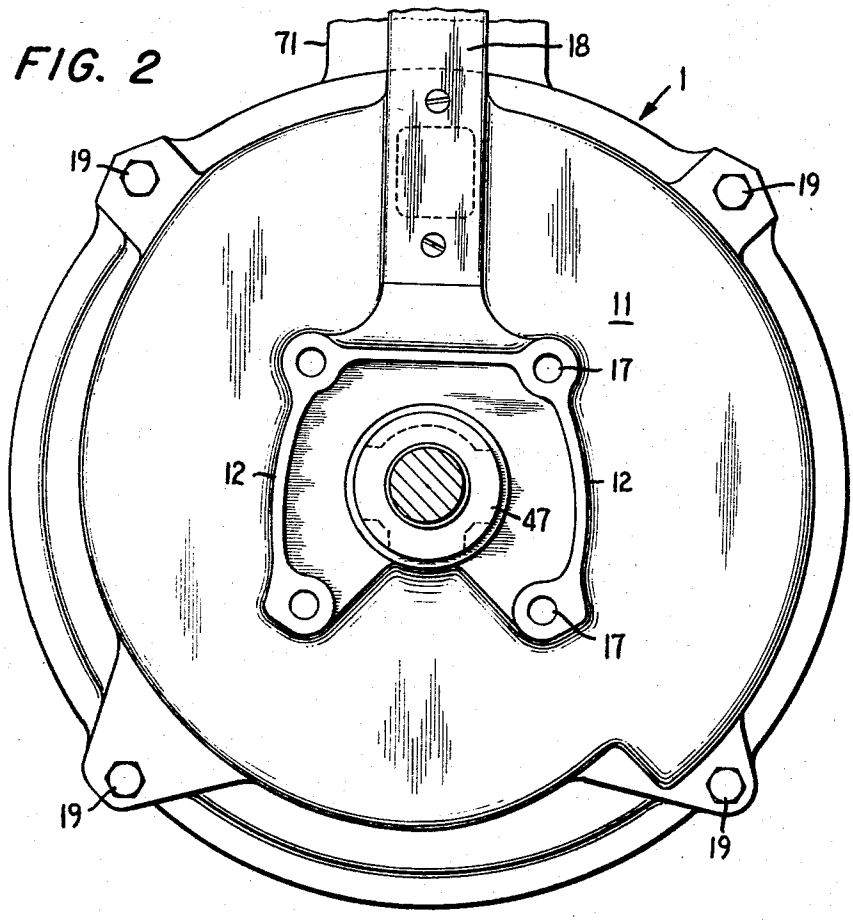
May 30, 1967 R. K. TETER 3,322,071

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FIG. 2



