

April 18, 1939.

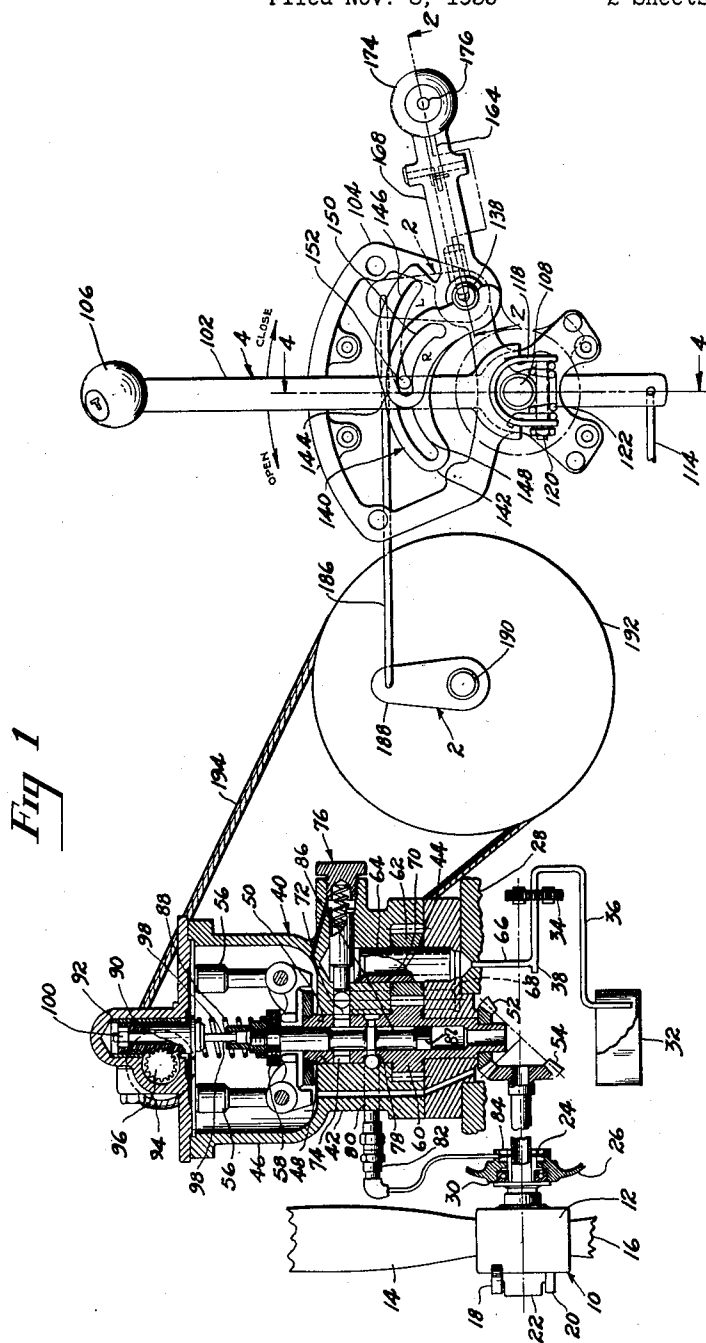
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2,154,887

CONTROL MEANS FOR CONTROLLABLE PITCH PROPELLERS

Filed Nov. 8, 1935

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 3

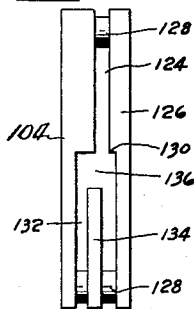


Fig. 2

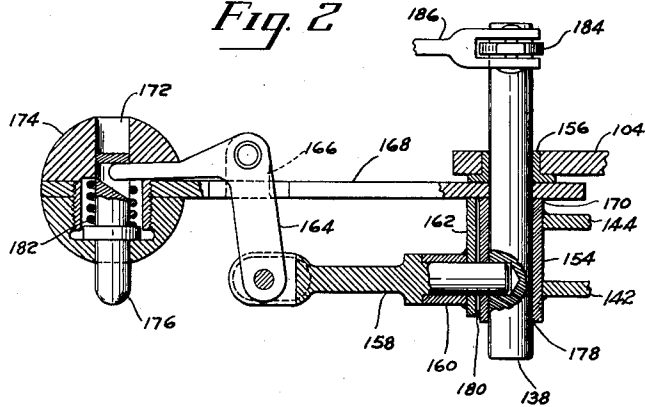


Fig. 4

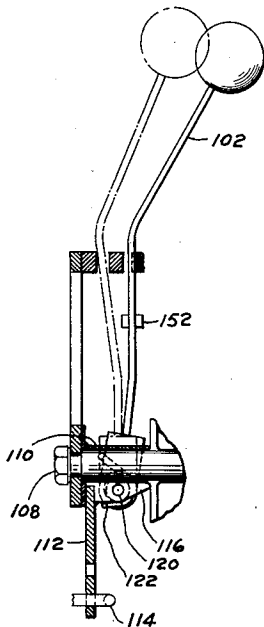
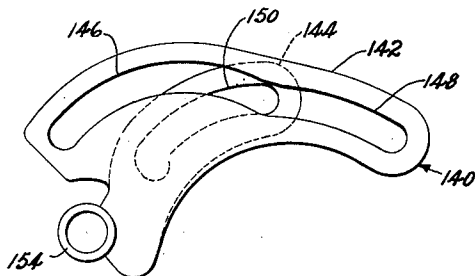


