Feb. 25, 1969 R. D. WALTER 3,429,269

FLUID PUMPS AND MOTORS

Filed Aug. 19, 1966 Sheet 1 of 2

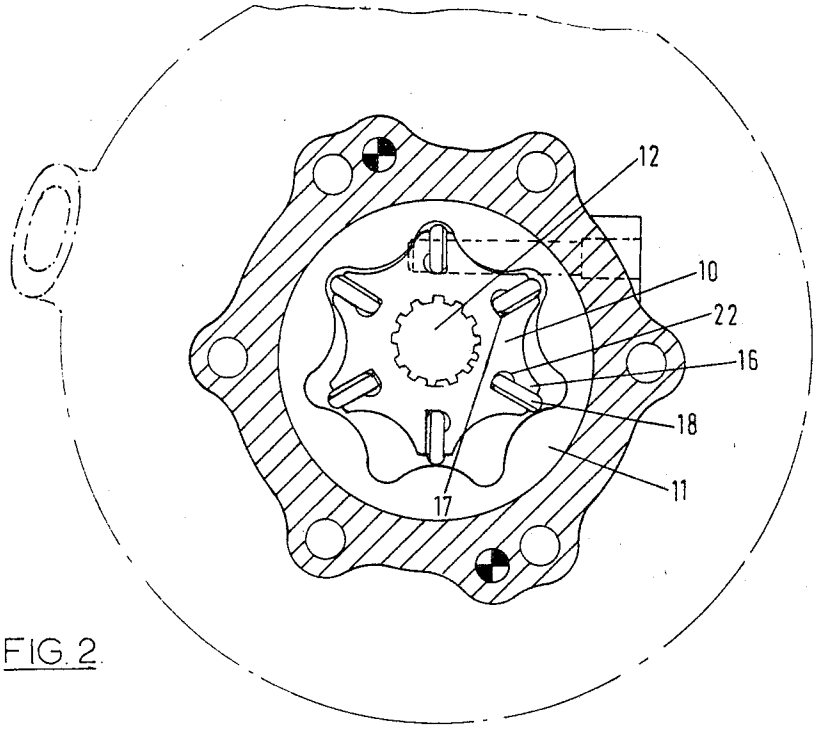


FIG. 2

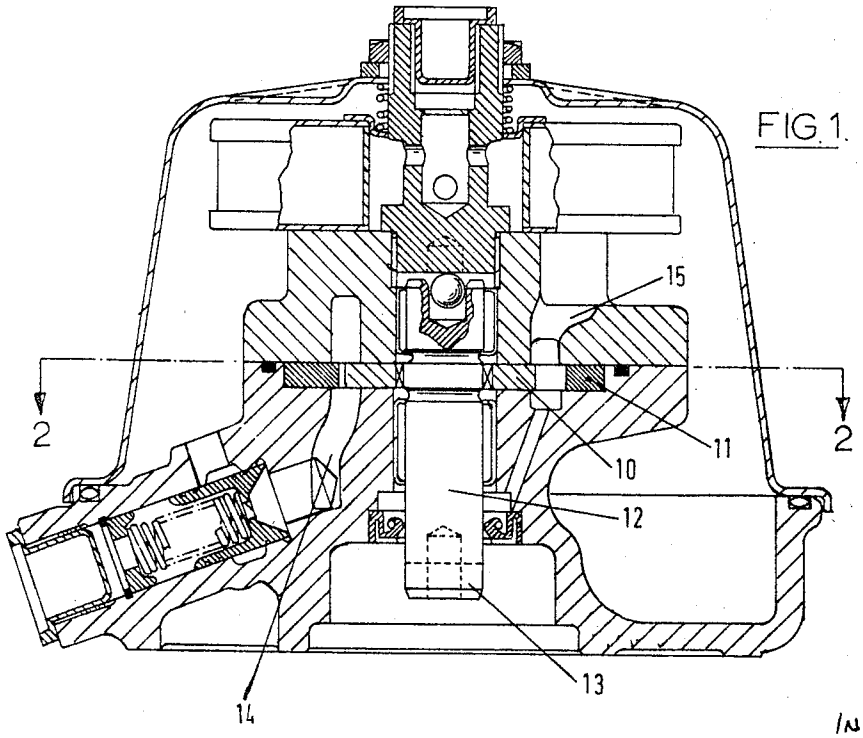


FIG. 1

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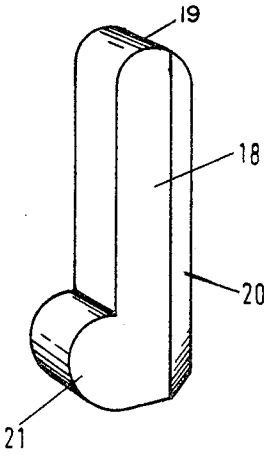


FIG. 3

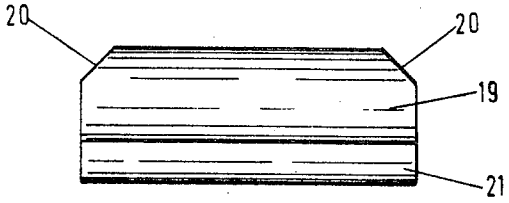


FIG. 4

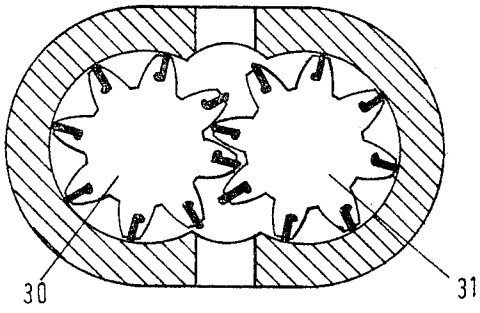


FIG. 5

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3,429,269

FLUID PUMPS AND MOTORS

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U.S. Cl. 103—126 1 Claim
Int. Cl. F04c *1/08, 17/10;* F02b *55/02*

ABSTRACT OF THE DISCLOSURE

Two meshing gears, the teeth of at least one of which are each provided with a radial recess accommodating a radially slidable sealing vane. The inner end of the recess has a pocket at one side thereof to receive a lateral projection on the sealing vane, which limits outer sliding of the vane so that drive is transmitted by interaction of the gear teeth rather than by the vanes which function for sealing purposes only.

This invention relates to fluid pumps and motors.

Rotary pumps and motors comprising an inner gear and an outer gear eccentrically mounted for rotation are known.

Generally, it is necessary to use generated surfaces for the co-operating portions of the gears in order to provide the necessary sealing to prevent leakage of operating fluid past the gear teeth. The manufacture of such pumps and motors is extremely costly because of the necessity of machining a number of generated surfaces. It has also been proposed to incorporate sealing vanes having generated outer surfaces in the teeth of the inner gear.

