

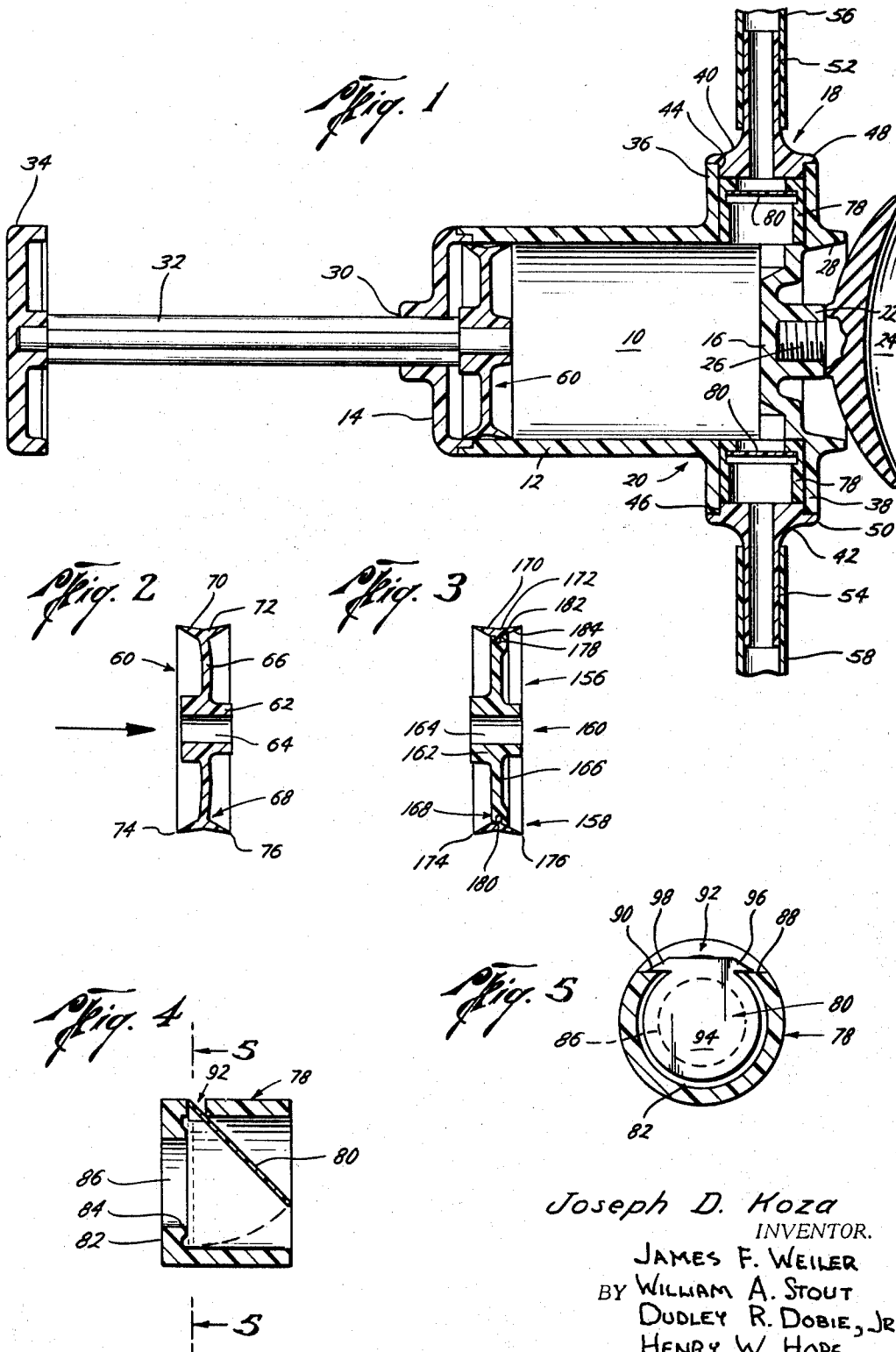
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1

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ABSTRACT OF THE DISCLOSURE

Generally, the present invention is comprised of a hand-operated, portable pump which is so arranged and constructed that it may be easily and inexpensively manufactured. The invention is further characterized by a unique piston which functions to insure a proper seal while offering a minimum of resistance to the operation of the pump; and by the flapper type valves used in the pump to provide proper operation with relative simplicity in manufacture.

