Feb. 3, 1948. E. F. HUBACKER 2,435,279

PUMP, VANE TYPE

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Fig. 1

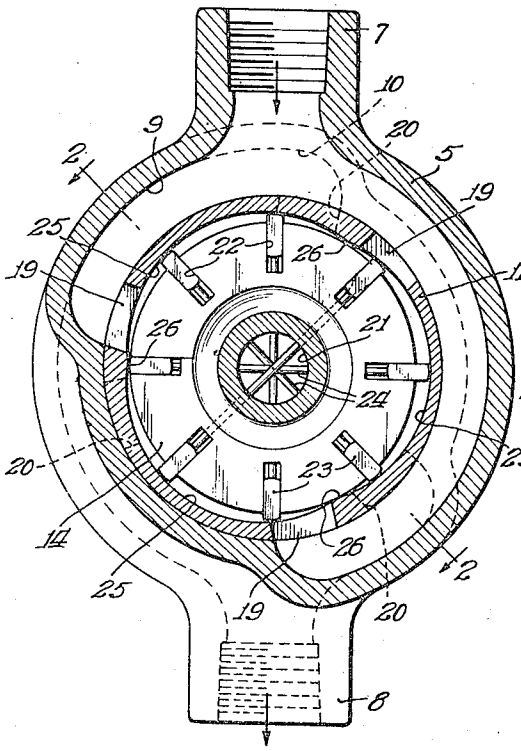


Fig. 2

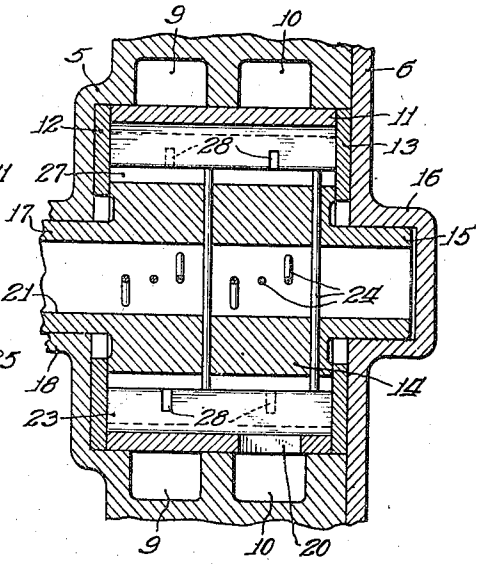


Fig. 3

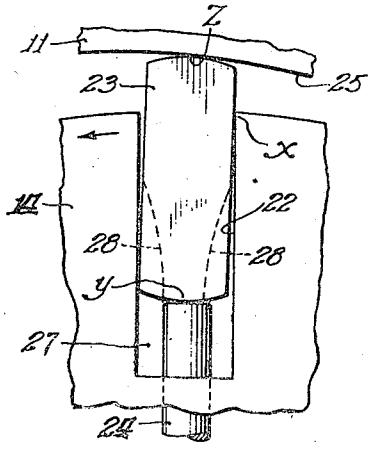
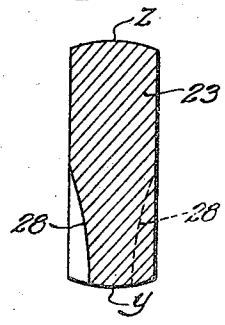


