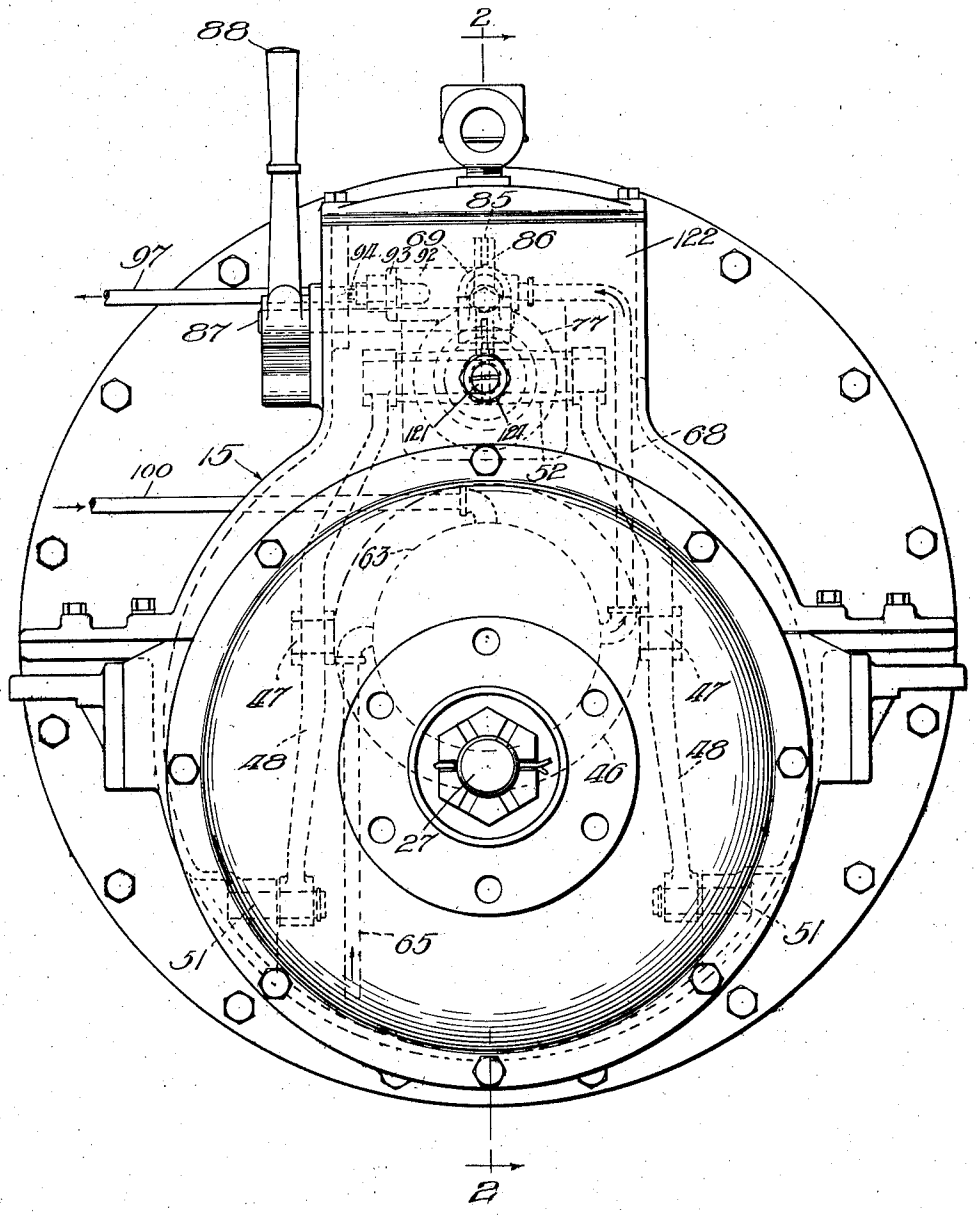
May 17, 1938. W. J. PEARMAIN 2,117,852

HYDRAULICALLY OPERATED REVERSING MECHANISM

Filed Nov. 18, 1935 7 Sheets-Sheet 1

Fig. 1.

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HYDRAULICALLY OPERATED REVERSING MECHANISM

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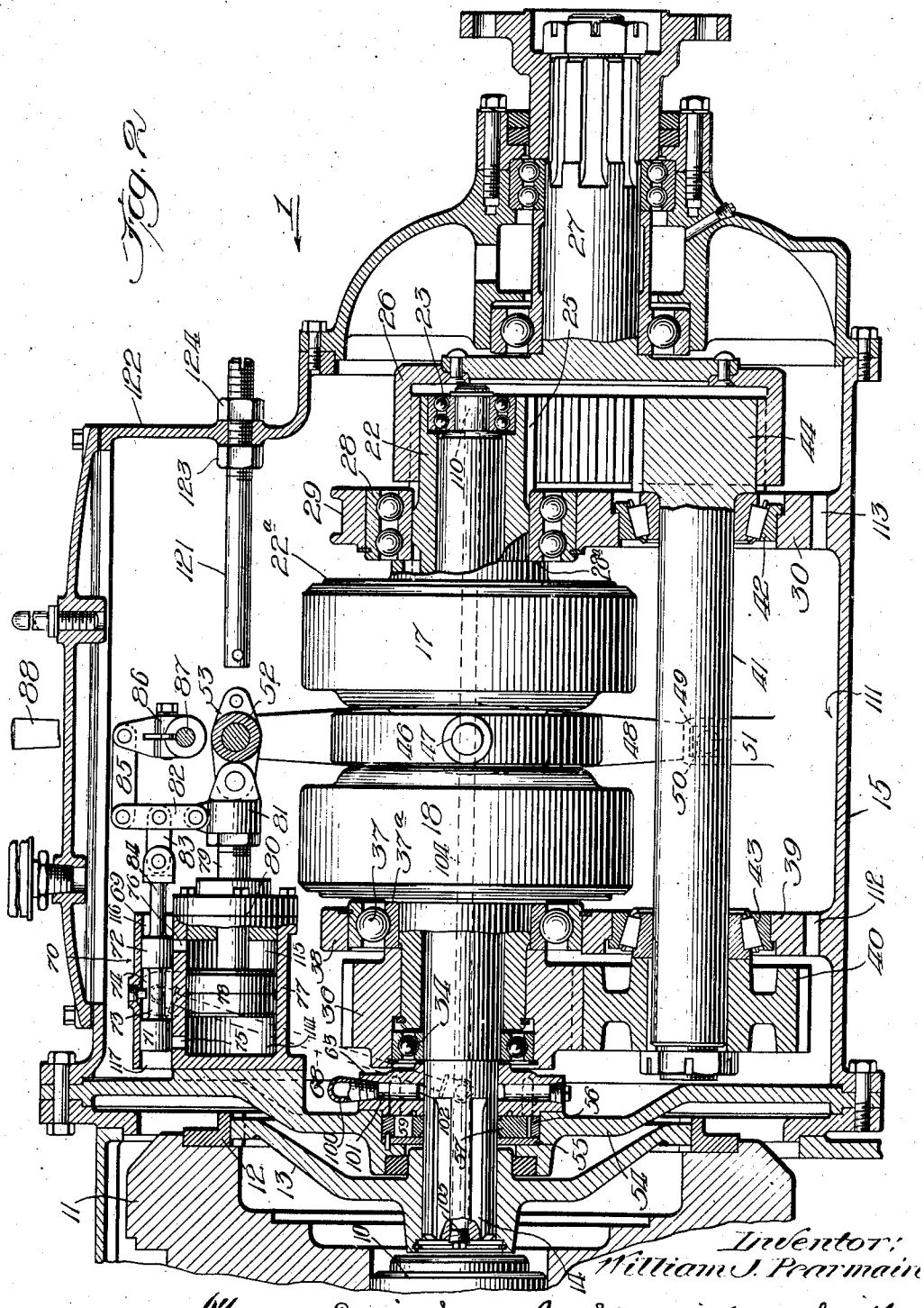

