April 18, 1950 E. MARTIN ET AL 2,504,209

REVERSING PROPELLER CONTROL

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Fig. 1

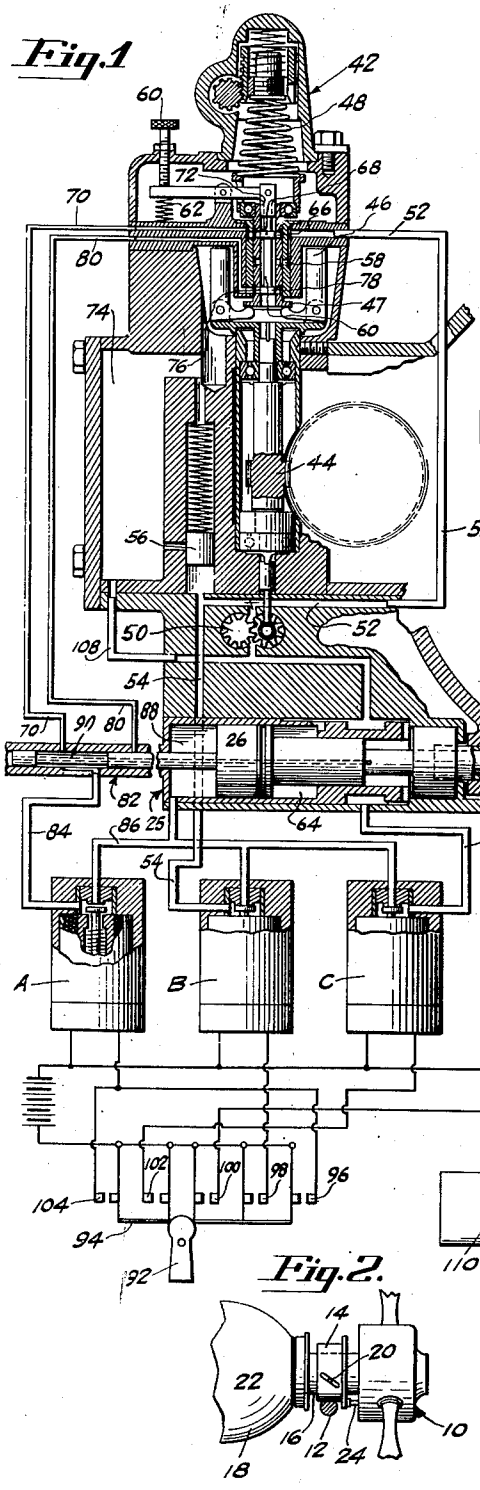


Fig. 3.

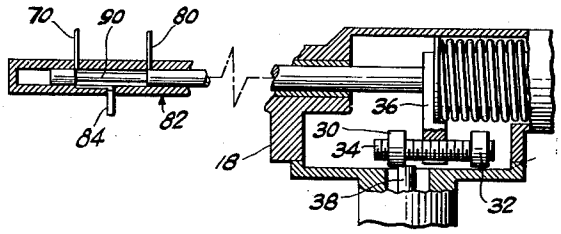


Fig. 4.

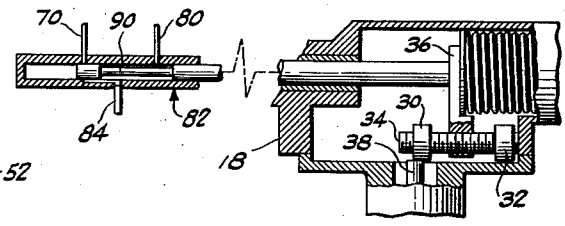


Fig. 5.

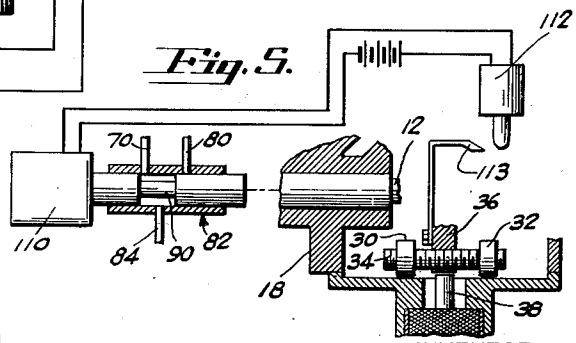


Fig. 2.

