May 7, 1957 R. P. LAMBECK ET AL 2,791,283

FEATHERING DETENT

Filed Feb. 25, 1954

FIG. 1

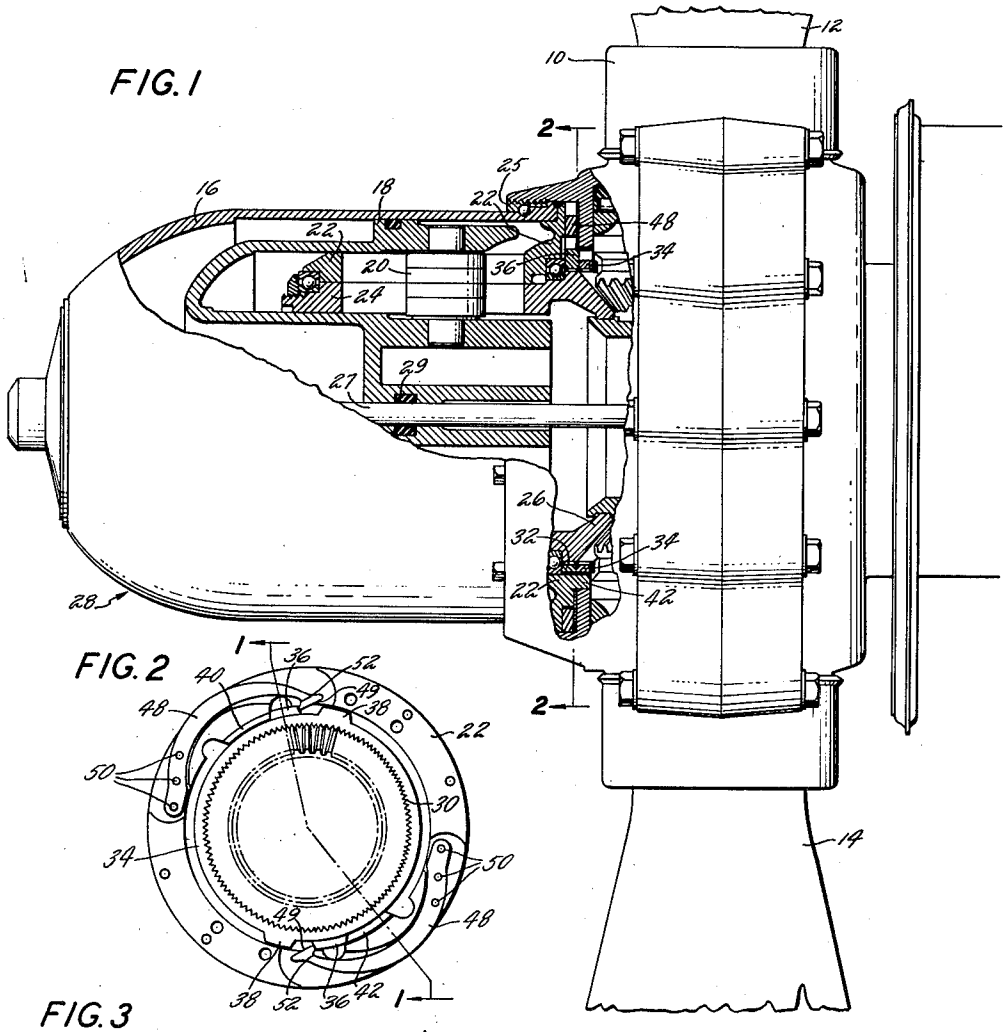
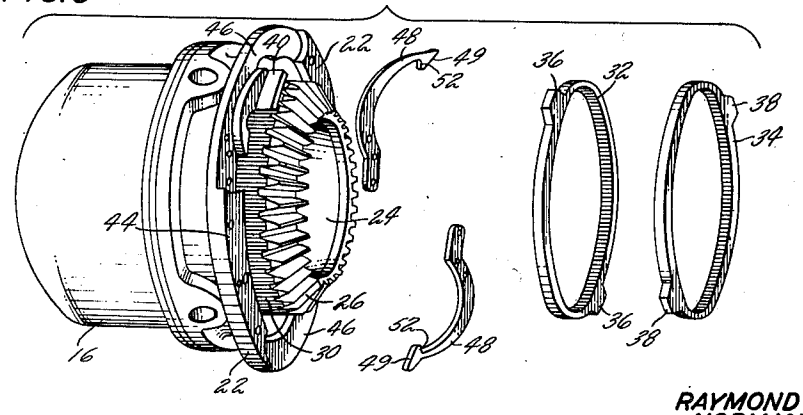


