

Aug. 21, 1951

J. D. DIETIKER

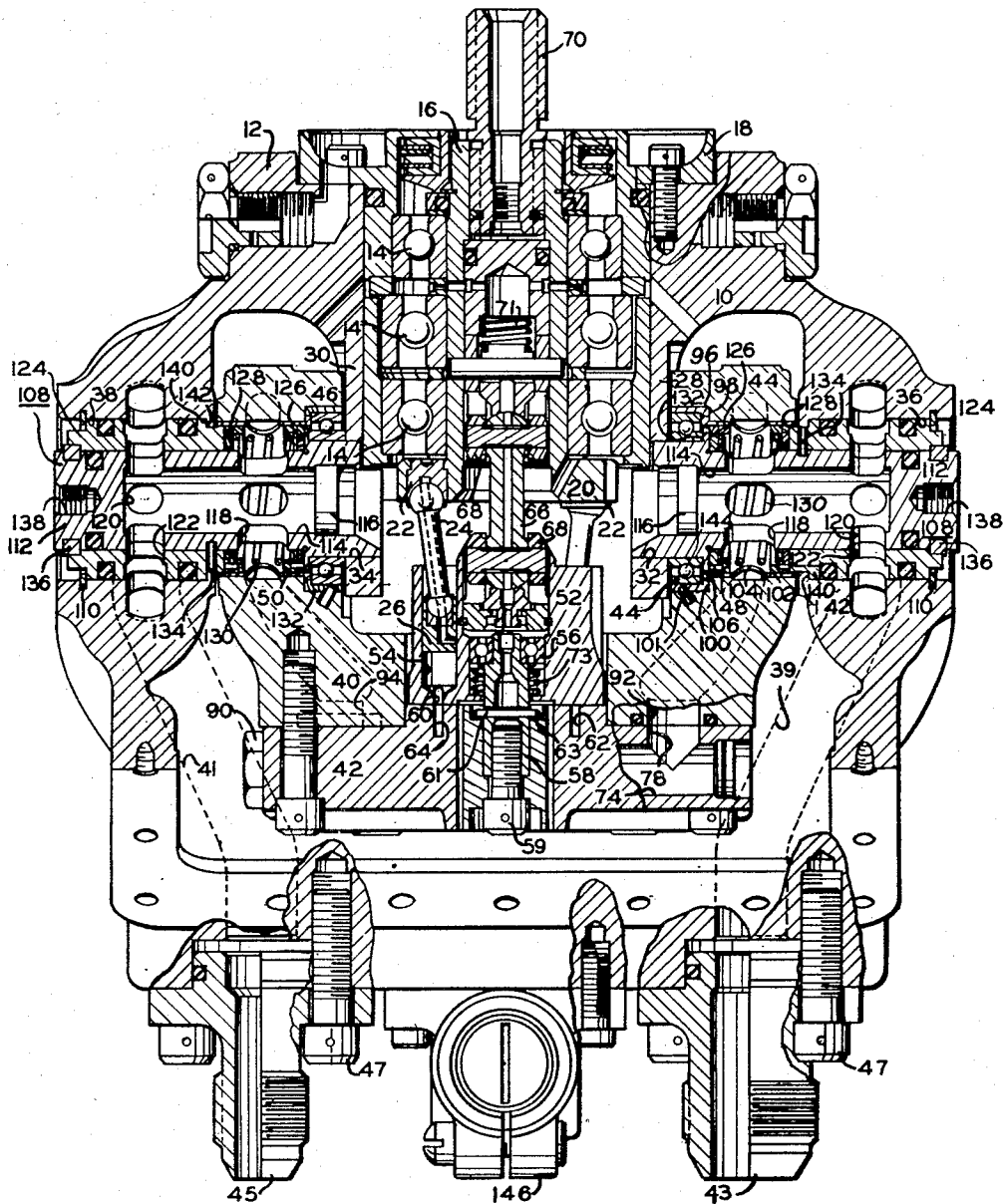
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FIG 1



