

March 12, 1963

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3,080,928

HYDRAULICALLY OPERATED VARIABLE PITCH PROPELLERS

Filed May 16, 1955

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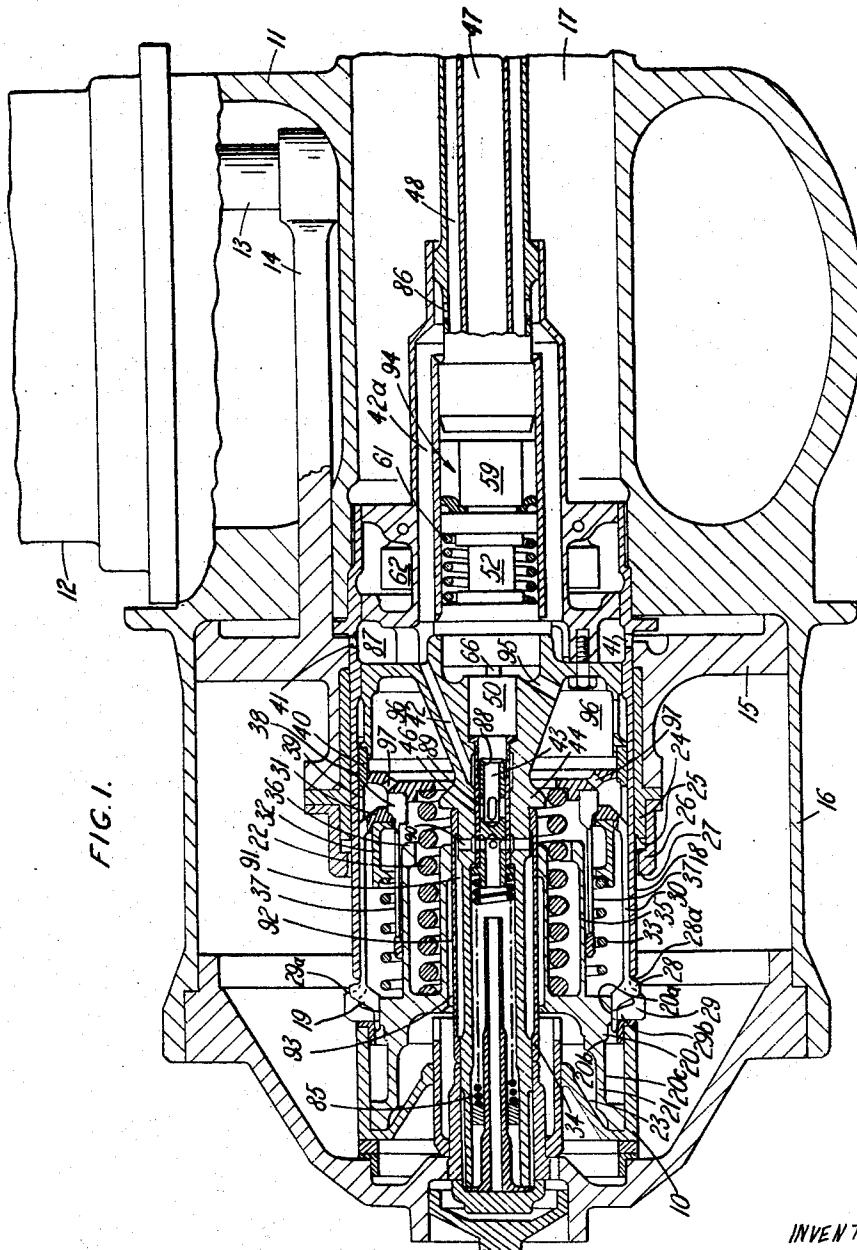


FIG. 1.

