Nov. 5, 1957 G. D. ROBINSON, JR 2,811,926

VARIABLE-CAPACITY ROTARY-VANE PUMP

Filed Aug. 8, 1956 2 Sheets-Sheet 1

FIG. 1

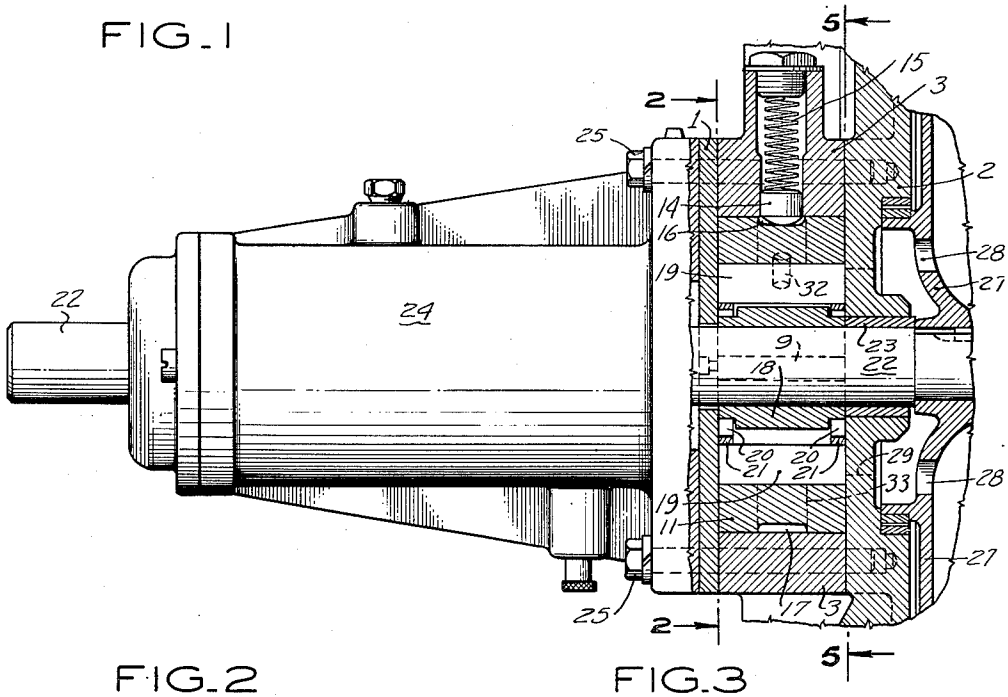

FIG. 2

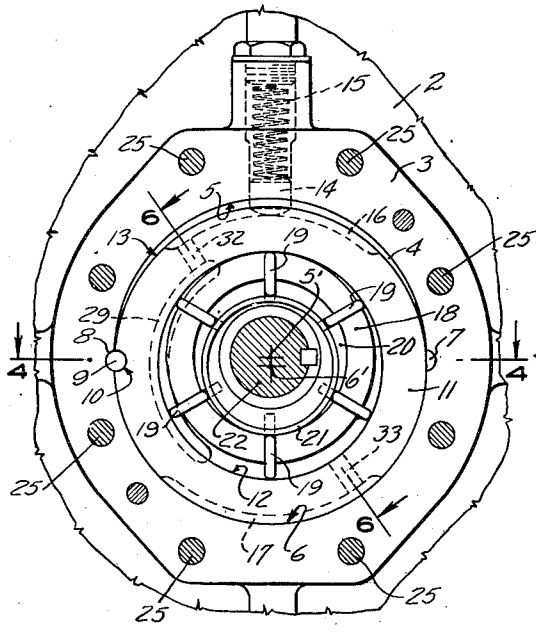

FIG. 3

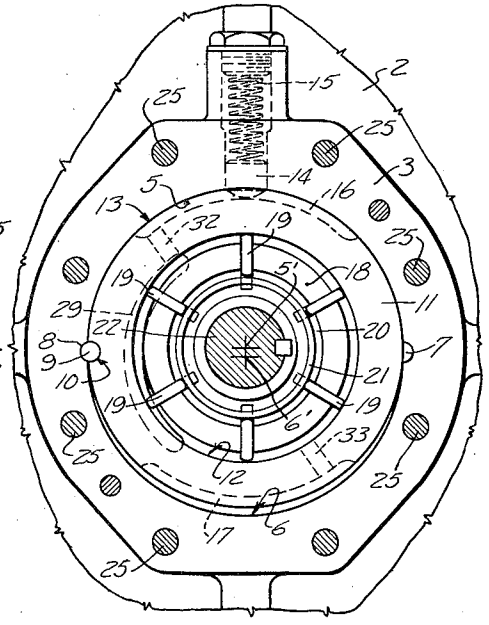

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FIG. 4

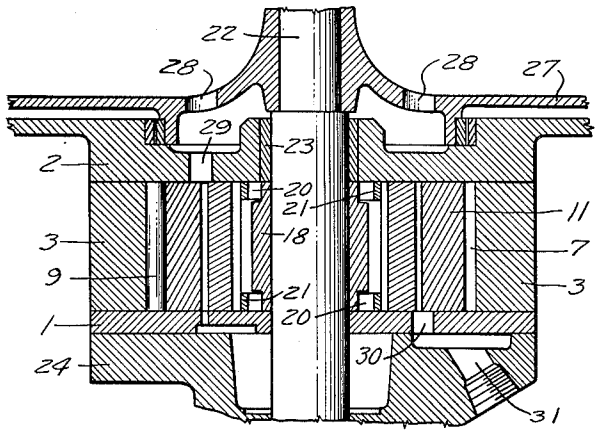


FIG. 5

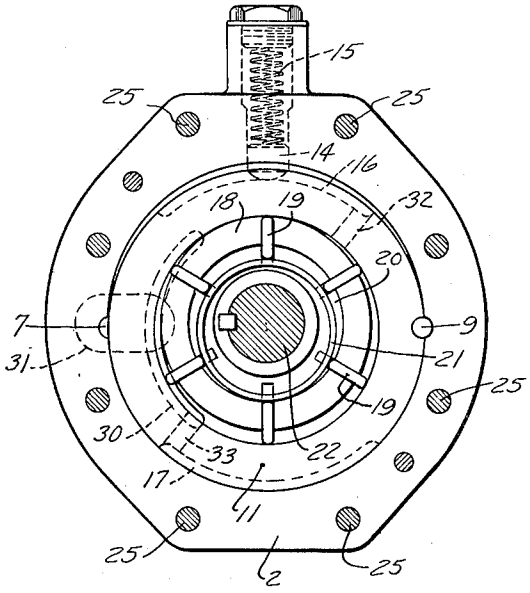
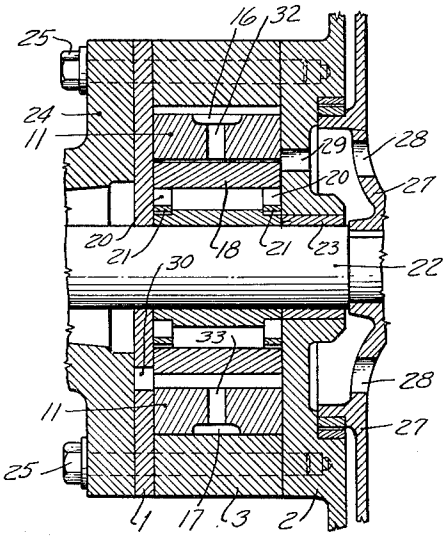


FIG. 6



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VARIABLE-CAPACITY ROTARY-VANE PUMP

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Application August 8, 1956, Serial No. 602,788

1 Claim. (Cl. 103—120)

This invention relates to improvements in variable-capacity pumps of the rotary-vane type.

The invention has for its object the provision of improved means for shifting the cylinder of the pump from active pumping position to inactive pumping position by the application of hydraulic pressure to the external surface of the pump cylinder without necessitating the formation of a special cylinder in the pump housing and a piston for the purpose.

This invention will be disclosed with reference to one illustrative embodiment of it in the accompanying drawings, in which

Fig. 1 is an elevational view, partly in longitudinal section, of a rotary-vane-type pump embodying the invention;

Fig. 2 is a cross sectional view taken on the line 2—2 of Fig. 1, showing the pump positioned for pumping at the maximum rate;

Fig. 3 is a view, taken similarly to Fig. 2 but showing the pump in non-pumping position;

Fig. 4 is a sectional plan view taken on the line 4—4 of Fig. 2;

Fig. 5 is a cross sectional view taken on the line 5—5 of Fig. 1; and

Fig. 6 is a fragmentary sectional view taken on the line 6—6 of Fig. 2.

