Feb. 5, 1952 R. E. GORDINIER 2,584,865

LIQUID PUMP

Filed May 31, 1947 2 SHEETS—SHEET 1

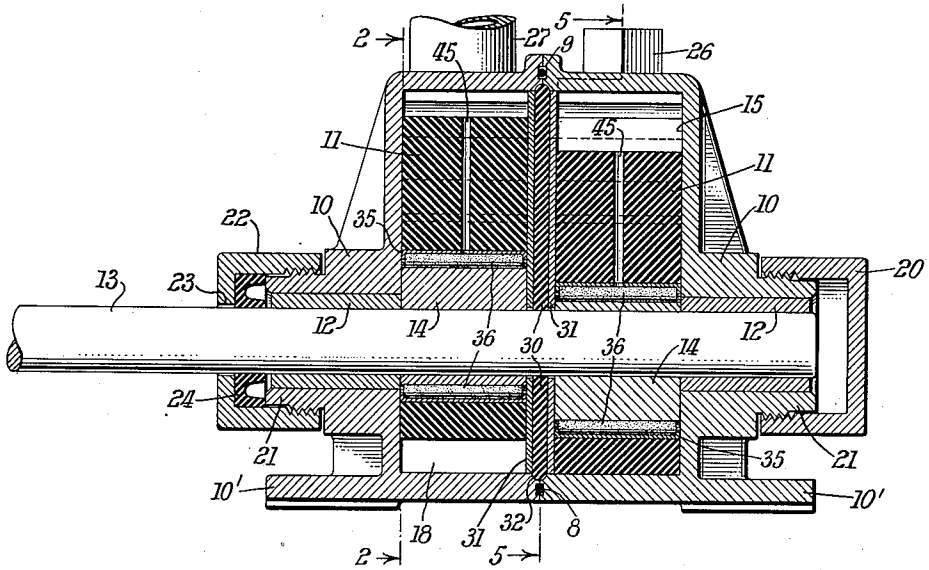


Fig. 1.

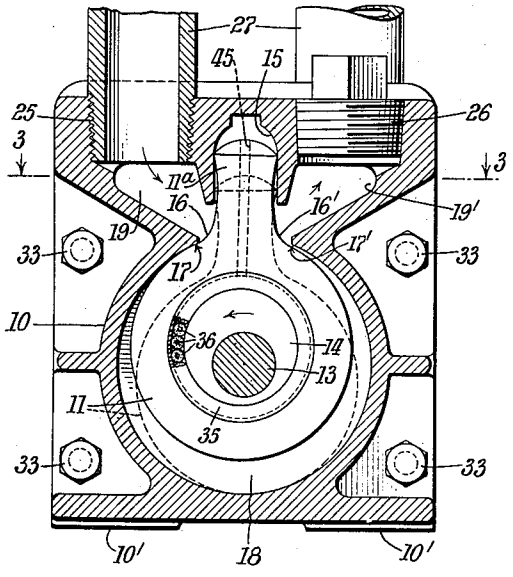


Fig. 2.

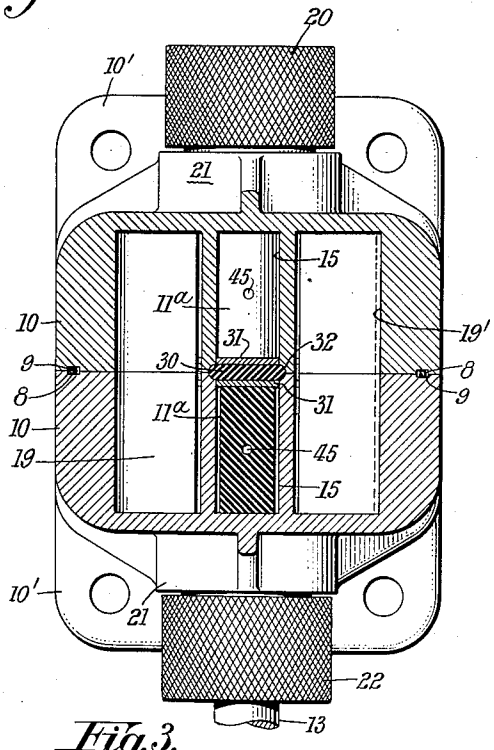


Fig. 3.

