Dec. 4, 1962 W. T. LIVERMORE 3,066,608

MULTIPLE PORTED TRANSMISSION PUMP

Filed Nov. 22, 1960 2 Sheets-Sheet 1

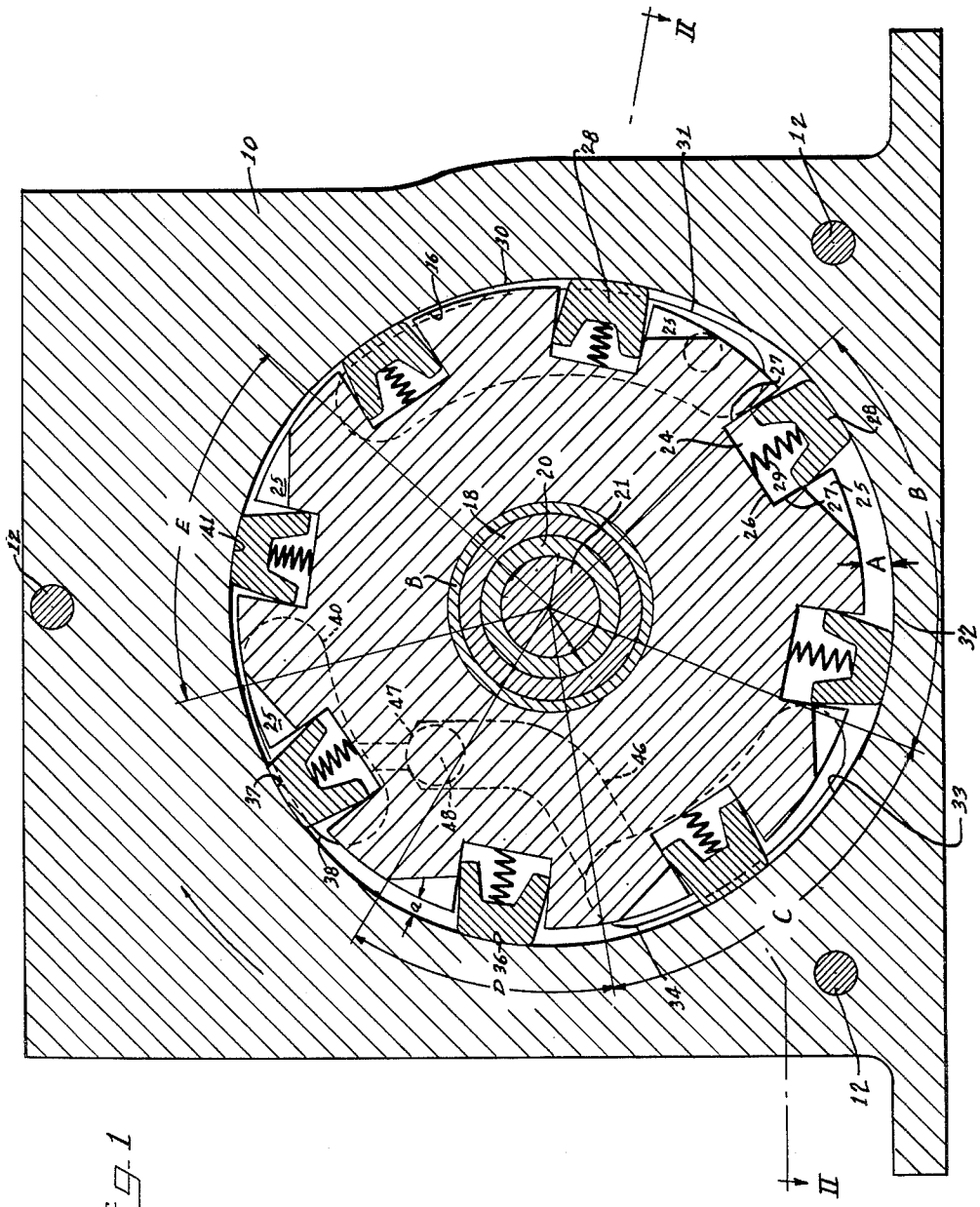


FIG. 1

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Fig. 2

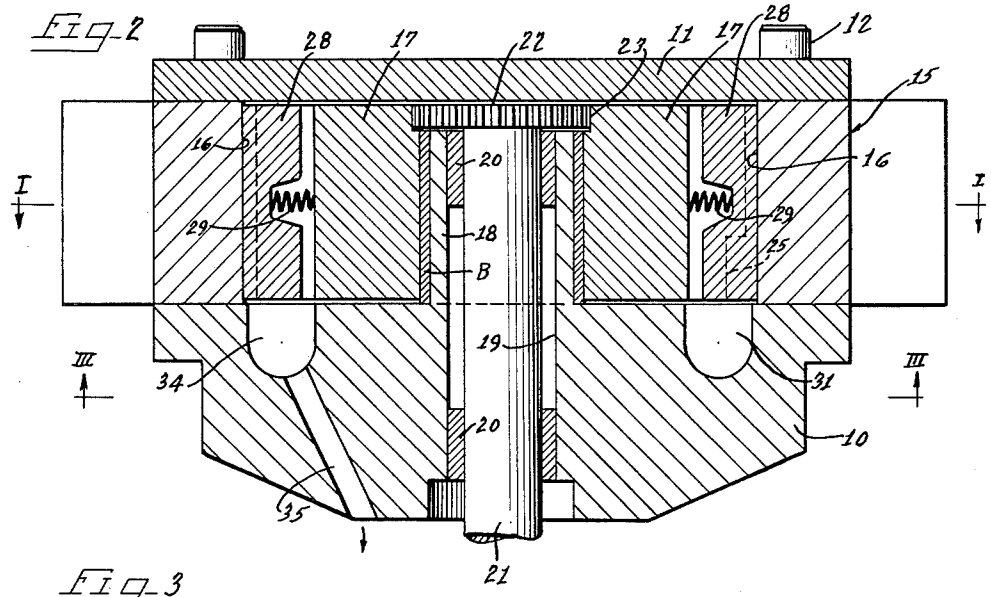
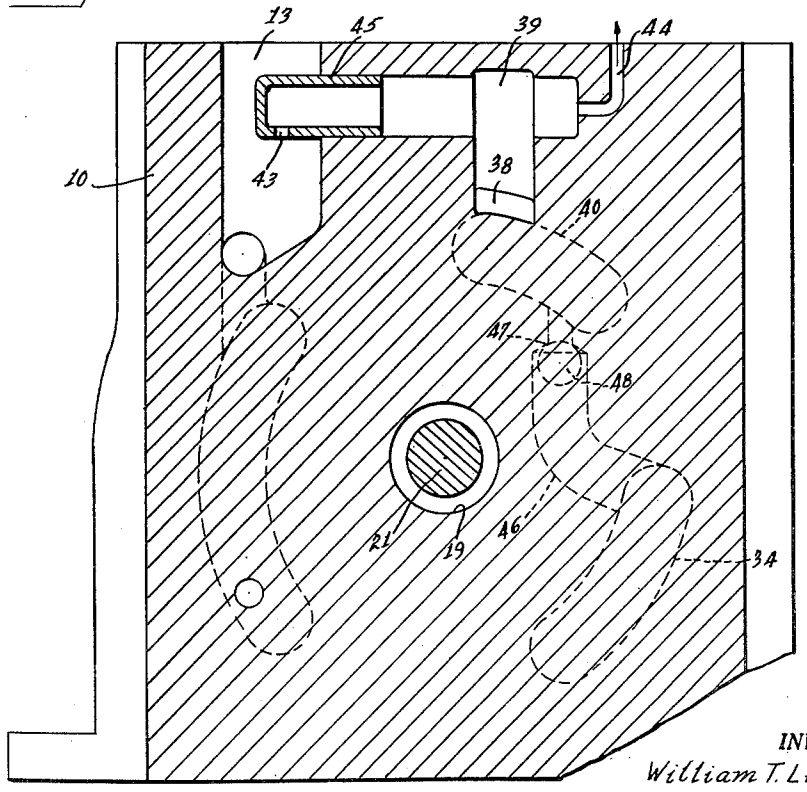


Fig. 3



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MULTIPLE PORTED TRANSMISSION PUMP

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1 Claim (Cl. 103—2)

This invention relates generally to pumps and more particularly relates to a pump of the type including a rotor carried means following the contour of an adjoining bore wall wherein the bore wall is characterized by alternate circumferentially spaced eccentric and concentric arc segments forming separated outlet areas for the development of a multiple pumping function in a unitary pump construction.