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REVERSING PROPELLER CONTROL

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Application January 10, 1944, Serial No. 517,686

23 Claims. (Cl. 170—160.19)

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This invention relates to control mechanism and more particularly to a control for a reversible propeller.

An object of the invention is to control automatically a propeller in its reverse position as well as in its forward position.

A further object is to maintain a constant speed of the propeller in both its forward and reverse positions.

A still further object is to provide mechanism for automatically changing the governor connections so that a single governor may control the propeller in both its forward and reverse positions.

Other objects and advantages will be apparent from the specification and claims, and from the accompanying drawing which illustrates what is now considered to be a preferred embodiment of the invention.

In the drawing:

Fig. 1 is a partially schematic vertical section through the governor and the control mechanism.

Fig. 2 is a schematic elevation of the propeller showing the connection of the control mechanism therewith.

Fig. 3 is a detail showing the pitch changing mechanism in contact with the low pitch stop.

Fig. 4 is a detail showing the pitch changing mechanism in reverse pitch position, and

Fig. 5 is a modification showing electrical means for operating the reversing valve.

Referring to Fig. 2, this invention relates to the control of a reversible pitch propeller generally indicated at 10 having a pitch changing rod 12 which has a definite and different position for each propeller pitch position. Although this invention is applicable to any propeller having a pitch changing mechanism positioned in accordance with the propeller pitch, it has been shown in connection with a reversible pitch propeller of the type forming the subject matter of Anderson application Serial No. 482,265, now abandoned, to which reference is made for a more detailed description of the propeller itself.

In general, movement of the pitch changing rod 12 will rotate cam 14 about a support 16 mounted on the engine nose 18 of the propeller driving engine. A pin 20 carried by support 16 and coacting with slot 22 in cam 14 will cause the cam to move axially toward and away from the propeller 10 as it is rotated in one direction or the other by movement of rod 12. The axial movement of the cam 14 actuates one part 24 of a follow-up valve, not shown, which, in turn,

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causes a change in propeller pitch in accordance with the movements of part 24. Thus, for each position of the rod 12 there is a corresponding pitch position of the propeller blades.

Referring now to Fig. 1, the rod 12 is actuated in one direction by servo piston 26 of a servomotor, generally indicated at 25, and in the opposite direction by springs 28. One end of rod 12 adjacent the springs 28 carries a pair of pitch limiting stops which will limit the movement of rod 12 and thus determine a low pitch position and a high pitch position for the propeller. As shown in Figs. 1, 3, and 4, these stops comprise nuts 30 and 32 carried on a threaded rod 34 mounted in an arm 36 secured to the end of rod 12. A stop pin 38 normally projects into the path of these nuts to limit the travel of the rod 12. Pin 38 may, however, be retracted by actuation of a solenoid generally indicated at 40 so that the propeller may be placed in either feathered position by allowing nut 32 to pass the pin 38, or in reverse pitch position by allowing the nut 30 to pass the pin 38 as shown in Fig. 4. In practicing this invention, the nut 30 is adjusted so that the low pitch position is the blade position required at zero airspeed at the start of take off. This angle is usually between 15° and 35° at the reference blade station.

The servomotor 25 is controlled by a governor generally indicated at 42 and by three solenoid actuated valves A, B, and C shown in Fig. 1 in their de-energized positions.

The governor is driven from the propeller driving engine through gear 44, by connections not shown, and comprises flyballs 46 acting through valve sleeve 47 against adjustable speeder spring 48. A pump 50 driven with the governor supplies fluid under pressure in lines 52 and 54. The pressure is regulated by a relief valve 56. Line 52 leads the pressure fluid through valve ports 58 to the interior of the valve sleeve 47. The flow of fluid through the valve sleeve 47 is controlled by the relative positions of the valve sleeve 47 and pilot valve 60. As has been previously indicated, the position of valve sleeve 47 is determined by the position of the flyweights 46. The position of pilot valve 60 is determined by adjusting screw 60 and spring 62.

