Oct. 21, 1958 H. BAADE ET AL 2,856,859

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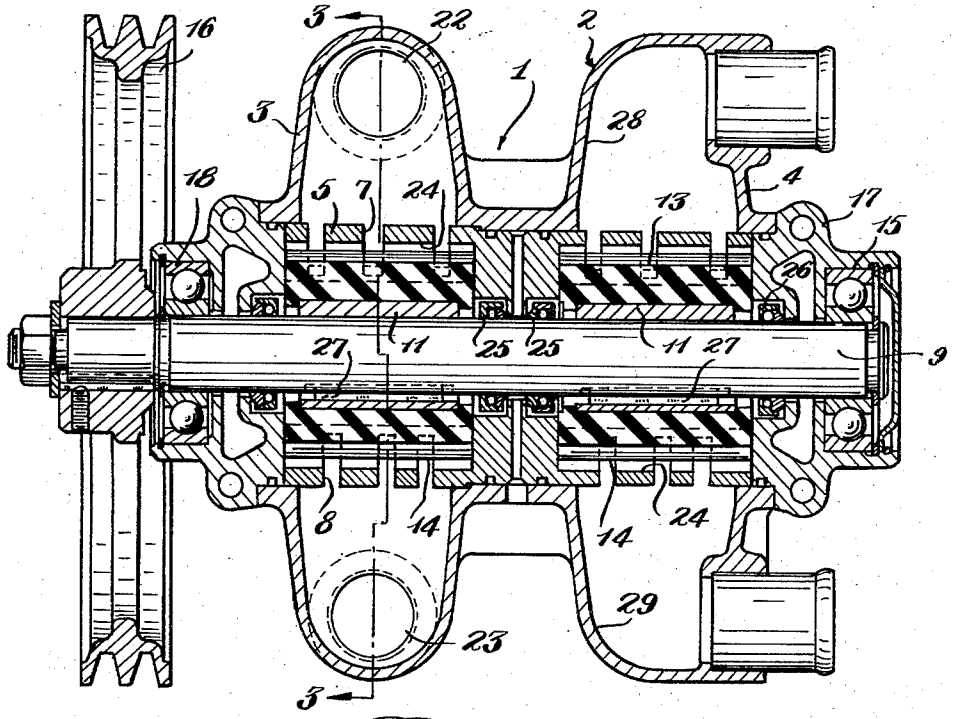