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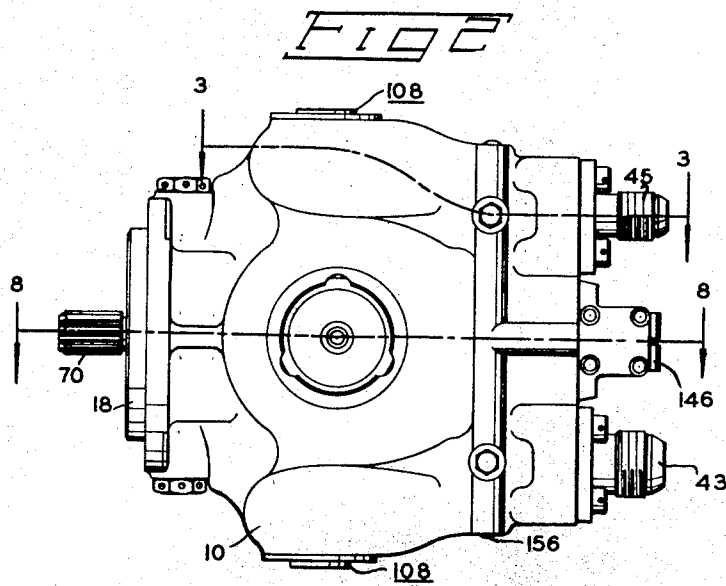
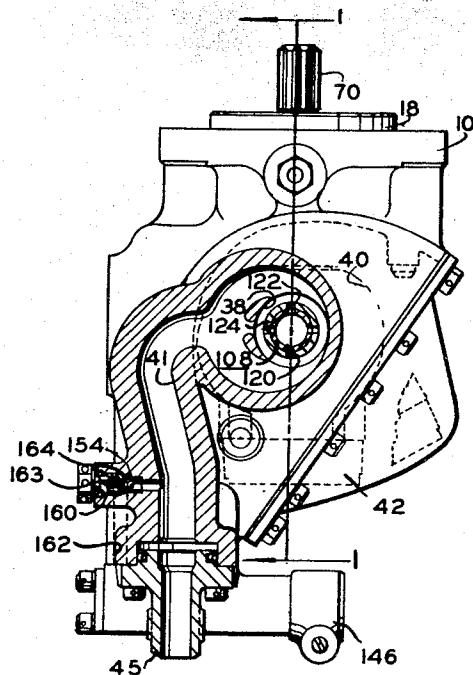
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Fig 4