From the above description, it will be seen that when the governor speeds up and flyballs 46 move outward and raise valve sleeve 47, valve port 66 will move upward so that it is no longer covered by land 68 of pilot valve 60 thus opening conduit 70 to drain through passages 72

and by connections, not shown, to the sump 74. At the same time, ports 76 are moved upward so that they are no longer covered by land 78. Conduit 80 is thus connected through port 76 with port 58 and pressure line 52. Slowing down of the governor and the consequent drawing in of the counterweights 46 through the action of spring 48 will connect conduit 70 with pressure line 52 and conduit 80 with drain to sump 74. In the normal operating position of the propeller in the forward pitch position as shown in Fig. 1, conduit 80 is blocked by a valve generally indicated at 82 into which both conduits 70 and 80 lead. Conduit 70 is connected through valve 82 with conduit 84 and through solenoid actuated valve A with conduit 86 and thence with pressure chamber 88 of the servomotor 25. When the governor speeds up and conduit 70 is connected with drain, springs 28 will force servo piston 26 to the left as seen in Fig. 1, the displaced fluid passing through conduit 70 to drain. This movement of the servo piston 26 and of rod 12 will cause an increase in pitch of the propeller blades to thereby increase the load on the engine and restore the engine-propeller speed to the value preselected by the setting of the governor speeder spring. On the other hand, when the governor speed falls below the preselected value, conduit 70 will be connected with the pressure fluid in line 52 and will lead this fluid to servomotor 25 forcing piston 26 to the right as seen in Fig. 1, and thereby causing a decrease in propeller pitch.

The above described operation of the governor, the servo valve, and the propeller is the normal operation when the propeller is in a forward pitch position. When the propeller is placed in a reverse pitch position and placed under control of the governor, it is necessary to move the propeller blades in a direction to increase the negative pitch when the speed is too great which is the exact reverse of the requirements when the propeller is in its forward position.

In order to accomplish this reversal in the relation between the governor and the single acting servomotor, the reversing valve 82 is provided, which at the proper time will block off conduit 70 and connect conduit 80 with the servomotor. As has been indicated above, movements of the flyballs 46 produce exactly opposite results in conduits 70 and 80.

As shown in Fig. 1, valve 82 has a plunger 90 connected with piston 26 to partake of the movements of that piston. As indicated in Fig. 3, the connections of conduits 70, 80, and 84 with valve 82 are arranged so that when the propeller blades are in zero pitch position, plunger 90 is about ready to change the connections so that a further reduction in pitch will connect conduit 80 to conduit 84 and block conduit 70. The valve will then be in the position shown in Fig. 4 where the governor will be able to maintain constant speed by adjusting the pitch of the propeller when it is in its reverse pitch position.

In order to place the propeller in its reverse pitch position from the position indicated in Fig. 1, switch handle 92 is moved to the left, moving contact bar 94 to the right and closing switches 96, 98, and 100 to energize thereby solenoids A, B, and 40. Energizing solenoid 40 will withdraw stop pin 38 thus permitting the propeller to assume a reverse position. Energizing solenoid A will close the valve controlled thereby thus disconnecting the governor from the servomotor 25. Energizing the solenoid B will open the valve controlled thereby thus connecting pressure line 54 with servomotor 25, forcing piston 26 to the right to decrease the propeller pitch. After the propeller has assumed a reverse pitch position and has moved from the position indicated in Fig. 3 to that indicated in Fig. 4, switch handle 92 may be released to de-energize all of the solenoids and return the control of the servomotor 25 to the governor. Port 76 and land 78 of the governor will then control the flow of pressure fluid in line 80 and thus control the flow of pressure fluid to and from servomotor 25 to maintain a constant propeller speed.

