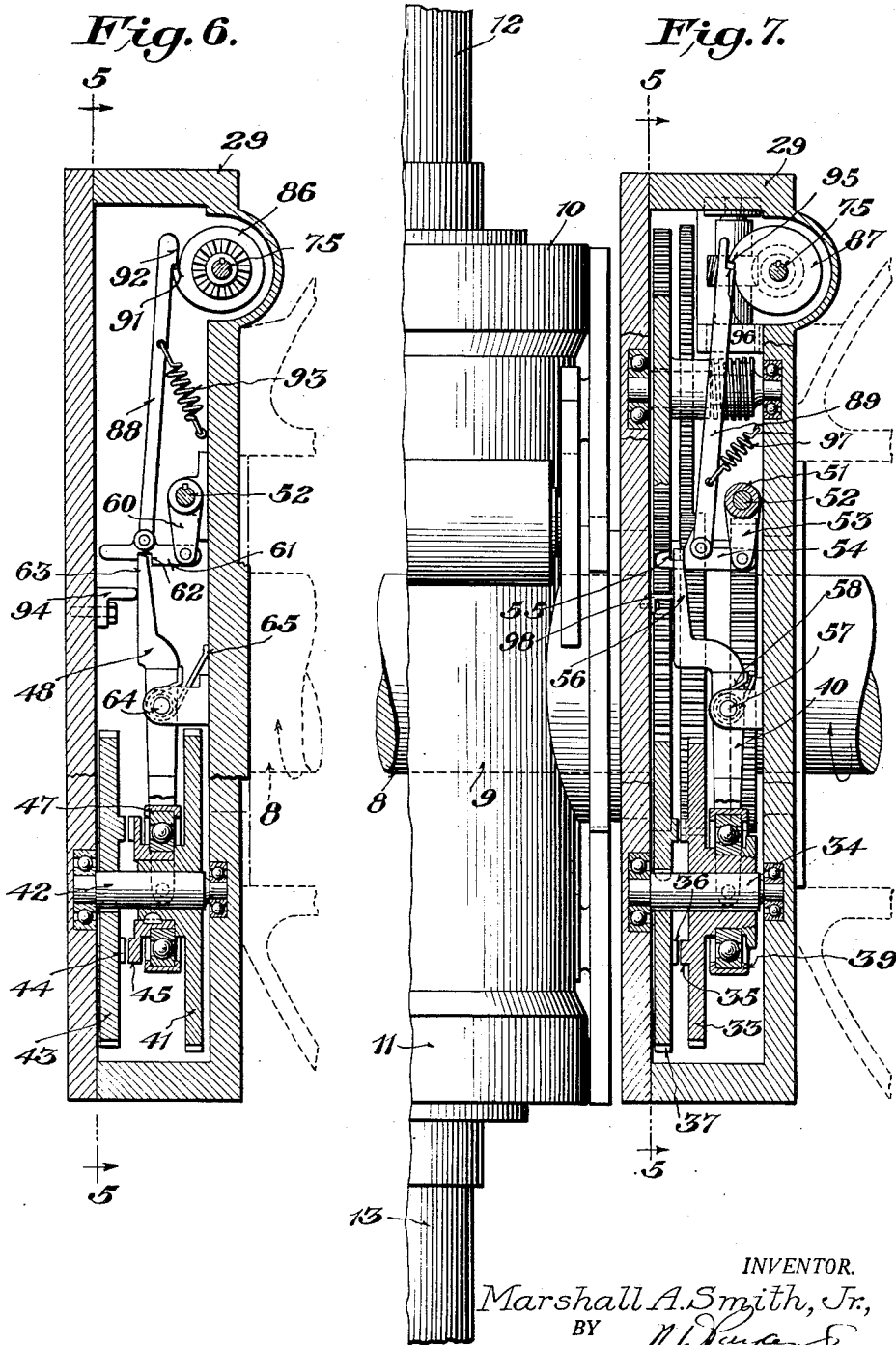
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VARIABLE PITCH PROPELLER

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4 Sheets-Sheet 4



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2,140,722

VARIABLE PITCH PROPELLER

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Application June 30, 1932, Serial No. 620,263

24 Claims. (Cl. 170-163)

This invention relates to propellers and more particularly to propellers of the type wherein the pitch of the blades may be varied during operation of the propeller.