Fig. 2

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HYDRAULICALLY OPERATED REVERSING MECHANISM

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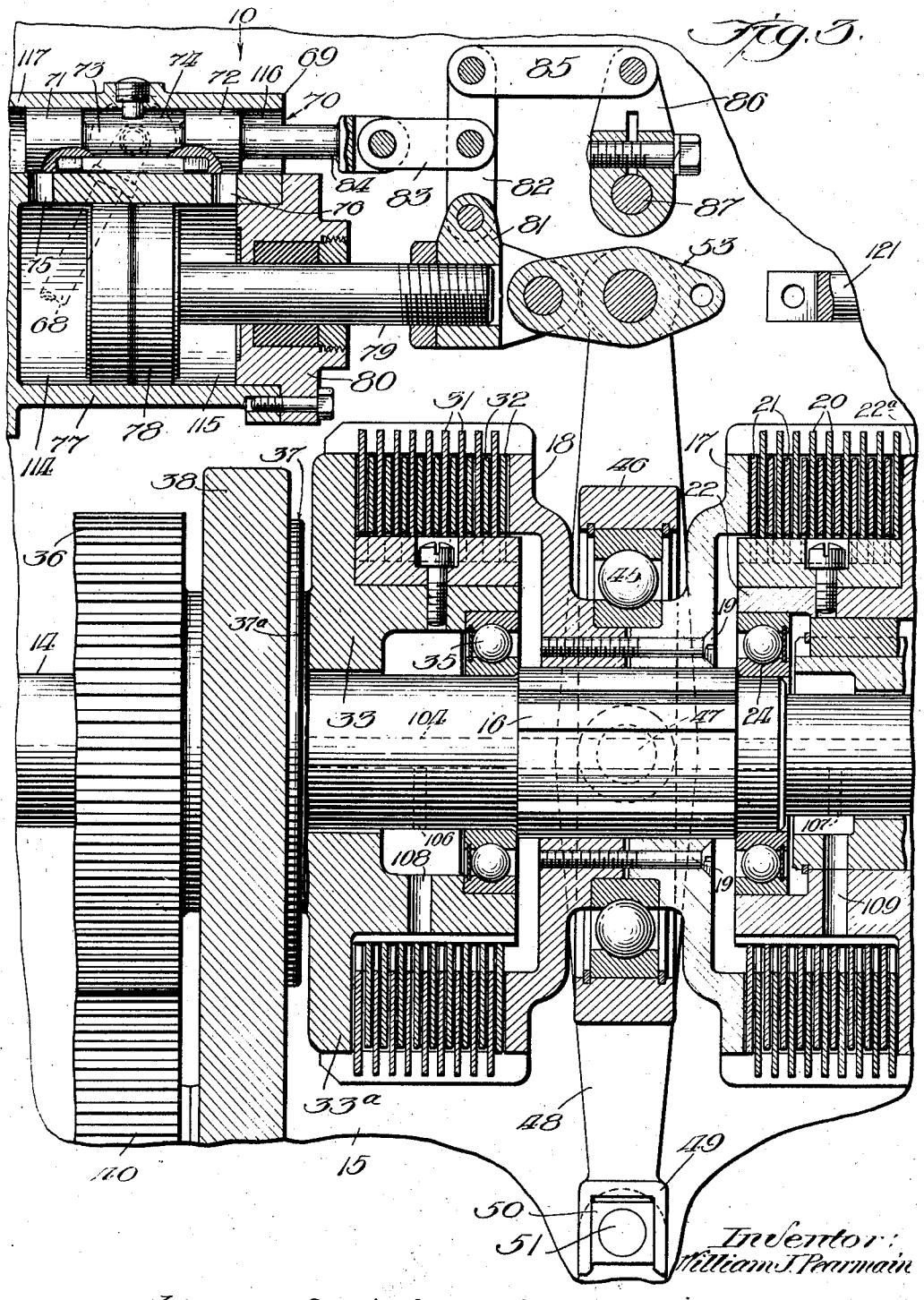
Fig. 3.

