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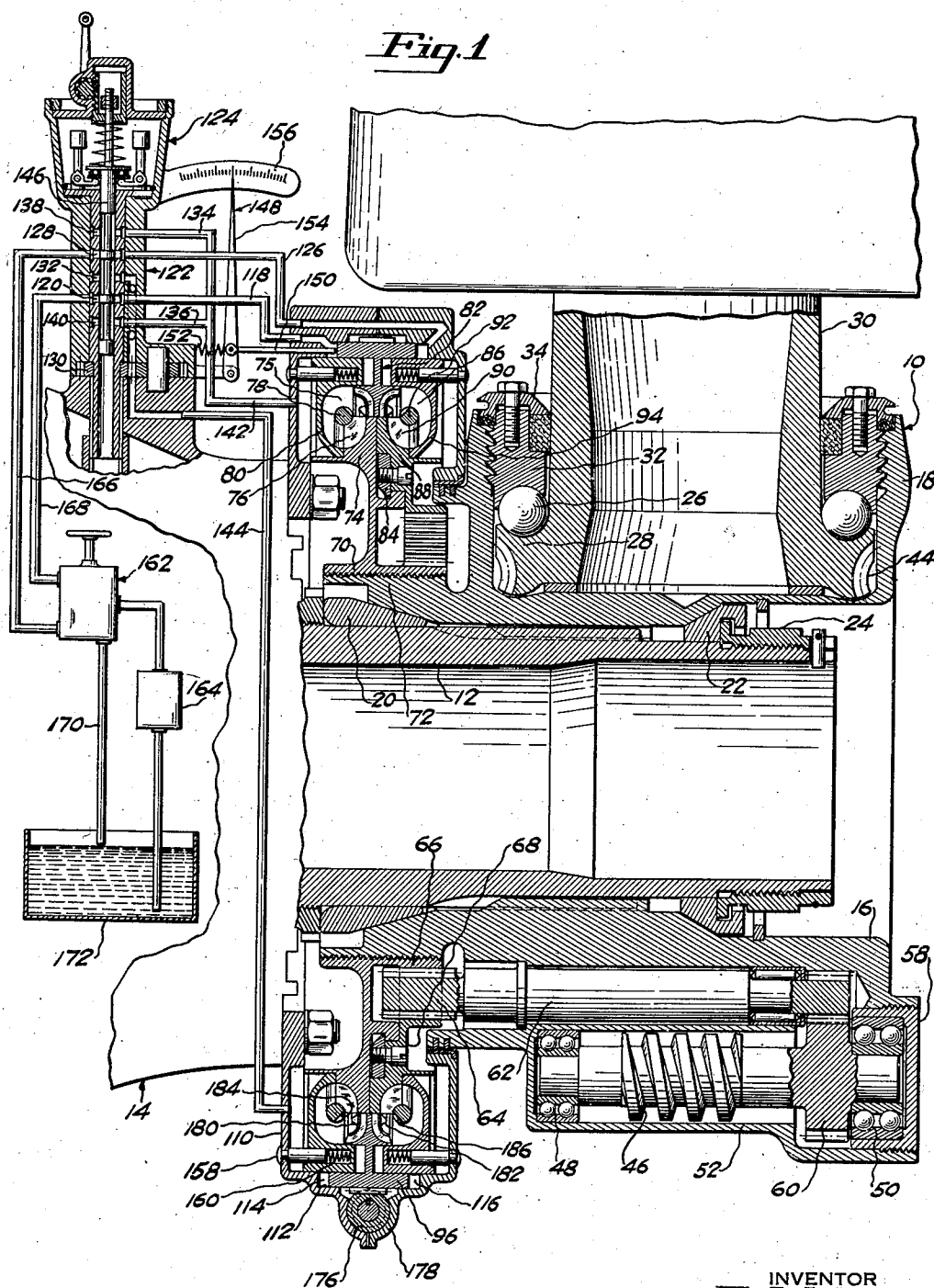
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PROPELLER PITCH CHANGING MECHANISM