Referring to these drawings; the rotary pump has been shown in one of its adaptations, namely, for the purpose of priming a centrifugal pump. The latter has been shown in part only as the invention is not limited to this one specific use. However, the complete centrifugal pump and the connections between it and the rotary pump are fully disclosed in the Alfred L. Grise Patent No. 2,612,844, granted October 7, 1952, to the assignee of the present invention. Reference to this patent may be had for a complete disclosure of the centrifugal pump if necessary or desired.

The rotary pump of this invention includes an outer housing which is composed of two side wall members **1** and **2** and an intervening annular member **3**, which affords a peripheral wall surrounding a chamber **4**, the end walls of which consist of the inner flat faces of the side wall members **1** and **2**. The peripheral wall of chamber **4** is composed of two opposed semi-cylindrical surfaces **5** and **6**, the axes of which are respectively indicated at **5'** and **6'**, and intervening connecting grooves **7** and **8**, herein shown as semi-cylindrical in form. The groove **8** receives a fulcrum pin **9** which is engaged in a similar groove **10** in the stator **11** of the pump.

This stator is of hollow cylindrical form with coaxially-disposed inner and outer cylindrical surfaces **12** and **13**. Its ends abut the inner flat faces of the side walls **1** and **2**. A plunger **14**, slidably mounted in a drilled hole in wall **3**, is urged radially inwardly by a spring **15**, bearing on the top of stator **11** and tending to move it downwardly into a first position wherein substantially all of the lower half of its cylindrical periphery **13** abuts and tightly fits the lower semi-cylindrical surface **6**. The stator is movable upwardly to a second position in which substantially all of the upper half of its cylindrical periphery abuts and closely fits the semi-cylindrical surface **5**. Recesses **16** and **17** are formed in the upper and lower periphery of stator **11** and these become closed when the stator is moved into its second and first-named positions, respectively, as will be clear from comparing Figs. 2 and 3. It will be clear that there is no communication between these recesses **16** and **17**.

The pump rotor **18** is of the well known vane type. It is cylindrical in form and provided with a circular series of angularly-spaced radially disposed vanes **19** which are slidably mounted in slots formed in the rotor. The ends of the rotor have annular recesses **20** therein, which receive one in each, rings **21**, supporting the ends of all the vanes and holding their outer edges engaged with the inner cylindrical wall of the stator. When the stator is in its first or lowermost position the axes of the rotor and stator are not coaxial and the rotor is positioned for pumping at the maximum rate. When the rotor is in its second or uppermost position the rotor and stator are coaxial and no pumping occurs. The rotor **18** is suitably fixed, as indicated, to a driving shaft **22** which is suitably supported in the same way as disclosed in the above-named Grise patent, in a sleeve bearing **23** fixed in side wall member **2** and by other bearings contained in the hollow member **24**.

This member **24**, the side wall member **1**, the peripheral wall member **3** and side wall member **2** are suitably clamped together as for example, by a series of cap screws **25** which pass through holes in the several members and thread into the member **2** which forms a side wall of the centrifugal pump housing. The impeller of the centrifugal pump is shown in part at **27** and has a series of holes **28** therein, through which fluid may be drawn from radial locations near the inlet eye of the housing into the inlet port of the rotary priming pump.

The inlet and outlet ports of the rotary pump are marked **29** and **30** and they are respectively formed in the side wall members **2** and **1** (Fig. 6). These ports **29** and **30** are in the form of arcuate slots which are separately shown in Figs. 2 and 5, respectively. The slot **29** communicates with all the holes **28** in the impeller and the slot **30** is connected by means in part at **31** in Fig. 4 and fully disclosed in the Grise patent, to the outlet of the centrifugal pump. Of course, if the rotary pump is not to be connected to a centrifugal pump, these slots will be suitably covered except for the necessary inlet and outlet passages. The inlet port **29** is in continuous communication with the recess **16** in member **11** by means of a radial hole **32** (Figs. 2 and 6) formed in said member. The outlet port **30** is in continuous communication with the recess **17** by means of a second radial hole **33** (Fig. 6) formed in member **11**.

