Feb. 14, 1967 E. T. NEUBAUER 3,303,783

FLUID PUMP APPARATUS

Filed July 1, 1964

FIG-1

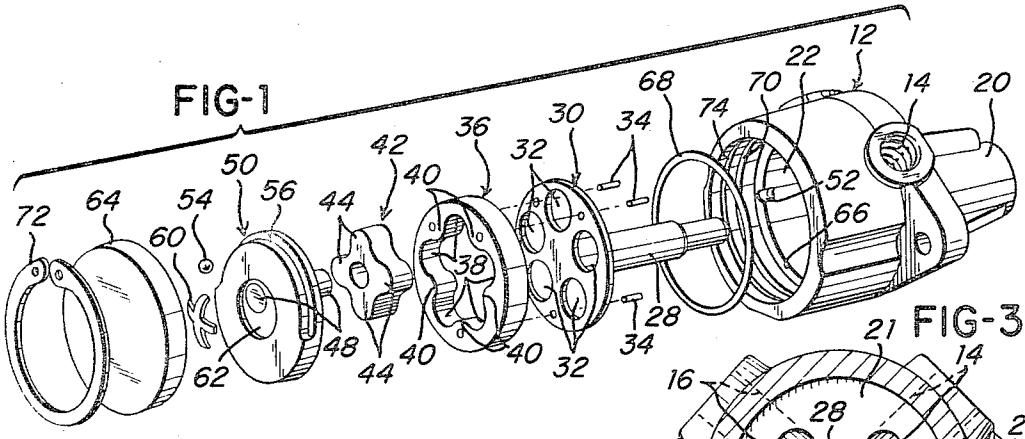


FIG-3

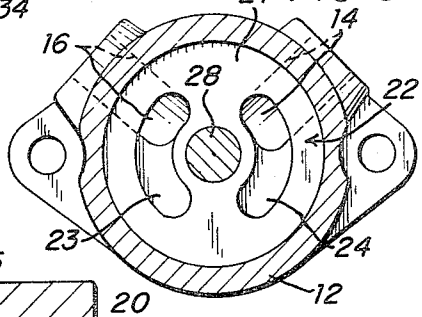


FIG-2

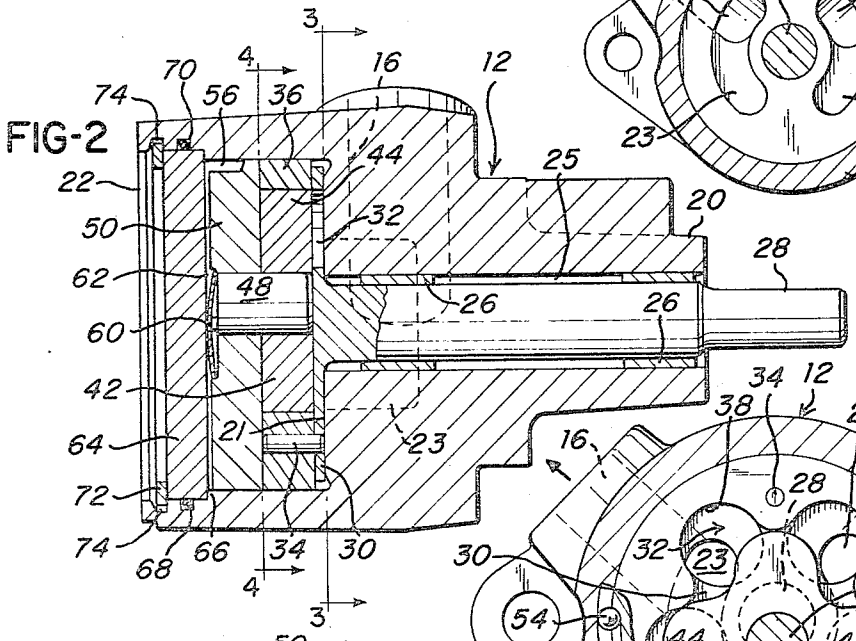


FIG-4

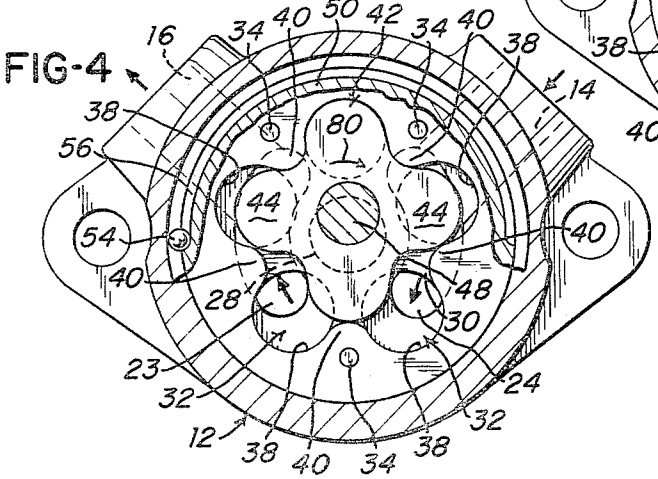
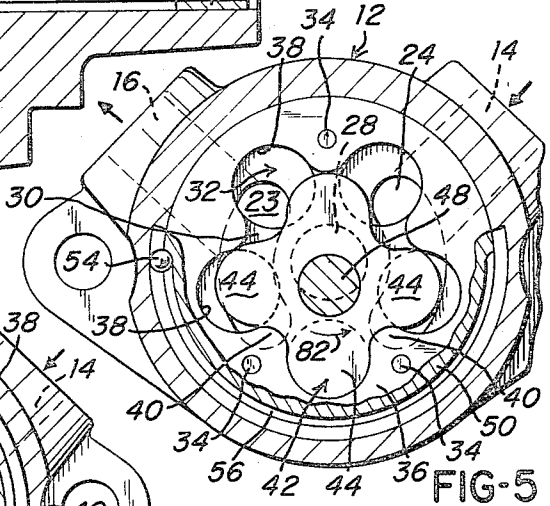


FIG-5



INVENTOR.
EMIL T. NEUBAUER

BY William R Jacox

ATTORNEY

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FLUID PUMP APPARATUS

Emil T. Neubauer, Sidney, Ohio; Third National Bank and Trust Company, executor of the estate of said Emil T. Neubauer, deceased, assignor to Tuthill Pump Company, Chicago, Ill., a corporation of Illinois

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1 Claim. (Cl. 103—3)

This application is a continuation-in-part of my co-pending application Serial No. 354,531 for Fluid Pump Apparatus, filed March 25, 1964, now abandoned.

This invention relates to fluid pump apparatus. The invention relates more particularly to rotary fluid pump apparatus.

An object of this invention is to provide fluid pump apparatus having a rotary member which pumps fluid in the same direction regardless of the direction of rotation of the rotary member.

Another object of this invention is to provide such pump apparatus which may be easily and readily assembled and disassembled.

Another object of this invention is to provide such pump apparatus which can be assembled without the use of nuts or bolts or the like.

Another object of this invention is to provide such pump apparatus which is relatively compact and small in physical size in consideration of the capacity thereof.

Another object of this invention is to provide such pump apparatus which may be constructed with a drive shaft concentric with a cylindrical housing or eccentric with respect thereto.