FIG. 1

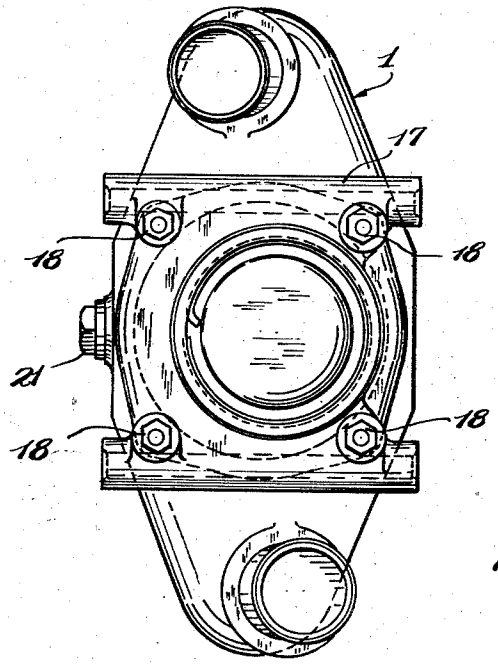


FIG. 2

INVENTORS
HENRY BAADE
BY ORPHEUS F. QUARTULLO
Oldham & Oldham
ATTORNEYS

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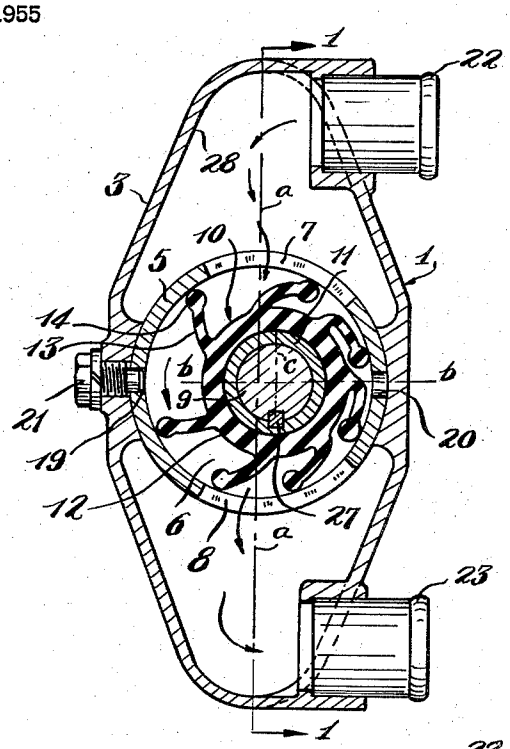


FIG. 3

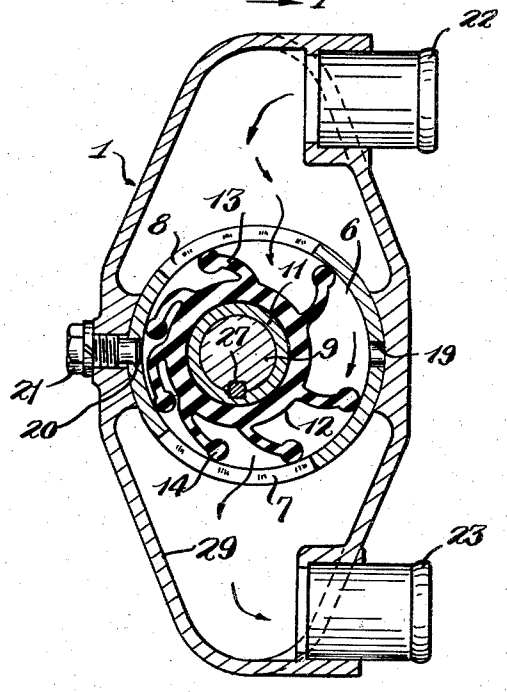


FIG. 4

INVENTORS
HENRY BAADE
BY ORPHEUS F. QUARTULLO
Oldham & Oldham
ATTORNEYS

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PUMP

Henry Baade and Orpheus F. Quartullo, Cleveland, Ohio, assignors to Visioneering Company, Inc., Cleveland, Ohio, a corporation of Delaware

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4 Claims. (Cl. 103—117)

This invention relates to pumps having alternate assemblies of the impeller thereof for rotation in opposite directions for pumping action using the same inlet and outlet in both assemblies.

Heretofore there have been many different types of vane pumps provided, which pumps have a wide variety of constructions. In some instances, it is very desirable to have a pump rotate in a clockwise direction whereas in other instances it is desirable that the pump would rotate in a counterclockwise direction. Usually prior types of pumps have required that the rotor assemblies be changed with alternate impellers being used for rotation in opposite directions, while the housings also must be changed for pump impeller rotation in an opposite direction.

The general object of the present invention is to provide a novel and improved pump using a flexible rubber impeller and wherein the pump is adapted to move large volumes of liquids at relatively low pressures.

Another object of the invention is to provide a flexible plastic or rubber impeller in a pump wherein the impeller arms, when in a free position, extend substantially radially of the pump shaft and have enlarged portions at the free ends of the impeller arms.

A further object of the invention is to provide a pump wherein a flexible impeller can be used to rotate in either direction in the pump and wherein the impeller is positioned eccentrically to the pump axis in either of two directions for rotation in opposite directions in the pump.

