June 12, 1951 H. F. GORSUCH 2,556,648

IMPELLER VANE FOR HYDRAULIC MOTORS

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Fig. 1.

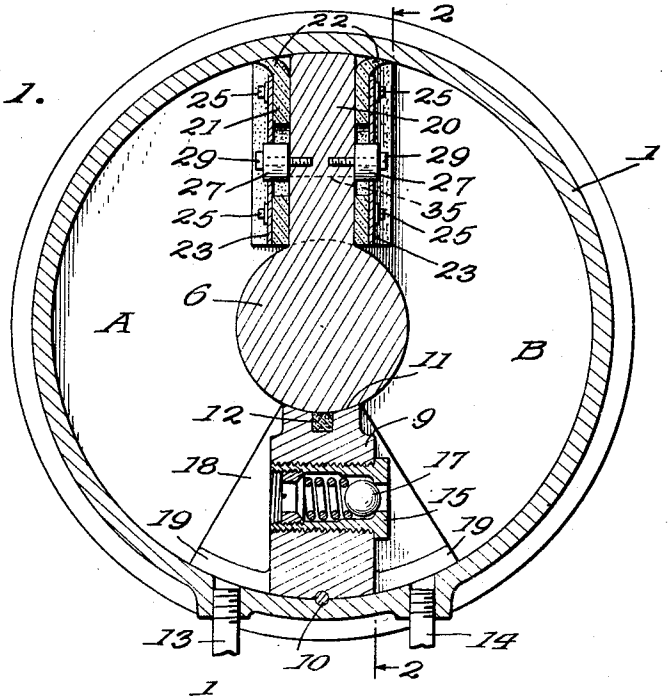
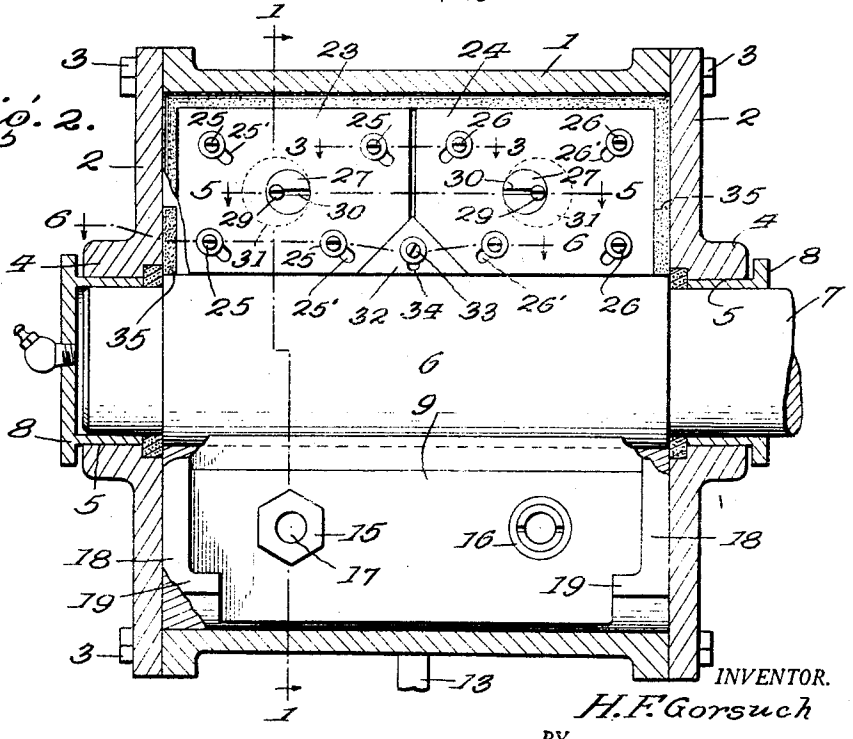


Fig. 2.



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Fig. 3.