One of the objects of the present invention is to provide in a propeller of the type having a plurality of radially-extending blades a novel mechanism for readily varying the pitch or angularity of the blades during operation.

Another object of the invention is to provide a novel variable pitch propeller wherein the pitch of the blades may be easily varied when the propeller is in motion by a novel mechanism deriving its power from the power of the propeller shaft.

Still another object is to provide in a variable pitch propeller of the above character, a novel mechanism for varying the pitch of the blades including a gear wheel operable rotatably in the same direction as, but at a speed different from that of the propeller shaft in order to vary the pitch of the blades.

Still another object is to provide a novel pitch changing mechanism for a propeller embodying a novel arrangement whereby said mechanism may be readily and easily actuated by a pair of gears drivably connected with the propeller shaft.

A further object is to provide in a propeller of the above character, a novel arrangement whereby the pitch changing mechanism is automatically rendered inoperative as soon as the pitch of the blades has been varied to a predetermined degree.

A still further object is to provide a variable pitch propeller embodying the above and other features which is so constructed and arranged as to be unusually compact and light in weight as well as positive in operation and one wherein the pitch of the blades of the propeller may be varied with a minimum of effort and attention on the part of the operator.

The above and other objects and novel features of the invention will appear more fully hereinafter from the following detailed description when taken in connection with the accompanying drawings wherein one embodiment of the present invention is illustrated. It is to be expressly understood, however, that the drawings are for purposes of illustration only and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

Referring to the drawings wherein similar reference characters refer to similar parts throughout the several views:

Fig. 1 is a rear view partly in section of a propeller embodying the principles of the present invention;

Fig. 2 is a sectional view taken on line 2-2 of Fig. 1;

Fig. 3 is a diagrammatic sectional view of a portion of the pitch changing apparatus taken on line 3-3 of Fig. 5;

Fig. 4 is a diagrammatic sectional view of another portion of the pitch changing apparatus taken on line 4-4 of Fig. 5;

Fig. 5 is a front sectional view of a portion of the pitch changing apparatus and control mechanism therefor taken on line 5-5 of Figs. 6 and 7;

Fig. 6 is a sectional view illustrating certain parts of the apparatus shown in Fig. 5 and taken on line 6-6 of the latter, and

Fig. 7 is a sectional view of certain of the parts illustrated in Fig. 5 and taken along line 7-7 of the latter.

Referring more particularly to Figs. 1 to 4 a variable pitch propeller embodying the principles of the present invention is illustrated therein as comprising a power or driving shaft 8 having a hub 9 suitably secured thereto, said hub being provided with a pair of radially-extending sockets 10 and 11 in which propeller blades 12 and 13 are rotatably mounted as by means of bearings 14 and 15 respectively, in order that the angularity of the blades may be varied during operation of the propeller. Suitable means, as will be more particularly referred to hereinafter and including a worm gear 16 and worm 17 on worm shaft 18, are provided for each blade for rotating the latter about their longitudinal axes to change the pitch thereof.

In the form shown, Figs. 3 and 4, the pitch changing mechanism is power operated by means of power derived from the power or driving shaft 8 and includes suitable gear means in the form of a double gear 19 having gear elements 20 and 21, the former of which is adapted to be in constant engagement with oppositely-disposed gear wheels 22 and 23 rotatably mounted in the hub sockets 10 and 11 respectively as by means of stub shafts 24 and 25. The gear wheels 22 and 23 are integrally formed with or otherwise suitably secured to pinions 26 and 27 respectively which are in constant mesh with gears 28, one for each blade, which last-mentioned gears are fixedly secured to worm shafts 18. As will be readily seen from Figs. 3 and 4, the gear means 19 is rotatably mounted upon the hub 9, which latter is in turn drivably connected with the

power or driving shaft 8, the gear means being in effect thus rotatably carried by the power shaft. It is here pointed out that during normal rotation of the shaft 8, the gear means 19 rotates with the hub 9 as a unit therewith, relative rotation between 19 and 9, however, effecting operation of the mechanisms connecting the former with the worm gears 16 to effect a change in pitch of the blades.