The present invention relates to pumping apparatus and more particularly to hand-operated, portable pumps.

A problem that occurs to motorists not too infrequently, is that of running out of gas on the open highway. When this happens, and if a service station is not readily available, a great deal of trouble is usually encountered. The least time consuming solution to this problem is siphoning gasoline from another person's car, assuming that the other person is willing.

The normal method of siphoning gasoline, however, is rather difficult and sometimes dangerous, since it must be started by someone sucking on a siphon tube. This could obviously result in a mouthful of gasoline with obvious ill effects.

The present invention seeks to provide a compact, portable, easily operated pump which may be carried in the trunk of the car for such emergencies. The pump is hand operated and is quite small, requiring little space for storage. It is, furthermore, extremely light in weight since it may be composed entirely of plastic. Furthermore, the pump may be easily operated by a woman or a child since little force is required to operate the pump due to a novel construction for the piston used in the pump.

The pump includes other novel features such as uniquely constructed valves composed of only two parts and being operated by the positive and negative pressures that are established in the piston chamber by the action of the piston.

Such a pump has numerous other uses around the home, office or business. For example, the necessity of the storage of gasoline for power lawnmowers, garden tractors, etc., can be eliminated along with the resultant hazards, due to the fact that gasoline may be taken easily and quickly from the family automobile for this purpose. It may be used for a portable sump pump for boat bottoms. Gaseous matter may also be pumped with the present invention.

The present invention is so compact and lightweight that it may be mounted as an accessory to the item with which it is to be used. Since it may be constructed entirely from plastic, it may be used to pump high explosive gases and fluids without the usual danger of sparking by metallic parts. Such plastic construction also provides corrosion resistance as well as allowing the parts of the pump to be fused together, whereby complete seals are insured. Furthermore, the pump may be sterilized.

It is, therefore, an object of the present invention to provide a compact, lightweight pump for portable use.

It is a further object of the present invention to provide a hand-operated pump which requires only a small force to operate.

2

A still further object of the present invention is to provide a pump which includes a novel design for its piston, this novel design allowing the pump to be manufactured inexpensively, but insuring a tight seal with the piston chamber while requiring the minimum of force to move the piston.

An additional object of the present invention is to provide a pump having a novel design for the valves used therein, which valves may be manufactured cheaply and are simple in design and operation.

A still further object of the present invention is to provide a pump, the operative parts of which may be manufactured entirely from plastic to eliminate the hazard of sparking when pumping explosive fluids or gases and to eliminate any deleterious effects on the pump when pumping corrosive substances.

Other and further objects, features and advantages will be apparent from the following description of a presently preferred embodiment of an invention given for the purpose of disclosure, taken in conjunction with the accompanying drawings, wherein like character references designate like parts throughout the several views, and where:

FIGURE 1 is a side view of one embodiment of the present invention, taken in section for purposes of illustration,

FIGURE 2 is a side-section view of the piston utilized in FIGURE 1 showing the configuration of the piston when it is being operated,

FIGURE 3 is a side-section view of a second embodiment of the piston utilized in the present invention,

FIGURE 4 is a side-section view of a valve used in the present invention, the flapper being in an open position, and

FIGURE 5 is a section view of the valve shown in FIGURE 4 and taken along section lines 5—5 of FIGURE 4, the flapper being shown in its closed position.

