

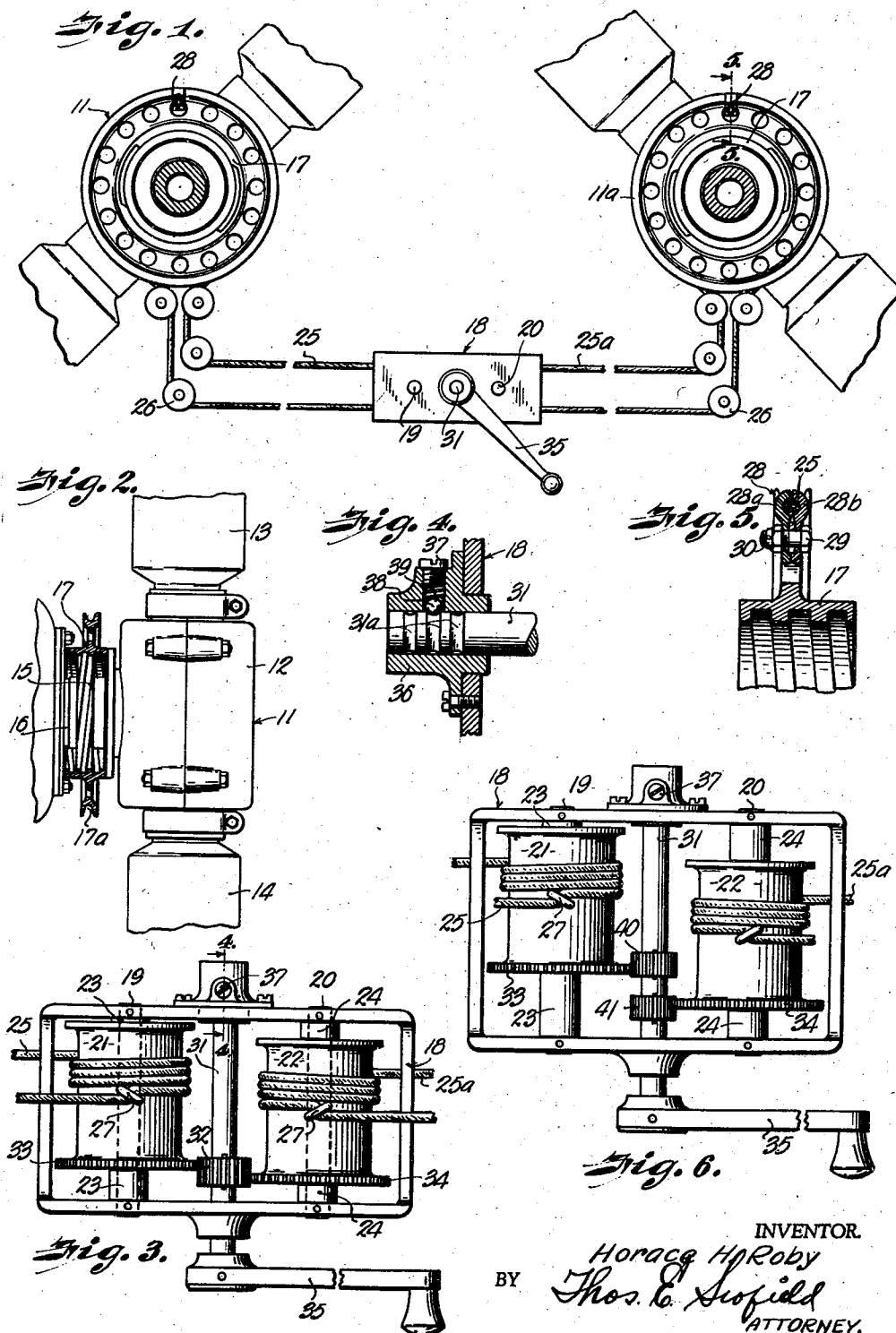
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PITCH ADJUSTING MECHANISM FOR VARIABLE PITCH PROPELLERS

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PITCH ADJUSTING MECHANISM FOR
VARIABLE PITCH PROPELLERSHorace H. Roby, Wichita, Kans., assignor to Roby
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7 Claims. (Cl. 170—135.6)

My invention relates to new and useful improvements in pitch adjusting mechanism for variable pitch propellers.