One of the features of the present invention resides in the rotation of the gear means 19 in the same direction at either a speed in excess of the speed of rotation of the shaft 8 or at a speed less than the rotation of said shaft to effect an increase or decrease in the pitch of the blades. In the form of the invention illustrated, the gear portion 21 of the gear means 19 may be suitably drivably connected with the power shaft 8 in order to effect one of the above described methods of rotation of the gear means 19. For this purpose there is drivably connected to the hub 9, within a suitable casing 29, a double gear 30 having gear portions 31 and 32 formed thereon, the former having a greater number of teeth cut thereon than the gear 21. In constant mesh with gear 31 is a gear 33 rotatably mounted upon a shaft 34 suitably journaled within the walls of casing 29. Formed upon one face of the gear 33 are clutch teeth 35 which are adapted to engage corresponding clutch teeth 36 formed upon the face of a gear 37 suitably keyed to the shaft 34, the gear 37 being in constant mesh with gear 21 and having the same number of teeth as the latter. The gear 33 is formed with less teeth than the gear 37 so that during rotation of the propeller the gear 33 will rotate at a speed slightly in excess of the speed of rotation of gear 37. Preferably the gear 33 has a hub 38 formed thereon with which a trunnion ring 39 cooperates, this last-named ring being provided with a suitable rocking lever 40 for moving the clutches 35 and 36 into engagement to effect a driving of gear 37 and gear means 19 at a speed slightly in excess of the propeller speed in order to vary the pitch of the propeller blades.

In order to effect a rotation of the gear means at a speed less than the speed of the propeller in order to cause a change in the pitch of the blades in the other direction, as for example a decrease in the pitch of the blades, the gear 32 is preferably formed with a less number of teeth than the gear 21 and meshes with the gear 41 having a greater number of teeth than the gear 21, see Fig. 4. As shown, the gear 41 is rotatably mounted upon a shaft 42 suitably journaled in the walls of casing 29, the said shaft having drivably secured thereto a gear 43 in constant mesh with gear 21. Formed upon the face of gear 43 are clutch teeth 44 which are adapted to be drivably connected with correspondingly formed clutch teeth 45 integrally secured to a collar 46 which is in turn rigidly attached to the gear 41. Interposed between the collar and said last-mentioned gear is a trunnion ring 47 having a cooperating rocking lever 48 for sliding the trunnion ring and gear 41 axially of the gear 32 in order to bring clutches 44 and 45 into driving engagement. It will be apparent from the construction of gears 32 and 41 that when the above-named clutches are brought into driving engagement with each other, the gear 21 will be rotated at a speed slightly slower than the speed of rotation of the propeller and this will effect a movement of the pitch changing mechanism including gears 22, 26, 28, 17 and 16 in

such a direction as to vary the pitch of the blades oppositely to that described in connection with the operation of gears 31 and 33.

From the above it will be appreciated that when the clutches 35—36 and 44—45 are disengaged as illustrated in Figs. 3 and 4, that the gear means 19 and the gears exteriorly of the housing 29 will rotate as a unit during rotation of the propeller and no change in the pitch of the blades will be effected. However, upon engagement of the clutch 35—36, the gear means 19 will be rotated in the same direction as, but at a speed slightly greater than, the speed of the propeller depending upon the ratio of the pitch diameters of gears 31 and 33, and the relative rotation between gear means 19 and the power shaft 8 will effect, for example, an increase in the pitch of the blades depending upon whether or not the worms 17 are provided with right or left hand threads. It will also be apparent that upon disengagement of the clutch 35—36 and engagement of clutch 44—45, that the gear means 19 will be rotated in the same direction as the direction of rotation of the power shaft 8 but at a speed slightly less than the speed of the latter, depending upon the ratio of the pitch diameters of gears 32 and 41 and that the relative rotation between gear means 19 and the power shaft 8 will effect a decrease in the pitch of the blades, depending as above set forth upon the direction of the threads upon the worms 17. This construction thus far described enables a positive change in the pitch of the propeller blades to be effected by means of the power derived from the propeller shaft in a simple and efficient manner.

In order to provide readily accessible means for operating the shifting levers 40 and 48, a pair of operating members 49 and 50 are positioned within easy reach of the operator.

