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VANE TYPE MOTOR

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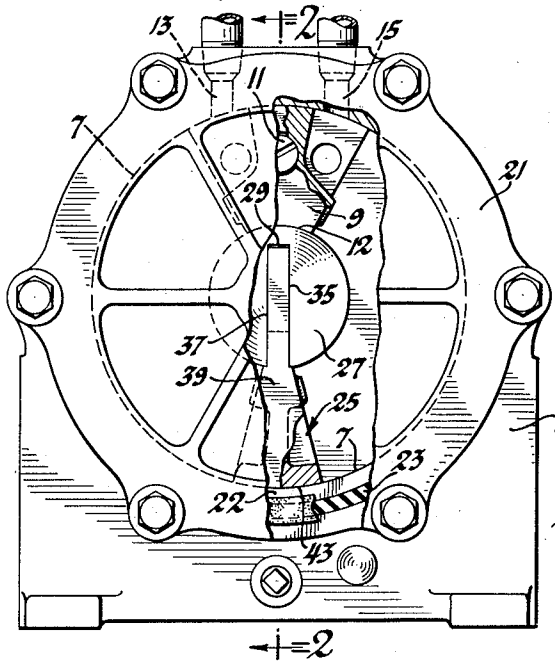


Fig. 1

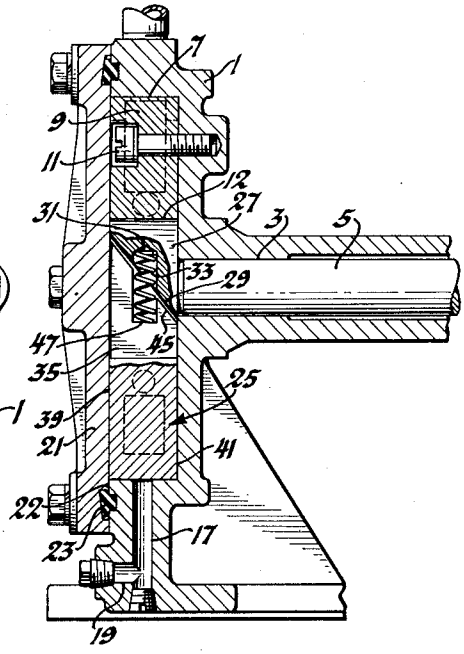


Fig. 2

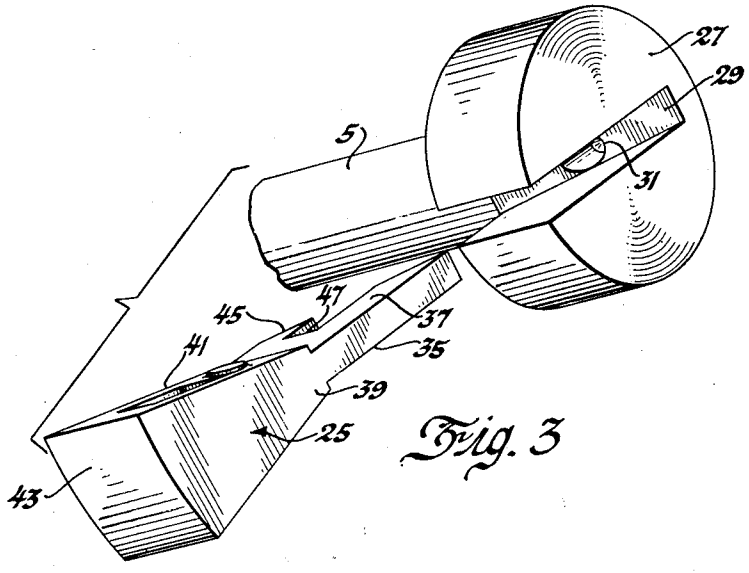


Fig. 3

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VANE TYPE MOTOR

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10 Claims. (Cl. 121—97)

The present invention relates to fluid motors of the vane type and more particularly to an improved and simplified construction of both the vane and shaft forming the rotor assembly of these motors.

