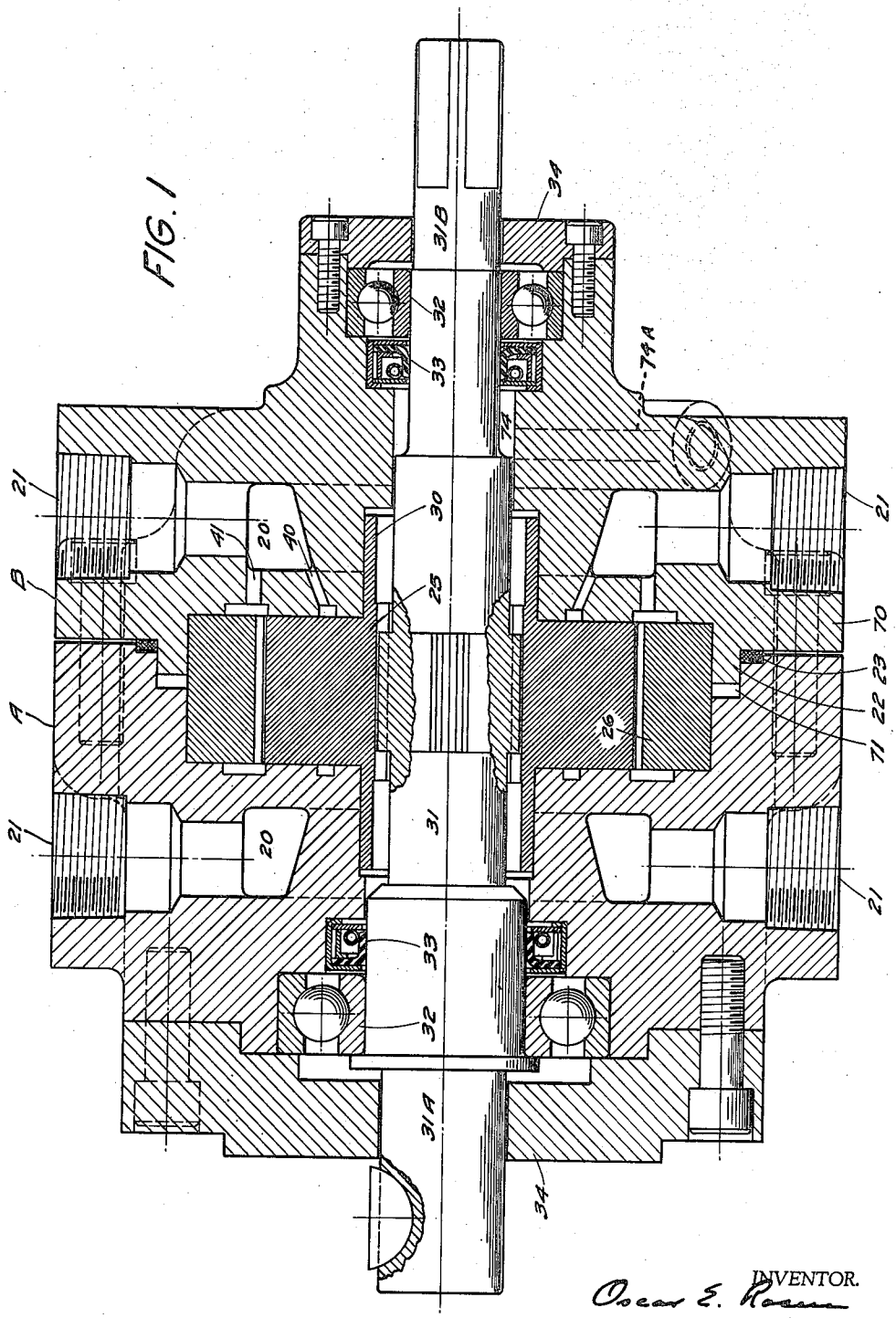
Jan. 15, 1946. O. E. ROSEN 2,393,223

HYDRAULIC MOTOR

Filed Dec. 29, 1941 3 Sheets-Sheet 1

FIG. 1



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HYDRAULIC MOTOR

