May 10, 1932. M. C. NIXON 1,857,392

PROPELLER APPARATUS

Filed July 14, 1930 2 Sheets-Sheet 1

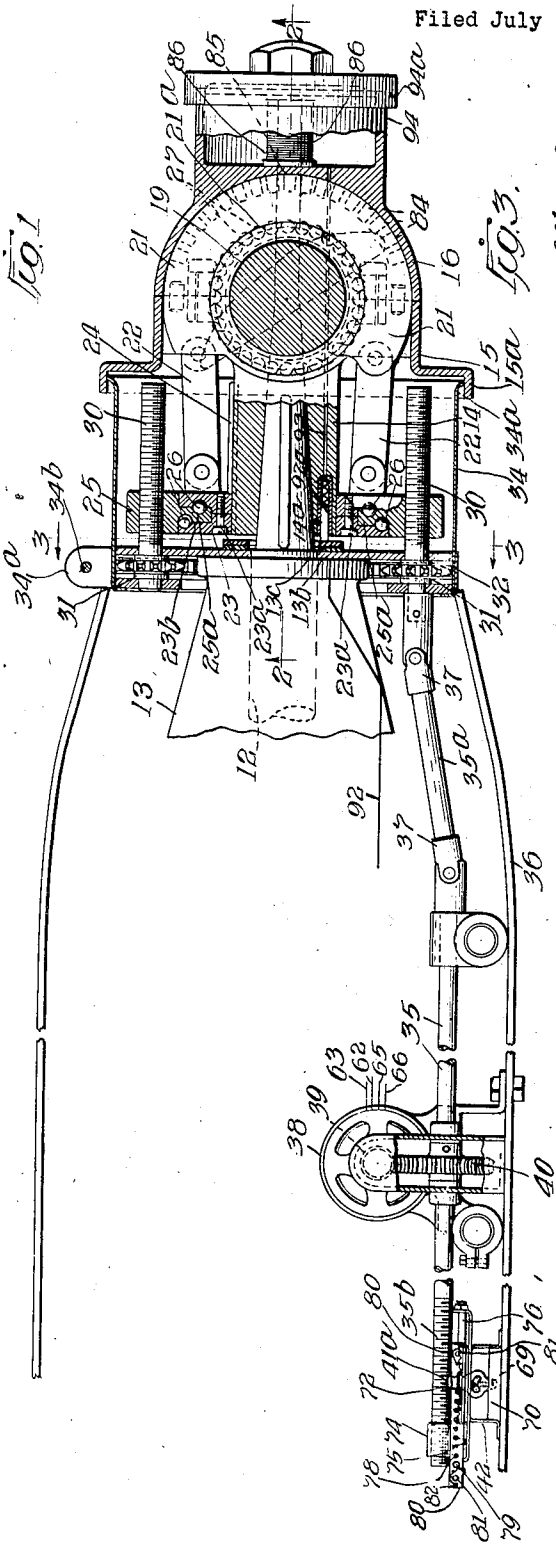


Fig. 1.

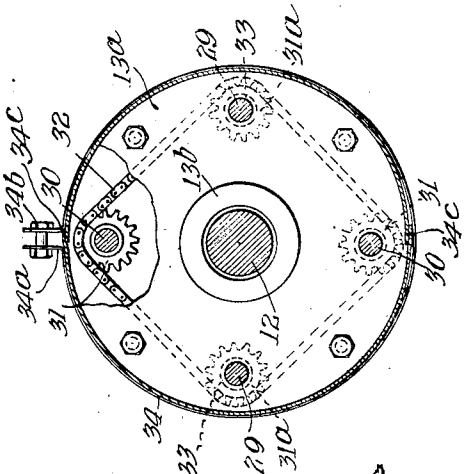


Fig. 3.

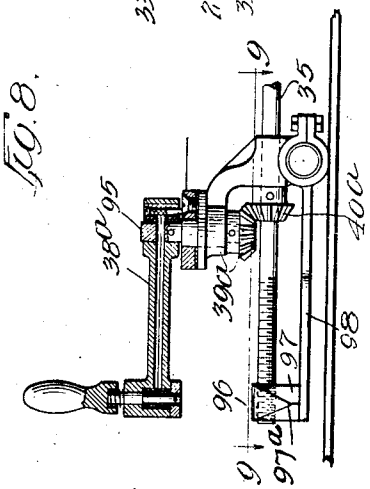


Fig. 8.

