April 21, 1953 R. E. GORDINIER 2,635,553

LIQUID PUMP

Filed July 18, 1947

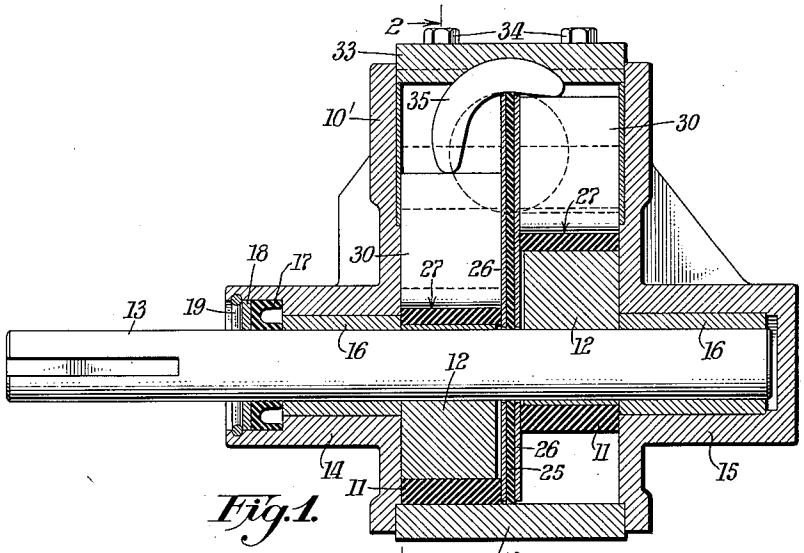


Fig. 1.

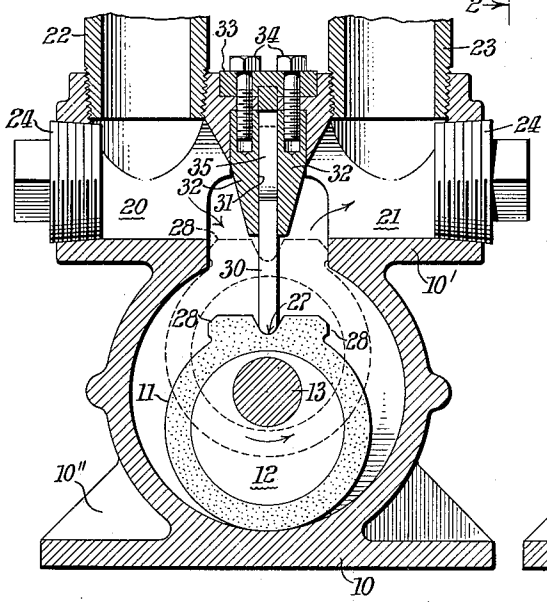


Fig. 2.

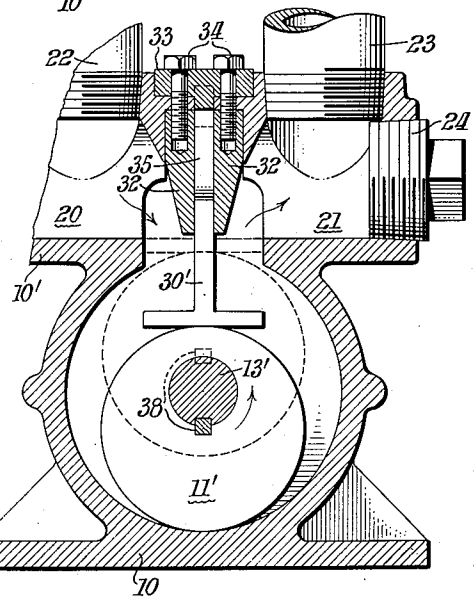


Fig. 3.