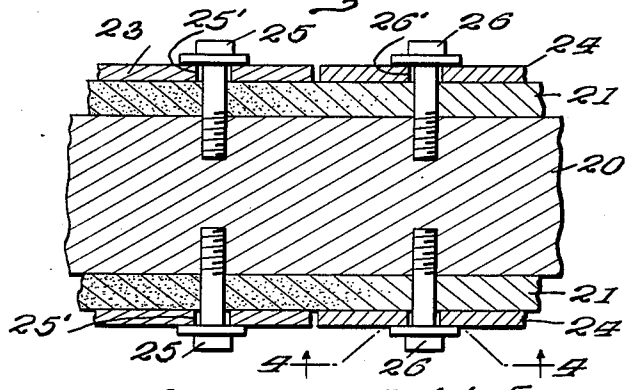


Fig. 4.

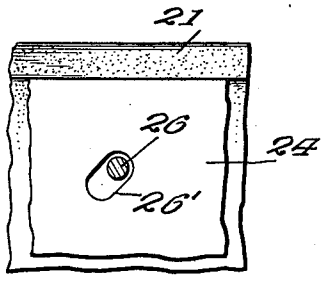


Fig. 5.

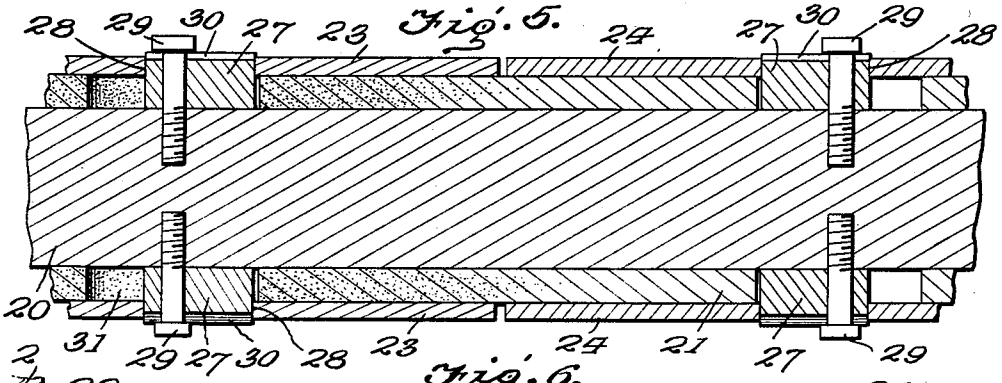


Fig. 6.

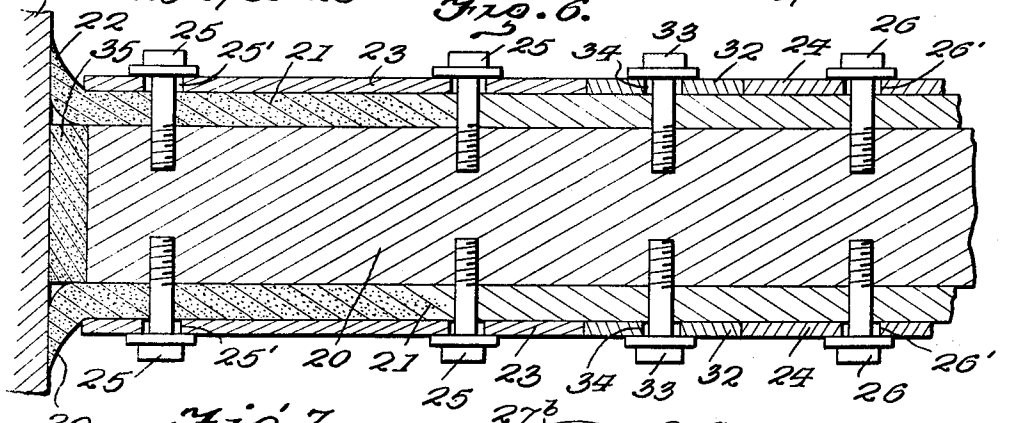
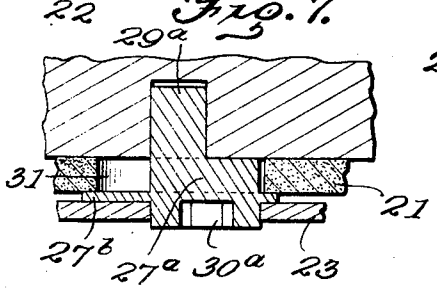


Fig. 7.