Referring more particularly to Figs. 5, 6 and 7, the operating member 49 is suitably connected with a sleeve 51 rotatably mounted with respect to a rod 52, the said sleeve being provided with a crank 53 connected with a link 54. As shown, the link 54 is provided at its outer end with a notch 55 adapted to receive the end portion 56 of the rocking lever 40, which latter is pivotally mounted at 57 to a portion of the casing 29, and maintained in the position shown by means of a spring 58, such as to maintain the clutches 35—36 disengaged. It will be readily apparent, however, from the above that upon movement of the member 49 in the proper direction, the rocking lever 40 will be moved about its pivot 57 in a clockwise direction as viewed in Fig. 7 to effect engagement of clutches 35—36 and consequent change in pitch of the propeller blades as above described.

In order to effect remote control of the clutches 44—45, the operating member 50 is drivably connected with the rod 52 which, at its other extremity, Fig. 5, is suitably journaled in a bracket 59 and carries a crank 60 which is pivotally connected to a link 61. As shown in Fig. 6, the link 61 is provided with a notch 62 adapted to receive the upper end portion 63 of the rocking lever 48, which latter is pivotally mounted intermediate its end as at 64 to a fixed portion of the casing 29, a spring 65 being provided for maintaining the lever 48 in such a position that the clutch 44—45 is normally disengaged. It will be readily apparent from the above that upon actuation of the member 50 and consequent rocking of the rod 52, with the parts shown in their

position illustrated in Fig. 6, the lever 48 will be rocked in a clockwise direction about its pivot 64 to effect engagement of clutches 44—45 and consequent operation of the pitch changing mechanism.

Means are provided by the present invention for discontinuing the operation of the pitch changing mechanism when the latter has varied the pitch of the blades to a predetermined degree and preferably, such mechanism is so constituted as to also indicate to the operator the pitch of the blades at all times. As shown, such means include a gear 66 constantly rotating at the same speed as the propeller and the motion of this gear is compared with the rotation of the gear means 19, through a suitable differentiating apparatus to effect disconnection of either of the clutches 35—36 or 44—45 as soon as the pitch of the blades has attained a predetermined maximum or minimum.

Referring more particularly to Figs. 3, 4 and 5, the gear 66 is drivably connected with the gear 31 and is so constructed as to have the same number of teeth and the same pitch diameter as said last-mentioned gear. Gear 66 is drivably connected in any suitable manner with a shaft 67 journaled in the walls of casing 29, the said shaft carrying within the casing 29 a worm 68 in constant mesh with a worm wheel 69 secured upon the lower end of a shaft 70 suitably rotatably mounted in the casing 29. Integrally formed upon the shaft 70 is a spiral gear 71 which meshes with a corresponding gear 72 formed upon a sleeve 73 having a bevel gear 74 formed integrally therewith, the said sleeve being rotatably supported by a shaft 75.

Referring more particularly to Fig. 3, a gear 76 having the same number of teeth and same pitch diameter as gear 21 is in constant mesh with said last-mentioned gear, the said gear 76 being drivably connected to a shaft 77 suitably rotatably mounted in the casing 29. As shown, the shaft 77 also carries a worm 78 which is adapted to mesh with a worm gear 79 carried by the lower end of a shaft 80, said shaft being rotatably mounted in casing 29 in any suitable manner. The said shaft 80 is also provided with a spiral gear 81 in constant mesh with a corresponding gear 82 carried by a sleeve 83 having a bevel gear 84 formed thereon similar to the bevel gear 74. As shown, Fig. 5, the sleeve 83 is rotatably supported by the shaft 75, which last-mentioned shaft has rotatably mounted thereon a bevel gear 85 which is in constant mesh with bevel gears 74 and 84. It will be apparent from the above construction that in the event that bevel gears 74 and 84 are rotating at the same speeds and in opposite directions, the gear 85 will rotate upon its mounting on shaft 75 and the latter will remain stationary. However, in the event that one or the other of the bevel gears 74 and 84 is rotating relatively to the other, the gear 85 in addition to its rotative movement about its pivot will partake of a bodily movement thus effecting rotation of shaft 75 in one direction or the other depending upon whether gear 74 or 84 has the greater speed.

