

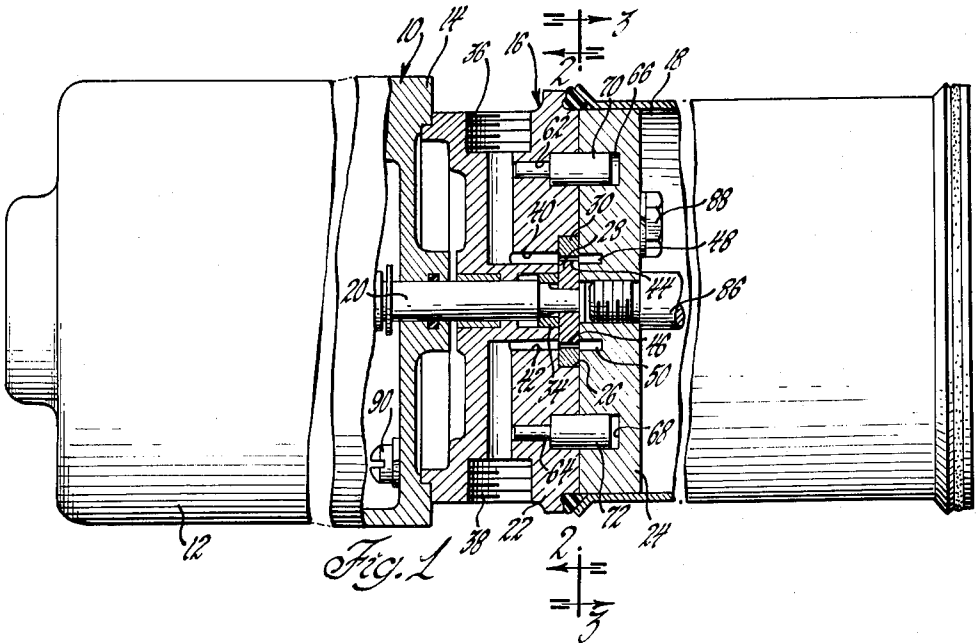
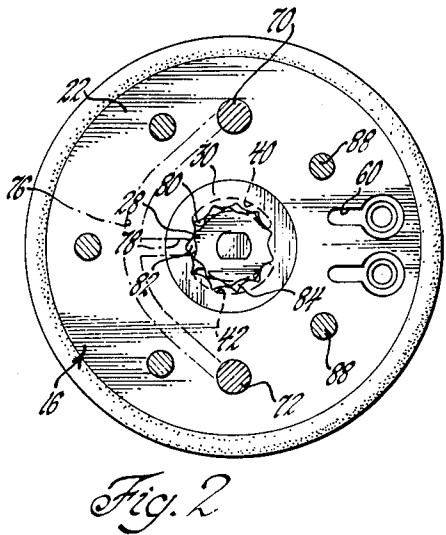
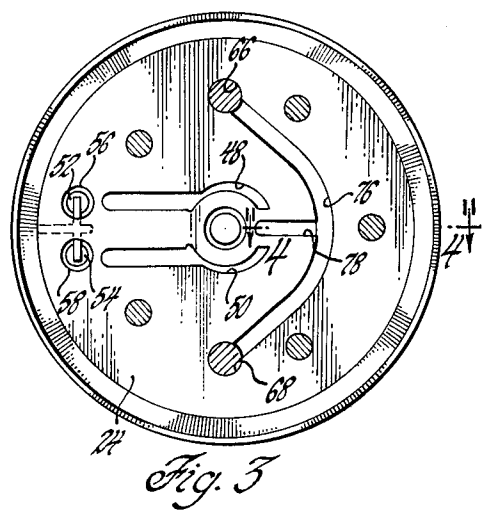
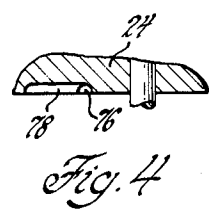
March 1, 1966

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3,237,566

FLUID TRANSFER PUMP

Filed Oct. 11, 1963



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FLUID TRANSFER PUMP

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Filed Oct. 11, 1963, Ser. No. 315,641
2 Claims. (Cl. 103-126)

This invention relates to fluid transfer pumps in general and more particularly to internal-external rotor pumps and means for improving the operational efficiency thereof and for eliminating audible noise incident to a fluid deficiency therein.

