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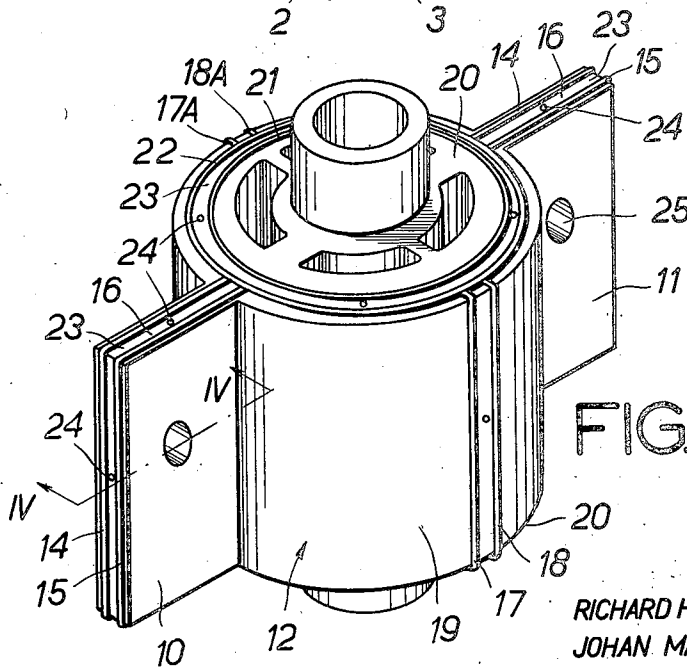


FIG. 2.

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Sept. 17, 1957

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2,806,451

PACKING AND SEALING SYSTEM FOR HYDRAULIC MOTORS

Filed March 22, 1956

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FIG. 3.

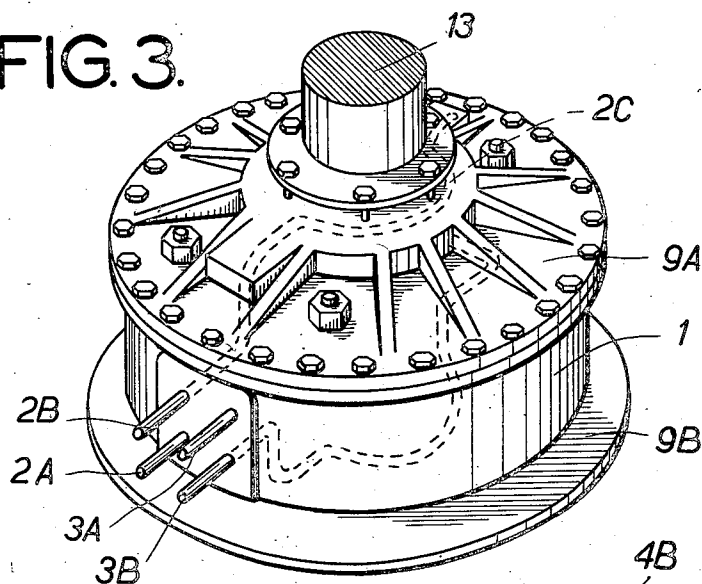
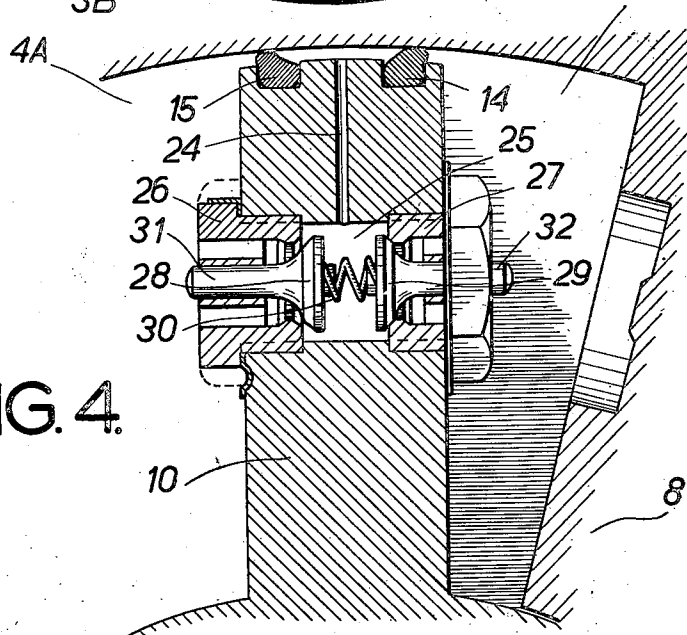


FIG. 4.



