Oct. 22, 1963 R. D. RYNDERS ETAL 3,107,628

VANE TYPE PUMP

Filed April 15, 1959 2 Sheets-Sheet 1

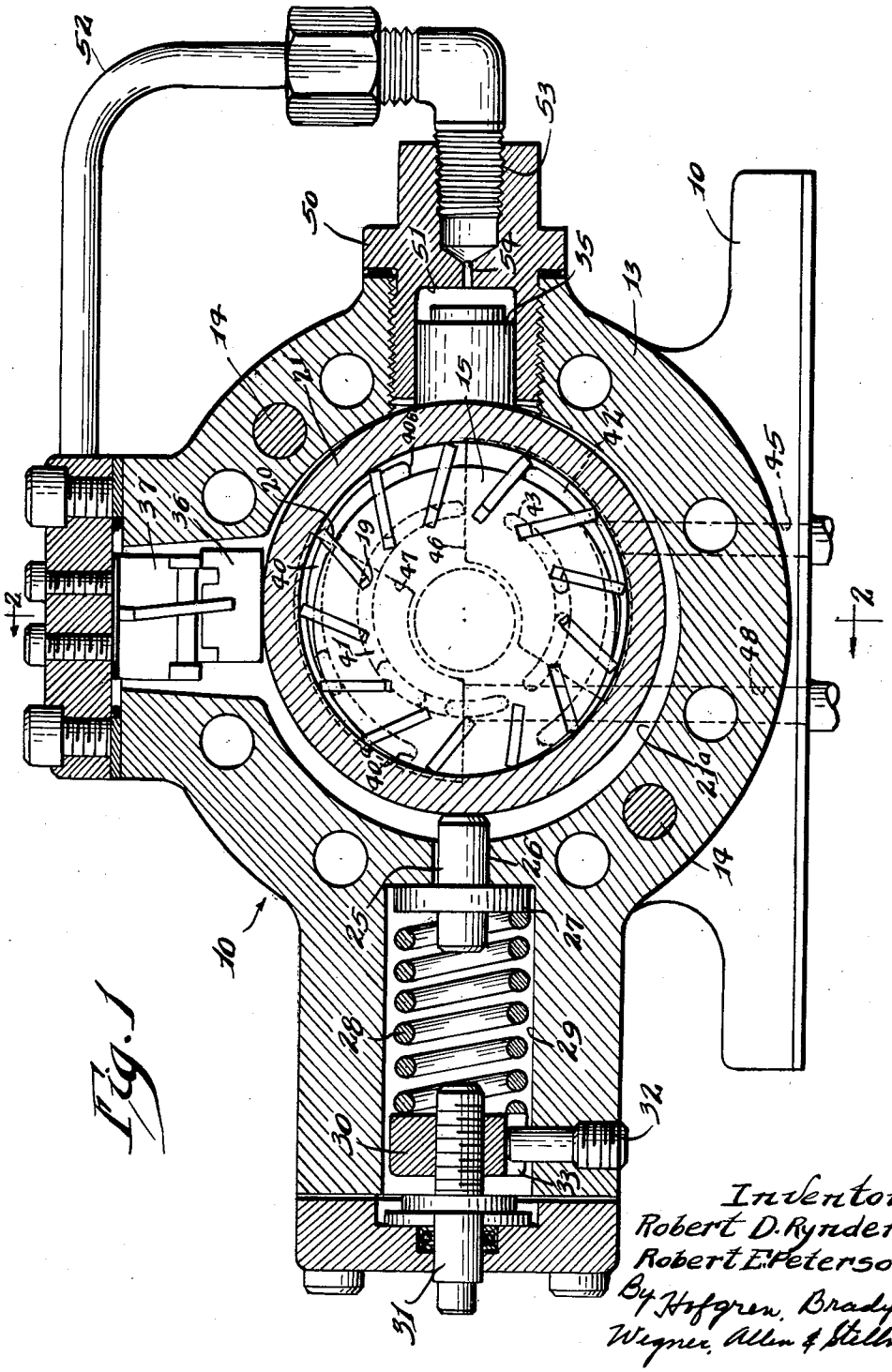


Fig. 1

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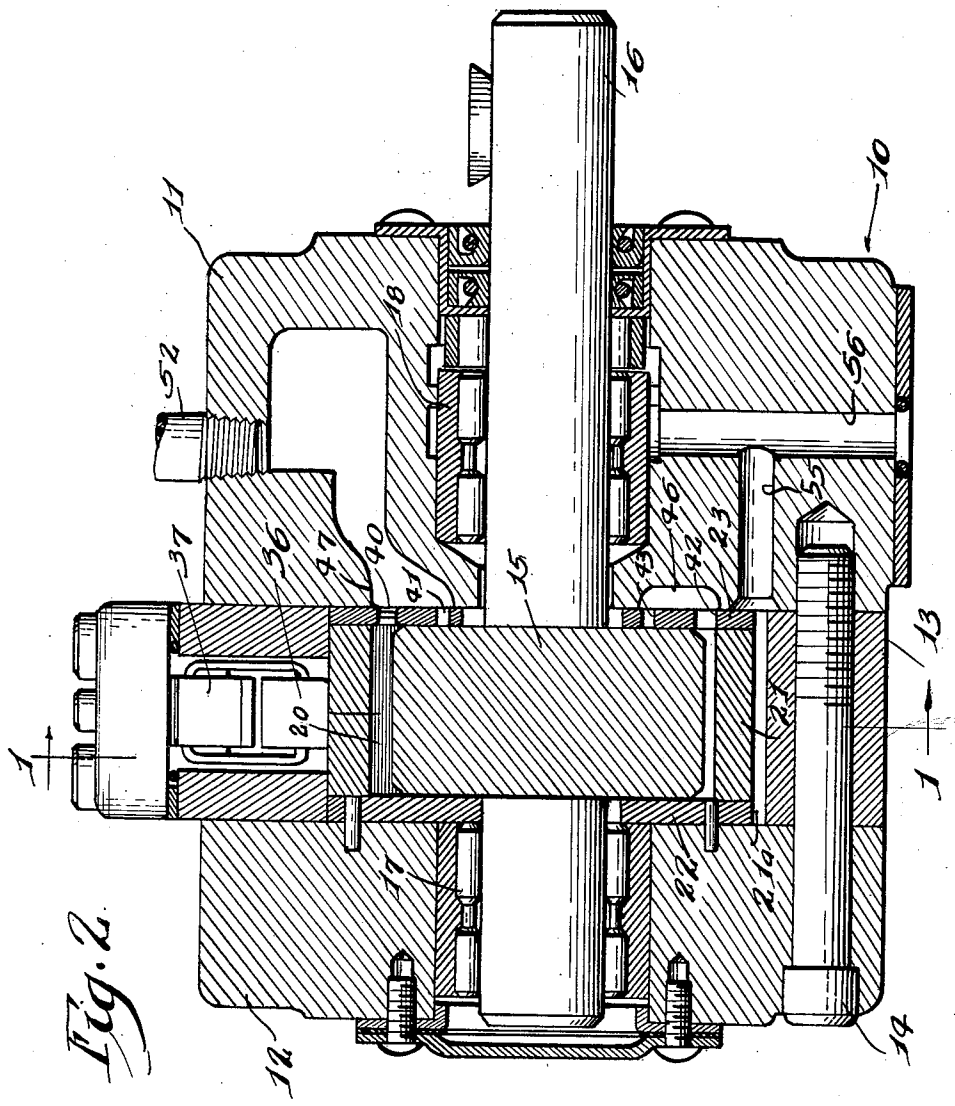


Fig. 2.

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VANE TYPE PUMP

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1 Claim. (Cl. 103—120)

This invention relates to a variable volume hydraulic vane type pump, and more particularly to such a pump in which the effect of vane pulsing is minimized, whereby a more nearly constant fluid pressure is obtained.

An object of this invention is to provide a new and improved variable volume vane type pump in which the rotor ring is stabilized.