Fig. 5



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UNITED STATES PATENT OFFICE

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CONTROL MEANS FOR CONTROLLABLE
PITCH PROPELLERSPaul S. Baker, West Hartford, Conn., assignor
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Application November 8, 1935, Serial No. 48,852

16 Claims. (Cl. 170—135.6)

This invention relates to improvements in control means for controllable pitch propellers and has particular reference to a manual control means for imposing a manual control upon the automatically operating propeller control mechanism, or maintaining the propeller in either its fixed high pitch or low pitch position at the will of the operator of the vehicle, such as an airplane upon which the propeller is mounted.

One of the objects of the invention lies in the provision of a control means of the character described combined with one of the usual manual control devices for the airplane or its engine so that the propeller may be controlled by the operation of the conventional manual control without the necessity of operating an additional control device for the propeller.

Another object of the invention resides in the provision of a manual control device for a controllable pitch propeller so combined with the throttle lever of the engine upon which the propeller is mounted that the propeller may be selectively moved to and maintained in either its fixed high pitch or low pitch position by the movement of the throttle in a direction to reduce the power of the engine to idling speed.

A still further object resides in the provision of a releasable connection between the propeller control means and the throttle of the engine upon which the propeller is mounted whereby the operator of the vehicle carrying the propeller may free the propeller control from the throttle and operate both the throttle and the propeller control independently of each other.

Other objects and advantages will be more particularly pointed out hereinafter, or will become apparent as the description proceeds.

In the accompanying drawings in which like reference numerals are used to designate similar parts throughout, there has been illustrated a suitable mechanical embodiment of what is now considered to be the preferred form of the invention, it is to be understood, however, that the drawings are for the purpose of illustration only and are not to be taken as limiting the invention, the scope of which is to be measured entirely by the scope of the appended claims.

In the accompanying drawings,

Fig. 1 is a diagrammatic illustration of a propeller, a propeller governor, a propeller governor control, and an engine throttle lever with which the propeller governor control is combined for simultaneous operation therewith, the throttle lever and manual control device being shown in elevation, while the governor and certain frag-

mentary portions of the engine are shown in vertical section.

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1 looking in the direction of the arrows.

Fig. 3 is a top plan view of the bracket and guide member for the propeller lever illustrated in Fig. 1.

Fig. 4 is a sectional view on the line 4—4 of Fig. 1.

Fig. 5 is a detailed elevational view on a somewhat enlarged scale of the cam portion of the manual control device illustrated in Fig. 1.

Referring to the drawings in detail, the numeral 10 generally indicates a propeller having a hub portion 12 to which are secured a pair of propeller blades 14 and 16 for rotation through a limited arc about their longitudinal axes to change the pitch angle or angle of attack of the propeller in accordance with variations in the power output of the engine. While there is illustrated a two-bladed propeller, it is to be understood that the invention is not in any way limited to any particular number of propeller blades.

The blades 14 and 16 are urged to their high pitch position by means of a pair of centrifugally acting counterweights 18 and 20 attached to the respective blades 14 and 16 and positioned in front of and to opposite sides of the propeller hub. The pitch increasing tendency of the counterweights 18 and 20 is controlled by a hydraulic mechanism 22 operated by fluid under pressure delivered from the engine upon which the propeller is mounted. The hydraulic mechanism 22 opposes the action of the counterweights 18 and 20 and rotates the blades 14 and 16 toward their low pitch position when fluid under pressure is supplied to the hydraulic mechanism. For a complete description of a suitable type of controllable pitch propeller, reference may be had to application Serial No. 656,533, filed February 13, 1933, by Frank W. Caldwell for controllable propeller.

The propeller 10 is mounted upon the power shaft 24 of a suitable power plant such as a radial internal combustion engine, fragmentary portions of which are indicated at 26 and 28, 26 being a fragmentary portion of the nose section of the engine crankcase through which the power shaft 24 extends, the power shaft being rotatably supported in this portion of the engine by means of a suitable anti-friction bearing 30. The fragmentary portion 28 is a flat pad member formed on the engine crankcase surrounding the projecting portion of one of the engine accessory drives. The engine is provided with an oil sump

or reservoir 32, and an oil pressure pump 34 in the usual manner for supplying lubricating oil under pressure to the internal lubricating system of the engine, the oil flowing through a conduit 36 from the sump or reservoir 32 to the pump 34 and through a similar conduit 38 from the pressure pump 34 to the engine lubricating system.