Referring now to FIGURE 1 of the drawings, the pump is composed of a cylindrical, enclosed housing or piston chamber generally indicated at 10. The chamber is made up of cylinder 12 and cylinder heads 14 and 16. Located near the head 16 are inlet and outlet openings, generally indicated by the numerals 18 and 20, respectively. Forming a part of the exterior side of the head 16 is an outstanding socket 22, to which is attached a suction cup 24. The suction cup 24 is attached to the socket 22 by stud 26 extending from the cup 24. The stud 26 may be secured in the opening by any conventional means, such as sonic welding, gluing, etc. A stabilizer ring 28 is located on the exterior surface of the head 16. This stabilizer 28 is a circular upstanding flange and acts against the suction cup 24 when the cup is attached to a support surface to prevent undesired movement of the pump while the pumping action takes place.

Turning now to the cylinder head 14, a central gland 30 is located in the place 14 to allow the piston rod 32 to move into and out of the piston chamber 10 in a reciprocating manner. The rod 32 in this embodiment has a cross-section in the shape of a cross as is shown. It is understood, of course, that the cross-sectional area of the shaft may be any desired shape. The particular configuration shown was selected so as to eliminate a heavy section which would materially increase the molding cycle. The gland 30 is constructed to conform in configuration to the rod 32 but is slightly larger than the shaft to allow the escape of air during the instroke of the piston. A handle 34 is attached to the outermost end of the rod 32 to provide means for the operation of the pump. Attached to the rod 32 within the cylinder 12 is the piston 60 which will be more fully discussed below.

Turning now to the inlet and outlet means 18 and 20, they are essentially the same in construction and are lo-

3

cated in diametrically opposed positions in the piston chamber. They are composed of outwardly extending valve chests 36 and 38 respectively. The valve covers 40 and 42 have shoulders 44 and 46, respectively, for engagement in the open ends of the valve chests 36 and 38. The shoulders 44 and 46 are dimensioned so as to provide an interference fit with the valve chests 36 and 38 when inserted therein. The radial flanges 48 and 50 may be sonically welded or glued to the valve chests 36 and 38, respectively, to insure a complete seal. The valve covers 40 and 42 also have outwardly extending spigots 52 and 54 for mating engagement with the conveying tubes 56 and 58, whereby the pump communicates with the containers from which the fluid is to be withdrawn and to which the fluid is to be pumped.

Turning now to the piston 60 used in the present invention, and referring to FIGURE 2, the piston is composed generally of a central or hub portion 62 having an opening 64 for the attachment of the rod 32. Extending outwardly from the hub 62 is the body portion 66 of the piston. The body portion 66 conforms to the configuration of the chamber 10 and extends to within a short distance from the sidewall 12. The body portion 66 is made relatively flexible whereby it will bow slightly when under pressure. At the edge of the body portion, generally indicated by the numeral 68, two resilient lips 70 and 72 extend outwardly at divergent angles. The edges 74 and 76 of the lips 70 and 72, respectively, are of greater diameter than the center and are the only portions of the lips that contact the walls of the cylinder when the piston is not moving. When the piston is in motion, however, additional portions of the leading lip will contact the sidewalls as will be more fully explained below.

Referring now to FIGURE 3, there is shown a second embodiment of the piston which constitutes a part of the present invention. This piston 160 comprises two elements 156 and 158, whereas the previously discussed embodiment is of single unit construction. The main unit or part 156 of the piston comprises a hub portion 162 having an opening 164, therein, and a body portion 166. In this respect, the pistons shown in FIGURES 2 and 3 are identical. The lips 170 and 172 and their rims 174 and 176 are identical to the corresponding part of the embodiment in FIGURE 2, but are formed as part of a separate unit 158.