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HYDRAULICALLY OPERATED REVERSING MECHANISM

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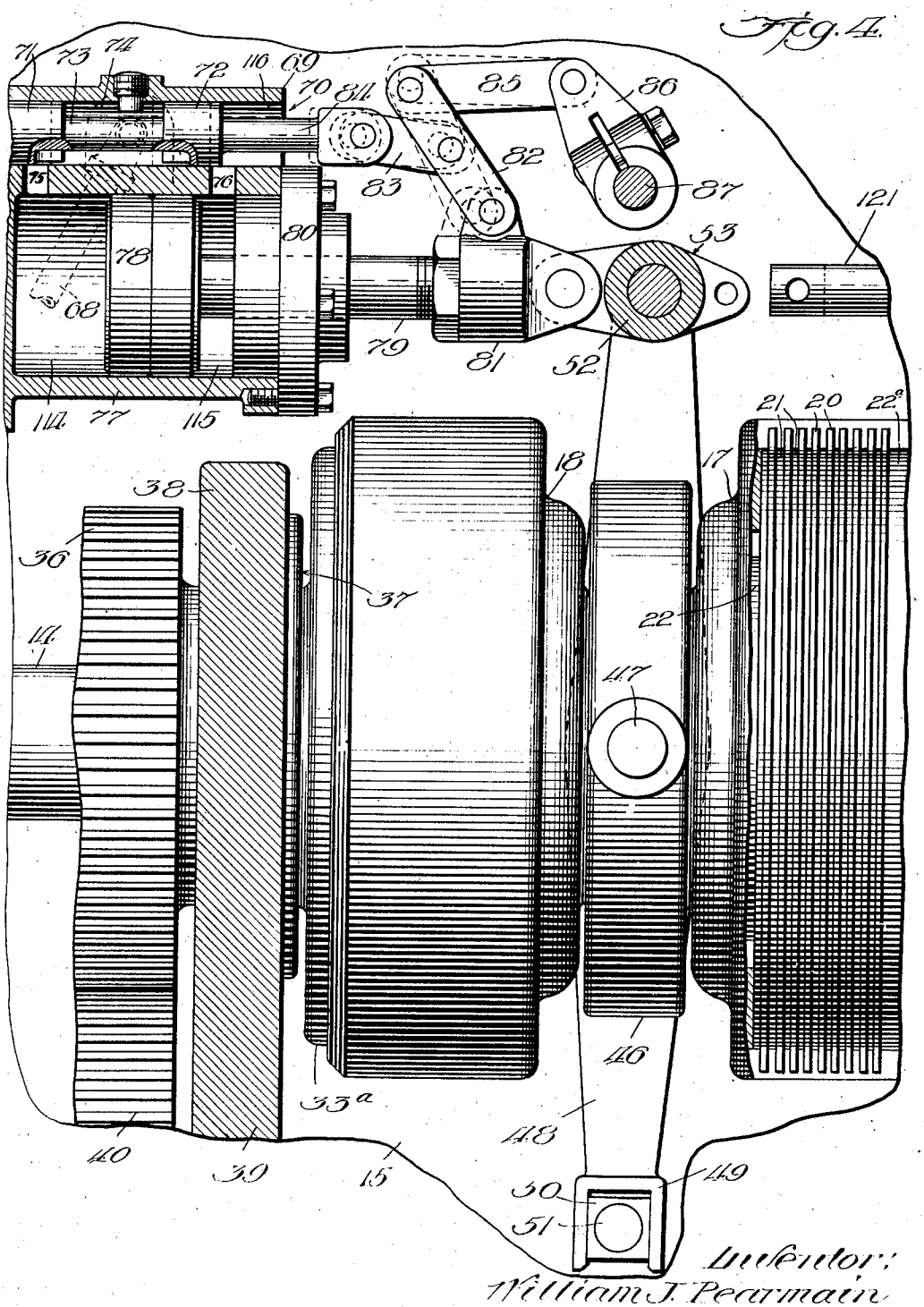
Fig. 4.

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HYDRAULICALLY OPERATED REVERSING MECHANISM

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Fig. 5.

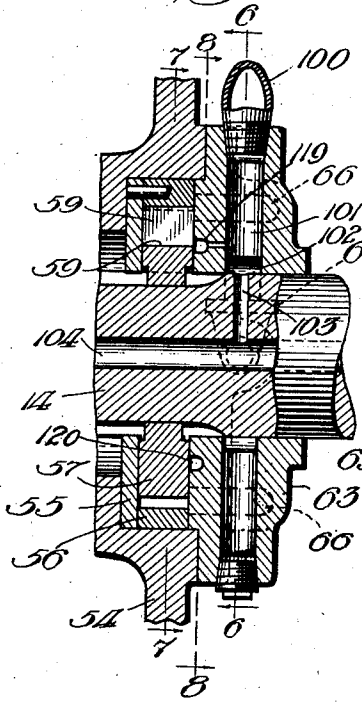



Fig. 6

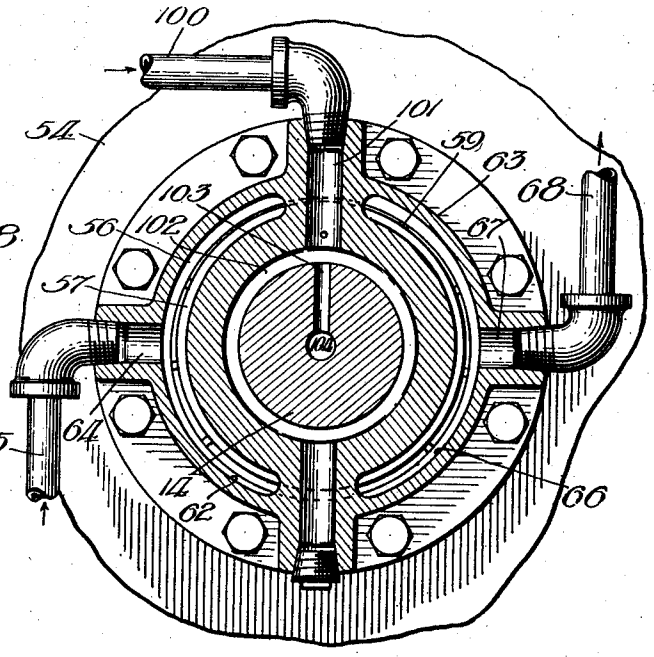
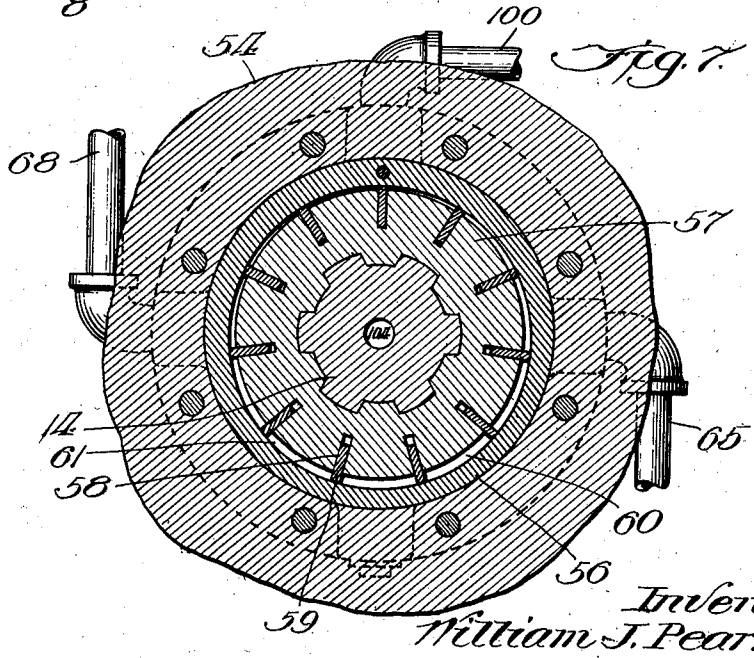



Fig. 7.

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HYDRAULICALLY OPERATED REVERSING MECHANISM

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Fig. 10.

