Dec. 5, 1967 F. J. REPP 3,356,036

PLUNGER-TYPE PUMP

Filed March 1, 1966

FIG. 1

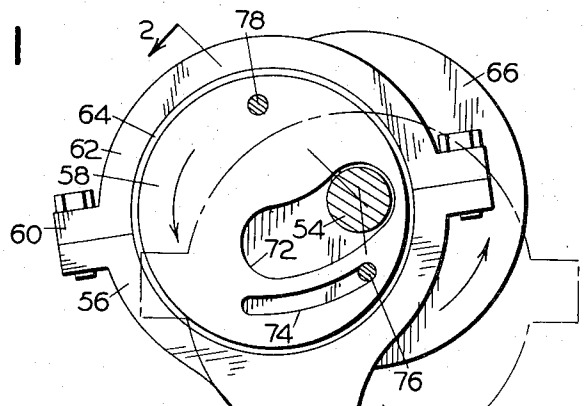


FIG. 4

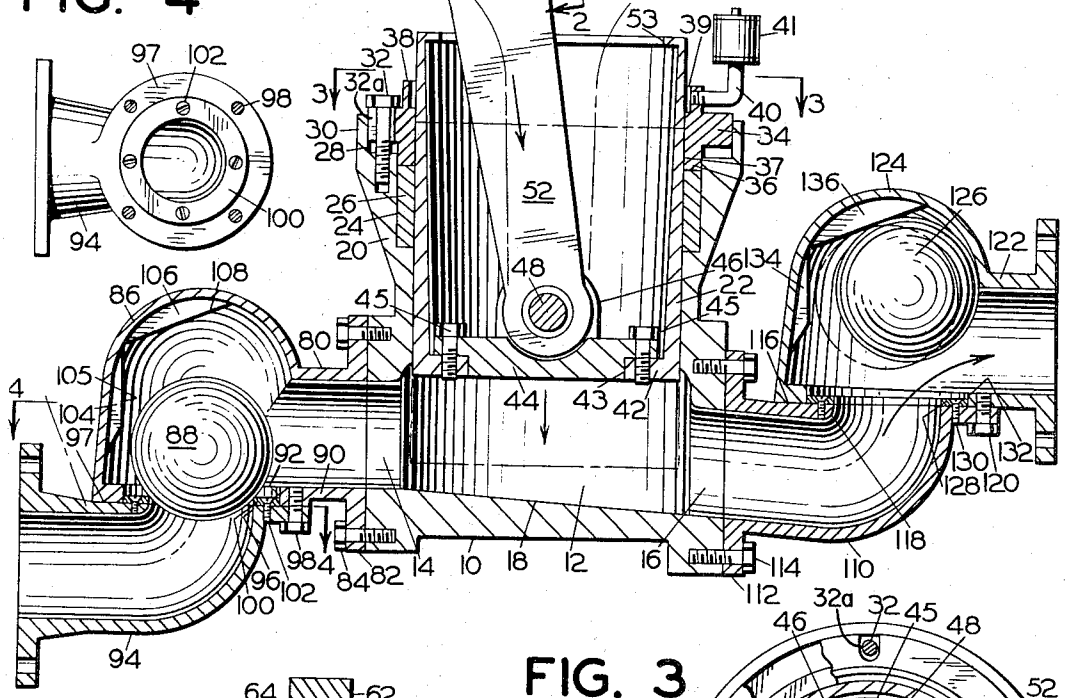


FIG. 3

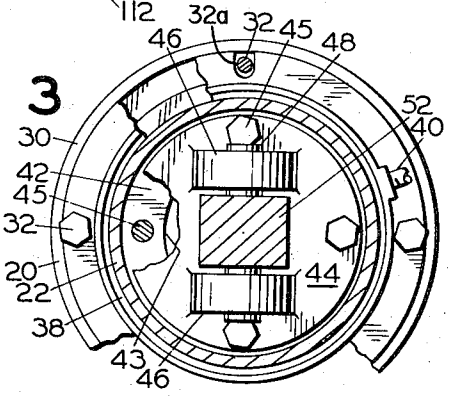
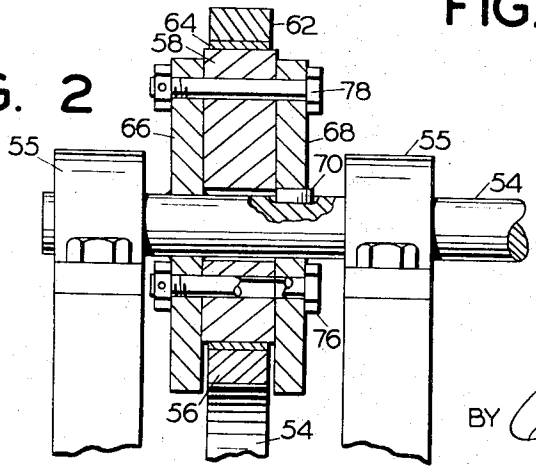