Another object of the invention is to provide a vane type pump in which a rotor ring surrounds a rotor having movable vanes, and the position of the ring is determined by a governor engageable with said ring, a pressure responsive member engages the ring at a location opposite from the governor to thereby capture the ring and wherein pump outlet pressure is exerted on the pressure responsive member in a direction urging said member toward the ring and a flow restricting orifice is provided in the fluid path for exerting said pressure on the pressure responsive member to block pressure pulsations from the pressure responsive member and prevent vane pulsing effecting said member.

Another object of the invention is to provide a pump as defined in the preceding paragraph in which the pressure responsive member and the governor are diametrically opposite each other, a thrust bearing is positioned to engage said ring at a location on a radial line extending from the axis of the rotor and normal to a line between the governor and pressure responsive member, and a port plate is adjacent said rotor and has balanced porting with a pressure port positioned symmetrically with respect to said line between the governor and member whereby the resultant of pumping forces on said ring generally coincides with said radial line.

Further objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a vertical section of the pump taken through the rotor and generally along the line 1—1 in FIG. 2; and

FIG. 2 is a vertical section taken generally along the line 2—2 in FIG. 1.

While this invention is susceptible of embodiments in many different forms, there is shown in the drawings and will herein be described in detail an embodiment of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claim.

The pump, as shown in the drawings and indicated generally at 10, has a three-part casing with end caps 11 and 12, and a central member 13. The casing is held together by bolts 14.

A rotor 15 is disposed within the casing and mounted for rotation therein on a shaft 16 which is rotatably mounted by bearings 17 and 18. The rotor 15 is provided with a plurality of outwardly opening slots 19, each of which slidably receives a vane 20 which may move outwardly into engagement with a rotor ring 21. The rotor ring 21 is movable between a position concentric with the axis of the rotor and varying non-concentric positions, as permitted by an oversize cavity 21*a* in the casing section 13. When the rotor ring is in a concentric relation with the rotor, the pump is in a no-flow state and is pumping

when the rotor ring is in non-concentric relation with the rotor 15. In order to form confined spaces between adjacent vanes 20, a cover plate 22 is mounted at one side of the rotor 15 and a port plate 23 is mounted at the opposite side. These plates slidably engage the edges of the rotor ring 21.

A governor for controlling the position of the rotor ring 21 is mounted in the casing section 13 and is engageable with the rotor ring. This governor embodies a movable member 25 extending through an opening in the casing to a position to engage the rotor ring. The member 25 is urged against the ring by a spring 28 mounted within a chamber 29 in the casing engaging flange 27 on the member 25. The opposite end of the spring 28 engages a plug 30 movably mounted in the chamber 29 and adjustable lengthwise of the chamber to vary the setting of the spring 28 by an adjusting screw 31 rotatably mounted in the casing. In order to hold the plug 30 against rotation while the screw 31 is adjusted, a pin 32 fixed in the casing section 13 slidably engages a notch 33 in the plug. The governor yieldably urges the rotor ring 21 away from a position concentric with the rotor 15 with a force determined by the compression of the spring.

A pressure responsive member in the form of a piston 35 is engageable with the rotor ring 21 diametrically opposite to the governor member 25 and is shaped to correspond to the curvature of the rotor ring 21. A line between the governor member 25 and the piston 35 extends through the axis of the rotor 15.

A thrust bearing 36 is disposed laterally of the line between the governor and piston 35 and is engageable with the rotor ring 21 and is on a radial line extending from the axis of the rotor and normal to a line between the governor and the piston 35. The thrust bearing 36 is mounted for movement relative to its base 37.

The governor member 25, the piston 35 and the thrust bearing 36 result in a three-point support for the ring and capture the ring.

The port plate 23 has a pair of spaced arcuate pressure ports 40 and 41 positioned at different distances from the center of the port plate and a pair of suction ports 42 and 43 also having an arcuate extent and spaced different distances from the center of the port plate. The inner pressure port 41 and the inner suction port 43 communicate with the base of certain rotor vane slots 19 so as to hydraulically balance the vanes while the outer pressure port 40 and the outer suction port 42 communicate with the space between the rotor 15 and the rotor ring 21 for a predetermined distance. The port plate 23 is positioned to provide balance porting whereby the ends 40*a* and 40*b* of the outer pressure port 40 are positioned symmetrically with respect to the line extending between the governor member 25 and the piston 35 whereby the resultant of pumping forces on said rotor ring 21 generally coincides with the radial line on which the thrust bearing 36 lies. With this orientation of the port plate 23 there is no resultant pumping force acting in a direction toward the governor, as is the case with "bias porting" in which the end 40*a* of the other pressure port 40 would extend substantially to the line between the governor and the piston 35 and passing through the rotor axis. The suction ports 42 and 43 are connected to tank through a passage 45 in the pump casing leading to the exterior thereof and communicating with a chamber 46 in the pump casing section 11 and which spans the suction ports 42 and 43.