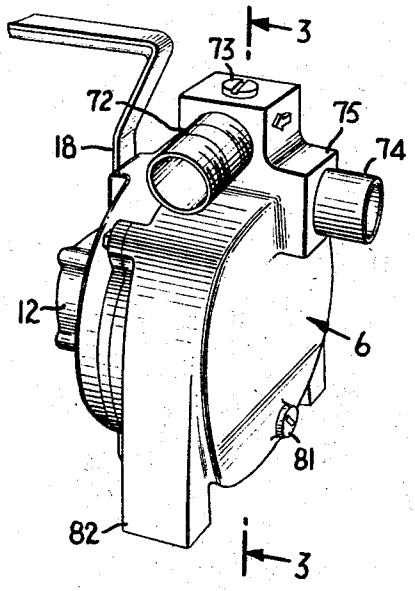


FIG. 1

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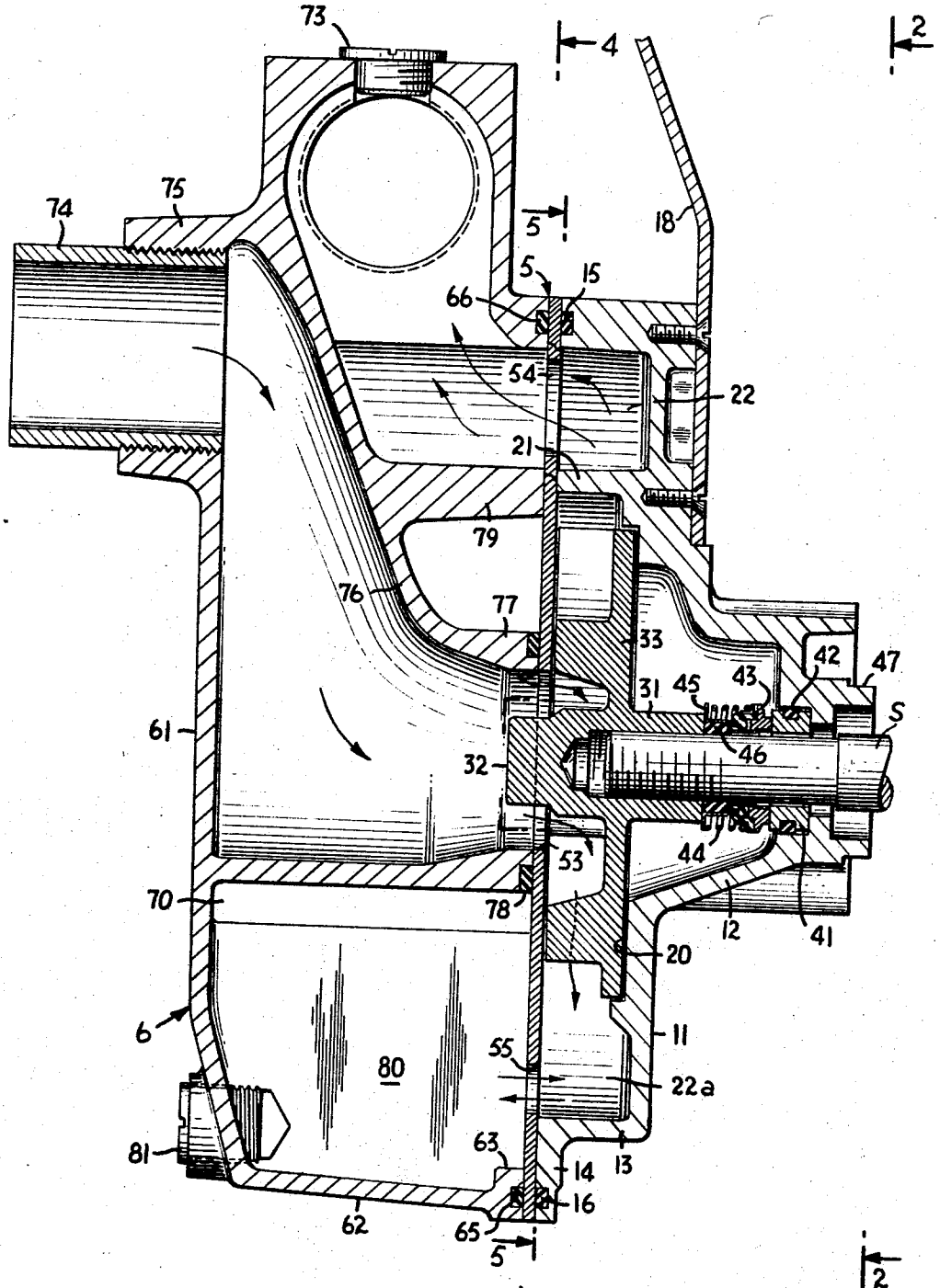


