Oct. 2, 1951 J. W. F. HOLL 2,569,717

REVERSIBLE VARIABLE VOLUME PUMP

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Fig. 1.

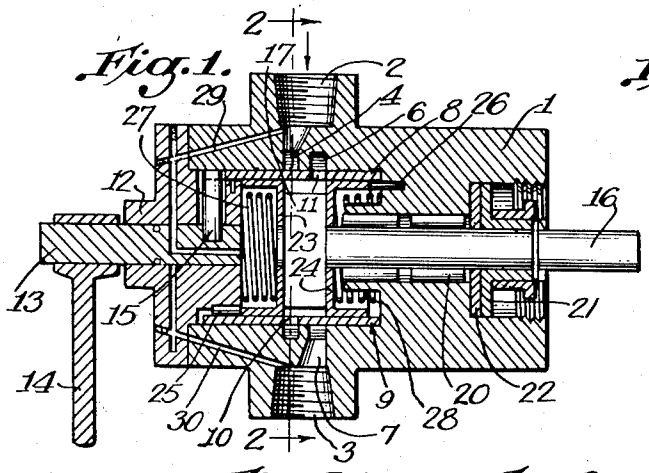


Fig. 2.

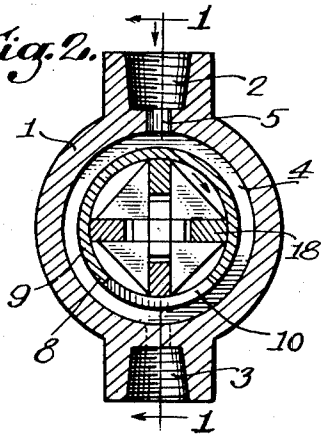


Fig. 3.



Fig. 4.



Fig. 5.

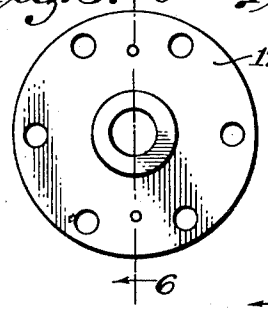


Fig. 6.

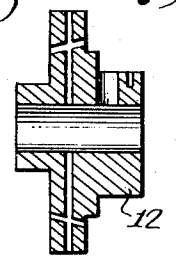


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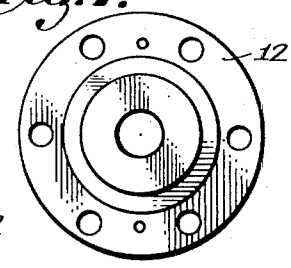


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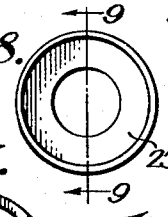


Fig. 9.

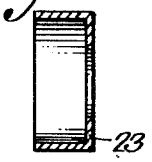


Fig. 10.

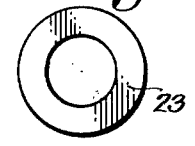


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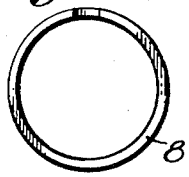


Fig. 15.

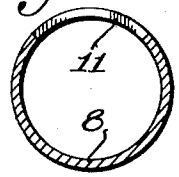


Fig. 11.



Fig. 12.

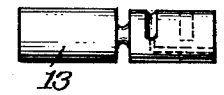


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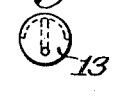


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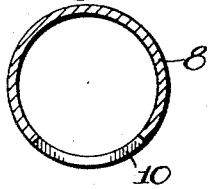
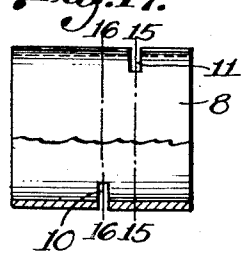


Fig. 17.



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Fig. 18.

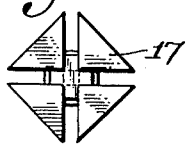


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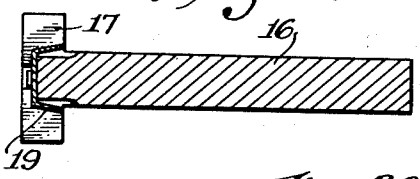


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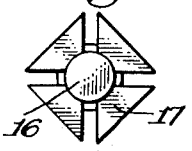


Fig. 21.

