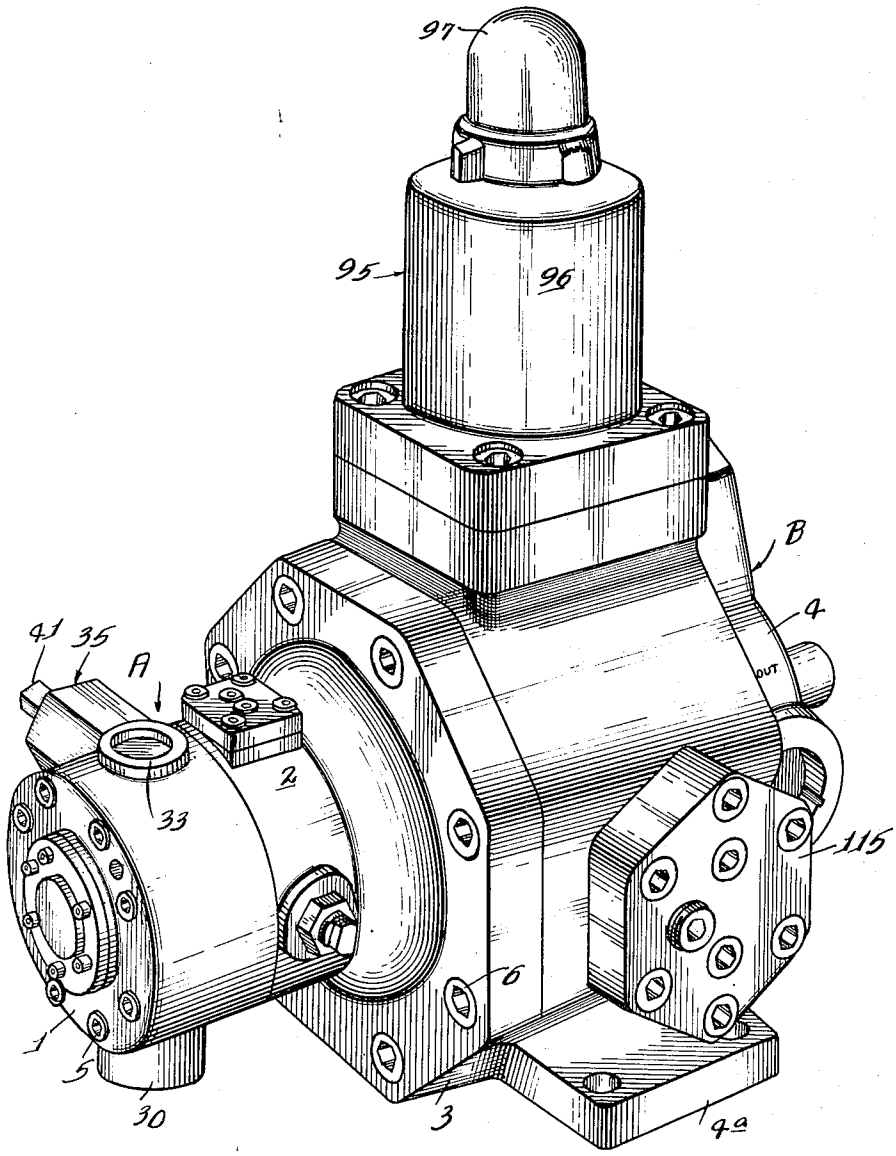
Oct. 2, 1956 G. B. MILLER ET AL 2,764,941

MULTIPLE PUMP

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5 Sheets-Sheet 1

Fig. 1.