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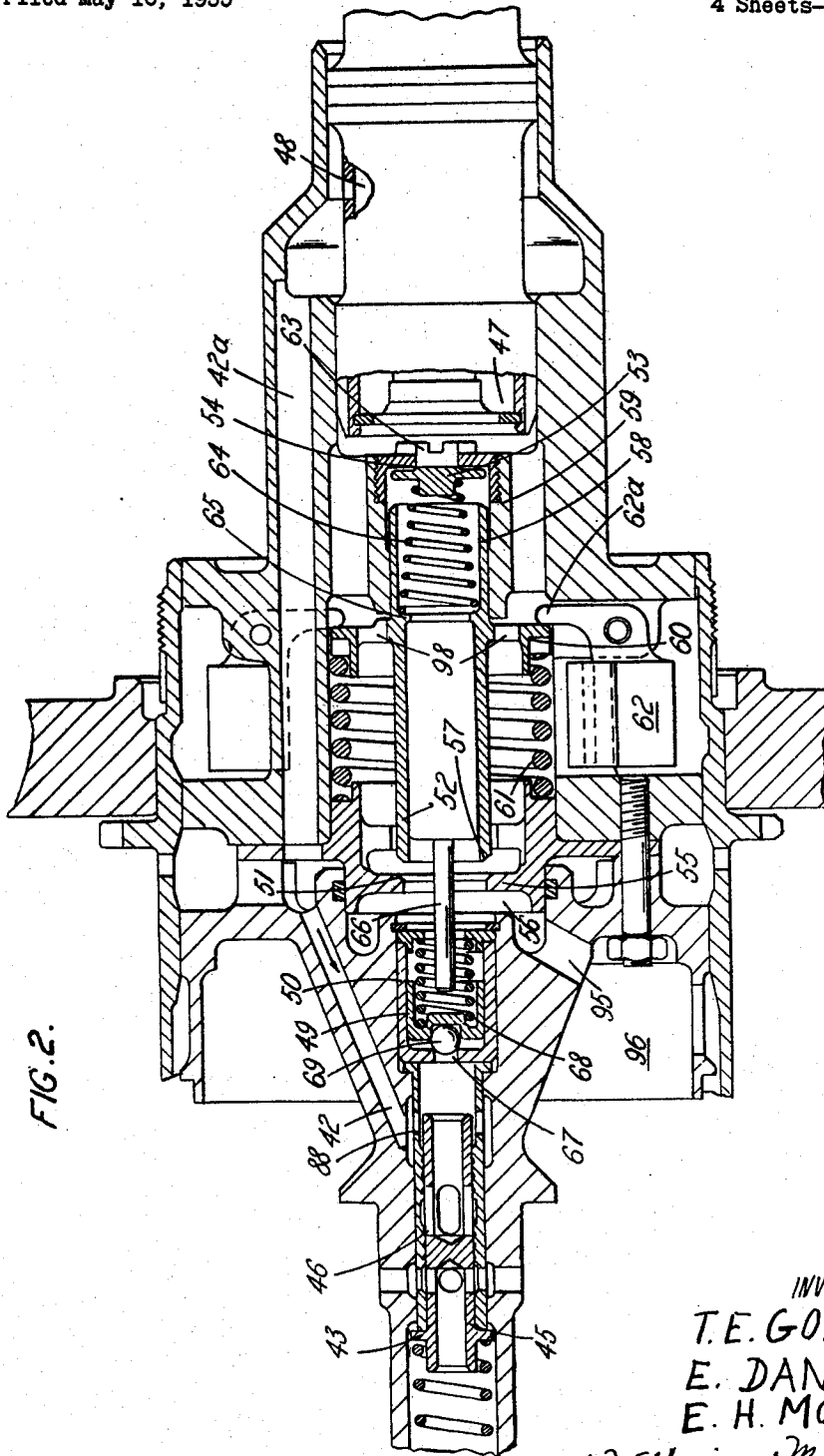
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Filed May 16, 1955

4 Sheets-Sheet 2



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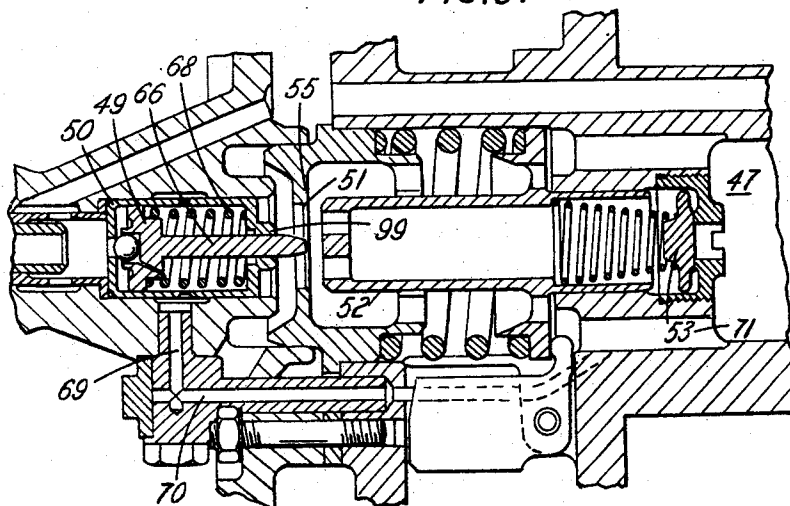
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Filed May 16, 1955

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FIG. 3.