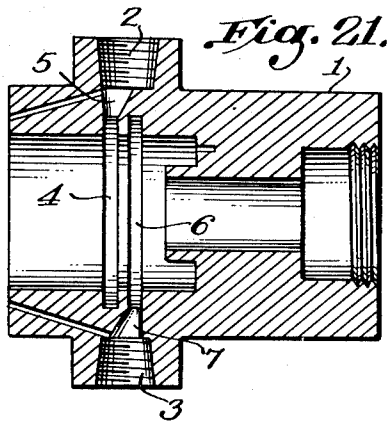


Fig. 30.

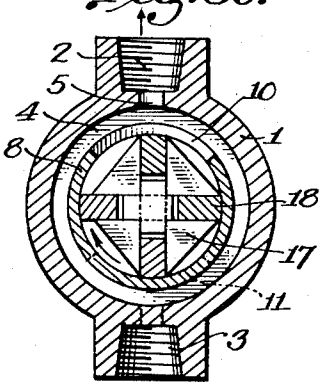


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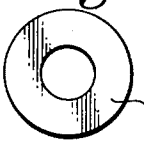


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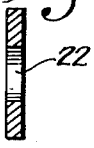


Fig. 24

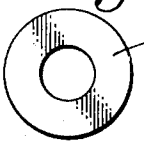


Fig. 32.

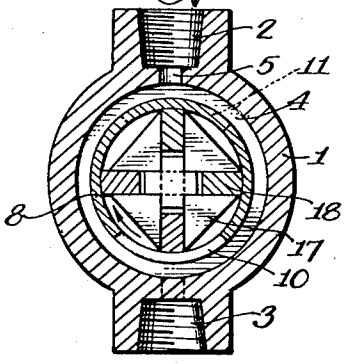


Fig. 31.

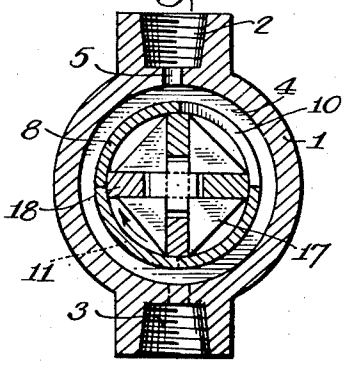


Fig. 25.

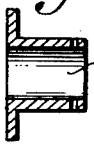


Fig. 26.

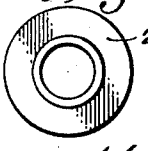


Fig. 27.

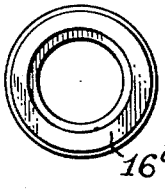
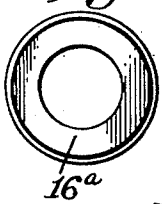


Fig. 28.



Fig. 29.



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Patented Oct. 2, 1951

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UNITED STATES PATENT OFFICE

2,569,717

REVERSIBLE VARIABLE VOLUME PUMP

James W. F. Holl, Los Angeles, Calif.

Application January 15, 1946, Serial No. 641,274

3 Claims. (Cl. 103—3)

1

This invention relates to a variable volume pump wherein an external manual control is provided to vary the volume of the pump and without varying the speed of the impeller or rotor head.

An object of my invention is to provide a variable volume pump in which there are end plates bearing against the sides of the rotor head, these end plates being non-rotatably held and also yieldably pressed against the rotor head; thus the rotor will wear in at one position of the end plates and no high spots will be formed on the end plates upon which the rotor can ride, that is the rotor will wear a seating surface on the end plates.

A feature of my invention is to provide a variable volume pump of the character stated in which the rotor is angular in shape, thus providing an effective bypass for the fluid and also a larger pumping chamber.

Another feature of my invention is to provide a variable volume pump of the character stated, in which the volume of the pump can be effectively varied from zero to maximum output and without surge in the fluid or vibration of the pump.

Other objects, advantages and features of invention may appear from the accompanying drawing, the subjoined detailed description, and the appended claims.

In the drawing:

Figure 1 is a longitudinal sectional view of my variable volume pump, as taken on line 1—1 of Figure 2.

Figure 2 is a sectional view taken on line 2—2 of Figure 1.

