Aug. 31, 1948. J. H. McCALEB 2,448,108

VARIABLE CAPACITY ROTARY PUMP

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Fig. 1.

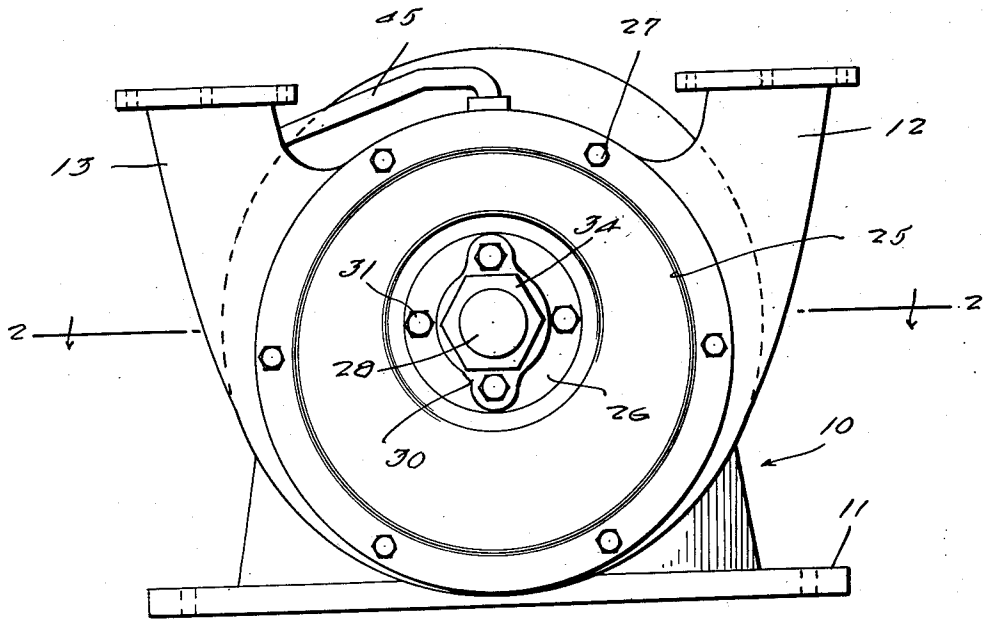


Fig. 5.

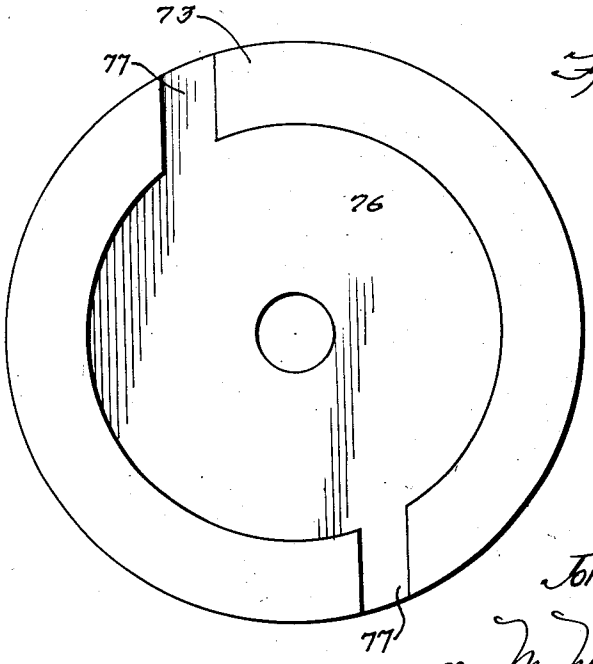
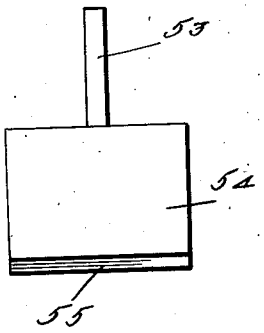


Fig. 9.



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Fig. 2.

