June 17, 1969 F. BAINES ETAL 3,450,057

DISPLACEMENT PUMP AND/OR MOTORS HAVING SLIDING VANES

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Fig. 1.

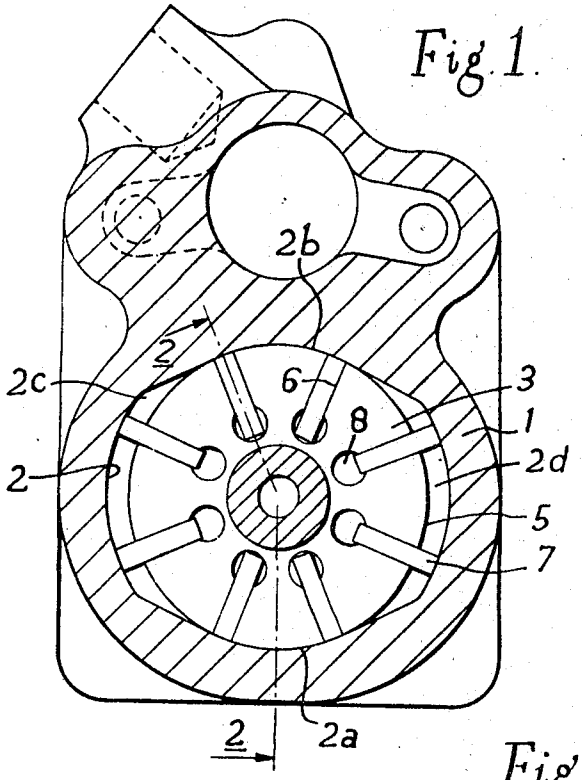
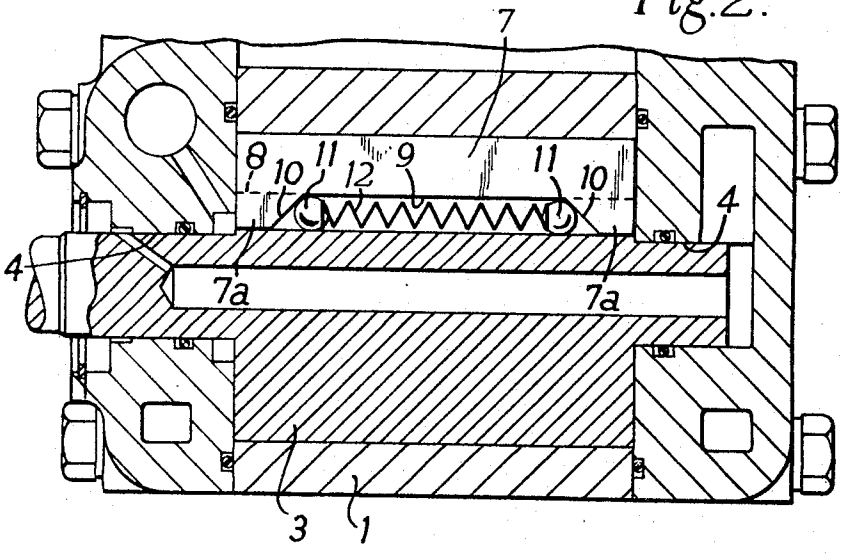


Fig. 2.



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DISPLACEMENT PUMPS AND/OR MOTORS HAVING SLIDING VANES

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U.S. Cl. 103—136 4 Claims

ABSTRACT OF THE DISCLOSURE

A radial reciprocating-movable-vane pump wherein each vane is biassed radially outwardly by means of an axially disposed helical spring which spring acts, through balls, upon a pair of inclined surfaces which project from the radially inner end of each vane.

This invention relates to displacement pumps or motors hereinafter jointly called displacement machines of the kind in which a working space between the circumference of a rotary member and a bore in a stationary member or generally between the circumference of one and the bone of the other of two members having coincident or parallel axes and performing relative rotation, is subdivided into chambers by vanes which are mounted in recesses of one of the members, and which project, generally radially of the axis of its rotation, to the circumference of the other member, the most common case being that in which the vanes are accommodated in radial slots of a cylindrical rotor and project from these slots into contact with the circumference of a stator bore which is non-circular or eccentric to the rotor axis. It is well known to provide a spring loading for the vanes in order to keep them in contact with the cooperating surface of the other member, but with the usual arrangement, which provides helical compression springs extending radially in the slots it is difficult to provide sufficient spring power to maintain reliable contact throughout the radial stroke of the vanes especially in view of the fact that it is undesirable to allow the contact pressure between the vanes and the cooperating surface to increase too much near the fully retracted position of the blades. The present invention has for an object to alleviate this problem.