Another object of this invention is to provide such apparatus which is also operable as a fluid motor.

Other objects and advantages reside in the construction of parts, the combination thereof, the method of manufacture, and the mode of operation, as will become more apparent from the following description.

In the drawing:

FIGURE 1 is a perspective exploded view of fluid pump apparatus of this invention.

FIGURE 2 is an enlarged side sectional view of the apparatus of FIGURE 1.

FIGURE 3 is a view taken substantially on line 3—3 of FIGURE 2 but on a slightly smaller scale.

FIGURE 4 is a sectional view taken substantially on line 4—4 of FIGURE 2.

FIGURE 5 is a sectional view similar to FIGURE 4 but showing elements of the apparatus in another position of operation.

Referring to the drawing in detail, fluid pump apparatus of this invention comprises a housing 12 which is provided with an inlet passage 14 and an outlet passage 16. The housing 12 is shown as having an extension portion 20.

The housing 12 has a chamber or cavity 22 therewithin. A bore 25 extends through the extension portion 20 and communicates with the cavity 22. The cavity 22 has an end wall 21 which is provided with a pair of spaced-apart elongate depressions or ports 23 and 24. The depression or port 23 provides communication between the cavity 22 and the passage 16. The depression or port 24 provides communication between the cavity 22 and the passage 14.

Any suitable bearing members 26 are shown within the bore 25 for rotatable support of a shaft 28.

Within the cavity 22 the shaft 28 carries a disc 30 for rotation therewith. The disc 30 is provided with a plurality of openings 32 therethrough. Attached to the disc 30 by any suitable means such as by means of pins 34 is a rotor 36. The rotor 36 is therefore rotatable with the disc 30 as the disc 30 forms a wall of the rotor 36.

