

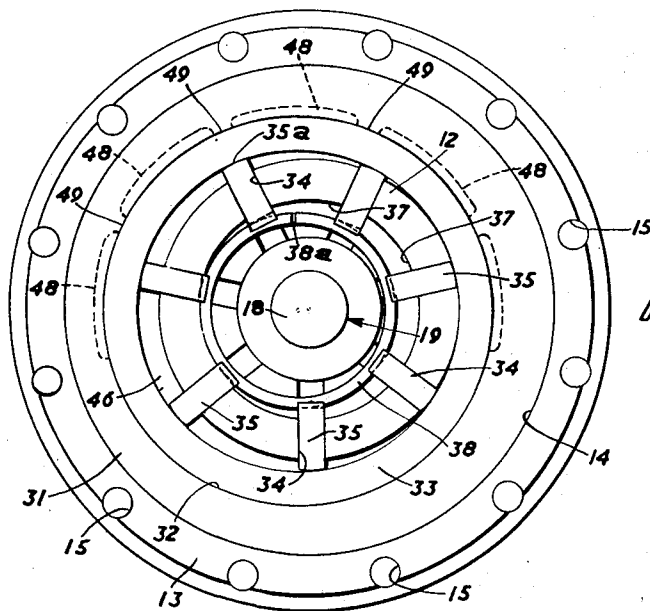
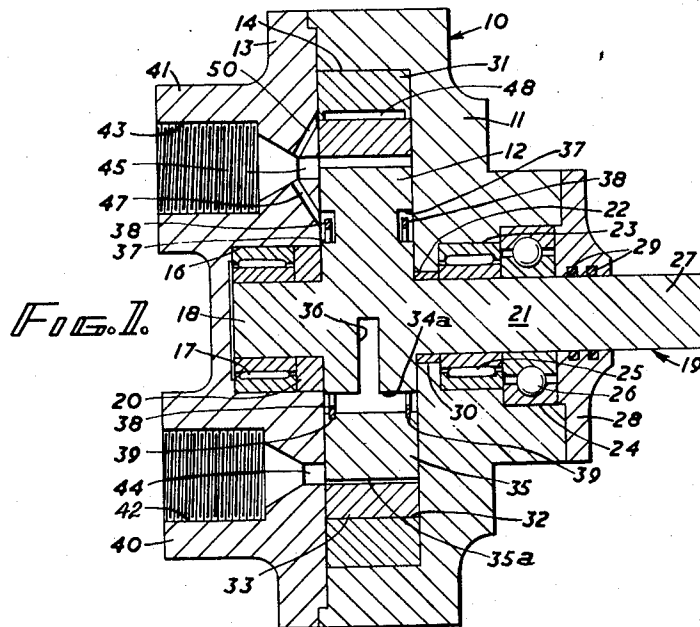
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VANE PUMPS

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VANE PUMPS

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This invention relates to rotary fluid displacement pumps of the sliding vane type, and has for one of its objects to provide an improved construction for reducing wear of, and friction between, relatively moving parts.

A further object is to provide a vane pump having a pressure chamber ring rotatively supported in the pump casing and disposed eccentrically of the rotor, and an area around the outer periphery of the pressure chamber ring on the pressure side of the pump which is placed in fluid communication with the pump delivery, said area being arranged under the action of fluid pressure thereon substantially to balance the fluid pressure reaction within the ring on the pressure side of the pump.

As a result of this arrangement the pressure chamber ring assumes a floating condition in dynamic equilibrium between the pump casing and the rotor and the resulting rotation of the pressure chamber ring thereby contributes to a reduction of wear and friction between the vanes and the interior surface of the ring.

One constructional embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 illustrates the pump in axial section, and

Figure 2 is an end elevation of the pump with the rotor housing removed.

Referring to the drawings, the pump casing 10 is formed in two parts and comprises a housing 11 for the pump rotor 12 and an end cover 13 which closes a cylindrical recess 14 formed in the housing, the latter and the end cover being spigoted together and secured to each other by bolts 15a passing through a ring of holes 15 drilled in the end cover. A blind bore 16 is formed centrally in the end cover 13 to receive an anti-friction bearing 17, which is preferably of the needle-roller type, for the inner portion 18 of the rotor shaft 19, such bearing being retained in position by a bush 20. The outer portion 21 of the rotor shaft 19 extends through an axial bore 22 in the housing 11, such bore being counterbored, as shown at 23 and 24, to receive an anti-friction bearing 25, similar to the inner bearing 17, to support the rotor shaft, and a further and preferably larger anti-friction bearing 26 to give additional support to the emergent driving end 27 of the rotor shaft. A gland ring 28 containing packing glands 29 through which the rotor shaft 19 passes closes the open outer end of the counterbore 24, and at the inner end of the rotor shaft a bush 30 is arranged between the inner bearing 25 and the rotor 12.

Within the cylindrical recess 14 in the housing 11 a fixed outer ring 31 is arranged, such ring having an eccentric axial bore 32 formed therein in which a single annular pressure chamber ring 33 is displaced from the axis of the pump rotor 12. The latter is formed with a plurality of angularly spaced radial slots 34 in each of which a sliding vane 35 is mounted, and at the base of each slot an inwardly projecting radial bore 36 is formed, such bores intercommunicating at the centre of the rotor shaft 19 to avoid trapping of fluid in the bases 34a of

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the slots as the vanes reciprocate and also to prevent the vanes exerting a pumping action on the fluid in such bases.