FIG. 2

FIG. 3



INVENTORS
RAYMOND P. LAMBECK
NORMAN B. NEWTON
BY Harris & Luther
ATTORNEY

United States Patent Office 2,791,283 Patented May 7, 1957

2,791,283

FEATHERING DETENT

Raymond P. Lambeck, Manchester, and Norman B. Newton, South Glastonbury, Conn., assignors to United Aircraft Corporation, East Hartford, Conn., a corporation of Delaware

Application February 25, 1954, Serial No. 412,502

10 Claims. (Cl. 170—160.32)

This invention relates to propeller pitch changing mechanism and particularly to mechanism for mechanically restraining the propeller blades against pitch reduction.

An object of this invention is mechanism for restraining the propeller blades in feathered position.

A further object is resilient detent mechanism releasably latching the propeller blades in a selected position, particularly a feathered position.

Other and additional objects will be apparent from the following specifications and attached drawings in which:

Fig. 1 is a side elevation, with parts broken away along the line 1—1 of Fig. 2, of an aeronautical propeller incorporating the blade restraining detents;

Fig. 2 is a section along the line 2—2 of Fig. 1 showing an end view of the pitch changing motor unit removed from the propeller hub and showing the spring detents and their cooperating mechanism;

Fig. 3 is an exploded view showing the pitch changing motor unit with the pitch stops and latch or detents arranged in exploded relation thereto.

In aeronautical propellers which have been feathered in flight, it has been usual to rely on the normal friction in the propeller to hold the propeller in feathered position. At the airplane speeds generally prevailing in the past, this friction has proved to be entirely adequate and any tendency of the propeller to move out of feathered position has been successfully resisted.

However, at the higher speeds now prevailing and contemplated, it has been found that the aerodynamic twisting moment reaches such a magnitude that the inherent friction in the propeller blade is no longer adequate to hold the blade in feathered position. There therefore results a tendency on the part of the blade to work its way out of feathered position and to reduce its pitch. As soon as the blade pitch is reduced, the blade begins to windmill and is then ordinarily automatically supplied with hydraulic force or other power to bring it into a governor control position or, if a propeller has been feathered because of some malfunctioning, to perhaps cause damage to either the engine or propeller.

In order to prevent this inadvertent unfeathering without, at the same time, inserting unwanted friction into the propeller or increasing the propeller friction beyond that inherent in the normal propeller construction, we have devised a latch forming the subject of this invention which will be automatically placed in latched position when the propeller is feathered but may be overcome by the power applied to the propeller pitch changing mechanism to unfeather the propeller.