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4 Sheets-Sheet 1

Fig. 1



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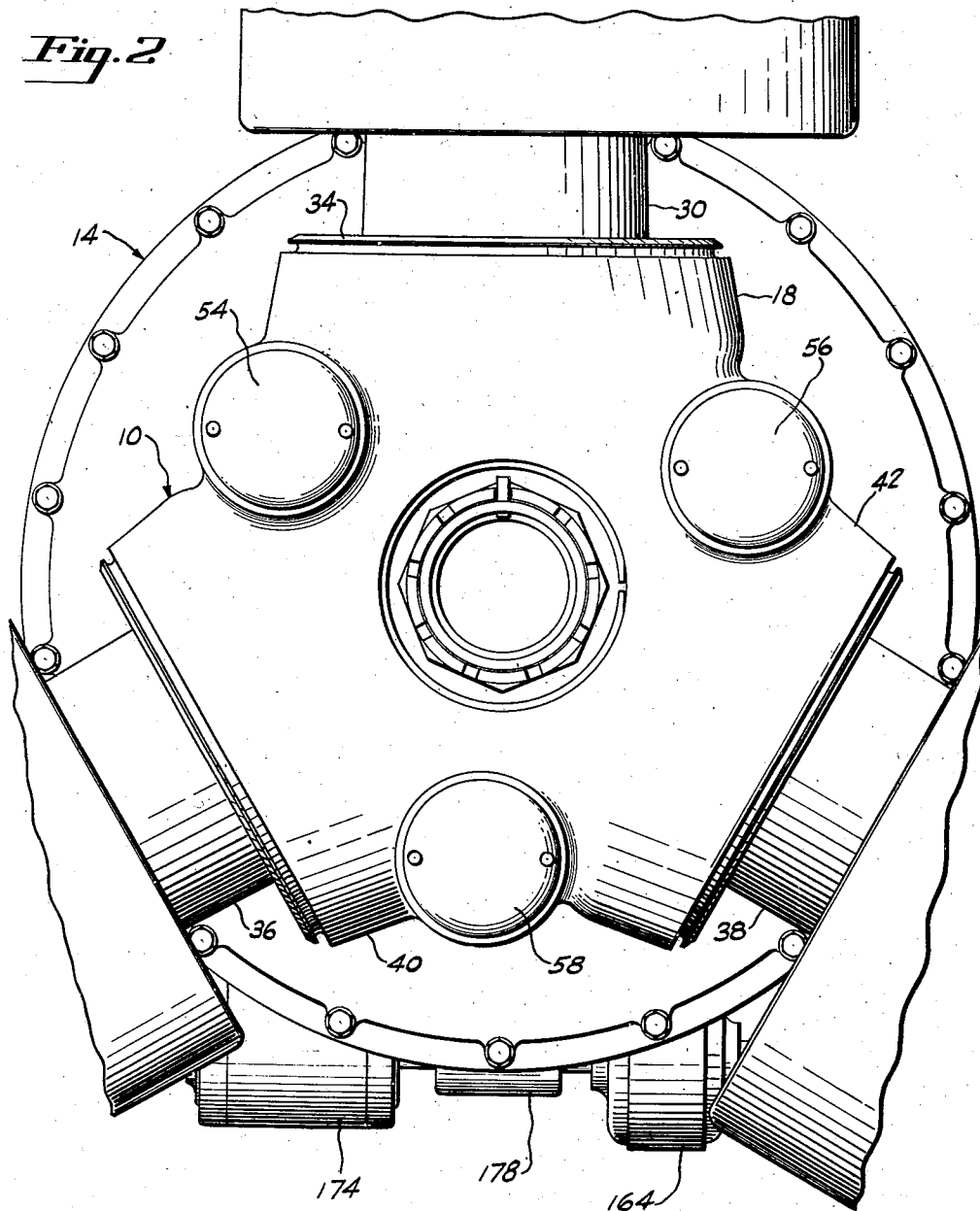
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Fig. 2



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Fig. 3

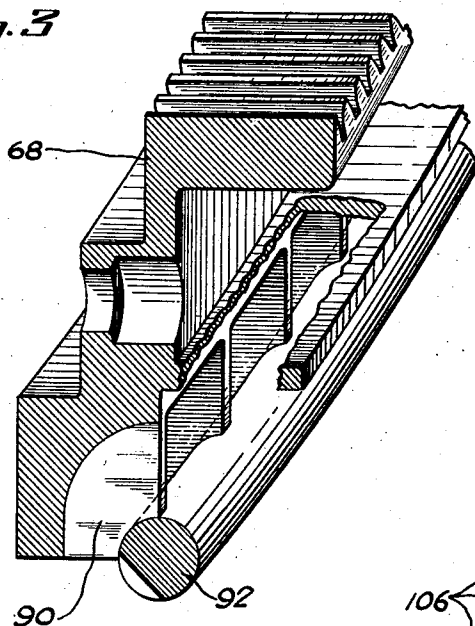
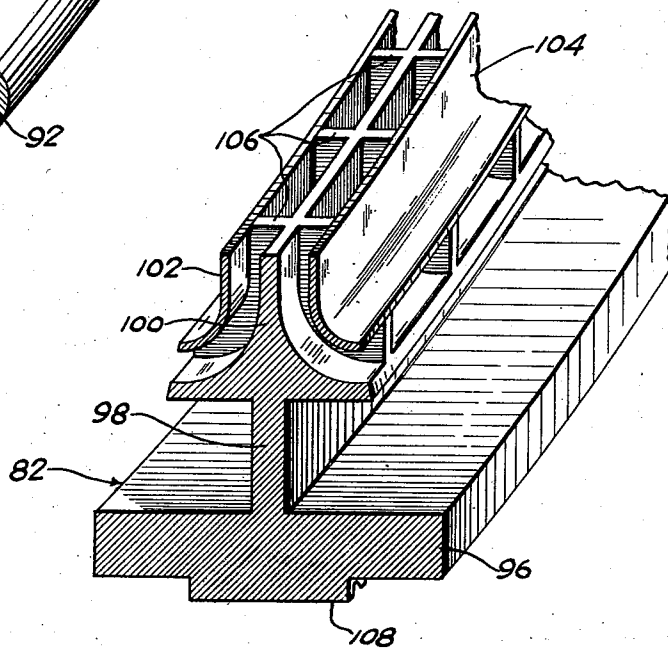