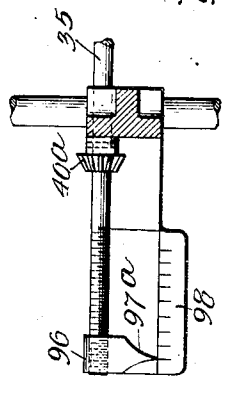


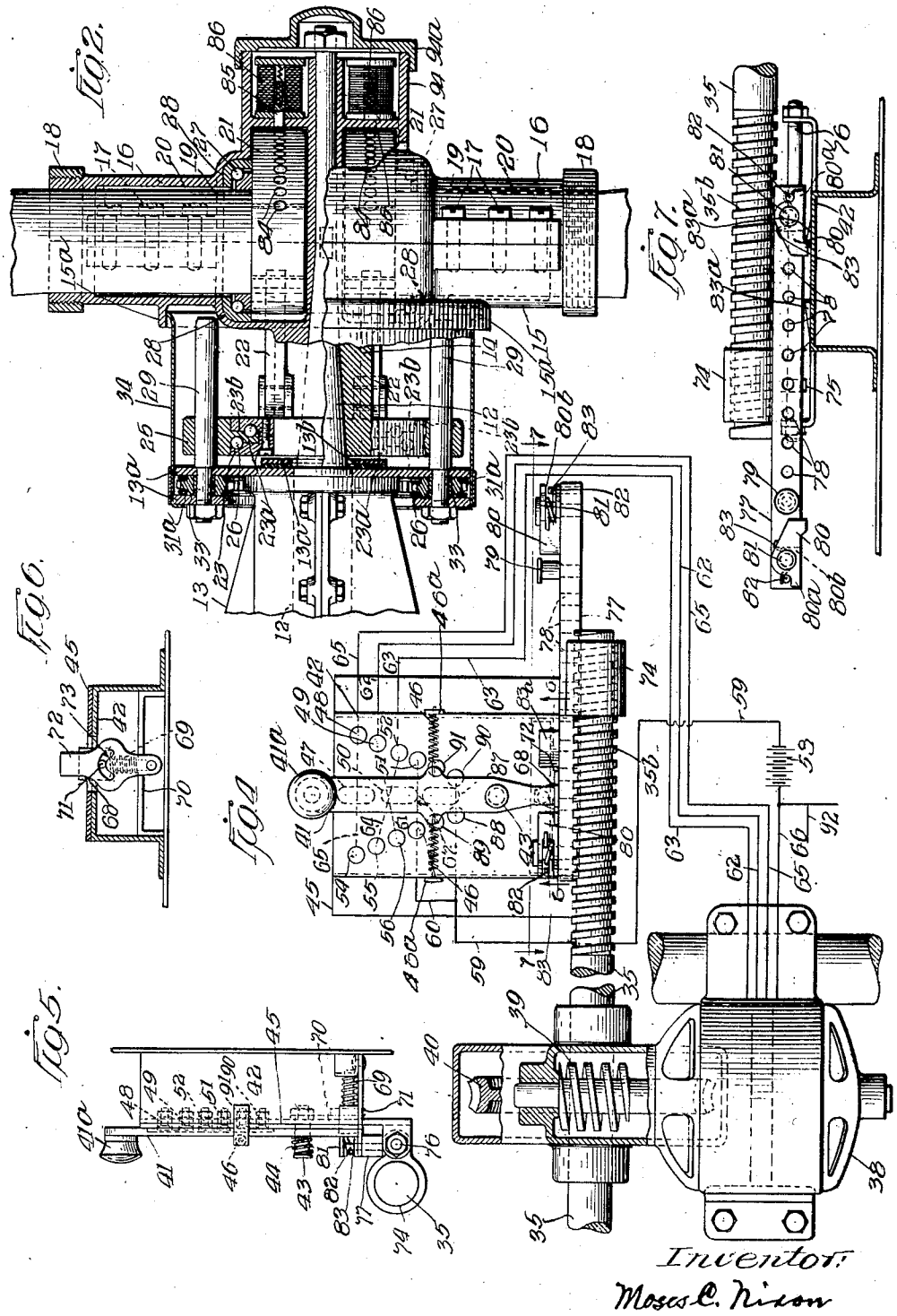
Fig. 9.

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PROPELLER APPARATUS

Filed July 14, 1930 2 Sheets-Sheet 2



Inventor:
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Patented May 10, 1932 1,857,392

UNITED STATES PATENT OFFICE

MOSES C. NIXON, OF CHICAGO, ILLINOIS

PROPELLER APPARATUS

Application filed July 14, 1930. Serial No. 467,767.

My invention relates to improvements in propeller apparatus, particularly adapted for aeroplanes, hydroplanes and other aircraft, and may be used in connection with other vehicles:

In my Patent 1,661,632, issued March 6, 1928, I have described and claimed certain means for shifting the propeller blade about its axis. My present invention aims to provide an improved means for effecting the desired shifting of the propeller blade.

A further object of my invention is to provide means for shifting the propeller blade as aforesaid which means is operated preferably by a reversible electric motor which may be placed in any desired position but which may be controlled by switching mechanism convenient to the pilot; or by any other suitable means.

It is a further object of my invention to provide an arrangement by which current to the electric motor will be automatically cut off upon the propeller blade being shifted to the desired predetermined position.

I contemplate employing suitable electrically operated means for releasing the propeller blade when locked in any one of its several positions of adjustment. It is another object of my invention to provide improved means for controlling the flow of current to the electric motor and to the propeller blade locking mechanism which is so arranged that the blade locking mechanism is released upon flow of current to the motor and upon the blade reaching the predetermined position of adjustment flow of current to the motor will be automatically cut off and the locking mechanism for the propeller blade will be automatically and simultaneously made effective.

Other objects of my invention will appear from the following description of certain preferred embodiments illustrated in the accompanying drawings in which—

Fig. 1 is a plan view of a fragmentary portion of an aeroplane equipped with my improvements, certain of the parts being in section to better show the construction;

Fig. 2 is a longitudinal view partly in section taken along the line 2—2 of Fig. 1;

Fig. 3 is a transverse sectional view on the line 3—3 of Fig. 1;

Fig. 4 is a view on an enlarged scale showing the motor employed for shifting the propeller blade about its axis and showing also the switch mechanism for controlling the flow of current to the motor and the magnets;

Fig. 5 is a side elevational view of the switch mechanism shown in Fig. 4;

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 4;

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 4, with certain parts omitted.

Fig. 8 is a detail view of hand operated means which may be employed in lieu of the electric motor; and

Fig. 9 is a sectional view on the line 9—9 of Fig. 8.