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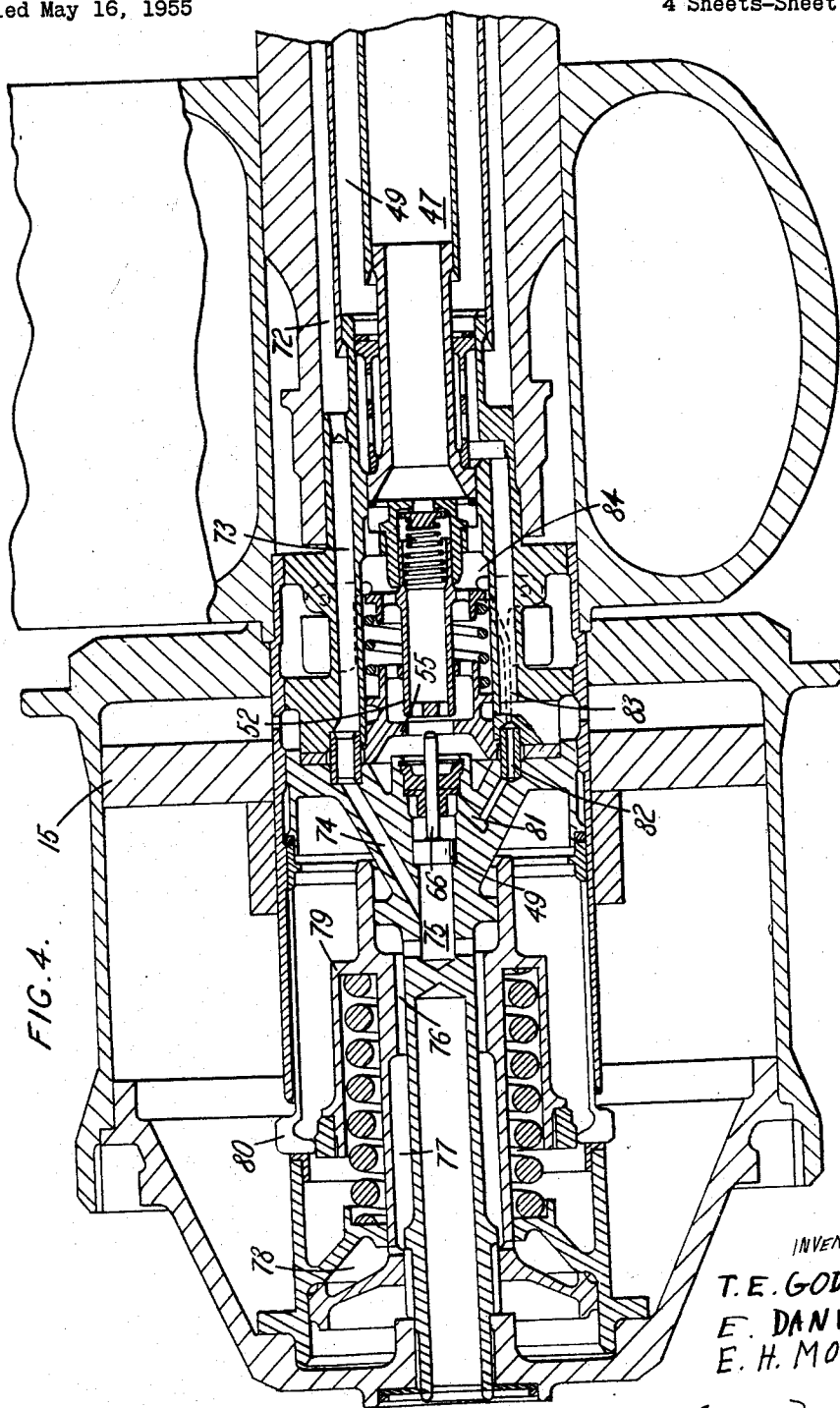
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HYDRAULICALLY OPERATED VARIABLE PITCH PROPELLERS

Filed May 16, 1955

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HYDRAULICALLY OPERATED VARIABLE PITCH PROPELLERS

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Filed May 16, 1955, Ser. No. 508,594
12 Claims. (Cl. 170-160.32)

This invention relates to hydraulically operated variable pitch propellers. In hydraulically operated variable pitch propellers, loss of oil pressure in the system, which may occur for example due to negative "g" conditions or a mechanical fault, permits the blade pitch to fine-off under the action of centrifugal force on the blades, with the result that serious overspeeding of the propeller can occur.

In the case where the propeller is driven by a turbine power plant, and more particularly in the case in which the propeller, and the compressor and turbine rotors of the power plant are coupled so that they rotate together, the inertia of the rotating system is of a high order. When the blades of the propeller are in a coarse pitch position, the aerodynamic forces on the blades are also large and the force required to set the rotating system in motion is considerable. Thus when starting the power plant (e.g. by means of an electric motor) the propeller blades are turned to a super-fine pitch position such that the combined inertia and aerodynamic forces to be overcome by the starting motor are at a minimum, this obviating the need for a large starting system.

In view of this there is provided means whereby, in addition to the normal flying pitch change range of the propeller, it is possible to move the propeller blades into a super-fine pitch position. This super-fine pitch position may also be valuable during the actual take-off, so that maximum propeller speed is obtainable, and sometimes also for landing when it may be necessary rapidly to increase the propeller speed in an emergency.