To return the propeller from the reverse pitch position to the position indicated in Fig. 1, switch handle 92 is moved to the right moving contact bar 94 to the left to close switches 102 and 104 thus energizing solenoids A and C. As before, solenoid A, when energized, disconnects the governor from the servomotor. Solenoid C, when energized, opens the valve controlled thereby and connects the servomotor with sump 74 through drain passages 106 and 108. Spring 28 will then return the servo valve and hence the propeller pitch to the normal forward pitch position and move valve plunger 90 to block conduit 80 and connect conduit 70 with conduit 84 at which time switch handle 92 may be released and the propeller control restored to the governor.

Fig. 5 shows a modification in which the valve 82 is actuated electrically in one direction by a solenoid 110 and may be spring pressed in the other direction. In this modification a switch 112 which is actuated by cam 113 is placed in a position to be actuated by movement of the rod 12 to close the switch as the propeller passes through the zero pitch position when changing from a forward to a reverse pitch, closing the switch 112, energizing solenoid 110 and moving valve plunger 90 to disconnect conduit 70 from conduit 84 and connect conduit 80 with conduit 84. The connections between the governor and the servomotor will, therefore, be reversed as the propeller passes through the zero pitch position from a forward to a reverse pitch position. When control is returned to the governor, it will then maintain constant speed in the reversed pitch position. When the propeller blades pass through the 0° pitch position in changing pitch from a reverse pitch position to a forward pitch position switch 112 will be opened, by a spring or its equivalent, and solenoid 110 will be de-energized. Plunger 90 will then be returned, by a spring or its equivalent, to the position indicated in Fig. 5 where line 70 is connected with line 84 and line 80 is blocked. Return of the control to the governor will then give constant speed governing in the forward pitch position.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described, but may be used in other ways without departure from its spirit as defined by the following claims.

We claim:

1. In combination with a propeller having pitch changing means including means for changing the propeller pitch between forward and reverse pitch positions, the propeller pitch being determined by the position of the pitch changing means, a governor connected with said pitch changing means for positioning said pitch changing means, and means actuated by said pitch changing means for reversing the connections between the governor and the pitch changing means to reverse the action of the governor on

said pitch changing means as the propeller changes from a forward to a reverse pitch position.

2. In combination with a propeller having pitch changing means including means for changing the propeller pitch between forward and reverse pitch positions, the propeller pitch being determined by the position of the pitch changing means, a governor connected with said pitch changing means for positioning said pitch changing means, said governor having means for supplying power to one side of said pitch changing means to move said pitch changing means in one direction upon an increase in speed and having other means for supplying power to said one side of said pitch changing means to move said pitch changing means in said one direction upon a decrease in speed, and means actuated by said pitch changing means for changing the connection between the governor and the pitch changing means to disconnect one of said power supply means from, and connect the other of said power supplying means with said one side of said pitch changing means to reverse the action of the governor on said pitch changing means as the propeller changes from a forward to a reverse pitch position.

3. In combination with a propeller having pitch changing means including means for changing the propeller pitch between forward and reverse pitch positions, the propeller pitch being determined by the position of the pitch changing means, a governor connected with said pitch changing means for positioning said pitch changing means, and means actuated by said pitch changing means for reversing the connections between the governor and the pitch changing means to reverse the action of the governor on said pitch changing means as the propeller passes through substantially zero pitch position.

4. In combination with a propeller having hydraulically actuated pitch changing means including means for changing the propeller pitch between forward and reverse pitch positions, the propeller pitch being determined by the position of said hydraulically actuated pitch changing means, a governor connected with said pitch changing means for positioning said pitch changing means by controlling the flow of hydraulic fluid to and from said pitch changing means, a valve and connections hydraulically connecting the governor and the pitch changing means, and means operatively connecting said valve and said pitch changing means to actuate said valve and reverse the action of the governor on said pitch changing means as the propeller changes its pitch direction.

5. In combination with a propeller having hydraulically actuated pitch changing means including means for changing the propeller pitch between forward and reverse pitch positions, the propeller pitch being determined by the position of said hydraulically actuated pitch changing means, a governor connected with said pitch changing means for positioning said pitch changing means by controlling the flow of hydraulic fluid to and from said pitch changing means, a pair of conduits, said governor having means for connecting one conduit with hydraulic fluid under pressure upon an increase in speed and having other means for connecting the other conduit with hydraulic fluid under pressure upon a decrease in speed and a valve connected with both said conduits and with one side of said pitch changing means and in one position connecting

one of said conduits with one side of said pitch changing means and blocking said other conduit and means operatively connecting said valve and said pitch changing means to actuate said valve by movements of said pitch changing means, and block said one conduit and connect said other conduit with said one side of said pitch changing means to reverse the action of said governor on said pitch changing means as the propeller blades pass through substantially zero pitch position.