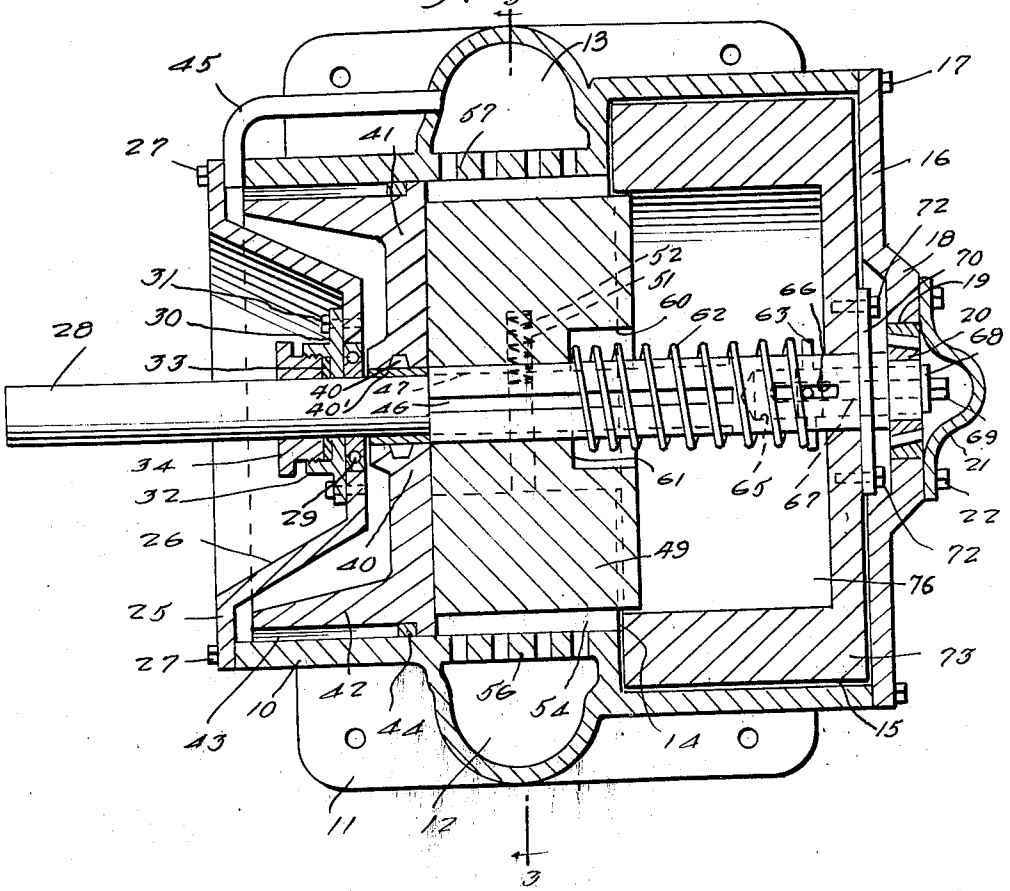


Fig. 7.

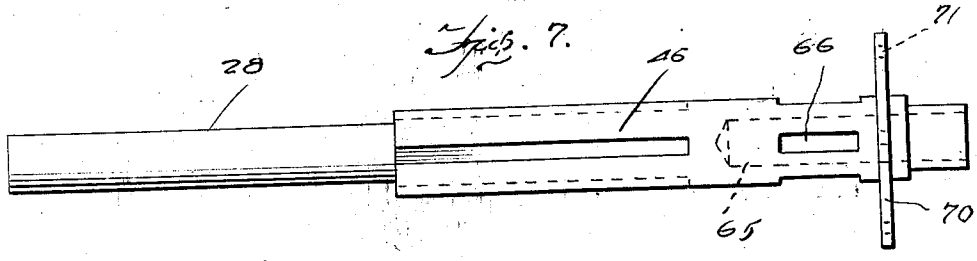
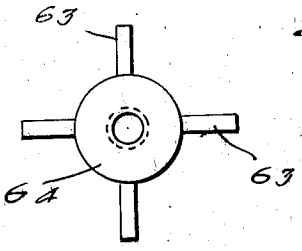


Fig. 8.



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Fig. 3.

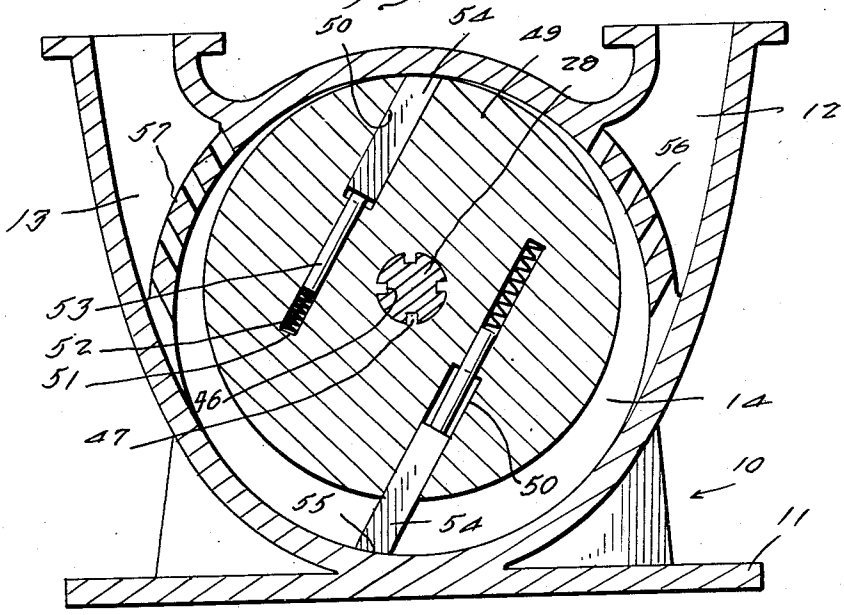


Fig. 4.

