May 26, 1953 R. E. GORDINIER 2,639,670

LIQUID PUMP

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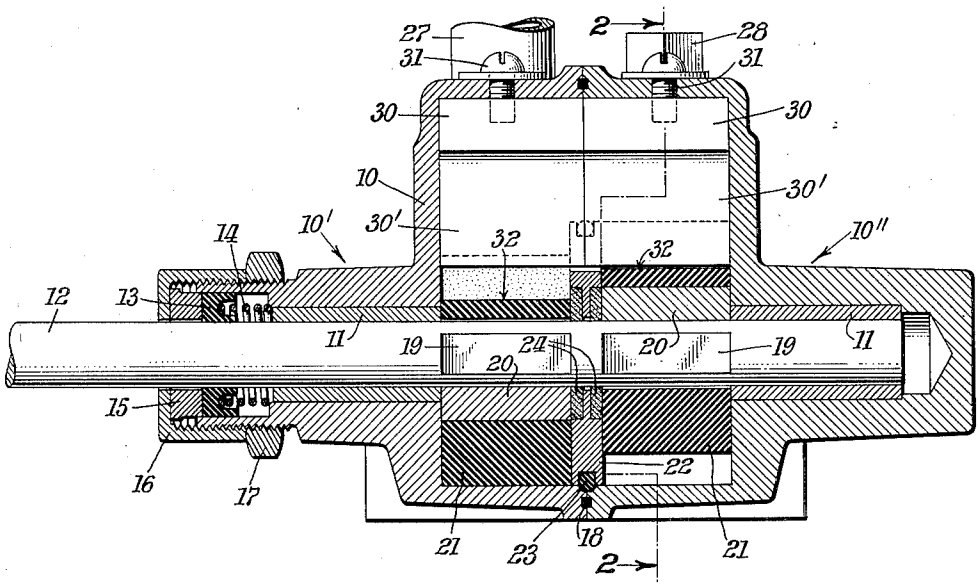


Fig. 1.

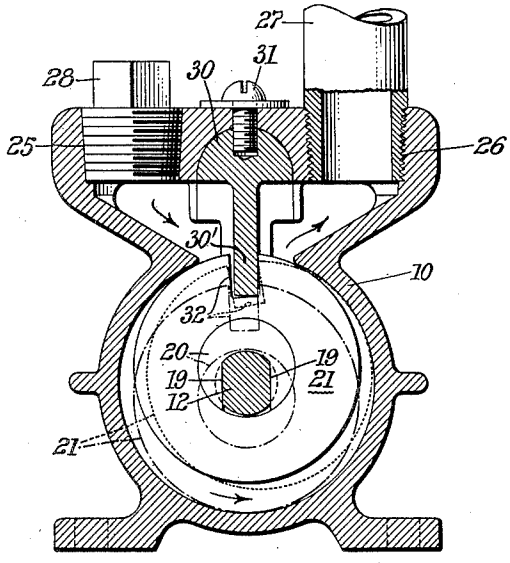


Fig. 2.

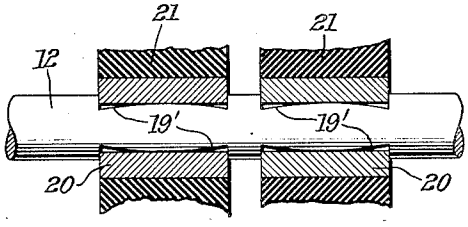


Fig. 3.

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LIQUID PUMP

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3 Claims. (Cl. 103—4)

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This invention relates to improvements in liquid pumps. It is particularly directed to pumps which derive their pumping action from the eccentric gyration of an impeller within a cylindrical pumping compartment.

The present invention is adaptable to pumps according to the general designs of my co-pending applications, Serial Numbers 751,595 filed May 31, 1947, now Patent No. 2,584,865, and 761,805 filed July 18, 1947. Likewise, the pump of the present invention employs driving elements similar to those of my co-pending application, Serial Number 26,491 filed May 12, 1948, now Patent No. 2,578,798.

Pumps having gyrating impellers, and particularly those of the style in which the impeller or impellers consist mainly of a cylindrical element, to which is added a protruding or projecting arm for the separation of intake from discharge and for restraining the impeller against rotation with respect to its driving eccentric, have one disadvantage in that they are not particularly adaptable to high pumping pressures. They are mainly used for purposes of scavenging or for circulating liquid materials where the pressure head is low. When it becomes necessary to pump higher pressures there is a tendency toward decreased efficiency due in part to loss of liquid sealing effectiveness between intake and discharge. As a rule, the impellers for pumps of this sort are made, at least in part, of a resilient and deformable material in order that solids may be carried through the pump without deleteriously effecting the pump parts, and the important advantage of pumps of this class is their adaptability for pumping liquids having small suspended solids.

It is the principal object of my invention to provide a pump of the class described which is particularly useful for pumping liquids at relatively high pressures.

Another object of my present invention is to provide a pump which combines the principle of gyrating impellers with a novel and efficient impeller arrangement in which the component parts are particularly suitable to accept the pumping stresses and wherein the effectiveness of the liquid seal between intake and discharge improves with an increase of discharge pressure.