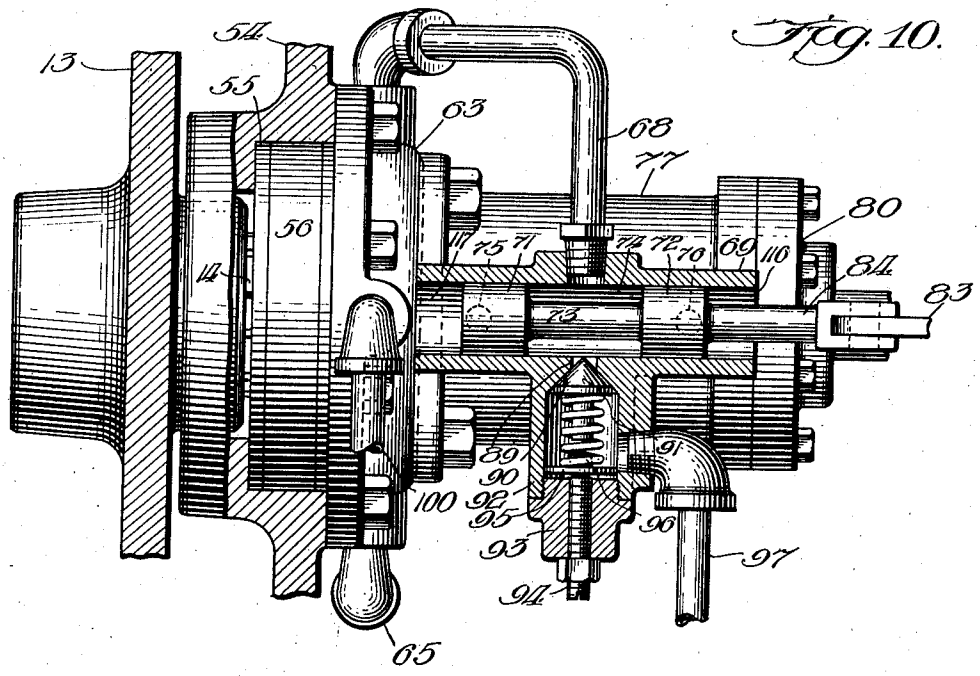



Fig. 8.

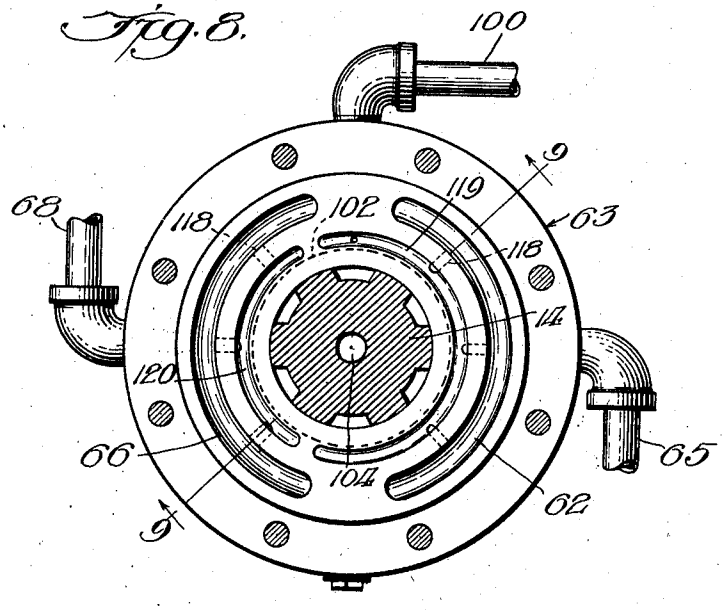
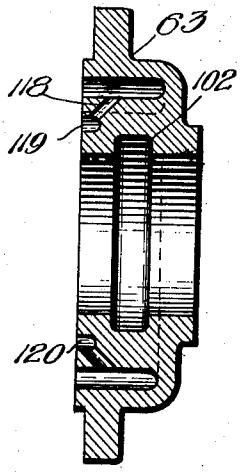



Fig. 9.

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HYDRAULICALLY OPERATED REVERSING MECHANISM

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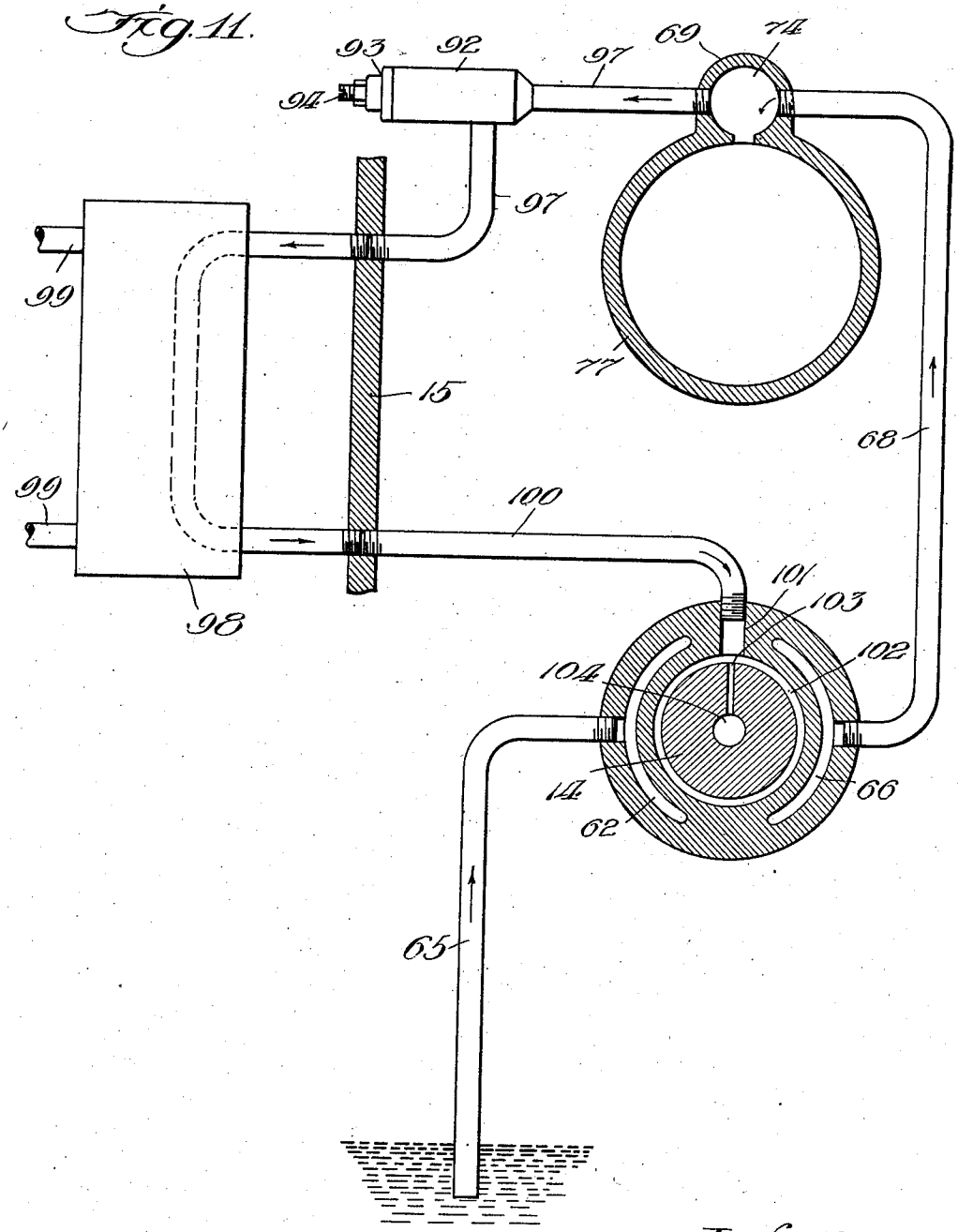
Fig. 11.