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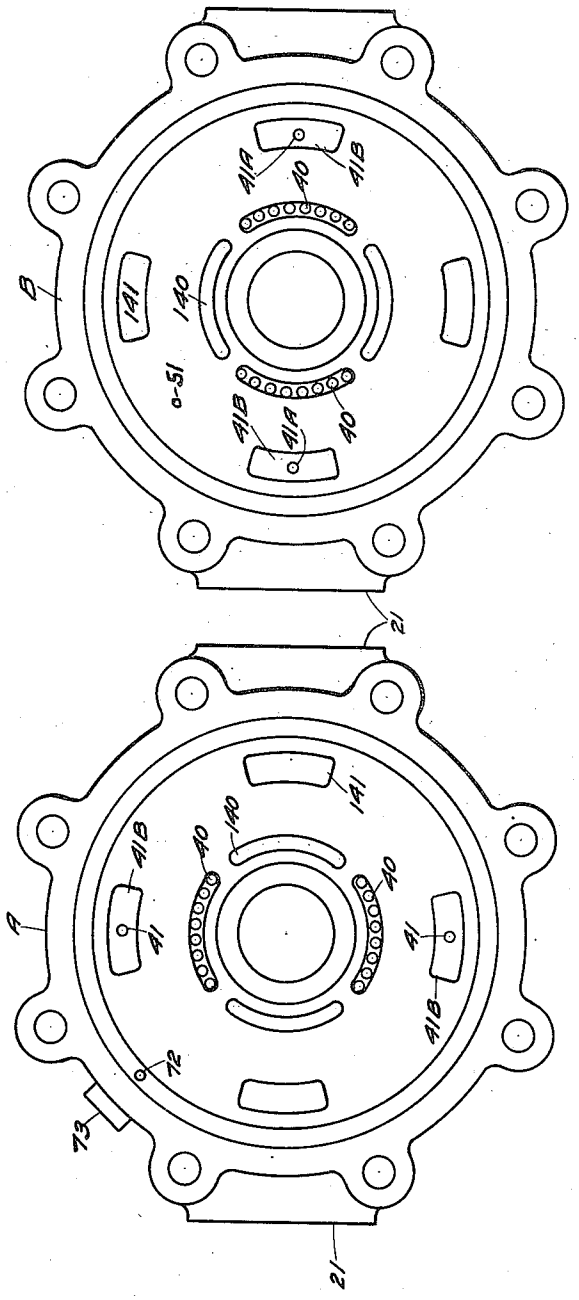

FIG. 2

FIG. 3

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HYDRAULIC MOTOR

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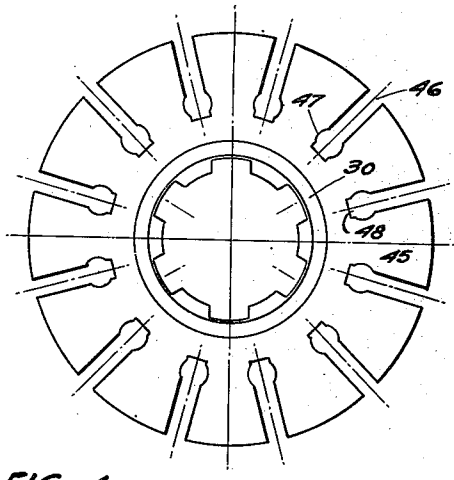