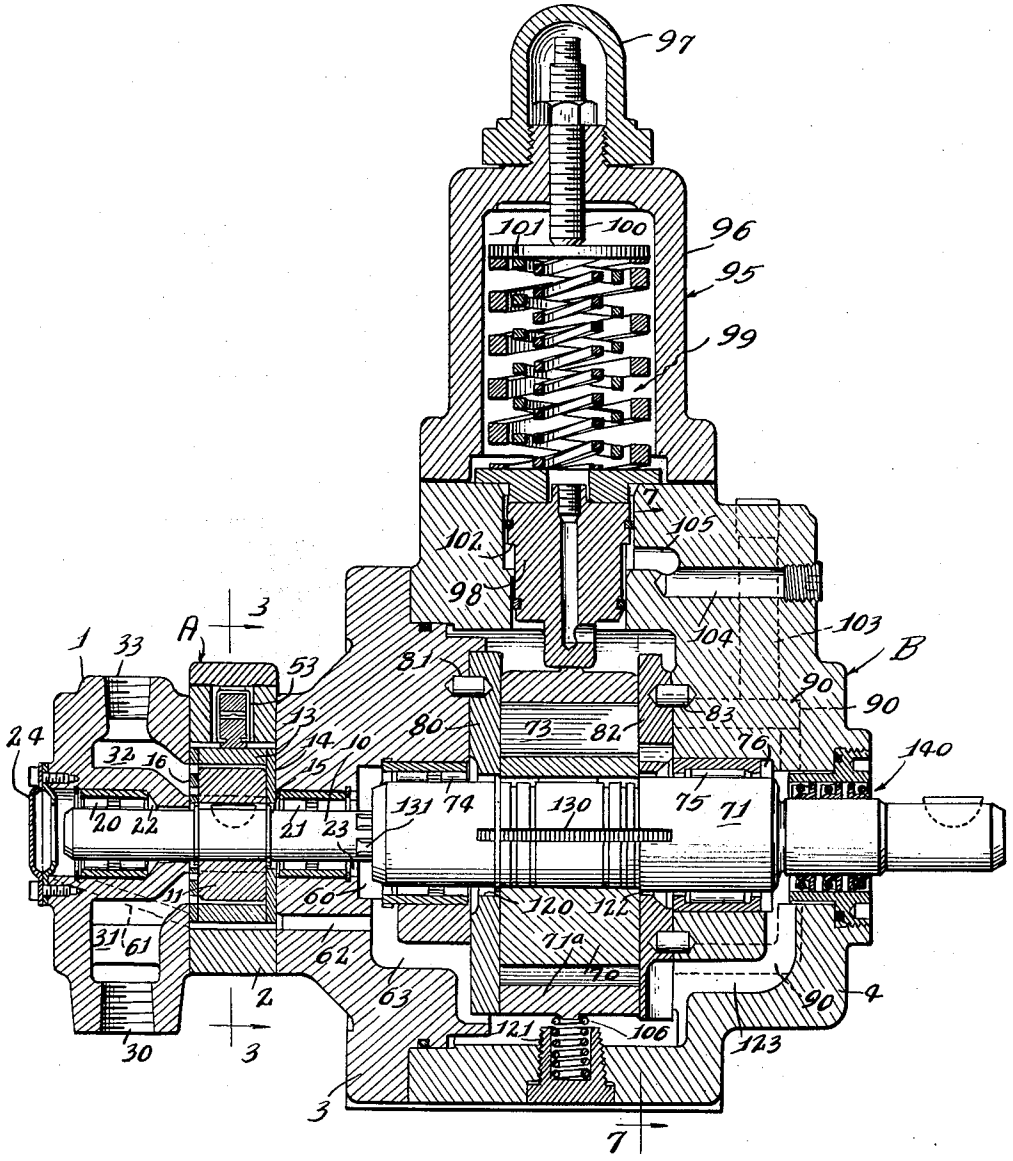
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Fig. 2.



