

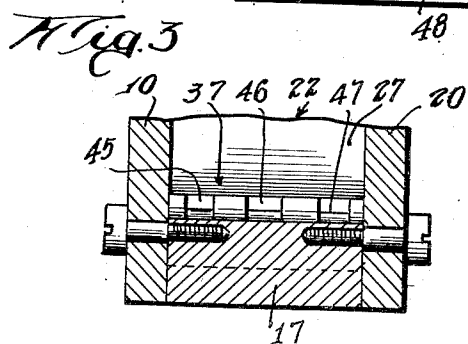
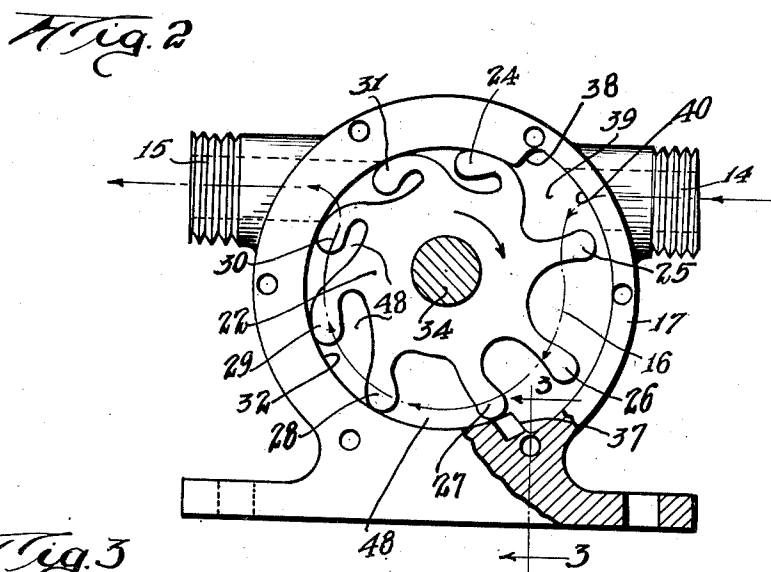
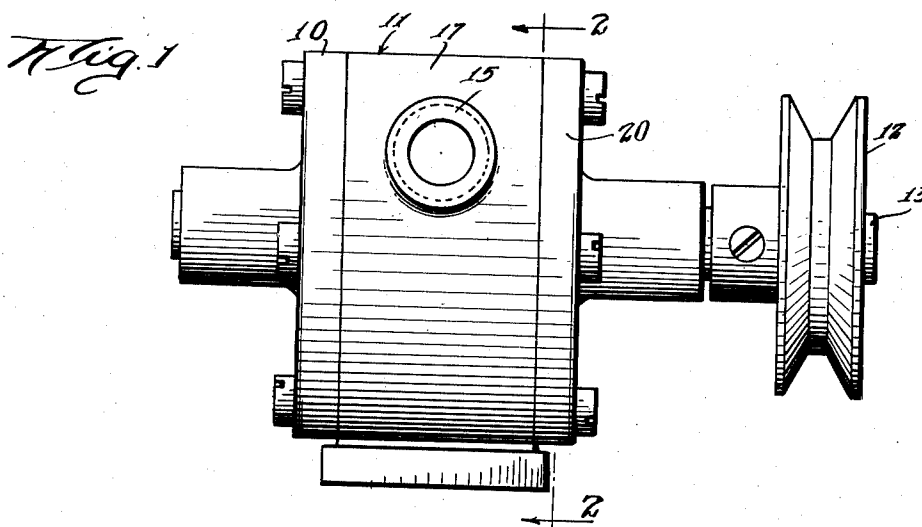
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The present invention relates to a pump.

It is desirable that a pump be efficient in operation and yet comprise few simple parts which require a minimum amount of attention and operate for a long period of time before replacement of any of the parts is necessary.

It is therefore, an object of the present invention to provide a pump having these desirable features.