Fig. 4



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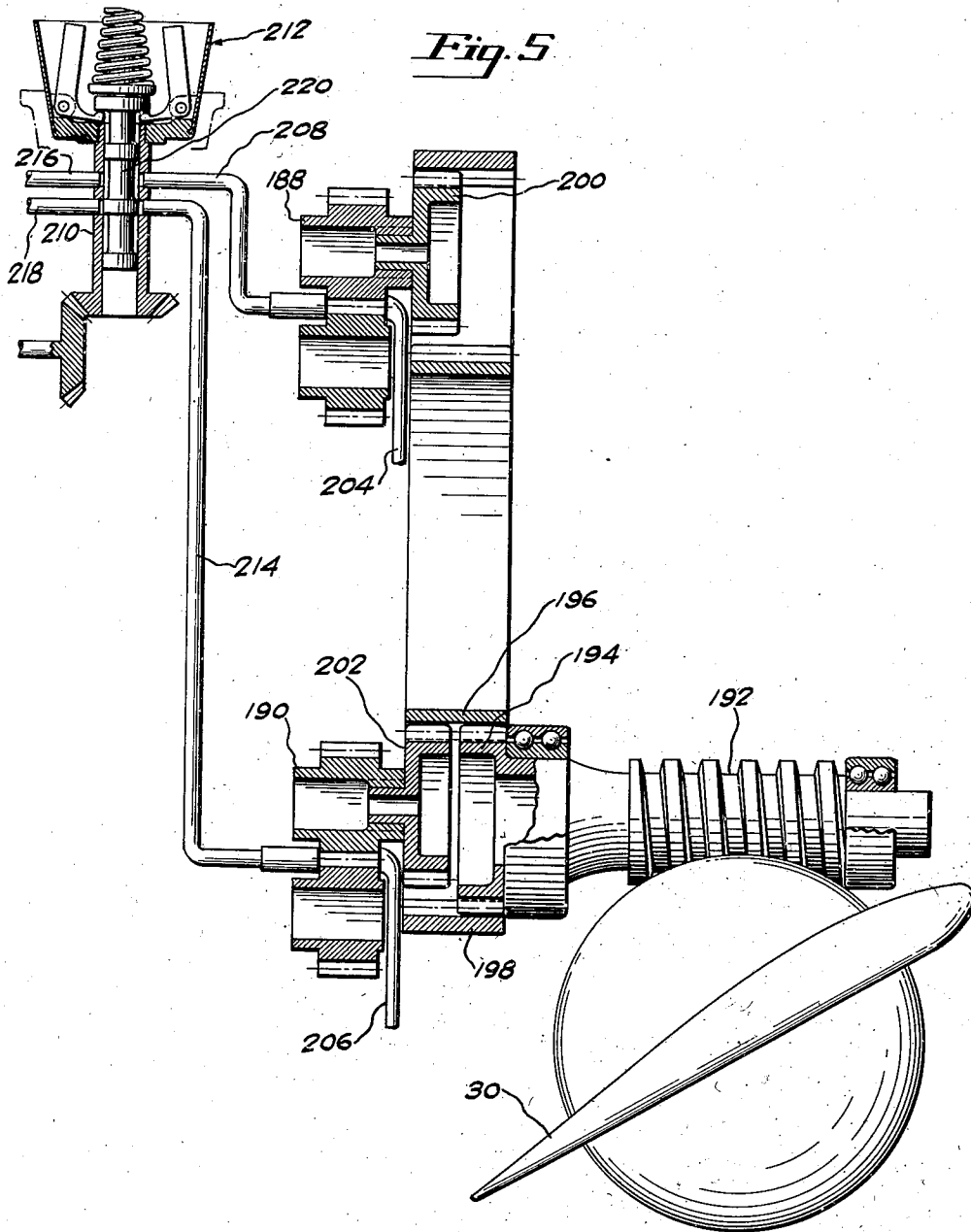
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PROPELLER PITCH CHANGING MECHANISM

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4 Sheets-Sheet 4



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PROPELLER PITCH CHANGING MECHANISM

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13 Claims. (Cl. 170—163)

This invention relates to improvements in controllable-pitch propellers and has for an object the provision of an improved pitch changing mechanism for such a propeller.

An object of the invention resides in the provision of an improved pitch changing mechanism of the character indicated powered by relative rotation between the propeller and the propeller driving engine.

A further object resides in the provision of an improved propeller pitch changing mechanism of the character indicated which is responsive to speed governing control and to a manual control for feathering and unfeathering the propeller.

A still further object resides in the provision of a pitch changing mechanism of the character indicated having a speed responsive control including a speed governor and follow-up mechanism between the pitch changing mechanism and the governor to maintain the propeller pitch at the setting corresponding to the speed demands of the governor and to avoid hunting between the governor and the pitch changing mechanism.