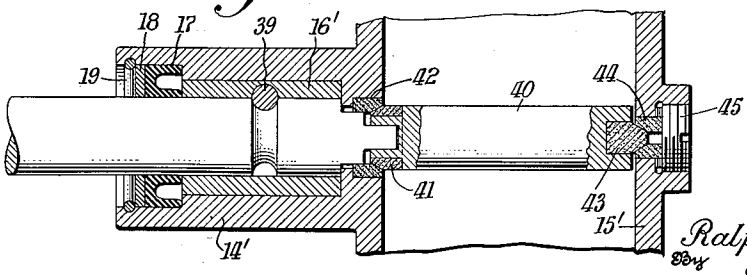


Fig. 4.

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LIQUID PUMP

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2 Claims. (Cl. 103—132)

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The present invention relates to improvements in liquid pumping apparatus, and more particularly to pumps of the type which employ impellers arranged to gyrate within a pumping compartment, deriving their suction and discharge characteristics by the rotary displacement by the impellers in the compartment.

In a co-pending application for Letters Patent, Serial No. 751,595, filed May 31, 1947 now Patent No. 2,584,865, dated February 5, 1952, I describe an improved gyratory impeller pump, the impellers having integral projecting portions which are arranged to reciprocate in a slot above the pumping compartment for the purpose of guiding the impellers against turning and also to form a barrier against the passage of fluid between the suction and discharge ports. This same style of pump may also be constructed with two-piece impellers, one element, considered as the main impeller element, is substantially cylindrical and which produces the pumping action, and the other being accessory thereto serving as the guiding and separating element.

A particular advantage of a gyratory impeller pump lies in its application for pumping fluids with suspended solid material. The impellers are usually constructed, at least in part, of a resilient and healable material; and a combined rolling and sliding action of the impeller surface against the interior of the pumping compartment tends to carry any suspended solids through the pump without damage to the pump parts.

It is the principal object of the present invention to provide a pump of this class, using the two-piece impeller construction and having an improved arrangement of parts for guiding and controlling the impellers. A further aim of the invention is to provide a gyratory impeller for such a pump having an improved port separator combined with and cooperating with an improved resilient non-metallic pumping or pressure producing structure. A still further object of the invention is to provide a gyratory impeller pump which has an efficient cycle of operation and which may be readily constructed with the usual machine tools employed in pump manufacturing procedures.

To these ends, in the pump of my present invention, I provide, in part, a dual impeller pump having a compartment divider between impellers, creating in effect two sub-compartments, similar to that which is described in my aforementioned application for Letters Patent. Each impeller for each sub-compartment is of two-piece construction including the gyratory element and a

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separator element. The gyratory element is driven by an eccentric and is arranged to interfit with a flat blade separator which reciprocates in a machine slot in the top of the pumping compartment. Movement of the flat blade separator in its upward direction results from a suitable connection with the gyratory element. In the reverse or downward direction, the blade is moved by the use of a special crescent shaped member which contacts the tops of both blades and oscillates in a slot provided in the pump housing. The impellers are arranged 180° out-of-phase so that when one impeller blade moves upwardly it will rock the crescent shaped member and force the other blade to travel downwardly with its corresponding gyratory element.

As an additional feature of the invention, and as a substitute for the impeller described above, I provide a non-resilient gyratory element contacting a T shaped sliding separator which is similar in some respects to that previously described, but which may be used to advantage in specific cases of fluid pumping. In either case provision is made on the impeller for a complete shut-off between the pumping compartment ports when the pump is on upper dead center, thus avoiding any tendency for back pressure during the interval between pumping cycles.

I have further provided an improved style of bearing for use with the pump shaft in apparatus of this description, wherein the bearing surface area is reduced to a minimum and where adjustable external pressure may be effected to completely seal the bearing joint against leakage from the pumping compartments.

Other objects and features of novelty will be apparent from the descriptions taken in connection with the drawing, in which—

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

Figure 2 is an end elevation view in cross-section through the left hand pumping compartment of Figure 1, taken on the lines 2—2 of Figure 1,

Figure 3 is a view similar to that of Figure 2, showing an alternative method of construction of the pump impeller of my invention, and

Figure 4 is a fragmentary section view through the shaft of my pump showing alternative bearing construction.