Like characters of reference designate like parts in the several views and referring to Figs. 1 and 2 of the drawings, it will be seen that the driving shaft 12 of the motor, that extends from the motor incasement 13 carries a hub 14 and secured to the hub 14 or integral therewith is a member 15, and another member 16 is rigidly secured thereto in any suitable manner, as by bolts or screws 17 and bands 18, the latter being pitch threaded on the ends of members 15 and 16, thus forming a rigid supporting incasement for the butt ends 19 of the propeller blades and associate parts. The butt ends 19 of the respective propeller blades are journaled in oppositely disposed sockets 20 of the supporting incasement.

Each propeller blade is provided with a segment 21 rigidly secured to it, and each segment is pivotally connected to one end of a link 22, the other end of which is also pivotally connected to a disc shaped member 23 which is slidable longitudinally with respect to the hub and is forced to rotate therewith by a key 24 carried by the hub 14. The member 23 is of two parts which may be secured together in any suitable manner, as by screws 23*a* and form a circumferential groove 23*b*. A collar or non-rotatable member 25 encircles the disc member 23 and is provided with an inwardly extending circumferential rib or tongue that extends into the groove 23*b*.

In the construction shown and described the rotatable disc member may be considered as one part while the collar member 25 which surrounds it may be considered as the other part and they may be considered either separately or as a unit. To prevent excessive friction and wear between the co-engaging parts and to provide for easy turning of the rotatable member 23 with respect to the non-rotatable member 25 I have provided anti-friction means, for example, ball bearings 26, in race-ways formed in the opposite sides of the circumferential rib carried by the non-rotatable member 25 and partly in the adjacent surfaces of the groove 23*b* of the rotatable member 23 thereby providing anti-friction means to receive the thrust when members 23 and 25 are moved longitudinally with respect to the hub 14 in either direction. The propeller blades are also provided with radial ball bearings 27 surrounding the hubs 19 of the propeller blades and inside the incasement formed by members 15 and 16, these latter bearings serve also as thrust bearings between the rims 21*a*, of which segments 21 form a part, and shoulders 28 of the incasement to receive the thrust incident to centrifugal force when the propeller is driven at high speed.

Enlarged plates 13*a* carried by the motor incasement 13 carries a pair of stationary guide pins 29, which project through openings provided in the collar 25, thereby holding the collar against rotation relative to the disc member 23. From the foregoing description it will be obvious that upon shifting the collar member longitudinally with respect to the hub 14 the disc member 23 will be correspondingly shifted and due to links 22 and segments 21 attached to the propeller blades, which are journaled in their respective sockets 20, will cause the propeller blades to be shifted about their respective axes.

The means for shifting the collar 25 includes a pair of stub shafts 30 which are journaled at one end in suitable bearings provided in connection with the enlarged plates 13*a*. The shafts 30 are threaded and extend through threaded openings provided in the collar 25. The shafts 30 have sprockets 31 fixed to them over which an endless chain 32 operates, the chain 32 also operates over idling sprockets 31*a* carried by the pins 29; upon the pins 29 and within each of the sprockets 31*a* is a tube 33 as spreaders to prevent the plates 13*a* being drawn toward each other and pinching the sprockets and to assure free turning movement of the latter. Turning movement imparted to one of the shafts 30, therefore, imparts a similar turning movement to the other shaft 30, thus serving to insure smooth longitudinal movement of the members 23 and 25 with respect to the hub 14.

To protect the links 22, members 23 and 25, stub shafts 30, sprockets 31 and 31*a*, chain 32 and other parts from exposure a housing 34 of cylindrical form is provided, which is rigidly secured, as by a band 34*a* and bolt 34*b*, to the enlarged plates 13*a*; the forward end of this housing is turned outwardly but within the rotating rim 15*a* which rotates around it, and as the vehicle moves forward prevents snow, rain, etc., from entering the housing. For convenience of assembling this housing may be made in two parts, the upper portion extending down over the lower part at 34*c* to provide storm proof protection.

Power for turning the stub-shafts 30 is supplied through a transmission element including shaft 35, which is journaled in suitable bearings carried by the main frame 36 of the structure. As shown in Fig. 1, the shaft 35 is directly connected with one of the stub-shafts 30 by means of universal connections 37 and shaft part 35*a*. This transmission element consisting of stub shaft 30, shaft 35 and parts 35*a* and 35*b* with their connections will be designated in some of the claims as a shaft. I prefer to employ power means for driving the shaft 35, one form being a reversible electric motor 38, being operatively connected with the shaft 35 by means of the worm 39 and gear 40.

The means for controlling the power means can include a three-position means of suitable construction. For example the flow of current to the motor 38 and the magnets 86 can be controlled by a switch lever 41 pivoted on a supporting member 42 by bolt 43, a spring 44 being provided between the lever and the head of the bolt. The lever 41 is insulated by a sheet of insulation 45 provided on the supporting member 42 under said lever.

In Fig. 4 the lever 41 is shown in its central or neutral position, it being held in such position by springs 46 each having one end attached to the lever and the other end is attached to a bracket 46*a* carried by the supporting member 42. As viewed in Fig. 4, when the lever 41 is moved to the right its contact plate 47 bridges the contact buttons 48 and 49 and its contact plate 50 bridges the contact buttons 51 and 52 which causes current to flow through the armature of the motor in one direction; and when the lever 41 is moved to the left its contact plate 47 bridges the contact buttons 54 and 55 and its contact plate 50 bridges the contact buttons 56 and 57 which causes the current to flow through the armature of the motor in the opposite direction.