The flow of oil under pressure to the hydraulic mechanism 22 is controlled by a combined governor, governor controlled valve, and a booster pump generally indicated at 40 mounted upon the accessory pad 28 of the engine crankcase.

The unit 40 comprises in general an integral governor valve and booster pump casing 42 mounted upon a pad 44 interposed between the casing and the engine pad 28, the upper portion of the casing 42 forming a bowl shaped housing 46 for the governor mechanism and the lower portion of the casing forming a housing for the valve mechanism and booster pump. The lower portion of the casing 42 is provided with a vertical aperture 48 through which extends a rotatable governor shaft 50 provided at its lower end with a driving connection such as a gear 52 meshing with a corresponding gear 54 driven by the power shaft 24 and carrying at its upper end a pair of governor flyweights 56. The governor shaft 50 is provided with an axial bore within which is slidably received a valve stem 58 and has formed upon the exterior thereof intermediate its length an integral gear 60 which constitutes one element of a booster pump, the other element of which comprises the gear 62 mounted upon the hollow bearing pin 64 supported in the casing 42 and the pad 44. The casing 42 is provided with a suitable pump chamber surrounding the gears 60 and 62.

Oil under pressure from the pump 34 is led to the booster pump through a branch conduit 66 leading from the conduit 38 to a channel 68 formed in the pad 44 and communicating with the chamber of the booster pump. From the booster pump the oil is led through a channel 70 to a chamber 72 which communicates at one end with an annular port 74 leading to the interior of the hollow shaft 50 and which communicates at its opposite end with a pressure relief valve generally indicated at 76 which communicates with the upper end of the hollow bearing pin 64.

From the above description it will be observed that the oil may flow from the pump 34 through the conduits 38 and 66 to the booster pump and from the booster pump to the chamber 72 from which it may flow to the interior of the governor shaft 50, provided the pressure in the interior of this governor shaft is below the pressure for which the pressure relief valve 76 is set. If the pressure in the interior of the governor shaft is above that for which the pressure relief valve is set, the oil from the booster pump will open the pressure relief valve and flow through the interior of the hollow bearing pin 64 back to the channel 68 and from the channel 68 back to the booster pump so that oil at the pressure imposed by the booster pump will simply recirculate through the booster pump and the bypass afforded by the pressure relief valve and the hollow bearing pin, and the pressure imposed upon the engine lubricating oil by the pressure pump 34 will not be effected by the action of the booster pump, that is, the booster pump will not rob the engine lubricating system of its necessary lubricating oil.

The governor shaft 50 is provided with a second annular port 78 opening into a channel 80 connected with a conduit 82 which leads through an oil collector ring 84 to the interior of the hollow power shaft 24 which communicates with the hydraulic mechanism 22. Between the annular ports 74 and 78, the valve stem 58 is provided with a valve 86 which controls the flow of oil from the chamber 72 to the channel 80 in response to the action of the governor flyweights 56 and also controls the return flow of oil from the channel 80 through the lower portion of the hollow governor shaft 50 back to the sump 32. The lower portion of the valve is provided with grooves as indicated at 87 to provide a free passage for the oil from the ports 78 to the sump. Thus, when the flyweights 56 are in their inner position which corresponds to a slow engine speed, the valve member 86 will be below the port 78 and the ports 74 and 78 will be placed in communication with each other so that oil will flow from the booster pump to the hydraulic mechanism 22 to operate the hydraulic mechanism to move the propeller blades 14 and 16 to their low pitch position. If the flyweights are out, corresponding to a high engine speed, the valve stem 58 will be moved up and the valve member 86 will be above the annular port 78 so that oil will flow from the hydraulic mechanism 22 through the lower portion of the hollow shaft 50 back to the sump 32 and this draining of the oil from the hydraulic mechanism will allow the counterweights 18 and 20 to move the blades 14 and 16 toward their high pitch position to absorb a greater amount of power from the engine.

The action of the flyweights 56 is controlled by a coiled compression spring 88 which opposes the centrifugal force tending to move the flyweights out as the engine speed increases. In order to vary the engine speed at which the governor acts to adjust the controllable propeller to maintain the speed constant, the loading of the spring 88 may be varied by a suitable manual regulating device, which, in the form of governor control illustrated, comprises an axially movable rack bar 90 slidably mounted in a well 92 provided in the cover of the governor chamber 46. The rack bar 90 is axially adjusted by means of a rotatable pinion 94 mounted upon a bearing shaft rotatably received in suitable bearings provided in the governor chamber cover, a projecting end of the shaft of the pinion 94 being provided with a pulley 96 secured thereon against relative rotation so that rotation of the pulley will rotate the pinion 94 and thus move the rack bar 90 axially of the well 92 to vary the loading of the spring 88.

