

June 21, 1960

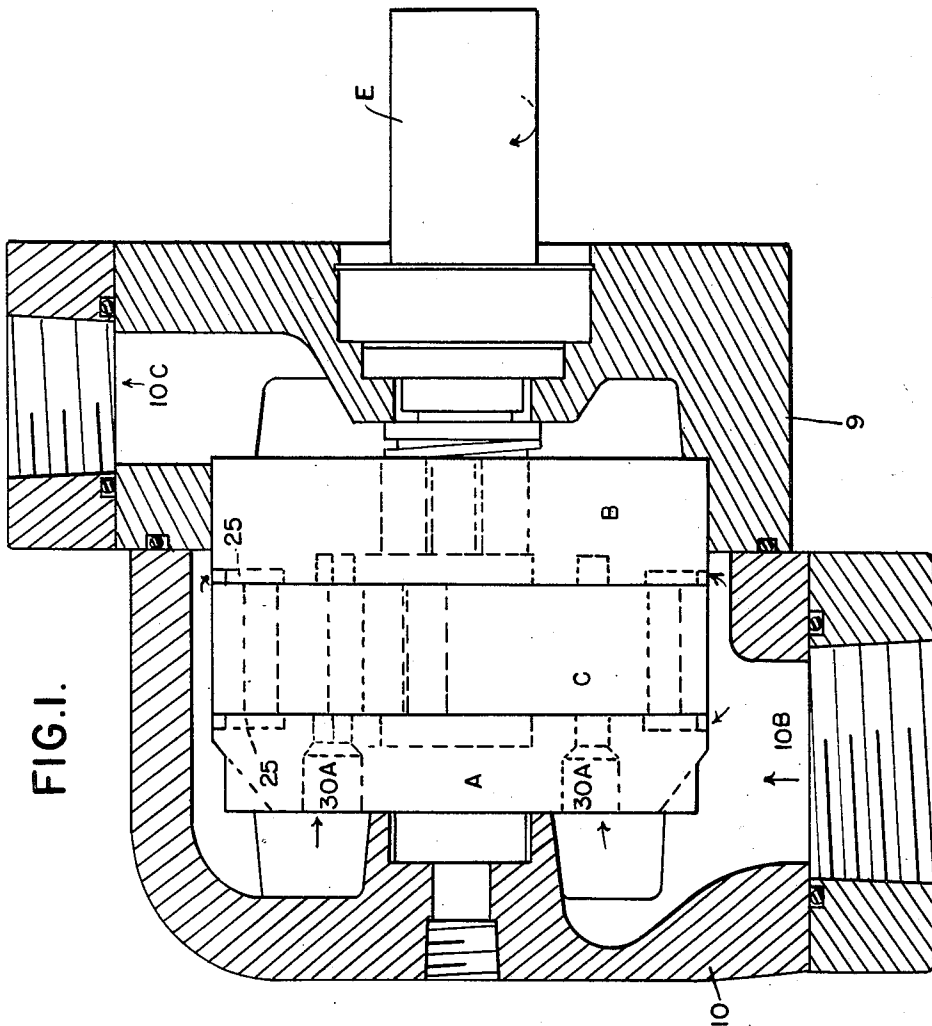
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2,941,479