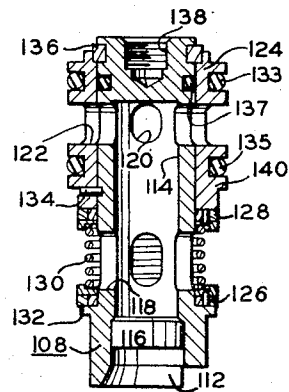


Fig 5

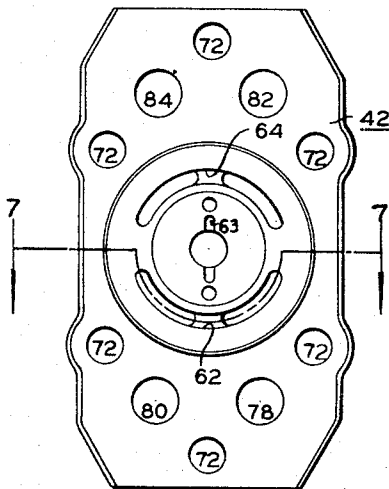


Fig 6

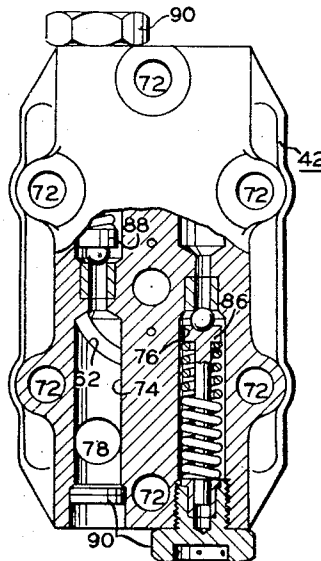
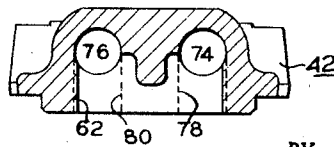


Fig 7



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FIG 8

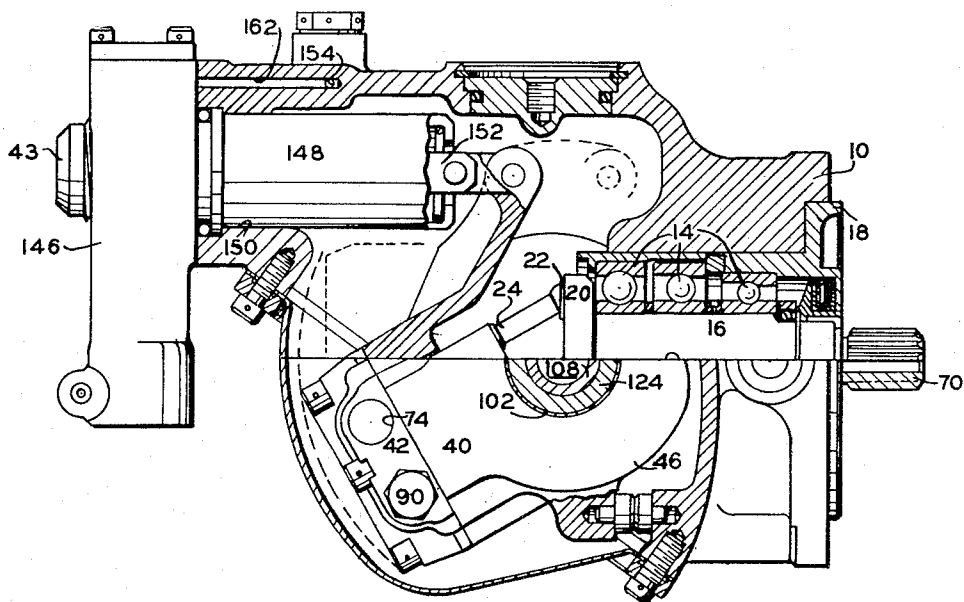
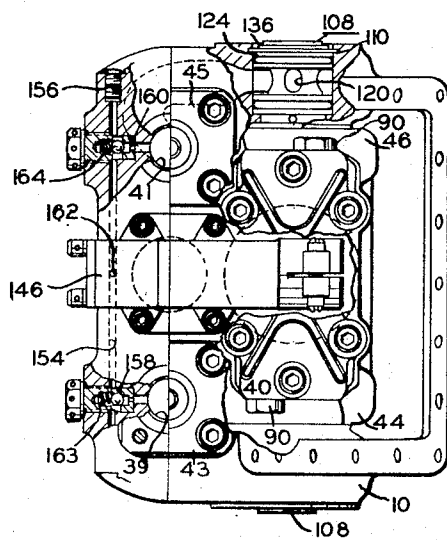


FIG 9

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This invention relates to power transmissions, particularly to those of the type comprising two or more fluid pressure energy translating devices, one of which may function as a pump and another as a fluid motor.

The present invention is particularly concerned with fluid pressure energy translating devices of the axial piston type having a swinging two-arm yoke member for varying the displacement of the device.