Another object of the invention is to provide a pump having an impeller which can be driven in either direction and wherein the impeller can be adapted to operate in a desired direction by a minimum of changes in the pump assembly.

Yet another object of the invention is to provide a pump housing member that can readily be rotated through an arc of 180° to adapt the pump housing for impeller rotation in an opposite direction.

Reference now is made to the attached drawings, wherein:

Fig. 1 is a vertical longitudinal section of one pump embodying the principles of the invention and taken on line 1—1 of Fig. 3;

Fig. 2 is a right side elevation of the pump of Fig. 1;

Fig. 3 is a vertical section taken on line 3—3 of Fig. 1; and

Fig. 4 is a section, similar to Fig. 3, only with the pump assembly being rearranged to rotate in the opposite direction to that shown in Fig. 3.

When referring to corresponding parts shown in the drawings and referred to in the specification, corresponding numerals are used to facilitate comparison between the drawings and the specification.

The present invention relates to a pump which comprises a pump housing, a sleeve supported in the housing and defining a pump chamber having an inlet and an outlet therein, a shaft, an impeller with resilient arms on the shaft, support means secured to the pump housing and

engaging said shaft to position it in the sleeve, which support means are engageable with the pump housing in alternate positions separated by 180° to make the shaft eccentric with relation to the sleeve in opposite directions from the center line thereof, which sleeve is also positionable in the pump housing in either of two positions separated by 180° whereby the two positions of the support means and the sleeve adapt the shaft and impeller for rotation in either desired direction dependent upon the assembly of the pump components.

Attention now is directed to the details of the structure shown in the accompanying drawings, and a pump is shown and indicated as a whole by the numeral 1. The pump 1 is provided with a housing 2, which housing 2 has two oval shaped sections 3 and 4 provided therein. A sleeve 5 defining a pump chamber 6 is positioned in and extends through the sections 3 and 4 of the housing 2 for receiving the actual pump mechanism therein for the individual portions of the pump 1. In this instance, the pump 1 comprises a double chamber pump made from the sleeve 5 with the two chambers of the pump being completely separate in pumping action. The pump 1 may obviously have one pumping chamber therein, or more than two, if desired, and individual sleeves may be provided for the different pump chambers.

As best shown in Fig. 3, the sleeve 5 has a plurality of axially spaced, circumferentially directed and aligned inlet slots 7 therein, and a second set of similar axially aligned and spaced outlet slots 8 that extend circumferentially of the sleeve in a substantially opposite portion thereof and positioned symmetrically with respect to the horizontal centerline of the pump as positioned in the drawings, in each section of the sleeve positioned in a pump chamber.

Fig. 3 shows that a drive shaft 9 is received in the pump housing 2 and extends therethrough, which shaft 9 is positioned eccentrically with relation to and extends through both sections of the sleeve 5. Thus the sleeve 5 has the center lines *a—a* and *b—b* whereas the shaft 9 is positioned on the center lines *c—c* and *b—b* so that shaft 9 is on a diameter of the sleeve 5, but not centered therein.

As an important feature of the invention, resilient, flexible means are used for forming separate impellers that are positioned within the sleeve 5 in the separate pumping chambers provided. Thus a pair of impellers 10 are provided and each impeller 10 comprises a metal bushing or driving sleeve 11 to which an impeller base or sleeve 12 is suitably secured, as by vulcanization. A plurality of axially extending impeller blades or arms 13 extend substantially radially from the impeller sleeve 12 under normal conditions but with such impeller arms being deflectable by contact with the wall of the bore of the sleeve 5. Preferably such impeller arms 13 each have enlarged bead or head sections 14 provided at the free ends thereof to rub or seal against the wall of the bore of the sleeve 5 on rotation of the pump. The impellers 10 may be made from any suitable material including rubber, synthetic rubber, or other plastic materials, such as vinyl plastics.

The shaft 9 is suitably journalled in the pump housing 2, as by bearings 15, and it has a conventional drive pulley 16 secured to one exposed end of the shaft 9.