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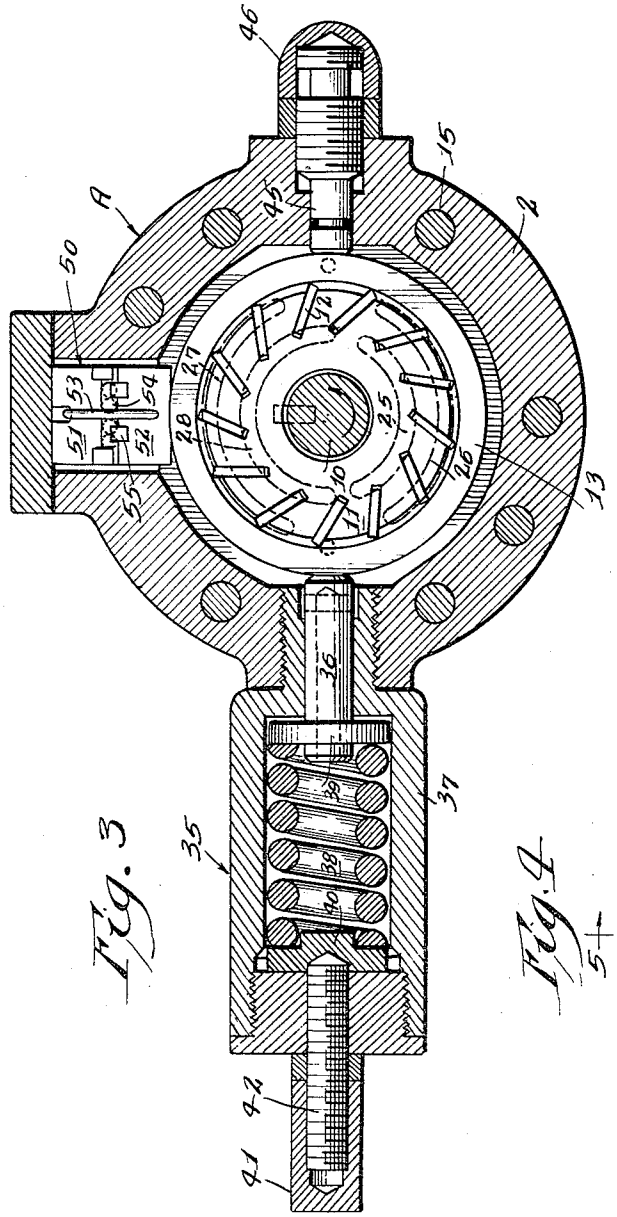