In the past it has been customary to pivotally journal the yoke arms within the casing member upon some stationary form of pintle construction also connected to the casing member. It has also been the practice to connect inlet and outlet flanges in line with the pintles which extend beyond the housing, resulting in increasing the width of the pump at the pintles. This arrangement is found to be inadequate for certain installations and, even where found adequate, when it became necessary to remove the pintle assembly for inspection or maintenance, the type of pintle assembly construction used combined with the constructional arrangement of the inlet and outlet flanges proved to be cumbersome.

It is an object of the present invention, therefore, to provide an improved pump or motor construction of the axial piston type having a swinging yoke for varying the displacement of the device wherein the width of the device is decreased at the pintles with consequent reduction in the weight and size of the pump.

It is also an object of the present invention to provide in pumps and motors of this general class a pintle assembly for pivotally connecting the yoke arms within the casing member of such a construction as to be in cartridge form easily insertable in and removable from the casing and yoke and, once removed, easily disassembled and reassembled.

It is a further object of the present invention to provide a pump or motor of this general class of improved and more rugged, compact and reliable construction capable of satisfactory operation over a long and useful life at extremely high pressures and high speeds.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the present invention is clearly shown.

In the drawings:

Figure 1 is a longitudinal cross section of a fluid pressure energy translating device embodying a preferred form of the present invention.

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Figure 2 is a plan view of the invention shown in Figure 1.

Figure 3 is a sectional view taken on line 3—3 of Figure 2.

Figure 4 is a sectional view of a portion of the invention shown in Figure 1.

Figure 5 is a view of the valve plate incorporated in Figure 1.

Figure 6 is a partial sectional view of the valve plate shown in Figure 5 shown from the opposite side.

Figure 7 is a view taken on line 7—7 of Figure 5.

Figure 8 is a view taken on line 8—8 of Figure 2.

Figure 9 is a broken sectional end view of the invention shown in Figure 1.

Referring now to Figure 1, there is illustrated a pump of the variable displacement type comprising generally a main frame or casing member 10 having flange means 12 for attachment to a suitable support. The casing 10 is provided with radial anti-friction and thrust bearings 14 on which a main drive shaft 16 is journaled. A seal for the projecting end of the shaft 16 is provided for by a closure member 18. The shaft 16 is provided with a socket flange 20 carrying a plurality of ball sockets 22 in which are mounted ball-ended connecting rods 24 carrying reciprocating pistons 26.

The casing 10 is provided with two inwardly-projecting tongues 28 and 30 having similar bores 32 and 34 in alignment, respectively, with similar bores 36 and 38 formed in the side walls of the casing member 10. An inlet passage 39 is formed in the side walls of the housing 10 which extends from the end of said housing opposite the shaft 16 laterally to bore 36, while a similar outlet passage 41 extends from the same end of the housing to bore 38. An inlet flange 43 and an outlet flange 45 registering with passages 39 and 41, respectively, are mounted on casing 10 by suitable bolts 47.

A yoke 40, to which is rigidly attached a valve plate 42 and which is provided with duplicate arms 44 and 46 having similar bores 48 and 50, respectively, is pivotally connected by the arms 44 and 46 within the casing member 10 by means hereinafter described in such a manner that the yoke bores 48 and 50 are in alignment, respectively, with the casing bores 36 and 38.

A cylinder barrel 52, having a plurality of cylinder bores 54 in which the pistons 26 are reciprocable, is journaled on a ball bearing 56 carried by a stud 58 which is rigidly secured to the valve plate 42 by means of a suitable bolt 59 threaded into the stud 58 and a pin 61 driven through the shaft and fitting into a slot 63 of

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the valve plate 42, as is shown more clearly in Figure 5. Each cylinder bore 54 is provided with a cylinder port 60 opening to the bottom face of the barrel 52, in Figure 1, which are adapted to cooperate with a kidney-shaped intake port 62 in the valve plate 42 on the suction stroke of pistons 26 and with a similarly-shaped output port 64 therein adjacent port 62 on the pressure stroke of said pistons as the barrel 52 is rotated. The barrel 52 for this purpose is driven from the shaft 16 through the medium of a Cardan shaft 66 having universal joints 68. A coupling shaft 70, which is splined to match the drive shaft 16, is provided for driving the pump. A light spring 71 urges the shaft 66 downwardly to take up any lost motion in the axial direction inherent in the universal joints 68. Another light spring 73 mounted on the shaft 58 tends to aid in urging proper contact between the opposite faces of the cylinder barrel 52 and the valve plate 42.