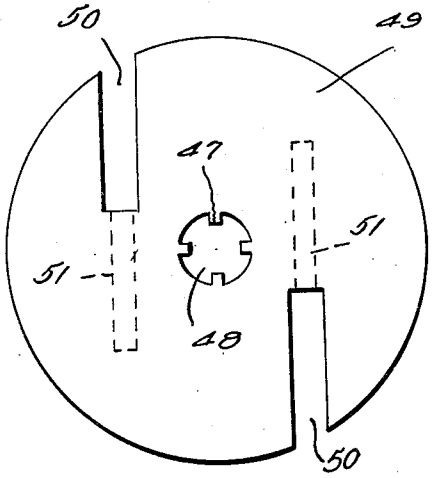
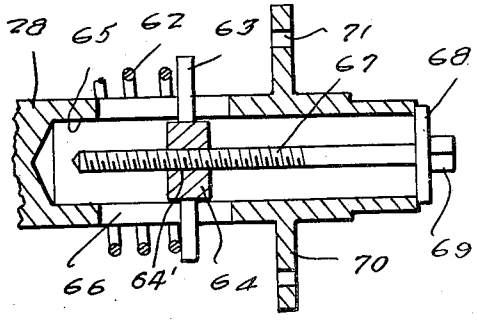


Fig. 6.



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Patented Aug. 31, 1948 2,448,108

UNITED STATES PATENT OFFICE

2,448,108

VARIABLE CAPACITY ROTARY PUMP

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Application June 4, 1946, Serial No. 674,240

6 Claims. (Cl. 103—120)

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This invention relates to a pump, and more particularly to a fluid pump for the transmission of hydraulic fluids.

A primary object of this invention is the provision of an improved hydraulic pump characterized by means for varying the fluid intake of the pump in accordance with the pressure on the outlet side thereof.

An additional object of the invention is the provision of means whereby such fluid intake is automatically varied without manual intervention.

Still another object of the invention is the provision of such a device characterized by means whereby the effective force of the pump drive is exerted against a progressively decreasing quantity of fluid as the pressure against which the fluid is pumped is increased, the quantity and the pressure being inversely proportional.

Still another object of the invention is the provision of such a device which may be readily adjusted to accommodate a variety of fluid pressures.

Still another object is the provision of such a pump which will be sturdy and durable in construction, reliable and efficient in operation, and relatively simple and inexpensive to manufacture, assemble and utilize.

Other objects reside in the combinations of elements, arrangements of parts, and features of construction, all as will be more fully pointed out hereinafter, and shown in the accompanying drawings, wherein there is disclosed a preferred embodiment of this inventive concept.

In the drawings:

Figure 1 is an end elevational view of one form of pump embodying features of the instant inventive concept.

Figure 2 is a sectional view taken substantially along the line 2—2 of Figure 1, as viewed in the direction indicated by the arrows.

Figure 3 is a sectional view taken substantially along the line 3—3 of Figure 2, as viewed in the direction indicated by the arrows.

Figure 4 is an end elevational view of one of the interior rotors of the pump, certain concealed portions thereof being indicated in dotted lines.

Figure 5 is an end elevational view of the other of the rotors of the pump.

Figure 6 is an enlarged longitudinal sectional view through one end of the drive shaft of the device showing the method of adjusting the tension of a spring influencing the rotor.

Figure 7 is a plan view of a portion of the drive shaft, concealed portions thereof being indicated in dotted lines.

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Figure 8 is an enlarged end elevational view of a constructional detail.

Figure 9 is a plan view of a still further constructional element.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Having reference now to the drawings, the device of the instant invention comprises a main casing 10 provided with a base flange 11 adapted to seat the device on any suitable supporting surface, and is provided with an inlet pipe 12 and an outlet pipe 13, on opposite sides thereof, the inlet and outlet, respectively, communicating with a crescent-shaped central chamber 14. The chamber 14 is, as best shown in Figure 2, in communication with a second cylindrical chamber 15, aligned therewith.