Many airplanes have two or more variable pitch propellers. It is desirable that the pitch of the blades and speed of rotation of the propellers be adjusted in order that they be moved in unison and are synchronized. Also, the pitch adjusting mechanism should be capable of operating each of the propellers separately. It is further desirable that the control mechanism be simple in construction to eliminate as far as possible the development of mechanical difficulties. The control must be mounted in the cockpit of the plane and in a position easily accessible to the pilot.

An important object of my invention therefore is the provision of a control mechanism for simultaneously or independently adjusting a plurality of variable pitch propellers.

Another object of my invention is the provision of a control mechanism of the above mentioned character that may be easily operated from the cockpit of the plane.

Still another object of my invention is the provision of a control of the above mentioned character that is efficient in operation and inexpensive to manufacture.

Other objects and advantages of my invention will be apparent during the course of the following description.

In the drawing forming a part of this specification and wherein like numerals are employed to designate like parts throughout the same,

Fig. 1 is a diagrammatic view illustrating the manner in which the control mechanism is associated with two variable pitch propellers to simultaneously or independently adjust the pitch of the propeller blades.

Fig. 2 is a side elevation of a variable pitch propeller, parts of the pitch changing mechanism being shown in section for clearness of illustration.

Fig. 3 is a top plan view of a pitch adjusting mechanism embodying my invention.

Fig. 4 is a fragmentary sectional view taken on the line 4—4 of Fig. 3.

Fig. 5 is a fragmentary sectional view taken on the line 5—5 of Fig. 1, and

Fig. 6 is a modified form of the pitch adjusting mechanism.

In the drawing wherein, for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 11 designates a variable pitch propeller of the type shown in my co-pending application, Serial No. 361,884, filed Oc-

tober 19, 1940, which matured into Patent No. 2,281,456 on the 28th day of April, 1942. Immediately behind the propeller is shown mechanism for changing the pitch of the propeller blades.

Housing 12 rotatably retains the shanks of propeller blades 13 and 14. A follower ring 15, slidable but non-rotatably mounted on a sleeve 16 which surrounds the crank shaft between crank case 10 and housing 12, fits within a cam member 17. The cam member 17 and follower ring 15 have a threaded connection so that rotation of the cam member causes the follower ring to move toward and away from housing 12. Control arms attached to follower ring 15 operate mechanically within housing 12 to rotate the propeller blades 13 and 14 about their axes to vary their pitch. Movement of the follower ring in one direction increases the pitch of the blades and movement of the follower ring in the opposite direction decreases the pitch of the blades. The direction in which the follower ring moves is dependent upon the direction in which cam member 17 is rotated.

A propeller and pitch changing mechanism identical with the construction hereinabove described is shown at 11a.

As shown in Fig. 1, I have provided a manual control for simultaneously or independently adjusting the pitch of propellers 11 and 11a. While the control mechanism here shown is adapted to simultaneously adjust two variable pitch propellers, it will be obvious that the mechanism can be easily adapted to control more than two propellers.

An essentially rectangular frame 18 is mounted behind the instrument board (not shown) of the airplane. Shafts 19 and 20 extend transversely through the frame and rotatably support drums 21 and 22. As shown in Fig. 3, drums 21 and 22 are positioned out of alignment. The drums are maintained in this relative position by sleeves 23 and 24 of different widths. An endless cable 25 passes around drum 21 and over the peripheral groove in pulley wheel 17a. As shown in Fig. 1, suitable fair lead pulleys 26 are used to guide and support the cable between drum 21 and pulley 17a. A staple 27 fastens the cable to the drum and a clamp 28 shown in Fig. 5 secures the cable to pulley 17a preventing slippage or creeping of the cable. The jaws 28a and 28b of the clamp firmly grip the cable and are fixedly attached to the periphery of the pulley 17a by engagement with a recess in the pulley's outer rim. The jaws are pressed together to grip the cable by a bolt 29 and nut 30.

When the propeller blades have a pitch substantially halfway between the maximum and minimum positions, clamping member 28 is located at a point diametrically opposite the point at which the cable leaves the pulley. The cable is tightly stretched between drum 21 and pulley 17 so that rotation of the drum will impart like rotation to the pulley.