Figures 3 and 4 are end and side views respectively of a rotor blade.

Figure 5 is an end view of the end plate for the housing.

Figure 6 is a sectional view taken on line 6—6 of Figure 5.

Figure 7 is a view taken from the opposite side of the end plate to that shown in Figure 5.

Figure 8 is an end view of one of the sealing cups.

Figure 9 is a sectional view taken on line 9—9 of Figure 8.

Figure 10 is a view from the opposite side of the cup to that shown in Figure 8.

Figure 11 is an end view of the control shaft.

Figure 12 is a side elevation of the control shaft.

Figure 13 is a view of the opposite end of the shaft from that shown in Figure 11.

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Figure 14 is an end view of the adjustable sleeve.

Figure 15 is a sectional view taken on line 15—15 of Figure 17.

Figure 16 is a sectional view taken on line 16—16 of Figure 17.

Figure 17 is a quarter sectional view of the control sleeve.

Figure 18 is an end view of the rotor head.

Figure 19 is a longitudinal sectional view of the rotor head and drive shaft.

Figure 20 is an end view of the same as viewed from the shaft end.

Figure 21 is a longitudinal sectional view of the housing.

Figures 22 and 23 are an elevation and a sectional view respectively of the packing disk.

Figure 24 is an end view of the packing nut.

Figure 25 is a sectional view of the same.

Figure 26 is an end view of the packing nut opposite to that shown in Figure 24.

Figure 27 is an end view of the shaft sealing nut.

Figure 28 is a transverse sectional view of the same.

Figure 29 is an end view of the same, this view being opposite to that shown in Figure 27.

Figures 30, 31 and 32 are similar to Figure 2, and are taken on the same section line. However, the controlling sleeve is shown in different positions to show the various possible flows through the pump.

Referring more particularly to the drawing, the numeral 1 indicates a housing, which includes ports 2 and 3, and either of these ports may be the intake or the outlet since the pump is reversible, as will be further described. However, for purposes of this description, it can be assumed that 2 is the intake and 3 is the outlet. An annular channel or passage 4 is formed in the body 1 and is open to the port 2 through the duct 5. A second annular groove 6 is formed in the body 1, is parallel to the groove 4 and is open to the port 3 through the duct 7. A control sleeve 8 is rotatably mounted in the bore 9 of the body 1, and the manner in which this sleeve is rotated from the outside of the pump will be further described.

The sleeve 8 is provided with two arcuate openings 10 and 11, which are aligned with the annular grooves 4 and 6 respectively. The flow of fluid from the rotor head through the ports 10 and 11 and through the annular grooves 4 and 6 and thence to the outlet of the pump will be further described.

An end plate 12 is bolted or otherwise suitably attached to the control end of the body 1. A control shaft 13 extends into the end plate 12 and is journaled therein. A control handle 14 attached to the shaft 13 permits the operator to control the flow of fluid from the pump. A drive pin 15 fits into the control shaft 13 and into a suitable opening in one end of the control sleeve 8. Thus when the shaft 13 is rotated, the sleeve 8 will be correspondingly rotated to control the flow of fluid through the pump.

A rotor shaft 16 extends into the body 1 and is continuously rotated by a suitable external source of power. A rotor head 17 is formed on the inner end of the shaft 16, and it is to be noted that the sides of the rotor head 17 are squared off or flat, thus providing more fluid space within the pump and permitting the movement of fluid around the head more effectively and without restriction. The head 17 is slotted to receive slidable blades 18, these blades bearing against the inner surface of the sleeve 8. The blades are spring pressed outwardly by means of U-shaped springs 19, which are fitted in the head 17 of the rotor. The shaft 16 may be journaled on roller bearings 20, and also a packing gland 21 seals the shaft 16 and prevents leakage around this shaft. The packing gland 21 bears against a thrust washer 22, all of which is usual in pumps of this type.

To provide effective side walls for the cylinder in which the rotor head 17 moves, I provide a pair of cups 23 and 24. These cups or blades, if desired, are held against rotation by means of pins 25 and 26 respectively. Also springs 27 and 28 urge the cups against the sides of the rotor. The fact that the end plates or cups are non-rotatably held is of importance. The rotor head will wear in, in a particular position. Since the volume of the pump is varied by rotation of the sleeve 8, the end cups need never be disturbed. Consequently there will be no end leakage from the pressure side of the head to the intake side thereof.