One end of the pump body is closed by a plate 16, secured to the periphery thereof, as by bolts 17, and provided with a boss 18 having a centrally positioned aperture 19 therein, within which is seated a roller bearing 20. An end cap 21 secured by annular screws 22 closes the aperture 19 in a fluid-tight manner on the outer side thereof.

The opposite end of the body 10 is closed by a plate 25 having a conical-shaped central depression 26 therein, and secured by annularly positioned screws or bolts 27 to the end of the casing 10. The center of the depression 26 is provided with an opening, through which extends a drive shaft 28, the shaft being journaled in suitable ball bearings 29. A sealing flange 30 is secured, as by bolts 31, to the bottom of the depression 26, and is provided with a threaded annulus 32, within which is positioned suitable packing 33, held in position by a packing nut 34.

The opposite end of the shaft 28 is journaled in the roller bearings 20, in the opposite end plate 16.

The shaft 28 extends through a suitable packing gland 40 on a spacing sleeve 40' in a bore positioned in the center of a web of a floating or a false end plate 41, positioned in the chamber 14, and longitudinally slidable therein, the plate 41 being provided with a circumferential flange 42, having longitudinal grooves 43 therein engageable on guiding projections 44 extending from the inner surface of the casing 10 to preclude rotation of the plate 41. A pipe 45 communicates with the space between the end plate

28 and the false end plate 41, and extends into the outlet 13.

Interiorly of the false plate 41 the shaft 28 is enlarged, and provided with channels or grooves 46, engaged by splines 47 carried interiorly of a bore 48 in a pump disc or rotor 49.

The rotor 49 is provided with opposite parallel chordal slot 50, having centrally positioned bores 51 extending from the ends thereof, within which are positioned compression springs 52, abutting the extremities of plungers 53 secured to fins or plates 54 slidable withn the slot 50, and provided with arcuate beveled ends 55 adapted to sweep the walls of the eccentric portion of the chamber 14.

Thus, it will be seen that fluid entering from inlet 12 into chamber 14, through a perforated plate 56, is picked up by the fins 54, which are extended to abut the interior surface of the casing 10. The fluid is then forced through a similar perforated plate 57 and through outlet 13, the fins 54 being retracted due to the eccentricity of the interior of the chamber 14.

The side of the member 49 away from the false end plate 41 is provided with a recess 60 forming a seat 61 against which seats one end of a relatively heavy compression spring 62 surrounding the shaft 28. The opposite end of the spring 62 is engaged by pins 63 forming a portion of a cylindrical member 64, seated within a bore 65 in the end of shaft 28, and extending outwardly through radially positioned slots 66 in the shaft. This spring 62 normally holds the rotor 49 in the position shown in Figure 2, and as the pressure of the discharge increases, the fluid passes into the area behind the floating element 41 forcing this element and the rotor against the compression of the spring and into the cavity 76 in the element 73. As best shown in Figure 6, the member 64 is provided with a centrally positioned threaded aperture 64' engaging the threads of a screw 67, which extends outwardly through the open end of the shaft 28, through a plate 68, and terminates in a head 69. Thus, it will be seen that rotation of the head 69 varies the position of the member 64, and consequently the pins 63 to vary the compression of the spring 62.

Suitably secured to the shaft at a point beyond the slotted aperture 66 is an annular plate 70, provided with apertures 71, through which are passed screws 72, securing the plate, and hence the shaft, to a drum-like member 73, substantially filling the chamber 15, and provided with a centrally positioned recess 76 of a diameter slightly in excess of that of the rotor 49 and positioned to receive said rotor. Chordal slots 77 in alignment with the fins 54 permit slidable movement of the rotor 49 within the recess 76, against the compression of the spring 62, in a manner to be more fully pointed out hereinafter.

From the foregoing, the operation of the device should now be readily understandable. Fluid entering the inlet 12 passes through the apertures in the plate 56, and is swept by the fins 54 toward the outlet 13, the operation continuing so long as the pressure in the outlet 13 is relatively low. Thus, during this phase of the operation, it will be seen that a relatively large volume of fluid may be passed through the pump. However, as the pressure in the outlet 13 increases, corresponding pressure is built up in the tube 45, and thus, in the space between the end plate 25 and the false end plate 41. As this pressure increases, the end plate 41 is forced to the right, as viewed in Figure 2, biasing the drum 49 into the recess

76 of the drum 73. Such movement effects a gradual closing of certain of the apertures in the plate 56, thus reducing the quantity of fluid admitted to the device, whereupon, the force of the pump is exerted against a lesser volume of fluid, thus increasing the effective force exerted thereby. As the pressure increases, the rotor 49 is slid progressively further into the recess 76, until such time as the pressure drops, whereupon, the spring 62 biases the same outwardly.

