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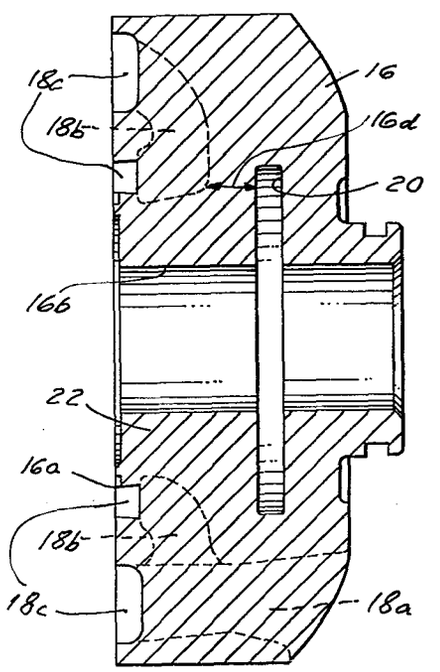
(54) Fluid pressure energy translating device.

(57) A fluid pressure energy translating device comprising a housing, a rotating group rotatably mounted for rotation within the housing. The housing includes a valving face (16a) engaged by the rotating group. The housing has portions (22) spaced from the valving face (16a) which are undercut to define grooves (20) so that portions of said valving face can move axially with respect to the rotary group to compensate for mechanical, fluid dynamic and thermal effects imposed by the fluid displacement and pressure.



EP 0 095 686 A2

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TITLE MODIFIED
see front page

Power Transmission

This invention relates to power transmissions and particularly to fluid pressure energy translating devices such as pumps or motors, especially of the rotary kind.

In fluid pressure energy translating devices such as pumps or motors, a rotary group is usually provided in a housing that includes an inlet and an outlet and rotation of the rotary group causes the fluid to be pumped out of the device in the case of a pump or causes rotation of the rotor upon applying pressurized fluid to the device in the case of a motor.

In one type of such device a form of pump and motor utilized in hydraulic power transmission comprises a rotor having a plurality of spaced radial vanes rotatably therewith and slideable relative thereto in slots provided in the rotor. The rotor and vanes cooperate with the internal contour of a cam to define one or more pumping chambers between the outer periphery of the rotor and the cam contour through which the vanes pass carrying fluid form an inlet port to an outlet port. Cheek plates are associated with each side of the cam and rotor through which the fluid flows to and from the rotor. Such sliding vane motors and pumps are well known as shown in US-A-2,919,651, 2,967,488 and 3,223,044 which are incorporated herein by reference.

In another type of pump and motor, meshing gears are provided in the housing which function to define

chambers that can operate as pumping chambers in the case of a pump or as pressure chambers in the case of a motor. Such an arrangement is shown in US-A-3,778,202 which is incorporated herein by reference.

One common problem to such pressure energy translating devices is the tendency for wear of the surfaces that function as valve faces engaging the rotary group. In extreme instances, the portions defining the valve faces may bind and cause mechanical seizure between the valve face and the rotary group.

In order to alleviate this difficulty, one of the cheek plates is made axially movable (US-A-2,919,651) or the cheek plates are of sheet material (US-A-3,752,609) which can flex. However, this makes it necessary to use a pump or motor housing which is more complex than without such cheek plates described above so that the device is much more expensive.

Accordingly, among the objects of the present invention are to provide a pressure energy translating device which will obviate excessive wear; which will reduce the occurrences of mechanical seizure; which permits the use of less expensive materials; and which achieves the objectives at minimal cost.

In accordance with the invention the housing of the fluid pressure energy translating device includes under cut portions defining grooves spaced from the valving face so that portions of the valving face can move axially with respect to the rotary group to compensate for mechanical, fluid dynamic and thermal effects imposed by the fluid displacement and pressure.

Fig. 1 is a diagrammatic sectional view of a pressure energy translating device embodying the invention;

Fig. 2 is a sectional view on an enlarged scale of a portion of the device taken in a radial plane different from that of Fig. 1;

Fig. 3 is a sectional view of another form of pressure energy translating device, and

Fig. 4 is a sectional view in direction of arrows IV-IV.