It is therefore known practice to arrange that the normal fine pitch stop at one end of the flying pitch change range may be broken down so that the piston of the pitch changing motor may slide over it and abut against a super-fine pitch stop.

Also, it is known practice to arrange that the super-fine pitch stop may also be broken down so that the propeller blades can move through the super-fine position into a reverse pitch position for aircraft braking purposes.

Certain of these pitch changing movements, like the occurrences discussed in the opening paragraph of this specification, give rise to overspeeding of the propeller, and it is the object of this invention to provide means whereby overspeeding of the propeller, within certain overspeed limitations, is prevented.

More particularly, the object of the present invention is to provide in the hydraulic pitch change system a hydraulic lock responsive to excessive propeller speed and preventing pitch change toward a fine pitch position.

A further object of the present invention is so to arrange the system that the lock is not broken down simply by a moderate reduction of the propeller speed unless this is accompanied by a restoration of the hydraulic pressure to a value at least equal to that existing on the coarse pitch side of the pitch change motor.

According to the present invention, a hydraulically operated variable pitch propeller of the type in which hydraulic liquid, supplied through a coarse pitch conduit, is employed in a pitch change motor to increase the pitch of the blades, is characterised by the combination with said propeller of a normally open lock valve in said coarse pitch conduit, means for closing the valve in re-

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sponse to the attainment of a propeller speed in excess of a predetermined value, said valve being adapted so that after it has been closed it remains closed when there is an excess of pressure on the pitch change motor side of the valve above that on the other side, and a non-return valve in a by-pass conduit by-passing said lock valve, which non-return valve is arranged to close when the pressure on the pitch change motor side of the non-return valve exceeds that on the other side of the non-return valve.

With this arrangement, when an overspeed condition occurs and the lock valve closes, the propeller is prevented from moving towards fine pitch because hydraulic liquid cannot exhaust from the coarse pitch side of the pitch change motor, there being a trapped volume of the liquid between the coarse pitch side of the pitch change motor and the lock valve which hydraulically locks the piston of the pitch change motor against further movement towards fine pitch and thereby prevents overspeeding of the propeller beyond the speed at which the lock valve is arranged to close. Hydraulic liquid cannot exhaust from the coarse pitch side of the pitch change motor through the by-pass conduit because of the non-return valve, which is closed by a rise of pressure on its pitch change motor side brought about by any tendency of the pitch change motor piston to move towards fine pitch.

With a variable pitch propeller which is movable to super-fine and reverse pitch some momentary overspeeding as the blade pitch is reduced to super-fine pitch and/or passes through the zero pitch position into reverse is usual, and allowable. It is therefore necessary in this case to provide means for preventing the normal functioning of the overspeed hydraulic lock as these pitch change movements are carried out.

To this end according to a feature of the present invention a hydraulically operated variable pitch propeller which is movable to a super-fine and/or reversed pitch, and which includes a fine pitch stop releasable by hydraulic liquid at a predetermined pressure to permit such movement, further comprises a hydraulically operable overriding means in communication with the fine pitch stop conduit conveying liquid to release said fine pitch stop, said overriding means being operated by said hydraulic liquid at said predetermined pressure to prevent the closing of said normally-open lock valve.

Two embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, whereof:

FIGURE 1 is a cross-sectional side elevation of a hydraulic variable pitch propeller capable of superfine and reversed pitch positions, and incorporating the present invention,

FIGURE 2 is a part of FIGURE 1 to a larger size showing details of the construction of the overspeed lock and the means for overriding the lock,

FIGURE 3 is a partial cross-sectional view corresponding to FIGURE 2, but showing a modified overriding means for the overspeed lock, and

FIGURE 4 is a cross-sectional side elevation of a hydraulic variable pitch non-reversing propeller having a separate hydraulic circuit to transmit pressure to break down a fine pitch stop, the propeller incorporating the present invention.

Referring to FIGURE 1 of the drawings, the propeller comprises a hub 11 upon which are journaled the blades 12 for rotation about their longitudinal pitch change axes. Each blade 12 comprises a crankpin 13 at its root end coupled by a connecting rod 14 to a piston 15 sliding in a cylinder 16 arranged coaxially with a driving shaft 17 in the nose portion of the hub 11.

The piston 15 is of annular form, and slides on a

stationary barrel 18 housing retractable fine pitch stop mechanism shown generally at 19. The fine pitch stops are in the form of abutments which are mounted on resilient tongues and are prevented from moving inwards by a retaining ring 20 on an annular stop-release piston 21 sliding inside the barrel 10. Normally this piston 21 is held at one end of its stroke by a spring 22 and is movable to the right under the pressure of fine pitch oil admitted to the chamber 23.

The piston 15 is provided with a sleeve 24 which is a sliding fit on the barrel 18, its forward end being provided with a chamfered abutment 25. Projecting forward from this sleeve 24 is an annular ring 26, the forward end of which is also provided with a chamfered abutment 27. The internal diameter of this ring is somewhat larger than the external diameter of the barrel 18 for a purpose which will hereinafter be described.