The rotor 36 is annular in shape and has a plurality of internal recesses or indentations 38 which are separated by protuberances 40. Preferably, there is a very small clearance between the periphery of the rotor 36 and the cylindrical walls of the cavity 22. Each of the openings 32 of the disc 30 is in alignment with one of the recesses 38 of the rotor 36 for communication therewith.

Within the annular rotor 36 is a rotor 42 which has a plurality of lobes 44. The rotor 42 is rotatably supported by a stud or shaft 48 which is carried by a support plate 50. The support plate 50 is coaxial with the rotor 36 and is rotatable within the cavity 22.

The structure as described above makes possible the production of the rotors 36 and 42 by a powdered metal process. However, if desired, the disc 30 and the rotor 36 may be integral.

The stud 48 is eccentric with respect to the central axis of the plate 50. Therefore, the rotor 42 rotates about an axis which is eccentric with respect to the axis of rotation of the rotor 36 within which the rotor 42 is disposed. Also, the position of the stud 48 is changed with rotative movement of the support plate 50.

The cylindrical wall forming the cavity 22 has a small socket 52 therein. A ball 54 is disposed within the socket 52 and within an elongate notch 56 at the periphery of the plate 50. The ball 54 thus limits the degree of rotative movement of the plate 50. The elongate notch 56 is shown as extending around substantially one-half of the periphery of the plate 50; thus the ball 54 limits the rotative movement of the plate 50 to substantially one-half of a revolution.

A thrust spring 60 is partially disposed within a depression 62 of the plate 50. The thrust spring 60 engages the plate 50 and a cover disc 64 and urges the plate 50 in a direction from the cover disc 64 so that there is a space therebetween. Within the cavity 22 is a shoulder 66 which is abuttingly engaged by the cover disc 64 for positioning thereof.

A sealing member 68 encompasses the cover disc 64 and is partially disposed within a groove 70 in the wall of the cavity 22. An arcuate snap ring 72 is partially disposed within a groove 74 and retains the cover disc 64 in its desired position within the cavity 22.

Operation

For operation of the apparatus of this invention as a pump, any suitable motor means (not shown) may be connected to the shaft 28 for rotation thereof.

Rotation of the shaft 28 causes rotation of the disc 30 and the rotor 36. Due to the fact that the lobes 44 of the rotor 42 mesh with the recesses 38 and the protuberances 40 of the rotor 36, the rotor 42 is rotated with rotation of the rotor 36.

As discussed above, the plate 50 is rotatable through a limited degree. Due to the fact that the plate 50 is in engagement with the rotors 36 and 42, rotation of the rotors 36 and 42 urges rotation of the plate 50. If the rotors 36 and 42 rotate clockwise, as illustrated by an arrow 80 in FIGURE 4, the plate 50 is urged to rotate clockwise. However, the ball 54 which is disposed within the socket 52 of the cavity 22 and within the notch 56 of the plate 50 limits the rotative movement of the plate 50 to a position as shown in FIGURE 4. Thus, the plate 50 maintains a given rotative position during clockwise rotation of the rotors 36 and 42, and the plate 50 maintains another rotative position during counterclockwise rotation of the rotors 36 and 42.

As stated above, due to the fact that the stud or shaft 48 is eccentric with respect to the plate 50, rotative movement of the plate 50 changes the position of the stud or shaft 48. Due to the fact that the rotor 42 is rotatably supported by the stud or shaft 48, the position of the rotor 42 changes with change in position of the stud or shaft 48.

Thus, when the rotors 36 and 42 are rotating clockwise, as shown in FIGURE 4, the stud 48 and the rotor 42 are positioned within the rotor 36, in the manner shown in FIGURE 4.

Also, as shown in FIGURE 4, there is always one or more of the recesses 38 of the rotor 36 which are open or partially open. Therefore, as the rotors 36 and 42 rotate, the lobes 44 of the rotor 42 move into and out of successive recesses 38 of the rotor 36. Thus, when the rotors 36 and 42 are rotating clockwise, the rotor 42 is positioned with respect to the ports 23 and 24 in the manner shown in FIGURE 4. Thus, fluid is drawn into the annular rotor 36 through the inlet passage 14, through the port 24 and through one or more of the openings 32. The fluid flows into the recesses 38 of the rotor 36 which are in communication with the port 24. Then as the rotors 36 and 42 rotate, the fluid is carried within the recesses 38 of the rotor 36.