In operation, assuming the parts to be positioned as in Fig. 2 and the rotor to be revolving counterclockwise, fluid, initially air, will be drawn from the eye of the impeller through the passages **28** and the inlet port **29** into the cylinder **11** and the spaces between successive blades **19** and carried to the outlet port **30** and expelled therefrom through passage **31**, all in the usual and well known manner. No substantial pressure will be built up until the air has been eliminated. Liquid is then drawn in by the pump and pressure builds up. When sufficient pressure builds up, then the pump cylinder **11** is to be moved by such pressure into its inactive position shown in Fig. 3. To some extent, this cylinder may be moved by the differential pressure within the cylinder because there is a greater area exposed to such pressure in the space that lies above a horizontal plane passing through the axis of the fulcrum **9** than there is below such plane. However, this invention also provides for pressure outside the cylin-

der in order to get a greater force to more quickly move the cylinder **11** from one extreme position to the other. While this has been done before by a piston and cylinder arrangement, such for example, as shown in the above-named Grise patent, the result is accomplished here in a different and better manner. Note that in Fig. 2, there is a chamber formed between the three walls of recess **17** and the wall **6** of member **3**. This chamber is sealed off from the other recess **16** and is closed completely except for its connection **33** with the outlet port. The upper half of cylinder **11** is subjected to inlet pressure through the hole **32**. The differential of these pressures is available, acting over a large area of the cylinder to raise the latter against spring **15** and move it into its upper and inactive position shown in Fig. 3. Thus, in effect, the cylinder functions also as a piston and the recess **17** as a cylinder for the purpose of moving the cylinder **11** to inactive position. As the cylinder **11** is moved upwardly, it presents an increasing area to the outlet pressure while the area subjected to inlet pressure diminishes, thus accelerating the movement of the cylinder into its inactive position. When the outlet pressure drops sufficiently, the cylinder **11** will be moved back into the Fig. 2 position by spring **15**. Thus, a very effective way of moving the cylinder **11** is provided and one which is exceedingly simple and can be manufactured at relatively low cost due to the simplicity of the machining operations. The member **3** is bored from one axis, as **5'**, and then moved slightly and bored again about the axis **6'**. The recesses **16** and **17** may be cast in the periphery of the cylinder and the passages **32** and **33** are simple drilled holes.

The invention thus provides an improved arrangement for shifting the cylinder of the pump from active pumping position to inactive pumping position by the application of hydraulic pressure to the external surface of the cylinder without necessitating the provision of a separate cylinder and piston in the pump housing for the purpose.

What is claimed is:

In a rotary-vane variable-capacity type pump, having an outer housing consisting of a pair of side wall members

and an interposed member affording a peripheral wall surrounding a chamber, the ends of which are formed by the inner faces of said side wall members, the peripheral wall of said chamber composed of two opposed semi-cylindrical sections the axes of which are spaced apart and two outwardly extending grooves, each interconnecting the adjacent ends of two semi-cylindrical sections, a stator comprising a hollow cylindrical member having coaxial inner and outer surfaces, a fulcrum for said stator mounted in one of said grooves, a spring-pressed plunger mounted in the peripheral wall of the housing tending to hold the stator in a first position, wherein one half of its outer cylindrical surface abuts one semi-cylindrical wall of said chamber, a rotor mounted within the stator and having radially movable vanes the outer edges of which engage the inner cylindrical wall of the stator, said rotor being disposed eccentrically of the stator when the latter is in said first position, and concentrically of the stator when the latter is in a second position wherein the other half of its outer cylindrical wall abuts the other semi-cylindrical wall of said chamber, said stator having diametrically-opposed recesses extending part way only around its periphery, said recesses being closed by said semi-cylindrical walls one when the stator is in said first position and the other when the stator is in said second position, said ends of said chamber having therein inlet and outlet ports communicating with the spaces between the stator and the rotor and its vanes, said hollow cylindrical member having therein passages one connecting one of said recesses to the inlet port and the other connecting the other of said recesses to the outlet port.

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