The fine pitch stop mechanism 19 comprises two sets of abutments 28 and 29. Abutments 28 are mounted on resilient tongues 30 which are a sliding fit inside barrel 18, and which, at their rear end, are integral with a ring 31 upon which is seated a sleeve 32. This sleeve forms a seating for a spring 33 the other end of which seats on the annular piston 21. The annular piston 21 is slidable on its inner diameter on an inner barrel 34. Carried concentrically with the piston 21 is a sleeve 35 the rear end of which carries a portion 36 which forms an abutment. Mounted on this sleeve 35 is a sleeve 37 provided with resilient tongues each of which carries an abutment member 38 shown in contact with the ring 31.

Abutments 29 are mounted on resilient tongues 39 which, at their rear end, are integral with a ring 40. As may be seen from FIGURE 1, the resilient tongues 30 and 39 lie around the same peripheral axis and are alternately placed, there being a clearance between each so that a passage is provided for the coarse pitch oil into the coarse pitch side of the pitch changing motor, that is, on the left-hand side of piston 15 in FIGURE 1.

The abutments 28 and associated tongues 30 together with the ring 31 and sleeve 32 are axially slidable to the left in FIGURE 1 against the pressure of a spring 33, whereas the abutments 29 and associated tongues 39 are fixed axially in the hub.

The retaining ring 20, fixed to the piston 21, is stepped to provide three diameters 20a, 20b and 20c.

The inner barrel 34 contains a pressure relief valve 43 which opens against the action of a spring 85, at a predetermined fine pitch pressure, to admit pressure oil to the chamber 23.

The operation of the stop mechanism 19 will now be described.

When the propeller is in coarse pitch the piston 15 is at the right-hand end of the cylinder 16 as shown in FIGURE 1, and the abutments 28 and 29 are extended outwards in the path of the piston as shown.

When the piston 15 moves to the left under fine pitch pressure transmitted by liquid admitted to the rear thereof through passage 48, ports 86, passage 42a, chamber 87 and ports 41, the fine pitch pressure also passes through passage 42 and ports 88 to the relief valve 43. The piston 15 continues to move to the left until the annular ring 26 passes over the abutment 28 (by virtue of the fact that its internal diameter is larger than the external diameter of abutment 28) and the chamfered part 27 contacts the correspondingly chamfered part 29a of the abutment 29, which is the normal fine pitch stop, and thus prevents the piston from moving further to the left and thus the propeller from attaining a super-fine pitch.

To attain a super-fine pitch, the fine pitch pressure is allowed to increase, so that the relief valve 43 is moved to the left in FIGURE 1 against the action of spring 85, and pressure oil passes to the chamber 23 through ports 89 and 90, annular passage 91, ports 92 and annular passage 93, whereupon the piston 21 and the retaining ring 20 move to the right in FIGURE 1 against the action of

the spring 22. As a result of this movement, the leg 29b of the abutment 29 springs down onto the 20b diameter of the retaining ring 20. This permits the piston 15 to move further to the left until the chamfered part 25 of the sleeve 24 contacts the correspondingly chamfered part 28a of the abutment 28, which forms the super-fine pitch stop. At the same time the abutments 36 on the sleeve 35 contact the abutments 38 thereby preventing further movement of the piston 21 to the right in FIGURE 1.

To put the propeller blades into reverse pitch the fluid pressure is increased still further, in any known or convenient manner. However much the pressure is increased in chamber 23 the piston 21 will not move to the right in FIGURE 1 to break the super-fine pitch stop due to the lock between abutments 36 and 38 which are now in contact. As the fine pitch pressure is increased at the rear of piston 15, however, which is abutting the abutments 28, the thrust of the spring 33 is overcome and as a result the piston 15, abutments 28, tongues 30, ring 31 and sleeve 32 move to the left in FIGURE 1 thus breaking the lock between abutments 36 and 38, and permitting the abutments 38 which are mounted on resilient tongues 37 to spring outwardly. This in turn permits the piston 21 to move to the right in FIGURE 1 until its extreme right-hand end abuts against a stop 44. Simultaneously the leg 29b of the abutment 29 springs onto the diameter 20c of the retaining ring 20, and then the toe of the abutment 28 springs onto the diameter 20b of the retaining ring 20 this permitting the piston 15 to move across to the left in FIGURE 1 to move the blades 12 into a reverse pitch position.

Coarse pitch oil passes to the pitch changing motor, on the left of piston 15 in FIGURE 1 from the passage 47 through the overspeed lock generally indicated at 94, and via port 95, chamber 96, ports 97, and then between the tongues 30 and 39. The overspeed lock 94 is arranged between the relief valve 43 and the passages 47 and 48. This will now be described.