Internal-external rotor pumps include an internal rotor member eccentrically disposed within an external rotor member and cooperatively formed therewith to provide gear-like teeth to effect drive and relative movement therebetween. Fluid receptive spaces are formed between the gear-like teeth of the rotors on one side and are closed on the radially opposite side in the course of relative movement therebetween. By means of inter-changeable fluid inlet and outlet openings through the rotor chamber wall, next adjacent the fluid receptive spaces forming on one side thereof and closing on the other side, fluid is transferred by the pump in one direction or the other by simply reversing the direction of rotation of the rotors.

As will be appreciated, if either of the fluid inlet or outlet openings communicating with the fluid receptive spaces between the pumps is smaller than the other, or is relatively disposed to supply less fluid than will fill the receptive spaces between the rotors when serving as the fluid supply source, then less than the full amount of fluid which the pump is capable of handling will be transferred across the pump and the operational efficiency will be lower than it should be. Further, wherever there is a deficiency of fluid in the pump system audible noise and aeration of the fluid result which are both annoying and further detrimental to the operational efficiency of the pump.

To avoid these difficulties, manufacturers are required to hold to close tolerances in the manufacture of rotor pump parts as well as in the assembly thereof. If the rotor members are relatively disposed in the rotor chamber so that the receptive spaces formed therebetween are exposed to less of the fluid access opening one side thereof, than on the other, then a fluid deficiency in the system will also result during operation in one rotational direction.

Close tolerances are both difficult and expensive to maintain for the manufacturer. Furthermore, wear in service, impurities in the system, and many other things can throw everything off balance and reintroduce the whole problem after a pump is placed in service and reflects most unfavorably on the manufacturer or the retail supplier.

It is an object of this invention to provide means for improving the operational efficiency of internal-external rotor pumps.

It is an object of this invention to provide a means for assuring full capacity operation of internal-external rotor pumps.

It is an object of this invention to provide means for eliminating noise in rotor pumps due to fluid deficiencies.

It is an object of this invention to provide means which will preclude aeration of fluid in a rotor pump due to fluid deficiencies.

It is an object of this invention to disclose a method of improving operational efficiency and eliminating noise in a rotor pump by introducing supplementary fluid into the pump in the course of fluid transfer to eliminate any fluid deficiency adversely affecting operation and creating noise.

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It is an object of this invention to provide means for introducing supplementary fluid between rotary parts from the supply passage of the pump.

It is an object of this invention to provide supplementary fluid passage means and means precluding the cross transfer of fluid around the pump.

It is an object of this invention to provide fluid passage means in an internal-external rotor pump between the inlet and outlet sides thereof with access to the fluid receptive spaces provided between the rotors intermediate the fluid supply and exhaust ports to supplement fluid deficiency therein for the reasons aforementioned.

These and other objects and advantages to be gained in the practice of this invention will be better understood and appreciated upon a reading of the following specification in regard a preferred embodiment of the invention and having reference to the accompanying drawing.

In the drawing:

FIGURE 1 is a side plan view of a fluid transfer pump incorporating the present invention and having parts broken away and shown in cross section.

FIGURE 2 is a cross-sectional end view of the fluid transfer pump by FIGURE 1 as seen in the plane of line 2-2 and looking in the direction of the arrows thereon.

FIGURE 3 is a cross-sectional end view of the fluid transfer pump of FIGURE 1 as seen in the plane of line 3-3 thereon and looking in the direction of the arrows.

FIGURE 4 is a fragmentary cross-section detail of a significant feature of the present invention as seen in the plane of line 4-4 of FIGURE 3 and looking in the direction of the arrows thereon.

Referring to the drawing in further detail:

A fluid transfer pump assembly 10 as shown as including a small reversible motor 12 having the casing 14 thereof engaged to one side of a pump housing 16 which has, in turn, a fluid reservoir chamber member 18 secured to the other side thereof. It will be appreciated that this is a small compact and essentially self-contained unit with appropriate motor operating and controlling leads and fluid supply and exhaust lines (not shown) connected thereto.

The motor 12 has its shaft 20 extended through suitable seals and bearings into the pump housing 16 for operative engagement with pump parts which will be subsequently described.

The pump housing 16 includes a fluid passage member 22 and a cover member part 24. A rotor chamber 26 is formed between the fluid passage member 22 and the cover member part 24. The rotor chamber 26 has an internal rotor member 28 and an external rotor member 30 provided therein. The external rotor member 28 is disposed eccentrically relative to the internal rotor member 30 and they are each formed with gear-like teeth and receptive spaces in a conventionally known manner for drive engagement therebetween and the forming of fluid receptive spaces which will later be described in further detail.