Fig. 3

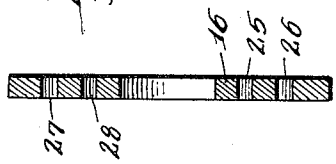


Fig. 5

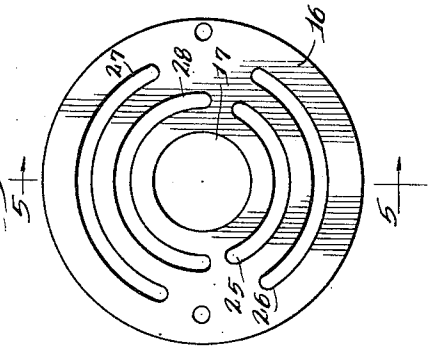


Fig. 4

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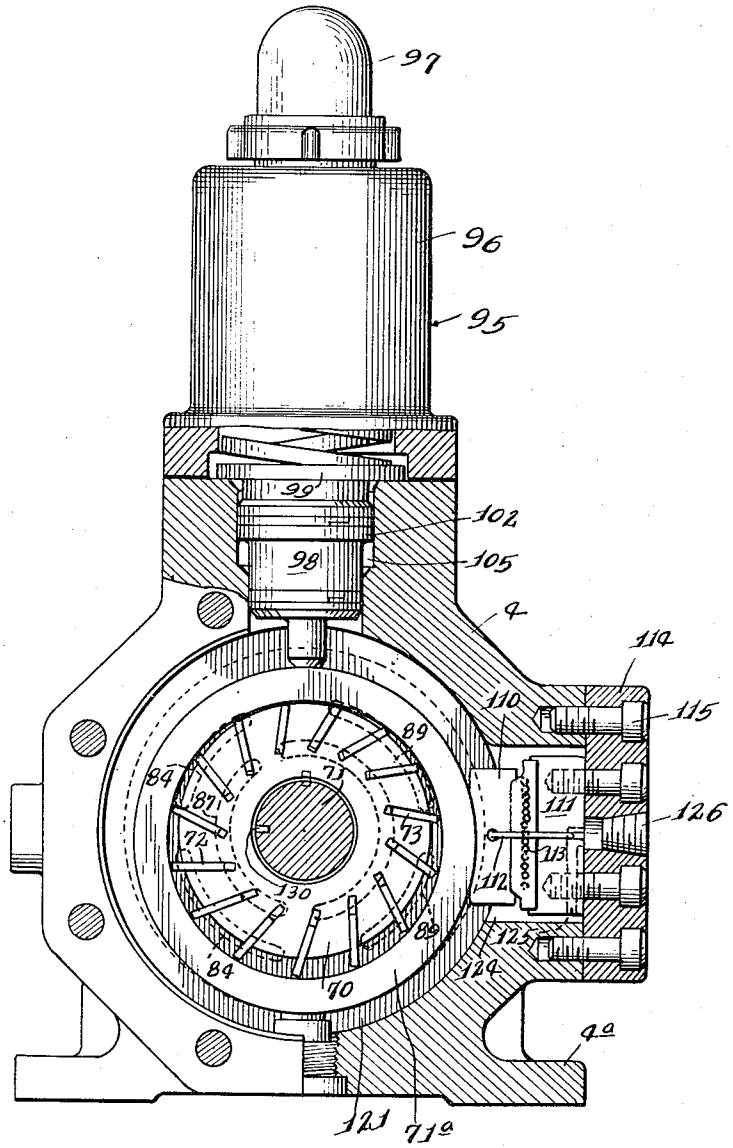
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Fig. 6



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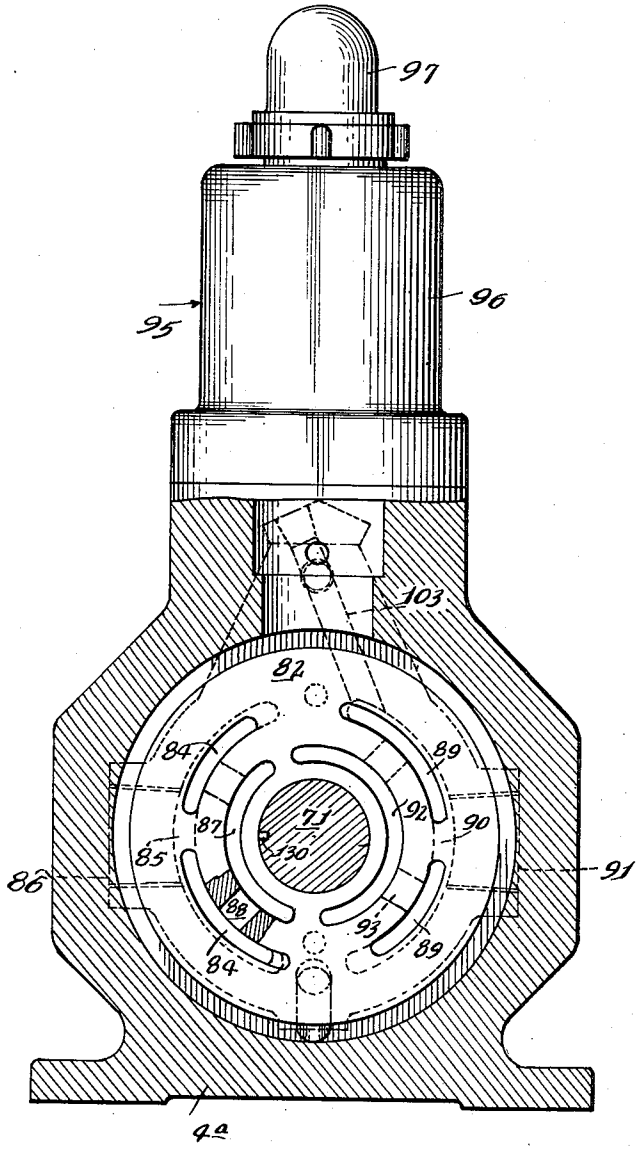
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MULTIPLE PUMP