It is an object of the present invention to provide a unitary pump construction capable of effecting a multiple pumping function.

Yet another object of the present invention is to provide a transmission pump which is capable of supplying clutch control pressure, and which is also capable of acting as a source of fluid pressure varying with rotative speed for use as a transmission governor.

Yet another object of the present invention is to provide an improved slipper type pump utilizing slippers which are free to move radially and to rock angularly while following an irregular contour of an adjoining pumping chamber wall shaped to provide circumferentially spaced separated multiple outlet areas, thereby to provide at least two separate pumping circuits.

Many other advantages, features and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the accompanying sheet of drawings in which a preferred structural embodiment of a pump incorporating the principles of the present invention is shown by way of illustrative example.

On the drawings:

FIGURE 1 is a cross-sectional view taken on the plane of the rotor such as line I—I of FIGURE 2 of a dual ported transmission pump incorporating the principles of the present invention;

FIGURE 2 is a cross-sectional view taken generally on line II—II of FIGURE 1 and illustrates additional details of construction of the dual ported transmission pump of the present invention; and

FIGURE 3 is a cross-sectional view taken generally on line III—III of FIGURE 2.

As shown on the drawings:

The pump of the present invention comprises a casing 10 which includes a middle section 15 having a cover 11 and all of the parts are held in firm assembly by a plurality of fasteners 12.

Although the pump of the present invention could embody both radial and side porting, the illustrative embodiment herein disclosed is a side porting arrangement wherein there is formed within the casing 10 an inlet passage 13 communicating with a pumping chamber shown generally at 16.

The pump is provided with a rotary fluid displacement means or rotor shown generally at 17 which is journaled for rotation on a bushing B carried by bearing boss 18 projecting into the pumping chamber 16 and which bearing boss 18 is intersected by a bore 19 having bearing means 20, 20 positioned therein for supporting and journaling a shaft 21. The shaft 21 has splined coupling means 22 carried on the end thereof effecting a splined connection as at 23 with the rotary fluid displacement means 17, thereby to rotatably drive the rotary fluid displacement means or rotor 17 within the pumping chamber 16.

The rotary fluid displacement means 17 is of the type comprising a rotor of smaller peripheral diameter than the pumping chamber 16 and there is formed in the peripheral surface thereof a plurality of circumferentially spaced notches each of which is indicated by the reference numeral 24.

Each notch is essentially rectangular in cross-section and includes a bottom wall 26 as well as two generally parallel side walls 27, 27. Received within each respective notch 24 is a slipper-type pumping element 28. In the exemplary form of the invention described and illustrated herein, each slipper 28 is of the type which is free to move radially and to rock angularly within the limits prescribed by the confines of the notch 24 and while the slipper 28 follows the contour of the adjoining bore wall of the pumping chamber 16. To preload the respective slippers 28 against such bore wall, there is provided a continuous biasing means such as a coil spring 29 which is shown bottomed against the bottom wall 26 of each respective notch or recess 24, the other end of the coil spring 29 being engaged against the back side of the slipper 28.

It will be further appreciated that the slippers 28 are in effect self-sealing since upon rotation the centrifugal force exerted on the slippers 28 will tend to urge the slippers radially outwardly into sealed engagement with the adjoining bore wall.

The rotor 17 is further provided with tapered notches as shown at 25 formed at each respective notch 24 in order to increase the area avialable for fluid to flow between the ports and the space between the rotor circumference and bore. Each notch 25 extends part way across the rotor 17 as shown by the dotted lines of FIGURE 2.