This latch is shown embodied in a propeller of well-known construction such as is shown in Patents Nos. 2,280,713 and 2,280,714. As this propeller is well-known, a brief description thereof will suffice for this application, reference may be made to the above mentioned patents for further details. The propeller comprises a hub 10 mounted on an engine driven by a propeller shaft, not shown, and carrying a plurality of propeller blades, two of which are shown at 12 and 14. Secured to the outboard side of the hub 10 is pitch changing motor unit indicated generally at 28 and comprising a cylinder dome 16 in which is reciprocally mounted a piston 18. Piston 18 carries cam followers 20 which run in oppositely directed helical cam slots in stationary cam 22 and movable cam 24 respectively. Stationary cam 22 is secured to hub 10 by any suitable means such as pins, not shown, connecting the stationary cam and the hub. The entire motor unit is held onto the hub by nut 25 threaded into the hub 10 and forcing the dome 16 and cam 22 against the hub 10. Movable cam 24 is mounted for rotation inside of stationary cam 22 and carries a gear 26 at the inboard end thereof which meshes with gears on the root or inboard ends of blades 12 and 14. Hydraulic fluid is selectively directed by any suitable means such as that shown in the aforementioned patents or as shown in Patent No. 2,653,668 or application Serial No. 400,738, filed December 28, 1953, by Earle Martin and Raymond P. Lambeck, for Propeller Hub Structure, to one side or the other of the piston 18 so as to move the piston longitudinally of the cylinder 16 and thus through the cams 22 and 24, turn the gear 26 and change the propeller blade pitch. The motor unit 28 may be removed as a unit by backing off nut 25 and pulling the unit forward over tube 27 which is secured at its inboard end to the propeller shaft and conduct pitch changing fluid to the outboard side of piston 18. Packing 29 is shown as sealing the joint between tube 27 and piston 18. Suitable mechanism, such as a separate pump or pressure fluid supply, may be utilized for supplying fluid to the propeller to insure its being moved to an extreme position to be thereby placed in a feathered condition. This same pump or fluid supply may be utilized to supply fluid to the opposite side of the piston to move the blades of the non-rotating feathered propeller out of feathered position and back to a normal or operating pitch position. These pumps and the hydraulic system have not been shown in this application because they are well-known in the art, are adequately disclosed in the cited patents and this invention can be understood without the added disclosure in this application.

The pitch changing motor unit indicated generally at 28 which is removable as a unit from the hub 10 is shown detached from the propeller hub in Figs. 2 and 3 and comprises, as indicated above, a stationary member 22 which is adapted to be secured to the hub and a movable member 24 terminating in the gear 26 adjacent the gear 26 on the external surface of the member 24. A series of serrations 30 are provided on the exterior of movable member 24 to receive stop rings 32 and 34 which are serrated on their inner surface to mate with the serrations 30 on the member 24. Stop ring 32 carries abutments 36 and stop ring 34 carries abutments 38. These abutments 36 and 38, when mounted on the member 24, constitute movable abutments which are brought into contact with stationary abutments 40 and 42 formed integrally with stationary member 22 of the pitch changing motor. These stop rings may be arranged to select any desired position at which they will contact the fixed abutment and prevent further movement of the pitch changing motor. In practice, abutments 36 are arranged to contact one side of abutment 40 when the motor and the blades geared thereto are moved to one extreme position, such as feathered position, and movable abutments 38 contact the other side of fixed abutments 40 and 42 upon the extreme movement in the opposite direction which may be either a low pitch position or a reverse pitch position as desired. As shown in Fig. 2, the motor

and the propeller blades geared thereto would be in feathered position with the abutments **36** in contact with one side of abutments **40** and **42**. It is obvious that if the two relatively movable parts of the motor are prevented from moving, that the motor can then no longer impart movement to the propeller blades and the propeller pitch will be determined by the location of the movable abutments.