The manner in which the flow of current through the motor is controlled will now be described: Assuming the lever 41 is moved to the left, (as viewed in Fig. 4) current will flow from the battery 58 through wire 59, wire 60, contact button 57, contact plate 50, contact button 56, wire 61, contact button 49, wire 62 through the armature of the motor

(not shown) back through wire 63, contact button 52, wire 64, contact button 55, contact plate 47, contact button 54, wire 65 through the field (not shown) of the motor and then wire 66 to the battery. To reverse the motor, the direction in which the current flows through its armature is reversed and in order to accomplish this the lever 41 is moved to the right-hand position. When lever 41 is in its right-hand position current flows as follows: from battery 58 through wire 59, wire 60, contact button 51, contact plate 50, contact button 52, wire 63 through the armature of the motor, wire 62, contact button 49, contact plate 47, contact button 48, wire 65 through the field of the motor and back through wire 66 to the battery.

The lever 41 may be locked in either the right or left hand position by means of a plunger 68 which projects through an opening in the supporting member 42 into the path of the lower end of the lever 41. The plunger is provided with a spring 69 about its stem and between its head and cross-bar 70. Movement of the plunger 68 is limited by a pin 71 (see Fig. 5) one end of which is adapted to bear against the supporting member 42. When the lever 41 is in its neutral position its lower end extends over the plunger 68. Upon swinging the lever 41 to one side or the other its lower end moves off the plunger 68 and the latter thereupon projects into the path of the lever and locks the lever in the desired position.

The means for automatically releasing the lever 41 so that it may return to its neutral position includes an arm 72 which is pivoted to the bracket 70, and is provided with a cam which receives the projecting end of the pin 71, the arrangement being such that upon swinging the arm 72 the plunger 68 is thereupon withdrawn from the path of the projecting end of the lever 41 and thereby releases the lever. The means for automatically swinging the arm 72 includes nut member 74 which has engagement with the threaded portion 35*b* of the shaft 35. The member 74 is provided with an arm 75 which straddles or surrounds a stationary rod 76 thereby preventing the member 74 from turning with the shaft 35. The member 74 carries a bar 77 which is provided with a plurality of apertures or sockets 78, any one of which is adapted to receive a plug member 79. The parts are so arranged that upon rotation of the shaft 35 the bar 77 moves forwardly or rearwardly, depending upon the direction of rotation of the shaft 35 and carries with it the member 79, which member 79 in due time engages the upper end of arm 72 thereby pushing it over to one side which, as before pointed out, causes the plunger 68 to be withdrawn from the path of the lower end of the switch lever 41 thereby unlocking it; upon being released the lever 41 moves to its neutral position which of course cuts off the flow of current to the motor and magnets.

In order to prevent the mechanism described for shifting the propeller blades from being damaged by the possible movement of the switch lever 41 in the wrong direction when the propeller blades are in one extreme position or the other, I preferably provide safety means to lock the switch lever against movement that would carry the propeller blades beyond the intended limit of their movement. The safety means for accomplishing said result is automatic in its operation and includes a pair of pawls 80 attached to one side of the bar 77. Each pawl is pivoted on a pin 81 which is carried by the bar 77, movement of the pawl being limited by the heel portion 80*a* thereof bearing against a stop pin 82 carried by the bar 77. Each pawl is provided with a slot 80*b* adapted to receive a spring 83 which is coiled about the pin 82, one end of the spring bearing on the pawl and the other end bearing against the stop pin 82 whereby the pawl is normally maintained in the position shown in Fig. 7 with its heel portion bearing against the side of the stop pin 82. The supporting member 42 carries two cam portions 83*a* over which the respective pawls ride when the bar 77 moves in one direction from the other.

The arrangement just described is such that, assuming the parts are in the position shown in Fig. 4, but with the switch lever moved to the left so that the contacts will be bridged and that current is supplied to the motor 38 so as to cause it to rotate in a direction to move the bar 77 to the left, with the plug 79 in the last right-hand hole of the bar 77 permitting the propeller blades to be shifted to the extreme limit of adjustment in one direction, the plug 79 finally engaging the free end of the arm 72 which causes the arm to be pushed to one side thereby withdrawing the spring pressed locking plunger 68 from the path of the lower end of the switch lever 41 and thus permitting the switch lever 41 to return to its neutral position under the influence of the springs 46. As the plug 79 approaches the arm 72 the pawl 80 rides the corresponding cam 83*a* and lower end of the switch lever 41 and when the switch lever is moved the pawl moves in between it and the cam 83*a* and directly in the path of the lower end of the switch lever 41 and when in such position it is impossible for the pilot to move the switch lever 41 to the left sufficiently to bridge the left-hand contacts. It will be obvious, however, that the switch lever 41 may be swung to the right so as to bridge the contacts on the right, which as before explained reverses the motor thereby causing the bar 77 to travel to the right as viewed in Fig. 4 and in such case the sloping surface on the under side of the right-hand pawl 80 permits the pawl to ride backwardly over the cam

83*a*. Movement of the bar 77 to the right with the plug 79 in the last hole in the left-hand end of the bar obviously will trip the switch lever 41 so that it will be swung to its neutral position and the left pawl 80 serves to prevent the switch lever 41 from again bridging the right-hand contacts thereby automatically preventing movement of the blades on their axes beyond the intended limit of their movement.

The means employed for locking the propeller blades in the desired predetermined position of adjustment is preferably similar to that shown in my aforesaid prior patent. As shown in Figs. 1 and 2, the segments 21 are each provided with a plurality of sockets or apertures 84 which are adapted to receive spring pressed plungers 85, that are controlled by an electro-magnet 86, the arrangement being such that when the magnets 86 are deenergized the plungers 85 lock the blades against turning on their axes but when the magnets are energized the plungers are withdrawn and the blades are unlocked. The locking mechanism for the blades is preferably controlled automatically by the switch lever 41. It will be noted that the lever 41 carries a contact plate 87 which bridges the contact buttons 88 and 89 when the lever 41 is moved to the left, the contact plate bridges the contact buttons 90 and 91 when the lever is moved to the right. The wiring arrangement is such that when either buttons 88 and 89 or 90 and 91 are bridged the circuit controlling the electro-magnets 86 is closed whereupon the plungers 85 are withdrawn.