Great difficulty has been experienced in providing satisfactory means for reducing fluid leakage between the rotor elements and also between the rotor and stator elements of such motors unless elaborate packing or sealing means are provided between these elements or unless a plurality of difficult and accurate machining operations are performed on these elements, particularly with the conventional constructions used. Where the vanes are fixed to or formed integral with the rotor shaft leakage is prevented between these elements, and the surfaces of the vane and shaft may be readily and accurately machined with reference to the shaft centers to permit movement of these elements in a substantially fluid tight manner with respect to the complementary radial and annular surfaces of the stator cylinder. The machining of the rotor shaft portion forming the vane hub so that it operates in a substantially fluid tight manner with respect to the inner end of the fixed or radially movable cylinder abutment or partition usually provided in these motors, however, must be preformed before assembly of the vane and shaft or by profile milling or grinding after assembly, as is necessary where the vane is formed integral with the shaft. With the separate vane construction the shaft is provided with a radial slot for reception of the vane to be fixed therein or with a diametral slot for a plurality of sliding vanes or a single sliding vane and a slot closure member. Where a closure member or a vane is fixed in the slot further machining of the hub is therefore necessary for the means by which these members are attached, such as keys or wedges. With any of the above constructions it is necessary that the entire peripheral surface of the shaft portion between the vanes forming the vane hub be continuous and smooth to eliminate the use of packing means and to prevent excessive leakage between the hub surface and the cylinder abutment. With the single vane, fixed radial abutment type of motor, where the rotor oscillates through an angle slightly less than 360 degrees, the vane is fixed to or formed integral with the shaft so that a continuous peripheral hub surface, with exception of the vane, may be provided for the reasons described above. In other constructions a diametral slot is cut in the shaft and a sliding vane and either a sliding or fixed packing piece inserted to prevent leakage through and by the end of the slot opposite that occupied by the vane. In any of the above described conventional vane and shaft constructions all of the accurate slotting operations on the shaft and accurate machining operations on the vanes, vane holding and vane packing means require time and, accordingly, the cost per rotor is high and the rate of production is low. The construction usually favored is the one in which the vane is formed integral with the shaft which requires no difficult finishing operations other than the profile machining of the vane hub.

The principal object, therefore, of my invention is to provide an improved construction of the elements comprising the rotor which enables these elements to be quickly and accurately machined and in which the time required for assembly of the elements is negligible.

Another object is the provision of an improved construction of the rotor vane and shaft which, when assembled, operates in substantially a fluid tight manner in the motor cylinder and permits the vane to move radially in substantially a fluid tight manner with respect to the shaft, and also permits the insertion of means for constantly urging the vane into firm contact with a cylinder surface.

The improved rotor vane and shaft construction by which the above objects and other advantages are obtained will be brought out in the following detailed description of my invention which is illustrated in the accompanying drawing, as applied to a fluid operated motor of the single oscillating vane fixed abutment type, for which this rotor construction is particularly adapted. This construction, however, may be employed in other types of motors to advantage, as will be evident.

Figure 1 of the drawing shows an end elevation of a fluid motor with certain parts broken away to show the details of my improved rotor construction to better advantage;

Figure 2 is a longitudinal cross sectional view taken on line 2—2 of Figure 1; and

Figure 3 is an exploded perspective view of the rotor shaft and vane elements showing the details of the construction thereof.