FIG. 3

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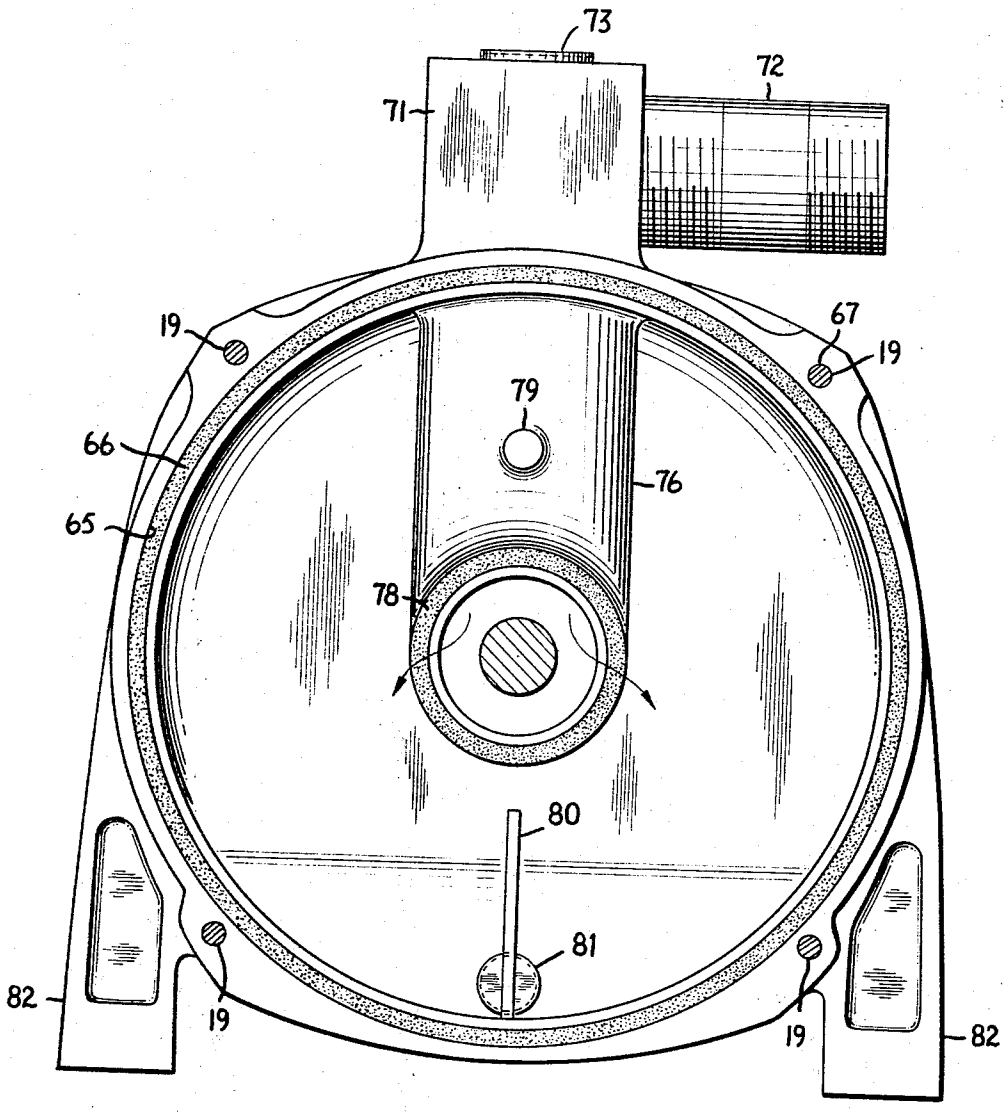