As is more clearly shown in Figures 5, 6 and 7, the valve plate 42, which is rigidly secured to the yoke 40 by suitable bolts placed through mounting holes 72 provided for that purpose, contains two parallel longitudinal bores 74 and 76, both of which are in communication with intake and output ports 62 and 64. The valve plate 42 also is provided with two transverse ports 78 and 80 adjacent to each other located between one end of the valve plate 42 and intake port 62, the former being in communication with bore 74 and the latter with bore 76. In addition, two similar transverse ports 82 and 84 are located between the opposite end of valve plate 42 and output port 64, the former being in communication with bore 74 and the latter with bore 76. Two suitable relief valve assemblies 86 and 88 are mounted inversely to each other in bores 74 and 76, and the bores are closed at each end by suitable plugs 90.

As shown in Figure 1, transverse ports 78 and 80 register with duplicate passages 92 in the yoke body, one only of which is shown in dotted lines, which extend into the arm 44 of said yoke and finally communicate with bore 48. Likewise, transverse ports 82 and 84 register with duplicate passages 94 in the yoke body, one only of which is shown in dotted lines, which extend into the other arm 46 of said yoke and finally communicate with bore 50.

Due to the fact that the methods of pivotally connecting the arms 44 and 46 within the casing member 10 are identical, an explanation of connecting one of said arms will suffice.

The bore 48 of arm 44 is provided with a sleeve 96 having a shoulder 98 resting on a shoulder 100 within bore 48 and is locked into arm 44 by means of a pin 101. An additional sleeve 102 having a plurality of ports 104 and a shoulder 106 is also inserted in bore 48 with shoulder 106 resting on shoulder 100 and abutting shoulder 98 of sleeve 96. When so inserted, ports 104 register with the yoke arm passages 92. A pintle assembly 108, shown in Figure 4, is then inserted within bore 48 and within sleeves 96 and 102 with the assembly 108 being held within said bore and sleeves by use of a snap ring 110.

As is shown in Figure 4, pintle assembly 108 comprises a cylindrical pintle 112 having a longitudinal bore 114 closed at its open end by means of a plug 116 which may be hydrogen-brazed within bore 114. Pintle 112 is provided with a plurality of ports 118 intersecting bore 114 adapted to register with ports 104 of sleeve 102

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and with a plurality of ports 120 also intersecting bore 114 adapted to register with a plurality of ports 122 in a sleeve 124 surrounding the upper periphery of pintle 112, in Figure 4. Duplicate split-type expansion seals 126 and 128 surround pintle 112, although other suitable seals may be used, and are spaced apart by means of a light spring 130 so that ring seal 126 abuts the upper side of a flange 132 on pintle 112 and seal 128 abuts the inner end of sleeve 124. Suitable seals 133 and 135 surround the outer periphery of sleeve 124 above and below ports 122, and a suitable seal 137 is provided for pintle 112 adjacent to seal 133. A loose-fitting pin 134 and a snap ring 136 securely lock the members of the assembly in assembled position.