It is a further object of my invention to provide an eccentrically driven gyratory impeller pump suitable for pumping liquids containing suspended solid material; and a still further object of my invention is to provide a gyratory impeller pump which combines simplicity of manufacture and long, useful life with ease of repair by inexperienced persons.

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Accordingly, in the preferred construction of the pump of my invention, I provide a cylindrical impeller adapted to gyrate in a pumping compartment under the influence of an eccentric located on the pump shaft. A metallic divider element depends rigidly from the inner top side of the pump compartment housing and engages a notch in the impeller to separate intake from discharge and to prevent the impeller from turning with respect to the eccentric. The impeller is removable without disturbing the divider when the pump is disassembled, after which the divider itself may be readily removed from the pump housing. The connection between the divider and the notched impeller, as will be hereinafter more fully explained, is line contact at low pressure in the pumping cycle, increasing to larger areas for more efficient liquid sealing as pressure during the cycle of operation increases.

The improved arrangement makes it possible to provide a pump of relatively small proportions for relatively high-pressure pumping performance, with the added advantage of the gyrating impeller principle outlined above. It will be understood that various changes may be made in the size and shape of the component parts of the pump of my invention and in the materials from which these parts are constructed without departing from the invention as particularly pointed out in the sub-joined claims.

In the drawings,

Figure 1 is an elevation view in cross-section, taken longitudinally and centrally through the pump of my invention.

Figure 2 is an elevation view in cross-section taken at the left side of the right hand pump impeller along the line 2—2 of Figure 1.

Figure 3 is a fragmentary view illustrating a modified connection between the impellers and the shaft of the pump of my invention.

Referring to Figure 1, I provide a hollow pump housing structure 10 by mating and securing together a pair of cast or forged metal half housing sections 10′ and 10″, each half section being provided with a self-lubricating anti-friction bushing 11 for a rotatable pump shaft 12. A ring gasket 13 inserted in suitable channels in the mating half sections provides a liquid seal therebetween. The space formed within the structure 10 includes a substantially cylindrical pumping compartment, above which is an irregular shaped open section for intake and discharge of the liquid being pumped.

The right hand end of shaft 12 terminates within a closed boss and the left hand end of the shaft projects from an open boss in the pump

housing to permit connection with a suitable prime mover, such as an electric motor. A liquid seal is provided where the shaft projects from the housing by the use of a deformable ring gasket 13 having an annular groove on the inner side thereof to accommodate a coiled compression spring 14 interposed between the gasket and bushing 11 to press the gasket radially into liquid sealing engagement both with the shaft and with the inner cylindrical surface of the open boss extension. Thrust washer 15 fitted over shaft 12 backs up gasket 13 and is secured in place by a knurled cap 16 which threadedly engages the outside surface of the boss, and a lock nut 17 serves to retain cap 16 in an adjusted position.

Shaft 12 is provided with two pairs of opposed flats 19, see also Figure 2, which engage two C-shaped metallic eccentrics 20 assembled thereover, the eccentrics in turn snugly engaging the cylindrical impellers 21 fitted thereover for rotation with respect thereto. Impellers 21 may be constructed of a resilient, deformable material such as rubber or neoprene or the like or they may be of non-resilient, deformable material such as thermoplastic resin, important considerations being in the choice of material being to provide a material which is compatible with the liquid to be pumped; which will not result in excess friction against the inner pumping compartment surfaces; and which will deform under the pressure contact of small solids which may become entrained within the pump during operation without scoring the internal compartmental surfaces.

Impellers 21, see Figure 1, fit snugly against the end faces of the pumping compartment in the respective half sections of the housing and they are separated from each other by the use of a disc-like divider element 22 fitted over shaft 12 having a peripheral ring gasket 23 in sealing engagement with the inner surface of the pumping compartment together with a pair of flat fibre disc gaskets 24 for rotative sealing against shaft 12 and providing replaceable wear plates against which eccentrics 20 may slide. In this manner the pump is liquid sealed into two separate pumping compartments and at the same time, shaft 12 is confined against movement longitudinally of the pumping compartment by interengagement of the various parts described.

In pumping, the impellers gyrate counterclockwise, see Figure 2, and by a continuing change in the position of clearance space between impellers 21 and the inner wall of pumping compartment, together with separating provisions to be described, liquid flows in the direction of the arrows from the left hand side through each pumping compartment and out of the pump at the right hand side. A threaded intake aperture 25 provides for a suitable connection to liquid supply and a like discharge aperture 26 on the right hand side provides for a piping connection, as by pipe 27, to discharge. Each compartmental housing portion is provided with both intake and discharge apertures 25 and 26 and one or both may be used. If unused, a pipe plug 28 may be fitted therein. The throw of eccentrics 20 is spaced 180° apart in order to equalize pumping pressures, as is well understood by those skilled in the art.

