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ROTARY PUMP

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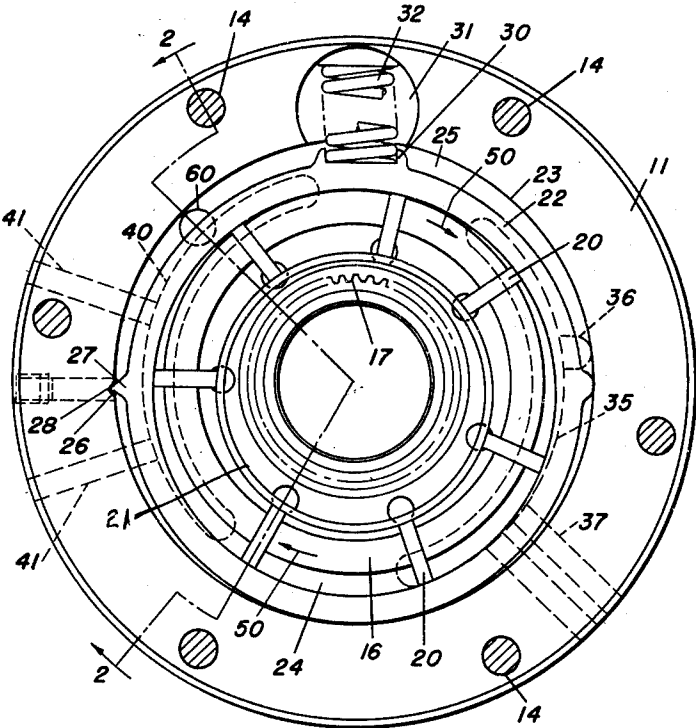


FIG. 1

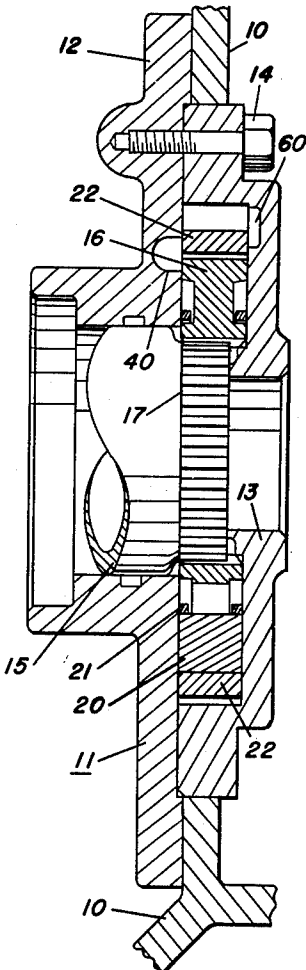


FIG. 2

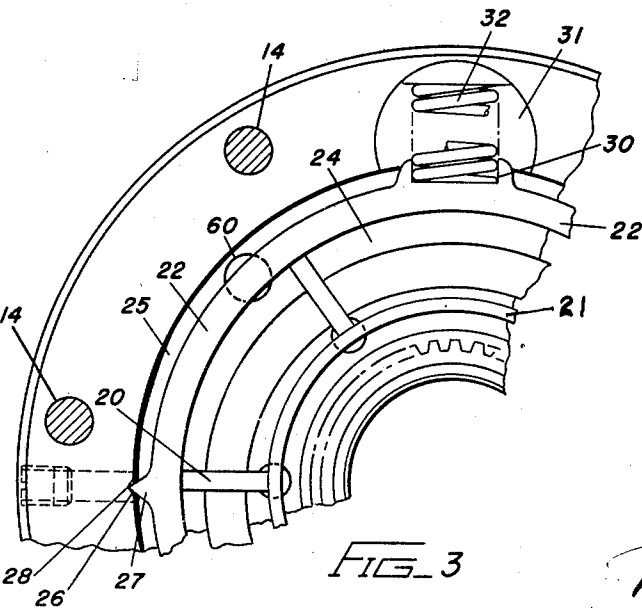


FIG. 3

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ROTARY PUMP

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This invention relates to rotary pumps and particularly to a vane type of pump with automatic regulation of the output pressure and the volume.