It should be noted that, by providing a separate sleeve for and forming a flange on the pintle 112, proper abutment members are automatically provided for the duplicate sealing rings 126 and 128 which, together with the spring 130, become an integral part of the cartridge upon assembly. When assembling, the cartridge seals 126 and 128 spaced apart by spring 130 may be mounted on the pintle 112 with seal 126 abutting the upperside of flange 132. When sleeve 124 is positioned upon pintle 112 and connected thereto by means of loose-fitting pin 134 and snap ring 136 so that ports 120 and 122 of pintle 112 and sleeve 124, respectively, register with each other, the inner extremity of sleeve 124 forms an abutment for ring seal 128. With the pintle and sleeve thus connected, spring 130 not only properly spaces apart the seals 126 and 128 above and below ports 118 permitting communication between ports 118 and ports 104 of sleeve 102, but also holds the same in abutment against flange 132 and the inner end of sleeve 124.

A threaded bore 138 is provided at the closed end of pintle 112 for convenience in threading a proper tool therein for easy removal of the complete assembly 108 simply by removing snap ring 110. Once the assembly 108 is removed, it may be easily disassembled simply by removing pin 134, shifting sleeve 124 against the slight resistance offered by spring 130 and removing snap ring 136. The point of insertion of assembly 108 is limited by a shoulder 140 of sleeve 124 forming an abutment against a shoulder 142 formed within bore 36 of casing 10.

A bearing 144, resting on the flange 132 of pintle 112 and shoulders 98 and 106 of sleeves 96 and 102, respectively, and abutting the outer periphery of pintle 112 and the inner periphery of sleeve 96, provides for proper pivotal bearing movement of yoke 40.

Referring now to Figures 1, 5 and 6, pintle assembly 108 serves to pivotally connect the yoke 40 within the casing member 10 in such a manner that fluid will be conducted on the suction stroke of pistons 26 through inlet passage 39 and ports 122 and 120 of sleeve 124 and pintle 112, respectively, to bore 114 of pintle 112. From bore 114, fluid is conducted through ports 118 and 104 of pintle 112 and sleeve 102, respectively, and by means of yoke passages 92 to ports 78 and 80 of valve plate 42 and within such valve plate to bores 74 and 76.

The resistance offered by relief valve 88 and the fact that the flow is blocked in the opposite direction by relief valve 86 prevents fluid from entering ports 82 and 84 and fluid enters the cylinder bores 54 containing the pistons 26 acting on the suction stroke by means of intake port 62 in valve plate 42. As the barrel 52 rotates,

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the fluid is forced out of bores 54 on the pressure stroke of pistons 26 to bores 74 and 76 of valve plate 42 by means of output port 64 where, inversely, the resistance offered by relief valve 85 and the blocking of fluid flow by relief valve 88 prevents fluid from flowing through ports 78 and 80. Pressure fluid is then conducted by means of ports 82 and 84 of plate 42 to yoke passages 94 which register therewith and by means of passages 94 to bore 114 of the opposite pintle 112 by means of corresponding ports 104 and 118, respectively, in the corresponding sleeve 102 and pintle 112. From bore 114, fluid is conducted through corresponding ports 120 and 122, respectively, of corresponding pintle 112 and sleeve 102 to outlet passage 41 and thence to outlet 45.

In order to vary the volume of fluid according to pressure requirements, suitable means may be provided to automatically regulate the movement of the yoke which in turn changes the angle between the cylinder barrel and the main drive shaft.

As is more clearly shown in Figures 3, 8 and 9, a pressure control body 146, containing suitable pressure control mechanisms, not shown, is mounted on casing member 10 between inlet flange 43 and outlet flange 45. Pressure control body 146 has a portion 148 extending into a bore 150. Portion 148 may contain suitable pressure responsive mechanism 152 linked to yoke 40 capable of shifting the angle of yoke 40 toward the neutral position after a predetermined pressure has been reached.