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 is illustrated a suitable mechanical embodiment for the purpose of disclosing the invention and a somewhat modified embodiment utilizing the same principles in a somewhat different mechanical arrangement. The drawings, however, are for the purpose of illustration only and are not to be taken as limiting or restricting the invention since it will be apparent to those skilled in the art that various changes in the illustrated embodiments may be resorted to without in any way exceeding the scope of the invention.

In the drawings,

Fig. 1 is a longitudinal sectional view of the hub portion of a propeller showing the application thereto of a pitch changing mechanism and control therefor constructed according to the invention.

Fig. 2 is a front-elevation view of the hub portion of the propeller shown in Fig. 1.

Fig. 3 is a detailed projectional view on an enlarged scale of a fragmentary portion of one of the fluid coupling elements shown in Fig. 1.

Fig. 4 is a detailed projectional view on an enlarged scale of a fragmentary portion of another of the fluid coupling elements shown in Fig. 1, and

Fig. 5 is a somewhat diagrammatic view of a modified form of pitch changing mechanism and control therefor.

Referring to the drawings in detail, the numeral 10 generally indicates a controllable-pitch propeller mounted upon the propeller shaft 12 of a propeller driving engine, generally indicated at 14. The propeller has a unitary hub member 16 provided with a central internally splined aperture through which the shaft 12 projects and a plurality of blade retaining sockets, one of which is indicated at 18. The hub 16 is secured on the shaft 12 by suitable means, such as the locating cones 20 and 22 and the retaining nub 24 screw threaded onto the end of the shaft 12, and the blades are retained in their sockets by suitable anti-friction thrust bearings each of which may comprise a row of ball elements 26 bearing at one side on a race 28 formed integrally on the end of the shank of the blade 30 and bearing at the other side on a race 32 screw threaded into the socket 18 and retained in position therein by a suitable locking ring 34 having peripheral splines which engage with corresponding splines in the open end of the socket. The propeller may have a plurality of blades, the particular propeller illustrated having three blades as indicated at 30, 36 and 38 in Fig. 2, mounted in respective blade sockets 18, 40 and 42.

Each blade carries upon the socket included end thereof a worm gear, as indicated at 44 in Fig. 1, and the hub member 16 carries a plurality of worms, one of which is indicated at 46 in Fig. 1, meshing respectively with the blade gears. Each worm element is mounted by respective end bearings, as indicated at 48 and 50, in a respective hub extension, as indicated at 52, which opens toward the forward side of the propeller and has a removable closure member, the closure members for the three worms being shown at 54, 56 and 58 in Fig. 2. Each of the worm members carries a spur gear element, as indicated at 60 in Fig. 1, meshing with a gear on the end of a respective drive shaft 62 rotatably mounted in the hub parallel to the worm element 46 and carrying at its end opposite the gear 60 a gear 64 having a tooth length greater than that of its mating gears. The gear elements 64 of the drive shaft 62 are located between a pair of ring gears one of which, as indicated at 66, has external gear teeth and the other of which, as indicated at 68, has internal gear teeth, the teeth of both ring gears meshing with the teeth of the elongated drive shaft gears.

The gear member 66 has a cylindrical inner

portion 70 screw threaded onto a cylindrical rearward extension 72 of the hub 16 and has an outer circumferential portion 74 which constitutes one cross-sectional quadrant of a toroidal fluid coupling structure 75 such as is well known to the art under the name of "Föttinger" clutch, or "Vulcan" coupling. This portion 74 of the gear element is provided with spaced internal vanes 76 which carry a ring shaped core member 78 located substantially centrally of the toroidal coupling chamber. Two cross-sectional quadrants of the coupling are formed by a fixed annular member 80 and the fourth quadrant is provided by one side of an axially movable member, generally indicated at 82 and illustrated in detail in Fig. 4. The gear member 68 is connected to the gear member 66 by means of a split two-piece washer 84 which maintains the member 68 adjacent to the member 66 and concentric therewith while permitting rotation of the member 68 relative to the member 66. The outer circumferential portion of the member 68 constitutes one cross-sectional quadrant of a second fluid coupling 86 disposed concentric with and parallel to the coupling 75 mentioned above. This outer portion 88 of the member 68 is provided with vanes 90 similar to the vanes 76 and these vanes carry a core member 92 similar to the core member 78. Two cross-sectional quadrants of the coupling 86 are provided by the relatively fixed member 94 and the fourth cross-sectional quadrant is provided by the side of the member 82 opposite the side constituting the fourth cross-sectional quadrant of the coupling 75.