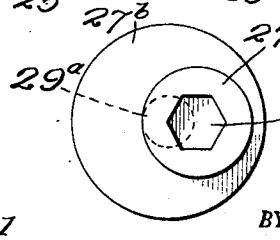


Fig. 8.

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UNITED STATES PATENT OFFICE

2,556,648

IMPELLER VANE FOR HYDRAULIC MOTORS

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Application May 17, 1948, Serial No. 27,503

14 Claims. (Cl. 309—22)

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My invention relates to new and useful improvements in a hydraulic motor of the rotary oscillatory type, driven by a fluid pressure generator under the selective control of a manually operated two-way valve. A generally similar motor is shown and described in my prior Patents Nos. 1,974,775 dated September 25, 1934, and 2,286,537 dated June 16, 1942.

More specifically the present invention consists in an improved impeller vane structure having a novel sealing or packing device embodying a packing strip of suitable material which preferably embraces both faces of the vane with its edges in sealing engagement with the inner walls of the motor cylinder, and having an adjusting plate overlying the strip and provided with means for shifting the plate in a movement having components both longitudinally and radially with respect to the vane carried by the motor shaft, so as to regulate the sealing engagement of the strip with respect to the adjacent walls of the cylinder.

The primary object of my invention is to provide an impeller vane and packing means which is capable of minute adjustment both for initial operation and to compensate for wear on the sealing edges of the packing strip.

Another object of the invention is to provide a quick and easy adjusting means which is positive in action and which may be securely locked in any selected adjustment.

With the above and other objects in view which will appear as the description proceeds, my invention consists in the novel features herein set forth, illustrated in the accompanying drawings and more particularly pointed out in the appended claims.

Referring to the drawings in which numerals of like character designate similar parts throughout the several views:

Figure 1 is a transverse sectional view through the cylinder of the motor, taken on line 1—1 of Figure 2;

Figure 2 is a longitudinal sectional view of the same taken on line 2—2 of Figure 1 and showing the cylinder partition, shaft, impeller vane and packing plate in elevation;

Figure 3 is an enlarged sectional detail of the impeller vane and packing taken on line 3—3 of Figure 2;

Figure 4 is a fragmentary view in elevation, taken on line 4—4 of Figure 3;

Figure 5 is an enlarged sectional view taken on line 5—5 of Figure 2;

Figure 6 is a similar view taken on line 6—6 of Figure 2;

Figure 7 is an enlarged sectional detail of a modified form of an eccentric adjusting element; and

Figure 8 is a plan view of the adjusting element shown in Figure 7.

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In the drawings, 1 represents the cylinder of a hydraulic motor constructed in accordance with my invention, the opposite ends of which are closed by cylinder heads 2 which are secured to the cylinder by means of bolts 3, threaded into peripheral flanges located adjacent the longitudinal extremities of the cylinder. Each of the cylinder heads 2 is provided with a central boss 4 which is drilled as at 5 to provide a journal for a longitudinally extending motor shaft 6, one end 7 of which preferably extends through the respective cylinder head to serve as a power connection to any desired element to be driven. Suitable packing glands 8 are provided in the journals 5 for sealing the shaft in the cylinder heads.

On one side of the shaft 6 I provide a partition 9 which extends radially from the shaft to the adjacent wall of the cylinder 1, being rigidly secured to said cylinder by a dowel 10 or other suitable means to prevent displacement. The shaft engaging edge of the partition 9 is concave as at 11, to correspond to the curvature of the shaft 6 and is provided with a longitudinally extending packing strip 12 for sealing the edge of the partition against the shaft 6, as will be seen from Figure 1. This partition divides the interior of the cylinder 1 into two pressure chambers A and B, each of which is arranged in communication with a pressure generator (not shown) by means of fluid conduits 13 and 14 respectively, said conduits being preferably connected to the pressure generator through a two-way valve for selectively regulating the flow of pressure operating fluid to the respective pressure cylinders.