Referring to Fig. 1 and 2, the pressure energy translating device comprises a sliding vane pump or motor 10 that includes a housing which has two cover like parts 11, 11a which together contain a cam ring 12 and cheek plates 16, 17. Within the internal contour 12a of the cam ring 12, a rotor 13 is arranged having a plurality of vanes 14 slideable in slots of the rotor 13. One end of each vane 14 is engaged by springs 14a whereas the other radially outer end engages the internal contour 12a and cooperates therewith. Between the periphery of the rotor 13 and the cam contour 12a, one or more pumping chambers are defined which carry fluid when the vanes 14 pass between valving faces 16a, 17a from an inlet port 18 to an outlet port 19. The rotor 13 is mounted on a shaft 15 journalled in the housing parts 11, 11a and extends through openings 16b, 17b in the cheek plates or members 16, 17 having the valving faces 16a, 17a which engage the rotating group defined by the rotor and vanes. The cheek plates 16, 17 have passages 18a, 18b, 18c and 19a, 19b, 19c, respectively, which connect the ports 18, 19 to the pumping chambers and include axially extending portions 18a, 19a, radially - circumferencially extending portions 18b, 19b and circumferencially extending portions 18c,19c.

In accordance with the invention, a recess in the form of an annular groove 20 communicating with the opening 16b through at least plate 16 is provided and extends radially parallel to the valving face 16a of the plate 16. There is a distance 16d between the groove 20 and the radially-circumferencially extending portions 18b of the passages which is small enough to allow flexing movement of a cheek plate portion 22 arranged between groove 20 and valving face 16a. In use, the recess or

groove 20 permits axial adjustment of portion 22 of the cheek plate 16 between the valving face 16a and groove 20 surrounding the shaft opening 16b in the cheek plate 16 so that portion 22 may move axially relative to the rotary group minimizing wear and mechanical seizure due to mechanical, fluid dynamic and/or thermal effects imposed by the fluid displacement and pressure.

By providing the annular recess, it is possible to make the members 16, 17 of a less heat conductive material so that cast iron can be used rather than aluminium, which is more costly.

By permitting the axial adjustment of the valving face 16a relative to the rotary group 13, 14, the normal lubricant film between the valving face and the rotary group is better maintained.

The annular recess 20 can be provided in one or both of the cheek plates or members 16, 17.

In the form of device shown in Fig. 3 and 4, the device comprises a gear pump or motor 25 which includes a front housing 30, a center housing 30a, and a cover 30b in which spaced shafts 26,27 with gears 28,29 thereon operate. Portions of the front housing 30 and a valving plate 37 define valving faces 31, 32 that are engaged by the rotary group comprising the two meshing gears 28, 29. The housing or casing 30, 30a, 30b has an inlet port and an outlet port (not shown) which are connected to the space where the gears 28, 29 mesh.

In accordance with the invention, an annular recess or groove 33 is provided in front housing 30 surrounding each shaft 26, 27 and is spaced from the valving face 31 by a distance 30d so that a portion 35 of the front housing 30 between the valving face 31 and the recess or groove 33 can flex and is free to axially adjust to the mechanical, fluid dynamics and/or thermal conditions. When a separate valve plate 37 is provided as is customary in gear pumps, no relief groove will be required on the side (30b) of the rotary group which is provided with the valve plate 37.

Claims

1. A fluid pressure energy translating device comprising
a body (11, 11a; 30, 30a, 30b),
a rotating group (13, 14, 15; 26, 27, 28, 29) rotatably mounted for rotation within the body (11, 11a; 30, 30a, 30b);
means (16, 17; 30, 37) defining valving faces (16a, 17a; 31, 32) engaged by the rotating group (13, 14, 15; 26, 27, 28, 29),
characterized by
portions (22; 35) of said means (16, 17; 30) being undercut by at least a groove (20; 33) spaced from said valving face (16a, 17a; 31) such that portions of said valving face (16a, 17a; 31) can move axially with respect to the rotary group (13, 14, 15; 26, 27, 28, 29).

2. The fluid pressure energy translating device set forth in claim 1
wherein the rotating group (13, 14, 15) includes a shaft (15), said undercut portions (22) defining an annular groove (20) communicating with the shaft (15) of the rotary group (13, 14, 15).

3. The fluid pressure energy translating device set forth in claim 1
wherein said rotary group comprises
a rotor (13),
a plurality of vanes (14) rotatably with the rotor (13) and slideable relative thereto in slots in the rotor (13), one end of each vane (14) engaging an internal contour (12a) in the body.

4. The fluid pressure energy translating device set forth in claim 3
wherein said means defining a valve face (16a, 17a) comprises cheek plates (16, 17) in the body.

5. The fluid pressure energy translating device set forth in claim 1
wherein said rotary group comprises a plurality of gears

(28, 29).

6. A fluid pressure energy translating device set forth in claim 1 wherein said portions of said body spaced from said valving face being undercut defining an annular groove (20) communicating with the shaft of the rotary group, such that portions of said valving face can move axially with respect to the rotary group.