Fig. 4



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PUMP, VANE TYPE

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Fig. 5

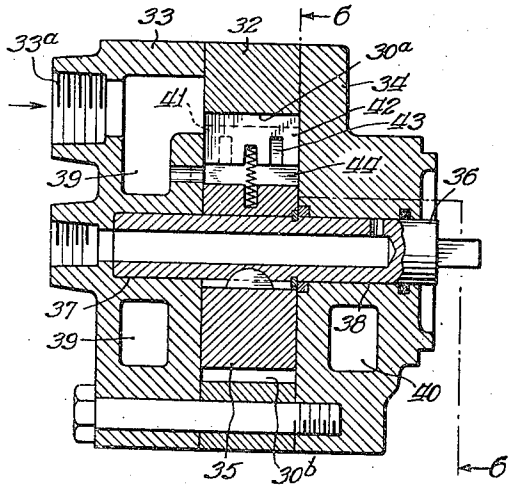


Fig. 6

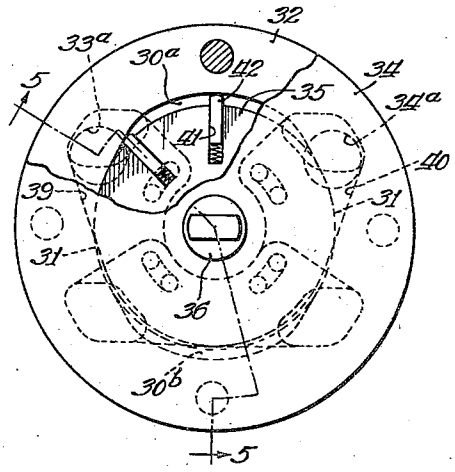


Fig. 7

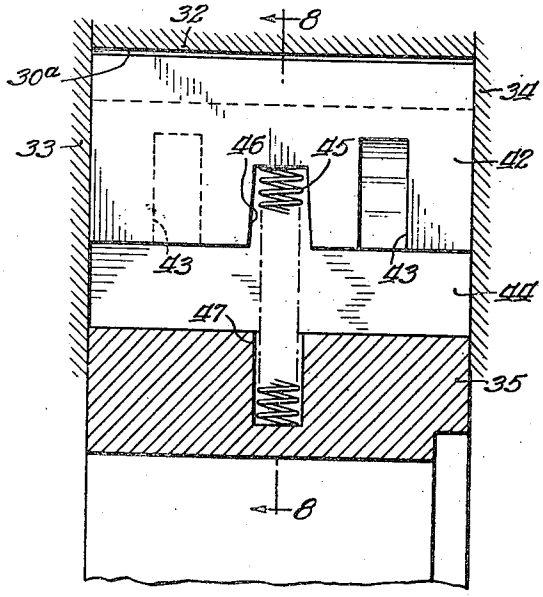
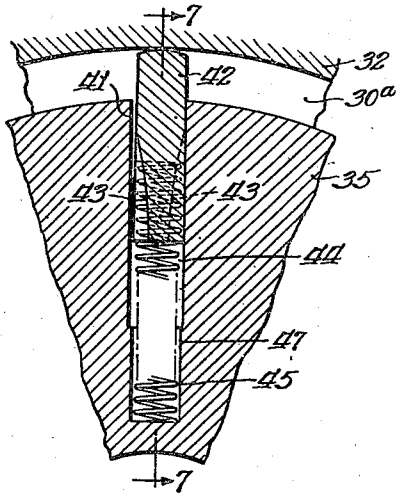


Fig. 8



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UNITED STATES PATENT OFFICE

2,435,279

PUMP, VANE TYPE

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Application October 25, 1943, Serial No. 507,570

2 Claims. (Cl. 103—136)

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The present invention relates to pumps and motors, particularly of the rotary reciprocable vane type.

It is the principal object of this invention to simplify the construction of a vaned type of pump or motor such as contemplated herein, and to improve the efficiency and operation thereof.

Another object of this invention is to provide simple and effective means for admitting pressure fluid under the radially inner portions of the vanes or blades thereby to assist in urging the blades into sealing engagement with the bore of the pump or motor housing. This function is performed by the novel instrumentalities disclosed herein which are effective regardless of the direction or rotation of the rotor structure. A further object is to provide the individual blades with the means which permits the pressure fluid to enter the space under each blade. A still further object is to provide a blade that is of novel construction and which is effective in the performance of the before mentioned function. Another object is to provide a seal between one side of the blade and the proximate face or wall of the slotted seat for the blade in the rotor body.

Additional objects, aims, and advantages of the present invention will be apparent to persons skilled in the art after the construction and operation of the pump and blade is understood from the herein description.

It is preferred to accomplish the numerous objects of this invention and to practice the same in substantially the manner hereinafter fully described and as more particularly pointed out in the appended claims, reference being made to the accompanying drawings that form a part hereof.