FIG. 4

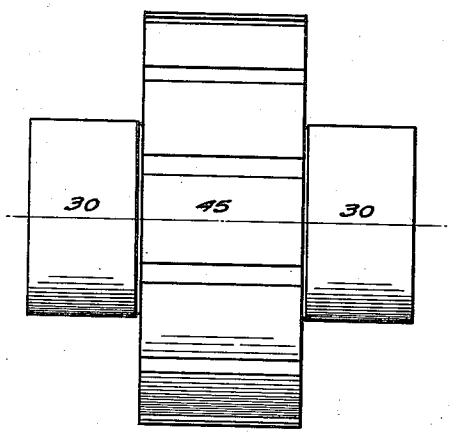

FIG. 5

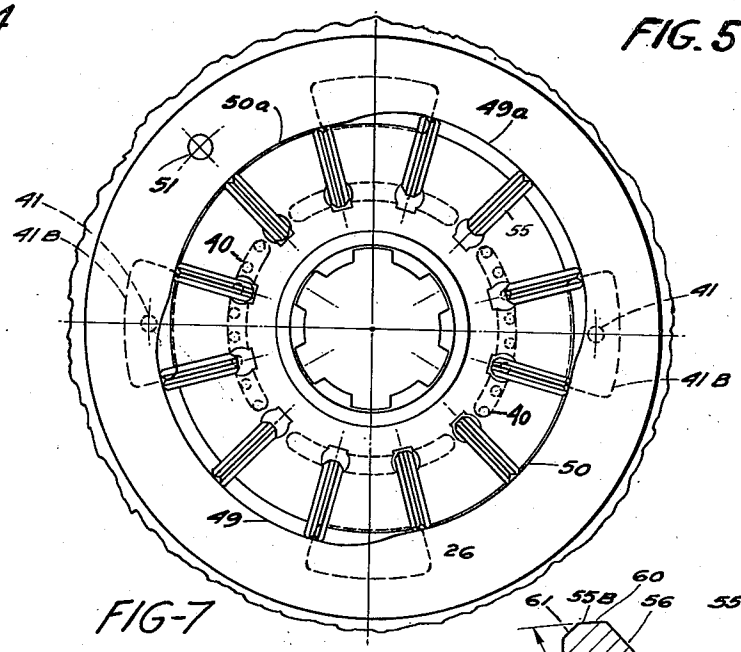

FIG. 6

FIG-7

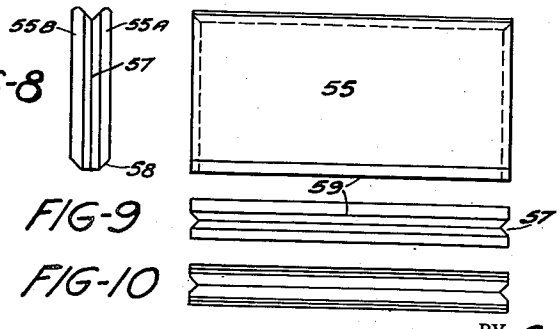

FIG-8

FIG-9

FIG-10

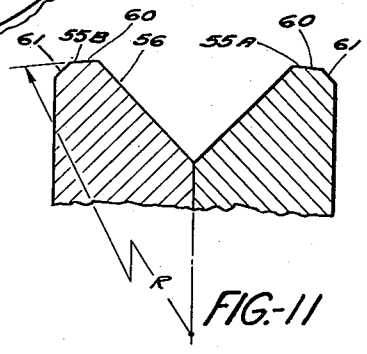

FIG-11

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HYDRAULIC MOTOR

Oscar E. Rosen, Detroit, Mich.

Application December 29, 1941, Serial No. 424,732

3 Claims. (Cl. 121—92)

The present invention relates to hydraulic motors and specifically to reversible hydraulic motors of the vane type.

Among the objects of the invention is to increase the efficiency of such motors by decreasing the leakage past the vanes, particularly during the slow speed and high load conditions.

Another object is a vane type motor in which while the vanes are forced outwardly against the enclosing housing, the friction between said vanes and housing is reduced to a minimum.

Another object is a motor of the vane type which will have a greater and more uniform torque delivery than those heretofore known and used.

Still other objects will readily appear to those skilled in the art upon reference to the following description and the accompanying drawings in which

Figure 1 is a central horizontal sectional view of a motor embodying the present invention.

Figure 2 is an elevational view of the inner face of member A to the left in Figure 1.

Figure 3 is a similar view of the member B to the right in Figure 1.

Figures 4 and 5 are respectively face and edge views of the rotor without the vanes.

Figure 6 is a face view of the rotor and rotor ring showing the vanes in place.

Figures 7 to 10 are face and edge views of one of the vanes somewhat enlarged; and

Figure 11 is a greatly enlarged partial sectional view showing the form of the outer edge of a vane.

A motor involving the present invention is, as shown in the drawings, composed of two main body parts A and B which, except for details mentioned below, are quite similar, and each consists of a casting provided with cored chambers **20** having inlet openings **21**. These openings will not ordinarily all be used, some of them being closed with suitable screw plugs. For example, the upper openings **21** in Fig. 1 may be active, while the lower ones are closed.

Each of the members A and B is provided in one face with part of the rotor chamber and the two parts are provided with suitable mating flange and seat elements **22**. When the parts are together, a suitable gasket **23** will be used to prevent leakage.

