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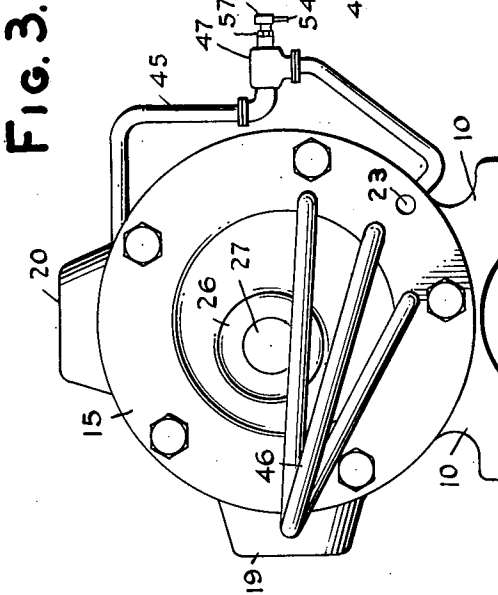
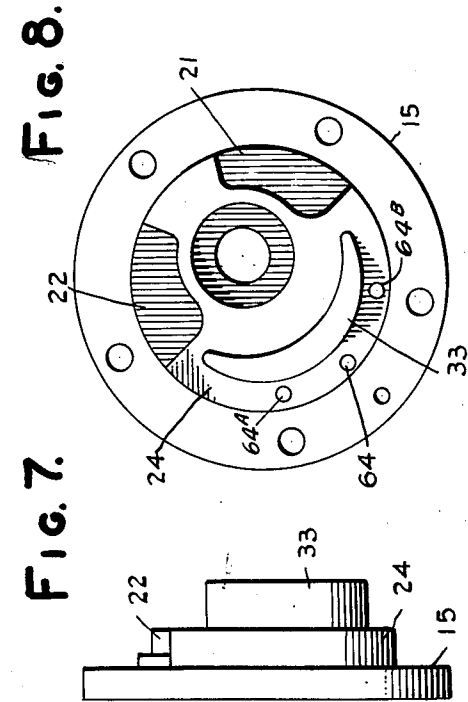
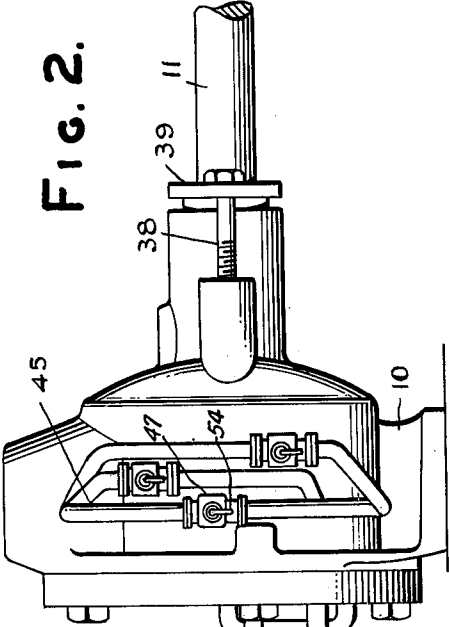
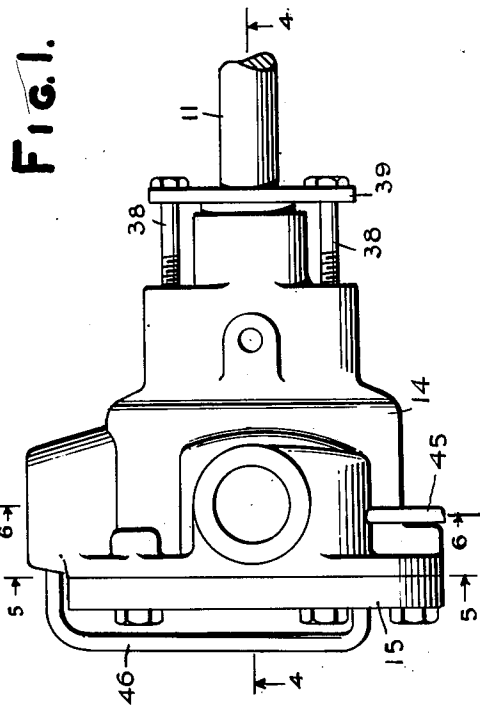
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2,630,759

VARIABLE VOLUME ROTARY PUMP

Filed Oct. 22, 1949

2 SHEETS—SHEET 1



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2 SHEETS—SHEET 2

FIG. 5.