Referring to Figures 1 and 2, the motor housing or stator 1 has a central bore 3 in which a rotor shaft 5 is supported in substantially a fluid tight manner for rotary movement. Another axial bore 7 concentric with the central bore 3 is provided in the stator 1 to form the internal

periphery and the rear wall of the motor cylinder. A radially extending cylinder abutment or partition 9 having an axial width equal to the axial depth of the cylinder bore 7 is fixed in fluid tight relation with the periphery and rear wall of the cylinder by means of cap screws shown at 11. The inner end of this abutment is provided with an arcuate surface 12 concentric with the central bore 5 which will be referred to later. The stator housing 1 is provided with openings 13 and 15 and the abutment recessed adjacent these openings for free passage of motive fluid into or out of the cylinder. Drain openings 17 and 19, shown closed by means of pipe plugs, are also provided in the lower part of the stator housing. A cylinder head 21 is held in tight contact with an annular face 22 on the stator housing adjacent the cylinder bore 7 by cap screws, a sealing gasket 23 being placed in complementary annular grooves in the head and face to prevent fluid leakage therebetween.

The rotor elements best shown in Figure 3 are the shaft 5 and a vane 25. The rotor shaft 5 has an enlarged diameter end or hub portion 27, the radius of which is slightly less than the radius of the arcuate surface 12 on the inner end of the abutment 9 so that the hub may oscillate in substantially fluid tight relation with respect to this arcuate surface. The axial length of the hub portion is slightly less than the axial depth of the cylinder bore 7 in the stator housing 1 so that the radial faces of the shaft hub portion 27 may oscillate in a substantially fluid tight manner with respect to the surfaces of the rear wall of the cylinder and the inner face of the cylinder head 21.

In order to allow the inner end of the vane 27 to slide radially in substantially fluid tight relation with respect to the hub portion 27 of the shaft and provide means for urging the vane radially outwardly from the shaft so that the outer end of the vane makes contact and oscillates in substantially fluid tight relation with respect to the inner periphery of the cylinder bore 7, and in order to maintain the shaft 5 and both the radial and peripheral surfaces of the hub portion 27 thereof in fluid tight relation with respect to the complementary surfaces on the stator cylinder and abutment surface referred to above, the following improved shaft and vane construction, shown best in Figure 3, is provided.

With this construction little machining and practically no time for assembly of the vane and shaft are required to provide a rotor which operates in a fluid tight and efficient manner in the stator cylinder.

The hub portion 27 of the rotor shaft 5 is provided with a recess or slot 29 extending diagonally with respect to the axis of the shaft from a point on the periphery of the shaft adjacent the hub portion 27 to a point in the end face of the hub portion located on the other side of the shaft near the hub periphery. The area of the sides of the diagonal slot 29 provides adequate sealing and supporting surfaces for the vane 25 and permits the drilling of a hole 31 in the diagonally extending bottom of the slot in a radial direction with respect to the shaft axis in the hub portion 27 to a depth necessary to support a helical compression spring 33, shown in Figure 2. This spring serves to constantly urge the vane 25 outward radially from the slot 29 into substantially fluid tight contact with the inner periphery of the cylinder bore 7 for oscillating movement with respect thereto.

The construction of the vane 25 is such that it may be cast to approximately finished size and form, the form being such that few and simple machine finishing operations are required. The faces 35 and 37 on the inner end of the vane are finished to slide in fluid tight relation in the slot 29 and the lateral edges 39 and 41 and the outer arcuate end 43 may be easily machine finished to slide in fluid tight sliding relation with the peripheral and wall surfaces of the cylinder by the use of a simple fixture in which the finished faces 35 and 37 may be clamped. The diagonal inner end surface 45 of the vane is recessed at 47 for a seat for the end of the helical spring and the diagonal surface at either side of this recess forms substantially a miter joint with the bottom of the slot 29 in the hub portion of the shaft when the vane is inserted in the slot. Finishing of this diagonal end surface is not usually required but may be necessary where high motive fluid pressures are used.

I claim:

1. In a rotor assembly for a fluid motor including a rotor shaft having a longitudinal slot of variable depth formed therein, the bottom of said slot intersecting the shaft center line at an acute angle, and a vane slidably mounted in substantially a fluid tight manner in said slot.