To equalize fluid pressures on the ends and sides of the rotor head, ducts 29 and 30 are provided, which extend from the ports 2 and 3 respectively and thence to the control shaft 13 and endwise through this shaft to the inner end of the rotor head. These ducts are selectively opened, depending on the position of the control shaft 13. The opening into the control shaft 13 extends from one side only and thus, in the position shown in Figure 1, pressure is conducted from the port 2, it being assumed that the port 2 is at this time the pressure port. If the port 3 is the pressure port, the shaft 13 is revolved 180 degrees and in this position pressure is conducted from the port 3 through the duct 30 and thence to the inner end of the rotor head, as described.

In Figure 2 the control sleeve 8 is shown for full volume of the pump, the flow being in the direction shown by the arrows. In Figure 31 a partial flow is shown in the direction shown by the arrows, and in Figure 32 a reverse flow is shown. The rotor 17 is eccentrically mounted in the sleeve 8. Therefore, there will be a pressure side of the rotor and a vacuum side of the rotor. The rotor rotates in the same direction at all times. Assuming first that the port 2 is the intake side of the pump, the opening or port 10 of the sleeve 8 is moved to the vacuum side of the rotor, and at the same time, the port 11 of

the sleeve 8 will be positioned on the pressure side of the rotor. The flow will then be from the port 2, thence through the annular groove 4, then through the port 10, thence around the rotor, then out through the port 11, the annular groove 6, and finally out through the outlet port 3. The fluid leaving the port 3 will thus be under pressure. If the fluid flow through the pump is reversed and the rotor will still revolve in the same direction as above, then by moving the handle 14, the port 11 of the sleeve is rotated 180 degrees from the first described position and is placed on the vacuum side of the rotor and at the same time the port 10 will be on the pressure side of the rotor, and thus the flow will be reversed through the pump. For minimum flow of the pump, the ports 10 or 11 are placed so that they partly overlap the pressure and the vacuum side of the rotor, thus causing the fluid to bypass and preventing full pumping action. In further explanation of the operation of this pump, the rotor is driven by a motor and, therefore, revolves continuously in one direction. The reversal of flow through the pump is accomplished by shifting the sleeve 8, as described, and changing the ports 10 and 11 from the pressure to the vacuum side of the rotor, depending on the direction of flow desired.

Having described my invention, I claim:

1. A variable volume pump comprising a housing, said housing having a bore therein and a pair of ports extending into said housing, said housing having a pair of arcuate grooves in the bore and extending transversely of the housing, one of said first named ports opening into one of the grooves and the other first named port extending into the other groove, a sleeve rotatably mounted in said bore, said sleeve having a pair of ports, one of the ports being in alignment with one of the grooves and the other port being in alignment with the other groove, a control shaft extending into the housing, and a pin fitted into the shaft and into the sleeve whereby said sleeve may be manually rotated, and a rotor mounted within the sleeve, blades projecting from the rotor, the periphery of said rotor being formed with flat faces.

2. A variable volume pump comprising a housing, said housing having a bore therein and a pair of ports, said housing having a pair of arcuate grooves in the bore and extending transversely of the housing, one of said first named ports extending into one of the grooves, the other first named port extending into the other groove, a sleeve journaled in the bore, said sleeve having a pair of ports, one of the last-named ports being aligned with one of the grooves and the other port aligned with the other groove, manual means to rotate said sleeve, a rotor mounted within the sleeve, said rotor being formed with flat faces on the periphery, blades projecting from the rotor, end plates bearing against the sides of the rotor and means non-rotatably holding said end plates.

3. A variable volume pump comprising a housing, said housing having a bore therein and a pair of ports, said housing having a pair of arcuate grooves in the bore and extending transversely of the housing, one of said first named ports extending into one of the grooves, the other port extending into the other groove, a sleeve journaled in the bore, said sleeve having a pair of ports, one of the last-named ports being aligned with one of the grooves and the other

last named port aligned with the other groove, manual means to rotate said sleeve, a rotor mounted within the sleeve, said rotor being formed with flat faces on the periphery, blades projecting from the rotor, end plates bearing against the sides of the rotor and means non-rotatably holding said end plates, and spring means bearing against the end plates and urging the same against the rotor.

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