FIG. 4

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FIG. 5

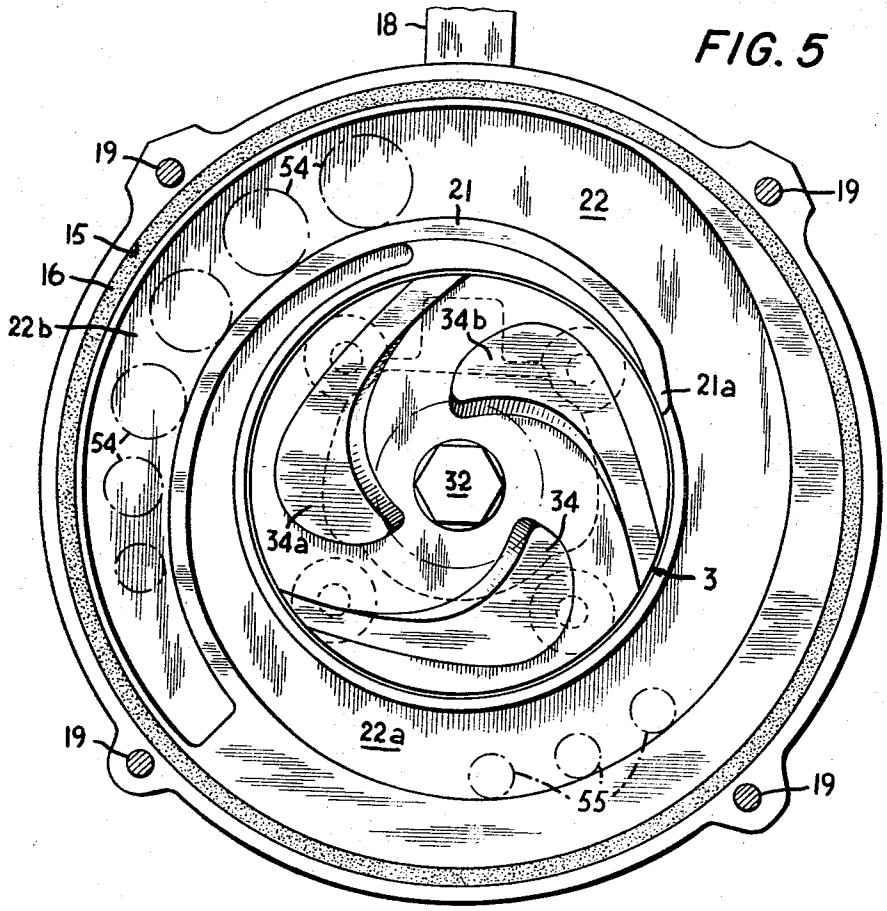
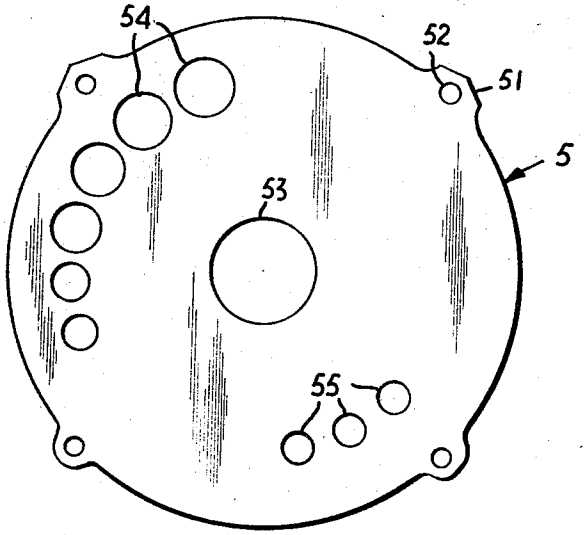


FIG. 6



United States Patent Office 3,322,071
Patented May 30, 1967

3,322,071

PUMP

Robert K. Teter, Port Chester, N.Y., assignor to Textron Inc., Byram, Conn., a corporation of Rhode Island

Filed June 10, 1965, Ser. No. 462,837
10 Claims. (Cl. 103—113)

The present invention relates to pumps and particularly to self-priming rotary pumps for liquids.

In self-priming pumps, a quantity of liquid is retained in a chamber in the pump and is recirculated through the pump during the priming operation. The recirculating liquid entraps air which is drawn in through the pump inlet and is discharged through the outlet of the pump so as progressively to evacuate the intake line and eventually draw in the liquid to be pumped. It is desirable to accomplish the evacuation of the intake line as rapidly as possible in order to minimize the time required for priming.

A problem encountered in self-priming pumps is that the recirculation of liquid which is required during the priming operation is continued throughout the operation of the pump. As this recirculation of liquid accomplishes no useful purpose after the priming is completed, the energy dissipated in recirculating the liquid represents a loss and hence a decrease in efficiency of the pump.

In an effort to avoid such loss of efficiency, it has been proposed to provide the pump with valve means for closing the recirculation passageways after priming has been completed. However, such valve means increases the cost of manufacture of the pump and is subject to deterioration and eventual malfunctioning, particularly when pumping corrosive liquids or liquids containing abrasive solids, so that maintenance costs are increased and "down time" required for maintenance is increased.

It is an object of the present invention to provide an improved self-priming pump having the desirable characteristics of rapid priming, high efficiency, low manufacturing cost, long serviceability and low maintenance cost. In accordance with the invention, the recirculation of liquid which is necessary during the priming operation, is substantially avoided during the subsequent pumping operation without the use of valve means, thereby increasing pump efficiency while avoiding the complications incident to the use of valves.

A further object of the invention is to provide a pump of simple construction which comprises few parts and can be mounted directly on the housing of a driving motor with the impeller of the pump fixed on the motor shaft. In accordance with the invention, the major elements of the pump consist only of a back plate, a wear plate, an end plate and an impeller, of which only the impeller is movable.