Within the rotor chamber will be mounted the rotor **25** shown in detail in Figures 4 to 11, and the rotor ring **26** which is adapted to surround the rotor and coact with the rotor vanes.

The rotor is provided with sleeve-like axial extensions **30** serving as bearing members which in turn are mounted in the parts A and B. It is also splined upon a shaft **31** which passes through the two body portions A and B having its ends projecting from the motor. The end **31A** of the shaft member is used for connection to the mechanism to be driven, while the end **31B** is preferably provided with flattened faces whereby a handle may be applied.

The shaft **31** will be mounted in suitable antifriction bearings **32** and conventional oil rings **33** may be used to prevent escape of fluid from the rotor chamber to the outside along the walls of the shaft. Suitable end plates **34** will be used to maintain the shaft in its proper position.

The faces of the two parts A and B in which the rotor chamber is formed, are shown in Figures 2 and 3, Figure 3 showing the face of part B while Figure 2 shows the part A. These faces are substantially identical and each shows the rotor end of passageways **40** and **41**, the passageways in part B being indicated as **40A** and **41A**. It should be noted that the passages **40** and **40A** consist each of a number of drilled holes, the combined area of which is greater than the area of the corresponding passages **41** and **41A**. These passageways **40** and **41**, of which there are two each, 180° apart, both lead from the same chamber **20**, and the passageways **40** lead into the rotor chamber near the base of the vanes, while the passageways **41** open into the chamber near the outer edge of the vanes into the arcuate depressions **41B**. The passageways in part B are similar to those in part A, but it should be noted that when the two parts are together, the passageways in part B are displaced 90 degrees from those in part A.

The rotor consists of a disc portion **45** provided with the axial bearing extension **30**, and with a plurality of radial slots **46**. These slots are provided in their bottoms with an enlarged chamber-like portion **47** and have the bottom wall **48** of the slot ground for a purpose to be explained later.

The rotor **45** is, as stated above, surrounded by the ring **26**, which is conveniently circular on the outside, but whose inside perimeter is divided into four zones **49—49A**, **50—50A**. These zones have cylindrical walls and the wall of the zones **50** and **50A** are formed with a radius only slightly larger than the radius of rotor **45**. The zones **49** and **49A** are also cylindrical and on a like radius, but with their centers displaced from the center

of the rotor so that these latter zones form in effect chambers concentric with the rotor.

The two chambers are displaced from each other 180° and are of course separated by the zones 50 and 50A. This ring 46 is mounted in the rotor chamber in parts A and B, and is preferably maintained against movement by means of a suitable pilot pin 51.

In the several slots 46 in the rotor 45 are slidably mounted a plurality of vanes 55. These vanes are coextensive in length with the axial length of the rotor 45, and their width is such as to make them rest on the bottom of a slot and extend nearly to the wall of a zone 50 or 50A.

Each of the vanes 55 consists of two identical member 55A and 55B having beveled edges on four sides as indicated in Figures 7 to 11. Each vane member is so beveled as to provide a small chamber 56 in the outer edge of the vane, and passages or grooves 57 in the side edges, while the bottom edge bevelling at 58 provides for passage of fluid around and under the vane in the bottom of the slot 46. It is preferred also to cut away a portion of the bottom edge as at 59, as indicated in Figures 7 and 9.

The outer edge faces of the vane members 55A and 55B are, as shown in Figure 11, provided with a portion 60 which is ground on a radius slightly larger than the radius of the rotor and a small outer edge bevel 61.

The two parts A and B are fastened together by suitable screws 70 with the ring 26 acting as a spacer. This leaves a small space 71 which is drained through the opening 72 leading to a suitable outlet passage in boss 73. The space 74 around shaft 31 will also be drained by a suitable passageway, 74A, leading to the same boss.

Referring now to Figure 6, it will be noted that, in the embodiment shown, there are twelve vanes 55 in the rotor and that the zones 50 and 50A are of such length as to extend over three vanes while the zones 49 and 49A are somewhat longer.

It will also be seen that the depressions 41B form continuations of the passages 41 and 41A, and that these depressions open to the spaces between the vanes several degrees behind the point where the passages 40 and 40A open to the chambers 47 behind the vanes. (This is assuming a counterclockwise rotation of the rotor, Fig. 6.)