The motor drive shaft 20 is formed for engagement with the internal rotor member 28 within a D-slot drive connection provided within the internal rotor member. A suitable seal 34 prevents fluid losses from the rotor chamber 26 through the shaft access passage.

Fluid passages or bores 36 and 38 are provided through relatively opposite sides of the pump housing 16 within the fluid passage member 22 and communicated with fluid ports 40 and 42 which are open to the rotor chamber 26. The fluid passages and ports are inter-changeable as fluid supply and exhaust passages and ports depending upon the direction of rotational drive imposed by the motor 12, as is conventionally known.

Like rotor chamber communication supply and exhaust ports 44 and 46 and passages 48 and 50 are pro-

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vided in the cover member 24 for communication with the fluid reservoir in the reservoir chamber member 18. Appropriate inter-connected check valve 52 and 54 are provided within check valve passages 56 and 58 between the reservoir supply passages 48 and 50 and the reservoir chamber. The check valves so arranged and inter-connected so that one is open and the other is closed to supply fluid to the inlet side of the pump in the event of any deficiency of fluid in the operating system. Since this reservoir supply system is generally known and forms no part of this invention it has not been considered necessary to describe or show it in any greater detail than has been done.

Referring still to the pump housing 16 and the fluid passage and cover members 22 and 24 thereof, a supplementary fluid supply passage means 60 is provided across the pump and has access to the rotor chamber 26. Such passage means 60 extend between the fluid supply and exhaust passages 36 and 38, as herein disclosed, and may take the form of a bleed passage; though it is preferably a check valve passage precluding fluid transfer across the pump as will subsequently be described.

Axially disposed passages 62 and 64 are provided through the passage member 22 for communication with the radially disposed fluid passages 36 and 38. Check valve chambers 66 and 68 are provided within the connecting passages 62 and 64 last mentioned, in the passage member 22, and within the cover member part 24. Check valve plungers or pistons 70 and 72 are disposed within the check valve chambers 66 and 68 and include a stem which is guided on the connecting passages 62 and 64. The check valve members 70 and 72 are closed when seated against the chamber end in the passage member 22. They are open when seated against the chamber end in the cover member part 24 and in such position enables fluid flow around themselves. They may be provided with a flat side (not shown) or otherwise be loosely fitted in the chambers 66 and 68 to facilitate the by-pass flow of fluid there around.

A semi-circular cross flow passage 76 is provided in the cover member part 24 of the pump housing 16. It extends between the two check valve chambers 66 and 68. It also includes, intermediate its ends, a radially disposed passage 78 which is open to the rotor chamber 26.

Referring now to FIGURE 2:

In the counter-clock rotation of the inner-disposed rotor member 28 and the like but relatively slower rotation of the external rotor member 30, it will be appreciated that progressively opening fluid receptive spaces 80 are formed between the internal and external rotor members over the fluid port 40.

The fluid receptive spaces formed between the relatively rotating parts obtain a relatively fixed size after passing past the port 40 and before reaching the other port 42. The fluid receptive space of relatively fixed size is designed as 82 in FIGURE 2.

Subsequently, the fluid receptive spaces become closing and exhausting fluid spaces which are designated 84, as they pass over the fluid port 42.

The phantom outline of the cross passage 76, in FIGURE 2, shows that the rotor chamber communicating passage 78 is disposed for access with the fluid transfer space 82 of relatively fixed size as the relatively rotating members cause the space to pass thereby.

In completing a structural description of the present embodiment of this invention, as shown by the drawings, it will be appreciated that the fluid reservoir chamber member 18 is held to the pump cover member part 24 by a tie bolt 86. The cover member part 24 is in turn held to the passage member 22 by fasteners 88 and the motor casing 14 is held to the pump housing member 22 as by fasteners 90.

The present invention, as adapted for use in the embodiment shown and described, works as follows:

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The fluid passages 36 and 38 serve as supply and exhaust passages, via the ports 40 and 42, to the rotor chamber 26. The passages and ports are completely filled with fluid and are replenished as necessary from the reservoir member 18, through the check valve passages 56 and 58.