FLUID PUMPS OR MOTORS OF THE VANE TYPE

Filed April 1, 1955

3 Sheets-Sheet 1



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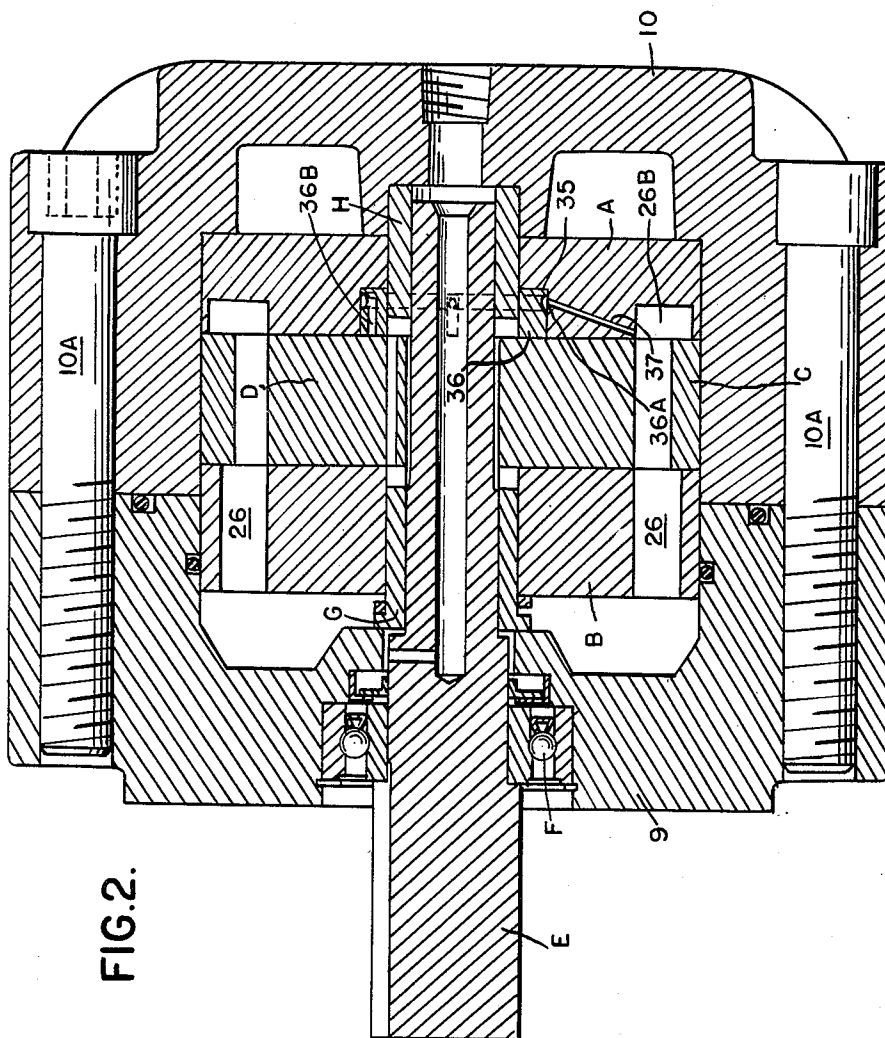


FIG. 2.

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FIG. 4.

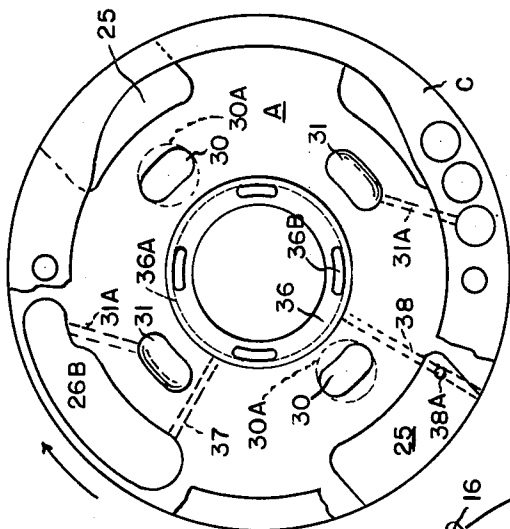


FIG. 3.