The bar 77 is provided with sockets for the plug 79 equal in number to the apertures 84 provided in the segments 21. By choosing the socket of the bar 77 in which the plug 79 is to be inserted the pilot predetermines the extent to which the propeller blades will be shifted on their axes. It is thus obvious that the location of the plug 79 in the bar 77 serves as a means for indicating to the pilot the pitch or position to which the propeller blades have been shifted.

The wiring arrangement for the electro-magnets 86 will now be described: A conductor 92 connects the battery to the ring-plate 13*b* which is secured in any suitable manner to one of the enlarged plates 13*a* and is insulated therefrom by an insulating ring-plate 13*c*. The hub 14 is longitudinally apertured with an insulating tube 14*a* therein, and in this tube is a spring-pressed brush 92*a* having contact with the ring-plate 13*b*; connected with this brush and leading through said aperture and secured to one terminal of each electro-magnet is a conductor 93, the other terminal of the magnets being grounded to either the housing 94 or the cap 94*a*. The contact buttons 89 and 91 are each grounded to the frame-work and when the lever 41 is in neutral position the circuits for the magnets 86 are open, in which case the magnets are of course, de-energized and the plungers 85 thereof are free to act under their respective springs. Upon moving the lever 41 to the left, for example, current will flow from the battery 58 through wire 59, contact button 88, contact plate 87, contact button 89 through the grounds, magnets 86, conductor 93, brush 92*a*, ring-plate 13*b* and conductor 92 to the battery. Current flows in a similar manner when the lever 41 is in its right-hand position in which case current flows through conductor 59 to the button 90, contact plate 87, contact button 91, the grounds, to the magnets, etc.

The means for controlling the flow of current to the motor and magnets shown in Fig. 4 is positioned against the wall of the ship, with the free end of the switch lever 41 extending upward to bring the knob 41*a* and the plug 79 within convenient reach of the pilot that they may be manipulated without moving from his seat, but the motor and battery may be placed as convenience dictates.

In Figs. 8 and 9 I have illustrated means whereby the shaft 35 may be rotated by hand, said means comprising a crank 38*a* fixed on a shaft 95 which carries a gear 39*a* in mesh with a gear 40*a* carried by the shaft 35. In said hand operated mechanism means similar to that described in my aforesaid patent may be employed for releasing the propeller blade locking mechanism.

In connection with said hand operated mechanism I preferably provide means whereby the pilot may know the extent to which the propeller blades have been shifted on their axes. Said indicating means including a nut member 97 carrying a pointer 97*a* which operates over a scale 98. The means for preventing the member 97 from rotating with the shaft 35 is similar to that heretofore described.

While I have illustrated and described certain preferred embodiments of the invention I do not wish to be limited to the particular construction shown and described, except only so far as the claims may be limited by the prior art.

I claim:—

1. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and mounted so that it may be adjusted about its longitudinal axis, a rotatable member slidably mounted with respect to the shaft and operatively connected with said blade for shifting the position of the latter about its axis, a non-rotatable member operatively connected with the rotatable member, stationary guides slidably engaged by the non-rotatable member and operating means having threaded connection with said non-rotatable member for shifting said members for the purpose specified.

2. In a propeller apparatus, the combina-

tion of a driving shaft, a propeller blade carried by said shaft and mounted so it may be adjusted about its longitudinal axis, a rotatable member slidably mounted with respect to the shaft and operatively connected with said blade for shifting the position of the latter about its axis, a non-rotatable member operatively connected with the rotatable member, guide means fixedly supported and extending through the non-rotatable member, a plurality of stub shafts having threaded engagement with said non-rotatable member, and means for simultaneously driving said stub-shafts.

3. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and mounted so that it may be adjusted about its longitudinal axis, a disc member slidably mounted with respect to said shaft and operatively connected with said blade for shifting the position of the latter about its axis, a collar member encircling said disc member and slidably mounted on rigidly supported members, a plurality of stub-shafts having threaded engagement with the collar member, and means for simultaneously driving said stub-shafts.

4. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and mounted so that it may be adjusted about its longitudinal axis, a disc member carried by and slidable longitudinally with respect to said shaft and operatively connected with said blade for shifting the position of the latter about its axis, a non-rotatable member encircling the disc member, guides fixedly supported and extending through said non-rotatable member, a plurality of stub-shafts having threaded engagement with said non-rotatable member, and means for simultaneously driving said stub shafts.

5. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and mounted so that it may be adjusted about its longitudinal axis, a disc member slidably mounted on said shaft and operatively connected with said blade for shifting the position of the latter about its axis, a collar member encircling said disc member and slidably mounted on rigidly supported guides, a plurality of stub-shafts having threaded engagement with said collar, sprockets carried by said stub-shafts, an endless chain operating over said sprockets, and operating means connected to one of said stub-shafts.

6. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and mounted so that it may be adjusted about its longitudinal axis, a disc member slidably mounted with respect to the shaft and operatively connected with said blade for shifting the position of the latter about its axis, a member non-rotatable with respect to the disc-member, and operating means for shifting the non-rotatable member including a shaft having two threaded portions one of which portions engages the last named member, the other threaded portion working through a non-rotatable member which carries a device adapted to indicate to the pilot the extent to which the propeller blade is shifted about its axis.

7. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and mounted so that it may be adjusted about its longitudinal axis, a disc member slidably mounted with respect to the shaft and operatively connected with said blade for shifting the position of the latter about its axis, a member encircling and non-rotatable with respect to the disc member, and operating means for shifting said member including a shaft having a threaded portion engaging the non-rotatable member and a reversible motor operatively connected with said last named shaft for driving it in either direction.

8. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and mounted so that it may be adjusted about its longitudinal axis, a rotatable member slidably mounted with respect to the shaft and operatively connected with said blade for shifting the position of the latter about its axis, a member non-rotatable with respect to the first named member, and operating means for said members including a shaft having threaded engagement with said non-rotatable member for shifting said members, a motor for driving said last named shaft, and automatic means for stopping the motor upon the propeller blade reaching a predetermined position of adjustment.

9. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and mounted so that it may be adjusted about its longitudinal axis, a disc member slidably mounted with respect to the shaft and operatively connected with said blade for shifting the latter about its axis, a member non-rotatable with respect to the disc member, a driving shaft having threaded engagement with the non-rotatable member for shifting said members, a reversible electric motor connected with said last named shaft, a three position switch for controlling current to said motor, means for normally maintaining the switch in neutral position, means for securing the switch in either of its other two positions, and means for automatically releasing the switch upon the propeller blade reaching the predetermined position of adjustment.

10. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and mounted so that it may be adjusted about its longitudinal axis,

a disc member slidably mounted with respect to the shaft and operatively connected with said blade for shifting the latter about its axis, a member non-rotatable with respect to the disc member, a driving shaft having threaded engagement with said non-rotatable member for shifting the latter, a reversible electric motor connected with said last named shaft, a spring pressed plunger for locking the propeller blade in the desired position of adjustment, an electro-magnet for withdrawing said plunger, a three position switch for controlling the current to said motor and said electro-magnet, means for normally maintaining the switch in neutral position, means for securing the switch in either of its other two positions, and means for automatically releasing the switch upon the propeller blade reaching the predetermined position of adjustment and for de-energizing the electro-magnet thereby permitting the spring pressed plunger to lock the blade in the position to which it has been adjusted.

11. In a propeller apparatus, having propeller blades shiftable in either direction on their axes by means including a reversible electric motor, the combination of a three position switch for controlling the current to said motor, means for normally maintaining the switch in its neutral position, means for securing the switch in either of its other two positions, and means for automatically releasing the switch so that it may return to its neutral position upon the propeller blades reaching their predetermined position of adjustment.

12. In a propeller apparatus having propeller blades shiftable in either direction about their longitudinal axes by means including a reversible electric motor, the combination of spring pressed plungers for locking the propeller blades in the desired positions of adjustment, electro-magnets for withdrawing said respective plungers, a three position switch for controlling the current to said motor and to said electro-magnets, means for normally maintaining the switch in its neutral position, means for securing the switch in either of its other two positions, and means for automatically releasing the switch upon the propeller blades reaching the predetermined position of adjustment and for de-energizing the electro-magnets thereby permitting the spring pressed plungers to lock the respective blades in the position to which they have been adjusted.

13. In a propeller apparatus having propeller blades shiftable in either direction on their axes by means including a reversible electric motor, the combination of a three position switch for controlling the current to the motor, means for normally maintaining the switch in its neutral position, means for securing the switch in either of its other two positions, means for automatically releasing the switch upon the propeller blades reaching the predetermined position of adjustment, and means for automatically securing said switch against movement that would cause the motor to carry the propeller blade beyond said predetermined position of adjustment.

14. In a propeller apparatus having propeller blades shiftable in either direction on their longitudinal axes by means including a reversible electric motor, the combination of a three position switch for controlling the current to said motor, means for normally maintaining the switch in its neutral position, means for securing the switch in either of its other two positions, a movable bar carrying means for automatically releasing the switch upon the propeller blade reaching the predetermined position of adjustment and means carried by said bar for automatically securing the switch against movement that would cause the motor to carry the propeller blades beyond the predetermined position of adjustment.

15. In a propeller apparatus having propeller blades shiftable in either direction about their longitudinal axes by means including a reversible electric motor, a three position switch for controlling the current to said motor, means for normally maintaining the switch in neutral position, spring pressed locking means adapted to hold the switch in either of its other two positions, a moving bar carrying means to trip said switch locking means when the propeller blades reach the predetermined position of adjustment, and a member carried by said moving bar which automatically moves into position to prevent moving the switch lever in a position to cause the motor to carry the propeller blades beyond the predetermined position of adjustment.

16. In a propeller apparatus, the combination of a driving shaft, a blade carried by said shaft and mounted so it may be adjusted about its longitudinal axis, power means operatively connected with said blade for shifting the latter about its said axis, and indicating means comprising a rotatable member connected with said blade and having a threaded portion working through a non-rotatable member which carries a device adapted to indicate the extent to which said blade is shifted about its axis.

17. In a propeller apparatus having propeller blades shiftable in either direction on their axes, the combination of power means for shifting said blades, a three position switch for controlling the operation of said power means, means for normally maintaining the switch in its neutral position, means for securing the switch in either of its other two positions, and means for automatically releasing the switch so that it may return to its neutral position upon the propeller

blades reaching the predetermined position of adjustment.