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LIQUID PUMP

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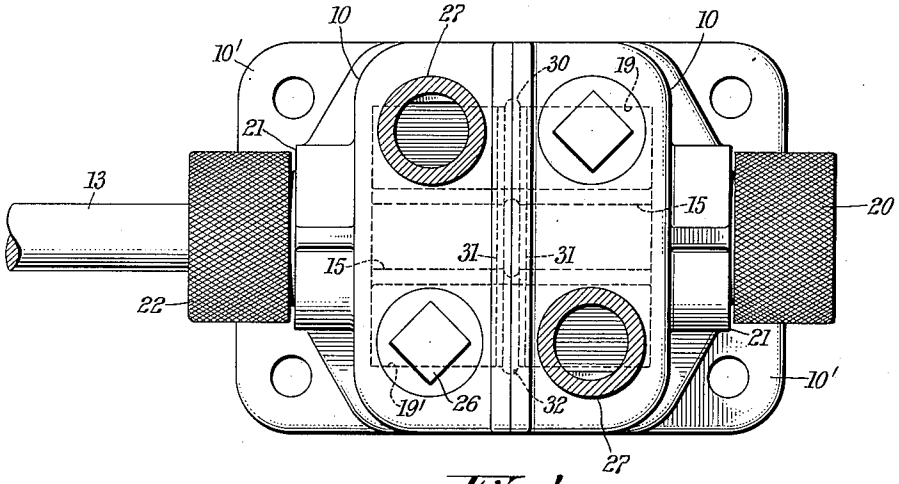


Fig. 4.

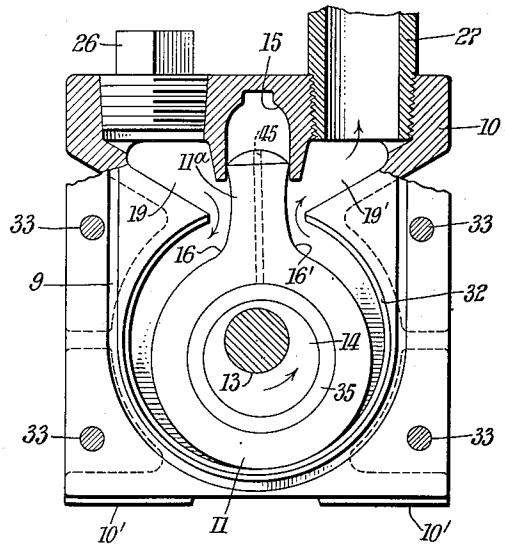


Fig. 5.

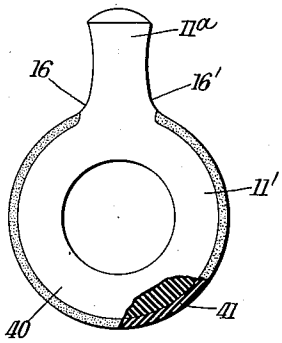


Fig. 6.

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UNITED STATES PATENT OFFICE

2,584,865

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 liquid pumps having gyratory operating impellers.

The particular advantage of a pump of this kind lies in its application for pumping fluids having suspended solid material included therein. The impellers are usually constructed of a somewhat resilient non-metallic material, and because there is a wiping action between the impeller of the pump body, the tendency is for the impeller to carry solids quite readily from intake to discharge without any grinding or mechanical interference between the impeller and the pump body which would deleteriously effect either of these members. Pump bodies are usually constructed of brass or stainless steel or other non-corrosive material and the impeller may be made of a resilient and healable material which will retain its desired shape without any harm done to it in the event that solids become impacted therebetween.