Fig. 1 is a vertical section taken transversely through the axis of a three cylinder or triple work chamber, pump or motor rotor and disclosing the instrumentalities for practicing a form of the invention contemplated herein;

Fig. 2 is a vertical section taken on the plane of line 2—2 on Fig. 1, and looking in the direction of the arrows;

Fig. 3 is an enlarged view showing details of the vane or blade and demonstrating its manner of operating;

Fig. 4 is a transverse section made through the vane or blade;

Fig. 5 is a sectional view of a two cylinder or two chamber pump or motor taken on the plane of line 5—5 on Fig. 6, showing a modified form of the invention contemplated herein;

Fig. 6 is a sectional view taken substantially on the plane of line 6—6 on Fig. 5;

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Fig. 7 is an enlarged elevation of the modified rotor blade, the adjacent structure shown in section on the plane of line 7—7 on Fig. 8; and

Fig. 8 is a transverse section taken on the plane of line 8—8 on Fig. 7.

The drawings are to be understood as being more or less schematic for the purpose of disclosing typical or preferred forms of the structure contemplated herein, and in these drawings like reference characters are employed to identify the same parts wherever these parts appear in the different views.

The pump or motor structure which is illustrated in Figs. 1 and 2 comprises a hollow housing 5 of a generally cylindrical shape having an open side that is closed by the removable closure plate 6. This housing has an inlet stub 7 and an oppositely disposed outlet stub 8. There is an inlet passageway 9 extending approximately two thirds of the circumference of the housing, and alongside said passageway 9 there is an outlet passageway 10 which also extends around approximately two-thirds of the circumference of the housing. These passageways 9 and 10 communicate with the respective stubs 7 and 8 intermediate their end portions, and it will be seen that the end portions of these passageways overlap each other in the manner shown in Fig. 1. The passageways 9 and 10 are non-communicating with respect to each other, and their overlapped portions are parallel.

The bore of the housing preferably consists of a cylindrical liner 11 and annular side plates 12 and 13 that provide guiding means for the rotor structure. The rotor body 14 fits the cylindrical liner and its ends engage the side plates 12 and 13 as shown in Fig. 2. The trunnion 15 of the rotor body is journaled in an axial bearing boss 16 on the closure plate 6 of the housing, and the other trunnion of the rotor body is journaled in an aligned bearing boss 18 on the side of the housing 5. A prime mover may be suitably connected to the trunnion 17 for actuating the rotor body within the bore of the housing where the device is to be operated as a pump or a similar connection may be made where the device is operated as a motor.

A plurality of inlet openings 19 are made in the cylindrical liner of the housing bore which establish communication between the inlet passageway 9 and the interior of the bore, and a plurality of outlet or discharge openings 20 made in the liner, alongside the respective inlet openings, provide communication between the bore and the outlet passageway 10.

The rotor body 14 has a central bore 21, and it is also provided with a plurality of outwardly opening longitudinal slots 22, the latter being radially disposed and provide pockets or guiding means for a plurality of vanes or blades 23 that are disposed therein. These vanes or blades comprise elongated metal strips that are of a length to extend from side to side of the rotor body 14 with their outer ends engaging the inner faces of the annular liner plates 12 and 13 that restrain said vanes or blades against longitudinal displacement. There are preferably eight of these blades 23, but it will be understood that the number may be varied in accordance with the service required or the particular specifications. By employing an even number of vanes or blades 23 it will be apparent that each blade is disposed in radial alignment with a diametrically opposite blade so that the blades are arranged in pairs in the manner shown. This disposition of the blades permits of a structure wherein during the operation of the pump, one blade of a pair will be moving inwardly while its cooperating or aligned blade will be moving outwardly with respect to their respective seats or guide pockets. This uniform and simultaneous movement of the blades of each pair is facilitated by means of a plurality of spacers 24, preferably in the form of pins, that are movable longitudinally in guide holes bored radially through the rotor body 14 in alignment with the slots or guide pockets 22. The ends of these pins contact the inner edges of the vanes or blades 23, and since said pins 24 are all of the same length all of the blades are uniformly spaced from their diametrically opposite or companion blades. This predetermined spacing of the blades is maintained constantly through each rotation of the rotor body. Furthermore, this arrangement dispenses with the use of springs and similar elements to urge the blades outwardly into sealing engagement with the bore surfaces of the pump housing.