The rack bar 90 is connected at the upper end of the valve stem 58 by means of a rod 98 which extends through an axial aperture provided in the rack bar and is provided at its upper end with a stop in the form of a screw threaded nut 100. This construction provides a lost motion connection between the rack bar 90 and the valve stem 58 such that, when the rack bar is in its lower limiting position, the lower end of the rack bar will contact the upper end of the valve stem and maintain the valve stem in its lowermost position to thus maintain the propeller at its fixed low pitch, and when the rack bar is in its uppermost limiting position the upper end thereof will contact the stop 100 and by reason of the connection between the rod 98 and the upper end of the valve stem will maintain the valve stem in its uppermost position and thus maintain the propeller in its fixed high pitch.

The extreme low pitch condition of the propeller is arranged to provide a condition of substantially zero incidence of the propeller blades or a "flat" propeller when the propeller is set in its extreme low pitch so that the propeller operates as an effective air brake to slow up the diving speed of the airplane on which it is mounted and at the same time has its wind milling effect minimized so that it does not tend to speed up or over rev the engine on which it is mounted while the airplane is in a dive.

For a more complete description of the governor control mechanism described above, reference may be had to application Serial No. 33,034, filed July 25, 1935, of Erle Martin and Frank W. Caldwell for Control means for controllable propellers.

In order to rotate the pulley 96 to vary the action of the governor to maintain the propeller in either its fixed low pitch or fixed high pitch position, a suitable manual control device must be provided within convenient reach of the operator, such as the pilot of an airplane upon which the controllable pitch propeller and the propeller control mechanism are mounted. As explained above, when such a controllable propeller and propeller controlling mechanism are mounted upon a type of airplane such as dive bomber in which all of the pilot's faculties are ordinarily employed in the maneuvering of the airplane, it has been found desirable to provide a form of manual control for the propeller which does not require separate operation by the pilot during the maneuvering of the airplane. In order to accomplish this object, it has been found desirable to combine the manual control for the propeller with one of the conventional airplane controls which must necessarily be operated by the pilot during maneuvering of the airplane, the most suitable conventional control for this purpose having been found to be the engine throttle.

The engine throttle lever as indicated at 102 is ordinarily mounted in a bracket 104, secured to the framework of the airplane within convenient reach of the pilot. In the construction illustrated the throttle lever 102, which may be provided at its upper end with a hand knob 106 if desired, is pivotally secured at its lower end upon a bearing shaft or pin 108 mounted in the lower portion of the bracket 104 by means of a construction which permits lateral as well as arcuate movements of the throttle lever about its pivotal support. A sleeve 110 particularly illustrated in Fig. 4 is rotatably mounted upon the pin 108 and is provided with a downwardly projecting lever member 112 apertured at its lower end to receive the end of a throttle rod 114. The sleeve 110 is provided upon the lower side thereof with a radially extending apertured lug 116 and the lower end of the throttle lever 102 has secured thereto a U-shaped stirrup member 118 having downwardly extending apertured leg members which overlies the lug 116. A bolt or pin 120 extends through the apertures in the lug and the stirrup to secure the throttle lever 102 to the sleeve 110 for pivotal movement in a lateral direction, but against relative movement in an arcuate direction centered on the axis of the pin 108. A loop spring 122 is interposed between the lug 116 and the stirrup 118 to resiliently urge the throttle lever 102 in a lateral direction to the right as illustrated in Fig. 4 for a purpose to be presently described.

The upper portion of the bracket 104 as particularly illustrated in Fig. 3, is formed as a guide member for the throttle lever in its swing-

ing movements about the axis of the pin 108. For this purpose the upper portion of the bracket member is provided with an arcuate slot 124 formed by mounting upon the bracket member a guide rail 126 maintained in spaced relation to the edge of the guide slot by suitable spacers 128. Intermediate the length of the slot 124 the edge of the bracket member forming one side of the slot carries a plate to provide an adjustable throttle stop 130 to limit the lower developed by a modern altitude rated engine when operated at an altitude below that at which the maximum power may be safely developed.

At a point in the travel of the throttle lever corresponding to the throttle setting for cruising speed at rated altitude, the guide member, comprising the upper surface of the bracket 104, is provided with an additional slot 132 parallel to the co-extensive portion of the slot 124 and providing for the throttle lever, during the portion of its travel between this point and the throttle closing position, an alternate path of travel. The slots 124 and 132 are divided from each other by a partition member 134 and a cross-over gate 136 is provided for the throttle lever between the throttle stop 130 and the adjacent end of the partition member 134.