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Patented May 17, 1938 2,117,852

# UNITED STATES PATENT OFFICE

2,117,852

## HYDRAULICALLY OPERATED REVERSING MECHANISM

William J. Pearmain, Racine, Wis., assignor to Twin Disc Clutch Company, Racine, Wis., a corporation of Wisconsin

Application November 18, 1935, Serial No. 50,287

8 Claims. (Cl. 192—87)

My invention relates to a reversing mechanism provided with an improved clutch device and actuating means therefor for effecting a transmission of power between driving and driven shafts and is more particularly concerned with a mechanism of this character for marine service.

In marine power installations, particularly those employing internal combustion engines, it is necessary to step down the revolution speed of the engine to a point that is satisfactory for the efficient operation of the propeller. Ordinarily this reduction is effected through a suitable arrangement of gearing which includes a reversing device. The reduction features of this invention, however, may be omitted wherever desired, as it simply constitutes an ancillary phase of my improved device.

So far as the arrangement of gears and reversing clutches is concerned, the disclosure of the present application is substantially identical with those of my copending applications, Serial Nos. 707,093 and 720,677, filed January 18, 1934, and April 16, 1934, respectively. In each of these mechanisms, however, the spring-actuated clutches were engaged and disengaged by manual operation, but this arrangement is unsatisfactory for high capacity units, because of the hand effort required.

It is therefore one object of my invention to provide a hydraulically operated reversing mechanism in which the control is manual and the reversing clutches are thrown into and out of engagement by hydraulic pressure established by a pump connected to the principal shaft of the mechanism which is driven by the main power source.

A further object is to devise a mechanism of the character indicated which is self-contained in respect of lubrication and in which the lubricating oil is pumped through a circuit arranged to accommodate the lubricating requirements of the mechanism and which includes devices that are actuable by the oil pressure to operate the reversing clutches.

These and further objects of my invention will be set forth in the following specification, reference being had to the accompanying drawings, and the novel means by which said objects are effectuated will be definitely pointed out in the claims.

In the drawings:

Figure 1 is an end view of the mechanism, as viewed in the direction of the arrow 1 in Fig. 2.

Fig. 2 is a sectional elevation taken along the line 2—2 in Fig. 1, looking in the direction of the arrows, the clutch actuating mechanism being illustrated in neutral position.

Fig. 3 is an enlarged sectional view, corresponding to a portion of Fig. 2, showing the reversing clutches in neutral position and the manually controlled, hydraulically actuated mechanism for operating the clutches.

Fig. 4 is a view similar to Fig. 3, but showing the hydraulic mechanism shifted to a position for engaging the forward drive clutch.

Fig. 5 is an enlarged, sectional elevation of the oil pump, as viewed in Fig. 2.

Figs. 6, 7 and 8 are sections along the lines 6—6, 7—7 and 8—8, in Fig. 5, looking in the direction of the arrows, and showing in detail, structural features of the oil pump.

Fig. 9 is a sectional view taken along the line 9—9 in Fig. 8, looking in the direction of the arrows, and showing the port plate for the oil pump.

Fig. 10 is a plan view, partly in section, of the reciprocating valve for the hydraulic mechanism, as viewed in the direction of the arrow 10 in Fig. 3, the hydraulic cylinder of the hydraulic mechanism and the oil pump being shown in simple plan view beneath the valve.

Fig. 11 is a diagrammatic view, partly in section, showing the oil circuit which is utilized to lubricate the mechanism and which forms an important part of the hydraulic control therefor.

Referring to Figs. 2 and 3, the numeral 10 designates a shaft which may be considered as the main power source and which has a flywheel 11 attached to the end thereof. The flywheel has bolted to its right face, as viewed in Fig. 2, an internally toothed ring 12 which meshes and therefore has driving connection with a similarly toothed spider 13 that is mounted on the left extremity of a driving shaft 14 and rotates therewith. For the purpose of description, the shaft 14 will be regarded as the driving shaft of the reversing mechanism. This shaft extends across the interior of a housing 15 and it is intermediately provided with an enlarged, splined portion 16 (see Fig. 3) which has fitted thereon a pair of drums 17 and 18 whose open ends face in opposite directions. These drums are fastened together by screws 19 in order to provide common, shiftable member which is adapted for axial movement along the portion 15, but partakes of the rotary movement of the shaft 14.

The drum 17 carries a plurality of fixed discs 20 which are arranged in alternating relation to a plurality of similar disks 21 supported on a hub 22. This hub is provided with an annular,

flange-like portion 22a between which and the opposite face of the drum 17, the discs 20 and 21 are adapted to be clamped in order to provide the forward drive clutch of the mechanism. The hub 22 is freely rotatable at its right end on a ball bearing 23 and adjacent the splined portion 16 upon a ball bearing 24, the inner races of the bearings 23 and 24 fitting closely the adjacent portions of the shaft 14. Adjacent the bearing 23, the periphery of the hub 22 is formed as a pinion 25 by directly cutting the teeth thereon, or a separate pinion may be keyed or otherwise secured to the hub 22. The pinion 25 (see Fig. 2) meshes permanently with an internal gear 26 that is fastened to a driven shaft 27 which projects without the housing 15 and may be suitably connected to a propeller or other type of shaft. As shown in Fig. 2, the pinion 25 is disposed above, or to one side of, the axis of the shaft 27, thereby providing space for an additional pinion to transmit a reversing drive to the shaft 27, as hereinafter described.

A thrust bearing 28 encircles the hub 22 with its inner race fitting closely around the hub and abutting against a shoulder 28a provided thereon. The outer race of the same bearing is fixedly retained within a cage 29 that is provided on a web 30 which extends upwardly from the bottom of the housing 15. The bearing 28, therefore, not only resists a portion of the thrust of the mechanism during direct drive, but it also operates as a support for the right end of the driving shaft 14, the support operating through the hub 22 and the bearings 23 and 24.

The drum 18 also supports a plurality of friction discs 31 which are arranged in alternating relation to a plurality of friction discs 32 that are carried by a hub 33 and these last named discs are adapted to be clamped between an annular flange 33a provided on the hub 33 and the adjacent face of the hub 18, thus constituting the reversing clutch of the mechanism. As with the direct drive clutch, the hub 33 is freely rotatable upon the outer races of ball bearings 34 and 35, whose inner races snugly fit the shaft 14. A pinion 36 is fixedly mounted on the hub 33 so as to rotate therewith and this end of the shaft 14 is supported by means of a thrust bearing 37, similar to the bearing 28, whose inner race snugly fits the periphery of the hub 33 and abuts against a shoulder 37a provided on the same hub. The outer race of the same bearing is fixedly retained within a cage 38 forming a part of a web 39 which extends upwardly from the bottom of the housing 15. The bearing 37 serves as a support for the left end of the driving shaft 14, in addition to taking a portion of the thrust of the mechanism during reverse drive.