As is more clearly shown in Figures 3 and 9, at the end of casing member 10 on which control body 146 is mounted, a passage 154 extends completely through casing member 10 and is closed by suitable plugs 156. Duplicate passages 158 and 160 are provided which extend from the end of casing member 10, passage 158 communicating directly with passage 154 and inlet passage 39, while passage 160 communicates directly with passage 154 and outlet passage 41. Another passage 162 is connected to passage 154 and is adapted to register with ports, not shown, in control body 146. Duplicate check valves 163 and 164 are mounted in passages 158 and 160 for permitting the pressure controlling mechanism to be effective in either direction of rotation of shaft 16. The inverse mounting of the relief valves 85 and 88 makes the valve plate porting immediately adaptable without any change to this reversal of rotation of shaft 15, while check valves 162 and 164 permit the pressure regulating mechanism to be equally effective for shifting the yoke in case of such reversal of rotation.

It should be noted that the placing of the inlet and outlet flanges at the end of the casing member does not in any way increase the length of the pump because of the fact that the pressure control body mounted on the casing member extends out to a distance equal to the extended distance of the inlet and outlet flanges. The placing of these flanges at the end of the pump does, however, greatly reduce the width of the pump at the pintles.

It should also be noted that the pintle assembly is completely removable from the casing member and the arms of the yoke simply by threading a proper pintle removal tool in the bore provided for that purpose and removing the snapping fitting into a groove in the casing. Also it is important to note that, upon removal of the

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complete assembly, it is a simple matter to disassemble and reassemble the same.

It should also be noted that, because of the inverse mounting the duplicate relief valves in the valve plate, the device is readily adaptable for reverse rotation of the drive shaft simply by rearranging the inlet and outlet flanges. In addition, the pressure regulating mechanism which changes the angle of the yoke toward a neutral position after a certain range of pressure has been reached is readily adaptable without any changes in the device for reverse rotation of the pump. This immediate adaptation to reverse rotation of the device is made possible by use of the novel mounting arrangement of the duplicate check valves which permits pressure fluid being delivered by the pump on the pressure stroke of the pistons, no matter what the direction of rotation of the main drive shaft, to enter the pressure control body from the casing conduit being used as an outlet and preventing reverse flow through the casing conduit being used as an inlet passage.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a fluid pressure energy translating device of the variable displacement type, the combination of a casing for the device including inlet and outlet connections, a two-armed swinging yoke having inlet and outlet passages formed in its arms, means for transferring fluid from the inlet passage to the outlet passages, hollow pintle bearing means associated with the casing and with said arms to provide a pivot for the yoke and to conduct fluid into and out of said passages, said pintle means being located for removal from the casing without disturbing the inlet and outlet connections, and means including fluid conduits extending transversely to the axis of said pintle bearing means at a point closely adjacent the yoke arms for carrying fluid between the hollow pintle bearing means and the inlet and outlet connections.

2. In a fluid pressure energy translating device of the variable displacement type, the combination of a casing for the device including inlet and outlet connections, a two-armed swinging yoke having inlet and outlet passages formed in its arms, means for transferring fluid from the inlet passage to the outlet passage, a unitary pintle cartridge assembly having sealing means formed as an integral part thereof associated with the casing and with said arms to provide a pivot for the yoke and to conduct fluid into and out of said passages, said cartridge assembly being located for removal from the casing without disturbing the inlet and outlet connections, and means including fluid conduits extending transversely to the axis of said pintle cartridge at a point closely adjacent the yoke arms for carrying fluid between the pintle cartridge and the inlet and outlet connections.

3. In a fluid pressure energy translating device of the variable displacement type, the combination of a casing for the device including inlet and outlet connections, a two-armed swinging yoke having inlet and outlet passages formed in its arms, means for transferring fluid from the inlet passage to the outlet passage, a unitary pintle cartridge assembly having an internal cylindrical cavity mounted in the casing and pro-

viding journals within the casing upon which the yoke arms are pivotally mountable, said cartridge assembly being located for removal from the casing without disturbing the inlet and outlet connections, means including fluid conduits extending transversely to the axis of said cartridge assembly at a point closely adjacent the yoke arms, and a plurality of ports in said cartridge in communication with said cavity registering with the yoke passages and with the casing fluid conduits for carrying fluid from the inlet connection to the yoke and from the yoke to the outlet connection.