6. In combination, a reversible pitch propeller having forward pitch positions and reverse pitch positions, pitch control means for said propeller, a governor for controlling said pitch control means in both forward and reverse pitch positions to maintain the speed of the propeller substantially constant at a preselected value by increasing the propeller pitch upon an increase in speed when in forward pitch and by changing the pitch in the opposite direction upon an increase in speed when in reverse pitch, means, independent of said governor, for moving the pitch control means to change the propeller pitch between forward and reverse pitch positions, means actuated by said pitch control means for reversing the relation between the governor and said pitch control means so that the effect of the governor on said pitch control means when the propeller is in reverse pitch will be the opposite of the effect on said pitch control means when the propeller is in forward pitch.

7. In combination with a hydraulic propeller governor having two controlled ports one of which is connected with a source of fluid under pressure upon an increase in speed and the other of which is connected with a source of fluid under pressure upon a decrease in speed, a valve, separate conduits leading from said ports to said valve, hydraulically actuated pitch controlling mechanism for said propeller including a pressure chamber, a single conduit connecting said valve with said pressure chamber, said valve in one position blocking one of said separate conduits and connecting the other of said separate conduits with said single conduit means operatively connecting said valve with said pitch controlling mechanism to move said valve to another position as the pitch changing mechanism passes a preselected position, said valve in said another position blocking said other separate conduit, and connecting said one of said separate conduits with said single conduit.

8. In combination, a propeller, pitch control means for said propeller, a hydraulic propeller governor having two controlled ports, one of which is connected with a source of fluid under pressure upon an increase in speed and the other of which is connected with a source of fluid under pressure upon a decrease in speed, a valve, separate conduits leading from said ports to said valve, a single conduit leading from said valve to the pitch control for said propeller, means operatively connecting said valve with said pitch control to move said valve and connect one or the other of said separate conduits with said single conduit in accordance with preselected positions of said pitch control.

9. Means for maintaining the speed of a reversible pitch propeller constant in both forward and reverse pitch positions comprising, pitch changing means including means hydraulically actuated in one direction and spring actuated in the other, means positioning the blades of said propeller in accordance with the position of said pitch changing means, a stop for limiting the ex-

tent of movement of said pitch changing means, means for withdrawing said stop, a governor having a pair of fluid controlling ports and means for connecting one port with fluid under pressure and the other port with drain when the governor speed is above a preselected value and for connecting said one port with drain and said other port with fluid under pressure when the governor speed is below a preselected value, a control valve, separate conduits leading from said ports to said control valve, a solenoid actuated valve, a single conduit leading from said control valve to said solenoid actuated valve, a conduit leading from said solenoid actuated valve to said hydraulically actuated pitch changing means, a source of fluid under pressure, a conduit leading from said source of fluid under pressure to said hydraulically actuated pitch changing means, another solenoid actuated valve located in said last-mentioned conduit, a drain, a conduit leading from said hydraulically actuated pitch changing means to said drain, a third solenoid actuated valve located in said last-mentioned conduit, means operatively connecting said control valve with said pitch changing means to position said control valve to connect one of said separate conduits with said single conduit and block off the other of said separate conduits in all forward pitch positions of said propeller, means for simultaneously closing said first mentioned solenoid actuated valve, opening said other solenoid actuated valve and withdrawing said stop to admit fluid under pressure to said hydraulically operated pitch changing means, place the propeller in reverse pitch position and move said control valve to block off said one of said separate conduits and connect said other of said separate conduits with said single conduit, means for opening said first mentioned solenoid actuated valve and closing said other solenoid actuated valve to restore control to said governor, whereby the governor may maintain the propeller speed constant in reverse pitch positions, means for simultaneously closing said first mentioned solenoid actuated valve, and opening said third solenoid actuated valve to drain said hydraulically actuated pitch changing means and place the propeller in forward pitch position and simultaneously move said control valve to restore the connection between said one of said separate conduits and said single conduit and block off the other separate conduit, whereby upon actuation of said means to restore control to said governor the governor may maintain the propeller speed constant in forward pitch position.