A similar endless cable 25a extends from drum 22 to an identical pulley 17a associated with the other propeller 11a. Cable 25a is similarly secured to drum 22 by a staple 27 and to the pulley 17a by a clamp 28. The cable 25a between the control frame and the pulley is likewise supported and guided by pulleys 28.

Shaft 31 is journaled in the frame 18 between drums 21 and 22. A pinion 32 keyed to shaft 31 meshes with gear 33 on drum 21 and gear 34 on drum 22. Shaft 31 is rotatably and longitudinally movable in the frame. At one end of the shaft is a handle 35 which is disposed in front of the instrument board in a position easily accessible to the pilot. The opposite end of the shaft is supported by a bearing 36. As shown in Fig. 4, the end of the shaft supported by bearing 36 is provided with a plurality of spaced annular grooves 31a. Bearing 36 has a radial passage in which is screwed a removable plug 37. A spherical detent 38 is positioned below the plug within the passage and is movable against the action of a spring 39. When the shaft 31 is shifted longitudinally one of the grooves 31a will move into register with detent 38 and spring 39 will cause the detent to drop into the groove thereby resisting further axial movement of the shaft.

When shaft 31 is longitudinally shifted in the frame so that detent 38 is in the middle groove 31a, pinion 32 will mesh with both gear 33 and gear 34, as shown in Fig. 3. When the pinion meshes with both gears, rotation of handle 35 will effect simultaneous rotation of drums 21 and 22. As the drums rotate, endless cables 25 and 25a will rotate both pulleys to the same degree. As the pulleys rotate, the follower rings within the cam members will move in unison to adjust the pitch of propellers 11 and 11a to the same extent.

If, however, the rotational speed of one engine is faster than the other, the control device may be easily adjusted to synchronize the engines, by increasing the pitch of the faster running propeller or by decreasing the pitch of the slower running propeller.

Handle 35 under such conditions is moved to shift shaft 31 so that pinion 32 disengages one of the gears 33 or 34. For example, if propeller 11 is running faster than propeller 11a, it may be adjusted independently of propeller 11a by shifting shaft 31 so that detent 38 seats in the innermost groove 31a at which time pinion 32 will disengage gear 34 but will mesh with gear 33. Rotation of the handle 35 now rotates drum 21 independently of drum 22 and the blades of propeller 11 are adjusted independently of propeller 11a.

When the pitch of propeller 11 has been adjusted so that both propellers are rotating at the same speed, shaft 31 is then shifted to bring pinion 32 again into mesh with both gears 33 and 34. There is no back lash torque on either of the drums 21 or 22, consequently neither of the drums will have any tendency to rotate when pinion 32 is out of mesh with the gears. The

bearings supporting shaft 31 should be sufficiently tight to hold handle 35 normally stationary.

Drum 22 may be rotated independently of drum 24 by shifting shaft 31 so that detent 38 enters the outermost groove 31a. Pinion 32 will then be in mesh with gear 34 and out of mesh with gear 33. Rotation of handle 35 will, under these conditions, increase or decrease the pitch of propeller 11a.

The form of the invention shown in Fig. 6 is identical with that shown in Fig. 3, except that two pinions 40 and 41 are provided in place of pinion 32. When shaft 31 is in the neutral position as in Fig. 6, pinions 40 and 41 are in mesh with gears 33 and 34 respectively. Rotation of handle 35 will simultaneously adjust the blades of both propellers 11 and 11a. It will be observed that the pinions are of substantially greater width than the gears; thus, if shaft 31 is shifted so that detent 38 enters the innermost groove 31a, pinion 40 will move out of mesh with gear 33 but pinion 41 will remain in mesh with gear 34. Rotation of handle 35 will then independently adjust the pitch of propeller 11a. Conversely, if shaft 31 is shifted so that detent 38 enters the outermost groove 31a, pinion 40 will remain in mesh with gear 33 but pinion 41 will move out of mesh with gear 34. Rotation of handle 35 will then independently adjust the pitch of propeller 11.

It is to be understood that the forms of the invention herewith shown and described are to be taken as preferred examples of the same and that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of my invention or the scope of the appended claims.