A specific object of the present invention is to provide an improved rotary pump having a rotor with a plurality of flexible or resilient vanes which are deformed in one revolution thereof, the pump being characterized by a structure which contributes to long operating life of such resilient vanes.

Another specific object of the present invention is to provide an arrangement in a rotary pump having a rotor with a plurality of flexible or resilient vanes which are deformed in one revolution thereof, the pump being characterized by a structure which assures a maximum amount of fluid between adjacent vanes thereby to assure high efficiency operation.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. This invention itself, both as to its organization and manner of operation, together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

Figure 1 is a view in elevation of a pump structure embodying the present invention coupled to a driving pulley.

Figure 2 is a view in elevation of the interior of the pump shown in Figure 1 with the end cover 10 removed and corresponds to a sectional view taken substantially on the line 2—2 of Figure 1; and

Figure 3 is a sectional view taken substantially on line 3—3 of Figure 2.

The pump 11 is driven by the pulley 12 secured on the pump rotary shaft 13 to pump a fluid such as water, oil, gas or the like entering the inlet 14 and leaving the outlet 15, the liquid through the pump following the general path indicated by the arrowed line 16.

The inlet and outlet 14, 15 are preferably formed integrally with the pump housing 17 and extend in the direction of one another on a line which is located at a relatively large distance from the center of rotation of the pump shaft 13, the shaft 13 itself being journaled for rotation in

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the end covers 10, 20 or extensions thereof in association with liquid tight seals which may be of conventional design.

Shaft 13 has affixed thereto the resilient, flexible or elastic rotary element 22 which may be of neoprene, rubber or other similar material which does not deteriorate appreciably in a chemical sense when brought into contact with the particular liquid pumped.

Preferably, this rotary element 22 affixed to shaft 13 and housed between covers 10, 20 in housing 17 has eight equally dimensioned vanes 24 to 31, inclusive, arranged in a symmetrical balanced pattern. As indicated in Figure 3, the side walls of the rotary resilient element 22 are straight and mutually parallel and are arranged to closely abut the inner surfaces of the covers 10, 20 thereby to provide good liquid tight seals.

The vanes 24 to 31, inclusive, revolve about the center of shaft 13 within the housing 17 and abuts the cylindrical inner wall 32 thereof. This cylindrical wall 32 lies on a circle drawn with the point 34 as a center, the point 34 being spaced a slight amount from the center of rotation of shaft 13, in which case the circle of rotation defined by the outer tip of any one of the equally dimensional vanes 24 to 31, inclusive, (if such vanes were not deflected by casing 17) is eccentrically located with respect to the circle defining wall 32 whereby each one of the vanes 24 to 31, inclusive, are deflected in increased amounts when and as they travel from the beginning point 37 to the terminating point 38 on the wall 32.

Immediately after each of such vanes 24 to 31 pass the point 38, they enter the enlarged region 39 immediately adjacent the cylindrical wall 40 having its radius or curvature at the center of rotation of shaft 13 and a radius greater than the distance from such center to the outer tip or radius of the vanes 24 to 31, whereby the vanes are relieved of stresses exerted thereon and they spring out into the region 39 and oscillate about their individual longitudinal axis of symmetry to produce alternate stressing of the resilient material in alternate directions until the energy originally stored therein due to deformation produced by wall 32 is dissipated.

The provision of this enlarged region 39 wherein the vanes 24 to 31 may oscillate is an important feature of the present invention in that it contributes to long life of the resilient material thereof by preventing "set" in the material.

Another important feature of the present invention resides in the structure of the beginning of circular wall 32 at its beginning point 37. The

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beginning edge of this wall 32 is what I term "serrated" as shown in Figure 2 and 3, the edge having cut-out portions 45, 46 and 47 through which the fluid to be pumped may flow in between adjacent vanes due to creation of a partial vacuum therebetween when and as the trailing vane of the tow engages the beginning point 37. This partial vacuum arises from the fact that the space designated 48 in Figure 2, as an example, becomes larger and larger when and as the vane 27 engages and travels over the serrated edge until this space assumes its largest volume when the vane 27 closes off the flow of liquid through the openings 45, 46, 47, the increase in volume being due to the fact that during the period of travel considered, the vane 27 is deflected to the right in Figure 2, a greater amount than is the vane 28 with the result that the spacing between vanes 27 and 28 is increased. These cutout portions 45, 46, 47 thus serve as a bypass to place opposite sides of the vane members in communication thereby to partially equalize pressure differences.