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Fig. 7



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MULTIPLE PUMP

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Application August 21, 1953, Serial No. 375,701

2 Claims. (Cl. 103—4)

This invention relates to a multiple pump.

An object of this invention is to provide a new and improved multiple pump having a pair of coaxially mounted vane-type pumps.

Another object of the invention is to provide a multiple pump unit having a pair of coaxially mounted vane-type pumps provided with a plate for connecting the two pumps together common to and forming a side of both pumps.

Another object of the invention is to provide a multiple pump unit having a pair of constant pressure vane-type pumps having separate oil inlets and outlets and wherein one of the pumps is constructed to provide a large volume of oil at low pressure and the other pump provides a small volume of oil at high pressure and wherein the pumps have a common connecting plate forming a side of each pump for securing one pump to the other.

Another object of the invention is to provide a vane-type pump having improved mechanism for lubricating the rotor shaft bearings.

Another object of the invention is to provide a vane-type pump wherein the rotor shaft has a slot extending lengthwise thereof for equalizing the pressure of the oil which leaks from between the sides of the rotor and the cover and port plates disposed on either side of the rotor.

The objects of the invention generally set forth, together with other ancillary advantages, are attained by the construction and arrangement shown by way of illustration in the accompanying drawing, in which:

Fig. 1 is a perspective elevational view of the multiple pump;

Fig. 2 is a vertical section of the multiple pump shown in Fig. 1 taken along the rotor shafts and showing the shafts in elevation;

Fig. 3 is a vertical section taken along the line 3—3 of Fig. 2 and showing the ports in the port plate in dot-dash lines;

Fig. 4 is a view in elevation of the port plate associated with the pump as shown in dot-dash lines in Fig. 3;

Fig. 5 is a vertical section of the port plate taken along the line 5—5 in Fig. 4;

Fig. 6 is a vertical elevation of the multiple pump shown in Fig. 1 with parts thereof broken away and parts in section; and

Fig. 7 is a vertical sectional view taken along the line 7—7 of Fig. 2 and showing parts in elevation.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail an illustrative embodiment of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

The multiple pump as shown in Fig. 1 comprises a basic pump housing formed of four parts; namely, an end casting 1, an annular casting 2, a connecting plate 3, and an end casting 4. The casting 4 is provided with a mounting flange 4*a*. Mounted within these housing components are a pair of constant pressure vane-type pumps.

One of the pumps, designated generally at A, is mounted within the end casting 1 and the annular casting 2. The other pump indicated generally at B is mounted within the end casting 4.

The housing components 1 and 2 of the pump A are secured to each other and to the connecting plate 3 by a plurality of threaded bolts 5. The connecting plate 3 is connected to the casting 4 of pump B by connecting bolts 6.

The pump unit A which is designed to provide a small amount of oil at high pressures and as shown in Figs. 1, 2, 3, 4 and 5 comprises a shaft 10 to which is keyed a rotor 11. The rotor 11 is provided with a plurality of outwardly opening slots, each of which slidably receives a vane 12 which may move outwardly into engagement with a concentric ring 13 which is mounted eccentrically of the rotor 11. A cover plate 14 is mounted adjacent one side of the rotor 11 and the ring 13 and has an opening 15 through which the rotor shaft 10 extends. A port plate 16 is mounted adjacent the other side of the rotor 11 and the ring 13 and has an opening 17 therein through which the rotor shaft 10 extends.