The objects and advantages of the invention will be understood more fully from the following description and claims in conjunction with the accompanying drawings which show by way of example a preferred embodiment of the invention and in which,

FIG. 1 is a somewhat schematic perspective view of a pump in accordance with the invention.

FIG. 2 is an end view looking in the direction of the arrows 2—2 shown in FIG. 3.

FIG. 3 is a vertical axial section taken approximately on the line 3—3 in FIG. 1, but with portions of the wear plate cut in other planes so as better to illustrate schematically the flow path of liquid in the pump.

FIG. 4 is a cross section taken approximately on the line 4—4 in FIG. 3.

FIG. 5 is a cross section taken approximately on the line 5—5 in FIG. 3, but with openings in the wear plate shown in broken lines in order to illustrate their location.

FIG. 6 is a side view on a smaller scale of the wear plate.

The self-priming pump shown by way of example in the drawings comprises a back plate 1, an impeller 3, a wear plate 5 and an end plate 6. The back plate 1 is shown as a dish-shaped casting or molding having an approximately circular body portion 11, a central bell portion 12 and a peripheral portion 13 having an edge portion 14 disposed substantially in a plane and provided with an annular groove 15 to receive an annular gasket 16 formed of resilient elastomeric material such as rubber. The central bell portion 12 is hollow and has a central bore to receive the shaft S of an internal combustion of other engine by which the pump is to be driven and a plurality of holes 17 to receive bolts or studs for mounting the back plate 1 directly on the motor housing. A handle 18 is secured to the back plate 1 for carrying the motor-pump unit. At its periphery, the back plate 1 is provided with holes to receive bolts 19 for securing the back plate, wear plate and end plate together as will be described below. By reason of the construction of the pump, it is possible to secure the pump parts together with a relatively small number of bolts, for example four as illustrated in the drawings, thereby reducing manufacturing costs.

The inside of the back plate 1 has a central impeller cavity 20 which is coaxial with the shaft S. A scroll 21 projects from the body portion 11 approximately to the plane of the wear plate 5 and spirals outwardly from a leading end portion 21*a* adjacent the impeller cavity to the peripheral wall 13 of the back plate. The scroll 21 and peripheral wall 12 of the back plate defines a volute passage 22 having an inlet portion 22*a* disposed between the scroll 21 and the impeller cavity and a discharge portion 22*b* disposed between the scroll 21 and the peripheral wall of the back plate.

The impeller 3 is conveniently formed as a casting or molding having a hub portion 31 which screws onto a threaded end portion of the engine shaft S. A hexagonal end portion 32 on the hub facilitates screwing the impeller onto and off of the shaft. A disc-like body portion 33 projects radially outwardly from the hub portion 31 and carries a plurality of vanes 34, three such vanes being illustrated by way of example in the drawings. Each of the vanes is of airfoil shape as can be seen in FIG. 5 with a somewhat bulbous nose portion 34*a* and a trailing tail portion 34*b*. The vanes 34 are preferably integral with the disc portion 33 and project toward and substantially to the wear plate 5 as seen in FIG. 3. In a radial direction, the nose portion 34*a* of the vanes are spaced outwardly from the projecting end 32 of the hub portion while the tail portions 34*b* extend outwardly substantially to the peripheral edge of the disc portion 33.

A suitable rotary seal is provided between the impeller shaft and the back plate 1. As illustrated by way of example in the drawings, the seal comprises a stationary sealing ring 41 which is seated in an annular recess of the back plate and is provided in its periphery with an annular groove to receive an O-ring seal 42. A rotary sealing ring 43 is pressed against the stationary sealing ring 41 by a compression spring 44 which acts between the ring 43 and a flanged ring 45 which seats against the ends of the impeller hub 31. An annular gasket 46 provides a fluid-tight seal between the ring 45 and the impeller shaft. A suitable seal is shown more fully in a co-pending application of Gilbert E. Buske, Ser. No. 423,470 filed Jan. 5, 1965. An annular finished surface 47 fits into a finished hole in the motor housing to assure centering of the pump relative to the engine shaft.