10. Means for maintaining the speed of a reversible pitch propeller constant in both forward and reverse pitch positions comprising, pitch changing means including means hydraulically actuated in one direction and spring actuated in the other, means positioning the blades of said propeller in accordance with the position of said pitch changing means, a stop for limiting the extent of movement of said pitch changing means, means for withdrawing said stop, a governor having a pair of fluid controlling ports and means for connecting one port with fluid under pressure and the other port with drain when the governor speed is above a preselected value and for connecting said one port with drain and said other port with fluid under pressure when the governor speed is below a preselected value, a control valve, separate conduits leading from said ports to said control valve, a solenoid actuated valve a single conduit leading from said control valve to said solenoid actuated valve, a conduit leading from said solenoid actuated valve to said hydraulically actuated pitch changing means, a source of fluid under pressure, a conduit leading from said source of fluid under pressure to said hydraulically actuated pitch changing means, another solenoid actuated valve located in said last-mentioned conduit, means operatively connecting said control valve with said pitch changing means to position said control valve to connect one of said separate conduits with said single conduit and block off the other of said separate conduits in all forward pitch positions of said propeller, means for simultaneously closing said first mentioned solenoid actuated valve, opening said other solenoid actuated valve and withdrawing said stop to admit fluid under pressure to said hydraulically operated pitch changing means, place the propeller in reverse pitch position and move said control valve to block off said one of said separate conduits and connect said other of said separate conduits with said single conduit, means for opening said first mentioned solenoid actuated valve and closing said other solenoid actuated valve to restore control to said governor, whereby the governor may maintain the propeller speed constant in reverse pitch positions.

11. Means for maintaining the speed of a reversible pitch propeller constant in both forward and reverse pitch positions comprising, propeller pitch changing means, including means hydraulically actuated in at least one direction and means positioning the propeller blades in accordance with the position of said hydraulically actuated means, a governor having a pair of fluid controlling ports and means for connecting one port with fluid under pressure and the other port with drain when the governor speed is above a preselected value, a control valve, means for passing all the governor controlled fluid through said control valve comprising separate conduits leading from said ports directly and only to said control valve, means hydraulically connecting said control valve with said hydraulically actuated means, means operatively connecting said control valve with said hydraulically actuated means to position said control valve to connect one of said separate conduits with said hydraulically actuated means, means to actuate said pitch changing means to place said propeller in reverse pitch position, and means in said control valve, actuated by said pitch changing means to connect the other of said separate conduits with said hydraulically actuated means and block off said one conduit when the propeller is in reverse pitch position.

12. Means for maintaining the speed of a reversible pitch propeller constant in both forward and reverse pitch positions comprising, propeller pitch changing means including means having an expansible chamber for receiving hydraulic fluid and hydraulically actuated in at least one direction and means positioning the propeller blades in accordance with the position of said hydraulically actuated means, a governor having a pair of fluid controlling ports and means for connecting one port with fluid under pressure and the other port with drain when the governor speed is above a preselected value and for connecting said one port with drain and said other port with fluid under pressure when the governor speed is below a preselected value, a control valve, separate conduits leading from said ports to said control valve, means hydraulically connecting said control valve with said chamber, means operatively connecting said control valve with said pitch

changing means to position said control valve to connect one of said separate conduits with said chamber when the propeller is in a forward pitch position, means to actuate said pitch changing means to place said propeller in reverse pitch position, and means in said control valve actuated by said pitch changing means to connect the other of said separate conduits with said chamber and disconnect said one conduit therefrom when the propeller is in reverse pitch position.