Referring to FIGURE 2, progressing rearwardly from the rear end of the bore 46 of the relief valve 43 the overspeed lock comprises an overriding piston 49 and cylinder 50, a lock valve seat 51, a lock valve body 52, a non-return valve body 53 and a non-return valve seat 54, all coaxially arranged on the axis of the shaft 17.

The lock valve seat 51 comprises an orifice plate 55, the space 56 on the forward side of which communicates with ports 95 and therefore the coarse pitch chamber of the pitch changing motor as previously described. Around the rear edge of the orifice is a seating 51 for the lock valve body 52 which is of hollow cylindrical form and has a corresponding seating 57 at its forward end. At its rear end the body 52 has a portion 58 slightly larger in diameter than the seating 57 and sliding in a fixed cylinder 59. The body 52 has between its ends an outwardly directed circumferential flange 60 forming an abutment for a coiled compression spring 61 urging the body 52 in the opening direction, i.e. towards the right in FIGURE 2. The flange 60 is perforated, as at 98, for the passage of coarse pitch oil around the outside of the body 52, and the flange 60, at its rear side, bears upon the ends of bellcranks 62a which form part of flyweights 62 which force the body 52 forwardly against the seating 51 to shut off the coarse pitch oil passage when the propeller speed rises a predetermined amount above the normal maximum.

When the lock valve body 52 closes onto the seating 51, hydraulic liquid is trapped between the left hand face of the piston 15 and the lock valve, the trapped volume of liquid providing a hydraulic lock which prevents the piston 15 moving to the left in FIGURE 1 i.e. in the pitch fining direction. More particularly it should be understood that when the lock valve closes hydraulic liquid is prevented from passing from the left hand

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side of the piston 15, between the tongues 30 and 39 into the chamber 96, and through the ports 95 into the space 56 (see FIGURE 2) and then from this space through the orifice in the plate 55 and around the outside of the valve body 52 and through the ports 98 to the coarse pitch conduit 47 by reason of the fact that the valve body 52, in closing onto the seating 51 prevents hydraulic liquid from passing from the space 56 to the ports 98.

Hydraulic liquid from the space 56 is however able to pass into the inside of the valve body 52, which it will be understood forms part of a by-pass conduit by-passing the lock valve.

Thus pressure building up on the downstream side of the valve 52 due to centrifugal force acting on the propeller blades 12 after the valve 52 has closed, is communicated through the hollow valve body 52 to the cylinder 59 in which the rear end of the body slides, and as the rear part of the body 52 is somewhat larger in diameter than the valve seat 51, a force is produced tending to keep the valve body 52 in its closed position even though the propeller speed falls slightly thus reducing the force applied to the flange 60 by the fly-weights 62.

The rear end of the cylinder 59 is provided with a port 63 communicating with the coarse pitch oil passage 47 and having on its forward side the seating 54 for the non-return valve body 53 which is housed within the cylinder 59. The body 53 is urged against the seating 54 by a light coil spring 64, bearing at its other end on a shoulder 65 provided around the interior of the body 52.

Pressure building up in the interior of the valve body 52, and therefore the cylinder 59, in excess of the pressure in the coarse pitch conduit 47 forces the non-return valve 53 on to its seating 54 when the lock valve is closed and prevents hydraulic liquid from the left hand side of the piston 15 passing from the space 56 through the body 52 and the cylinder 59 to the coarse pitch conduit. When the lock valve is closed therefore hydraulic liquid from the coarse pitch side of the pitch change motor cannot by-pass the lock valve through the lock valve body and the cylinder 59, to break down the hydraulic lock effected by the closure of the lock valve.

If after the lock valve has been closed due to an overspeed condition being set up, the pressure in the coarse pitch supply passage 47 rises above that in the interior of the valve body 52 (and therefore that on the coarse pitch side of the pitch change motor) the non-return valve 53 opens and allows the higher pressure in passage 47 to act in the pitch change motor to increase the pitch of the blades. When the speed has fallen sufficiently, due to the increased blade pitch, the fly-weights 62 then allow the lock valve to open under the action of spring 61 and operation then proceeds normally.

If therefore after a temporary fault develops in the hydraulic system which causes the lock valve to close the fault is corrected, the lock valve is re-opened and the propeller again commences to operate in the normal manner.

To override the action of the overspeed lock 94 when the propeller is moved to super-fine or to reverse pitch, the lock valve body 52 is provided at its forward end with a stem 66 projecting through the orifice plate 55 into the path of travel of the overriding piston 49 sliding in the cylinder 50. This cylinder 50 communicates, through a port 67 in its forward end, with the bore 45 containing the fine pitch stop relief valve 43. The piston 49 is urged away from the end of the stem 66 by a coil spring 63 surrounding the stem and abutting the rear end of the cylinder 50, and carries in its crown a valve member 69 which closes the port 67. When the fine pitch pressure is increased for the purpose of breaking down the fine pitch stop, or the super-fine pitch stop as previously described,

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it also opens the overriding valve 69 against the pressure of the spring 68 and moves the piston 49 into contact with the stem 66 so that movement of the body 52 to the left in FIGURE 2, and therefore closing of the lock valve at a moderate permissible overspeed is prevented.