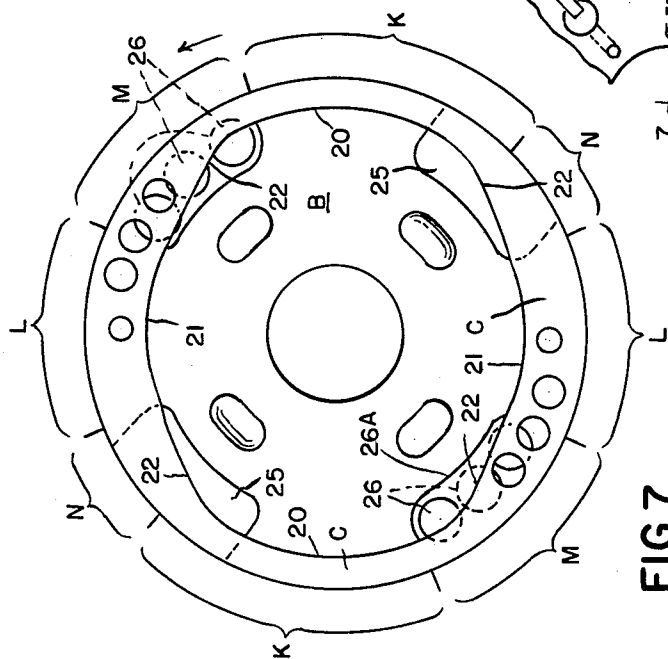


FIG. 6.

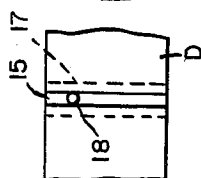


FIG. 5.

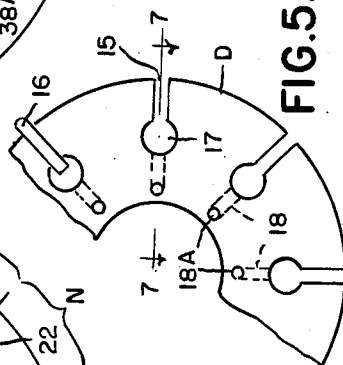
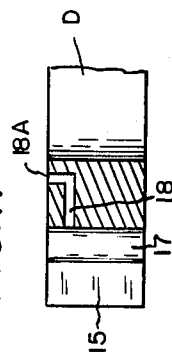


FIG. 7.



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FLUID PUMPS OR MOTORS OF THE VANE TYPE

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Filed Apr. 1, 1955, Ser. No. 498,544

3 Claims. (Cl. 103—136)

The present invention relates to fluid pumps or motors and specifically to pumps or motors of the vane type.

In pumps or motors of this type, a rotor having radially arranged slots in its periphery with vanes radially slidable therein is surrounded by a ring variously called a vane track or cam ring. This ring is provided on its inner periphery with arcuate surfaces contacting the ends of the vanes and of varying radii so that the vanes are moved into, or allowed to partially project from the periphery of the rotor as it turns.

Various expedients have been used to insure the outward movement of the vanes and probably the most generally used is the provision of conduit means to lead some of the fluid from the pressure side of the pump or motor to the bottoms of the slots under the vanes.

This, however, is open to the objection that the operation of the pump or motor at high pressure produces such a high pressure of the vane edges against the cam ring that scoring of the ring and excessive wear on the vane edges occurs and shortens the life of the device.

Among the objects of the present invention is to provide means for utilizing the fluid pressure from the pressure side of the pump, or motor to move the vanes radially outward against the ring and hold them against the forces acting to push them inwardly, but to reduce the pressure in the slots to such degree that the wear of the ring and vanes is minimized.

Another object of the invention is to provide means for reducing the fluid pressure under the vanes to a fixed proportion of that in the pressure side of the pump, which proportion will remain constant throughout the range of pressures developed by the pump or used in the motor.

Still other objects and advantages will readily occur to those skilled in the art upon reference to the following description and the accompanying drawings in which:

Figure 1 is a central longitudinal section of a pump embodying the present invention.

Figure 2 is a similar section on another plane.

Figure 3 is a plan view of the inner surface of the outlet cheek plate and cam ring.

Figure 4 is a similar view of the inlet cheek with the cam ring partially broken away.

Figure 5 is an elevation of a portion of a rotor.

Figure 6 is a fragmentary view of the same looking into a vane slot.