The rotor shaft 10 is rotatably mounted in roller bearings 20 and 21 which are disposed in a recess 22 in the end casting 1 and a recess 23 in the connecting plate 3, respectively.

An end seal for the recess 22 in the end casting 1 comprises a cap member 24 which is secured to the end plate 1 by suitable means and which has a gasket disposed therebetween.

The port plate 16, as shown in Fig. 4, has a pair of oil inlet ports 25 and 26 and a pair of pressure ports 27 and 28. These ports are shown in dot-dash line in Fig. 3 where the port plate is not shown, to indicate the location of the ports with respect to the vanes 12 which are slidably mounted in the rotor 11.

The end casting 1 is provided with an inlet 30 and a passage 31 which connects with the ports 25 and 26 in the port plate 16.

As is apparent from Fig. 3, the inlet oil passing through port 26 enters the areas defined by the vanes 12, the outer periphery of the rotor 11 and the inner periphery of the rotor ring 13. Oil entering through inlet port 25 passes into the slots in the rotor 11 behind the vanes 12 and acts to equalize the pressure on the vanes.

As the rotor 11 is rotated in a counterclockwise direction as shown in Fig. 3, the area between a pair of vanes 12, the outer periphery of the rotor 11 and the inner periphery of the rotor ring 13 decreases and at this time this area comes into communication with a pressure port 27 in the port plate 16 which communicates with a passage 32 in the end casting 1 and an outlet 33. The portion of the slots in the rotor 11 disposed behind the vanes 12 comes into communication with the port 28 which also communicates with the passage 32 in the end casting 1.

The pump A as stated previously is a vane-type pump and is constructed to provide a single-throw in that there is only one set of oil inlet ports and one set of pressure ports. The pump is constructed to insure constant fluid pressure on the outlet side thereof and this is accomplished by a spring-type governor indicated generally at 35. This governor comprises a piston 36 which is slidably mounted in a casting 37 secured to the annular casting 2 and a spring 38 disposed between a plate 39 on the piston 36 and a plate 40. The spring 38 may be

adjusted by removing the top cap 41 and adjusting the screw 42. Thus, with the pump in operation, the rotor ring 13 is in engagement with the piston 36 which acts to control the position of the rotor ring 13 with respect to the rotor 11 in order to properly control the fluid pressure in the outlet side of the pump. This pump is also constructed to enable adjustment for variable volume in that the eccentric position of the rotor ring 13 may be varied with respect to the rotor 11 by an adjustable plunger 45 which is threaded in the annular casting 2. Access to this plunger is provided by a removable cap 46.

To overcome the outward thrust of the rotor ring 13 caused by the force of the oil being placed under pressure by the rotor 11 and vanes 12, a thrust aligning block mechanism is provided. This block mechanism, indicated generally at 50, comprises a fixed block 51 and a movable block 52, shaped to the contour of the rotor ring 13 which is held to the block 51 by a clip 53. A plurality of roller bearings 54 are mounted between the fixed block 51 and the movable block 52 to permit free movement of block 52 with respect to fixed block 51. The rollers 54 are held between the blocks by a clip member 55.

There is a certain amount of oil which leaks from between the sides of the rotor 11 and the adjacent walls of the cover plate 14 and port plate 16. The oil leaking from between the side of the rotor 11 and the wall of cover plate 14 passes through the opening 15 in the cover plate and through the roller bearings 21 and into a recess 60 and a passage 63 in the connecting plate 3. This oil then passes to the drain through passages which will be discussed more fully hereinafter.

Oil leaking from between the other side of the rotor 11 and the wall of the port plate 16 passes out through opening 17 in the port plate and through bearings 20. The oil then passes through a passage 61 in the end plate 1 which communicates with an area surrounding the outer periphery of the rotor ring 13. This area communicates with a passage 62 in the connecting plate 3 which connects with the passage 63 also in the connecting plate 3.