In the arrangement just described with reference to FIGURES 1 and 2 of the drawings it will be noted that the rear of the overriding piston 49 is, when the lock valve 52 is open, normally subjected to the coarse pitch oil pressure in addition to that of the spring 68. When the lock valve body 52 is moved to the left in FIGURE 2 so that it closes on the seating 51, the coarse pitch oil line is divided into two zones—one between the piston 15 and the non-return valve body 53, and the other between the other side of the non-return valve and the constant speed unit, which, in known manner controls the pitch of the propeller. The second zone is subject to whatever pressure the constant speed unit calls for in the coarse pitch line, i.e. either feed pressure or return flow pressure according to whether the constant speed unit is demanding a coarser or a finer pitch. The pressure in the other zone, between the valve body 53 and the piston 15 is not predictable as here there is a trapped volume of oil, the pressure of which depends partly on the pressure prevailing on the fine pitch side of the piston 15.

This unpredictable pressure might under certain conditions affect the operation of the overriding piston 49, and to prevent this the overriding arrangement may be modified in a manner which will now be described with reference to FIGURE 3. Referring to FIGURE 3, in which parts which have already been described are indicated by the same reference numerals as before, the modification consists in venting the back of piston 49 to the second zone referred to above. Accordingly in the modified arrangement the cylinder 50 is placed in communication with the passage 47 via passages 69, 70 and 71. Additionally, the piston 49 carries the stem 66 which projects through the rear wall of the cylinder 50 which is closed at its end by a packing gland 99 so as to form a chamber communicating with vent passage 69.

With this arrangement, when the lock valve body 52 is closing, the coarse pitch pressure, which is momentarily building up on the coarse pitch side of the piston 15, is not permitted to communicate with the rear of the piston 49 and thus the permissible overspeed during pitch change, is maintained at a relatively stable value.

Referring now to FIGURE 4, in which the propeller shown is of the type which features an independent pressure supply for the operation of the pitch stop retracting mechanism as described in the specification of British Patent No. 672,953. The propeller is non-reversing and thus only one set of retractable stops 80 are provided to prevent movement of the piston 15 from fine pitch to super-fine pitch position.

As described in the specification referred to, when it is required to move the blades into super-fine pitch a solenoid valve is operated by the pilot, this allowing high pressure oil to pass through the annular passage 72, which is separate of the passages 47, 49 as previously described in this specification, passages 73, 74, into chamber 75. From here it passes via channels 76 and 77 into chamber 78 to operate the stop release piston 79 which slides to the left in FIGURE 4 and permits the stops 80 to spring inwardly. Thus the piston 15 is allowed to move to super-fine position.

According to the present invention, the pressure in the chamber 75 acts on the forward end of the overriding piston 49, the arrangement being that when the pressure in the passage 72 is increased to break the super-fine pitch lock the piston 49 is displaced to the right in FIGURE 4 and the stem 66 extends through the orifice in the plate 55, and prevents the lock-valve body 52 seating on the plate 55, during the momentary overspeeding of the propeller as it is moved into a super-fine pitch.

In addition, the rear of the piston 49 is vented to the

coarse pitch oil passage 47 via passages 81, 82, 83 and 84, for the reason previously discussed.

The operation of the overspeed lock is otherwise as previously described, and those reference numerals in FIGURE 4 which are not otherwise referred to, indicate parts which correspond to parts indicated by like reference numerals in the other figures.

While it is preferred to arrange the overspeed device in the propeller hub this is not essential and the device could be separate from the propeller if desired.

We claim:

1. In a hydraulically operated variable pitch propeller comprising a plurality of propeller blades, a hydraulic pitch change motor operatively connected to adjust the pitch of the blades, and a coarse pitch fluid conduit connected to said motor to convey hydraulic fluid thereto to actuate the motor in the sense to increase the pitch of the blades, a normally open lock valve in said coarse pitch conduit, propeller speed responsive means operatively connected with said lock valve for closing the lock valve solely in response to the attainment of a propeller speed in excess of a predetermined maximum operating value, said lock valve being adapted so that after it has been closed it remains closed when there is an excess of pressure on the pitch change motor side of the lock valve above that on the other side, a by-pass fluid conduit bypassing said lock valve, and a non-return valve in said by-pass conduit for closing said by-pass conduit when the pressure on the pitch change motor side of the non-return valve exceeds that on the other side of the non-return valve.