The operation of the double fluid coupling is substantially as follows. Referring to Fig. 4 it will be observed that the member 82 comprises an annular band portion 96 connected by a central internal web 98 with a clutch control structure 100 comprising two rows of radial chambers separated by a continuation of the web 98 and closed on their outer sides by the annular members 102 and 104. These chambers are separated circumferentially by transverse partitions as indicated at 106 which may be formed integrally with the adjacent portion of the web 98 or rigidly secured thereto. On its outer surface the band portion 96 is provided with a ring of gear teeth 108. When the member 82 is in the neutral position shown in Fig. 1 both sets of passages therethrough are blocked off by the respective peripheral surfaces of the members 66 and 68. Under these conditions, although the members 66 and 68 rotate relative to the fixed members 80 and 94 and the member 82 and carry with them the respective vanes 76 and 90, the couplings do not create any important drag since the interior surfaces of the respective members 80 and 94 are smooth and the surfaces of the ring members 102 and 104, with which the fluid in the couplings comes in contact, are also substantially smooth. Under these conditions the fluid is simply carried around in the clutch members without producing any effective braking action. If, however, the member 82 is moved axially until the passages at one side thereof register with the space at the other end of the vanes of the respective gear member, the vanes will force the fluid through the passages in the member 82 and the fluid will begin to spiral in the coupling member and force will be required to shear the fluid between the vanes 76 and the transverse partitions 106 in the member 82, which force will place a braking action on the corresponding gear member 66 or 68. If the member 82 is moved to the left, as viewed

in Fig. 1, the gear member 66 will be held and the drive shafts 62 will be caused to rotate as they are revolved about this gear member by the rotating propeller hub and will in turn rotate the respective worm elements 46 which worm elements will react with the respective blade carried gears 44 and rotate the blades in a pitch changing direction. If, however, the member 82 is moved to the right as viewed in Fig. 1, the gear 68 will be held and the drive shafts 62 will be rotated in the opposite direction as they are revolved within the gear 68 by the rotating propeller hub and will act through the respective worm elements 46 and blade carried gears 44 to turn the blades in the opposite direction from the direction in which they are turned if the gear 66 is held.

The fluid coupling mechanism is enclosed in an annular casing 110 which provides an annular chamber 112 for the band portion 96 of the member 82 somewhat wider than the band portion itself. The inner surface of the band portion 96 bears upon the peripheral surfaces of the fixed members 80 and 94 thus providing a closed annular chamber at each side of the band member 96, as indicated at 114 and 116. The chamber 114 is connected by a suitable fluid passage 118 with a set of ports 120 provided in a valve, generally indicated at 122, actuated by a speed governor of the centrifugal type, generally indicated at 124, while the chamber 116 is connected through a suitable fluid passage 126 with a set of ports 128 in the valve 122. Fluid under pressure from a suitable pump, such as is indicated at 130, is led to the interior of the valve 122 through the ports 132, and drain channels 134 and 136 lead from the valve ports 138 and 140. The drain channels are connected through a suitable conduit 142 with the reservoir in the interior of the casing 110 and the intake of the pump 130 is connected through a suitable conduit 144 with the interior of the casing 110, preferably near the bottom thereof as is particularly illustrated in Fig. 1. With this arrangement the pump 130 will draw fluid from the reservoir within the casing 110 and force it into the valve to the ports 132. If the valve plunger 146 is lowered, due to an underspeed condition, the channel 126 will be connected with the drain channel 134 and the channel 118 will be connected with the pressure channel from the pump 130. Under these conditions the annular chamber 114 will be filled with fluid under pressure and the chamber 116 will be connected with drain, thereby forcing the member 82 to the right as viewed in Fig. 1, which will hold the gear 68 and cause the worm elements 46 to rotate the blade in a pitch decreasing direction. Similarly, if the plunger 146 is raised, due to an overspeed condition, the channel 118 will be connected with the drain channel 136 and the channel 126 will be connected with the pump outlet thereby applying fluid pressure to the annular chamber 116 and connecting the chamber 114 with drain to force member 82 to the left, as viewed in Fig. 1, to hold the gear 66 and rotate the blades through the worm members 46 in a pitch increasing direction.

Whenever the gear 66 is held against rotation the relative rotation of the propeller hub 16 will cause this gear to move axially along the screw threads between the gear 66 and the propeller hub 16. If the gear 68 is held rotation of the gears 64 will cause the gear 66 to rotate in the opposite direction and move in the opposite axial direction along the lead screw. Thus, if the gear

66 is positioned on the end of the hub 72 at a definite known position for a known pitch angle of the propeller blades, the position of this gear along the lead screws will always be exactly indicative of the pitch angle of the propeller. The arrangement is such that, when the member 82 is moved laterally to connect one of its series of radial chambers with one of the fluid couplings, this action of the lead screw between the gear 66 and the propeller hub will cause the clutch mechanism to follow this movement of the member 82 until the passages are again cut off thus leaving the propeller blades at the pitch required by the speed change demand of the governor 124. Since the passages of the member 82 will be cut off at a predetermined relative position between this member and the clutch mechanism it follows that the lateral position of the member 82 is also continuously indicative of the pitch angle of the propeller blades and the angle of the propeller pitch at all times can be indicated by means of a simple indicator such as is generally indicated at 148. Such an indicator may comprise a plunger 150 in contact with the adjacent side of the band portion 96 of the member 82 and held in contact therewith by a compression spring 152 and a pointer 154 connected with this plunger and movable along a scale 156 graduated in propeller pitch angles.