The pump output passes from the port plate to a chamber 47 formed in the valve casing section 11 and the chamber connects to a passage 48 leading to the exterior of the pump.

In a vane type pump there is a slight pulsation in the pressure of the fluid delivered due to vane pulsing as successive vanes discharge to the pump outlet. In order to stabilize the pump and remove these pulsations from affecting the position of the rotor ring **21**, the porting is balanced to have the resultant of pumping forces act against the thrust bearing **36** as described above, and it is necessary to provide an external signal for determining the position of the rotor ring **21** by exerting a force against the governor. This is accomplished by applying pump outlet pressure to the piston **35**. Specifically, the piston **35** is mounted in a casing plug **50** which is formed with a cylinder **51** to slidably receive the piston **35**. A fluid line **52** extends between the pump outlet chamber **47** and the casing plug **50**, with the line **52** threadably attached to the plug **50**, as indicated at **53**.

Means are provided to prevent vane pulsing from reaching the piston **35** to thus filter out pulses in the control signal to the piston member, comprising a flow restricting orifice **54** formed in the casing plug **50** and located between the cylinder **51** and the end of the fluid line **52**. The vane pulsing is further dampened by the pump outlet chamber **47** having an area greater than the area of the pressure port to reduce the velocity of fluid in the chamber to a velocity less than the velocity of the fluid in the pressure port.

As shown in FIG. 2, the space **21***a* outside the rotor ring **21** is connected to drain through passages **55** and **56** formed in the casing section **11**.

With the pump as disclosed herein, the effect of pressure pulsations within the pump itself is nullified since these pressure forces are exerted directly against the thrust bearing **36**. In order to thus control the pressure of the hydraulic fluid delivered by the pump, and more particularly the position of the rotor ring which determines this, an external signal is applied to the rotor ring through the piston **35** to urge the rotor ring **21** towards the governor and the governor spring **28** may then determine the position of the rotor ring. This external signal is dampened to avoid the effects of vane pulsing and this is accomplished by the flow restricting orifice **54** located in the fluid path to the cylinder for the stabilizing piston **35**, and said aforementioned pump outlet chamber **47** of greater area than the area of the pressure port.

We claim:

A variable volume hydraulic vane type pump comprising, a casing, a rotor rotatable in said casing having movable vanes, a rotor ring surrounding said rotor and movable between a position concentric with the rotor to

place the pump in a no-flow state and a plurality of positions non-concentric with the rotor to deliver fluid from the pump, means for capturing the ring for controlled movement including a yieldable governor engaging said ring and urging the ring away from said concentric position, a piston engageable with said ring diametrically opposite from said governor, a cylinder connected to said casing for housing said piston, and a thrust bearing engageable with said ring at a location on a radial line extending from the axis of the rotor and normal to a line between the governor and the piston, a port plate adjacent said rotor having balanced porting with a pressure port positioned symmetrically with respect to said line between the governor and piston whereby the resultant of pumping forces on said ring generally coincides with said radial line, and means for continuously applying a filtered external pressure signal to the ring to position the ring as determined by both the governor and the cylinder comprising a passage connecting the pressure port to said cylinder whereby fluid pressure is exerted in a direction to urge the piston toward the ring, and a flow restricting orifice in said passage to filter out pressure pulsations due to vane pulsing, said passage at a location between said orifice and pressure port having an area greater than that of the pressure port to have the velocity of fluid at said location less than the velocity of fluid at said pressure port to have pressure pulsations at said location out of phase with pressure pulsations at the port plate.

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