2. A propeller as claimed in claim 1, wherein said lock valve comprises an orifice in said coarse pitch conduit, a tubular valve body slidably mounted in said coarse pitch conduit and movable to a position in which one end face of said body seats with the bounding wall of said orifice to close said orifice and thereby interrupt communication between the part of said coarse pitch conduit on one side of said orifice and the part of said coarse pitch conduit on the other side of said orifice, and wherein part at least of said by-pass conduit is provided by the interior of said tubular valve body.

3. A propeller as claimed in claim 2 wherein said valve body is normally held out of engagement with the wall of said orifice by means of a spring, and wherein said speed-responsive means comprises a flyweight carried for rotation with the propeller, said flyweight being arranged to move said valve body against the action of said spring to close said orifice when the propeller speed exceeds said predetermined value.

4. A propeller as claimed in claim 2 wherein said valve body is on the side of said orifice remote from the pitch change motor, and slides at one end in a cylinder fixed relatively to said coarse pitch conduit and positioned towards the end of said valve body remote from said orifice, said end of said valve body being of larger diameter than the end of said valve body adjacent said orifice so that said valve body is urged in the closing direction in response to an excess of pressure on the pitch change motor side of the valve above that on the other side, and wherein said cylinder houses said non-return valve.

5. A propeller as claimed in claim 4 wherein said non-return valve comprises a port in the end wall of said cylinder, and a valve body to close said port, said non-return valve body being housed in said cylinder and being urged against the co-operating end wall of the cylinder by a coiled spring bearing at one end against the non-return valve body and at its other end against an internal shoulder in said tubular valve body.

6. A propeller as claimed in claim 2, wherein said propeller includes a fine pitch stop, stop releasing means actuable by hydraulic liquid at a predetermined pressure, a fine pitch stop conduit for conveying hydraulic liquid at said predetermined pressure to said stop releasing means, and a hydraulically operable overriding means in

communication with the fine pitch stop conduit, said overriding means being operable by hydraulic liquid at said predetermined pressure to prevent the closing of said normally open lock valve.

7. A propeller as claimed in claim 6, wherein said overriding means comprises an overriding cylinder on the side of said orifice remote from said tubular valve body, said overriding cylinder being axially aligned with said tubular valve body, a piston in said overriding cylinder, the overriding cylinder being in communication with said fine pitch stop conduit on the side of said piston remote from said tubular valve body, and spring means urging said piston away from said tubular valve body, the arrangement being such that when the hydraulic pressure in said fine pitch stop conduit is increased to release the fine pitch stop, said piston is displaced in said overriding cylinder towards said cylindrical valve body and prevents said valve body closing said orifice.

8. A propeller as claimed in claim 7, wherein said cylindrical valve body or said piston carries a stem which passes freely through said orifice, the piston, or the tubular valve body, engaging said stem when said piston is displaced towards said tubular valve body, the stem then preventing movement of the tubular valve body to close said orifice.

9. A propeller as claimed in claim 8, wherein the space in said overriding cylinder on the side of said piston adjacent said orifice is closed against the entry of hydraulic liquid from the pitch change motor side of said orifice, and said space is connected to the coarse pitch conduit on the side of said orifice remote from said pitch change motor.

10. A propeller as claimed in claim 7, wherein there is provided a spring-loaded valve between said fine pitch stop conduit and said overriding means, which spring-loaded valve opens to connect said overriding means with said fine pitch stop conduit when the pressure in said fine pitch stop conduit attains said predetermined value.

11. A propeller as claimed in claim 10, wherein said spring-loaded valve comprises a port in the end wall of said overriding cylinder remote from said tubular valve body and a ball valve housed in the crown of said piston to close said port under the action of the spring means urging the piston away from the tubular valve body.

12. In a hydraulically operated variable pitch propeller comprising a plurality of propeller blades, a hydraulic pitch change motor operatively connected to adjust the pitch of the blades, a fine pitch stop, hydraulic stop releasing means actuable by hydraulic fluid at a predetermined pressure to release said fine pitch stop, a coarse pitch fluid conduit connected to said motor to convey hydraulic fluid thereto to actuate the motor in the sense to increase the pitch of the blades, and a stop releasing fluid conduit connected to said hydraulic stop releasing means to convey thereto fluid at said predetermined pressure to actuate said hydraulic stop releasing means to release said fine pitch stop, a normally open lock valve in said coarse pitch conduit, propeller speed responsive means operatively connected with said lock valve for closing the lock valve solely in response to the attainment of a propeller speed in excess of a predetermined maximum operating value, said lock valve being adapted so that after it has been closed it remains closed when there is an excess of pressure on the pitch change motor side of the lock valve above that on the other side, hydraulically operable overriding means in communication with said stop releasing fluid conduit actuable with said stop releasing means by fluid at said predetermined pressure to override the action of said speed responsive means and prevent the closing of said lock valve, a by-pass fluid conduit bypassing said lock valve and a non-return valve in said by-pass conduit for closing said by-pass conduit when the pressure on the pitch change side of the non-return valve exceeds that on the other side of the non-return valve.

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