The pinion 36 is in constant mesh with a gear 40 fixedly attached to one end of a counter-shaft 41 that is rotatably mounted in bearings 42 and 43 that are carried in the webs 30 and 39, respectively. The opposite end of the shaft 41 has fixedly connected thereto a pinion 44 that is in permanent mesh with the internal gear 26 and located on the opposite side of the axis of the shaft 27 from the pinion 25.

The inner race of a ball bearing 45 is clamped between the adjacent faces of the drums 17 and 18 by the screws 19 (see Fig. 3) and encircling and fixedly connected to the outer race of the same bearing is a yoke 46 which is provided with a pair of laterally extended trunnions 47 which project from opposite sides thereof (see Fig. 1). A pair of arms 48 are pivotally mounted on the trunnions 47, respectively, and the lower end of each arm is bifurcated as at 49 to embrace a block 50 that is freely rockable on a pin 51, the latter being conveniently mounted in the wall of the housing. The upper ends of the arms 48 are pivotally connected to stub arms 52, respectively, which project laterally in opposite directions from a link 53 (see Fig. 3) whose movements to and fro, as hereinafter described, effects a rocking of the arms 48 on their respective pivots to thereby throw either of the aforesaid clutches into engagement. In the relative positions shown in Fig. 3, these clutches occupy neutral or non-driving positions.

The foregoing structural features of the forward and reverse drive clutches and the associated gearing are substantially identical with those disclosed and claimed in the aforesaid pending applications. The present invention essentially differs from the latter in the hydraulic gear provided for actuating the clutches and this mechanism will now be described.

Referring to Figs. 2, 5, 6 and 7, the left end 54 of the housing 15, as viewed in Fig. 2, is counterbored where the shaft 14 extends therethrough and a closure plate 55 is seated in the bottom of this counterbore. A pump chamber ring 56 is also closely fitted in the counterbore and is pinned to the ring 55. The inner diameter of the ring 56 is somewhat greater than the diameter of the shaft 14 and the bore of the ring is eccentrically located with respect to the shaft, the center of the bore being located a short distance below the center of the shaft, as clearly indicated in Fig. 7, for a purpose hereinafter explained. A pump rotor 57 is drivably connected to the shaft 14 and the left face thereof, as viewed in Fig. 5, closely fits the adjacent face of the ring 55.

A plurality of radial slots 58 are cut inwardly from the peripheral face of the rotor 57 and a vane 59 is freely slidable in each of these slots, so that when the pump rotor is operating, each of the vanes will be moved outwardly into contact with the bore of the chamber ring 56. As clearly indicated in Fig. 7, the eccentricity of the bore of the ring 56, in conjunction with the pump rotor, defines suction and delivery chambers 60 and 61, respectively. The chamber 60 is in communication with an intermediate chamber 62 having the parti-annular shape indicated in Fig. 6 and which is located in a cover plate 63 that is securely held to the housing end 54, the pump rotor operating between this cover plate and the ring 55. The intermediate chamber 62 communicates through a suction port 64, also formed in the cover plate 63, and one end of a suction pipe 65 is in communication with this port, the opposite end of the pipe terminating in the lower end of the housing 15 and specifically in a reservoir portion thereof, as hereinafter described.

The delivery chamber 61 of the pump communicates with a second intermediate chamber 66, also of parti-annular shape as indicated in Fig. 6, and which is also formed in the cover plate 63. The chamber 66 communicates with a delivery port 67 within which is mounted one end of a delivery pipe 68 whose opposite end is mounted in the wall of a valve housing 69 so as to deliver fluid into the interior of this housing. (See Fig. 10.)

A piston valve 70 is reciprocably mounted in the housing 69 and is provided with piston portions 71 and 72 which are spaced and connected by a neck 73 that defines with the valve housing a receiving chamber 74 which is in communica-

tion with the delivery end of the pipe 68. As illustrated in Fig. 3, the piston valve 70 is occupying a neutral position and completely masks ports 75 and 76 which are located adjacent the opposite ends of a cylinder 77. A piston 78 is reciprocably mounted within the cylinder and its piston rod 79 projects outwardly through a cover plate 80 that closes the indicated end of the cylinder and the extremity of the rod has affixed thereto a connector part 81 which is pivotally attached to the adjacent end of the link 53 so that, when the piston 78 is moved in either direction, a corresponding rocking movement of the levers 48 is effected.

One end of a link 82 is also pivotally connected to the part 81 and one end of a link 83 is pivotally connected to an intermediate portion of the link 82, and the opposite end of the link 83 is pivoted in the valve rod 84. The other end of the link 82 is pivotally connected to one end of a link 85 and the opposite end of the latter link is pivotally connected to a lever 86 that is fixedly mounted on a rock shaft 87 suitably journaled in the housing 15 and which extends outwardly thereof for affixation to an operating handle 88. Accordingly, when the handle 88 is rocked forwardly or rearwardly, or toward the left or right, respectively, as viewed in Fig. 2, the piston valve 70 will be moved accordingly, but without moving the piston 78.

Referring to Fig. 10, the exhaust of the fluid chamber 74 is provided by a port 89 formed in the wall of the valve housing and which terminates in a valve seat 90 that is adapted to be engaged and to thereby close the port 89 by a valve 91. This valve operates in a housing extension 92 whose open end is closed by a plug 93. An adjusting screw 94 is threaded through the plug 93 and the inner end thereof engages a spring plate 95. One end of a coil spring 96 bears against the plate 95 and the opposite end against the valve 91. By suitably choosing the spring 96 and appropriately adjusting the screw 94, any desired pressure may be set up in the valve 91 and when this pressure is exceeded by a rise in pressure in the fluid chamber 74, fluid will escape through the port 89 into an exhaust pipe 97, one end of which is mounted in the housing extension 92 and is in communication with the interior thereof.

The exhaust pipe 97 passes through a wall of the housing 15 and thence through a cooler 98 of any appropriate design and through which cooling water may be circulated by means of the pipes 99. A return pipe 100 leads from the cooler 98 and its delivery end is mounted in the cover plate 63 and is in communication with a port 101, also provided in this plate (see Figs. 5 and 6). Fluid passing through the port 101 is discharged into an annular chamber 102, also provided in the cover plate, and which encircles the driving shaft 14 (see Figs. 5 and 6). A radial passage 103 is drilled in the shaft 14, the outer end of this passage registering with the chamber 102 and the inner end with an axial hole 104 that extends the length of the driving shaft 14.