In order to permit free lateral movement thereof the fluid coupling mechanism is held in position by suitable means, such as the pins 158 secured to the casing 110 and projecting into apertures in the fixed portion 80 and 94 of the coupling members. Centering springs, as indicated at 160, may be disposed between the inner ends of these pins and the bottoms of the respective apertures in the fixed coupling members which springs will maintain the fixed members of the coupling mechanism in fluid tight contact with the rotatable portion to avoid leakage of fluid from the coupling members during operation.

The propeller may be feathered or unfeathered by a suitable control, such as the manually actuable valve 162 connected at one side with a source of fluid under pressure such as the pump 164 and connected at its opposite side by means of suitable conduits 166 and 168 with the channels 126 and 118. This valve may be operated when the governor actuated valve 122 has been brought to its closed position, as shown in Fig. 1, to continuously apply fluid under pressure to either one of the chambers 114 or 116 and connect the opposite chamber to drain through suitable means such as the channel 170 leading to the sump or reservoir 172. It is believed unnecessary to show the valve details as it is obvious that any valve which has a neutral position in which all the lines are blocked and will connect the pump 164 with line 168 and line 170 with line 166 in one position and connect the pump 164 with line 166 and line 170 with line 168 in the other position would be satisfactory. By maintaining a constant force on one side or the other of the portion 96 of the member 82 the member 82 may be moved to either extreme lateral position so that the pitch changing mechanism will have to turn the propeller blades to their full feathered position before the passages in the member 82 can be cut off by the coupling mechanism or alternatively, will have to move the blades out of their feathered condition and return them to their constant-speed control range of pitch angles before the passages can be cut off.

In order to feather or unfeather the propeller

when the engine is not operating there is provided an electric motor 174 which may be conveniently secured to the bottom portion of the casing 110 to drive a worm element 176 enclosed in a casing extension 178 and meshing with the teeth 108 in the member 82. These gear teeth 108 and the worm element 176 normally act as a lock to keep the member 82 from rotating when the motor 174 is not energized; the reaction to the braking forces of the hydraulic couplings being transmitted through these elements to the casing 110. The member 82 is provided along each inner face thereof with suitable lugs, as indicated at 180 and 182, engageable in notches as indicated at 184 and 186 in the core members 78 and 92 when the member 82 is moved to one or the other of its extreme lateral positions. With a lug engaged in a corresponding notch in one of the core members one of the gears 66 or 68 may be positively rotated by the motor drive until the propeller is feathered or unfeathered as the case may be. In order to supply fluid under pressure to move the member 82 to its extreme lateral condition the motor 174 may drive a pump, which may be the pump 164 shown in Fig. 1. The fact that the motor would have to be operated and would rotate the member 82 in order to rotate the pump 164 would not interfere with the operativeness of the device during feathering or unfeathering operations with the engine and propeller rotating.

The form of the invention shown in Fig. 5, operates on the same principles as the apparatus described above, the principal difference being that two fluid pumps 188 and 190 are substituted for the two fluid coupling members shown in Fig. 1 and described above. In the arrangement shown in Fig. 5 the drive shafts 62 have been omitted and the worm elements 192 mesh with the blade end gears and each is provided at its end with a spur type gear 194 which meshes with two ring gears 196 and 198. The pump 188 carries a gear 200 which meshes with the ring gear 198 while the pump 190 carries a gear 202 which meshes with the ring gear 196. The inlet of the pump 188 is connected with a suitable source of fluid, such as the sump 172, by a conduit 204 and the inlet of the pump 190 is connected with the sump by a similar conduit 206. The outlet of the pump 188 is connected by a conduit 208 with a valve 210 operated by a speed governor 212 and the outlet of the pump 190 is connected with an axially spaced part of the valve 210 by a conduit 214. A pair of spaced drain conduits 216 and 218 lead from the valve 210 back to the reservoir or sump 172.

With this arrangement, if the valve plunger 220 is raised due to an overspeed condition, the conduit 208 will be blocked off and the pump 188 restrained from rotation thereby holding the gear 200 and cause rotation of the worm members 192 in a direction to rotate the propeller blades in a pitch increasing direction. The outlet channel 214 of the pump 190 will be simultaneously connected with the drain line 218 so that this pump can rotate freely permitting the gear 196 to rotate as it is driven by the gear 194. Likewise, when the plunger 220 is lowered to the position shown in the figure due to an underspeed condition, the line 214 from the pump 190 will be blocked causing the gear 198 to be held and the worm members to rotate the blades in a direction to reduce the propeller pitch. The valve is so constructed that when the governor is in its "on speed" condition in which the counterweights are

substantially parallel to the shaft by which they are carried, both lines 208 and 214 are opened to drain so that both pumps may rotate freely permitting the gears 196 and 198 to rotate with the propeller without undue restraint or drag and without changing the pitch of the propeller. The apparatus shown in Fig. 5 may be provided with propeller feathering and unfeathering apparatus of the general character illustrated in Fig. 1 and described in connection with that figure except that the motor might be made reversible and the pump 164 omitted. It is thought, however, that an additional illustration of such feathering and unfeathering apparatus is not necessary for the purpose of this disclosure.