The pump B is generally similar to pump A but is of a much larger size as is apparent from Figs. 1 and 2 and has certain structural differences. The pump B is constructed to provide a large volume of oil at a relatively low pressure. The pump B has a rotor 70 which is keyed to a shaft 71 for rotation therewith. Disposed around the rotor 70 is a concentric rotor ring 71*a* which is mounted eccentrically of the rotor 70. The rotor 70 is provided with a plurality of slots 72 in which vanes 73 are slidably mounted.

The rotor shaft 71 is rotatably mounted in the connecting plate 3 and in end casting 4 by roller bearings 74 mounted in the recess 60 provided in the connecting plate 3 and roller bearings 75 mounted in a recess 76 provided in the end plate 4, respectively.

A cover plate 80 encloses one side of the rotor 70 and rotor ring 71*a* and is pinned to the connecting plate 3 by dowel pins 81. A port plate 82 encloses the other side of the rotor 70 and rotor ring 71 and is pinned to the end casting 4 by dowel pins 83.

The port plate 82 has a pair of inlet ports 84 communicating with an arcuate passage 85 which is in communication with a fluid inlet 86 provided in the end casting 4. In order to permit the entry of oil into the slots 72 behind the vanes 73 an additional inlet port 87 is provided which communicates with the inlet ports 84 by a passage 88 in the body of the port plate 82. The oil which is discharged from the pump under pressure passes out through outlet ports 89 in the port plate 82. These ports 89 communicate with a passage 90 in the end casting 4 which is in communication with an outlet 91. A port 92 in the port plate 82 communicates with the ports 89 by passages 93 to permit exhausting of the oil from the area of the slots 72 disposed behind the vanes 73.

The pump B is also constructed to provide a constant outlet pressure and has a spring-type governor indicated generally at 95 mounted in a housing 96 provided with a cap 97. This governor has a piston 98 which engages with the rotor ring 71*a* and a plurality of springs, indicated generally at 99, which urge the piston 98 against the rotor ring 71*a*. When it is desired to adjust the springs 99 the cover 97 may be removed and the screw 100 rotated which forces the plate 101 down to compress the springs 99. The piston 98 has a flange 102 which is subjected to the pressure of the oil being pumped by the pump B. This provides for a more sensitive pressure control and is effected by having a plurality of passages 103, 104 and 105 in the end casting 4 which connect the outlet passage 90 in the end casting 4 with the area of the piston having the raised flange 102.

A spring and plunger mechanism 106 acts between the rotor ring 71*a* and the end casting 4 to maintain the rotor ring 71*a* in engagement with the piston 98 and to control the eccentricity of the rotor ring 71*a* with respect to the rotor 70. Thus, this pump may be shifted to a no-load position.

A thrust aligning block 110 shaped to the contour of the rotor ring 71 is held to a fixed block 111 by a clip 112. The block 110 may readily move with respect to the fixed block 111 because of rollers 113 mounted therebetween.

A plate 114 has the block 111 secured thereto and is secured to the end casting 4 by a plurality of threaded bolts 115.

Oil which slips between the side of the rotor 70 and a wall of the cover plate 80 passes through an opening 120 in the cover plate 80 through which the shaft 71 extends and passes through the roller bearings 74 into the recess 60. The oil then moves into passage 63 in the connecting plate 3. This oil then mixes with the leakage oil which has come from bearings 20 and 21 of pump A and passes into an area 121 defined by the inner wall of the casting 4 and the outer periphery of the ring 71*a*. The oil which leaks from the other side of the rotor 70 passes out through an opening 122 in the port plate 82 through which the shaft 71 passes and through roller bearing 75 and out into the recess 76 which communicates with the area 121 surrounding the rotor ring 71*a* by a passage 123. This oil then passes out through an opening 124, as shown in Fig. 6, a passage 125 and an outlet 126.