The above referred to rotation of shaft 75 is utilized in order to disengage either the clutch 35—36 or the clutch 44—45 as soon as the pitch of the blades has reached a predetermined value, depending upon which of these clutches is engaged. As shown, Fig. 5, the shaft 75 is provided upon the ends thereof with cams 86 and 87 adapted to cooperate with notched levers 88 and

89, which, at their lower ends, are pivotally connected with links 61 and 64 respectively. Each of the cams 86 and 87 is preferably connected with the shaft 75 by means of a toothed clutch element 90 which preferably are provided with different numbers of teeth upon their opposite faces in order to secure a vernier effect in adjusting the cams 86 and 87 with respect to the shaft 75.

As shown, the cam 86 is provided with a projection 91 which is adapted during clockwise rotation of the cam as viewed in Fig. 6 to engage the notched end 92 of lever 88 to lift said lever upwardly against the tension of return spring 93 to effect disengagement between the end portion 63 of lever 48 and the notch 62 provided in link 61 in order to permit the spring 65 to return the lever 48 to such a position as to disengage clutch 44—45, thus bringing the upper end of lever 48 into engagement with a stop 94, it being understood that prior to this operation the lever 48 has been rocked in a counter-clockwise direction about its pivot 64 to effect engagement of the clutch 44—45.

In the event that clutch 35—36 has been placed into engagement, it will be appreciated that rotation of cam 87, see Fig. 7, in a counter-clockwise direction will effect engagement between a projection 95 on said cam and the upper notched end 96 of lever 89 which will cause the said lever to be moved downwardly as viewed in Fig. 7 against the tension of return spring 97 to effect disengagement between the notched end 55 of link 54 and the portion 56 of lever 40 whereupon the spring 58 will be effective to move the said lever in a counter-clockwise direction about its pivot 57 in order to effect disengagement of the clutch 35—36 and returning the said lever to such a position that the upper end portion thereof will engage a stop 98. If desired, a suitable indicating mechanism 99, Fig. 5, may be interconnected with the shaft 75 by any suitable coupling means such as that shown at 100.

In operation, if it be desired to increase the pitch of the blades for example, it is only necessary for the operator to actuate the member 49 in the proper direction to engage the clutch 35—36 whereupon the gear means 19 will be rotated in the same direction as the propeller, at a speed slightly in excess of the speed of the latter whereupon the gears 22, 26, 28, 17 and 16 will be rotated to increase the pitch of the blades. During this operation, it will be readily seen that the bevel gears 74 and 84 will be rotated at different speeds due to the fact that the gear wheel 76, in constant mesh with the gear means 19, is rotating at a speed slightly greater than the speed of rotation of the gear wheel 66. Such relative movement between the gears 74 and 84 will effect, through gear 85, a rotation of shaft 75 in counter-clockwise direction as viewed in Fig. 7 to effect a release between the link 54 and the lever 40, as above described in order to permit the return of said lever to the position shown in Fig. 7, whereupon the clutch 35—36 is disengaged and further change in the pitch of the blades consequently arrested.

In the event that it is desired to decrease the pitch of the propeller blades, proper actuation of the member 50 will, through rod 52, crank 60, and link 61, move the lever 48 in such a direction as to effect engagement between the clutch elements 45—44, see Fig. 6, thereby causing rotation of the gear means 19 through gears 32, 41 and 43 at a speed slightly less than the speed

of the propeller but in the same direction as the direction of rotation of the latter. It will be appreciated that due to the relative rotation of the gear means 19 and the power shaft 8, the pitch changing mechanism comprising gears 22, 26, 28, 17 and 16 will be rotated in the opposite direction to effect, for example, a decrease in the pitch of the propeller blades. It will be also appreciated that during this phase of the operation of the propeller, the speed of rotation of gear 76 of the pitch limiting mechanism will be less than the speed of rotation of the gear 66 which will effect a relative rotation between bevel gears 74 and 84, Fig. 5, to cause a rotation of the shaft 75 in the opposite direction or in a clockwise direction as viewed in Fig. 6. As soon as the shaft 75 and the cam 86 secured thereto has rotated a sufficient amount after engagement between the projection 91 and the notched end 92 of the lever 88 so as to release the upper end portion 63 of lever 48 from the notch 62 in link 61, the return spring 65 will effect a counter-clockwise movement of the lever 48 about its pivot 64 in order to disengage the clutch 44-45 and arrest any further movement of the pitch changing mechanism. It is to be pointed out that the relative position of the cams 86 and 87 will determine the limits of the movement of the pitch changing mechanism in either direction and by the provision of the vernier-like clutch members 90 interposed between the shaft 75 and said cams, substantially any position of said cams with respect to the shaft 75 may be secured.