Referring to Figures 1 and 2, a hollow, substantially cylindrical pumping compartment member 10 forms the main pump body in the preferred embodiment of my invention, within which are located a pair of eccentrics 12 suitably fixed to

shaft 13 and arranged 180° out-of-phase with each other. A header portion 10' on the top of member 10 provides for port openings and a footing 10'' is added, integral with member 10, so that the pump as a whole may rest on a suitable support. Impellers 11 of resilient non-metallic material are arranged with a sliding bearing fit on eccentrics 12 so that they may gyrate within the pumping compartment under the influence of eccentrics 12, and one pumping cycle takes place for each revolution of shaft 13.

As shown in Figure 2, shaft 13 is arranged to rotate counter-clockwise and the pumping cycle starts when impeller 11 is on upper dead center, as shown in the broken lines in this view, with the fluid to be pumped disposed in the crescent shaped space therebelow between the impeller and the compartment. As impeller 11 is moved downwardly, during rotation of shaft 13, proceeding first to the left and then to the right as it contacts the compartment surface, pressure is effected on the contained fluid which is forced out from the pump through the discharge port 21 and discharge conduit 23 in the direction of the arrow. While fluid is thus being ejected from the pump, a new supply is admitted through suction conduit 22 and suction port 20 on the left hand side of the impeller, to be discharged on the subsequent pumping cycle. This gyratory cycle of operation is well known in the art and need not be further elaborated upon here.

A pair of end enclosing covers 14 and 15, Figure 1, are arranged to abut opposite sides of body portion 10 and are suitably gasketed therewith, thereby forming the complete pumping compartment enclosure and further providing supports for shaft 13 which is trunnioned in anti-friction bearings 16 therein. The right hand cover 15 closes off the shaft termination to prevent leakage of fluid from the pump which might otherwise seep through the clearance space between shaft 13 and bearing 16. The left hand cover 14, through which the shaft 13 projects for interconnection with a motor or other suitable driving means, is counter-bored for the insertion of a resilient gasket member 17 which is held in place by means of a retaining washer 18 and a spring clip 19. With the spring clip in place, a certain amount of axial thrust is exerted by washer 18 against gasket 17, squeezing the material of the gasket radially outwardly against the counterbore and radially inwardly against the shaft 13 to seal the pump against leakage along the shaft extension, yet permitting shaft rotation during pumping. The pumping compartment is divided into the two separate sub-compartments for the separate impellers 11 by means of the resilient divider 25 interposed between two metal plates 26 which tend to displace the material of member 25 radially outwardly against the inner surface of compartment 10 and inwardly against shaft 13 when the pump is assembled, to thereby seal the sub-compartments from each other.

Referring again to Figure 2, for a detailed description of the impeller and parts accessory thereto, flat metal blade separators 30 fit in a suitable arc-shaped groove 27 in the top surface portion of impellers 11 intermediate of the raised portions 28 and, likewise, blades 30 are arranged to reciprocate in slots 31 between pairs of anti-friction inserts 32 held in place in the top of the pump by means of a supporting cap 33 and interconnecting machine screws 34. Sufficient clearance is allowed between inserts 32 so that blades 30 may slide freely therebetween; however, this clearance is not excessive to the extent that fluid leakage will exist between the left hand and right hand ports 20 and 21. Blades 30 therefore serve to baffle intake from discharge and also to prevent impellers 11 from rotating with respect to the pumping compartment during operation of the pump.

A crescent shaped metal member 35, of the same thickness as blades 30, is disposed in the top of the pump between the inserts 32 and is guided in an arc-shaped groove in the cap 33. Member 35 contacts the top surfaces of blades 30 and interconnects the blades so that, as one blade moves upwardly during operation of the pump, the other blade is forced down following its impeller. Thus, there is two way control of both blades, impellers 11 serving as the driving element upwardly and member 35 returning the blades downwardly. The fitting of parts is such that pressure contact exists at all times between the blade and its corresponding impeller so that a fluid-tight joint is maintained therebetween.