FIG. 2



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PLUNGER-TYPE PUMP

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This invention relates to new and useful improvements in pump structures and is particularly concerned with a reciprocating or plunger type pump.

An important object of the present invention is to provide a pump structure of the type described having novel features which singularly and in combination provide improved pumping efficiency, long life of the pump, and a minimum of maintenance.

A more particular object is to provide a pump chamber in a plunger-type pump employing an inclined bottom wall which serves to assist the flow of material through the pump and also serves to prevent damage to the reciprocating plunger.

Another object is to provide in a plunger-type pump novel means which assist in guiding the plunger in its reciprocating motion to maintain an efficient pumping action and to prolong the normal life of the piston.

Still another object is to provide a plunger-type pump having inlet and outlet ball valve means and means associated with the ball valve means for re-positioning the latter on their valve seats after each valving function whereby to prolong the life of these valve means and to cause them to work more efficiently.

Additional objects and advantages will become apparent from the following description taken in connection with the accompanying drawings which illustrate a preferred form of the device.

In the drawings:

FIGURE 1 is a vertical cross sectional view of a pump structure embodying features of the present invention;

FIGURE 2 is a fragmentary, vertical sectional view taken on the line 2—2 of FIGURE 1;

FIGURE 3 is a fragmentary, horizontal sectional view partly broken away and taken on the line 3—3 of FIGURE 1; and

FIGURE 4 is a horizontal, fragmentary sectional view taken on the line 4—4 of FIGURE 1.

Referring now in particular to the drawings, the present invention comprises a plunger or piston type pump having a hollow housing **10**. The interior of the housing **10** comprises a pump chamber **12** having an inlet open end **14** and an outlet open end **16**. Chamber **12** may assume any suitable cross sectional configuration such as circular or non-circular, and in its longitudinal dimension the bottom surface **18** thereof is inclined downwardly from the inlet end **14**. The direction of incline of surface **18** and the purpose of such incline will be explained hereinafter.

Leading upwardly at right angles from the housing **10** with its lower end in communication with pump chamber **12** is a cylinder **20** which slidably receives a plunger or piston **22**. Cylinder **20** has an upwardly located annular groove **24** in its inner surface in which an annular packing or sealing ring **26** is adapted to be removably mounted and furthermore has an upwardly opening annular socket **28** defined by an upwardly extending wall or flange **30**, the socket **28** being enlarged laterally with relation to the groove **24** and the upper end of the latter opening into said socket.

Removably mounted in the socket **28**, as by means of stud screws **32**, is an annular piston guide ring **34**. This guide ring has a downwardly directed flange **36** of selected thickness and diametral dimension for engaging in groove **24**. The inner wall surface **37** of the guide ring **34** is coextensive with the inner wall surface of the cylinder and thus serves as an upper guide ring for the piston. Also, since the flanged portion **36** of the ring projects downwardly into the packing ring groove **24** the ring serves as a gland in holding the packing ring **26** in place. The outer periphery of ring **34** has a machined fit with the inner surface of wall **30**, and the studs **32** project through radially elongated slots **32***a* in the said ring.

Ring **34** also has an upwardly extending flange or wall **38** thereon the inner diameter of which is larger than the inner diameter of the ring **34** itself whereby to form a lubricant receiving area or reservoir **39** between such flange and the outer surface of the plunger **22**. Lubricant is admitted to the area **39** by a conduit **40** mounted in the flange **38** and leading from a supply container **41**.