The wear plate 5 is shown as being formed of sheet material of substantially uniform thickness. It can hence be made easily and inexpensively as a sheet metal or other stamping. The wear plate is substantially circular

except for projecting ear portions **51** in which are provided holes **52** to receive the bolts **19** for holding the parts of the pump in assembled relations. A central opening **53** which, as seen in FIG. 3 provides a central inlet for admission of liquid to the impeller **3**. The wear plate is also provided with one or more discharge openings **54** and one or more priming openings **55**. In the example illustrated in the drawings, there are six discharge openings **54** of graduated size and three priming openings **55** which are of equal size and have a smaller total area than the discharge openings.

The end plate **6** is shown as a dish-shaped casting or molding having an approximately circular end wall **61** and a peripheral wall **62** having a peripheral edge portion **63** which lies substantially in a plane and is provided in its face with an annular recess **65** to receive an annular gasket **66** which is similar to and preferably identical to the gasket **16** of the back plate **1**. At its periphery, radially outwardly of the gasket **66**, end plate **6** is provided with bolt holes **67** to receive the bolts **19**. When the parts are assembled with the wear plate **6** sandwiched between the back plate **1** and end plate **6** as illustrated in FIG. 3, and the bolts **19** are tightened, the parts are held in assembled relationship and the gaskets **16** and **66** provide a fluid-tight seal between the back plate, wear plate and end plate.

The end plate **6** is preferably deeper than the back plate **1** and provides a chamber **70** of substantial volume to hold and store liquid for priming the pump. In the upper part of the end plate **6**, there is provided a discharge passage **71** communicating with the chamber **70** and provided with suitable connecting means such as a nipple **72** which serves as the pump discharge or can be connected to any desired discharge line. A removable inspection and filling plug **73** is shown screwed into a threaded opening in the upper portion of the discharge passage **71**.

The end plate **6** is also provided with a suitable inlet connection illustrated as a nipple **74** screwed into a threaded inlet opening **75**. The inlet opening **75** communicates with a passage **76** which extends downwardly and inwardly and terminates in an inner end portion **77** providing a central opening concentric with the impeller and registering with the opening **53** of the wear plate. A seal between the end portion **77** of the passageway **76** and the wear plate **5** is provided by a sealing ring **78**. A stud or post **79** projects inwardly from a central portion of the wall of the passage **76** and abuts the wear plate **5** at a location substantially opposite to that of an adjacent portion of the scroll **21** of the back plate **1**.

The end plate **6** is also provided with baffle means for inhibititing rotary circulation of liquid in the chamber **70**. As illustrated in the drawings, there is provided a vertical baffle **80** which extends upwardly from a lower portion of the peripheral wall **62** of the end plate with its upper edge space from the lower portion of the passage **76**. In an axial direction, the baffle **80** extends from the end wall **61** to the wear plate **5**. A removable drain plug **81** is screwed into a threaded opening in the lower portion of the end plate **6** communicating with the chamber **70** on both sides of the baffle **80**. The end plate is shown as provided with portions **82** forming feet or supports for the pump.

With the parts assembled as shown in FIG. **3**, it will be seen that the central opening **53** of the wear plate **5** provides a central inlet passage to the impeller **3**. The discharge openings **54** of the wear plate provide communication between the discharge portion **22***b* of the volute passage **22** and the chamber **70** of the end plate **6**. The openings **55** of the wear plate **5** provide communication between the chamber **70** and the inlet portion **22***a* of the volute passage **22** which as will be seen in FIG. 5, is in direct communication with the impeller cavity. With reference to FIG. 5, it will be seen that if the pump is considered as being divided in quadrants which are numbered sequentially starting at a vertical reference line extending upwardly from the axis of the impeller and proceeding in the direction of rotation of the impeller, the discharge openings **54** of the wear plate **5** are mostly in the first quadrant and some in the second, the priming openings **55** are in the third quadrant and the leading edge **21***a* of the scroll **21** is in the fourth quadrant.

In operation of the pump, the impeller **3** is rotated by rotation of the engine shaft S on which the impeller is mounted. During a priming period, liquid which has remained in the pump from previous operation, or is introduced through the opening of plug **73**, is recirculated in the pump, being drawn from the chamber **70** through openings **55** of the wear plate into the impeller cavity **20** and inlet portion of the volute passage **22** and being discharged through the openings **54** of the wear plate from the discharge portion **22***a* of the volute passage back into chamber **70**. During this recirculation, air is drawn in through the inlet connection **74** and is mixed with the recirculating liquid so as to be carried through the discharge openings **54** into the chamber **70**, whereupon it is discharged through the discharge connection **71** to evacuate air from the inlet line.

