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ROTARY PUMP

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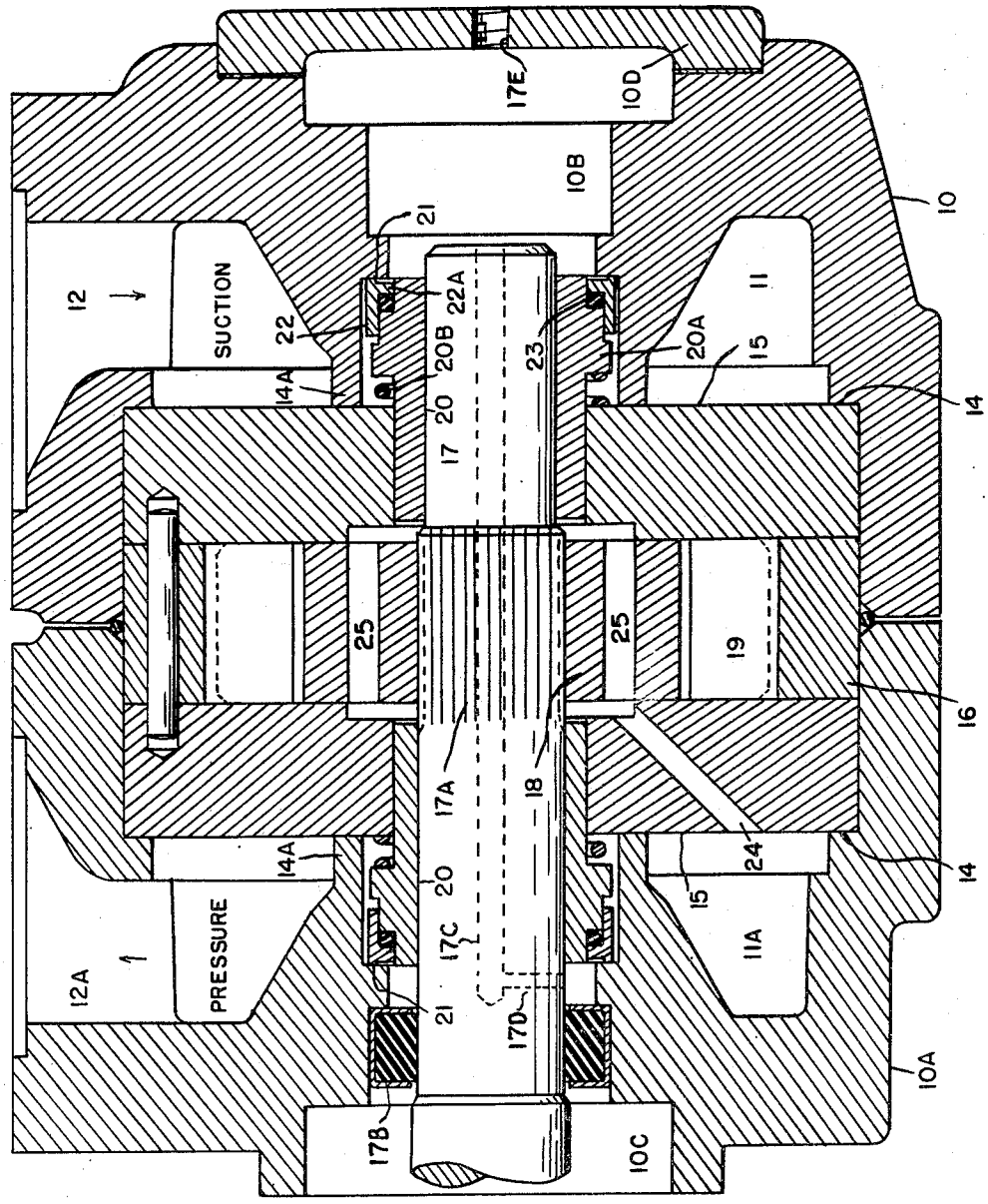

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ROTARY PUMP

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The present invention relates to rotary fluid pumps or motors and more specifically to bearings for the rotors of such devices.

In the operation of rotary fluid pumps and motors, especially where considerable pressure is developed, there is usually leakage at the rotor bearings, the fluid passing along the shaft inside the bearing and also along the outer surface of the bearing bushing since it is impracticable to so install such bushings as to prevent such leakage.

Among the objects of the invention is to provide a bearing for the rotors of such pumps or motors that will overcome such leakage and in addition be self-aligning.