Pumps of this type may be used in connection with automobile engines and transmissions and when driven by the engine they are of course subjected to greatly varying speeds, say from 400 R.P.M. up to 4000 R.P.M. or more. Such pumps supply fluid pressure not only for lubrication but for engagement and disengagement of clutches and other devices. The required pump pressures run as high as 80 lbs. or 100 lbs. per square inch and there must be sufficient volume to quickly operate the clutches or other devices.

One such pump is shown in Patent No. 2,064,421 dated December 15, 1936, in which the rotor is enclosed within a ring or barrel which may be moved from a concentric to an eccentric position relative to the axis of the rotor to thereby vary the volume between zero and the maximum desired, and the volume is controlled by varying the eccentricity of the ring or barrel in accordance with the discharge pressure of the pump which pressure of course will depend upon the speed of rotation and the volume of the fluid required at any particular time. In the use of some pumps of this type it has been found that when a sudden increase in volume is required the pump barrel will not move quickly enough from its minimum or concentric position to its other extreme where it will produce the greater volume and there is therefore a lag in the action of the clutch or other device involved. It is this situation that the present invention is intended to remedy.

One of the objects of the invention therefore is the provision of means for limiting the minimum action of the automatic controlling means of the rotary type of pump last above described.

Another object of the invention is to provide in a pump of the general type shown in said Patent No. 2,064,421 a means which will prevent the pump reaching its otherwise minimum capacity so that it will more quickly increase its capacity when called upon to do so.

Another object of the invention is to provide a rotary pump with automatic pressure and volume control with a minimum of heating effects.

Another object of the invention is to provide a secondary control for a pump having a normal control for its output volume ranging from zero to maximum so that the pump will more quickly increase its output or attain maximum output when suddenly called upon to do so.

Other objects of the invention will appear from the following description taken in connection

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with the drawing, which forms a part of this specification, and in which:

Fig. 1 shows a side view of a pump made in accordance with this invention, one of the side plates and the pump driving shaft being removed;

Fig. 2 is a section through the pump shown in Fig. 1, taken on section line 2—2, with the side plate and driving shaft in place; and

Fig. 3 is a slightly enlarged view of a portion of the pump shown in Fig. 1 with the controlling ring in another position.

Referring to the drawings, a support for the pump is shown at 10, and the pump casing 11 is mounted thereon and secured thereto by any conventional means. The casing consists of side plates 12 and 13 which plates are secured together by a series of bolts 14. A drive shaft for the pump is indicated at 15 and this shaft is connected to the rotor 16 of the pump as by serrations or splines 17.

The rotor 16 is mounted between the plates 12 and 13 and it is provided with a series of radial vanes 20 which are held outwardly by rings 21.

Surrounding the rotor and its vanes is a movable ring 22, the interior of which is slightly larger than the exterior of the rotor 16, and the exterior of which is somewhat smaller than the bore 23 of the casing. Thus there is a space or chamber 24 between the rotor 16 and the ring 22 and a space of chamber 25 between the ring 22 and the casing 11.

The casing 11 is notched as at 26 and the ring 22 has an exterior projection 27 which fits into the notch 26 so that the movement of the ring 22 in the casing is about the pivot point 28 thus provided.

At the upper part of the ring 22 as shown in Fig. 1 there is a socket 30 and adjacent thereto the casing 11 is cut out to form an opening 31. A coil spring 32 has one end in the socket 30 and the other end in the opening 31 in the casing thus tending to yieldingly force the ring 22 downwardly about the pivot 28.

The casing 11 is provided with a suitable arc-shaped inlet passage 35 shown in broken lines in Fig. 1 as communicating at all times with the chamber 24 and one or more radial passages 37 for connection to any suitable source of fluid supply. A radial extension 38 to the inlet passage 35 connects with the chamber 25 so that the latter is always subjected to inlet suction.