13. Means for maintaining the speed of a reversible pitch propeller constant in both forward and reverse pitch positions comprising, pitch changing means including means having an expansible chamber for receiving hydraulic fluid and hydraulically actuated in at least one direction and means positioning the blades in accordance with the position of said hydraulically actuated means, a governor having a pair of fluid controlling ports and means for connecting one port with fluid under pressure and the other port with drain when the governor speed is above a preselected value and for connecting said one port with drain and said other port with fluid under pressure when the governor speed is below a preselected value, a control valve, separate conduits leading from said ports to said control valve, means hydraulically connecting said valve with said chamber, electrically operated means, including a switch actuated by said pitch changing means, to position said control valve, said control valve connecting one of said separate conduits with said chamber when the propeller is in a forward pitch position, means to actuate said pitch changing means to place said propeller in reverse pitch position, said control valve being actuated by operation of said switch in response to said pitch changing means to connect the other of said separate conduits with said chamber and disconnect said one conduit therefrom when the propeller is in reverse pitch position.

14. In combination with a propeller having pitch changing means including means for changing the propeller pitch between forward and reverse pitch positions and whose pitch is determined by the position of the pitch changing means, a governor for positioning said pitch changing means, said governor having one means for supplying power to move said pitch changing means in one direction upon an increase in speed and having other means for supplying power to move said pitch changing means in said one direction upon a decrease in speed, means connecting said governor and said pitch changing means, and means including electrically operated mechanism actuated by said pitch changing means for changing the connection of the governor with the pitch changing means to replace said one of said power supply means by the other of said power supply means to reverse the action of the governor on said pitch changing means as the propeller changes between forward and reverse pitch positions.

15. In combination with a propeller having hydraulically actuated pitch changing means including means for changing the propeller pitch between forward and reverse pitch positions and whose pitch is determined by the position of said hydraulically actuated pitch changing means, a governor connected with said pitch changing means for positioning said pitch changing means by controlling the flow of hydraulic fluid to and from said pitch changing means, means connecting said governor and said pitch changing means, means for reversing the action of the governor

on said pitch changing means as the propeller changes between forward and reverse pitch positions comprising a valve in the connection between the governor and the pitch changing means, and means, including a switch and a solenoid, operatively connecting said valve and said pitch changing means and operated by movement of said pitch changing means to actuate said valve.

16. In combination with a propeller having hydraulically actuated pitch changing means including means for changing the pitch between forward and reverse pitch, a governor connected with said pitch changing means for controlling the flow of hydraulic fluid to and from one side of said pitch changing means, a pair of conduits, said governor having means for connecting one conduit with hydraulic fluid under pressure upon an increase in speed and having other means for connecting the other conduit with hydraulic fluid under pressure upon a decrease in speed and a valve connecting said one conduit with said one side of said pitch changing means and blocking said other conduit, and means, including a switch operated by the pitch changing means, connected with electric power means for operating said valve to block said one conduit and connect said other conduit with said one side of said pitch changing means to reverse the action of said governor on said pitch changing means as the propeller blades pass through substantially zero pitch position.

17. In combination with a propeller having hydraulically actuated pitch changing means including means for changing the pitch between forward and reverse pitch, a governor connected with one side of said pitch changing means for positioning said pitch changing means by controlling the flow of hydraulic fluid to and from said one side of said pitch changing means, means connecting both of said devices with said one side of said pitch changing means including a valve in the connection between the governor and said one side of said pitch changing means selectively connecting either of said devices with said one side and blocking the other device, and means mechanically connecting said valve and said pitch changing means to actuate said valve and reverse the action of the governor on said pitch changing means by switching from one to the other of said devices as the propeller changes from a forward to a reverse pitch position.