Plunger **22** has a bottom end wall **42** provided with a central opening **43** for receiving a flanged crank connecting insert **44**, such insert being removably secured to the end wall **42** by stud screws **45**. Connecting insert **44** has a pair of integral upwardly directed lugs or blocks **46** supporting a short shaft **48** therebetween. Pivotally mounted on the shaft **48** is a piston rod or crank arm **52**, the piston rod extending downwardly through an open upper end **53** of the piston. The connecting insert **44**, being removably secured to the piston, may be replaced in the event it becomes worn without replacing the entire piston, or, vice versa, the piston may be replaced without replacing the connecting insert.

Piston rod **52** has reciprocating driving movement by a power driven shaft **54**, FIGURES 1 and 2, journaled in a pair of standards **55** and operative in eccentric relation with the piston rod to produce such reciprocating motion. More particularly, the upper end of piston rod **54** has a hollow circular enlargement **56** in which is rotatably confined a crank disc **58**, the enlargement **56** being split and having a flanged connection **60** with an upper semi-circular cap portion **62**. A bearing bushing **64** is disposed between the disc **58** and the enlargement **56**.

Mounted on the shaft **54** in concentric relation therewith and on opposite sides of the disc **58** are round drive plates **66** and **68**, the drive plates **66** and **68** being secured to the shaft for rotation therewith. The plate **66** may be welded or otherwise secured on the shaft but for the purpose of assembly and disassembly the plate **68** is keyed to the shaft by key means **70**. Crank disc **58** of the crank has an arcuate, elongated slot **72** through which the shaft **54** passes and furthermore has an elongated arcuate slot **74** receiving an adjustment holding bolt **76** which extends also through the two drive plates and which together with a connecting bolt **78** establishes a drive connection between the drive plates **66** and the disc **58**. As apparent in FIGURE 1, the arcuate slot **72** in the disc **58** is offset from the center thereof and extends in an arc having the bolt **78** as its center. The arcuate slot **74** also has the bolt **78** as its center. The offset or eccentric disposition of the crank disc **58** with relation to the shaft **54** and the concentric drive plates **66**, **68** upon rotation of the shaft provides a reciprocating operation of the plunger. The extent of throw of the crank is dependent upon the adjusted relation of the shaft **54** in the slot **72**, and the adjusted position is accomplished by selectively positioning the bolt **76** in its slot, the latter slot being of sufficient length to permit desired limit adjustment of the disc **58** on the shaft.

Removably secured to the inlet side of the housing **10** is a hollow valve housing **80**, such valve housing having an end flange **82** for securement to the housing **10**, as by stud screws **84**, and also having a bulbous portion **86** in which is contained a ball valve **88**. The bottom wall **90** of valve housing **80** has an opening **92** directly below the bulbous portion **86**, and an inlet fitting **94**, having an outlet opening **96**, is removably secured, as by means of stud

screws 98, to the housing 80 in a position whereby the outlet opening 96 is in registry with the bottom opening 92. In a preferred construction, the inlet fitting 94 has a flat upper wall portion 97 to support an annular seating ring 100 thereon which is disposed in the outlet opening 92 and which serves as a seat for the ball 88. Seating ring 100 is removably secured to the inlet fitting 94 by screws 102.

As will be seen more fully hereinafter, when material is being drawn into the inlet portion of the pump by means of an upstroke of the plunger, the ball valve 88 is forced upwardly into the bulbous portion 86 whereby to be in an out-of-the-way position for the passage of material through the pump. An abutment rib having a substantially vertical edge 105 extends up along the inner surface of housing portion 86, and leading from such rib is a second abutment rib 106 having an edge 108 which leads inwardly of the housing and is angled upwardly. The purpose of ribs 104 and 106 is to provide a rotative adjustment of the ball valve 88 each time said ball valve is raised upwardly into abutment therewith. That is, on each upstroke of the pump plunger the ball 88 is moved upwardly and in such upward movement engages and rolls up along rib 104. If the ball moves upwardly against rib 106 it will roll along the angled edge thereof, and in any case will engage one or the other or both of said ribs. Such rolling adjustment of the ball valve on each stroke of the plunger prevents uneven wearing of the valve and therefore contributes to a long and efficient sealing life.