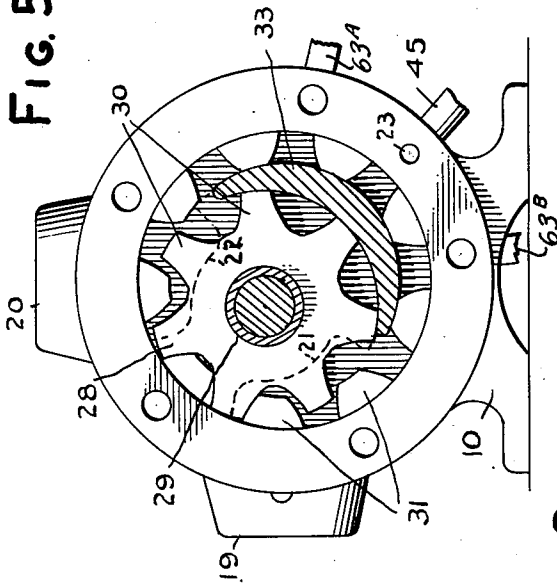


FIG. 4.

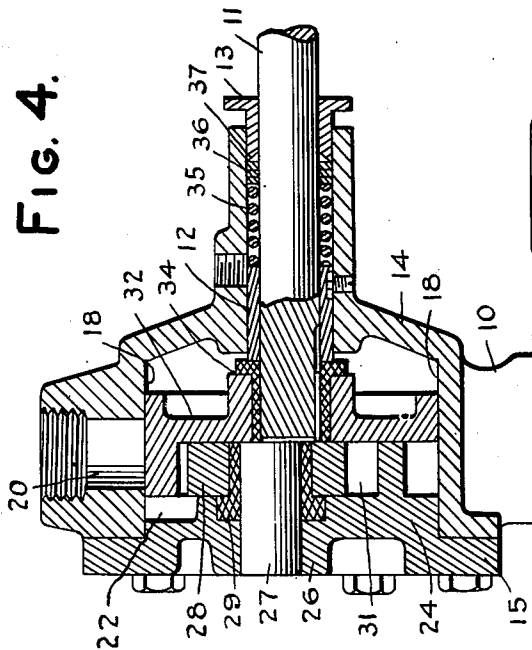


FIG. 9.

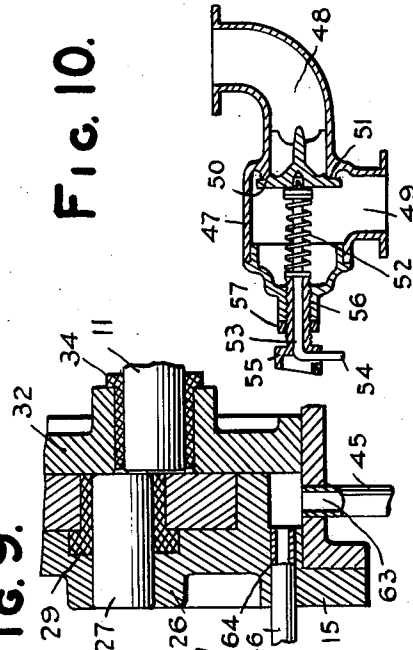


FIG. 10.

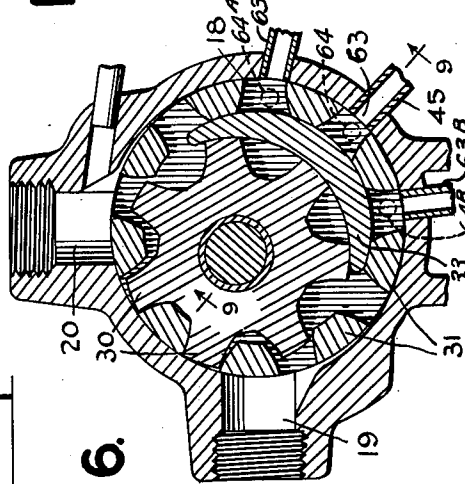


FIG. 6.