When the priming operation is completed, liquid from the inlet line is drawn through the inlet passage **76** and through the central opening **53** of the wear plate, and is propelled by the impeller **3** into the volute passage **22**, whereupon it flows through the discharge openings **54** of the wear plate into the upper portion of chamber **70** of the end plate **6** and is discharged from the top of the chamber through discharge connection **71**. As the fluid pressure in the inlet portion of the volute passage **22** where the priming openings are located, is approximately the same as that prevailing in chamber **70**, there is no substantial flow of liquid from chamber **70** through openings **55** into the volute passage and hence substantially no recirculation of liquid during normal pumping operations, such as occurs during priming. In fact, after priming has been completed, there appears to be a certain amount of flow through openings **55** from the volute passage **22** to the chamber **70**, i.e., in a direction reversed to that which occurs during the priming operation. By avoiding any substantial recirculation of liquid through the priming circuit during normal pumping operation, the efficiency of the pump is materially increased.

While a preferred embodiment of the invention has been shown by way of example in the drawings, it will be understood that the invention is in no way limited to the illustrated details of design.

What I claim is:

1. A self priming liquid pump adapted to be mounted on a motor having a housing and a shaft, comprising a dished back plate having an annular peripheral edge portion and a central opening, means for mounting said back plate on said motor housing with said shaft received in said opening, said back plate having on its inner side a central impeller cavity and a volute passage around said cavity and defined by a peripheral wall and a scroll having a leading end adjacent said cavity, and spiriling out to said peripheral wall, said volute passage having an entry portion communicating with said cavity and a discharge portion separated radially from said cavity by scroll, an impeller on said shaft and in said cavity, a end plate having an annular peripheral edge portion conforming substantially to and facing said peripheral edge portion of said back plate, said end plate defining a liquid storage chamber, a discharge outlet at the upper part of said chamber and an inlet passage extending through said chamber and having a central outlet end, a wear plate having an annular peripheral edge portion interposed between said peripheral edge portion of said back plate and end plate, said wear plate having a central inlet opening providing communications between said inlet passage and said impeller cavity, at least one discharge opening providing communication between the discharge

portion of said volute passage and an upper portion of said chamber and at least one priming opening providing passage between said impeller cavity and a lower portion of said chamber, said wear plate being a sheet metal stamping of substantially uniform thickness with said openings punched therein, means for securing said wear plate between said end plate and back plate and means providing a seal between said peripheral portions of said end plate, wear plate and back plate, whereby during the priming of said pump, liquid flows through said priming opening from said chamber to said impeller cavity and is discharged through said discharge opening from said volute passage to said chamber.

2. A pump according to claim 1 in said seal providing means comprises annular gasket channels defined in opposed edge faces of said peripheral portions of said end plate and back plate and annular seals of resilient material received respectively in said channels and pressing on opposite faces of said peripheral portion of said wear plate.

3. A pump according to claim 1, in which said priming opening in said wear plate opens into said entry portion of said volute passage.

4. A pump according to claim 1, in which, with the axis of said impeller horizontal and with quadrants numbered sequentially starting with a reference line extending perpendicularly upward from said axis and proceeding in the direction of rotation of said impeller, said discharge opening is in the first quadrant, said priming opening is in the third quadrant and said leading end of said scroll is in the fourth quadrant.

5. A pump according to claim 3, in which said wear

plate has a plurality of discharge openings located in the first and second quadrants.

6. A pump according to claim 3, in which said wear plate has a plurality of priming openings located in said third quadrant.

7. A pump according to claim 1, in which said end plate has an intake connection in an upper portion and in which said inlet passage extends downwardly through said chamber from said intake connection to said central inlet opening of said wear plate.

8. A pump according to claim 1 further comprising baffle means in the lower portion of said chamber to restrain rotary movement of liquid in said chamber.

9. A pump according to claim 1 in which said end plate is more deeply dished than said back plate.

10. A pump according to claim 1, in which said impeller comprises a disc portion disposed in the inner portion of said cavity in said back plate and a plurality of volute vanes projecting from said disc portion substantially to said wear plate.

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