The operation of the throttle lever in the guide member, described above, is as follows:

Considering that the throttle lever 102 is in the throttle closing or engine idling position and the airplane is on the ground at an altitude of approximately sea level, the throttle lever may be moved forwardly to open the throttle but will come in contact with the throttle stop 130 at the position which determines the maximum safe power output of the engine at sea level. The lever may, of course, be moved laterally against the action of the spring 122 and moved past the throttle stop, the purpose of the throttle stop being to notify the pilot when he has reached the maximum safe power output of the engine at altitudes below that at which the engine is rated. When the airplane and engine are above the rated altitude the throttle may be safely advanced past the throttle stop to its upper limiting position.

Considering now that the airplane is above the altitude for which the engine is rated, and it is desired to close the throttle to reduce the power of the engine to idling power, the throttle will first be drawn back to a position in line with the cross-over gate and from this position it may be drawn back to its throttle closing position in either one of two alternate paths of travel; that is, it may be drawn straight back through the slot 124 or it may be crossed over against the action of the spring 122 through the gate 136, and drawn back through the slot 132. Whether the throttle is to be drawn back in the normal path of travel through the slot 124, or in the alternate path of travel through the slot 132, will depend upon the purpose of the ensuing maneuver. If the power of the engine is being reduced to make a landing, the throttle will be drawn back through the normal path of travel, but if the power of the engine is being reduced for a maneuver such as a bombing dive, the throttle will be drawn back through the alternate path of travel comprising the slot 132, for a purpose to be presently described.

The bracket member 104 is provided in a position somewhat spaced from the bearings of the pin 108 with suitable bearings for an additional bearing shaft or pin 138 upon which is mounted a U-shaped cam member generally indicated at

140 and particularly illustrated in Fig. 5. This cam member 140 constitutes a divided or double element for the major portion of its extent and has an elongated portion 142 lying upon one side of the throttle lever 102 and a shorter oppositely disposed portion 144 lying upon the opposite side of the throttle lever from the portion 142. The portion 142 is provided with a cam slot comprising two portions 146 and 148 and the portion 144 has a single cam slot 150. The throttle lever 102 is provided with a transverse pin 152 disposed in a position to engage in the cam slots of the member 140 and of such a length that it engages only one member of the cam at a time. Thus, when the throttle lever is moved in the normal path of travel comprising the guide slot 124, the corresponding end of the pin 152 engages in the slots 146 and 148 in the cam portion 142. The portion 148 in which the pin engages when the throttle lever is in that portion of the slot 124 beyond the throttle stop 130 is in the form of a circular arc centered upon the axis of the pin 108 so that the cam is not moved during movements of the throttle lever in such portion of the guide slot 124. The portion 146 of the cam slot, however, in which the pin 152 engages when the throttle lever is in the portion of the guide slot 124 below the throttle stop 130 diverges radially outward from the arc of the portion 148 so that when the throttle lever 102 is moved in the portion of the slot 124 below the throttle stop toward throttle closing position, the cam is rotated to the left as viewed in Fig. 1. The cam slot 150 of the cam portion 144 diverges radially inward from the arc of the slot portion 148 so that when the throttle lever is crossed over through the space 136 so that the pin 152 engages in the cam slot 150 and the throttle lever is then moved toward throttle closing position, the cam 140 will be rotated to the right as viewed in Fig. 1.

The cam 140 is provided with an integral sleeve 154 rotatably mounted upon the pin 138 which is in turn rotatably mounted in bearings, one of which is indicated at 156, in the bracket member 104. The pin is caused to rotate with the sleeve 154 by means of a releasable lock comprising a detent 158 slidably mounted in a tubular extension 160 secured upon a sleeve member 162 which partly surrounds the cam sleeve 154, the axis of the tubular extension being radially disposed with respect to the shaft 138. The outer end of the detent 158 is pivotally connected to one arm of a bellcrank lever 164 which is pivotally mounted at its center on a lug 166 formed upon the arm 168 of a manually operable lever. One end of the arm 168 is provided with an aperture 170 through which the shaft 138 extends, the shaft being non-rotatably secured to the arm at this aperture, the end of the bellcrank lever 164 opposite its connection with the detent 158 extends through an opening into a transverse bore 172 provided in a hand knob 174 secured upon the outer end of the lever arm 168. Within the bore 172 the end of the bellcrank lever is engaged by a spring pressed plunger 176 in such a manner that depression of the plunger will move the bellcrank lever 164 to withdraw the detent 158 from its engagement in the well 178 provided in the shaft 138 and from its engagement in the aperture 180 in the sleeve 154 through which the detent passes. When the plunger 176 is depressed as described above, the sleeve 154 is rendered rotatable relative to the shaft 138 so that movement of the cam 140 does

not impart any rotative movement to the shaft and the shaft may be rotated independently of the cam by the lever arm 168. When the detent is in a position to engage the sleeve 154 and the shaft 138, however, as illustrated in Fig. 2, rotational movements of the shaft 138 are entirely dependent upon movements of the cam 140. The detent is normally maintained in engagement in the sleeve 154 and shaft 138 by means of a coiled compression spring 182 disposed within the hand knob 174 and urging the plunger 176 to its outermost position as illustrated in Fig. 2.