A further special feature of the present invention is that the bearings 15, and thus the shaft 9, are positioned in the pump 1 by means of end plates, or caps 17 removably and reversibly secured to the remainder of the pump housing 2, as by cap screws 18. These end caps 17 provide the specific means by which the shaft 9 is positioned eccentrically within the sleeve 5. The end caps 17 are of such a construction that they can be rotated through 180° with relation to the pump housing 2 and be engaged

therewith for moving the shaft 9 supported thereby from the eccentric position shown in Fig. 3 with relation to the pump housing 2, over to that shown in Fig. 4 in the drawings. It also should be noted that the sleeve 5 has a pair of diametrically opposed holes or bores 19 and 20 provided therein for engaging a lock screw 21 extending through the housing 2 for being received in one of the bores 19 or 20 depending upon which one is presented for engagement with such screw 21. It will be seen that the sleeve 5 has been rotated through 180° from the position shown in Fig. 3 over to that shown in Fig. 4. Hence by reversing the position of the end caps 17, by rotating them through 180°, and by rotating the sleeve 5 through 180°, the pump 1 of the invention can be revised from being adapted to be driven in counterclockwise direction over to being a pump adapted for rotation in a clockwise direction. The drawings also clearly bring out that for both operative positions of the pump impeller and shaft, the inlet and outlet slots 7 and 8 are in similar positions with relation to the eccentricity of the shaft 9 and the direction of rotation thereof. Hence the impeller arms 13 are pressed in as they approach the outlet slots 8 and are permitted to flex outwardly more towards a radial position in the pump as they are moved past the inlet slots 7 to draw liquid into the sleeve. As the impeller arms move liquid through or around the sleeve 5 over towards the outlet slots 8, the impeller sleeve 12 is moved radially towards the outlet slots 8 to aid in the discharge of liquid from the pump. The impeller 10 and shaft 9 are so positioned in the sleeve 5 that the volumn defined between a pair of adjacent impeller arms, the impeller hub or sleeve portion 12, and the sleeve 5 is increased adjacent the inlet slots 7 and decreased adjacent the outlet slots 8 to provide the pumping action.

By the particular shape of the housing 2 provided in the pump of the invention, portions of the housing 2 surrounding the sleeve 5 are used for providing inlet and outlet liquid receiving chambers for the pump. Hence Fig. 3 clearly shows that an inlet tube or connection 22 is provided on the housing for passage of fluid into the housing 2 for flow into and through the slots 7 as the pump impeller 10 is rotated and with the fluid expelled from the pump flowing through an outlet tube 23 that receives pumped liquid from the outlet slots 8 through the portion of the housing 2 adjacent such slots. This inlet 22 and outlet 23 function for either direction of rotation of the impeller.

The sleeve 5 is counterbored at 24 from each end thereof to provide the impeller receiving chambers therein and the center part of the sleeve positions conventional packing rings or glands 25 therein to seal the pump chambers from each other. Similar sealing rings 26 are carried by the end caps 17 to seal around the shaft 9. Keys 27 secure the impellers 10 to the shaft 9.

Fig. 3 of the drawings shows that there is less circumferential distance between the end of the outlet slot 8 and the start of the inlet slot 7 in the direction of rotation than from the end of the inlet slot 7 to the start of the outlet slot 8. However, the slots 7 and 8 are of equal length. The inlet chamber in the pump housing 2 is indicated by the numeral 28 and 29 is the outlet chamber to which conventional means connect for passage of liquid to and from the pump 1. The inlet 22 and outlet 23 can be reversed, if desired, for pumping liquids through the pump 1 with opposite rotational directions from those shown.

From the foregoing, it can be seen that the pump of the invention can be shipped to an intended user and that such user can readily adapt the pump for rotation in either desired direction and that the assembly of the pump can be changed after a period of service without any difficulty to permit the user to rearrange operation of the pump, if desired.