There is thus provided by the present invention a novel variable pitch propeller embodying positively acting means for varying the pitch of the blades, which means is power operated by the power or propeller shaft. By providing the positively actuating clutches for drivably connecting the pitch changing gear means with the power shaft, a relatively simple arrangement is secured and one which eliminates the use of brakes and brake bands heretofore utilized in certain types of variable pitch propellers. By providing the pitch limiting mechanism any danger that the pitch of the blades may be increased or decreased below a predetermined amount is avoided, thus relieving the operator from the necessity for close observance of and undivided attention to the pitch changing operation.

While only one embodiment of the invention has been disclosed and described herein, it is to be expressly understood that the invention is not limited thereto but may be embodied in various other forms as well understood by those skilled in the art. Reference will therefore be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A variable pitch propeller having a power shaft and a plurality of blades adjustable to vary the pitch thereof, gear means rotatably carried by the shaft for adjusting the blades to vary the pitch thereof in response to driving of said gear means at a speed different from the propeller speed, means for driving said gear means at a speed different from the propeller speed including a double gear fixed to the shaft, and means for operatively connecting and disconnecting said double gear to and from said gear means.

2. A variable pitch propeller having a power shaft and a plurality of blades adjustable to vary the pitch thereof, gear means rotatably carried by the shaft for adjusting the blades to vary the pitch thereof in response to driving of said gear

means at a speed different from the propeller speed, means for driving said gear means at a speed different from the propeller speed including a double gear fixed to the shaft, and means for operatively connecting and disconnecting said double gear to and from said gear means, said last-named means including a pair of independently operable clutches.

3. A variable pitch propeller having a shaft and a plurality of blades adjustable to vary the pitch thereof, gear means rotatably carried by the shaft for adjusting the blades to vary the pitch thereof in response to driving of said gear means at a speed different from the propeller speed, means for driving said gear means at a speed different from the propeller speed including a double gear fixed to the shaft, and means for operatively connecting and disconnecting one or the other of the gear portions of said double gear to and from said gear means.

4. A variable pitch propeller having a shaft and a plurality of blades adjustable to vary the pitch thereof, gear means rotatably carried by the shaft for adjusting the blades to vary the pitch thereof in response to driving of said gear means at a speed different from the propeller speed, means for driving said gear means at a speed different from the propeller speed including a double gear fixed to the shaft, and means including a pair of selectively operable independent clutches for operatively connecting one or the other of the portions of said double gear to and from said gear means.

5. A variable pitch propeller having a shaft and a plurality of blades adjustable to vary the pitch thereof, gear means rotatably mounted on the shaft for adjusting the blades to vary the pitch thereof in either direction according as said means is driven at a speed in excess of the propeller speed or at a speed less than the propeller speed, a pair of gears drivably connected to and carried by said shaft, one for driving said gear means in one direction and at a speed in excess of the propeller speed and the other for driving said gear means in said one direction and at a speed less than the propeller speed, and means for independently and operatively connecting one or the other of the gears of said pair of gears with said gear means.

6. In a variable pitch propeller having a rotatable shaft, a hub drivably connected with said shaft, a plurality of propeller blades rotatably mounted in said hub, pitch changing mechanism for said blades operable in the same direction at different speeds for increasing or decreasing the pitch of the blades, and means including a pair of gears fixed to said shaft for selectively actuating said mechanism at said different speeds.

7. A variable pitch propeller having a shaft and a plurality of blades adjustable to vary the pitch thereof, gear means rotatably mounted on the shaft for adjusting the blades to vary the pitch thereof in either direction according as said means is driven at a speed in excess of the propeller speed or at a speed less than the propeller speed, a pair of gears drivably connected to and carried by said shaft, one for driving said gear means in one direction and at a speed in excess of the propeller speed and the other for driving said gear means in said one direction and at a speed less than the propeller speed, means for operatively connecting one or the other of said pair of gears independently to said gear means, and means for automatically rendering said last-

named means inoperative after a predetermined movement thereof.