A portion of the upstanding flange **44** on stationary member **22** is removed at **46** to provide a recess into which a latch **48** may be placed. One end of latch **48** is secured by securing means such as pins or rivets **50** to the upstanding flange **44**. The opposite end of the latch is formed with a hook **52** which is adapted to spring in back of movable abutment **36** when that abutment is brought into contact with stationary abutment **40** as shown in Fig. 2. The portion of latch **48** between the securing means **50** and the hook **52** forms a cantilever spring which is prestressed to resiliently hold the hook **52** in a position in back of the abutment **36**. The hooked end of latch **48** is provided with a wedging portion **49**. Abutment **36**, moving counter-clockwise as viewed in Fig. 2, coacts with wedging portion **49** to gradually lift the hooked portion to a position on the outer periphery of abutment **36** and further energize the cantilever spring portion of latch **48**, from which position the latch will snap in back of abutment **36** when the abutment **36** moves past the hook portion **52**. The portion of the abutment **36** coacting with the hook portion **52** is shaped so as to provide a small force component directed to move the hook **52** outward upon application of pitch reducing force to the abutment **36**. The force component exerted by abutment **36** and directed to move the latch outward is preferably a materially smaller portion of the total force applied to the latch **48** by the abutment **36** in the pitch reducing direction than in the pitch increasing direction so that a comparatively small force will be required to bring the latch into latching position but a comparatively large force will be required to move the latch out of latching position. In the preferred form as shown, two latches **48** are provided.

When it is desired to move the propeller out of feathered position, hydraulic fluid is supplied to the appropriate side of piston **18** to move abutment **36** away from abutments **40** and **42**. Such movement is resiliently resisted by the latch **48** but the force applied to abutment **36** by the hydraulic motor is sufficient to overcome the resistance and move the hooked portion **52** of the latch outwardly so that it will slide over movable abutment **36**, allowing the propeller pitch to be reduced and the propeller thus unfeathered.

The latch **48**, being purely mechanical in nature, is spring-pressed back of the abutment **36**. The shape of the ends of the abutment **36** is such that the force applied to movable member **24** by the pitch changing motor will have a component urging the latch **48** outward to unlatched position. It is thus obvious that we have provided means for imparting additional friction or restraining forces which are automatically operable when the propeller reaches feathered position to hold the propeller in feathered position. It is also clear that we have provided means by which this restraining force may be overcome by the pitch changing motor to permit movement of the propeller out of feathered position. It will be obvious from the structure above described that this additional friction or restraining force acts only when the propeller is in feathered position and does not in any way affect any of the other operations of the propeller.

While there has been described and illustrated a mechanical embodiment of what is now considered to be the preferred form of the invention, it is to be understood that the invention is not limited to the construction so illustrated and described but that such changes in size, shape and arrangement of parts may be resorted to as come within the scope of the subjoined claims.

We claim:

1. In a controllable pitch propeller, propeller pitch changing mechanism, stop means positively mechanically limiting the extent of pitch change by said mechanism, and a detent connected with said pitch changing mechanism and having a single restraining position and mechanically forced into and out of restraining position by said mechanism moving into and out of the pitch change limiting position and releasably restraining said pitch changing mechanism only in the limiting pitch change position determined by said stop mechanism.

2. In a controllable pitch propeller, an hydraulically actuated pitch changing motor having a fixed part and a movable part, means mechanically connecting said motor with the propeller blades to vary the blade pitch, stop means having one part fixed on the fixed part of said motor and another part fixed on and movable with the movable part of said motor for positively limiting power movement of said motor in one direction and positioning the blades in a preselected position in their pitch changing movement, a spring actuated detent secured to one part of said motor and coacting with a portion of the stop means fixed on the other part of said motor to releasably latch said motor and the blades actuated thereby in said preselected position, said last-mentioned stop means and said detent being relatively movable into and out of latching position by movement of said motor parts.

3. In a controllable pitch propeller, an hydraulically actuated pitch changing motor having a fixed part and a movable part, means connecting said motor with the propeller blades to vary the blade pitch, stop means having a fixed abutment positioned by the fixed part of said motor and a movable abutment positioned by the movable part of said motor, said movable abutment being movable by said motor into contact with said fixed abutment to limit the pitch changing movement of said motor and position said blades in feathered position, a spring actuated latch secured to one part of said motor for coaction with the abutment positioned by the other part of the motor, said latch and coacting abutment relatively movable by said motor into latching position with said latch latching behind the abutment positioned by the other part of said motor to releasably hold the two abutments in contact when the propeller is in feathered position.