While a suitable mechanical arrangement in two somewhat modified forms has been hereinabove described and illustrated in the accompanying drawings for the purpose of disclosing the invention, it is to be understood that the invention is not limited to the particular arrangement so illustrated and described, but that such changes in the size, shape and arrangement of the various parts may be resorted to as come within the scope of the sub-joined 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. Propeller pitch changing mechanism comprising, a pair of fluid couplings each having a portion rotatable with the propeller and a portion fixed relative thereto, means for rendering said fluid couplings alternatively effective to produce a braking action on the portion thereof rotatable with the propeller, said means including a source of fluid under pressure and a speed governor for controlling the application of pressure fluid to said couplings, and gear means for converting the braking action of one of said couplings into a propeller pitch change in one direction and the braking action of the other coupling into a propeller pitch change in the opposite direction, said gear means including, an annular internally toothed gear on the rotatable portion of one of said couplings, an externally toothed annular gear on the rotatable portion of the other coupling, pinion gears between and meshing with both of said annular gears, a shaft extending from each pinion gear, and gear means operatively associated with said shafts and the blades of said propeller for changing the propeller pitch.

2. Propeller pitch changing mechanism comprising, a pair of fluid coupling devices each having a portion rotatable with the propeller and a portion fixed relative thereto, means incorporated in said coupling devices and common to both of them for rendering said couplings alternatively effective to produce a braking action on the portions thereof rotatable with said propeller, and gear means operatively connected with said coupling devices and the blades of said propeller for converting the braking action of one of said couplings into a propeller pitch change in one direction and the braking action of the other coupling into a propeller pitch change in the opposite direction, said gear means including, an annular internally toothed gear on the rotatable portion of one of said couplings, an externally toothed annular gear on the rotatable portion of the other coupling, pinion gears between and meshing with both of said annular gears, a shaft extending from each pinion gear, and gear means operatively associated with said shafts and the

blades of said propeller for changing the propeller pitch.

3. Propeller pitch changing mechanism comprising, a pair of fluid coupling devices each having a portion rotatable with the propeller and a fixed portion, means common to and concentric with both coupling devices for rendering said devices alternatively effective to produce a braking action on the part thereof rotatable with said propeller, said means comprising an annular member incorporated in said coupling devices and movable from a neutral position between said devices where it presents an uninterrupted surface to the flow of fluid in both couplings to either of two alternative operative positions in one of which it enters one of said devices and by obstructing the flow of fluid renders said device effective, and in the other alternative position said annular member enters the other of said devices and renders said other device effective, and gear means operatively connected between said devices and the blades of said propeller for converting the braking action of one of said devices into a propeller pitch change in one direction and the braking action of the other device into a propeller pitch change in the opposite direction, said gear means including, a gear on the rotatable portion of one of said couplings, a gear on the rotatable portion of the other coupling, a shaft having a gear meshing said first gears, and means operatively associated with said shafts and blades for changing the propeller pitch.

4. Propeller pitch changing mechanism comprising, a pair of fluid coupling devices each having a portion rotatable with the propeller and a fixed portion, means common to both coupling devices for rendering said devices alternatively effective to produce a braking action on the part thereof rotatable with said propeller, said means comprising an annular member incorporated in said coupling devices and movable from a neutral position between said devices to either of two alternative operative positions, one position rendering one of said devices effective and in the other position rendering the other of said devices effective, and gear means operatively connected between said devices and the blades of said propeller for converting the braking action of one of said devices into a propeller pitch change in one direction, and the braking action of the other device into a propeller pitch change in the opposite direction, said devices including an annular fluid chamber at each side of said annular member, and means for introducing fluid under pressure into one of said chambers while simultaneously venting fluid from the other of said chambers.

5. Propeller pitch changing mechanism comprising, a pair of fluid coupling devices each having a portion rotatable with the propeller and a fixed portion, means common to both coupling devices for rendering said devices alternatively effective to produce a braking action on the part thereof rotatable with said propeller, said means comprising an annular member incorporated in said coupling devices and movable from a neutral position between said devices to either of two alternative operative positions, one position rendering one of said devices effective and in the other position rendering the other of said devices effective, and gear means operatively connected between said devices and the blades of said propeller for converting the braking action of one of said devices into a propeller pitch change in one direction and the braking action of the other

device into a propeller pitch change in the opposite direction, each of said fluid couplings including a toroidal fluid containing chamber, and said annular member having annular sets of substantially radially disposed fluid passages, one set of fluid passages being moved into one of said toroidal chambers when the annular member is moved in one direction from its central position, and the other set of radial passages being moved into the other toroidal chamber when the annular member is moved in the opposite direction from its central position.

6. Propeller pitch changing mechanism comprising, a pair of annular fluid couplings disposed substantially concentric with the axis of rotation of the propeller, each having a portion rotatable with the propeller and a portion fixed relative thereto, means incorporated in said couplings alternatively operative to apply a fluid brake between the relatively fixed and the relatively rotatable portion of each coupling, and gear means carried by said propeller operating to convert the braking action in one of said couplings into a propeller pitch change in one direction and the braking action in the other of said couplings into a propeller pitch change in the opposite direction.