It should also be noted that the passages 40 and 40A are considerably larger than the passages 41 and 41A.

When the several parts of the motor are assembled, the diametrically opposite passages 40 and 41 are displaced 90° from the diametrically opposite passages 40A and 41A so that one of each pair is in position to coact with each motor chamber or zone 49 and 49A.

The resulting action of the several parts and passages mentioned is as follows:

Fluid under pressure, supplied to a chamber 20, enters the passages 40 and 41 (to produce the counterclockwise motion, Fig. 6) and, since the passage 40 is open ahead of passage 41, the first action is to thrust the vane 55 outward against the ring 26. Then, as soon as the rotor has moved a few degrees, fluid from passage 41 flows behind the vane to continue the rotation.

When the rotor has moved a quarter of a revolution the fluid flows out of the passages 40A and 41A into the other chamber 20 and out.

By virtue of the fact that the passage 41 is smaller than its parallel passage 40, and also the fact that passage 40 leads into a chamber or chambers from which there is no free flow while there is free flow or its equivalent through a passage 41, the pressure in the chambers 47 behind the vanes will be greater than the pressure between the vanes.

As a result, the vanes are held out against the ring 26 throughout what may be termed the "power quadrant," that is, until the rotor has moved far enough for the fluid to begin to exhaust through the passages 40A and 41A.

However, unless something is done to compensate for it, the outward pressure on the vanes under such conditions would be too great and would result in too great friction between the vanes and ring 26, with consequent excessive wear. So, a suitable proportion of this pressure is counteracted by forming in the outer ends of the blades the chambers 56 and connecting these with the chambers 47 by the grooves 57. By this means the outward thrust upon the vanes may be partially balanced and reduced to a suitable amount.

Further, by making the vanes of two leaves, the chamber 56 is maintained even when the vane is moving along the slope between, for example, zones 49 and 50.

As stated above, during the power quadrant, the vanes are pressed outwardly. When, however, the vanes reach the exhaust quadrant, the action changes. When the liquid begins to flow out, the flow will be more free through the passages 40A than through 41A and consequently there will be a higher pressure between than behind the vanes, and due to the beveled edges 61, the vanes will be thrust inwardly and will remain in their inner position until again thrust outwardly as described above.

It is, of course, to be understood that the above described action takes place simultaneously in both zones 49 and 49A, so that the motor is exactly balanced. In order to insure a balanced pressure, at the side edges of the vanes, the slots 140 and 141 may be formed between the passages 40 and 40A and between the passages 41 and 41A.

Now having described the invention and the preferred embodiment thereof, it is to be understood that the invention may be embodied in other specific forms without departing from the spirit or essential scope thereof, and it is desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

I claim:

1. A hydraulic motor of the vane type consisting of mating housing members having provided in their adjacent faces a rotor chamber, fluid inlet and outlet means connected to said chamber near the periphery thereof, fluid inlet and outlet means connected to said chamber near the axis thereof, a rotor in said chamber and provided with radially movable vanes, said vanes each consisting of a pair of leaves notched at their radially inward edges to provide a small chamber, and beveled at their adjacent radially outward edges to provide a second small chamber and also provided with a passage connecting said small chambers, said last mentioned fluid inlet entering said chamber at the inner edges of said vanes, means for supplying fluid under pressure to an inlet at the periphery and an inlet near the axis and means for maintaining a higher pressure at the second mentioned inlet than that at the peripheral inlet,

and means for conducting the higher pressure fluid to the outer edge faces of said vanes.

2. In a rotary vane type motor, a rotor having radial slots therein, movable vanes in said slots, said vanes being each provided with a chamber in its radially outer edge and with conduit means connecting said recess with the inner end of its slot, an inlet chamber for receiving fluid under pressure, a relatively large passageway leading from said inlet chamber to said rotor to the inner ends of said slots, and a relatively small passageway leading from said chamber to the outer periphery of said rotor between the outer edges of said vanes.

3. In a rotary motor of the vane type, a rotor provided with radial slots, and with movable vanes in said slots, said vanes each consisting of two leaves arranged in face to face relation, the leaves being beveled on their adjacent outer edge corners and their adjacent side edge corners whereby to form a chamber in said outer edge and channels leading therefrom to the rearward edge face.

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