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PACKING AND SEALING SYSTEM FOR HYDRAULIC MOTORS

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Application March 22, 1956, Serial No. 573,190

Claims priority, application Norway November 21, 1955

4 Claims. (Cl. 121—99)

This invention relates to packing and sealing systems for hydraulic motors and, more particularly to such systems which embody packings of cord made from a resilient material.

An example of packing cords are O-cords which are specially suited for use as gaskets in hydraulic devices such as steering gears, hydraulic control means and the like, which find use, for instance, on ships and vessels. Such O-cords are cheap to produce and easy to install and enable effective sealing between the different movable and stationary parts in hydraulic devices employing high pressures. Even at varying pressures, an effective sealing between parts is obtained.

The use of O-cords for sealing purposes has many advantages in preference to the use of other sealing materials, and the present invention has as an object the provision of an improved packing system, embodying O-cords or the like, wherein pressure losses are avoided with maximum efficiency even at quite high pressures.

Other and further objects and features of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawings and following specification wherein is disclosed an embodiment of the invention with the understanding that such changes, combinations and modifications of the same may be made as fall within the scope of the appended claims without departing from the spirit of the invention.

In the drawings:

Figure 1 is a diagrammatic plan view of a reciprocating hydraulic motor in accordance with one embodiment of the invention.

Figure 2 is a perspective view of the piston hub and associated O-cord packings of the motor in Figure 1.

Figure 3 is a perspective view of the assembled motor.

Figure 4 is a section as taken along the line IV—IV of Figure 3.

In the hydraulic motor of Figure 1, the motor has a casing 1 with its associated conduits 2 and 3 for supplying and discharging hydraulic fluid. The position of the movable parts in the motor is controlled by respectively supplying and discharging pressure fluid through the conduits 2 and 3 by means of control and pump means not shown.

The conduits 2 and 3 lead to two sets of diametrically opposed working chambers 4 and 5 defined by a cylindrical wall 6, two diametrically opposed partition members 7 and 8, a bottom plate 9A not shown in Figure 1, and a top plate 9B.

The hydraulic fluid supplied to and discharged from the working chamber groups 4 and 5 acts on two diametrically opposed vanes 10 and 11 arranged as integral parts of a motor hub 12. The vanes 10 and 11 divide each chamber group into two individual chambers 4A, 4B, and 5A and 5B, respectively. One chamber in a group, for instance chamber 4A, cooperates with the diametrically opposed chamber in the other group, i. e., the chamber 5B, and is supplied with pressure fluid in unison therewith, whereby the motor hub may be moved to the angu-

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lar position desired and thus move a device 13 (which may be, for example, a rudder stem, a pillar for loading boom or the like) over a corresponding angle.

With special reference to Figure 3, the conduits 2 and 3 are led into the casing 1 at different levels. The conduit 2 has a first branch channel 2A leading through the partition member 7, to the chamber 4A to the left and a second branch channel 2B leading to the chamber 5B to the right through a channel 2C in the cover plate 9B. The ports of the channels 2A and 2B open into said chambers 4A and 5B, respectively, in the same rotational sense, e. g. for urging the vanes of the swingable motor member 12 in a clockwise direction.

The second conduit 3 has a first branch channel 3A leading through the partition member 7 to the chamber 5A to the right, and a second branch channel 3B leading through a channel 3C in the bottom plate 9A to the left chamber 4B. The ports of said channels 3A and 3B open into said chambers 5A and 4B, respectively, in the same rotational sense, e. g. for urging the reciprocating member 12 in a counterclockwise direction.