In accordance with the principles of the present invention, the casing 10 and specifically the bore wall forming the peripheral surface of the pumping chamber 16 is specially constructed. Thus, there is provided an irregular contour in the bore wall which is characterized, first of all, by an inlet area constituting an arc segment 30 of the bore wall. It will noted that such arc segment is eccentrically offset relative to the axis of the rotor 17, thereby to provide between the peripheral surface of the rotor 17 and the bore wall of the pumping chamber 16 an expanding pie-shaped area of increasing volume. Thus, as the respective pairs of slippers 28, 28 move through the inlet area or arc segment 30, the space between each adjoining pair of slippers will be increasing in volume and such expanding space will be filled with inlet fluid. A side inlet port 31 is provided in the casing which communicates with the inlet area and the inlet passage 13 and which also supplies inlet fluid to the expanding space between the bottom wall 26 of each respective notch 24 and the back side of each respective slipper element 28.

Proceeding in rotational series and assuming a clockwise rotation of the rotor 17, using the orientation of FIGURE 1, it will be noted that the bore wall of the pumping chamber 16 is next provided with an arc segment shown at 32 and extending through an angular arc identified at B. The arc segment 32 is spaced radially outwardly of the outer peripheral surface of the rotor 17 by a spacing dimension indicated at A, and such arc segment 32 is concentric with respect to the rotor 17 so that no radial movement of the slippers will occur as the slippers 28 move through the angle designated at B.

Next, the irregular contour of the bore wall provided in pumping chamber 16 is characterized by an outlet area and includes a bore wall 33 which is eccentrically disposed relative to the rotor 17, thereby to provide a decreasing volume for the space between adjoining pairs of slippers 28 and the amount of such diminution being represented by a reduction from the dimension A to the dimension represented by *a*. The arc segment 33 ex-

tends through an angle represented by C, as shown on FIGURE 1. In register with the outlet area, there is provided a side discharge port 34 which communicates not only with the space outwardly of the rotor 17 and between the respective pairs of slipper elements 28, 28, but also with the space inwardly of each respective slipper 28 and within each respective notch 24. Within such spacing dimension, therefore, a compression action occurs and fluid at increased pressure is discharged from the pump through the outlet port 34. The casing 10 has formed therein a discharge passage 35 which may be provided with suitable coupling connection means so that the fluid discharged therethrough may be supplied to a point of utilization. Since the pump of the present invention is described in connection with its application to a transmission system, for example, the transmission system of an automotive vehicle, it will be understood that the discharge port 34 could be connected to a transmission clutch so that control pressure would be supplied through the passage 35 for actuation of the transmission clutch during the operation of the vehicle.

Next, the bore wall of the pumping chamber 16 is provided with an arc segment shown at 36 and which arc segment constitutes a metering arc concentric with the rotor 17 so that no radial movement of the slippers occurs. Throughout the length of the metering arc, which extends through an angle of arc shown at D, the spacing dimension between the bore wall arc segment 36 and the outer peripheral surface of the rotor 17, is equal to the dimension shown at *a*.

Next, the bore wall of the pumping chamber 16 is formed with an arc segment 37 forming an outlet area 38. Thus, the bore wall arc segment 37 is disposed to be eccentric with respect to the rotor 17, thereby forming a decreasing area so that the volume of the space between adjoining pairs of slippers 28 is decreasing and a compression action will occur as the rotary fluid displacement means move through such second outlet area. The casing is also provided with a second side outlet port 40 and an outlet passage 39 so that a second pumping action will occur and fluid under increased pressure will be discharged outwardly through the outlet passage 39. The second pumping arc is supercharged by filling with fluid already under pressure from the first pumping arc. Any fluid trapped behind the slippers 28 will be discharged through the side port relief areas 40 into the outlet passage 39.

Between the arc segment 37 and the arc segment 36, there is provided the last arc segment in the bore wall of the pumping chamber 16, namely, the slipper seal arc 41 which extends through an angular displacement shown at E and which slipper seal arc operates to seal the outlet passage 39 from the inlet passage 13 and the inlet area 14.