The end of the shaft 138 opposite the end which carries the sleeve 154 projects through the bearing 156 and has secured thereon against relative rotation, an apertured lever arm 184 to the outer end of which is pivotally connected a link member 186 which operatively connects the lever arm 184 with a similar lever arm 188 secured upon one end of a bearing shaft 190 against relative rotation with respect thereto, so that the shaft 190 will be rotated in accordance with the rotation of the shaft 138 as the cam member 140 is moved by the throttle lever 102 or as the shaft 138 is independently moved by the manually operable lever 168.

A sheave 192 is mounted upon the shaft 190 against relative rotation with respect thereto and a cable 194 operatively connects the sheave 192 with the pulley 96. The sheave 192 has a diameter approximately three times the diameter of the pulley 96 so that rotational movements of the shaft 190 are multiplied as they are transmitted to the shaft of the pinion 94 whereby a relatively slight movement of the cam 140 acting through the lever arms 184 and 188 and the link 186 will cause a relatively large movement of the pinion 94, the distance between the divergent ends of the cam slots 146 and 150 being sufficient to move the rack bar 90 from one to the other of its two limiting positions.

The operation of the device is substantially as follows:

Supposing the airplane to be flying at a cruising speed and at an altitude above that for which the engine is rated so that the throttle lever is somewhere in the upper portion of the slot 124 on the throttle opening side of the throttle stop 130. If the pilot now wishes to put the airplane into a dive he will move the throttle lever back to the cross-over gate at which point he will cross the lever over through the space 136 and continue to move the lever back through the guide slot 132. When the throttle lever is crossed over through the space 136, the pin 152 is removed from its engagement in the cam slot 148 and is engaged in the end of the cam slot 150. As the throttle lever is now moved back to its throttle closing or engine idling position the cam member 140 is rotated to the right as viewed in Fig. 1 which causes the sheave 192 to be rotated to the right with a consequent right hand rotation of the pinion 94. This right hand rotational movement of the pinion 94 moves the rack bar 90 to its lower limiting position and moves the valve member 86 on the valve stem 48 to a position below the valve port 78 so that the port 74 is connected with the port 78 and fluid under pressure is delivered to the hydraulic mechanism 22 to move the propeller blades 14 and 16 to their low pitch or flat position. Thus, when going into a dive the propeller may be automatically adjusted to its extreme low pitch or flat position with the closing of the engine throttle and in this position will serve as an air brake to prevent the speed

of the airplane or the rotational speed of the engine from becoming dangerously excessive during the dive.

On the other hand, if the pilot desires to go from his cruising speed into a gliding angle instead of into a dive, the throttle lever 102 is moved through the slot 124 to the engine idling position. Without the cross-over through the space 136, the pin 152 stays in engagement in the cam slot in the portion 142 of the cam so that the cam will be rotated to the left as viewed in Fig. 1 with a consequent left hand rotation of the sheave 192 and pinion 94. This left hand rotation of the pinion 94 moves the rack bar 90 to its upper limiting position in which the valve member 86 on the valve stem 74 is positioned above the port 78 and the hydraulic fluid is allowed to drain from the hydraulic mechanism 22 through the lower end of the hollow governor shaft 50. When the pressure is thus released in the hydraulic mechanism the counterweights 18 and 20 will move the respective propeller blades 14 and 16 to their high pitch position and the propeller will be maintained in its fixed high pitch position during the landing glide so as not to interfere with the landing speed of the airplane.

When it is desired to again increase the power of the engine when coming out of a dive, when taking off after landing or when the pilot decides not to complete a landing and puts the airplane into a climb, the throttle lever is advanced and the cam is rotated in a direction opposite to that in which it was rotated when the ship was placed in the diving or gliding condition.

This opposite rotation of the cam, rotates the sheave 192 and the pinion 94 to move the valve 86 and bring the propeller out of the extreme high pitch or low pitch condition and place it again under the control of the speed responsive governor. When the pin 152 is in the slot portion 148 of the cam, the governor is adjusted for a certain speed determined by the position of the slot and its rotative effect upon the sheave 192 and the pinion 94. The speed setting of the governor may be changed by disconnecting and moving the hand lever 168, but when the cam is operatively connected to the sheave the speed setting is constant for any particular cam when the engine is operating at cruising power or above.