It will thus be seen that, with a constant force exerted on the pump through the drive shaft, the pump is readily and automatically converted from a low pressure high volume pump to a relatively high pressure low volume pump substantially automatically without adjustment of the driving mechanism from the shaft 28.

From the foregoing, it will now be seen that there is herein provided an improved pump, which accomplishes all the objects of this invention, and others, including many advantages of great practical utility and commercial importance.

As many embodiments may be made of this inventive concept, and as many modifications may be made in the embodiment hereinbefore shown and described, it is to be understood that all matter herein is to be interpreted merely as illustrative and not in a limiting sense.

I claim:

1. In a rotary pump, a casing providing a chamber, an inlet and an outlet connection on said casing and in communication with said chamber, a drive shaft extending through said chamber and rotatably supported in said casing, a rotor having sliding blades in the periphery thereof mounted on said shaft for longitudinally sliding movement, a drum having a circumferential recess fixedly mounted on said shaft, the drum being so positioned that its recess receives said rotor, means resiliently urging said rotor out of the recess in the drum, and pressure means operatively connected to said rotor urging the rotor into the recess against the resilient means.

2. In a rotary pump, a casing providing a chamber, an inlet and an outlet connection on said casing and in communication with said chamber, a drive shaft extending through said chamber and rotatably supported in said casing, a rotor having sliding blades in the periphery thereof mounted on said shaft for longitudinal sliding movement, said motor being provided with slots, a drum having a circumferential recess fixedly mounted on said shaft, the drum being so positioned that its recess receives said rotor, said drum being provided with chordal slots, the chordal slots being positioned to register with the slots in the rotor to receive the sliding blades, means resiliently urging said rotor out of the recess in the drum, and pressure means operatively connected to said rotor urging the rotor into the recess against the resilient means.

3. In a rotary pump, a casing providing a chamber, an inlet and an outlet connection on said casing and in communication with said chamber, a drive shaft extending through said chamber and rotatably supported in said casing, a rotor having sliding blades in the periphery thereof mounted on said shaft for longitudinal sliding movement, a drum of a diameter greater than that of said rotor and having a circumferential recess fixedly mounted on said shaft, the drum being so positioned that its recess receives said rotor, means resiliently urging said rotor out of the recess in the drum, pressure means op-

eratively connected to said rotor urging the rotor into the recess against the resilient means, and a floating element slidably positioned on said drive shaft and contacting the end surface of the rotor adapted to be influenced by the pressure means to move the rotor longitudinally on the shaft and into the circumferential recess of the drum.

4. In a rotary pump, a casing providing a chamber, an inlet and an outlet connection on said casing and in communication with said chamber, a drive shaft extending through said chamber and rotatably supported in said casing, a rotor having sliding blades in the periphery thereof mounted on said shaft for longitudinal sliding movement, a drum having a circumferential recess fixedly mounted on said shaft, the drum being so positioned that its recess receives said rotor, resilient means in the recess urging the rotor therefrom, a floating element slidably mounted on said shaft and contacting the end surface of the rotor, means preventing rotation of the floating element in the chamber, an end plate having a conically-recessed, centrally-disposed section, and a pressure connection providing communication means between the discharge side of the rotor and an area between the end plate and floating element.

5. In a rotary pump, a casing providing a chamber, an inlet and an outlet connection in said casing and in communication with said chamber, a drive shaft extending through said chamber and rotatably supported in said casing, a rotor having sliding blades in the periphery thereof mounted on said shaft for longitudinal sliding movement, a drum having a circumferential recess fixedly mounted on said shaft, the drum being so positioned that its recess receives said rotor, a floating element slidably mounted on said shaft and contacting the end surface of the rotor, a pressure connection providing communicating means between the discharge side of the rotor and an area between said floating element and the end of the casing whereby pressure from the discharge urges the rotor into the circumferential recess of the drum, and a spring in said recess urging said rotor out of the recess.

6. In a rotary pump, a casing providing a chamber, an inlet and an outlet connection on said casing and in communication with said chamber, a drive shaft extending through said chamber and rotatably supported in said casing, the rotor having sliding blades in the periphery thereof mounted on said shaft for longitudinal sliding movement, a drum having a circumferential recess fixedly mounted on said shaft, the drum being so positioned that its recess receives said rotor, means urging the rotor out of the recess in the drum, a floating element slidably mounted on said shaft and contacting the end surface of the rotor, and a connection providing communicating means between the discharge side of the rotor and an area between the floating element and end of the casing whereby pressure from the discharge urges the floating element and rotor into the recess of the drum.

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