Removably secured to the outlet side of the housing 10 is an outlet fitting 110 having an end flange 112 for securement to the housing as by means of stud screws 114. This fitting has a flat upper wall portion 116 provided with an outlet opening 118. Seated on the fitting 110 and secured thereto as by stud screws 120 is a hollow outlet valve housing 122 having a rounded or bulbous portion 124 in which is contained a ball valve 126 similar to the ball valve 88. Also similar to the inlet valve means, the ball valve 126 is associated with an annular seating ring 128 removably secured on the upper flat wall portion 116 by screws 130. Housing 122 has a bottom opening 132 which registers with outlet opening 118 in the fitting 110 but which is somewhat enlarged relative to the latter opening for mounted disposition of seating ring 128.

Bulbous portion 124 also has ball abutment ribs 134 and 136 shaped and located the same as the ribs 104 and 106 and for the same purpose. FIGURE 1 illustrates in dotted lines the position of the ball 126 in the outlet valve housing when it first comes into abutment with the rib 136 and in full lines the position of the ball after it has rolled along the edge of said rib for rotatably adjusting itself with relation to the valve seat.

In the operation of the pump wherein the plunger is driven vertically in reciprocatable motion in the cylinder, the ball valves lift and seat alternately to cause one-way movement of media being pumped. One important feature of the present structure is the shape of the pump chamber 12 and particularly the inclined bottom wall 18 thereof. As apparent in FIGURE 1 the wall 18 inclines downwardly from the inlet opening 14 or more specifically is angled with relation to the plane of the end wall 42 of the plunger, the direction of downward inclination of such wall, or in other words the widening portion thereof, being toward the outlet opening 16. By means of such structure the media being pumped flows more freely toward the outlet and in addition any particles in such media are moved down the wall 18 by the downward pinching force exerted by the plunger. Thus, particles which ordinarily may damage the plunger are forced right on through.

The ball valves 88 and 126, being rotatably adjusted upon each stroke of the plunger, have a long operating life and since they do not become unevenly worn perform an efficient sealing function. Another feature resides in the use of the plunger guide ring 34 which serves to guide the plunger and contribute to efficient operation and long life thereof. More particularly, since the ring 34 has a machined fit within the wall 30, it provides an upper guiding cylinder surface for the plunger 22. Such upper guiding surface for the plunger serves to prolong the life of the plunger and cylinder since lateral forces acting on the plunger by the eccentric drive are adequately taken care of. Also, since the ring holding studs pass through slots 32*a* and since the ring has outer peripheral engagement with the wall 30, no appreciable shearing forces act on the studs.

It is to be understood that the form of my invention herein shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. A pump comprising a housing, means defining a longitudinally extending pump chamber therein having a bottom wall and inlet and outlet openings, a cylinder leading angularly from said housing and communicating therewith, said cylinder having a guiding surface adjacent to the pump chamber, a plunger operative in said cylinder along said guiding surface, said plunger being operative toward and away from said bottom wall of the pump chamber for moving liquid through said chamber, an end wall on said plunger, valve means at opposite ends of said pump chamber arranged to permit liquid being pumped to move in one direction through said pump chamber, the bottom wall of said pump chamber and said end wall of the plunger having an acute angled disposition with relation to each other with the widening area therebetween leading toward the outlet opening, means in said cylinder disposed outwardly from said inner guiding surface defining a socket, a guide ring removably mounted in said socket and having an inner guiding surface coextensive with the guiding surface of said cylinder, and a flange on said guide ring extending away from said pump chamber, said flange having an inner defining surface disposed outwardly from the plane of the inner defining surface of said guide ring whereby to form a lubricant containing reservoir between said flange and said plunger.

2. The pump construction of claim 1 wherein the means disposed outwardly from said inner guiding surface for defining a socket comprises wall means, the outer periphery of said guide ring bearing against the inner periphery of said socket wall means, a flange on said guide ring extending toward said pump chamber, the inner defining surface of said flange being coextensive with the guiding surface of said cylinder, means in said inner guiding cylinder surface defining a groove leading from said socket toward said pump chamber, a packing ring in said groove, said downwardly depending flange projecting into said groove for engaging said packing ring, and a flange on said guide ring extending away from said pump chamber, said flange having an inner defining surface disposed outwardly from the plane of the inner defining surface of said guide ring whereby to form a lubricant containing reservoir between said flange and said plunger.

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