8. In a variable pitch propeller having a rotatable shaft, a hub drivably connected to said shaft, a plurality of propeller blades rotatably mounted in said hub, pitch changing mechanism for said blades operable in the same direction at different speeds for increasing or decreasing the pitch of the blades, a pair of gears fixed to said shaft, means for connecting one or the other gear of said pair to said mechanism for selectively actuating said mechanism at said different speeds, and means operable after actuation of said mechanism to a predetermined degree for automatically rendering said mechanism inoperative.

9. A variable pitch propeller having a shaft and a plurality of blades adjustable to vary the pitch thereof, gear means rotatably carried by the shaft for adjusting the blades to vary the pitch thereof in response to driving of said gear means at a speed different from the propeller speed, means for driving said gear means at a speed different from the propeller speed including a driving gear means secured to said shaft, a pair of gears in constant mesh with said driving gear means, and means for selectively drivably connecting and disconnecting one or the other of said pair of gears to and from said gear means.

10. A variable pitch propeller having a shaft and a plurality of blades adjustable to vary the pitch thereof, gear means rotatably carried by the shaft for adjusting the blades to vary the pitch thereof in response to driving of said gear means at a speed different from the propeller speed, means for driving said gear means at a speed different from the propeller speed including a driving gear means secured to said shaft, a pair of gears meshing with said driving means, said gears of said pair constituting, with said driving gear means, gear sets of different ratios, and means for operatively connecting either gear set with said gear means to the exclusion of the other set.

11. In a variable pitch propeller having a rotatable shaft, a hub drivably connected with said shaft, a plurality of propeller blades rotatably mounted in said hub, pitch changing mechanism for said blades operable in the same direction at different speeds for increasing or decreasing the pitch of the blades, a driving member secured to said shaft and a pair of gears independently drivably connected with said member and selectively connectable with said mechanism for actuating the latter at said different speeds.

12. In a variable pitch propeller having a rotatable shaft, a hub drivably connected with said shaft, a plurality of propeller blades rotatably mounted in said hub, pitch changing mechanism for said blades operable in the same direction at different speeds for increasing or decreasing the pitch of the blades, a driving member secured to said shaft, a pair of gears each separately driven by said member at different speeds, and means for selectively connecting one or the other of said gears with said mechanism for actuating the latter at said different speeds.

13. In a variable pitch propeller having a rotatable shaft, a hub drivably connected therewith, a plurality of propeller blades rotatably mounted in said hub, means operable for varying the pitch of the blades including a gear rotatably mounted on said shaft, a pair of gears separately meshing with said first named gear, a driving member secured to said shaft, a second pair of gears each gear of which is separately driven at different

speeds by said member, and means for drivably connecting a gear of one pair with a gear of the other pair.

14. In a variable pitch propeller having a rotatable shaft, a hub drivably connected with said shaft, a plurality of propeller blades rotatably mounted in said hub, pitch changing mechanism for said blades operable in the same direction at different speeds for increasing or decreasing the pitch of the blades, a driving gear means secured to said propeller shaft, and means including a pair of gears drivably connected with said driving gear means and selectively axially movable into driving engagement with a portion of said mechanism for driving said mechanism at said different speeds.

15. In an aircraft having a variable pitch propeller, the combination with a power operated rotatable adjusting means concentrically arranged in respect to a propeller shaft, a control means including a pair of gears fixed to said shaft to determine operation of said adjusting means in either direction to start blade adjusting action, and means contemporaneously operating with said adjusting means to limit said blade adjusting action.

16. A rotary propeller having blades mounted for adjustment to vary the pitch thereof; means including a rotatable member for moving the blades to vary their pitch in one direction or the other according as the rotatable member is driven at a speed in excess of or less than propeller speed; two rotary idler members; means for constantly driving said idler members during rotation of the propeller, one at a speed in excess of propeller speed and the other at a speed less than propeller speed; and means for operatively connecting one idler member or the other to the rotatable member, to accordingly drive the latter at a speed in excess of or less than propeller speed.