2. In a rotor assembly for a fluid motor including a cylindrical shaft having a longitudinal slot of variable depth, the bottom of said slot intersecting the shaft center line and extending angularly from the shaft end face to a point in the shaft periphery adjacent the end face, a rotor vane having an end portion formed to be slidably inserted in said slot to substantially close the slot and prevent fluid leakage between the shaft and vane, and means adapted to be placed in said slot to constantly urge the vane out of said slot.

3. In a rotor assembly for a fluid motor including a cylindrical rotor shaft having a longitudinal slot, the bottom of said slot extending diagonally part way through one end of said shaft and across the longitudinal center line thereof, said slot bottom being recessed near the central portion thereof, a vane having an end portion formed for insertion in the slot in substantially a fluid tight relation with the slot sides and resilient means adapted to be placed in the recess of the slot bottom to urge the vane out of said slot.

4. In a rotor assembly for a fluid motor including a cylindrical rotor shaft having a longitudinal variable depth slot the bottom of said slot extending between one end face of the shaft and the shaft periphery at one side only, and intersecting the center line of the shaft, said slot bottom having a radially extending recess, resilient means supported in the recess and a rotor vane slidably supported in said slot in substantially a fluid tight manner and constantly urged radially outward from the slot by said resilient means.

5. In a rotor assembly for a fluid motor including a rotor shaft having an enlarged diameter cylindrical end portion, said end portion having a longitudinal slot of variable depth, the bottom of said slot extending at an acute angle with respect to and intersecting the longitudinal center line of said cylindrical end portion, a rotor vane supported for radial movement in said slot in a fluid tight manner and means for constantly urging said vane radially outward with respect to the axis of said rotor shaft.

6. In a rotor assembly for a fluid motor including a rotor shaft having an enlarged cylindrical end portion in which a longitudinal variable depth

slot extends between the two end faces of said enlarged diameter end portion on both sides of the shaft center line, said slot bottom having a recess extending substantially radially inwardly therefrom, a rotor vane having an end portion formed to move radially and axially in fluid tight relation with respect to the slot sides and the bottom, the inner end of the vane having a recess in alignment with said recess in the slot bottom, and spring means located in said recesses to urge the vane radially outward from the slot.

7. In a rotor assembly for a fluid motor including a rotor shaft having an enlarged diameter cylindrical end portion, said end portion having a longitudinal slot, the bottom of said slot extending radially and axially with respect to the longitudinal axis of the shaft and across the enlarged end portion only between the lateral faces thereof, and also intersecting the longitudinal axis of the shaft, and a rotor vane having an inner end formed to substantially fill said slot and slide radially in fluid tight relation with respect to the slot sides.

8. A rotor mechanism for a fluid motor comprising a cylindrical shaft having a longitudinal slot of variable axial and radial depth and constant width, the bottom of said slot intersecting the end face of the shaft near the circumference thereof and extending at an acute angle therefrom through the center line of the shaft to the circumference of the shaft adjacent the end face at the opposite side of the shaft, and a vane having a portion adapted to move in fluid tight sealing relation in the confines of the slot.

9. A rotor for a fluid motor comprising a shaft having a longitudinal slot, the bottom of said slot intersecting the longitudinal axis of the shaft at an acute angle and extending from a point in the shaft end face immediately adjacent the periphery of said face to a point in the opposite side of the shaft periphery, and a rotor vane slidably mounted in fluid sealing relation in said slot.

10. A rotor for a fluid motor comprising a cylindrical shaft provided with an enlarged diameter cylindrical end portion having a longitudinal slot therein, the bottom of the slot intersecting the center line of said shaft at an acute angle and extending from a point in the outer end face of the cylindrical end portion immediately adjacent the periphery of said outer end face on one side of the center line of the shaft to a point on the other side of the shaft center line where the inner radial face of the cylindrical end portion intersects the periphery of the shaft proper, and a vane carried in fluid tight relation in said slot for radial movement with respect to the shaft axis.

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