The casing 10 is formed with a passage 42 in which is carried means forming an orifice 43 positioned between the inlet port 13 and the outlet passage 39, for example, a thin plate orifice forming means 45. The outlet passage 39 is further connected to a passage formed in the casing 10 and shown at 44. In a transmission pump, it will be understood that the fluid at increased pressure supplied to the passage 44 can be utilized as a governor pressure to act directly on the shift valves or to act through a relay valve.

From the foregoing description, it will be noted that the pump of the present invention has a single inlet passage 13 feeding the working arc A and as applied to a transmission system, the displacement of the pump equals the sum of the displacements required for operating the clutches and for the governor function. The working arc A discharges clutch-operating oil or fluid through the outlet port 34 at the pressure determined by the transmission valving. Another portion of the oil supplied by the working arc A, for example, approximately one-half of it, passes through the metering arc *a* to the orifice 43 which causes the pressure in the governor passage 44 to rise as the square of the speed.

Since the slippers 28 in the metering arc *a* meter the oil to the orifice 43, the governor pressure will be quite independent of the amount of oil being used by the transmission through the outlet port 34. Moreover, the metering arc *a* is supercharged by the working arc A insuring completeness of fill of the metering arc *a* at all times. This has been found to be very important in devices of this type.

It may be noted there is no restriction on the downstream side of the thin plate orifice to vary the pressure drop across the orifice with changes in speed. At higher speeds, the discharge from the orifice 43 will exert a supercharging effect at the inlet 13, particularly since the orifice 43, as shown, discharges in the direction of flow.

In order to prevent pressure built up in the port 39 from becoming excessive at high speeds, the casing 10 is formed with a check valve means between the two pumping circuits. Specifically, such check valve means include a passageway 46 in which is formed a valve seat 47 controlled by a check valve 48. The passageway 46 interconnects the first outlet port 34 and the second outlet port 39 and the check valve 48 prevents the pressure in the second outlet port 39 from exceeding the pressure in the first outlet port by permitting one way flow thereto. The pressure in the port 34 is limited to a reasonable value by a valve in the automotive transmission clutch operating system.

Although minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

A pump comprising

a pump casing

including a middle section

having a cover,

said middle section having a pumping chamber formed therein providing a bore wall,

said casing having side porting formed therein for communicating with said pumping chamber and further including an inlet passage,

rotary fluid displacement means comprising,

a rotor of smaller diameter than said pumping chamber and having formed in the peripheral surface thereof

a plurality of circumferentially spaced notches each notch being essentially rectangular in cross-section and having side and bottom walls,

a slipper-type pumping element in each notch of the type free to move radially and to rock angularly while following the contour of an adjoining bore wall of the pumping chamber,

spring means in each notch preloading each corresponding pumping element into engagement with said bore wall,

said bore wall having a surface which is irregular in configuration and which includes in rotational series

an inlet arc segment eccentric with said rotor and forming an increasing volume,

a first segment of pumping arc concentric with the fluid displacement means and in which no pumping action occures during movement of the rotary fluid displacement means therethrough,

a second segment of pumping arc shaped to form an outlet area having a decreasing volume and in which a compression occurs as the fluid displacement means moves therethrough,

a third segment of the pumping arc being a metering arc concentric with the fluid displacement means, and

a fourth segment of the pumping arc shaped to

comprise a second outlet area having a decreasing volume and in which compression occurs as the fluid displacement means moves therethrough,

and a fifth segment of pumping arc forming a sealing arc generally concentric with the fluid displacement means,

said side porting including an inlet adjacent said inlet segment and

a first outlet port formed in said casing for discharge of fluid from said second arc segment at operating pressure,

said casing having formed therein a second outlet port including

side port relief areas receiving fluid compressed in said fourth segment and fluid trapped behind said slipper means,

said casing having a passage formed therein intersecting said first and second outlet ports,

and a check valve in said passage permitting only one way flow between said first and second outlet ports to prevent excessive pressure build up at high speeds in one of the outlet ports,

said bore wall being formed to communicate the respective outlet areas,

thereby filling the second outlet area by supercharging with fluid already under pressure from said first outlet area,

whereby said pump is provided with dual pumping circuits for developing a dual pumping action.

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