Inasmuch as the oil leaking from the side of the rotor 70 which is adjacent the port plate 82 is at a pressure much higher than the oil leaking from the other side of the rotor 70 means are provided for equalizing the pressure of the oil leaking from both sides of the rotor. This means comprises a slot 130 in the shaft 71 which is of a length sufficient to communicate with the openings 120 and 122 in the cover plate 80 and port plate 82, respectively. This insures the equalizing of the pressure on both sides of the rotor and makes for better operation of the pump. An end seal 140 is provided for the end of shaft 71.

The shaft 10 of the pump A may be splined to the shaft 71 of pump B as shown at 131 in Fig. 2, thus enabling the use of a single prime mover for rotating the shafts of both pumps.

We have thus provided a multiple pump having a single housing enclosing a high-pressure, low-volume pump, such as pump A, a large-volume, low-pressure pump such as the pump B each of which may be separately constructed and joined together into a single unit by a common connecting plate 3 which forms a side of each pump and which is provided with recesses for receiving the ends of the drive shafts for the respective pumps and with passages for discharging the leakage oil which passes through the shaft bearings for lubrication thereof.

The multiple pump may be externally controlled to provide a large volume of oil and a small volume of high-pressure oil when needed. Thus, the multiple pump may be used in many applications, for example, machine tools, where large and small quantities of oil are needed.

We claim:

1. A vane-type pump having a casing in which is mounted a drive shaft having a rotor secured thereto, bearings mounted in the casing adjacent the rotor on opposite sides thereof for rotatably supporting said shaft, an annular ring eccentrically disposed around said rotor, a plurality of vanes slidably mounted in slots provided in the rotor and movable outwardly therefrom into engagement with the ring, a cover plate secured to the casing between the rotor and the adjacent bearing and enclosing one side of the ring and rotor and having an opening through which the drive shaft passes, the diameter of said opening being larger than the diameter of the shaft to permit oil leaking from between the side of the rotor and the cover plate to pass out through the shaft bearing adjacent thereto, a port plate secured to the casing between the rotor and the other bearing and enclosing the other side of the ring and rotor and having an opening therein through which the drive shaft passes, said opening being of a diameter slightly larger than that of the shaft to permit oil leaking from between the other side of the rotor and the port plate to pass out through the shaft bearing adjacent thereto, and separate passages connecting the outer end of the bearings on opposite sides of said rotor with a common drain outlet, said drive shaft having an elongated slot in the periphery thereof extending lengthwise of the shaft and communicating with the openings in the cover and port plates for equalizing the pressure of the oil leaking between the rotor and the plates.

2. A multiple pump comprising: first and second vane-type pumps; each of said pumps comprising a casing, a drive shaft having one end rotatably supported in said casing, a rotor secured to the shaft and housed in the casing and having a plurality of transversely extending angular vane slots in the periphery thereof, a plurality of vanes slidably mounted in the slots provided in the rotor and movable inwardly and outwardly with respect to the rotor, an annular ring housed in the casing and

eccentrically disposed around said rotor and vanes, cover and port plates enclosing respectively opposite sides of the ring and rotor, means mounted in said casing for regulating the eccentricity of said ring to control said pump, each of said casings being open at one side; a connecting plate common to and forming a part of both pumps for joining the open side of said pumps together into a single multiple pump unit, said pumps having their drive shafts coaxially disposed and splined together to form a common drive shaft, said connecting plate having a pair of communicating, coaxial recesses for receiving respectively the splined ends of said drive shafts, roller bearings mounted in said recesses for rotatably supporting said shafts, leakage fluid from said pumps passing respectively to the associated bearings in said connecting plate, and a passage communicating with said recesses for conducting leakage fluid from the outer end of the bearings to a drain outlet.

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