The partition 9 is drilled transversely at two longitudinally spaced points to receive adjustable pressure relief valves 15 and 16 which may be of any conventional design, those shown in the drawings being of the type embodying a spring pressed ball 17. These valves are arranged for operation in opposite directions, valve 15 being normally closed and operable at a predetermined pressure in chamber B to exhaust into chamber A, while valve 16 is normally closed but operable at a predetermined pressure in chamber A to discharge into chamber B, as and for the purpose hereinafter described.

The opposite longitudinal extremities of the partition 9 are preferably provided with segmental flanges 18 which lie closely against respective cylinder heads 2 and their outward radial extremities are turned inwardly to form arcuate abutments 19 which limit the rotary movement of the vane in opposite directions within the cylinder 1, as will hereinafter appear.

My improved impeller vane structure comprises a vane proper 20 which is rigidly secured to or forms a part of the shaft 6, extending radially therefrom to the adjacent inner wall of the cylinder 1. Preferably on each side of the

vane 20, I provide a packing strip 21 of leather, rubber, or other suitable packing material, which projects both radially and longitudinally beyond the vane, in sealing engagement with adjacent surfaces of the cylinder wall and the cylinder heads, the sealing edges of said strip being preferably chamfered as shown at 22 in Figures 1 and 6. Overlying each of the packing strips 21 is a pair of adjusting plates 23 and 24 which are secured to the vane 20 by means of a series of screws 25 and 26 respectively, said screws extending through angularly disposed slots 25' and 26' in respective plates 23 and 24. As will be seen from Figure 2, the slots 25' in plate 23 are disposed radially upwardly and to the left as viewed from this figure, while the slots 26' in plate 24 are disposed radially upwardly and to the right. By this arrangement the respective plates are enabled to move on the vane with respect to the packing strip 21, through a movement having components both longitudinally and radially with respect to the vane. In other words, each of the plates 23 and 24 is shiftable radially outwardly toward the wall of the cylinder 1 and longitudinally toward the adjacent cylinder head 2, for the purpose of regulating the sealing engagement of the edges of the sealing strip with the adjacent faces of the cylinder wall and cylinder heads.

The adjustment of the plates 23 and 24 on the vane 20, is accomplished by means of a novel eccentric adjusting element, one form of which is illustrated in Figures 1, 2 and 5. In these figures the adjusting element comprises a circular disc 27, disposed in a complementary opening 28 in the plates 23, 24, said disc 27 being eccentrically mounted for rotation about a stud 29 threaded into the face of the vane 20. The outer face of the disc 27 preferably projects beyond the face of the respective plate 23, 24 and is provided with a transverse slot 30 for engagement by a screwdriver or other suitable tool and in order to accommodate the movement of the disc about the axis of the stud 29, the packing strip is provided with a circular opening 31 which is concentric with the axis of the stud 29 and extends radially beyond the outer limits of movement of the eccentric disc 27. It will thus be seen that by loosening the screws 25 in the plate 23, for example, and rotating the eccentric disc 27 in counterclockwise direction about the axis of the stud 29, said plate will be caused to move bodily, radially outwardly toward the inner wall of the cylinder 1, and at the same time, longitudinally toward the inner wall of the adjacent cylinder head 2, the slots 25' guiding and permitting such movement. When the proper adjustment has been attained, tightening of the screws 25 which may be provided with lock washers, will lock the plate 23 in the selected adjustment. As a further means of securing the adjustment, the stud 29 may be tightened and screwed into the vane 20, thus preventing displacement of the eccentric disc 27.