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VARIABLE VOLUME ROTARY PUMP

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11 Claims. (Cl. 103-42)

1

This invention relates to gear type pumps designed for operation by constant speed motors, and comprises means for controlling the volume output and the pressure to suit variable conditions of demand and load.

Among the objects of the invention are to provide a simple, efficient and inexpensive control system for reducing the volume output of fluid during operation of the pump, and maintain the working pressure, as where lower volume displacement is required to operate hydraulic pressure operated machinery.

Another object is to change the output of pumps subjected to conditions causing overloading, in order to relieve the motor and prevent stalling and damage to the working parts.

Still another object is to provide the more simple sturdy gear type of pump with a variable delivery control system thus adapting an inexpensive type pump for operating hydraulic circuits heretofore requiring more complicated and expensive variable displacement pumps and control units.

With these and other objects in view I have devised an illustrative embodiment of the invention as shown in the accompanying drawings, and hereinafter described and claimed.

In the drawings, Fig. 1 is a plan view of a self-metering rotary or gear type pump, showing my invention applied thereto; Fig. 2 is a side view and Fig. 3 is an end view of the same; Fig. 4 is a vertical axial section on the line 4-4 in Fig. 1; Figs. 5 and 6 are transverse vertical cross-sections on the lines 5-5 and 6-6 in Fig. 1, respectively; Fig. 5 showing the gears in side elevation; Figs. 7 and 8 are a side view and an inside face view of the end cover plate; Fig. 9 is a cross-section on the line 9-9 in Fig. 6; and Fig. 10 is a vertical axial cross-section of the by-pass valve for controlling the volume output and pressure of the pump, enlarged scale.

Referring to the drawings, particularly Figs. 4, 5 and 6, the pump shown therein has a base 10 which supports the pump shaft 11 by means of antifriction metal bushings 12, 13 or other suitable bearings mounted in the ends of a suitable cylindrical casing 14 having one end closed by a cap 15 which is removably secured thereto by cap screws or other suitable means as shown in Fig. 2.

The pump cylinder 18 is formed within the casing 14 with its axis in alignment with the axis of the pump shaft 11. Inlet and outlet openings 19, 20 communicate through the external wall of the pump cylinder with the inlet and outlet ports

2

21, 22, respectively, as shown in Fig. 8, these ports being circumferentially spaced at ninety degrees or so apart around the axis of the pump shaft. The end of the pump cylinder 18 is normally closed by the cover plate or disc 15 which has a circular flange 24 on its inner face projecting into the pump cylinder and provided with a boss or hub 26 on its outer face containing a bored hole for the idler gear shaft 27. A pin or stud 23 is provided engaging in a complementary hole in the cover for locating the two parts of the cylinder in the proper angular position relative to each other for supporting the eccentric idler gear shaft midway between the inlet and outlet ports 21, 22 as shown in Figs. 3, 4, 5 and 6.

The idler pump gear 28 is mounted on an anti-friction metal sleeve 29 which is journaled on the inner end of the shaft 27 and its radial teeth 30 mesh at one side of the pump cylinder between the adjacent inlet and outlet ports with the open ended crown teeth 31 which project from the inner face of a disc-like rotor 32 on the inner end of the pump shaft 11. The working faces of the radial teeth 30 are concave and the working faces of the crown teeth 31 are convex and the outer ends of the mating teeth 30, 31 are in close contact with the inner cylindrical wall of the pump chamber 18 along a line of tangency half way between the inlet and outlet ports measured along the shortest wall of the cylinder separating said ports, the effect of the contact of these teeth with each other and with the wall being to close all communication between the inlet and outlet ports along the cylinder wall and between the inner face of the cover projection 24 and the adjacent sides or end faces of the teeth 30, 31 as well as between the inter-engaging teeth. The lune shape space in the pump chamber between the points of the teeth 30, 31 diametrically opposite the circumferential region of engagement of the teeth is filled by a flange 33 projecting from the inner face of the cover plate 24, thus preventing fluid from passing between the teeth in this region.