7. A fluid pressure energy translating device set forth in claim 1 wherein said rotating group rotatably mounted for rotation within the body, comprises intermeshing gears (28, 29) and shafts (26, 27) on which said gears are mounted.

8. A fluid pressure energy translating device set forth in claim 4 wherein said cheek plates (16, 17) include passage means (18a, 18b, 18c), characterized in that said groove (20) has a distance (16d) from said passage means (18a, 18b, 18c) which is small as to allow flexing movement of said undercut portion (22).

9. A fluid pressure energy translating device set forth in claim 5 wherein said body (30, 30a, 30b) includes at least one valving face (31), characterized in that said groove (33) has a distance (30d) from said valving face (31) which is small as to allow flexing movement of said undercut portion (35).

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FIG.1

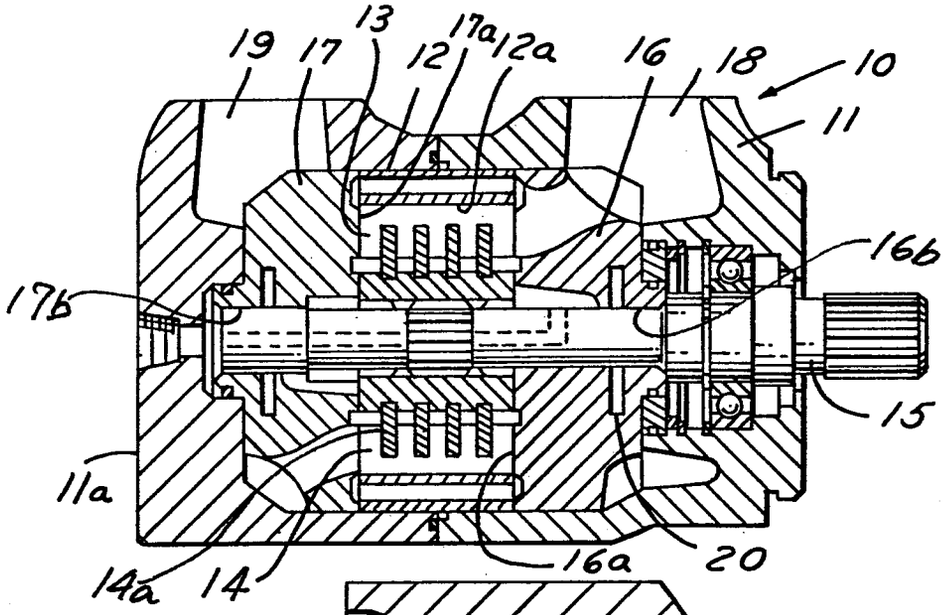

FIG.2

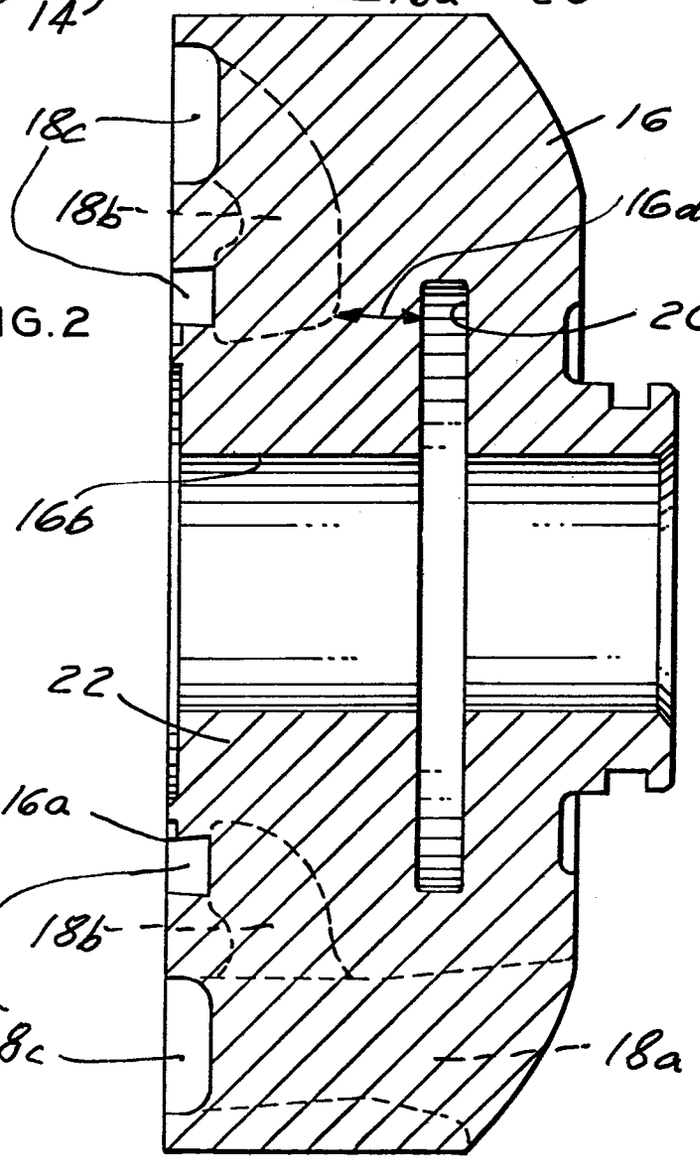

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FIG.3

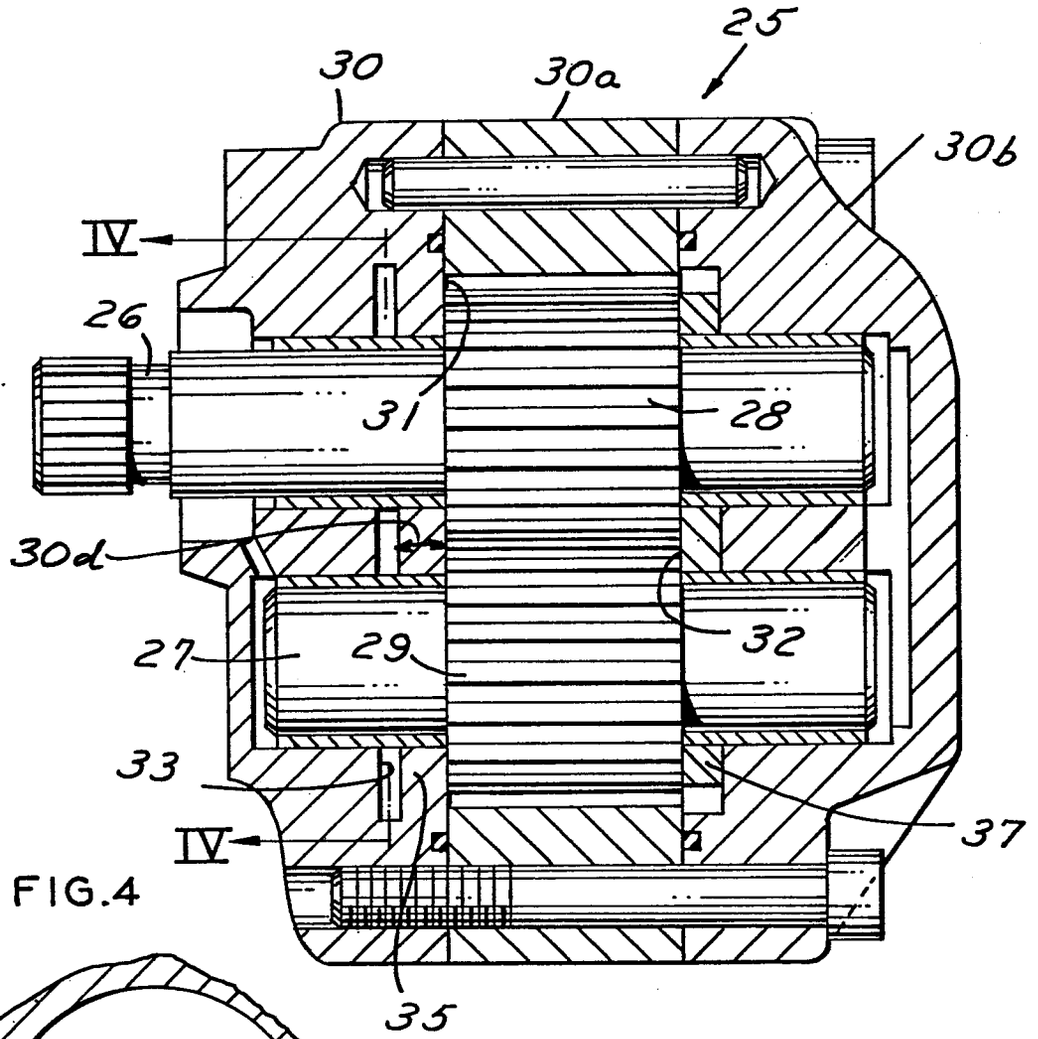

FIG.4