Figure 7 is a section on line 7—7 of Figure 5.

In the drawings, and the following description there is shown a pump but it should be understood that the improvements can be utilized in a motor with minor modification.

As shown in Figures 1 and 2, the pump comprises a two part housing 9 and 10 fixed together by screws 10A. In one portion of the housing is an inlet 10B and in the other an outlet 10C, and between suitable internal shoulders are held the working parts of the pump consisting of an inlet cheek plate A, an outlet cheek plate B and a cam ring or vane track C, the latter enclosing a rotor D.

The rotor D is splined on a drive shaft E mounted in suitable bearings F, G and H in the housing and in the two cheek plates and consists of a metal disc of such thickness as to have a sliding fit between the cheek plates A and B and provided in its periphery with radial slots 15 in which are slidably fitted vanes 16 (see Fig. 5). Only one vane is shown, but it should be understood that there will be as many vanes as there are slots.

As shown in Figures 5 to 7, the vane slots 15 comprise an outer narrow portion in which the vanes are fitted and these open at their bottoms to through passages 17 whose diameter is somewhat greater than the vane thickness. Further, communicating with each passage 17, is a short radial passage 18 in turn communicating with a lateral passage 18A opening to a side face of the rotor.

As shown in Figure 3, the cam ring C is so shaped that its inner periphery is divided into sections or zones, two of which 20 are diametrically opposite and are arcs while two other diametrically opposite sections or zones 21 are also arcs but of a smaller radius than that of the arcs 20. These several arcs are evenly spaced about the periphery and merge into each other by interposed short ramp portions 22. Since the vanes 16 contact the inner surface of ring C in operation, the difference in length of the radii of arcs 20 and 21 is the amount of radial movement of the vanes.

In the Figure 3 disclosure it will be noted that the respective zones are shown bracketed and reference characters K, L, M and N are used to indicate the respective zones corresponding to the sections 20, 21 and two ramp portions 22 of the inner periphery of the cam ring C, respectively.

Fluid inlet to the intravane spaces is through the slots 25 formed in the outer edges of the cheek plates and fluid outlet is through passages 26 through the cheek plate B near the edge. These passages 26, it will be noted, open to a shallow chamber 26A in cheek plate B, and that a similar chamber 26B is formed in cheek plate A to register therewith.

During operation of the device, as the rotor D rotates in the direction of the arrow shown in Figure 3, the vanes in the rotor as they pass from a zone N to a zone K are taking in the fluid which is held between the vanes until they reach a zone M where the fluid is discharged. During their traversal of the zone L, the vanes are held back in their slots by the shorter radius portion 21 of the inner peripheral surface of the cam ring C until they reach the next fluid intake zone N.

The cheek plate A, as shown best in Fig. 4, is provided on its inner face with a plurality of depressions or shallow arcuate chambers 30 and 31, of which two, 30, are located radially inward of the inlet slots 25 and in such radial location as to open to the rotor passages 17. These chambers 30 are also open to the pump inlet chamber 10B through passages 30A. The chambers 31 are located radially inward from the outlet passages 26 and are connected through a passage 31A to an extension of the outlet chamber 26B beyond the passages 26.

Cheek plate A is also provided with an annular recess 35 formed around the central opening on its inner face in which is set a ring 36 shown in cross section in Figure 2. This ring, as shown, is provided in its outer periphery with a groove which when the ring is pressed in place, forms an annular chamber 36A and is also axially slotted as at 36B, the slots being open to chamber 36A and to the adjacent face of the rotor D.

The slots 36B are so located as to open to and register with the passages 18A shown in Figures 5 and 7 in the rotor D. The chamber 36A is in communication with the outlet chamber 26B through a small passage 37 and also with an inlet slot 25 through a passage 38 and branch opening 38A. The passages 37 and 38 are preferably

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of the same length and diameter and their area somewhat less than the cross-sectional area of annular chamber 36A.