4. In a controllable pitch propeller having blades movable about a longitudinal axis for pitch adjustment and having a blade supporting hub in which the propeller blades when in feathered position are urged in a pitch reducing direction by aerodynamic twisting moments, means releasably resiliently and frictionally restraining said blades against pitch reducing movement about said longitudinal axis, comprising a spring pressed friction latch, having two parts, one part operably connected with said blades and the other part connected with said blade supporting hub, said parts being relatively movable by movement of said blades, one of said parts being movable into latching position with the other part against the spring pressed friction of said latch by movement of said blades into feathered position.

5. In a controllable pitch propeller having a pitch changing motor in which the propeller blades when in feathered position are urged in a pitch reducing direction by aerodynamic twisting moments, means for releasably restraining said blades against pitch changing movement out of feathered position, comprising a spring pressed latch having two propeller carried parts, means including said motor connected with said blades moving one part of said latch relative to the other, means fixing said other part on said propeller, spring means forcing said parts into latching relation when said parts reach a preselected relative position, said one of said parts movable by said motor out of latching relation with said other part.

6. In a controllable pitch propeller having a propeller carried pitch changing motor having a movable portion

and a stationary portion in which the propeller blades when in feathered position are urged in a pitch reducing direction by aerodynamic twisting moments, means for releasably restraining said blades against pitch reducing movement, comprising a spring pressed latch having two parts, means including the movable portion of said motor connected with said blades moving one part of said latch relative to the other, said other part being connected with the stationary portion of said motor, spring means resisting movement of said parts into latching position and forcing said parts into latching relation when said blades reach feathered position, said one of said parts movable by said motor to overcome the latching spring resistance and move said parts out of latching relation in unfeathering movement of said motor.

7. A pitch changing motor unit for a controllable pitch propeller comprising a stationary part and a movable part, stops connected with said parts limiting relative movement of said parts in one direction, power actuated means for moving said movable part, latch means connected with said motor and mechanically latching said motor parts against relative movement in the opposite direction, means, including said movable part, forcing said latch into latching position against resilient resistance of said latch upon movement of said movable part in said one direction to a selected position and means actuated by movement of said movable part in said opposite direction by said power actuated means moving said latch out of latching position against resilient resistance of said latch upon movement of said movable part in said opposite direction.

8. In combination with a motor having two relatively movable parts for changing the pitch of propeller blades, abutments carried by said parts and movable with said parts into abutting relation to mechanically prevent movement of said parts beyond a predetermined pitch position, latch means carried by one of said motor parts and coacting with the abutment carried by the other motor part to releasably latch said motor against pitch movement from said predetermined pitch position, said motor unlatching said latch by forcefully overcoming the latching force of said latch.

9. A device as in claim 8 in which the latch comprises a cantilever spring having a hooked portion at one end coacting with said abutment carried by said other part to latch said parts.

10. In combination with a pitch changing motor having two relatively movable parts, abutments carried by said parts and movable with said parts into abutting relation to prevent movement of said part beyond a predetermined position, a latch comprising a cantilever spring having a hooked portion at one end and having a wedging surface coacting with said abutment to lift the latch by movement of the abutment in one direction with comparatively small amount of force applied to said abutment, said abutment having a surface coacting with said hooked portion of said latch to require a comparatively large amount of force applied to said abutment in moving the abutment in the opposite direction to move said latch to unlatch said hooked portion and means actuated by said motor unlatching said latch.

References Cited in the file of this patent

UNITED STATES PATENTS

2,343,416	Keller	Mar. 7, 1944
2,392,364	Caldwell et al.	Jan. 8, 1946
2,469,660	Martin	May 10, 1949
2,609,057	Crowhurst	Sept. 2, 1952
2,652,122	Longfellow	Sept. 15, 1953

FOREIGN PATENTS

513,591	Great Britain	Oct. 17, 1939