18. In a propeller apparatus having propeller blades shiftable in either direction on their axes, the combination of power means for shifting said blades, a three position switch for controlling the operation of said power means for normally maintaining the switch in its neutral position, means for securing the switch in either of its other two positions, means for automatically releasing the switch upon the propeller blades reaching the predetermined position of adjustment, and means for automatically securing said switch against movement that would cause the power means to carry the propeller blades beyond said predetermined position of adjustment.

19. In a propeller apparatus, the combination of a driving shaft, an axially adjustable propeller blade carried thereby, a single shaft having spaced threaded portions, means actuated by one of said portions for adjusting the blade, a non-rotatable member mounted for sliding movement and carried and actuated by the other threaded portion, and an indicator carried thereby.

20. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and mounted so that it may be adjusted about its longitudinal axis, a reversible electric motor, means actuated thereby for changing the pitch of the blade, a three-position switch for controlling current to said motor, means for normally maintaining the switch in neutral position, means for securing the switch in either of its other two positions, and means for automatically releasing the switch upon the propeller blade reaching the predetermined position of adjustment.

21. In a propeller apparatus the combination of propeller blades shiftable in either direction about their longitudinal axes by means including a reversible mechanism, the combination of spring-pressed plungers for locking the propeller blades in the desired position of adjustment, electro-magnets for withdrawing said respective plungers, a three-position element for controlling the reversible mechanism and the electro-magnets, means for normally maintaining said element in a neutral position, means for securing said element upon the propeller blades reaching the predetermined position of adjustment and for deenergizing the electro-magnets, thereby permitting the spring-pressed plungers to lock the respective blades in the positions to which they have been adjusted.

22. In a propeller apparatus, the combination of a driving shaft, a blade carried by said shaft and mounted so it may be adjusted about its longitudinal axis, power means operatively connected with said blade for shifting the latter about its said axis, and controlling means normally in neutral position and shiftable for adjusting position of the blade in either direction by the power means.

23. In a propeller apparatus, the combination of propeller blades shiftable in either direction on their axes, the combination of power means for shifting said blades, a three-position controlling element for controlling the operation of said power means, means for normally maintaining the controlling element in neutral or one of said positions, means for securing the controlling element in either of its other two positions, and means for automatically releasing the controlling element so that it may return to its neutral position upon the propeller blades reaching the predetermined position of adjustment.

24. In a propeller apparatus, the combination of propeller blades shiftable in either direction of their axes, the combination of power means for shifting said blades, a three-position controlling element for controlling the operation of said power means for normally maintaining the controlling element in its neutral position, means for securing the controlling element in either of its other two positions, means for automatically releasing the controlling element upon the propeller blades reaching the predetermined position of adjustment, and means for automatically securing said controlling element against movement that would cause the power means to carry the propeller blades beyond said predetermined position of adjustment.

25. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried thereby for angular adjustment about its longitudinal axis, a rotatable member slidably mounted relative to the shaft and operatively connected with the blade for shifting the blade about its axis, guide pins fixedly mounted, a non-rotatable member slidably mounted on the pins and operatively connected with the rotatable member, screw-threaded shafts engaging the non-rotatable member and parallel with the guide pins and means for rotating the shafts to feed the non-rotatable member along the guide pins.

26. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried thereby for angular adjustment about its longitudinal axis, a rotatable member slidably mounted relative to the shaft and operatively connected with the blade for shifting the blade about its axis, guide pins fixedly mounted, a non-rotatable member slidably mounted on the pins and operatively connected with the rotatable member and parallel with the guide pins, sprockets rotatable with the shafts, idler sprockets carried by the pins, a driving connection between all of the sprockets, and operating means connected to one of the shafts.

27. In a propeller apparatus, the combination of a propeller blade shiftable in either

direction about its longitudinal axis, the combination of power means for shifting said blade, a three-position controlling mechanism for controlling the operation of said power means, means for normally maintaining the controlling mechanism in neutral position, means for securing the controlling mechanism in one of its operative positions for effecting a shifting of the blade in one direction, and means for securing the controlling mechanism in its other operative position for effecting a shifting of the blade in the other direction.

28. In a propeller apparatus having propeller blades shiftable in either direction about their longitudinal axes by mechanism including power means, the combination of a three-position controlling element, means for normally maintaining the controlling element in central position, means for securing the controlling element in either of its other two positions, and means for automatically releasing the controlling element so that it may return to its neutral position upon the propeller blades reaching their predetermined position of adjustment.

29. In a propeller apparatus having propeller blades shiftable in either direction about their longitudinal axes by mechanism including power means, the combination of spring-pressed plungers for locking the propeller blades in adjusted position, electromagnets for withdrawing said respective plungers, three position means for controlling said power means and the current to the electro-magnets, means for normally maintaining the controlling means in central position, means for securing the controlling means in either of its other two positions, and means for automatically releasing the controlling means upon the propeller blades reaching the predetermined position of adjustment and for de-energizing the electromagnets thereby permitting the spring-pressed plungers to lock the respective blades in the position to which they have been adjusted.

30. In a propeller apparatus having propeller blades shiftable in either direction on their axes by means including power means, the combination of three-position controlling means for normally maintaining the controlling means in neutral position, means for maintaining the controlling means in either of the other two positions, means for automatically releasing the controlling means upon the propeller blades reaching the predetermined position of adjustment, and means for automatically securing said controlling means against movement that would cause the power means to carry the propeller blades beyond said predetermined position of adjustment.

31. In a propeller apparatus having propeller blades shiftable in either direction on their longitudinal axes by means including power means, the combination of three position means for controlling said power means, means for normally maintaining the controlling means in neutral position, means for maintaining the controlling means in either of two other positions, a movable element carrying means for automatically releasing the controlling means upon the propeller blade reaching the predetermined position of adjustment, and means carried by said element for automatically securing the controlling means against movement that would cause the power means to carry the propeller blades beyond the predetermined position of adjustment.