Disadvantages with pumps of this style in the past have resided principally in the lack of a completely effective cycle, a loss being experienced through a portion of the cycle near the upper dead center of the pump as the impeller position changes from suction to discharge in the pump cycle. Still further disadvantages have been the lack of attention to manufacturing simplicity and to problems of wear and breakage resulting from frictional contact between relatively moving parts.

It is the principal object of this invention to provide a pump of the class described having a more effective pumping cycle than has heretofore been possible with gyratory impeller pumps. A further object of the invention is to provide an eccentrically driven gyratory impeller pump which may be readily constructed with conventional machine tools using known manufacturing methods and having a minimum number of parts of different design.

A still further object of the invention is to provide a dual gyratory impeller pump having a fluid tight liquid seal between the impellers, which will withstand a substantial amount of wear without a loss of efficiency in the pumping cycle.

A further object of this invention is to provide an improved anti-friction bearing for use with pumps of the class described which will give satisfactory operation in the pumping of liquids, which is furthermore not affected by corrosion and which may be used between a metallic eccentric and a non-metallic impeller.

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In the pump of my invention I provide, in part, a dual impeller arrangement, the housing for which is constructed with a pair of identical halves for simplicity of construction and service. Intermediate of the two impellers, the housing is divided by a resilient separator sealing member flanked by a pair of non-resilient abutment plates. The size of component parts is such that, when the pump is assembled, the non-resilient members press against the resilient separator and displace the material thereof radially, so that firm pressure is exerted against the housing and the pump shaft thus precluding the possibility of communication between the two pumping compartments. Wear is taken by the non-resilient materials which are suitably constructed therefor.

The impellers, the housing contours and the intake and discharge port arrangements give a highly efficient pumping cycle without a tendency to back pressures. In a modification of impeller construction I provide the advantages of a resilient surface impeller combined with a core of non-resilient, non-metallic material having improved wearability; and for low friction losses between the non-metallic impeller and its metallic eccentric I also have provided an improved anti-friction bearing.

In the drawings,

Figure 1 is a side elevation view in cross-section, taken longitudinally through the pump of my invention,

Figure 2 is an end elevation view partly in cross-section taken adjacent the left hand pump impeller, on the line 2—2 of Figure 1,

Figure 3 is a plan view of the pump of my invention, partly in cross-section, taken on the line 3—3 of Figure 2,

Figure 4 is a top plan view of the pump of my invention,

Figure 5 is a cross-section view taken on the line 5—5 of Figure 1 to illustrate pump construction, particularly as relates to the flow of liquid therethrough, and

Figure 6 is a side elevation view of a modified impeller construction for use with the pump of my invention.

In the drawings, with particular reference to Figures 1, 2, and 3, the pump of my invention includes a pair of identical housing half portions 10 arranged in opposing relationship to form a closed hollow cylindrical compartment for the pump impellers 11 with communicating port spacing thereabove. While the particular embodiment of my invention shown is that of a

dual impeller pump, susbtantially the same construction employing identical housing halves could be pursued in making a single impeller pump, with slight modifications which could readily be made by persons skilled in the art of pump construction.

Housing portions 10 are suitably gasketed with each other by means of a circular section resilient gasket member 8 which is placed in a rectangular groove 9 formed by the abutting surfaces thereof, and they are provided with supporting feet 10' suitably drilled for mounting the pump on a supporting base. Housing portions 10 are also horizontally bored and provided with specially fitted sleeves 12 to provide bearings for the impeller shaft 13 which extends therethrough and to which may be connected a suitable prime mover, as an electric motor. A pair of metal eccentrics 14 of non-corrosive material are fixed to shaft 13 within the housing cylinder, carrying thereon the impellers 11. Roller bearings may be provided, as shown, to reduce friction losses between impellers 11 and eccentrics 14, or, the impellers may fit directly on the eccentrics.