The casing is also provided with a suitable arc-shaped outlet passage 40 and radial extensions thereof indicated at 41 which extensions

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may connect with the devices to be supplied with fluid.

These passages 35, 36, 37, 40 and 41, may be formed either in the plate 12 or the plate 13. As shown, they are in the plate 12, the dash lines in Fig. 1 indicating that they are in the plate 12 that is removed in that figure.

From the above description it will be understood that as the rotor 16 is operated in the direction of the arrow 50 as shown in Fig. 1, fluid will be drawn into the chamber 24 and expelled through the outlet passages 40 and 41. If but little fluid is needed there will be resistance to the passage of the fluid from the pump and this will build up a pressure in the upper part of the ring 22, between the rotor and the ring, which pressure will tend to move the ring 22 upwardly, in Fig. 1, against the action of the spring 32. As the ring 22 closely approaches or coincides with the axis of rotation of the rotor 16 the volume of fluid pumped will decrease practically to the vanishing point because the vanes will do nothing but carry the fluid around and create no suction in the inlet passages. This of course takes very little power to operate the pump and while the pressure is somewhat at its maximum in the outlet passages the volume of flow through the passages is substantially zero.

But if there is a sudden demand for volume at the outlet ports the pressure on the upper part of the ring will drop, the ring will revert to the position in which it is shown in Fig. 1 and as the ring moves downwardly the volume increases.

But it has been found that under the conditions above described there is a lag in the volume produced because of the time element involved in the shifting of the ring from its zero position to its full position and this is objectionable where the pump is used as for operating a clutch in which considerable volume and higher pressure are required.

So in the present invention provision is made for a secondary control means which will limit the movement of the ring 22 as it moves toward concentric position. As shown, this means comprises a port 60 formed in one of the plates of the casing, as in the plate 13. This port 60 is in communication with the chamber 25 and throughout the greater part of the range of movement of the ring 22 it is so covered by the ring 22 that it cannot communicate with the chamber 24 in which the rotor operates. It is so shown in Fig. 1. But as the volume required decreases and pressure builds up to move the ring toward its concentric position, the ring uncovers the port 60 so that it communicates both with the chamber 25 and the chamber 24, thus forming a by-pass between those two chambers, and since this relieves the pressure in the chamber 24, the ring 22 will move no farther toward its concentric position. This position of the ring 22 is particularly shown in Fig. 3.

Thus with little or no volume being demanded from the pump, the ring 22 will be in the position shown in Fig. 3, with the port 60 just cracked open, and the pump will operate at perhaps 20% of its capacity, the surplus being bypassed through the port 60 either to the inlet porting or by a passage to the source of supply. Then upon sudden demand for greater volume a very few thousandths movement of the ring 22 will close the port 60 and the volume delivered by the pump will immediately increase while at the same time maintaining the pressure and the demand will be supplied. Thus the secondary

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control means, by limiting the movement of the ring 22, has made it possible for the ring to quickly close the port 60 and meet the sudden demand made for greater volume at maintained high pressure. Usually this demand is met by the mere closing of the port 60 but should more volume be required the ring 22 may continue its movement even to the limit of its range where the pump will supply its maximum volume at maximum pressure. Thus there is assured the volume demanded and at full pressure and the lag in the operation of the clutch or other device, under the conditions recited, is minimized or removed.

It will be understood that various forms of the invention other than that described above may be used without departing from the spirit or scope of the invention.

What is claimed is:

1. In a rotary pump, a rotor, means cooperating with the rotor to form a pump chamber and casing, said casing having inlet and outlet passages therein, said means including a ring surrounding the rotor and movable relative thereto to vary the output volume of the pump, means to automatically control the volume varying position of said ring, and a secondary control means for said ring including a by-pass passage having a port, said by-pass connecting said chamber with said inlet passage, and said port cooperating with and being covered and uncovered by said ring depending upon the movement thereof, said port being progressively uncovered as the outlet volume diminishes and the pump pressure increases.