Thus, when supplying hydraulic pressure fluid to the conduit 2, and discharging hydraulic fluid from the conduit 3, the reciprocating motor member 12 is urged in a clockwise direction, the angle of movement being determined by the amount of pressure fluid supplied compared with the volumetric capacity of the chambers. Provided that no leakage occurs, the amount of pressure fluid supplied to the corresponding conduit 2 or 3 may be taken as a measure of the angular movement of the reciprocating member 12.

Thus, it is paramount to arrange for the most leak proof sealing obtainable between all parts of the motor, not only to avoid pressure losses by such leakage, but also to enable the use of the supplied amount of pressure fluid as a measure of the angular displacement of the vanes in the motor. Therefore, parallel O-cords 14 and 15 are arranged along the outer edges 16 of the vanes 10 and 11. Further, two additional sets of O-cords 17 and 18 are extended in an axial direction on the outer surface 19 of the hub 12, these sets being diametrically opposed to each other and disposed intermediate the vanes 10 and 11. On the end faces 20 of the hub 12, the latter two sets are furthermore continued radially inwardly over a short distance, such as at 17A and 18A, until they meet the outer one of two annular O-cords 21 and 22 arranged concentrically around the axis of the hub 12.

It is preferred that the different sets of O-cords 14 and 15, and 17 and 18 have equal dimensions, whereas the last mentioned set of O-cords 21 and 22 is arranged with the inner one 21 having a lesser diameter than the outer one 22. This is because the latter set has a predetermined one of the cords always faced towards the pressure side in the motor, whereas the pressure side is shifted from one side to another at the other sets.

The O-cords 14 and 15 are preferably composed of parts having the desired length corresponding to the length of the edges 16, and are bonded or vulcanized together at their meeting ends and at their junction with the outer circular ring 22. Similarly, the O-cords 17 and 18 are composed of lengths bonded at their ends to the outer circular ring 22.

It is seen in the preceding that the different sets of O-cords 14 and 15, 17 and 18, and 21 and 22, define small chambers 23 between a high pressure chamber and a low pressure chamber. By means of small passages 24 arranged in the interior of the hub 12 and the vanes 10 and 11, the defined chambers 23 are charged with pressure fluid from the pressure side of the system.

In order to obtain such supply of pressure fluid to the passages 24 and hence to the chambers 23, the passages 24 are connected to the interior of a bore 25 in each

vane, the detailed construction of which is shown in Figure 4.

It is seen in Figure 4 that the bore 25 extends through each vane from one face to another, and in each end of said bore a valve seat including the members 26 and 27 is arranged. The valve members 28 and 29, respectively, are arranged in each valve seat member 26 and 27 and form in association therewith a one way valve opening from the corresponding side into the interior of the bore 25. A return spring 30 is arranged between the valve members 28 and 29 and urges these valve members towards their seats so as to close the valve. Preferably the return spring 30 is compressed sufficiently only for returning the valve members to their seats.

Each valve member 28 and 29 has a stem 31 and 32 integral therewith, each of the stems 31 and 32 extending outside of the plane of the vane and seat at the corresponding side thereof. The object of the valve is to relieve pressure when the vanes reach an extreme position whereat the corresponding stem 31 and 32 engages the wall of the corresponding one of the partition members 7 or 8, and the valve member of the stem is pressed inwardly.

If the vane is moved by pressure fluid acting towards the face carrying the valve member 28, this valve will be opened by the pressure. However, the valve comprising the seat 27 and valve member 29 will normally be closed by the pressure fluid acting against said valve. But upon reaching an extreme position, the stem 32 engages the corresponding face of a partition member and is urged into the bore 25, whereby the pressure differential between the two sides of the vanes is relieved through the bore by the valve member 28 being moved to open position by the pressure of hydraulic fluid and the movement of the valve member 29 to open position by the aforesaid engagement.

The interior of the bore 25 will be subjected to the high pressure of the system regardless of the side towards which the pressure fluid acts. Therefore, the passage 24, extending from the middle of the bore 25, will also always be charged with pressure fluid.