The left end of the passage 104 is closed by a plug 105, so that fluid introduced into the passage must move toward the right. Similar radial passages 106 and 107 are provided in the driving shaft, the inner ends of these passages being in communication with the axial passage 104 and the outer ends registering with passages 108 and 109 provided in the hubs 33 and 22, all respectively. By this means, it is possible to deliver lubricating oil, which is the fluid employed to operate the hydraulic gear above described, between the faces of the clutch discs when they are in the separated condition illustrated in Fig. 3, or when either clutch is disengaged.

The axial hole 104 continues to the right extremity of the driving shaft, so that the lubricating oil may be thrown from the end 110 thereof onto the internal gear 26. The oil which escapes from the end of the driving shaft ultimately is collected in a reservoir 111 provided in the bottom of the housing 15 and free movement of this oil from the ends of the housing through the webs 39 and 30 is permitted by passages 112 and 113, respectively.

The operation of my improved reversing mechanism will now be described. Referring to Figs. 2, 3 and 4, it will be assumed that the shaft 10 is rotating at some determined speed, which rotation is in turn transmitted to the driving shaft 14 by the spider 13, and that the shifting arms 48 occupy the neutral position shown in Fig. 3. In this position of the indicated parts, it will be noted that, while the clutch drums 17 and 18 are rotating with the shaft 14, the shifting arms 48 and the parts which operate the same permit this rotation by reason of the association of the yoke 46 with the outer race of the ball bearing 45.

If now it is desired to transmit a direct or forward drive to the driven shaft 27, the hand lever 88 will be rocked toward the left, as viewed in Fig. 2, which movement would be forward with respect to the position of the reversing mechanism in a boat, for example. This movement of the lever 88 will accordingly shift the piston valve 70 toward the left, as viewed in Fig. 3, and substantially to the dotted position indicated in Fig. 4, the intermediate linkage also assuming the dotted position shown in the same figure. Because of the pivotal connection of the link 82 with the part 81, the aforesaid movement of the hand lever 88 does not affect the piston 78.

The piston valve 70 being shifted toward the left, as just stated, the piston portions 71 and 72 uncover the ports 75 and 76, respectively, so that oil under pressure as established by the pump rotor 57 will pass through the connecting pipe, ports and passages into the fluid chamber 74 and thence through the port 75 into the chamber 114 to the left of the piston 78. It will be understood that up until the time that the piston valve 70 is shifted, lubricating oil is being raised through the pipe 65 by the oil pump and then delivered to the pipe 66, from which it passes through the fluid chamber 74 in the valve housing 69 and, because of the pressure established, the valve 91 is unseated, thus permitting the uninterrupted flow of the oil through the pipe 97, cooler 98, pipe 100 and thence through the axial passage 104 to the internal gear 26, and then to the reservoir 111.

However, when the piston valve 70 is shifted toward the left, a relief for this oil flow is permitted by the passage of the oil into the chamber 114 and the ensuing reduction in oil pressure on the valve 91 either permits this valve to close entirely or to partially close, dependent upon the setting of the spring 96.

The oil that is delivered into the chamber 114 moves the piston 78 toward the right, as viewed in Fig. 3, thereby throwing the shifting arms 48 in the same direction and throwing into engagement the forward drive clutch by compressing the friction discs 20 and 21 between the drum 17 and the hub flange 22a.

With the forward drive clutch in engagement, the drive from the shaft 10 is transmitted

through the flywheel 11, spider 13, driving shaft 14, the right hand or forward drive clutch comprising the drum 17, friction discs 20 and 21 and hub 22, which in the present instance also includes the driving pinion 25 that is in mesh with the internal gear 26 and thence to the driven shaft 27.

The piston 78 is moved toward the right by the oil pressure until the forward drive clutch is definitely in engagement and, at this time, the positions of the piston, piston valve and associated linkage is substantially as indicated by full lines in Fig. 4. In other words, the shifting of the piston 78 has also occasioned a slight return of the piston valve toward the right, as viewed in Fig. 4, from the dotted line position to which the piston valve had been originally moved by the hand lever 88. However, this relocating of the piston valve is not sufficient to mask the ports 75 and 76, so that oil under pressure is maintained in the chamber 114 in order to continue the engagement of the forward drive clutch. After the required pressure has been established in the chamber 114, any excess in oil pressure that may be established by the oil pump will be relieved through the relief valve 91 and the oil then passing through the port 89 will complete the circuit as hereinbefore described. Moreover, any oil that may have originally been in the chamber 115 to the right of the piston 78, as viewed in Fig. 3, will be exhausted through the port 76 and then through the open end 116 of the valve housing 69. Oil escaping through the indicated openings simply drips over the mechanism beneath and is finally collected in the reservoir 111.

If now it is desired to reverse the drive to the mechanism, the operating handle 88 will be rocked toward the right, as viewed in Fig. 2 to thereby move, through the associated linkage, the piston valve 70 toward the right, as viewed in Figs. 3 and 4, and substantially to a position at the opposite end of the housing 69, corresponding to that indicated in dotted lines in Fig. 4. During this movement, the chamber 115 will be placed in communication with oil under pressure in the chamber 74 through the port 76, while the chamber 114 will be opened to the exhaust through the port 75, as permitted by the open end 117 at the left end of the housing 69. In other words, the valve position will be exactly the reverse of that hereinbefore described.

Accordingly, the piston 78 will be moved toward the left, as viewed in Fig. 3, and any oil that may be in the chamber 114 will be exhausted as aforesaid. The shifting arms 68 will accordingly be rocked toward the left, as viewed in Fig. 3, thus throwing into engagement the reversing clutch, as formed by the drum 18, friction discs 31 and 32 and the hub flange 33a.

The reverse drive will then occur through the following parts: The flywheel 11, spider 13, driving shaft 14, reversing or left hand clutch, pinion 36, gear 40, counter-shaft 41, pinion 44, and then through the internal gear 26 to the driven shaft 27.

Any lubricating oil that is not exhausted through the openings 116 or 117, dependent upon the direction of drive, is finally exhausted through the relief valve 91, pipe 97, cooler 98, and return pipe 100, for final passage through the axial hole 104 in the driving shaft. As before stated, some of the oil passing through this hole in the driving shaft is sprayed onto the friction discs, while the remainder passes through the end of the shaft and is sprayed onto the internal gear for final collection in the reservoir 111.

It will be understood that the nature of the linkage connection between the piston valve 70 and the piston rod 79, in conjunction with the movement of the operating lever 88, is such, that when the operating handle is moved from the forward drive position illustrated in Fig. 4 to the neutral position illustrated in Fig. 3, the piston valve 70 will be moved to a position such that the piston portion 72 thereof will communicate the chamber 115 with the fluid chamber 74 through the port 76 and will communicate the chamber 114 with the exhaust opening 117 through the port 75. Oil pressure will accordingly move the piston 78 toward the left, as viewed in Fig. 3, and, during this movement, the piston valve 70 is slowly moved to the masking position, illustrated in Fig. 3, whereupon the indicated movement of the piston 78 will cease and the piston will then occupy the position shown in Fig. 3. A similar movement occurs when the operating handle is moved from a reverse position to the neutral position.