2. In a rotary pump, a rotor, means cooperating with the rotor to form a pump chamber and casing, said casing having inlet and outlet passages therein, said means including a ring surrounding the rotor and movable relative thereto to vary the output volume of the pump, means to automatically control the volume varying position of said ring, and a by-pass passage having a port, said by-pass connecting said chamber with said inlet passage, and said port cooperating with and being covered by said ring throughout the greater part of its range of movement but uncovered adjacent the lower volume end of said range.

3. In a rotary pump, the combination of a casing, a ring within the casing, said ring having inlet and outlet passage means cooperating therewith, an outer fluid flow chamber between said casing and said ring, a rotor within the ring, an inner fluid flow chamber between said ring and said rotor, means for so mounting the ring in the casing that the ring may shift from a concentric to an eccentric position relative to the rotor, means controlling the automatic shifting of the ring with changes in the discharge pressure of the pump, and means comprising a by-pass passage having a port in communication with said outer chamber, said port being adapted to be placed in communication with said inner flow chamber, said port being covered and uncovered by the ring during the varying movements thereof to limit the minimum action of said controlling means by uncovering the port as the discharge pressure increases above a fixed value.

4. In a rotary pump, the combination of a casing, a ring within the casing, said ring having inlet and outlet passage means cooperating therewith, an outer fluid flow chamber between said casing and said ring, a rotor within the ring, an inner fluid flow chamber between said ring

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and said rotor, means for so mounting the ring in the casing that the ring may shift from a concentric to an eccentric position relative to the rotor, means controlling the automatic shifting of the ring with changes in the discharge pressure of the pump, and means comprising a by-pass passage formed in the casing, said passage being in communication with said outer chamber and having a port, said port being adapted to be placed in communication with said inner flow chamber, said port being covered and uncovered by the ring during the varying movements thereof to insure maintenance of the desired discharge pressure by uncovering the port as the discharge pressure increases above a fixed value.

5. In a rotary pump, the combination of a casing, a ring within the casing, said ring having inlet and outlet passage means cooperating therewith, an outer fluid flow chamber between said casing and said ring, a rotor within the ring, an inner fluid flow chamber between said ring and said rotor, means for so mounting the ring in the casing that the ring may shift from a concentric to an eccentric position relative to the rotor, means controlling the automatic shifting of the ring with changes in the discharge pressure of the pump, and a secondary control means for limiting the movement of said ring in one direction and comprising a by-pass passage formed in the casing, said passage being in communication with said outer chamber and having a port, said port being adapted to be placed in communication with said inner flow chamber, said port being covered by said ring throughout the greater part of its range of movement but becoming uncovered adjacent the lower volume and high pressure end of said range.

6. In a rotary pump, the combination of a casing, a ring within the casing, said ring having inlet and outlet passage means cooperating therewith, an outer fluid flow chamber between said casing and said ring, said outer fluid flow chamber communicating with said inlet means, a rotor within the ring, an inner fluid flow cham-

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ber between said ring and said rotor, means for so mounting the ring in the casing that the ring may shift from a concentric to an eccentric position relative to the rotor, means controlling the automatic shifting of the ring with changes in the discharge pressure of the pump, and a secondary control means including a passage having a part adjacent said outlet means for connecting the inner and outer chambers only when said ring is near the concentric end of its range of movement for limiting the action of the first of said controlling means.

7. In a rotary pump, the combination of a casing, a ring within the casing, said ring having inlet and outlet passage means cooperating therewith, an outer fluid flow chamber between said casing and said ring, said outer chamber communicating with said inlet means, a rotor within the ring, an inner fluid flow chamber between said ring and said rotor, means for so mounting the ring in the casing that the ring may shift from a concentric to an eccentric position relative to the rotor, means controlling the automatic shifting of the ring with changes in the discharge pressure of the pump, and a secondary control means including a passage having a part adjacent said outlet means for connecting the inner and outer chambers only when said ring is near the concentric end of its range of movement, said secondary control means limiting the movement of said ring by reducing said discharge pressure suddenly upon slight movement of said ring adjacent said concentric end of its range of movement.

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