Further, as vane 27 passes through the enlarged region 39 and reaches the point 37 at the leading edge of the serrated section, the velocity of this vane is greatly diminished or reduced to zero for an instant while at the same time, vane 28 moves away from vane 27, thereby creating a substantial vacuum in the space between vanes 27 and 28 which causes liquid to be drawn within such space or cavity 48 through serrations or bypasses 45, 46 and 47 until such cavity 48 is filled or is substantially filled with liquid. Continued rotation of the rotor advances vane 27 to a point indicated in Figure 2 where the serrations are passed to thereby seal the fluid in the cavity 48 between vanes 27 and 28. As the rotor continues to rotate further, the capacity or space 48 becomes smaller and causes a progressively increasing pressure to be exerted against the preceding vane 29. Such increasing pressure against vane 29 is in turn transmitted by means of the fluid between vanes 29 and 30 to the vane 30 in which case, substantially equal and opposite pressure on the opposite sides of vanes 28, 29 and 30 do not cause substantial movements of the vanes 28, 29 and 30 and hence, vanes 28, 29 and 30 remain rigid. As a consequence, fluid forced out at port 15 is under great pressure inasmuch as vane 31 is deflected substantially its maximum amount and is now an obstruction to further travel of liquid. Thus, the pressure of the liquid between vanes 30 and 31 is greater than the pressure of the liquid between vanes 29 and 30, which latter pressure is greater than the pressure of the liquid between vanes 28 and 29 and further, the pressure of the liquid between vanes 28 and 29 is greater than the pressure of the liquid between vanes 27 and 28, and, as a consequence, there is a steady and constant delivery of fluid through the port 15.

Thus, provisions are made for increasing the volume between adjacent vanes at the beginning of the pumping period and for simultaneously allowing liquid to be drawn therein by the resulting suction force developed. The fluid then subsequently entrapped between adjacent vanes is carried around the discharge opening 15 where it is expelled. Upon further rotation, the vanes in succession snap out into the enlarged region 39 into which liquid entering from the inlet opening 14 enters.

While the particular embodiments of the present invention have been shown and described, it

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will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

I claim:

1. A rotary pump having a rotor with a plurality of spaced deformable vane members, a casing with a chamber defined in part by a cylindrical peripheral wall of said casing, said peripheral wall being eccentrically located with respect to the axis of rotation of said vane members, said casing having an inlet and an outlet in communication with said chamber, each of said vane members being arranged to move in succession from a position out of engagement with said wall to a position into engagement with said wall to thereby produce pumping cavities of variable volume which are defined by adjacent vane members and said wall, and a bypass in said peripheral wall effective when one of said vane members initially engages said peripheral wall and expands its corresponding pumping chamber to place opposite sides of said one vane member in communication with each other and with said inlet.

2. The invention defined in claim 1 characterized by the fact that said bypass is provided by "serrating" the peripheral wall.

3. A rotary pump having a rotor with a plurality of spaced deformable vane members, a casing with a chamber defined, in part, by a peripheral wall arranged in the path of movement of said vane members thereby to deflect the same to produce pumping cavities of variable volume which are defined by adjacent vane members and said wall, means rotatably supporting said rotor in eccentric relationship to said wall, said casing having an inlet and an outlet in communication with said chamber, said chamber having an enlarged portion within which said vane members enter in succession without engagement to thereby relieve stresses produced in said vane members by their engagement with said peripheral wall, and a bypass in said peripheral wall effective when one of said vane members initially engages said peripheral wall and expands its corresponding pumping cavity to place opposite sides of said one vane member in communication with each other and with said inlet.