A certain throttling action is obtained in the passage 24 so that the pressure in the spaces 23 does not equal the pressure of the driving fluid, but only a certain fraction thereof, this fraction being sufficiently great to obtain good sealing effect.

It is preferred to arrange the cords in grooves without any close fit, in order to allow the rings to be urged into engagement with the outer stationary parts of the motor, by supplying the pressure fluid to the lower side of these rings. By corresponding deformation of the cross section of the O-cords, a suitable sealing effect is obtained in the hydraulic motor.

By means of the present arrangement, a sealing effect of up to 100 percent in smaller size hydraulic swinging motors is obtained. Accordingly, the invention provides an improved packing and sealing system.

There will now be obvious, to those skilled in the art, many modifications and variations using the principles set forth and realizing many or all of the objects and advantages of what has been described but which do not depart essentially from the spirit of the invention.

What is claimed is:

1. In a hydraulic mechanism, a casing, double acting chambers within said casing, a swinging member, radially extending vanes on said swinging member and received within said chambers, sets of first and second conduits respectively connected to said chamber on opposite sides of said vanes for directing fluid selectively under pressure into opposite ends of each chamber to shift said vanes in controlled direction therein, said vanes thereby defining high and low pressure spaces in the chambers with leakage paths therebetween, chamber packing means defining a sealing space across the leakage paths from the high pressure spaces to the low pressure spaces and means for

delivering a throttled supply of pressure fluid to said sealing space.

2. In a hydraulic mechanism, a casing defining hydraulic fluid chambers, a swinging member pivotally mounted within said casing for swinging over an arc of less than 90° to both sides from a normal position, vanes integral with said swinging member and received within the hydraulic fluid chambers in said casing, each of said vanes dividing a corresponding one of said chambers into two equal spaces in said normal position, first conduit means for supplying hydraulic fluid simultaneously to a first set of spaces on one corresponding side of said vanes, second conduit means for supplying hydraulic fluid simultaneously to a second set of spaces on the opposite side of said vanes, packing means arranged in parallel on said swinging member for defining packing spaces therebetween, bores arranged between said first set of spaces and said second set of spaces, check valve means arranged in said bores for preventing a fluid flow from said first set of spaces to said second set of spaces and allowing pressure fluid to fill the interior of said bores, and communication lines from the interior of said bores to said packing spaces.

3. In a hydraulic mechanism, a hollow casing, diametrically opposed double acting chambers within said casing and diametrically opposed partition members therebetween, a swingable member pivotally mounted within said casing and comprising a central hub carrying diametrically opposed vanes received within said chambers, said hub being supported radially by said partition members, each of said vanes dividing a corresponding one of said chambers into hydraulic fluid receiving spaces with leakage paths therebetween, a first set of conduits being connected with a respective end of each chamber for directing fluid under pressure to move said vanes in one direction, a second set of conduits being connected with the opposite end of each chamber for directing pressure fluid under pressure to move said vanes in the opposite direction, first packing means providing sealing between said vanes and the walls of said chambers, second packing means providing sealing between said partition members and said hub, each of said packing means comprising two cords of resilient material having substantially circular cross section and running in spaced relationship in grooves across the leakage paths to be sealed thereby so as to define a sealing space across each leakage path, and means for providing a throttled supply of pressure fluid to said sealing spaces regardless of which set of conduits is supplied with pressure fluid.

4. In a hydraulic mechanism, a hollow casing, walls within said casing defining chambers for receiving hydraulic fluid, conduits for supplying pressure fluid to said chambers and for discharging hydraulic fluid from same, a member pivotally mounted within said casing, vanes supported on said member for dividing each chamber into a pressure space and a discharge space and a path therebetween, packing means arranged in the path between said pressure spaces and said discharge spaces, said packing means comprising two cords of resilient material of substantially circular cross sections arranged in spaced relationship transversely to the path from said pressure spaces to said discharge spaces, and supply means for providing a throttled supply of pressure fluid to a position intermediate said cords in said path; said supply means defining passages leading from a bore connecting said first set of conduits and said second set of conduits and comprising check valve means arranged to prevent a fluid flow from one set to another and allowing the interior of said bore to be supplied with fluid pressure.

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