17. A rotary propeller having blades mounted for adjustment to vary the pitch thereof; means including a gear rotatable about the propeller axis, for moving the blades to vary their pitch in one direction or the other according as the gear is driven at a speed in excess of or less than propeller speed; two rotatably mounted idler gears; two driving gears meshing respectively with the idler gears and fixed to rotate with the propeller to drive one idler gear at a speed in excess of propeller speed and the other idler gear at a speed less than propeller speed; and means for operatively connecting one idler gear or the other with the first mentioned gear, to accordingly drive the latter at a speed in excess of or less than propeller speed.

18. A propeller hub mounted on a driving shaft, a plurality of blades adjustably mounted to vary the pitch of said blades; planetary gearing carried by said hub and a rotatable gear supported from said shaft, said gearing and said gear adapted to vary the pitch of said blades in one direction or the other accordingly as said rotatable gear is driven at a speed in excess of or less than said hub, means for driving said rotatable gear including two idler members mounted for independent rotation, means for constantly driving said idler members from said shaft and other means for connecting or for disconnecting either of said idler members to and from said rotatable gear.

19. A variable pitch propeller having a power shaft and a plurality of blades mounted for adjustment to vary the pitch thereof; means in-

cluding planetary gearing carried by the hub and a rotatable gear carried by said shaft to vary the pitch of the blades in one direction or the other accordingly as said rotatable gear is driven at a speed in excess of or less than propeller speed; means for so driving said rotatable gear including two idler members mounted for independent rotation, means for constantly driving said idler members during rotation of the propeller, and means for positively operatively connecting and disconnecting each of said idler members to and from the rotatable gear.

20. A variable pitch propeller having a shaft and a plurality of blades adjustable to vary the pitch thereof, gear means rotatably mounted on the shaft for adjusting the blades to vary the pitch thereof in either direction according as said means is driven at a speed in excess of the propeller speed or at a speed less than the propeller speed, gear mechanism drivably connected to and carried by said shaft, means for connecting said gear mechanism to said gear means to drive the same at a speed in excess of the propeller speed or at a speed less than propeller speed, said last named means including a pair of idler members in constant mesh with said gear mechanism, clutch teeth associated with one side face of each of said idler members, and means for selectively connecting said gear means with either of said idler members including positively acting clutch mechanism adapted to engage said clutch teeth associated with the idler members, together with means operable to interrupt further change in pitch after the latter has reached a predetermined value.

21. A rotary propeller having blades mounted for adjustment to vary the pitch thereof; means including a gear mounted for rotation about the propeller axis, for moving the blades to vary the pitch thereof in one direction or the other according as the gear is driven at a speed in excess of or less than propeller speed; a pair of idler gears separately mounted for independent rotation; means for driving said idler gears respectively at speeds in excess and less than propeller speed; and means for operatively connecting one idler gear or the other to the first mentioned

gear, to accordingly drive the latter at a speed in excess or less than propeller speed.

22. A rotary propeller having blades mounted for adjustment to vary the pitch thereof; means including a gear mounted for rotation about the propeller axis, for moving the blades to vary the pitch thereof in one direction or the other according as the gear is driven at a speed in excess of or less than propeller speed; a pair of idler gears separately mounted for independent rotation; means for driving said idler gears respectively at speeds in excess of and less than propeller speed; and clutch means for operatively connecting one idler gear or the other to the first mentioned gear, to accordingly drive the latter at a speed in excess of or less than propeller speed.

23. A rotary propeller having blades mounted for adjustment to vary the pitch thereof; means including a rotatable member for moving the blades to vary their pitch in one direction or the other according as the rotatable member is driven at a speed in excess of or less than propeller speed; two idler members mounted for independent rotation; means responsive to rotation of the propeller to drive one of said idler members at a speed in excess of propeller speed and the other idler member at a speed less than propeller speed; and means for operatively connecting one idler member or the other to the rotatable member, to accordingly drive the latter at a speed in excess of or less than propeller speed.

24. In a variable pitch propeller having a rotatable shaft, a hub drivably connected therewith, a plurality of propeller blades rotatably mounted in said hub, means operable for varying the pitch of the blades including a gear rotatably mounted on said shaft, a pair of gears separately meshing with said first named gear, a driving member secured to said shaft, a second pair of gears, each gear of which is separately driven at different speeds by said member, means for drivably connecting a gear of one pair with a gear of the other pair, and means for automatically disengaging said last named gears after a predetermined change in pitch.

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