While there has been illustrated and described a particular mechanical embodiment of the idea of the invention, it is to be understood that the invention is not limited to the particular embodiment so illustrated and described, but that such changes in the size, shape, and arrangement of parts may be resorted to as come within the scope of the appended claims.

Having now described the invention so that others skilled in the art may clearly understand the same, what it is desired to secure by Letters Patent is as follows:

1. In combination with a controllable pitch propeller, and an engine for driving said propeller, a throttle lever for controlling the power of said engine, means for controlling the pitch of said propeller effective to determine the direction of propeller pitch change toward either a high pitch or a low pitch condition alternatively, and means operatively connecting said engine control with said propeller control arranged to provide alternative connections whereby the propeller pitch may be alternatively constrained toward a higher pitch or lower pitch condition

upon operation of said engine control to reduce the power of said engine.

2. A control means for an aircraft engine and a controllable pitch propeller driven thereby comprising, manually operable means for controlling the power of said engine, guide means defining a normal path of travel for said manually operable means over its entire range of movement, and an overlapping auxiliary path of travel for said manually operable means over a portion of its range of movement, means comprising a double cam having oppositely disposed parts of different contour respectively engageable with said manually operable means when in said normal path and when in said auxiliary path, and means operatively connecting said cam parts with said propeller controlling mechanism to decrease the pitch angle of said propeller as said manually operable means is moved to engine idling position in said auxiliary path and to increase the pitch angle of said propeller when said manually operable means is moved to engine idling position in said normal path.

3. In combination with a controllable pitch propeller, a propeller pitch controlling means, and an engine for driving said propeller, manually operable means for controlling the power of said engine, means selectively engageable with said manual means and actuatable thereby to selectively maintain said propeller in its limiting low-pitch condition or its limiting high-pitch condition whenever said manual means is positioned to reduce the power of said engine to idling power, and means providing an engine controlling movement and a separate pitch selecting movement for said manual means.

4. In combination with a controllable pitch propeller, propeller pitch controlling means, and a propeller driving engine, manually operable means for controlling the power of said engine, guide means defining a normal path and an auxiliary path of travel for said manual means co-extensive with a portion of said normal path, and means actuated by said manual means only when in said auxiliary path of travel to decrease the pitch angle of said propeller as said manual means is operated to reduce the power of said engine.

5. In combination with a controllable pitch propeller, propeller pitch controlling means, and a propeller driving engine, manually operable means for controlling the power of said engine, guide means defining a normal path and an overlapping auxiliary path of travel selectively traversible by said manual means to control the power of said engine, means operable by said manual means only when in said auxiliary path to decrease the pitch angle of said propeller as said manual means is actuated to reduce the power of said engine, and means operable by said manual means only when in said normal path to increase the pitch angle of said propeller as said manual means is actuated in said normal path to reduce the power of said engine.

6. In combination with a controllable pitch propeller, propeller pitch controlling means, and a propeller driving engine, manually operable means for controlling the power of said engine by actuating the engine throttle, guide means defining a normal path of travel for said manual means and an auxiliary path overlapping said normal path, yieldable means urging said manual means to follow said normal path, means actuatable by said manual means when in throttle closing position in said auxiliary path to maintain said propeller in fixed low-pitch condition,

and means actuatable by said manual means when in throttle closing position in said normal path to maintain said propeller in fixed high-pitch condition.

5 7. In combination with a controllable pitch propeller, propeller pitch controlling means, and a propeller driving engine, manually operable means for controlling the power of said engine, guide means defining a normal path of travel and
10 an overlapping auxiliary path selectively traversible by said manual means, a double cam having overlapping divergent parts operatively connected with said propeller pitch controlling means operative respectively to increase or decrease the pitch
15 of said propeller, and means operated by said manual means engageable with said pitch increasing portion of said cam when said manual means is in said normal path and releasable from said pitch increasing cam portion and engageable
20 with said pitch decreasing cam portion by moving said manual means into said auxiliary path.

8. In combination with a controllable pitch propeller, propeller pitch controlling means, and a propeller driving engine, manually operable
25 means for controlling the power of said engine, guide means defining a normal path of travel for said manually operable means over its entire range of movement and an overlapping auxiliary path of travel for said manually operable means
30 over a portion of its range of movement, means comprising a double cam having oppositely disposed parts of different contour respectively engageable with said manually operable means upon movement of said manually operable means into
35 said normal path or into said auxiliary path, and means operatively connecting said cam parts with said propeller controlling mechanism to decrease the pitch angle of said propeller as said manually operable means is moved toward engine
40 idling position in said auxiliary path and to increase the pitch angle of said propeller when said manually operable means is moved toward engine idling position in said normal path.