4. A rotary pump having a rotor with a plurality of spaced deformable vane members, a casing with a chamber defined, in part, by a peripheral wall in the path of movement of said vane members to produce deflection thereof, means rotatably supporting said rotor with respect to said casing in eccentric relationship to said peripheral wall, said casing having an inlet and an outlet in communication with said chamber, each of said vane members moving in succession from a position out of engagement with said wall to a position into engagement with said wall to thereby produce pumping cavities of variable volume which are defined by adjacent vanes and said wall, and a bypass in said wall effective when one of said vane members initially engages said peripheral wall and expands its corresponding pumping cavity to place opposite sides of said one vane member in communication with each other and with said inlet.

5. A rotary pump having a rotor with a plurality of spaced deformable vane members, a cas-

ing with a chamber defined, in part, by a peripheral wall arranged in the path of movement of said vane members to produce deflection thereof, said casing having an inlet and an outlet in communication with said chamber, means rotatably supporting said rotor in said casing in eccentric relationship to said peripheral wall, each of said vane members being arranged to move in succession into engagement with said wall to thereby produce pumping cavities of variable volume which are defined by adjacent vanes and said wall, a bypass in said peripheral wall effective when one of said vane members initially engages said peripheral wall and expands its corresponding pumping chamber to place opposite sides of said one vane member in communication with each other and with said inlet, and said casing having an enlarged portion into which said vane members enter without engagement with the casing.

6. In a rotary pump of the type having a casing with a chamber defined by a peripheral wall which is arranged to deflect deformable vane members on a rotor and to thereby produce pumping cavities of variable volume, and wherein said casing is provided with an inlet and an outlet in communication with said chamber, and wherein said rotor is rotatably mounted in said casing in eccentric relationship to said peripheral wall with said vane members moving from a position out of engagement with said wall to a position into engagement with said wall, the improvement which resides in providing a bypass in said wall effective when one of said vane members initially engages said peripheral wall and expands its corresponding pumping cavity to place opposite sides of said one vane member in communication with each other and with said inlet to at least partially equalize the pressure difference resulting from deflection of said one vane member.

7. In a rotary pump having a plurality of rotatable spaced deformable vane members, a rotor, means mounting said vane members on said rotor, a casing with a relatively stationary chamber defined, in part, by a peripheral wall arranged in the path of movement of said vane members to produce deflection thereof, means rotatably supporting said rotor with respect to said casing in eccentric relationship to said peripheral wall, said chamber having an enlarged portion into which said vane members enter without engagement with said casing, said casing having an inlet and an outlet in communication with said chamber, said peripheral wall being engaged by said vane

members in succession when and as they leave said enlarged portion to cause deflection of corresponding ones of said vane members to thereby produce pumping cavities of variable volume which are defined by adjacent vane members and said peripheral wall, a portion of said peripheral wall being "serrated" or peripherally grooved to provide a bypass in said peripheral wall, said bypass being effective when one of said vane members initially engages said peripheral wall and expands its corresponding pumping chamber to place opposite external sides of said corresponding one vane member in communication with each other and with said inlet.

8. In a rotary pump of the type having a casing with a chamber having a peripheral wall arranged to deflect rotatable deformable vane members to produce pumping cavities of variable volume which are defined by adjacent vanes and said wall and wherein said casing has an inlet and an outlet in communication with said chamber, and wherein said vane members are mounted on a rotor which is rotatably supported in said casing with said vane members in eccentric relationship to said peripheral wall, the improvement which resides in providing an enlarged portion in said chamber within which said vane members enter without their outer peripheries touching said chamber to thereby allow oscillations of said vane members therein by the forces originally stored therein by deflection thereof, and a bypass in said peripheral wall effective when one of said vane members initially engages said peripheral wall and expands its corresponding pumping cavity to place opposite external sides of said one vane member in communication with each other and with said inlet, said bypass being closed off when the corresponding pumping cavity has reached its maximum volume.

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