In addition to their interconnection by the bores 36, the bases 34a of the slots 34 are also interconnected by annular grooves 37 arranged one on each side of the rotor 12, and within each of such grooves a spring ring 38 of rectangular cross-section and having a gap 38a formed therein is mounted, each spring ring being retained in transverse alignment with the respective vane 35 by a groove 39 formed towards each side of the base of the latter so that the spring rings urge the vanes outwardly and maintain their tips 35a in contact with the inner cylindrical surface of the pressure chamber ring 33.

Two bosses 40, 41 formed on the end cover 13 are bored to provide connections 42, 43 which open respectively into arcuate suction and delivery ports 44, 45 adjacent opposite sides of the pump chamber 46 lying between the inner cylindrical surface of the pressure chamber ring 33 and the cylindrical outer surface of the rotor 12. The delivery port 45 also opens by means of a channel 47 into one of the annular grooves 37 in the side of the rotor 12 and thereby admits pressure fluid to the undersides of the vanes 35 to maintain their tips 35a in contact with the pressure chamber ring 33, this fluid loading of the vanes being additional to the loading imposed by the spring rings 38.

A number of angularly spaced arcuate chambers or pockets 48 are formed around the interior cylindrical surface of the fixed outer ring 31, such chambers or pockets being separated by intervening lands 49 which support the pressure chamber ring 33. Such ring, which is of substantially the same width as the width of the vanes 35, forms the entire peripheral wall of the pump chamber 46 from end to end of the latter. The pockets 48 are interconnected by means of channels 50, one of which is shown in Figure 1, with the delivery connection 43 so that fluid pressure acts on the outside of the pressure chamber ring 33 over an area which is determined by the extent of the pockets. This area is determined so that the fluid pressure acting thereon substantially balances the fluid pressure reaction on the inside of the pressure chamber ring 33, whereby this ring assumes a floating condition in dynamic equilibrium between the fixed ring 31 and the rotor 12, and the resulting rotation of the pressure chamber ring thereby contributes to a reduction of wear and friction between the vanes 35 and the interior surface of the ring. The chambers or pockets 48 are disposed substantially symmetrically about the arc defined by the pressure side of the pump.

I claim:

1. A rotary fluid displacement pump of the sliding vane type and comprising a pump casing having a vane-carrying rotor supported at opposite ends therein, a single pressure chamber ring, which forms the entire peripheral wall of the pump chamber from end to end of the latter rotatively supported in the pump casing and disposed around the rotor eccentrically thereof, means surrounding said pressure chamber ring for locating it against radial movement in the pump casing and means establishing fluid communication between the pump delivery and the outer periphery of the pressure chamber ring on the pressure side of the pump to apply fluid pressure to said outer periphery substantially to balance the fluid pressure reaction within the ring on the pressure side of the pump.

2. A pump according to claim 1, wherein said means for establishing fluid communication comprise a chamber arranged between the outer periphery of said pressure chamber ring and said pump casing, an inner wall of said chamber forming the means by which said fluid pressure reaction is balanced.

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3. A pump according to claim 1, wherein said means for establishing fluid communication comprise a plurality of angularly spaced chambers arranged between the periphery of said pressure chamber ring and said pump casing, lands which form part of said means for locating said pressure chamber ring and support the latter separating said chambers from each other, the inner walls of said chambers forming said means by which said fluid pressure reaction is balanced.

4. A vane pump comprising in combination a pump casing having a first chamber forming a cylindrical pump chamber, a rotor supported at its opposite ends in said first chamber, a plurality of vanes slidably mounted in radial slots in said rotor, a single pressure chamber ring, of substantially the same width as the width of said vanes, which forms the entire peripheral wall of said first chamber from end to end of the latter and is rotatably mounted in said pump casing and located against radial movement therein, said pressure chamber ring being disposed eccentrically of the rotor, a second chamber in said pump casing disposed on the pressure side of the pump and having an inner wall formed by the outer periphery of the pressure chamber ring, a delivery port connected to said first chamber, and a channel connecting said second chamber to said delivery port so that fluid pressure in said second chamber produces a force which tends to urge the pressure chamber ring in a diametrical direction towards the pressure side of the first chamber and balance the fluid pressure reaction within the pressure ring on the pressure side of the pump.

5. A vane pump comprising in combination a pump casing having a first chamber forming a cylindrical pump chamber, a rotor supported at its opposite ends in said

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first chamber, a plurality of vanes slidably mounted in slots in said rotor, a single pressure chamber ring, of substantially the same width as the width of said vanes, which forms the entire peripheral wall of said first chamber from end to end of the latter and is rotatably mounted in said pump casing and located against radial movement therein, said pressure chamber ring being disposed eccentrically of the rotor, a plurality of angularly spaced second chambers disposed substantially symmetrically about the arc defined by the pressure side of the pump and having their inner walls formed by the outer periphery of the pressure chamber ring, lands which support the pressure chamber ring and separate said chambers from each other, a delivery port connected to said first chamber, and a channel connecting said second chambers to said delivery port so that fluid pressure in said second chambers produces a force which tends to urge the pressure chamber ring in a diametrical direction towards the pressure side of the first chamber and balance the fluid pressure reaction within the pressure chamber ring on the pressure side of the pump.

References Cited in the file of this patent

UNITED STATES PATENTS

1,093,005	Myers	Apr. 14, 1914
1,728,321	Antonelli	Sept. 17, 1929
1,965,388	Ott	July 3, 1934
2,725,013	Vlachos	Nov. 29, 1955

FOREIGN PATENTS

14,968	Great Britain	Feb. 17, 1916
510,545	Great Britain	Aug. 3, 1939
835,271	France	Sept. 19, 1938