The inner bore of the pump housing comprises triple cam surfaces including offsets 25 of arcuate shape that are cut into the bore and provide the compression chambers through which the outer edges of the blades 23 will sweep during each stroke thereof. These cam offsets are flanked by three cam rises 26. The cylindrical surface of the rotor body engages these raised cam portions 26 which center said rotor by providing a tripod-type of bearing thereof. The cam surfaces 25 and 26 provide camming means, which positively move each pair of blades in unison and also bodily independently of the rotor body 14. When the rotor is moving, a blade entering one of the three offsets or cam surfaces 25 will pass an inlet 19 and will then compress the fluid until the latter is discharged through the next outlet opening 20. With the arrangement shown, there are always at least two blades passing through an offset of compression chamber, and by employing eight blades cooperating with triple offsets there will be twenty-four compression strokes during each revolution of the rotor when operated as a pump or corresponding number of driving impulses when operated as a motor. When one blade of a pair is engaged with a hump or raised portion 26 the diametrically opposite blade will be in the deepest portion of the opposite cam surface so that these aligned blades will move respectively inward and outward simultaneously and at the same speed of bodily radial movement and constantly at the same distance apart.

Referring to Figs. 3 and 4, it will be seen that the relative transverse dimensions of the guide slot 22 and the blade 23 are such that there is sufficient clearance between these parts to permit the blade to cant or tilt with respect to the the direction of rotation of the rotor 14 as determined by the relative pressures on the opposed sides thereof, this in turn depending on whether the same is being operated as a pump or a motor. In the tilted position shown the trailing face of the blade will be in firm engagement with the adjacent corner x of the slot thereby to provide a seal extending the length of the blade and slot. The longitudinal movement of the spacer rods 24 exert a certain amount of force against the inner edge y of the blade to urge the blade bodily outward so that its other edge z will form a seal against the surfaces of the housing bore through which it sweeps.

The compression of the fluid in the chamber in front of the blade, when used as a pump and rotated in the direction indicated by the arrow, will cause the canting or tilting in the manner shown in Fig. 3, and when the structure is used as a motor the blade will be tilted by the force exerted against it by the impelling fluid. In order to admit the compressed fluid to the space 27 between the inner edge y of the blade and the bottom of the guide slot 22 both the faces of the blades are provided with a plurality of relief channels 28 through which the pressure fluid will be fed into the space 27. In this manner the radially outwardly directed force of the pressure fluid against the edge y of the blade will seal the outer edge z against the bore surface. Thus the high pressure on one side of the blade is positively divided and sealed against the low pressure on the trailing side of the blade. In this connection it is assumed that the revolution of the rotor is in the direction indicated by the arrow thereon. The arrangement and structure described permits the rotor being revolved in either direction, and likewise adapts the structure for use as a motor or a pump without alteration.

In Figs. 5 to 8, inclusive, a modified structure is shown that comprises a pump or motor having two oppositely disposed compression chambers 30*a* and 30*b*. The assembly in this modification is of smaller diameter than in the form illustrated in Figs. 1 and 2 by reason of the more compact disposition of the component parts. The chambers 30*a* and 30*b*, and the intermediate cam off-sets 31 are made in the inner surface of an annular or ring-shaped block 32 that has side members 33 and 34 secured to it to enclose said block 32, and the rotor body 35, that is anchored to the axially disposed actuating shaft 36. One end of this shaft extends into a socket 37 in the central portion of side member 33, and the other portion of said shaft passes through a central bore 38 in the other side member 34 for connection to suitable driving means (not shown) that may be any prime mover.

The side member 33 has a segmental passageway 39 communicating the inlet 33*a* with chambers 30*a* and 30*b*. The other side member 34 has a similar segmental passageway 40 communicating the discharge port 34*a* with the chambers 30*a* and 30*b*. These ports 33*a* and 34*a* may have their functions reversed depending upon the desired direction of rotation or whether being operated as a pump or a motor.

The rotor body 35 is provided with a plurality of outwardly opening guide slots 41 that extend across the body and are disposed radial to the

axis thereof to provide pockets or guiding means for the vanes or blades 42. Relief channels 43 are made in the faces of these blades through which the pressure fluid will pass to the spaces 44 back of the inner edges of the blades to urge them outwardly so that the other or outer edges of said blades will effect a positive sealed contact with the opposing work faces of the pump or motor. In order to insure the above-mentioned sealed contact and also to permit retraction and projection of the blades into and out of the guide slots 41 elastic means such as springs 45 are placed back of these blades. Recesses 46 are made in the inner edges of the blades to receive the outer portions of said springs, and wells 47 are bored in the bottoms of the slots 41 to seat the other portions of these springs.