A modified form of eccentric adjusting disc is illustrated in Figures 7 and 8 where, instead of a separate stud threaded into the vane 20, the adjusting element is made in one piece. In these figures it will be seen that the disc 27*a* is disposed eccentrically on the non-threaded stud 29*a*, rotatably mounted in a suitable opening in the vane 20. As in the other form, the disc 27*a* is arranged to rotate eccentrically within a circular opening 31 in the packing strip 21. However, immediately adjacent the packing strip,

the modified disc is provided with a radial flange 27*b* which is concentric with the stud 29*a* and slightly overlies the adjacent edges of the opening 31 in the sealing strip 21, being interposed between said sealing strip and the sealing plate 23. The outer face of the disc 27*a* projects through the plate 23 for engagement by a suitable adjusting tool. In this form, instead of a slot for engagement by the adjusting tool, the disc 27*a* is shown as provided with a hexagonal recess 30*a* for receiving the complementary end of the tool.

The operation of this modified form of eccentric disc is essentially the same as the one previously described, except that it is unnecessary to further tighten the stud as the engagement of the flange 27*b* by the adjacent edges of the plate 23 and packing strip 21, when the screws 25 are tightened, firmly secures the eccentric disc against displacement.

Referring to Figure 2 of the drawings, I provide an additional means for maintaining the adjustment of the plates 23 and 24, in the form of a triangular plate 32 which is interposed between the adjacent lower corners of the plates 23 and 24 which are cut out to accommodate the triangular plate 32. This plate 32 is similarly secured to the vane 20 by means of a screw 33 which extends through a vertical slot 34 in the plate, which is thus capable only of vertical movement. By this arrangement, after the plates 23 and 24 have been adjusted outwardly and longitudinally by the eccentric discs, the outward movement of the triangular plate 32 into engagement with the adjacent edges of said plates 23 and 24, and the tightening of the screw 33 prevents inward displacement of the plates 23, 24.

As an added means for sealing the shaft 6 and vane 20, I preferably provide a packing element 35 in a suitable recess in each end of the vane, said packing cooperating with the sealing medium in the packing glands 8 to prevent the leakage of fluid past the shaft.

While I have shown the locking screws 25, 26, and studs 29 arranged concentrically on opposite sides of the vane 20, it should be noted that in smaller models, where the vane is of less transverse dimensions, it is preferable to stagger the tapped holes so as to avoid interference of the screws on opposite sides of the vane.

In operation of a motor constructed in accordance with my invention, fluid pressure is selectively admitted through conduits 13 or 14 into one of the chambers A or B which causes the vane 20 to rotate the shaft in one direction or the other. For the purpose of illustration, let us assume that pressure is admitted into chamber B through conduit 14. The vane 20 will be rotated and with it the shaft 6, in counterclockwise direction until the vane engages the abutment 19 in chamber A, said chamber A being evacuated during this operation through the conduit 13. The valve 15, being set to withstand a predetermined operating pressure, remains closed in normal operation, but should the proper pressure be exceeded, the ball 17 would be depressed against its spring to release the pressure into chamber A, thus avoiding the breakage of equipment by excess pressures. The operation of the vane and shaft in the opposite direction is accomplished by a reversal of this procedure, with the admission of fluid pressure through conduit 13.

After continued operation of the motor, a certain amount of wear occurs at the sealing edges

of the packing strips **21** and in order to compensate for this wear, the packing plates **23**, **24** are adjusted by the eccentric adjusting discs, as previously described. The plate **23** is adjusted by rotating its eccentric disc **27** in counterclockwise direction while the plate **24** is adjusted by rotating its eccentric adjusting disc **27** in clockwise direction. Thus, the plates **23** and **24** are moved radially outwardly and longitudinally away from one another to force the sealing edges of the strips **21** into tighter engagement with the walls of the cylinder **1** and the adjacent faces of the cylinder heads **2**.

It will be apparent from the description and drawings that I have provided a novel and practical impeller vane and packing structure for hydraulic oscillating motors which not only insures a tight sealing engagement of the packing strip, but is easily and readily adjustable and may be firmly locked in a selected adjusted position.

From the foregoing it is believed that my invention may be readily understood by those skilled in the art without further description, it being borne in mind that numerous changes may be made in the details of construction without departing from the spirit of the invention as set forth in the following claims.