Raised portions 28 on impellers 11 serve as a stopper by projecting into the aperture in housing 10 formed at the port openings 20, 21 and thus sealing these suction and discharge ports from the pumping compartment as the impellers approach and leave upper dead center, avoiding back pressure which would otherwise occur at this part of the pumping cycle. By reason of the resilient deformable nature of the material of impeller 11 portions 28 may be a very close fit in this aperture, in fact, the overall width may be slightly larger than the aperture to enhance the effectiveness of the seal at this location, and during the gyratory movement the raised portions 28 will be worked in and out of the aperture with more or less of a side-to-side movement.

The impeller 11' of Figure 3 may be substituted for impeller 11 of Figure 2 in instances where a substantially rigid, wear resistant material will serve the requirements, as for example where destructive solids like sand and grit are not present in the liquid to be pumped. It is to be noted here that impeller 11', which may be metal or plastic, is fastened directly to shaft 13' as by keys 38 and rotates therewith to perform the pumping action. Blade 30', of T cross-section, rides on impeller 11' very much in the manner of a valve tappet on its cam, performing the function, as previously described, of baffling the pump intake from the discharge. A difference in construction exists in that the blade 30' of this construction, in its extreme upward position, closes off the aperture between ports 20 and 21 to prevent back pressure which would otherwise occur as the impeller passes upper dead center.

Alternative bearing construction for the pump shaft, according to Figure 4, may also be substituted for that shown in Figure 1. Accordingly, a stub driving shaft 13' is arranged to extend outboard of the end closure 14' for interconnection with a source of power and to extend within the enclosure in bushing 16' to drive a second shaft 40 through a suitable square pin and hole driving connection, locked in place with pin 39. Shaft 40, on the left hand end, has an annular, tapered ring of extremely hard wear resistant material 41 cemented thereto which bears against a corresponding insert 42 in closure 14'. On the right hand end of shaft 40 a similar wear resistant tapered pin 43, cemented to the shaft, fits with insert 44 in closure 15'. Bearing adjustment is provided for by the set screw 45 in the closure 15'. The wear resistant bearings are non-corrosive and during pump operation are lubricated

by the fluid pumped; and may be adjusted for high unit pressure thus avoiding a tendency toward leakage of fluid.

In operation, the pump intake conduit is joined with a supply of fluid to be moved and likewise, the discharge conduit is connected to the discharge line. If, instead of the vertically disposed conduits, it is desirable to have horizontal intake or discharge, the pipe plugs 24 and conduits 22, 23 may be interchanged according to the requirements.

The pumping developed in the two sub-compartments is equalized by the communication existing therebetween on the intake and discharge sides, but no back pressure is permitted by which communication will exist between intake and discharge to reduce the efficiency of the pumping apparatus.

It will be understood that the invention is not limited to the particular details shown by way of illustration, but that many changes may be made within the scope of the appended claims.

I claim:

1. In a liquid pump of the class described, in combination, a cylindrical pumping compartment, a pump shaft extending axially therethrough and having an eccentric fixed thereto, intake and discharge ports communicating with the pumping compartment at a parallel walled aperture terminating therein, a cylindrical impeller fitted over said eccentric for gyration within said compartment, said impeller including a resilient, deformable, parallel sided extension portion aligned with and corresponding in size to said aperture, whereby the aperture may be periodically sealed from the compartment during pumping, and a separator travelling with the impeller and forming a baffle between the intake and discharge ports.

2. In a liquid pump of the class described, in

combination, a cylindrical pumping compartment, a pump shaft extending axially therethrough and having an eccentric fixed thereto, intake and discharge ports communicating with the pumping compartment at a walled aperture terminating therein, a cylindrical impeller fitted over said eccentric for gyration within said compartment, said impeller including a resilient, deformable, parallel sided extension portion aligned with and larger than the terminating area of said aperture, whereby the aperture may be periodically sealed from the compartment thereby during pumping, and a separator travelling with the impeller and forming a baffle between the intake and discharge ports.

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