Referring to Fig. 8, it will be seen that, while the slot 41 has parallel side walls or faces, the proximate or opposing side faces of the blade 42 converge towards each other in an outward direction. In other words, the blade 42 is of a tapered construction with the widest portion innermost in the slot 41, with the result that the force exerted by the fluid in the chamber in front of the blade will cause the blade to cant or tilt until a portion of its surface contacts the adjacent wall of the slot, thus providing a seal along the length of the blade and slot. This sealing position, as shown in Fig. 8, is quite effective for providing a clearance between the other face of the tilted blade and its confronting slot wall for admitting the pressure fluid through the slot to the inner edge of the blade thereby to urge the blade outwardly into sealing position or engagement with the work faces of the compression chambers.

It will appear that either the tapered construction of blade of Fig. 8 or the straight construction of Fig. 4 may be used interchangeably.

While this invention has been described in detail in its present preferred form or embodiment, it will be apparent to those skilled in the art, after understanding the improvements contemplated herein, that various changes and modifications may be made therein without departing from the spirit or scope thereof. It is aimed in the appended claims to cover all such changes and modifications.

I claim:

1. A rotary fluid pressure device of the vaned-type adapted for rotation in two directions for providing respectively a pump and a motor, said device comprising a cylindrical housing having therein a bore defining a work chamber with cam surfaces; a rotor body rotatable in two directions in said bore; radial guide slots in said rotor having parallel unbroken side walls; and blades operable in said guide slots and having plane side faces converging towards each other in a direction radially outward with respect to the rotor axis whereby during either rotative movement of the rotor a titlting of the blades is effective to engage a tapered face of each blade in flat surface contact with the adjoining slot wall and to effect a clearance space between the other face of the blade and the other wall of the slot; and transverse channels in the radial inner regions of each blade, said channels and said clearance spaces together providing the sole means for conducting pressure fluid from said work chamber to the inner edges of said blades during either direction of rotation of said rotor.

2. A rotary fluid pressure device of the vaned-type adapted for rotation in two directions for providing respectively a pump and a motor, said device comprising a cylindrical housing; side by side inlet and outlet passageways in said housing; a cylindrical liner in said housing having a bore defining a work chamber with cam surfaces, an inlet opening in said liner establishing communication between said inlet passageway and said bore; an outlet opening in said liner providing communication between said bore and said outlet passageway; a rotor body rotatable in said liner bore; radial guide slots in said rotor having parallel unbroken side walls; and blades operable in said guide slots and having plane side faces converging towards each other in a direction radially outward with respect to the rotor axis whereby during either rotative movement of the rotor a tilting of the blades is effective to engage a tapered face of each blade in flat surface contact with the adjoining slot wall and to effect a clearance space between the other face of the blade and the other wall of the slot; and transverse channels in the radial inner regions of each blade, said channels and said clearance spaces together providing the sole means for conducting pressure fluid from said work chamber to the inner edges of said blades during either direction of rotation of said rotor.

EARL F. HUBACKER.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,333,323	Livermore	Nov. 2, 1943
1,366,139	Traudt	Jan. 18, 1921
1,996,875	McCann	Apr. 9, 1935
2,225,803	Smith	Dec. 24, 1940
2,278,131	Livermore	Mar. 31, 1942
159,066	Beekman	Jan. 26, 1975
1,133,937	Crow	Mar. 30, 1914
2,056,910	Schauer	Oct. 6, 1936
2,371,081	Tucker et al.	Mar. 6, 1945

FOREIGN PATENTS

Number	Country	Date
451,416	Germany	Nov. 4, 1926
689,408	France	May 27, 1930
22,712	Great Britain	1911
53,868	Austria	1912

Certificate of Correction

February 3, 1948.

Patent No. 2,435,279.

EARL F. HUBACKER

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Column 3, line 52, for the word "thereof" read *therefor*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 4th day of May, A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.