As shown each of the openings 32 is in alignment with one of the recesses 38 and serves as a port leading to and from its respective recess 38. Each of the openings 32 is smaller than the space between the depressions or ports 23 and 24. Thus, as each of the recesses 38 passes from communication with the depression 24 to communication with the depression 23, fluid is retained within the recess 38. Then as the recesses 38 approach the port 23, successive lobes 44 of the rotor 42 move into successive recesses 38 of the rotor 36 and force fluid therefrom. As the fluid is forced from the recesses 38 the fluid flows through the openings 32 which are in communication with the port or depression 23, and the fluid flows into the outlet passage 16. Thus, fluid is forced outwardly through the outlet passage 16, as shown in FIGURE 4.

When the shaft 28 is rotated in the opposite direction, the rotors 36 and 42 rotate counterclockwise, as illustrated by an arrow 82 in FIGURE 5. Therefore, due to the fact that the plate 50 is in sliding engagement with the rotors 36 and 42, the plate 50 is rotated counterclockwise throughout its limited degree of rotative movement. As stated above, the rotative movement of the plate 50 is limited by the ball 54 which is located within the socket 52 of the cavity 22 and within the elongate groove 56 of the plate 50. Thus, the rotative position of the plate 50 during counterclockwise rotation of the rotors 36 and 42 is as shown in FIGURE 5. Thus, the stud or shaft 48 is in the position thereof shown in FIGURE 5 and the rotor 42 is positioned with respect to the ports 23 and 24 as shown in FIGURE 5.

Therefore, when the rotors 36 and 42 rotate counterclockwise fluid is drawn into the recesses 38 when the recesses 38 are adjacent the depression or port 24 and fluid is carried in the recesses 38 until the recesses 38 come into communication with the depression or port 23. When the recesses 38 come into communication with the depression or port 23, successive lobes 44 of the rotor 42 move into successive recesses 38 of the rotor 36 and force fluid from the recesses 38 through the openings 32 which are in communication therewith. The fluid is thus forced from the cavity 22 into the depression or port 23. Thus, fluid is forced outwardly from the cavity 22 through the outlet passage 16 in the manner illustrated in FIGURE 5 when the rotors 36 and 42 rotate counterclockwise.

Thus, it is understood that in either direction of rotation of the shaft 28, fluid pump apparatus of this invention forces fluid in the same direction. Thus, the same inlet passage and the same outlet passage are used in either direction of rotation of the shaft 28.

The apparatus of this invention may also be used as a fluid motor, if so desired, by forcing fluid therethrough.

Although the preferred embodiment of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claim.

The invention having thus been described, the following is claimed:

Reversible fluid pump apparatus comprising, a housing provided with a wall forming a cylindrical cavity therein, said cavity having a socket in which is disposed a ball to engage a groove in a support member hereinafter defined, said housing having spaced apart inlet and outlet passages leading to said cavity, a first annular, shaft-supported rotor within said cavity having a plurality of internal recesses and an end wall with apertures therethrough opening into communication with each of said internal recesses whereby rotative movement of said first rotor establishes communication between any one of said apertures and said inlet or outlet; a support member having an elongated peripheral groove extending around substantially one-half of the periphery of said support member, whereby engagement with said ball in said housing limits rotative movement thereof, said support member having a stud shaft extending into said first rotor and having an axis of rotation at a position spaced from the axis of rotation of the shaft supprting said first rotor; a second rotor carried by said stud shaft and rotatable within said first rotor, said second rotor having a plurality of radial lobes, the number of said plurality of lobes being one less than the number of recesses of said first rotor, each lobe being substantially the size and shape of each of the recesses of said first rotor, each lobe being movable into and out of the recesses of said first rotor with rotational movement of said first and second rotors; an internal shoulder on said housing; a cover disc within the cavity substantially parallel to the support plate and adjacent thereto, the cover disc engaging the shoulder, the cover disc enclosing the support plate and the rotors within the cavity of the housing; resilient means intermediate the cover disc and the support plate and urging separation thereof so that a space exists between the cover disc and the support plate; the housing having an internal annular groove adjacent the cover disc; an arcuate snap ring partially disposed within the groove and engaging the cover disc and urging the cover disc toward the shoulder.

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DONLEY J. STOCKING, *Primary Examiner.*

SAMUEL LEVINE, MARK M. NEWMAN, *Examiners.*

W. L. FREEH, *Assistant Examiner.*