From the foregoing, it is submitted that a relatively inexpensive, uncomplicated pump assembly has been provided wherein identical pump components can be used to provide either a pump adapted for clockwise rotation, or for counterclockwise rotation, as desired. The novel, flexible impeller and impeller arms of the pump of the invention aid materially in the functioning of the pump and permit liquids to be pumped efficiently under relatively low pumping pressure. Such resilient impeller arms aid in sealing the pumped liquid in the pump. Thus it is contended that the objects of the invention are achieved.

While one complete embodiment of the invention has been disclosed herein, it will be appreciated that modification of this particular embodiment of the invention may be resorted to without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. A pump comprising a pump housing, a sleeve defining a pump chamber and having inlet and outlet slots therein, said sleeve extending through and being rotatable in said pump housing and having a pair of diametrically opposed set screw receiving apertures therein, set screw means engaging said pump housing and said apertures to secure said sleeve to said housing, a shaft, impeller means on said shaft, end cap means secured to said pump housing and positioning said shaft in said sleeve, said end cap means being engageable with said pump housing in alternate positions and make said shaft and impeller means eccentric with relation to said sleeve in diametrically opposite directions, said sleeve being positionable in said pump housing in either of two positions separated by 180° whereby the two positions of said end cap means and said sleeve adapt said shaft for rotation in opposite directions.

2. A pump comprising a pump housing, a sleeve rotatably supported in said housing and defining a pump chamber having an inlet and an outlet formed in said sleeve, means securing said sleeve in said pump housing in either of two arcuate positions spaced 180° apart, a shaft, an impeller on said shaft and having circumferentially flexible freely movable resilient rubber impeller arms thereon, end cap means secured to said pump housing and positioning said shaft in said sleeve, said end cap means being engageable with said pump housing in alternate positions separated by 180° to make said shaft and impeller eccentric with relation to said sleeve in diametrically opposite directions, said sleeve being positionable in said pump housing in either of two positions separated by 180° to maintain said inlet and outlet in fixed relation to the eccentricity of said shaft whereby the two positions of said end cap means and said sleeve adapt said shaft for rotation in either direction.

3. In a pump, a sleeve defining a pump chamber, said sleeve having a plurality of substantially diametrically opposed circumferentially extending inlet and outlet slots therein, a drive shaft eccentrically positioned in said sleeve, a flexible impeller secured to and driven by said drive shaft, said impeller having a plurality of axially extending bendable rubber arms thereon with enlarged end portions resiliently brushing against the bore of said sleeve, pump housing means rotatably positioning said sleeve, and end caps reversibly secured to said pump housing and engaging said drive shaft to position and journal such drive shaft and said impeller in different eccentric positions in said sleeve whereby the positions of said shaft and said sleeve can be changed for opposite directions of drive of said drive shaft and said rubber arms press against said sleeve for pumping action.

4. In a pump, a sleeve defining a pump chamber, said sleeve having a plurality of substantially diametrically opposed circumferentially extending inlet and outlet slots therein, a drive shaft eccentrically positioned in said sleeve, a flexible impeller secured to and driven by said drive shaft, said impeller being eccentrically positioned in said sleeve and having a plurality of axially extending bendable rubber arms thereon with enlarged end

portions resiliently brushing against the bore of said sleeve, a plurality of axially spaced circumferentially aligned inlet slots and a plurality of axially spaced circumferentially aligned outlet slots being provided in said sleeve, each of the arms of said impeller being of an axial length as to engage all of the inlet and outlet slots, pump housing means positioning said sleeve, said sleeve being rotatably positioned in said pump housing means, means for securing said sleeve to said pump housing means in either of two positions spaced 180° from each other, and end caps reversibly secured to said pump housing and engaging said drive shaft to position and journal such drive shaft for reversible direction of rotation but with the same direction of flow through the pump.

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