As previously mentioned, it depends upon the rotational direction imposed on the rotors by the drive motor 12 as to which passages and ports supply fluids to the rotor chamber 26 and which serve as fluid exhausting passages and ports. For purposes and discussion we will consider the fluid passage 36 and 40 as providing fluid to the rotor chamber 26 and the passage 38 and 42 as receiving fluid from the rotor chamber.

Reviewing, for a moment, difficulties heretofore experienced it will be appreciated that if the tolerances between the internal and external rotor members 28 and 30 are not held extremely close, and likewise the size of the ports 40 and 42 and the supplying and exhausting spaces 80 and 84 formed between the rotor members, or if the rotor members are rotationally displaced to close the fluid receptive spaces 80 therebetween before such spaces are formed to full size or otherwise full of fluid, then a fluid deficiency will be created in the fluid transfer spaces 80 and less than maximum fluid will be delivered to the outlet side of the pump.

Now, with a counter-clockwise rotation of the rotors 28 and 30, fluid is supplied to the opening fluid receptive spaces 80 through the port 40. The fluid is transferred in the receptive spaces between the rotors past the access passage 78 which connects to the cross passage 76. This occurs, as previously mentioned, after the spaces are as large as they will become and before they begin to close to force fluid therefrom; namely when they are between the ports 40 and 42 and disposed as the space 82 identified in FIGURE 2.

With the fluid pump operating as mentioned, the rotors 28 and 30 being turned counter-clockwise, the input side of the pump is represented by the passage 36 and the output or pressure side of the pump is represented by the passage 38. Accordingly, the check valve 70 will be held closed and the check valve 72 will be open to provide fluid under output pressure in the cross passage 76. This, in turn, provides fluid through the rotor chamber access passage 78 under sufficient pressure to fill any fluid void in the fluid space 82 between the rotors. The fluid in the cross passage 76 also assists in holding the check valve closed on the input side of the pump.

It will be appreciated that a relatively small amount of fluid is needed to fill a void in the fluid transfer space 82. Furthermore, since the space is of relatively fixed size, no great pressure is needed to produce the flow of fluid needed to fill any existing void. Consequently, a bleed passage between the input and output sides of the pump and in communication with the rotor chamber 26, without the check valves 70 and 72, might serve the intended purpose as far as being sure that the fluid transferring spaces are completely filled. The bleed-back of fluid around the rotors would not be serious. However, with the check valve arrangement shown there is no cross transfer of fluid what-so-ever involved.

When the internal and external rotors 28 and 30 are rotated in the opposite direction, clockwise, the fluid passages 36 and 38, and their ports 40 and 42, serve opposite fluid supply and exhaust purposes. Consequently, the other side of the pump becomes the pressure side, the other check valve 70 is opened and the check valve 72 is closed but the same condition of fluid under pressure in the cross passage 76, and to the rotor chamber 26 via the access passage 78, remains and any existing fluid void in the fluid transfer space 82 will be filled to capacity.

As previously stated, the assurance given in the use of this invention that maximum fluid is transferred both increases the operational efficiency of the pump and precludes any audible noises which are due to deficiencies

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and thereby avoids the necessity of overly close tolerances as regard the manufacture and assembly of the pump parts.

Although a preferred embodiment of this invention has been shown and described in detail, it will be appreciated that certain modifications and improvements are within the scope of the teachings set forth. Accordingly, such of these improvements and modifications as are within the spirit of the invention and are not specifically excluded by the language of the hereinafter appended claims, are to be considered as inclusive thereunder.

I claim:

1. A fluid transfer pump, comprising, a housing having a pump chamber provided therein, internal and external rotor members cooperatively formed and disposed within said pump chamber for providing fluid receptive spaces therebetween in the course of relative rotation thereof, fluid suction and pressure chambers provided in said pump housing in communication with said pump chamber and the fluid receptive spaces between said rotor members, a cross-flow passage provided in said housing and extending between said fluid suction and pressure chambers, said cross-flow passage being in communication with the fluid receptive spaces between said rotor members independent of the communication of said fluid suction

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and pressure chambers for filling fluid voids with fluid, and check valve means provided in the cross-flow passage for selectively permitting the flow of pressure fluid through said cross flow passage to the spaces between said rotor members from only one of said fluid suction and pressure chambers.

2. The invention defined in claim 1 where said check valve means are so arranged as to prevent flow of pressure fluid from the suction chamber and to permit flow of fluid from said pressure chamber into said cross flow passage.

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