The rotor 32 is secured on a bushing 34 which is splined on the inner end of the pump shaft 11 to have a capacity for some longitudinal movement with respect thereto while rotating in unison with it, and the rotor 32 is normally held with the end faces of its teeth 31 in close contact with the inner face of the end cover plate 24 by means of a coil spring 35 bearing against the bushing 12 at one end and against packing washers 36, 37 at the other end which in turn engage the inner cupped end of bushing 13.

The bushing 13 is axially adjustable in the opening in the casing 14 and is secured against rotation therein by the screw bolts 38 which pass through the flanges or lugs 39 on the outer end of the bushing and serve to hold the washers 36, 37 in place against the pressure of the spring 35, thereby constituting a leak-proof packing for the end of the shaft 11 which projects through the bushing 13. The spring 35 also permits axial movement of the rotor 32 to relieve excessive pressure in the cylinder 18 should this be developed to a dangerous extent.

The pump is driven by a motor or engine connected to the shaft 11, and during normal operation of the pump as shown in Fig. 2, rotor 32 and idler 28 rotate anti-clockwise, thus drawing fluid from suction port 21 and inlet or supply pipe 19 and carrying it between the idler teeth 30 and rotor teeth 31 on either side of abutment 33. As the fluid carrying gear teeth approach discharge port 22 they gradually mesh forcing the fluid through said discharge port and outlet pipe 20, until they are completely in mesh at a position equidistant between the suction and discharge ports and against the inner surface of the cylinder wall, forming a barrier to prevent the passage of fluid between said ports.

The volume of fluid passing through the pump is metered by the capacity of the spaces between the successive gear teeth 30 on the idler and 31 on the rotor, and depends upon the speed of rotation of the pump shaft 11, being independent of the pressure within the working range of the pump. In order to adjust or control the volume of fluid delivered per revolution of the pump shaft, a by-pass pipe in two sections 45, 46 is provided connecting the discharge side of the pump with the inlet side of the pump, a shut off valve 47 being located in either section of this pipe to close it when full volume of discharge is desired. This valve is of any suitable design, that shown in Figs. 2, 3, and 10 having a body with a longitudinal bore 48 to which one of the ends of the pipe 45 is connected, and a transverse bore 49 to which the other end of this pipe 45 is connected. The valve plunger 50 is slidable in the longitudinal bore 48 at the inner end of which is a seat 51 against which it is held by the spring 52 pressing upon a washer pinned on the inner end of the stem 53, the outer end 54 of which is bent laterally to engage in one or the other end of a bayonet notch formed in the flanged extremity 55 of an adjusting thimble 56 screwed into a threaded opening in the end of the casing 47 in axial alinement with the valve. A lock nut 57 holds the thimble in adjusted position. In one angular position of the valve stem its bent end is in the slot and the valve is held down on its seat. In its other angular position the stem can lift against the pressure of the spring 52 to permit opening of the valve. Lighter or heavier springs may be substituted for the spring 52 to control the pressure of the fluid being pumped.

The valve plunger 50 may be lifted off from its seat by turning the stem 53 out of the bayonet notch slot and raising it against the pressure of the spring 52 and rotating its bent end 54 to engage against the outer end of the flange 55 to secure it in lifted position, thereby holding the valve open. Thus the valve may be manually set in either closed or open position, or it may be set to open under pressure in the pump outlet in excess of that for which the spring 52 is adjusted.

The flow of fluid through the pipes 45, 46 is

also controlled automatically by means of the rotor gear teeth 31, which alternately cover and uncover angularly alining openings or ports 63, 64 in the external circumferential wall of the pump chamber and in the cover plate 15, located in the region where fluid is being carried by the respective gear teeth from the suction port to the discharge port as shown in Figs. 6 and 9. The diameter and radial position of the opening 64 and the corresponding circumferential position and diameter of the opening 63 determine the amount of fluid by-passed each time a tooth 31 uncovers the side port 64, as obviously the spaces between these teeth vary radially from their inner ends which abut the flange 33 to their outer side faces which abut the inner circumferential wall 18 of the pump cylinder; and consequently by locating the opening 64 nearer to or farther from the axis of the pump it will be uncovered for a longer or shorter interval of time during the passage of the tooth as seen in Fig. 6, and thus more or less fluid will be by-passed.