18. Means for maintaining the speed of a reversible pitch propeller constant in both forward and reverse pitch positions comprising, pitch changing means including means hydraulically actuated in one direction, a governor having a pair of fluid controlling ports and means for connecting one port with fluid under pressure and the other port with the drain when the governor speed is above a preselected value and for connecting said one port with drain and said other port with fluid under pressure when the governor speed is below a preselected value, a control valve, separate conduits leading from said ports to said control valve, an electrically actuated valve, a single conduit leading from said control valve to said electrically actuated valve, a conduit leading from said electrically actuated valve to said hydraulically actuated pitch changing means, a source of fluid under pressure, a conduit leading from said source of fluid under pressure to said hydraulically actuated pitch changing means, another electrically actuated valve located in said last-mentioned conduit, means operatively connecting said control valve with said pitch changing means to position said control valve to con-

nect one of said separate conduits with said single conduit and block off the other of said separate conduits in all forward pitch positions of said propeller, means for simultaneously closing said first-mentioned electrically actuated valve and opening said other electrically actuated valve to admit fluid under pressure to said hydraulically operated pitch changing means, place the propeller in reverse pitch position and move said control valve to block off said one of said separate conduits and connect said other of said separate conduits with said single conduit, means for opening said first-mentioned electrically actuated valve and closing said other electrically actuated valve to restore control to said governor whereby the governor may maintain the propeller speed constant in reverse pitch positions.

19. Means for maintaining the speed of a reversible pitch propeller constant in both forward and reverse pitch positions comprising, pitch changing means including means hydraulically actuated in one direction, a governor having a pair of fluid controlling ports and means for connecting one port with fluid under pressure and the other port with drain when the governor speed is above a preselected value and for connecting said one port with drain and said other port with fluid under pressure when the governor speed is below said preselected value, a control valve, separate conduits leading from said ports to said control valve, a single conduit connecting said control valve and said hydraulically actuated pitch changing means, a selectively actuated valve in said single conduit, a source of fluid under pressure, a conduit connecting said source of fluid under pressure and said hydraulically actuated pitch changing means, another selectively actuated valve located in said last-mentioned conduit, said control valve connecting one of said separate conduits with said single conduit, means for simultaneously closing said first-mentioned selectively actuated valve and thereby blocking all hydraulic connection between said governor and said pitch changing means and opening said other selectively actuated valve to admit fluid to said pitch changing means and reverse the propeller pitch, means movable with said pitch changing means for moving said control valve upon movement of the propeller to reverse pitch, to disconnect said one separate conduit from and connect said other separate conduit with, said single conduit, means for restoring control to said governor with the propeller in the reverse pitch position.

20. Means for maintaining the speed of a reversible pitch propeller constant in both forward and reverse pitch positions comprising, propeller pitch changing means, including hydraulically actuated means for positioning the propeller blades, a source of hydraulic pressure, means connecting said source with said hydraulically actuated means including, a governor controlling the flow of hydraulic fluid between said source and said hydraulically actuated means to vary the propeller pitch and control the propeller speed, means for actuating said pitch changing means to move the propeller blades between forward and reverse pitch positions, a reversing control valve located in said connecting means between said governor and said hydraulically actuated means and operatably connected with said pitch changing means and movable with said blades as they pass through zero pitch to reverse the controlling action of said governor on said hydraulically actuated means.

21. In combination with a reversible controllable pitch propeller, a governor for controlling the propeller speed by varying the propeller pitch, means connecting said governor with said propeller, means for changing said connecting means to reverse the action of said governor on said propeller, means for reversing the propeller pitch, and means responsive to propeller pitch changing movement for actuating said changing means to reverse the action of said governor on said propeller when the propeller reaches a predetermined pitch position.

22. In combination with a reversible controllable pitch propeller, a governor for controlling the propeller speed by varying the propeller pitch, means operatively connecting said governor with said propeller, means for changing said connecting means to reverse the action of said governor on said propeller, manually controlled means for reversing the propeller pitch, and means responsive to pitch changing movement for actuating said changing means.

23. In combination with a propeller having blades and blade pitch changing means, a speed responsive governor operatively connected with said pitch changing means and positioning said blades to maintain the propeller speed substantially constant, manually controlled means for changing the blade pitch including means for changing the pitch in either direction between forward and reverse pitch, and means positioned in accordance with the blade pitch and operatively associated with the connection between said governor and said pitch changing means including means to reverse the pitch changing effect of said governor by changing the connection between said governor and said pitch changing means as the blade pitch changes in either direction between forward and reverse pitch.

ERLE MARTIN.
MURRAY C. BEEBE, JR.

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