In the operation of the pump, the rotor being moved in the direction indicated by the arrows in Figures 3 and 4, fluid will be drawn in between the vanes from inlets 25 as the vanes move from an arc 21 to an arc 20 and at the same time fluid is drawn into passages 17 under the vanes in the rotor through passages 30A and chambers 30 in the cheek plate A. As soon as a passage 17 leaves the depression or chamber 30, the small passage 18A opens to a slot 36B and this registry is maintained until the vane in the particular slot reaches the adjacent end of the outlet chamber 26B. Then, as the passage 18A leaves the slot 36B, the passage 17 begins to register with the depression or chamber 31. This process is of course repeated with each vane in turn and again repeated as the rotor moves around over the succession of slots and chambers.

As will be noted, the vanes will be held out against the cam ring by the pressure of the fluid in the slots derived from the pressure of fluid in the outlet chamber, first through the direct passages 31A and depressions or chambers 31 and, second, through the passage 37, chamber 36A and passages 18A and 18.

The pressure in passage 31A is slightly higher than the pressure in the outlet since the passage connects with the outlet chamber 26B at the end of the latter at a point beyond the outlets 26. This end of the outlet chamber is therefore a pocket in which the pressure is slightly higher due to the inertia of the fluid.

The pressure from annular chamber 36A is, however, in the form shown only about half the full discharge pressure since, while the chamber 36A is always connected to the full discharge pressure, it is also always open to the inlet chamber. The fluid in the conduit formed by passage 37, chamber 36A and passage 38 is therefore subjected at one end to the full discharge pressure or higher and at the other end to substantially zero pressure. Accordingly, the fluid in chamber 36A, substantially at the middle portion of the conduit, will be under a pressure of about half the pressure of the discharge, and will remain so no matter what pressure may be developed by the pump.

By suitably varying the proportions of the several portions of the conduit 37, 36A, 38 a different ratio than that above described may of course be obtained if desired.

I claim:

1. In a fluid pump or motor of the vane type comprising a housing provided with a fluid inlet chamber and a fluid outlet chamber, one of which during operation contains fluid under a pressure greater than that in the other chamber, and enclosing working parts con-

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sisting of a pair of cheek plates, a rotor mounted for rotation therebetween, and provided with radially slidable vanes in slots therein, and a cam ring surrounding said rotor and contacting the edges of said vanes, means for maintaining said vanes in contact with said ring, said means comprising a constantly open conduit leading from the high pressure to the low pressure chamber and a second conduit intermittently connecting an intermediate portion of the first conduit to said slots under said vanes.

2. In a fluid pump or motor of the vane type having an inlet chamber and an outlet chamber one of which, during operation, contains fluid under a pressure higher than that in the other, a rotor comprising a metal disc having in its periphery radially arranged slots in which are radially slidable vanes, and a cam ring surrounding said rotor and provided on its inner periphery with cam surfaces contacting said vanes and controlling the movement thereof, means for forcing said vanes outwardly to maintain contact with said ring, said means comprising an annular chamber, a constantly open conduit leading from said high pressure chamber to said annular chamber, a second constantly open conduit leading from the annular chamber to the lower pressure chamber, and conduit means intermittently connecting said annular chamber to the vane slots under the vanes.

3. In a fluid pump or motor of the vane type comprising a housing provided with a fluid inlet chamber and a fluid outlet chamber, one of which during operation contains fluid under a pressure greater than that in the other chamber and enclosing working parts consisting of a pair of cheek plates, a rotor mounted for rotation therebetween, and provided with radially slidable vanes in slots therein, and a cam ring or vane track surrounding said rotor and contacting the edges of said vanes, means for maintaining said vanes in contact with said ring, said means comprising an annular chamber in the cheek plate adjacent the high pressure chamber and adjacent the axis of said plate, a constantly open conduit connecting said annular chamber with said high pressure chamber, a constantly open conduit connecting said annular chamber with the low pressure chamber and a third conduit intermittently connecting the annular chamber to the slots under the vanes.

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