4. In a fluid pressure energy translating device of the variable displacement type, the combination of a casing for the device having a removable access cover, a two-armed swinging yoke having inlet and outlet passages formed in its arms, means for transferring fluid from the inlet passage to the outlet passage, hollow pintle bearing means associated with the casing and with said arms to provide a pivot for the yoke and to conduct fluid into and out of said passages, inlet and outlet connections formed in the casing, and means including fluid conduits extending to said pintle bearing means at a point closely adjacent the yoke arms for carrying fluid between the hollow pintle bearing means and the inlet and outlet connections, said pintles being removable from the exterior of the casing without disturbing the inlet and outlet connections whereby the yoke may be removed from the casing upon removal of the access cover while the inlet and outlet connections remain connected.

5. In a fluid pressure energy translating device of the variable displacement type, the combination of a casing for the device, inlet and outlet connections formed therein, means forming a pair of duplicate bores in said casing, duplicate conduits extending from said connections to the bores, a two-armed swinging yoke, inlet and outlet ports formed therein, means for transferring fluid from the inlet port to the outlet port, means forming a bore in each arm adapted to register with the casing bores, inlet and outlet passages in said arms extending from the yoke inlet and outlet ports to the yoke bores, cylindrical pintle bearing means having an internal cavity stationarily mountable within the casing bores and extending into the yoke arm bores providing a pivot therefor, a first plurality of ports in said pintle means intersecting said cavity and registering with the casing inlet and outlet conduits for conducting fluid from the inlet connection to the pintle cavity and from the pintle cavity to the outlet connection, and a second plurality of ports in said pintle means also intersecting the cavity and registering with the yoke arm inlet and outlet passages for carrying fluid to and from the cavity and the yoke inlet and outlet ports.

6. In a fluid pressure energy translating device of the variable displacement type, the combination of a casing for the device, inlet and outlet connections formed in one end of the casing, means forming a pair of duplicate bores in the

sides of said casing, a two-armed swinging yoke, inlet and outlet ports formed therein, means for transferring fluid from the inlet port to the outlet port, means forming a bore in each arm adapted to register with the casing bores, inlet and outlet passages in said arms extending from the yoke inlet and outlet ports to the yoke bores, cylindrical pintle bearing means having an internal cavity stationarily mountable within the casing bores and extending into the yoke arm bores providing a pivot therefor, duplicate conduits connected to the casing inlet and outlet connections and extending laterally in the side walls of the casing to the casing bores at a point closely adjacent the yoke arms, a first plurality of ports in said pintle means intersecting said cavity and registering with the casing inlet and outlet conduits for conducting fluid from the inlet connection to the pintle cavity and from the pintle cavity to the outlet connection, and a second plurality of ports in said pintle means also intersecting the cavity and registering with the yoke arm inlet and outlet passages for carrying fluid to and from the cavity and the yoke inlet and outlet ports.

7. In a fluid pressure energy translating device of the variable displacement type, the combination of a casing for the device including inlet and outlet connections, a two-armed swinging yoke having inlet and outlet passages formed in its arms, means for transferring fluid from the inlet passage to the outlet passage, pintle bearing means mounted within the casing and providing journals upon which the yoke arms are pivotally connected, said pintle bearing means being located for removal from the casing without disturbing the inlet and outlet connections, said pintle bearing means having an internal cylindrical cavity and a first plurality of ports and a second plurality of ports in communication with the cavity, said first plurality of ports registering with the yoke arm inlet and outlet passages for conducting fluid between the pintle means and the yoke, and means forming inlet and outlet fluid conduits extending respectively from the inlet and outlet connections transversely to the axis of the pintle bearing means at a point closely adjacent to the yoke arms and registering with the second plurality of ports for carrying fluid between the pintle means and the inlet and outlet connections.

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