Other objects and advantages will be apparent to those skilled in the art upon reference to the following description and the accompanying drawings in which the figure is a central longitudinal section of a rotary pump of the vane type showing bearings made in accordance with the present invention.

In the drawing, a rotary pump is shown in section. The pump is of the vane type. The particular pump shown consists of substantially identical end housing members 10 and 10A, adapted to be held together by suitable bolts or screws (not shown), each member being provided with a fluid chamber 11 and 11A and with a fluid passage 12 and 12A opening thereto, the passage 12 being the pump inlet and the passage 12A being the outlet. Around the outer portion of the chambers 11—11A each of the end members is provided with a shoulder 14 which is coaxial with the shaft 17 and concentric with an annular flange 14A of smaller diameter. Respective flanges 14A separate the suction chamber 11 and the pressure chamber 11A from chambers through which the shaft 17 passes, as will later be described. Between the shoulders 14 and between the flanges 14A are clamped two ported cheek plates 15 and an interposed pump ring 16, this latter providing the peripheral wall of the pump chamber of which the side walls are the plates 15. Within the pump chamber is mounted for rotation with shaft 17, a rotor 18 carrying in suitable slots radially arranged slidable vanes 19.

The details of the porting of plates 15 are not shown as they do not constitute part of the invention. It seems sufficient to state that the coaction of the rotor, the ring 16 and plates 15 control the flow of fluid through the pump.

As shown, the shaft 17 extends through member 10A from a suitable driving motor (not shown) and is splined at 17A in rotor 18. The free end of shaft 17 extends into member 10 and bearing bushings 20 for the shaft are supported in, and rather freely fit central bores formed in plates 15.

As shown, the members 10—10A are bored axially for the reception of the shaft and bushings and provide chambers 10B and 10C, the latter being open to receive the driving end of the shaft and the former 10B being

closed by a suitable plate 10D. Each of these axial bores is provided with an annular shoulder 21, at a suitable distance from flange 14A, providing an abutment for the bushing 20 and its associated elements. It will now be clear how the flanges 14A isolate the suction and pressure chambers each from one of the spaces around the shaft 17. Port 24 in one of plates 15 and ports 25 through rotor 18 admit pressure fluid from the pressure chamber 11A to react outward on the inner ends of bushings 20.

The bushings 20 are each provided on their outer surface with a stepped flange 20A between which and the adjacent plate 15 is a suitable spring 20B tending to force the bushing toward shoulder 21. Surrounding the bushing and slidably fitting the lower part of flange 20A is a short sleeve or ring 22, L-shaped in cross section with the base of the L forming an inwardly projecting flange 22A, while between the flange 22A and the adjacent face of flange 20A is an O-ring gasket 23. The ring 22 contacts the shoulder 21.

The bushings 20, despite their free fits in plates 15 do not rotate with the shaft 17. They have substantial friction with shoulder 21 under the hydraulic pressure to which they are subject. The springs 20B also develop some friction. Thus, the parts 20 are bearing bushings with a secondary sealing function.

In the operation of the pump, the high pressures developed in the pump chamber will thrust the bushings outwardly against the shoulder 21, a small amount of movement being allowed by the compression of the O-ring 23 which, however, effectively seals against leakage between the bushing 20 and ring 22. Leakage around the outside of ring 22 is substantially eliminated by accurate surfacing of the shoulder 21 and the contacting end of ring 22, the freedom of alinement afforded to ring 22 by O-ring 23, and the loading afforded by spring 20B and fluid pressure. It is preferred to relieve the end surface of ring 22 so as to increase the unit pressure against shoulder 21.

Since substantially no leakage outside of the bushings 20 is permitted, their fit into plates 15 may be such that a small play may be allowed and consequently provide for self-alignment of the bearings.

A small amount of the fluid being handled by the devices will pass along the bearing surface and will collect in chamber 10B and in that portion of 10C sealed off behind the conventional oil seal 17B. This fluid in chamber 10C is conducted to chamber 10B through the axial bore 17C and lateral passage 17D in the shaft 17. From the chamber 10B it will be led out through a suitable drain conduit indicated by the threaded opening 17E in plate 10D.