In order to insure adequate lubrication of the pump rotor and the free and positive movement of the vanes 59 in their slots, angularly inclined oil passages 118 (see Figs. 8 and 9) communicate the intermediate chambers 62 and 66 with partiannular grooves 119 and 120 provided in the face of the cover plate 63. The grooves 119 and 120 are located in a position such that they substantially register with the inner ends of the slots 58 (see Fig. 5), and hence oil under pressure maintains the outward position of the vanes, thus avoiding any necessity for springs.

In the event of the installation of these mechanisms in craft provided with twin screws and accordingly with propeller shafts running in opposite directions, the suction and delivery pipes 95 and 96 would be reversed from the positions indicated in Fig. 6, according to the direction of rotation of the shaft of the engine to which the particular reversing mechanism is connected.

If the hydraulic gear should fail for any reason, it is still possible to operate the mechanism for forward drive by virtue of the bar 121 which is threaded through an end wall 122 of the housing. As illustrated in Fig. 2, this bar is shown as unconnected to the link 53 and this arrangement is normal, so long as the hydraulic gear is functioning. In the event of a failure of the latter, however, the link 53 is disconnected from the part 51 and is connected to the adjacent end of the bar 121. If the nut 123 is then backed off sufficiently, rotation of the nut 124 will serve to pull the bar 121 toward the right and hence throw the forward drive clutch into engagement.

A reversing mechanism of the character indicated above may be built for use in installations requiring high capacity, because the operating effort required to actuate the forward and reverse clutches is provided by the operation of the mechanism itself through the medium of oil pressure. Moreover, this pressure is created by the use of a medium which is in turn utilized to lubricate the mechanism as a whole, so that the latter is a fully self-contained unit.

I claim:

1. In a reversing mechanism, the combination of a driving shaft, a pair of gears freely rotatable on the shaft, clutches for positively driving either of the gears, a member shiftable to engage either clutch, and hydraulic means for shifting the member comprising a cylinder, a double-acting piston operating in the cylinder and connected

to the member, a manually controlled valve for admitting fluid to either end of the cylinder, a pump driven by the shaft, and a pipe connecting the pump and valve for delivering fluid under pressure to the cylinder.

2. In a reversing mechanism, the combination of a driving shaft, a pair of gears freely rotatable on the shaft, clutches for positively driving either of the gears, a member shiftable to engage either clutch, and hydraulic means for shifting the member comprising a cylinder, a double-acting piston operating in the cylinder and connected to the member, a manually controlled valve for admitting fluid to either end of the cylinder, a pump driven by the shaft, a pipe connecting the pump and valve for delivering fluid under pressure to the cylinder, and a release valve in communication with the admission valve adapted to maintain a constant pressure in the pipe leading from the pump to the valve.

3. In a reversing mechanism, the combination of a driving shaft, a pair of gears freely rotatable on the shaft, clutches for positively driving either of the gears, a member shiftable to engage either clutch, and hydraulic means for shifting the member comprising a cylinder having a port adjacent each end, a double-acting piston operating in the cylinder and connected to the member, a reciprocable valve adapted to mask the ports when in neutral position and shiftable to open the ports to the incoming fluid and exhaust, respectively, a pump driven by the shaft, and a pipe connecting the pump and valve for delivering fluid under pressure thereto.

4. In a reversing mechanism, the combination of a driving shaft, a pair of gears freely rotatable on the shaft, clutches for positively driving either of the gears, a member shiftable to engage either clutch, and hydraulic means for shifting the member comprising a cylinder having a port adjacent each end, a double-acting piston operating in the cylinder and connected to the member, a manually controlled, reciprocable valve adapted to mask the ports when in neutral position and shiftable to open the ports to the incoming fluid and exhaust, respectively, a connection between the valve and piston constructed and arranged to provide for manual actuation of the valve in either direction independently of the piston and an automatic shifting of the valve when the piston is subjected to pressure, a pump driven by the shaft, and a pipe connecting the pump and valve for delivering fluid under pressure thereto.

5. In a reversing mechanism, the combination of a housing having an oil reservoir, a driving shaft in the housing, a pair of gears freely rotatable on the shaft, clutches for positively driving either of the gears, a member shiftable to engage either clutch, a hydraulically actuated device connected to the member for shifting the same, a pump driven by the shaft and having communication with the device for delivering fluid under pressure thereto, a suction pipe connecting the reservoir and pump, and means for returning fluid from the device to the reservoir.

6. In a reversing mechanism, the combination of a housing having an oil reservoir, a driving shaft in the housing, a pair of gears freely rotatable on the shaft, clutches for positively driving either of the gears, a member shiftable to engage either clutch, and hydraulic means for shifting the member comprising a cylinder having a port adjacent each end, a double-acting piston operating in the cylinder and connected to the member, a manually controlled, reciprocable valve adapted to mask the ports when in neutral position and shiftable to open the ports to the incoming fluid and exhaust, respectively, a pump driven by the shaft, a suction pipe connecting the reservoir and pump, a delivery pipe connecting the pump and valve, and means for returning the fluid from the cylinder to the reservoir.

7. In a reversing mechanism, the combination of a housing having an oil reservoir, a driving shaft in the housing having an axial oil passage and radial oil passages extending therefrom, a pair of gears freely rotatable on the shaft, clutches for positively driving either of the gears, a member shiftable to engage either clutch, and hydraulic means for shifting the member comprising a cylinder having a port adjacent each end thereof, a manually controlled, reciprocable valve adapted to mask the ports when in neutral position and shiftable to open the ports to the incoming oil and exhaust, respectively, a pump housing encircling the shaft and having suction and delivery chambers, a pumping element driven by the shaft within the housing, a suction pipe connecting the reservoir with the suction chamber, a delivery pipe connecting the delivery chamber with the valve, and a return pipe connecting the exhaust side of the valve with the housing, said last-named housing connection being in communication with a port formed in the housing and adapted to register with one of said radial passages, whereby the oil passing through the return pipe is delivered into the axial passage, and certain of the other radial passages being located along the shaft to discharge oil on the clutches.

8. In a reversing mechanism, the combination of a driving shaft, a pair of gears freely rotatable on the shaft, clutches for positively driving either of the gears, a member shiftable to engage either clutch, and hydraulic means for shifting the member comprising a cylinder having a port adjacent each end, a double-acting piston operating in the cylinder and connected to the member, a reciprocable valve adapted to mask the ports when in neutral position and shiftable to open the ports to the incoming fluid and exhaust, respectively, a first link pivotally mounted on the rod of the piston, a second link pivotally connected at its ends to the valve and first link, respectively, means for manually actuating the first link to thereby manually actuate the valve in either direction independently of the piston, the valve being responsive to movements of the piston when the latter is subjected to pressure, a pump driven by the shaft, and a pipe connecting the pump and valve for delivering fluid under pressure thereto.

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