It is an object of the present invention to provide an improved rotary pump or motor which does not necessarily require the use of generated surfaces.

According to the invention a rotary pump or motor comprises two gears mounted in meshing relationship for rotation relative to each other, each of the teeth of at least one of said gears being provided with a slidable sealing vane, means for urging each vane into sealing relationship with the other gear surface and means associated with each vane to limit the extent to which it can project from the gear surface.

A preferred embodiment of the invention is hereinafter particularly described with reference to the accompanying drawings, in which:

FIGURE 1 is a longitudinal section of a part of a pump constructed in accordance with the present invention;

FIGURE 2 is a section on the line 2—2 of FIGURE 1;

FIGURE 3 is a perspective view of a vane on an enlarged scale;

FIGURE 4 is a plan view of a vane on an enlarged scale; and

FIGURE 5 is a diagrammatic representation of a further embodiment of the invention.

As shown in FIGURE 2 the inner gear comprises a rotor **10** having six teeth and the outer gear an annulus **11** having seven teeth, the rotor being mounted on a splined shaft **12** which is adapted to be connected to a driving shaft at **13**. All the curves on the teeth shown in the drawing are part cylindrical surfaces and no generated surfaces are employed.

When the rotor **10** is driven in a clockwise direction the intermeshing teeth transmit the drive to the annulus **11** which is driven at a slower angular velocity due to its having one tooth more than the rotor **10**. Thus a pressure gradient is developed across the teeth and a fluid entering via inlet **15** is discharged from outlet **14** under pressure.