Impellers 11 are constructed of non-metallic material such as rubber or synthetic plastic, preferably somewhat resilient, and they are arranged to travel in a gyratory path within the cylindrical housing space under the influence of the eccentrics 14. As shown in Figure 2, impellers 11 are arranged to travel with their eccentricity spaced approximately 180°.

Suction and discharge are produced by a combined rolling and sliding of the cylindrical surface of impeller 11 against the larger inner cylindrical surface of the confining housing, gradually opening and closing a crescent shaped clearance portion 18 which lies between the impeller and the inner cylindrical surface. A vertically disposed projecting portion 11*a* on impeller 11 protrudes upwardly into a slot 15 located in the top of the pump housing, preventing rotation of the impeller with respect to the housing during periods when the shaft 13 is turning, also separating the intake from the discharge in the pump. A close fit is maintained between impellers 11 and the end walls of the housing assembly, as indicated in Figure 1.

In pumps of this class, and presuming that the shaft of Figure 2 rotates counter-clockwise, the pumping or pressure cycle in the left hand pumping compartment of Figure 1. starts when the impeller radius 16 closes off the left hand port 19 at a line 17, as shown in the full lines in Figure 2. As shaft 13 is turned, eccentric 14 carries impeller 11 in a gyratory path to continuously decrease the crescent shaped space 18 below and mainly to the right of the impeller, forcing the liquid upwardly through the right hand port 19'. Concurrently, as the liquid is being forced upwardly through port 19', the impeller surface moves away from line 17 permitting liquid to flow downwardly into the pump housing from port 19 and providing a supply which will be discharged during the next subsequent pumping cycle. When the liquid from space 18 has been entirely discharged, the impeller surface 16' will make line contact at 17' and will seal off the discharge port 19' against back pressure.

The radii 16 and 16' which join the vertical portion 14 with the main cylindrical portion of impeller 11 are critically curved to compensate for the eccentricity of the impeller action and to maintain sealing contact at line 17' beyond the normal gyratory contact of the cylindrical impeller surface with the compartment surface until impeller contact is again made at line 17. When the impeller is in its top vertical position on upper dead center there is no clearance between the surface of contours 16 and 16', and lines 17 and 17', destructive mechanical interference being avoided by the resilient impeller surface. When the eccentric has moved the impeller a few degrees past upper dead center in counter-clockwise rotation, as shown in Figure 2, the impeller surface 16' moves away from line 17' re-opening the right hand port and initiating a new pumping cycle.

Combining the cycle of pumping in two compartments, with the intake and discharge ports of both compartments interconnected and the impeller eccentricity spaced 180°, gives a more uniform pressure curve for the pump. The important requisite is to avoid any period of back-pressure, which I have accomplished in suitably curving the impeller 11 to carry sealing contact with the port openings beyond the normal gyratory contact of a circular impeller at a port opening.

The housing portions 10 are identical halves to simplify pump construction and likewise to simplify service in the field of operation. Each half is, in itself, interchangeable with the other half, including the assembly therewith of the sleeve bearings 12 in which shaft 13 is trunnioned. On the right hand end of the housing a pressure tight closure is effected by placing thereon the threaded cap 20 which engages screw threads machined externally of the bearing support 21. On the left hand end a similar closure cap 22 is threadedly fastened to the bearing support portion 21 with an opening 23 to permit driving shaft 13 to extend therethrough. Intermediate of cap 22 and the bearing support portion on the left hand end is a gasket 24 which may be adjustably compressed to exert pressure radially against the shaft and the interior surface of the cap, giving a sealed joint which will effectively prevent leakage of liquids which may be forced outwardly of the pump through the clearance between the anti-friction bearing 12 and shaft 13.

Referring to Figures 4 and 5, each identical half 10 is also provided with two threaded openings 25 communicating with the left and right hand ports 19, 19' in the top section of the pump assembly. As shown in Figure 4, two of these port openings, one on the intake side of the pump and the other on the discharge side, may be closed off as by the pipe plugs 26, and the pipe nipples 27 may be threadedly fixed to the other communicating openings. Any similar arrangement of piping may be used most suitable to the connections desired, or, if it is desirable to connect both intake or discharge to a pair of intake or discharge lines, this may be done.