Separation between intake and discharge in the upper portion of the pumping compartment is provided by the use of a rigid metal divider element 30 which seats in a curved section slot in the housing and is secured to the housing by button head screws 31 which project downwardly through the housing into tapped holes provided. The lower depending portion 30' of divider element 30 is in the form of a flat plate which extends for the entire compartment length between the inner compartment faces and engages clearance slots 32 in the impellers. A corresponding close fitting slot is provided in disc separator 22, and by thus connecting the parts, impellers 21 and disc 22 are restrained from turning in the housing during pumping operations.

Inasmuch as the eccentric center moves in an orbital path about the drive shaft center during pump operation, thus continuously tending to change the angular relationship between the center lines of plate portion 30' and slots 32, and also by reason of the fact that there must be sliding of plate 30' in slots 32, it is necessary to make the slots 32 wider than plate 31' to accommodate this motion. When an impeller is passing upper or lower dead center without pumping load there will be a position where clearance space exists between these mating parts, but after leaving either of these central positions the plate and slots will be skewed with respect to each other and in sealing contact on both side walls thereof. The full lines of Figure 2 illustrate the upper central position, the broken lines show the lower central position, and the dotted line indicates a position approximately 30° before upper dead center. During pump operation, stress from the combined forces of friction and liquid pressure will tend to press the right hand slot wall against the side of the divider plate, thus ensuring sealing area therebetween and improving the liquid joint with the increase of pressure. This condition is particularly evident when using impellers of resilient, deformable characteristics whereby a flattening between the parts may take place which is consistent with the pressure conditions in the pump in more nearly equalizing the unit pressure over the area of contact. Furthermore, as the pressure builds up, the center line of the slot approaches parallelism with the center line of the plate and further tends to enhance the liquid sealing condition between intake and discharge.

An alternative form of engagement between eccentrics 20 and shaft 12 is shown in Figure 3 where, in place of parallel flats, I employ flats 19' having a slightly curved surface. This mode of connection permits the eccentric to float and avoids any misalignment between the impellers and the pumping compartment in the event that the shaft is not truly perpendicular thereto.

In operation, the pump of my invention may be employed for pumping liquids with some entrained solids against higher pressure heads than has heretofore been possible with pumps of this class. The mechanical features of the pump are such that fabrication is a relatively simple procedure and repair and service may be readily accomplished by persons unskilled in pump construction. It will be understood that the invention is not limited to the preferred physical embodiment shown but that various modifications may be made in the size, shape and material of the component parts without departing from the substance of the invention as particularly pointed out in the subjoined claims.

I claim:

1. In a liquid pump of the class described, in combination, a pump housing, said housing forming a substantially cylindrical pumping compartment with intake and discharge space in communication therewith, a pump shaft extending through the housing axially of the compartment and journalled in the housing, a first divider

member located within the housing and laterally disposed with respect to the axis of the compartment to section said compartment into a plurality of sub-compartments, said first divider member being provided with an external peripheral ring seal adapted to contact the inner surface of the compartment in liquid tight engagement and having wear plates recessed therein and trunnioned over said shaft, notched impellers within said sub-compartments adapted to gyrate therein and to force liquid therethrough, and a second divider disposed longitudinally of the axis of the pumping compartment and extending therein in liquid sealing engagement with said notched impellers to separate intake from discharge.

2. In a liquid pump of the class described, in combination, a pump housing, said housing forming a substantially cylindrical pumping compartment with intake and discharge space in communication therewith, a pump shaft extending through the housing axially of the compartment and journalled in the housing, a first divider member located centrally within the housing and laterally disposed with respect to the axis of the compartment to section said compartment into a plurality of sub-compartments, said first divider member being notched and provided with an external peripheral ring seal adapted to contact the inner surface of the compartment in liquid tight engagement and having wear plates recessed therein and trunnioned over said shaft, notched impellers within said sub-compartments adapted to gyrate therein and to force liquid therethrough, and a second divider disposed longitudinally of the axis of the compartments engaging the notch in the first divider and extending into the compartment in liquid sealing engagement with the notched impellers to separate intake from discharge.

3. In a liquid pump of the class described, in combination, a pump housing forming a cylindrical pumping compartment with communicating intake and discharge space, a pump shaft axially of the compartment journalled in the housing, a divider within the housing laterally arranged with respect to the compartment forming two sub-compartments, said divider being provided with an external ring gasket to seal against the inner face of the compartment and with removable, opposed wear plates recessed therein, facing the sub-compartments, and trunnioned over said shaft, notched impellers within the sub-compartments in opposing abutment against said wear plates, and a second divider longitudinally of the axis of the pumping compartment and extending therein in liquid sealing engagement with said notched impellers to separate intake from discharge.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
839,022	McQuown	Dec. 18, 1906
858,594	Gause et al.	July 2, 1907
1,229,676	Tice	June 12, 1917
1,489,416	Anderson et al.	Apr. 8, 1924
1,501,596	Guttner	July 15, 1924
1,694,783	Johnson et al.	Dec. 11, 1928
1,984,664	Teves	Dec. 18, 1934
2,236,660	White	Apr. 1, 1941
2,351,050	Karey	June 13, 1944

FOREIGN PATENTS

Number	Country	Date
108,006	Switzerland	Dec. 16, 1924
656,320	France	Jan. 2, 1929