In order to prevent leakage of fluid past the teeth, each rotor tooth **16** is provided with a slot **17** to receive a slidable sealing vane **18**. Each vane is formed with a semi-cylindrical sealing surface **19** and two longitudinal edges **20** thereof are chamfered to provide a channel between the vane and the wall of the slot **17**. The channels are provided on the leading edge of the vane since this communicates with fluid at the higher pressure. Pressurised fluid therefore enters the slot **17** and urges the vane **18** outwardly.

Each vane is provided on its trailing edge with a projection **21** which engages in a recess **22** in the rotor **10**. This arrangement limits the outward movement of the vane but does not prevent sufficient outward movement to effect sealing where required. In the absence of some form of limiting means it is possible for a vane to extend from its slot and contact the annulus in a position which will cause the rotor and annulus to lock. This situation can occur when a vane contacts an outer tooth in driving relationship so that the vane experiences a tangential force which prevents its retraction into the slot. The limiting means serve to prevent and ensure that the annulus is driven by the rotor teeth and not by the vanes.

Limiting means other than that described above may be used but the use of a single projection on the trailing side of the vane is advantageous. The recess in the rotor is formed on the side of the tooth which is subject to least stress; a similar recess in the leading side of the tooth which drives the annulus would tend to weaken it at a position where strength is needed.

Whilst the embodiment described above acts as a pump it will be apparent to one skilled in the art that the device could also function as a motor by feeding in pressurised fluid. In this case the channels should be provided in the trailing edge of the vanes in order to communicate with the higher pressure fluid.

The pump or motor described above represents a considerable advance over the prior art in that it enables an efficient pump or motor to be produced relatively inexpensively since all the curved parts of the rotor and annulus are non-generated curves. Furthermore, the sealing of the teeth is effected very simply and does not require the provision of a multiplicity of channels within the rotor and complex valve control means.

It will be apparent that the embodiment described above is capable of modification within the scope of the invention. For example further assistance to urge the vanes radially and prevent leakage may be provided by spring means. In one example, each vane has a channel extending longitudinally along one side and a blade spring extends through the channel and around the base of the vane. This assists good contact between the other side of the vane and the slot wall and also between the vane tip and the annulus, due to the spring urging the vane in two directions, i.e. circumferentially and radially.

In another modification, each slot has a projection and one side of the vane has a recessed portion which receives the projection to limit outward sliding movement of the vane. An undulatory blade spring extends longitudinally of the vane between the projection and the upper wall of the recessed portion and abuts one slot wall so that this spring also urges the vane both outwardly and into contact with the opposite slot wall. The use of spring means means to prevent leakage at the vane-slot clearances may allow rotation in one direction only with efficient working.

Another embodiment of the invention is shown in FIGURE 5. The rotor meshes with a second and similar rotor and the high pressure/low pressure seal occurs at the point where the two rotors mesh and between the sealing vane ends and the housing periphery. Only one rotor

need be provided with vanes, but if both rotors are provided with vanes, a double seal will result.

I claim:

1. In a rotary pump or motor, the combination of two meshing gears each having teeth substantially conjugate to the teeth of the other with drive being transmitted by interaction of conjugate surfaces of meshing teeth, each tooth of at least one of said gears being provided with a single radially extending recess open at its outer end and terminating at its inner end in a closed pocket disposed laterally at one side of the recess, a radially slidable sealing vane disposed in the recess of each tooth so that during rotation of said one of said gears said vane acts to seal the teeth thereof to the other gear in a radially outwardly slid position of the vane, and a lateral projection provided at one side of the inner end portion of each vane and disposed in the pocket of the recess in the associated tooth, whereby to provide stop means for limiting outward sliding of the vane to prevent the outer end thereof from reaching the conjugate surfaces of the teeth and also thereby prevent transmission of drive by the vane, the side of each vane opposite from that equipped with said projection being provided with chamfered longitudinal edges forming channels for admission of fluid pressure into the inner end of said recess to bias the vane radially outwardly.

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91—135; 103—130, 136; 123—8; 230—152