The spring 35, in addition to securing the packing tightly in place and relieving excessive pressure in the pump chamber also serves to maintain the side faces of the teeth 31 in close contact with the inner face of the cover so as to prevent leakage through the opening 64 as well as to prevent leakage from the inlet to the outlet sides of the pump.

If desired a plurality of by-pass pipes as for instance, 45^A and 45^B, 46^A and 46^B and ports or openings 63^A, 63^B, 64^A and 64^B analogous to the ports 63 and 64, each with its own control valve, may be provided, the ports being circumferentially arranged with spaces between them varying, and each uncovering a different area at each passage of a tooth, so arranged that one or two or all may be put in operation in sequence or simultaneously and thereby the volume of fluid by-passed may be correspondingly varied.

The invention is not restricted to the details of construction shown in the drawings, changes in the size, shape, position and number of passages provided to suit the type of pump and nature of use to be served being contemplated as within the scope of the invention.

What is claimed as my invention is as follows:

1. A rotary gear type of fluid pump having a chamber provided with spaced inlet and outlet passages with intermeshing gears disposed between them, and a by-pass connecting said passages for reducing the volume output of said pump, said by-pass leading through two spaced, alining ports in that portion of the wall of said chamber which encloses an area of neutral pressure, said ports being adapted to be covered and uncovered intermittently by the teeth of at least one of said gears passing between them, whereby the flow through said by-pass is metered between said gear teeth.

2. A rotary gear pump as set forth in claim 1 wherein said by-pass is provided with a control valve.

3. A rotary gear pump as set forth in claim 2 wherein there are a plurality of by-pass passages each with its own control valve.

4. A rotary gear pump as set forth in claim 1 wherein the by-pass ports are disposed diametrically opposite to the region of engagement of said gears.

5. A rotary gear type of fluid pump having a chamber provided with spaced inlet and outlet passages with intermeshing gears disposed between them connected by a by-pass around said

5

gears, one of said gears engaging the end wall of said chamber with the sides of its teeth, spring means for maintaining said gear in close contact with said end wall, a port in said end wall and another alining port in the side wall of said chamber, said ports being located in an area of neutral pressure opposite the section of said chamber including said inlet and said outlet and adapted to be covered and uncovered by the successive gear teeth passing between them and thereby metering the passage of fluid through said by-pass between said gear teeth.

6. A rotary gear type of fluid pump having a cylindrical chamber provided with spaced inlet and outlet passages disposed at an angle with respect to each other, with intermeshing driving and driven gears filling said chamber between said passages and providing means for pumping a measured amount of fluid at a fixed speed of rotation, said driving gear having inwardly facing teeth arranged circumferentially on the face of a disc rotor to project axially thereof, the outer surfaces of said teeth conforming to the diameter of said chamber and the end faces thereof lying in a plane at right angles to the axis of rotation thereof, an end wall for said chamber against which the end faces of said teeth bear flatwise, a port in said end wall and an alining port in the side wall of said chamber, both ports lying in a neutral section of said chamber opposite that bounded by the inlet and outlet passages and in position to be covered by said teeth passing between them as said gear rotates, passages connecting one of said ports with said inlet passage and other port with said outlet passage and means for controlling the flow of fluid through said connecting passages.

7. A gear pump as set forth in claim 6 having automatically operating adjustable means for controlling the flow of fluid through the connecting passages.

8. A gear pump as set forth in claim 7 having manual means for putting said automatically

6

operating adjustable means into and out of operation.

9. A gear pump as set forth in claim 6, having automatically operating adjustable means for controlling the flow of fluid through the connecting passages, and manual means for holding said adjustable means both wide open and fully closed.

10. A rotary gear pump as claimed in claim 1 wherein there are a plurality of by-pass passages, the aligning ports of each by-pass uncovering a different area at each passage of a gear tooth.

11. A rotary gear pump as claimed in claim 10 in which each by-pass carries individual control means whereby said by-pass passages may be individually opened or closed in sequence or simultaneously.

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