9. In combination with a controllable pitch propeller, a propeller driving engine, and propeller pitch controlling means including a hydraulic blade turning mechanism, a valve controlling said mechanism, and an engine driven governor controlling said valve, a manually actuatable engine power control, guide means providing two separate selectively traversible paths
50 of travel for said manual power control, a pitch increasing cam operatively connected with said governor, a pitch decreasing cam operatively connected with said governor, and means operative to actuate said pitch increasing cam only when
55 said manual control is moved in one of said paths of travel and to actuate said pitch decreasing cam only when said manual control is moved in the other of said paths of travel.

10. In combination with a controllable pitch propeller, propeller pitch controlling means comprising, hydraulic means for turning the propeller blades, a valve controlling said blade turning
65 means, and an engine driven governor controlling said valve, an engine for driving said propeller and said governor, and a governor regulating means operative in its limiting positions to maintain said valve open or closed against the action
70 of said governor and maintain said propeller in its fixed low-pitch or fixed high-pitch position respectively, manually operable means for controlling the power of said engine, guide means defining a normal path and an alternative auxiliary
75 path of travel for said manual means, means com-

prising a cam having two divergent parts selectively engageable with said manually operable means by selecting one or the other of said alternative paths to be followed by said manual means, and motion multiplying means operatively connecting said cam parts with said governor regulating means to maintain said propeller in fixed
5 low-pitch position when said manually operable means is moved to engine idling position in said auxiliary path of travel and to maintain said propeller in fixed high-pitch position when said manually operable means is moved to engine idling position in said normal path of travel.

11. In combination with a controllable pitch propeller, a propeller pitch controlling mechanism comprising hydraulic means for turning the propeller blades, a valve controlling said blade turning means, and an engine driven governor controlling said valve, an engine driving said propeller and said governor, and a governor regulating means comprising a rack bar, a pinion for moving said rack bar to vary the speed setting of said governor, and a pulley for rotating said pinion, manually operable means for controlling
15 the power of said engine, guide means defining a normal path and an alternative overlapping auxiliary path of travel for said manual means, a two-part cam having oppositely disposed diverging parts selectively engageable with said manual means by a selection of one or the other
20 of said alternative paths of travel, and means comprising a sheave and cable for transmitting movements of said cam parts to said pulley to adjust said governor whereby the pitch angle of said propeller will be decreased as said manually operable means is moved toward engine idling position in said auxiliary path of travel, and the pitch angle of said propeller will be increased as said manually operable means is moved toward engine idling position in said normal path of travel.

12. In combination with a controllable pitch propeller, a propeller pitch controlling means, and a propeller driving engine, a throttle for controlling the power of said engine, a throttle guide defining a normal path and an overlapping auxiliary path of travel for said throttle, means including a cam engageable with said throttle when in engine idling position in said auxiliary path of travel to actuate said propeller controlling mechanism to maintain said propeller in limiting low-pitch condition, and a cam engageable with said throttle when in engine idling position in said normal path of travel to actuate said propeller controlling mechanism to maintain said propeller in limiting high-pitch condition, a releasable lock between said cams and said propeller controlling mechanism, and manual means associated with said lock and said control mechanism operative to connect said cams with said propeller controlling mechanism or to release said
55 cams and provide an independent control for said controlling mechanism.

13. In an airplane having a controllable pitch propeller, a propeller driving engine, a manual throttle control for said engine, and a propeller pitch controlling mechanism, means associated with said manual control and operative when actuated by said manual control in its throttle closing movements to selectively place said propeller
65 in high-pitch when said throttle is closed for landing said airplane or to place said propeller in low-pitch when said throttle is closed for diving said airplane.

14. A control for a controllable pitch propeller 75

for operation in conjunction with the manual power control of a propeller driving engine comprising, a pair of oppositely acting cams operatively connected with the propeller pitch control means, a universal mounting for said manual control, means limiting the movements of said manual control to intersecting cam selecting and power controlling paths, and means carried by said manual control selectively engageable with said cams by movement of said manual control in said cam selecting path and operative to actuate the selected cam to change the pitch of said propeller in the corresponding direction upon movement of said manual control in a power controlling path.

15. A combined engine and propeller control for a constant speed engine propeller combination comprising, an engine throttle lever, means providing a normal path and an auxiliary path of travel for engine power controlling movements of said throttle lever, means engageable with said throttle lever only when in said normal path of

travel for increasing the pitch of said propeller upon a throttle closing movement of said lever, and means engageable with said throttle lever only when in said auxiliary path of travel for decreasing the pitch of said propeller upon a throttle closing movement of said lever.

16. In a control for a constant speed engine propeller combination, a manually operable lever for controlling the throttle of the engine, means constraining said lever to follow one or the other of two alternative paths in its movements between open throttle and closed throttle positions, means alternatively engageable by said manual means by selection of one or the other of said alternative paths to increase or decrease the pitch of said propeller upon movement of said lever to control said throttle, and means for disabling said lever engageable means and controlling the pitch of said propeller independently of said throttle control.

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