7. Propeller pitch changing mechanism comprising, a pair of annular fluid couplings each having a portion mounted on the propeller hub and rotatable with the propeller and a portion held against rotation relative to the propeller but movable to a limited extent in the direction of the axis of rotation of the propeller, an annular member having a fluid conducting portion upon each side thereof and movable laterally relative to said non-rotatable portions from a neutral position in which both fluid conducting portions are out of communication with the interiors of both of said couplings to operative positions in which the respectively adjacent fluid conducting portions are alternatively brought into communications with the interiors of said fluid coupling, and a lead screw between said relatively rotatable portion of said couplings and said propeller hub for moving said couplings laterally to follow-up the movements of said annular member and return said annular member to a neutral position relative to said couplings as the propeller pitch change indicated by the initial movement of said annular member is accomplished, and means operated by relative rotation of said couplings to effect pitch changes of said propeller.

8. Propeller pitch changing mechanism comprising, a pair of fluid couplings, an annular member disposed between said couplings and movable laterally in opposite directions from a neutral position to render said couplings alternatively effective to produce a braking action, propeller carried gear means operatively associated with said couplings for converting the braking action produced by one of said couplings into a propeller pitch change in one direction and the braking action produced by the other of said couplings into a propeller pitch change in the opposite direction, and means constraining said fluid couplings to move laterally in the same direction as the lateral movements of said annular member to restore said annular member to a neutral position relative to said couplings when the propeller pitch change incident to a particular amplitude of movement of said annular member from its neutral position has been accomplished.

9. Propeller pitch changing mechanism comprising, a pair of fluid couplings, an annular member

disposed between said couplings and movable laterally in opposite directions from a neutral position to render said couplings alternatively effective to produce a braking action, propeller carried gear means operatively associated with said couplings for converting the braking action produced by one of said couplings into a propeller pitch change in one direction and the braking action produced by the other of said couplings into a propeller pitch change in the opposite direction, and means constraining said fluid couplings to move laterally in the same direction as the lateral movements of said annular member to restore said annular member to a neutral position relative to said couplings when the propeller pitch change incident to a particular amplitude of movement of said annular member from its neutral position has been accomplished, and an indicator operatively associated with said couplings and actuated by the lateral movements thereof to indicate the pitch angle of said propeller.

10. Propeller pitch changing mechanism comprising, a pair of fluid couplings, an annular member disposed between said couplings and movable laterally in opposite directions from a neutral position to render said couplings alternatively effective to produce a braking action, propeller carried gear means operatively associated with said couplings for converting the braking action produced by one of said couplings into a propeller pitch change in one direction and the braking action produced by the other of said couplings into a propeller pitch change in the opposite direction, and means for driving said annular member to change the propeller pitch when the propeller is not rotating.

11. Propeller pitch changing mechanism comprising, a pair of fluid couplings, an annular member disposed between said couplings and movable laterally in opposite directions from a neutral position to render said couplings alternatively effective to produce a braking action, propeller carried gear means operatively associated with said couplings for converting the braking action produced by one of said couplings into a propeller pitch change in one direction and the braking action produced by the other of said couplings into a propeller pitch change in the opposite direction, fluid pressure actuated means for imparting said lateral movements to said annular member, a manually controllable motor for driving said annular member, a fluid pump driven by said motor, and a manually actuated valve for controlling the direction of lateral movements of said annular member to control the direction of pitch change accomplished when said annular member is motor driven.

12. Propeller pitch changing mechanism comprising, a pair of fluid couplings, an annular member disposed between said couplings and movable laterally in opposite directions from a neutral position to render said couplings alternatively effective to produce a braking action, propeller carried gear means operatively associated with said couplings for converting the braking action produced by one of said couplings into a propeller pitch change in one direction and the braking action produced by the other of said couplings into a propeller pitch change in the opposite direction, a manually controlled motor for driving said annular member to change the propeller pitch when the propeller is not rotating, said motor having a gear connection with said annular member and normally acting to restrain

said annular member against rotation while permitting free lateral movements thereof.

13. Propeller pitch changing mechanism comprising, a pair of fluid couplings, an annular member disposed between said couplings and movable laterally in opposite directions from a neutral position to render said couplings alternatively effective to produce a braking action, propeller carried gear means operatively associated with said couplings for converting the braking action produced by one of said couplings into a propeller pitch change in one direction and the braking action produced by the other of said couplings into a propeller pitch change in the opposite direction, fluid pressure actuated means 15

for imparting said lateral movements to said annular member, a manually controllable motor for driving said annular member, a fluid pump driven by said motor, and a manually actuated valve for controlling the direction of lateral movements of said annular member to control the direction of pitch change accomplished when said annular member is motor driven and means providing positive driving connections between said annular member and said gear means through the respective coupling when said annular member is moved to its extreme lateral displacement from its neutral position in either direction.

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