I claim:

1. An impeller vane structure for a hydraulic motor of the type including a cylindrical casing, a rotary shaft extending coaxially of said casing, and a radial partition between one side of said shaft and the inner periphery of the casing; said impeller vane structure comprising a rigid vane fixed to said shaft and extending radially and longitudinally thereof substantially to the respective walls of the casing, a sheet of packing material embracing at least one side of said vane with its edges contacting the inner walls of said cylinder in sealing engagement, an adjusting plate of smaller dimensions than said sheet, fixed to said vane and overlying said sheet, and means for adjusting the position of said plate with respect to said sheet to regulate the sealing engagement of the latter.

2. An impeller vane structure as claimed in claim 1, including means for adjusting the radial position of said plate with respect to said sheet and means for locking said plate in the adjusted position.

3. An impeller vane structure as claimed in claim 1, including means for shifting said plate with respect to said sheet through a movement having components extending both longitudinally and radially with respect to said shaft, and means for retaining said plate in adjusted position.

4. An impeller vane structure as claimed in claim 1, including eccentric means for shifting said plate with respect to said sheet through a movement having components extending both longitudinally and radially with respect to said shaft, and means for retaining said plate in adjusted position.

5. An impeller vane structure as claimed in claim 1, wherein said adjusting plate is formed in two sections arranged longitudinally, side by side, and overlying said sheet, means for shifting said plates in generally opposite directions, through movements having components extending both longitudinally and radially with respect to said shaft, and means for retaining said plates in adjusted positions.

6. An impeller vane structure as claimed in claim 5, including means for diagonally shifting said plates radially outwardly and in longitudinal directions generally away from one another.

7. An impeller vane structure as claimed in claim 6, wherein said plates are respectively provided with oppositely disposed diagonal slots, locking screws extending through said slots into said vane, and eccentric elements rotatably carried by said vane and operatively engaging respective plates for shifting the latter with respect to said sheet.

8. A device for adjusting the sealing engagement of a packing strip on the impeller vane of a hydraulic motor, comprising at least one plate overlying said packing strip, and means supported by said vane, mounting said plate for sliding movement with respect to said packing strip, to regulate the proximity of the edge of said plate to the wall of said cylinder.

9. A device for adjusting the sealing engagement of a packing strip on the impeller vane of a hydraulic motor, comprising a pair of plates arranged side by side and overlying said packing strip, and means supported by said vane, mounting said plates for individual sliding movement with respect to said packing strip, to regulate the proximity of the edges of said plates to the wall of said cylinder.

10. A device for adjusting the sealing engagement of a packing strip on the impeller vane of a hydraulic motor, comprising a pair of plates arranged side by side and overlying said packing strip, and eccentric means supported by said vane, for shifting said plates diagonally, outwardly and longitudinally in opposite directions to regulate the proximity of the edges of said plates to the adjacent walls of said cylinder.

11. A device for adjusting the sealing engagement of a packing strip on the impeller vane of a hydraulic motor, comprising a pair of plates arranged side by side and overlying said packing strip, eccentric means supported by said vane, for shifting said plates diagonally, outwardly and longitudinally in opposite directions to regulate the proximity of the edges of said plates to the adjacent walls of said cylinder, and means for locking said plates in adjusted positions.

12. A device as claimed in claim 11, wherein said locking means includes a supplemental wedge-shaped plate interposed between adjacent edges of said first named plates.

13. A device as claimed in claim 11, wherein said eccentric means comprises eccentric discs rotatably mounted on said vane and operatively engaging complementary openings in respective plates.

14. A device as claimed in claim 11, wherein said packing strip is provided with openings to accommodate said eccentric means, said eccentric means comprising eccentric discs rotatably supported by said vane and having concentric flanges interposed between the inner face of each plate and the adjacent portion of the packing strip, to prevent rotation of said discs when said plates are in locked position.

HOWARD F. GORSUCH.

REFERENCES CITED

The following references are of record in the file of this patent:

FOREIGN PATENTS

Number	Country	Date
8,888	Great Britain	May 3, 1893