According to the invention the radial application pressure of each vane is provided by a helical spring which extends axially of the pump and which cooperates by a steel ball or other thrust block with a suitably inclined root portion of the vane. Preferably both ends of the spring are arranged to cooperate by steel balls or other thrust blocks with suitably inclined end surfaces of an axially extending recess provided at the inner end of each vane. Alternatively the inclined surfaces may be secured in the rotor.

One embodiment of the invention is illustrated by way of example in the accompanying drawing in which

FIGURE 1 is an elevation, partly in section, at right angles to the axis of rotation, of one form of vane-type pump incorporating the invention, and

FIGURE 2 is a scrap section on line 2—2 of FIGURE 1.

Referring now to the drawing, a rotary vane-type machine has a housing 1 formed with a cylindrical operating chamber 2 of oblong cross-section, in which a circular-section rotor body 3 is mounted for rotation in bearings 4. The circumference 5 of the rotor body extends in close contact with two opposite sections 2*a* and 2*b* of the wall of the chamber 2, thus creating two pockets 2*c* and 2*d* respectively between the circumference 5 of the rotor

body and the end portions of the elongated chamber 2. In order to enable fluid to enter at one side and be expelled on the other side of each pocket 2*c* and 2*d*, flat vanes 7 are slidably accommodated in radial slots 6 of the rotor 3 so as to enable the vanes to recede sufficiently to pass along the portions 2*a* and 2*b* of the chamber 2 and to move outwardly to remain in contact with the wall of the elongated chamber 2 in the pocket-like end portions 2*c* and 2*d*. Each slot 6 penetrates, at its radially inner end a cylindrical bore 8 extending longitudinally of the rotor, symmetrically to the slot 6, and having a diameter somewhat greater than the width of the slot, and each vane 7 is formed at its end facing the bottom of the slot 6 with a longitudinal recess 9 extending throughout the width of the vane and having a depth at least equal to the diameter of the bore 8. The recess 9 is terminated by two end surfaces 10 which are inclined to face each other. Each inclined surface 10 is provided on an inwardly projecting ear 7*a* of the vane 7, and two steel balls 11, fitting loosely into the diameter of the bore 8, are arranged in each bore inside the recess 9 and constitute cam elements which are urged respectively against the surfaces 10 by a helical thrust spring 12 accommodated in the bore 8 and supported with each end on one of the balls 11.

It will be readily appreciated that under the thrust of the spring 12 the two balls 11 are urged against the surfaces 10 so that, with the cooperation of the reaction force at the bottom surface of the slot, each ball exerts an outwardly acting force on the vane 7, and it will be also appreciated that, more particularly in a rotor whose axial length is substantially greater than the depth of the slots 6, a spring 12 of considerable length can be accommodated without difficulty, enabling the outwardly acting force to be maintained reasonably constant over the required length of stroke. Although the inclined surfaces 10 are shown as rectilinear surfaces inclined at 45° to the axis of the rotor, their shape may vary in order to ensure a suitable dependency of the application pressure upon the radial position of the vane in its slot, and if desired, the inclined surfaces may be provided on elements fixed in the rotor, in which case the balls are urged by the spring between the cam surfaces and the flat root of the vane.

What we claim is:

1. A displacement machine of the kind in which a working space between the circumference of one and the bore of the other of two mutually rotatable members having axes extending in the same direction, is subdivided by vanes slidable in radial slots of one of the members to maintain contact with the other member, wherein each vane-and-slot assembly of said one member is formed with a guide surface in one of the elements of said assembly, said guide surface extending in the direction of said axes, and the other element of said assembly is formed, at its side facing said one element, with a pair of surfaces, one adjacent each end of said member, the two surfaces of said pair facing each other and being inclined in opposite directions relative to the direction of said axes, the machine including for each said assembly a pair of thrust blocks slidable on said guide surface in the direction of said axes, and a helical spring interposed between said two thrust blocks to urge said vanes into contact with said other member by wedge action of each block with said guide surface and with one of said inclined surfaces.

2. A displacement machine as claimed in claim 1, wherein each said inclined surface is provided on a radially projecting ear portion of the vane.

3. A displacement machine as claimed in claim 1 or claim 2, wherein the thrust blocks are ball-shaped.

4. A displacement machine as claimed in claim **1** or claim **2**, wherein the thrust blocks are balls of a diameter greater than the thickness of the vanes, the balls and helical springs associated with each vane being accommodated in an axial bore of said one member, arranged symmetrically to the centre plane of the slot accommodating the vane.

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