The edge portion 168 of the central or main body of the embodiment of FIGURE 3 substantially differs from the edge 68 of the embodiment in FIGURE 2. The edge 168 is enlarged and carries a peripheral groove 178 in the edge face 184, which is essentially at right angles to the body portion 166. The separate unit 158 is an angular ring having on its outer surface the lips 170 and 172 and on its inner surface 182 a peripheral perturbation or ridge 180. The surfaces 182 and 184 are formed for mating engagement so that when the rib 180 is interlocked with the groove 178, an air tight seal is formed throughout the entire surfaces 182 and 184. The surface 184 of the ring 158 is so dimensioned that its inside diameters are slightly smaller than the outside diameters of the corresponding portions on the face 184 of the edge 158. When the ring 158 is in place, therefore, a tight fit is formed between the units 158 and 156. The body portion 166 of the inner part 156 has the same flexibility as does the corresponding portion 166 of the embodiment of FIGURE 2. Likewise, the lips 170 and 172 of this second embodiment have the same resiliency as do the lips 70 and 72.

Turning now to FIGURES 4 and 5, the construction of the valves used in the present invention is shown in greater detail. FIGURE 4 shows a side view of the two basic elements of the valve, the collar 78 and the flapper 80. The collar is a cylindrical member having an internal radially extending flange 82. The flange 82 has an axially extending lip or rim 84 which forms the valve seat. A somewhat restricted opening 86 is formed by the flange

4

82 and its lip 84, through which the fluid being pumped passes when the flapper 80 is in its open position, as shown in FIGURE 4. Support means for the flapper is provided by surfaces 88 and 90 which are formed in the sidewall of the collar by the slot 92.

The design of the flapper 80 can best be seen in FIGURE 5. It is composed essentially of a disc portion 94 having extending from the top thereof, and from either side, shoulders 96 and 98. The shoulders rest on the supporting surfaces 88 and 90 respectively, whereby the disc is freely suspended within collar 78. As can be seen in FIGURE 4, the slot 92 is formed adjacent the seating rim 84, whereby the suspended disc is relatively close to, if not in contact with, the rim 84 when hanging from the support surfaces formed by the slot 92.

The operative position of the valves is shown in FIGURE 1. The collar 78, with the flapper inserted, is placed inside the valve chests 38 and 36. Upstanding shoulders, stops or the like are utilized in the members 36 and 38 to properly position the collars inside the cylindrical members. The valve covers 40 and 42 are then inserted and sealed if desired. For the inlet means 18, the collar is inserted with the flange 82 as the outermost end. On the outlet side, the flange end is innermost. This arrangement of the valves provides for the proper operation of the valves as will be explained.

Turning now to the operation of the present invention, the pump is first placed in an operative position by attaching it to a convenient surface by means of the suction cup 24. For example, it may be attached to the fender or trunk lid of the family automobile from which gasoline is to be siphoned for use in a power lawnmower.

It may, of course, be permanently attached to the mower as an accessory. The stabilizer ring 28 will act against the outer surface of the suction cup thereby preventing excessive rocking action while the pump is in use.

The inlet tube 56 is placed within the container from which the fluid is to be withdrawn, and the outlet tube 58 is placed in the receiving container. The pump is now ready to be operated and the person using the pump then pushes and pulls on the handle 34, causing the piston to move within the chamber 10 in a reciprocating manner. The cross-section area of the shaft prevents the rotation of the shaft and any resultant detrimental effect that this would have on the sliding seal.

The outstroke of the piston 60 will create a negative pressure in the section of the chamber between the piston 60 and the end plate 16 which draws the fluid through the inlet means 18. The instroke of the piston 60 will force the fluid that has been drawn into the chamber out of the outlet means 20 and through the outlet tube 58 to the receiving container. Thus the reciprocating piston functions to move the fluid through the pump in the manner well known in the art of pumping.

During the outstroke of the piston 60, the fluid being drawn into the chamber will act against the flapper 80 in the inlet valve causing it to move inwardly toward the piston chamber. No force will oppose this movement of the flapper until it reaches the position shown in FIGURE 4, whereby the circular cross-sectional area of the disc 94 will contact the narrower upper portions of the circular collar 78 and prevent further movement of the flapper. Accordingly, the inlet valve is open to allow the fluid to enter the piston. During the outstroke, the outlet valve will close due to the suction created by the upstroke. The suction will cause the flapper 80 in this valve to also be drawn inwardly toward the piston chamber. This flapper will, however, contact the lip 84 which will prevent further inward movement of the flapper. In this manner the outlet valve is closed during the upstroke of the piston.