Having thus described my invention, I claim:

1. In combination with a plurality of propellers of the type having rotatable elements for adjusting the pitch of their blades, a control device for simultaneously or independently adjusting the pitch of the propellers comprising a frame, a plurality of drums rotatably mounted in the frame, a gear on each of said drums, endless cables running over the drums and said pitch adjusting rotatable elements, means securing the cables to the drums and to the rotatable elements, a rotatable shaft longitudinally adjustable in said frame, a bearing supporting one end of the shaft, a plurality of spaced annular grooves in the end of the shaft extending through the bearing, a spring pressed detent in the bearing adapted to enter the grooves as the shaft is shifted longitudinally to releasably hold the shaft in a selected adjusted position, and a pinion on the shaft engageable with all of the gears or with a selected one of the gears in different adjusted positions of the shaft.

2. In combination with a plurality of propellers of the type having rotatable elements for adjusting the pitch of their blades, a control device for simultaneously or independently adjusting the pitch of the propellers comprising a frame, a plurality of drums rotatably mounted in the frame, a gear on each of said drums, endless cables running over the drums and said pitch adjusting rotatable elements, means securing the cables to the drums and to the rotatable elements, a rotatable shaft longitudinally adjustable in said frame, means for releasably holding the shaft in a plurality of adjusted positions, and a pinion on the shaft engageable with all of the

gears or with a selected one of the gears in different adjusted positions of the shaft.

3. In combination with a plurality of propellers of the type having rotatable elements for adjusting the pitch of their blades, a control device for simultaneously or independently adjusting the pitch of the propellers comprising a frame, a plurality of drums rotatably mounted in the frame, a gear on each of said drums, endless cables running over the drums and said rotatable elements, means securing the cables to the drums and to the rotatable elements, a rotatable shaft longitudinally adjustable in said frame, and a pinion on the shaft engageable with all of the gears in one adjusted position of the shaft and independently engageable with each of said gears in other adjusted positions of the shaft.

4. In combination with a plurality of propellers of the type having rotatable elements for adjusting the pitch of their blades, a control device for simultaneously or independently adjusting the pitch of the propellers comprising a frame, a plurality of drums rotatably mounted in the frame, a gear on each of said drums, an endless cable running over the drums and said rotatable elements, means securing the cable to the drums and to the rotatable elements, a rotatable shaft longitudinally adjustable in said frame and a pinion on the shaft for each of the gears, all of said pinions being engageable with their respective gears in one adjusted position of the shaft and each of said pinions being independently engageable with its respective gear in other adjusted positions of the shaft.

5. In combination with a plurality of propellers each of the type having a rotatable element for adjusting the pitch of its blades, a control device for simultaneously or independently adjusting the pitch of the propellers comprising a frame, a plurality of drums rotatably mounted in the frame, a driven member on each of said drums,

an endless cable running over the drums and said rotatable elements, means securing the cables to the drums and to the rotatable elements, a rotatable shaft longitudinally adjustable in said frame, and a drive member on the shaft engageable with all of the driven members in one adjusted position of the shaft and independently engageable with each of said driven members in other adjusted positions of the shaft.

6. In combination with a plurality of propellers of the type having rotatable elements for adjusting the pitch of their blades, a control device for simultaneously or independently adjusting the pitch of the propellers comprising a frame, a plurality of drums rotatably mounted in the frame, means cooperating with the drums and rotatable elements to cause the drums to transmit motion to the rotatable elements, a gear on each of said drums, a rotatable shaft adjustably mounted in said frame and gear means on the shaft engageable with all of the gears in one adjusted position of the shaft and independently engageable with each of said gears in other adjusted positions of the shaft.

7. In combination with a plurality of propellers of the type having rotatable elements for adjusting the pitch of their blades, a control device for simultaneously or independently adjusting the pitch of the propellers comprising a frame, a plurality of drums rotatably mounted in the frame, means cooperating with the drums and rotatable elements to cause the drums to transmit motion to the rotatable elements, a driven member on each of the drums, a rotatable shaft adjustably mounted in the frame, and drive means on the shaft engageable with all of the driven members in one adjusted position of the shaft and independently engageable with each of the driven members in other adjusted positions of the shaft.

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