I claim:

1. A self-aligning, self-sealing bearing structure for a rotary shaft which passes through an opening in the wall of a pressure chamber, which comprises in combination with said wall and shaft, means defining a seal chamber surrounding said opening on the outer side thereof and having an annular shoulder spaced from and surrounding the shaft and presented toward the interior of said chamber; a bearing bushing surrounding said shaft and freely fitting in said opening, said bushing being in the form of an elongated sleeve with an encircling flange at its end remote from the pressure chamber said flange being within said seal chamber; a ring having a flange which extends radially inward, the ring being in telescopic relation with a portion of said encircling flange, the ring having an annular surface adapted to mate with said annular shoulder and form a seal; a resilient annular gasket confined between said flanges; and a coil compression spring encircling said bushing

and reacting between the flange thereon and a portion of said wall.

2. A bearing bushing assembly comprising in combination an elongated sleeve member whose bore is adapted to serve as a bearing, said member having near one end an encircling flange; a ring having a flange which extends radially inward, the ring being in telescopic relation with a portion of said encircling flange, said ring when assembled with the sleeve affording a sealing surface at the end of the sleeve member; a resilient annular gasket confined between the flanges in the ring and sleeve respectively; and a coil compression spring encircling said sleeve and adapted to react on that side of the sleeve flange which is remote from the ring.

3. A self-aligning and self-sealing bearing structure for a rotary shaft which extends through an opening in the wall of a pressure chamber, comprising in combination with said wall and chamber, a sleeve-like bearing bushing structure surrounding said shaft and freely fitting said opening around the shaft, the inner end of said bushing structure being subject to pressure within the chamber, whereby it is loaded in an outward direction; a sealing ring telescopically mounted on the outer end of said bushing; a resilient gasket between said ring and bushing; and means affording an enclosure encircling the shaft and having an annular shoulder engaged by the ring to seal the outer end of the bushing when loaded by said pressure.

4. An expansible chamber device of the vane type comprising in combination a rotary shaft; a vaned rotor turning with said shaft; cheek plates and a ring enclosing said rotor and defining therewith at least one working space, said cheek plates having coaxial central bores larger than said shaft and through which said shaft extends; housing means embracing said cheek plates and ring and holding them fixedly in assembled relation, said housing means and cheek plates defining an annular inlet chamber and an annular discharge chamber on opposite sides of said rotor and cheek plates, and also defining shaft chambers each surrounded by a corresponding one of said annular chambers and isolated therefrom, each shaft chamber having an annular shoulder presented toward the interior of the housing means; bearing bushings in which said shaft rotates, one bushing freely mounted in the central bore of each of said cheek plates, each axially shiftable on its shaft and each formed at its outer end to seal against a corresponding one of said annular shoulders; and yielding means urging said bushings toward respective annular shoulders.

5. An expansible chamber device of the vane type comprising in combination a rotary shaft; a vaned rotor turning with said shaft; cheek plates and a ring enclosing said rotor and defining therewith at least one working space, said cheek plates having coaxial central bores larger than said shaft and through which said shaft extends; housing means embracing said cheek plates and ring and holding them fixedly in assembled relation, said housing means and cheek plates defining an annular inlet chamber and an annular discharge chamber

on opposite sides of said rotor and cheek plates, and also defining shaft chambers each surrounded by a corresponding one of said annular chambers and isolated therefrom, each shaft chamber having an annular shoulder presented toward the interior of said housing means; bearing bushings in which said shaft rotates, one bushing freely mounted in the central bore of each of said cheek plates, each axially shiftable on the shaft and each formed at its outer end to seal against a corresponding one of said annular shoulders; and yielding means urging said bushings toward respective annular shoulders, said yielding means including ports for admitting pressure fluid from one of said annular chambers to react against the inner ends of said bushings.

6. An expansible chamber device of the vane type comprising in combination a rotary shaft; a vaned rotor turning with said shaft; cheek plates and a ring enclosing said rotor and defining therewith at least one working space, said cheek plates having coaxial central bores larger than said shaft and through which said shaft extends; housing means embracing said cheek plates and ring and holding them fixedly in assembled relation, said housing means and cheek plates defining an annular inlet chamber and an annular discharge chamber on opposite sides of said rotor and cheek plates, and also defining shaft chambers each surrounded by a corresponding one of said annular chambers and isolated therefrom, each shaft chamber having an annular shoulder presented toward the interior of said housing means; bearing bushings in which said shaft rotates, one bushing freely mounted in the central bore of each of said cheek plates, each bushing being axially shiftable on the shaft and having an annular gasket-seat near its outer end; resilient gaskets on said seats; sealing annuli sustained by said gaskets and dimensioned to seal against respective ones of said annular shoulders; and yielding means urging said bushings toward respective annular shoulders.

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