32. In a propeller apparatus having propeller blades shiftable in either direction about their longitudinal axes by means including power means, three position means for controlling said power means, means for normally maintaining the controlling means in neutral position, spring-pressed locking means adapted to hold the controlling means in either of two other positions, a moving element carrying means to trip said locking means when the propeller blades reach the predetermined position of adjustment, and a member carried by said moving element which moves into position to prevent moving the controlling means in a position to cause the power to carry the propeller blades beyond the predetermined position of adjustment.

33. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and mounted so it may be adjusted about its longitudinal axis, rotatable means operatively connected with said blade for shifting the latter in either direction about its said axis and having a threaded portion, a non-rotatable member carried by said rotatable means and mounted for sliding movement and actuated by said threaded portion, and an indicator carried by the non-rotatable member for indicating the position of said blade.

34. In a propeller apparatus having propeller blades shiftable in either direction about their longitudinal axes by mechanism including power means, the combination of three-position controlling means, means for normally maintaining the controlling means in neutral position, means for securing the controlling means in either of two other positions, and means for automatically releasing the controlling means so as to return to neutral position upon the propeller blades reaching their predetermined position of adjustment.

35. In a propeller apparatus, the combination of a driving shaft, a blade carried by said shaft and mounted so it may be adjusted about its longitudinal axis, power means operatively connected with said blade for shift-

ing the latter about its said axis, and indicating means comprising a rotatable member connected with said blade and having a threaded portion operatively engaging a non-rotatable member which carries a device adapted to indicate the extent to which said blade is shifted about its axis.

36. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and shiftable in either direction about its longitudinal axis, power means for shifting the propeller blade, means for locking the propeller blade in adjusted position, a three-position controlling mechanism for controlling the position of said power means and for releasing said locking means, means for normally maintaining the controlling mechanism in neutral position, means for securing the controlling mechanism in one of its operative positions for effecting release of said locking means and shifting the blade in one direction, and means for securing the controlling mechanism in the other position for effecting a shifting of the blade in the other direction.

37. In a propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and shiftable in either direction about its longitudinal axis, power means for shifting the propeller blade, means for locking the propeller blade in adjusted position, electrically operated means for releasing said locking means, a three-position controlling mechanism for controlling the operation of said power means and for closing the electric circuit for releasing said locking means, means for normally maintaining the controlling mechanism in neutral position, means for securing the controlling mechanism in one of its operative positions for effecting a shifting of the blade in one direction, and means for securing the controlling mechanism in its other position for effecting a shifting of the blade in the other direction.

38. In a propeller apparatus, the combination of a driving shaft carrying a propeller blade shiftable in either direction about its longitudinal axis, power means for shifting said blade, means for locking said blade in adjusted position, a three-position means for controlling said power means and releasing the locking means, means for normally maintaining the controlling means in neutral position, means for securing the controlling means in one of its other positions for effecting unlocking of and shifting the blade in one direction, and means for securing the controlling means in another position for effecting the unlocking of and shifting said blade in the other direction, and means for automatically stopping adjustment of the blade when it reaches its predetermined position of adjustment.

39. Propeller apparatus, the combination of a driving shaft, a propeller blade carried by said shaft and mounted so it may be adjusted about its longitudinal axis, power means operatively connected with said blade for shifting the latter about its said axis, and indicating means including a rotatable member and a non-rotatable member, said rotatable member being driven by said power means and adapted to impart a sliding movement to the non-rotatable member to indicate to the pilot the angular position of said blade.

40. Propeller apparatus including propeller blades, power means for shifting the blades in either direction about their longitudinal axes, means shiftable into either of three positions for controlling the power means, said controlling means being shiftable into either of two of said positions for shifting said blades into the desired position of adjustment.

41. Propeller apparatus including propeller blades, power means for shifting the blades in either direction about their longitudinal axes, means having three positions including neutral, for controlling said power means, means for normally maintaining the controlling means in neutral position, automatic means adapted to hold the controlling means in either of two other positions, a moving element, means thereon for tripping said automatic means when the propeller blades reach the predetermined position of adjustment, and a member carried by said moving element into position to prevent moving the controlling means into position as to cause the power to carry the propeller blades beyond the predetermined position of adjustment.

42. Propeller apparatus including propeller blades, power means for shifting the blades in either direction about their longitudinal axes, means shiftable into either of three positions, including neutral, for controlling the power means, means normally maintaining the controlling means in neutral position, means for maintaining the controlling means in either of the other two positions, means for releasing the controlling means upon the propeller blades reaching the predetermined position of adjustment, and automatic means for securing the controlling means against movement that would cause the power means to carry the propeller blades beyond the predetermined position of adjustment.

43. Propeller apparatus including propeller blades, power means for shifting the blades in either direction about their longitudinal axes, three position means, including a neutral position, for controlling said power means, means for normally maintaining the controlling means in neutral position, means for shifting the controlling means into either of its other two positions for adjusting said blades about their said axes in either direc-

tion, a movable element adapted to release the controlling means when the propeller blades reach the predetermined position of adjustment, and means to prevent moving the controlling means into position that would cause the power means to carry the propeller blades beyond the predetermined position of adjustment.

44. Propeller apparatus including propeller blades, power means for shifting the blades in either direction about their longitudinal axes, shiftable means for controlling the shifting of said blades about their said axes in either direction, means for predetermining the extent of shifting of said blades, and means to prevent moving the controlling means into position that would cause the power means to carry the propeller blades beyond the predetermined position of adjustment.

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