Referring back to Figures 1 and 3, a divider seal is provided intermediate of the two pump housing halves to segregate the pumping compartments below ports 19 and 19'. This seal comprises a resilient deformable member 30 of rubber or the like flanked on either side by a pair of non-deformable metal compression plates 31. The shape of the seal and the compression plates conforms substantially to that of the circular inside bore of the housing, extending upwardly into the slot 15. As in the case with the impellers 16, slot 15 prevents the seal 30 and plates 31 from turning with respect to the pump housing during pump operation. I have found it desirable to extend the resilient member into

a groove or chamfer 32 formed by the abutment of housing portions 10 which locates the resilient member centrally of the housing bore. The proportions of the divider seal and the pump parts are such that when the pump halves 10 are drawn together by the through bolts 33, with eccentrics 14 and impellers 11 included therebetween, there will be a tendency to compress plates 31 between the eccentrics and the impellers and to displace the resilient material of member 30 radially outward, thus filling the chamfer and sealing the two pumping compartments from each other; and also displacing the resilient material radially inwardly against shaft 13 to provide an annular seal therewith.

The roller bearing interposed between impellers 11 and their respective eccentrics 14 to reduce frictional losses consists of a retainer member 35 carrying a series of spaced graphite or graphite impregnated rollers 36. Graphite has the advantage, in a liquid pump, of being entirely non-corrosive and making periodic lubrication unnecessary; also, inasmuch as a roller bearing which operates between rigid and non-rigid members such as between eccentric 14 and impeller 11, is not subjected to the stress encountered between two rigid members, a graphitic bearing of comparatively low tensile strength may be satisfactorily employed at this location. A small hole 45, as shown in Figures 1, 2, and 5 may, furthermore, be drilled down through the projecting portion 11*a* of the impeller to communicate with the roller bearing and provide a supply of liquid under pressure for purposes of additional lubrication and for cooling.

As an alternative for the impeller construction of Figures 1 and 2, the impeller 11' of Figure 6 may be substituted in certain pumping applications. Impeller 11' comprises a rigid core section 40, partly covered with a layer of resilient material such as rubber or synthetic rubber, the rigid and resilient materials being bonded together as by vulcanizing. With a composite impeller of this description the rigid material may be chosen for qualities of long wear and resistance to breakage while the layer 41 may be chosen to give suitable characteristics for the resistance to abrasion and wear which is necessary on the impeller surface.

Although I have herein made an effort to render my invention more readily understood by describing it in detail with a specific application, it is to be understood that these disclosures are principally for the purpose of clarity and that they are not to be construed as a limitation on the invention.

I claim:

1. In a fluid pump, in combination, a pump shaft, a plurality of impellers engaging over the shaft and adapted for pumping movement during shaft rotation, a pump housing including shaft trunnions, intake and outlet ports and a compartment for the impellers, a resilient deformable compartment divider interposed between the impellers, and rigid plates flanking the divider to compress and displace the material thereof into fluid sealing engagement with the compartment surface whereby the compartment may be hermetically partitioned into separate sub-compartments for each impeller.

2. A compartment divider for fluid pumps comprising, in combination, a resilient deformable member adapted to be interposed between pump impellers in a cylindrical pumping compartment and conforming with the shape and size of the compartment, and non-deformable means flanking the resilient deformable member adapted to displace the material of the resilient deformable member radially into fluid sealing engagement against the surface of said pumping compartment.

3. A compartment divider for fluid pumps comprising, in combination, a resilient deformable member adapted to be interposed between pump impellers in a cylindrical pumping compartment and conforming with the shape and size of the compartment, and a pair of non-deformable members flanking the resilient deformable member adapted to displace the material of the resilient deformable member radially into fluid sealing engagement against the surface of said pumping compartment.

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