During the instroke of the piston 60, the flappers move in the reverse directions from those described above. At the end of the outstroke, the piston is located in the position shown in FIGURE 1. Fluid or air has been drawn

into the piston chamber and during the instroke of the piston, will be forced out of the chamber. As the instroke begins, the fluid or air in the chamber will cause an outwardly directed force to be created against the flappers 80 in the two valves. This outward force the flapper 80 in the inlet valve to move away from the piston chamber, whereupon it will move against the rim 84, thereby closing the valve in the inlet means.

The outward force acting against the flapper in the outlet valve, however, causes the flapper to move to its open position since such movement is unopposed, at least until it assumes the position shown in FIGURE 4. The continuation of a piston in its downwardly direction will, accordingly, force the fluid or air in the chamber out of the outlet means and into the receiving container. The forces created by the reciprocating action of the piston 60 and by the movement of the fluid itself are sufficient to maintain the valves in their desired position, depending upon the phases of the operation, and to insure the proper pumping operation of the pump.

Turning to the piston utilized in the present invention, the configuration assumed by the piston when it is not subjected to the forces which are incurred when its motion is shown in FIGURE 1. When in this configuration, the body portion 66 is essentially flat.

When the piston is in motion, it tends to assume the shape shown in FIGURE 2. Here the piston is moving in the direction of the arrow shown. The forces created by the shaft acting against the hub portion 62 and by the friction created due to the sliding contact of the lips 70 and 72 against the sidewall 12, cause the piston to assume a generally convex configuration in the direction of its movement. This is illustrated in FIGURE 2 by the bending shown in the body portion 66.

This bending results in a turning or rotating of the edge portion 68 which is normally at approximately right angle to the body portion 66. The edge, and in turn the lips, turn away from the direction of movement thereby creating increased contact by the forwardmost or leading lip 72 against the cylinder wall. The following or trailing lip 70 is sufficiently flexible that it will yield as the lips rotate in the aforesaid manner, whereby contact between the lip 70 and the sidewall 12 is constantly maintained.

When the piston is in motion, the greatest opposing forces will bear against its leading side and lip. The previously described twisting of the piston, resulting from the flexible nature of the body portion 66, places the greatest contact with the sidewall of the chamber on the leading lip, thereby insuring that the fluid or the air in the chamber will not bypass the piston 60. In this same manner, the pressure is decreased between the trailing lip 70 and the piston chamber, whereby the minimum amount of force necessary to move the piston is maintained. It is to be understood that the trailing lip retains sufficient contact with the sidewall 12 to prevent the bypassing of fluid or air around the lip and into the space defined by the angle between the two divergent lips 70 and 72.

During the movement of the piston in the direction opposite to the arrow shown in FIGURE 2, the action of the body portion 66 and the lips 70 and 72 is reversed. In this manner the lip 70 becomes the leading lip, and the lip 72, the trailing lip. The body portion 66 bows in the direction opposite of that shown in FIGURE 2. Therefore, in both the upstroke and the downstroke, the maximum pressure or contact between the piston and the chamber sidewall is maintained on the leading edge or lip where it is most needed. At the same time, pressure is reduced on the trailing lip to maintain the force necessary to operate the pump as small as possible.

The operation of the second embodiment of the piston shown in FIGURE 3 is the same as the operation of the one unit piston. The body portion 166 bows in the same manner and the rotation or twisting of the lips 170 and 172 is also the same. Although only a single-unit and

double-unit piston are shown and described herein, it is to be understood that various other constructions of the piston may be utilized and still employ the invention disclosed herein.

As can be seen, therefore, the objects set forth at the outset are achieved by the present invention. A compact pump has been provided in which provides both reliable performance and ease of operation as well as a device which is economical to manufacture. The pump which is the subject matter of the present invention combines novel construction to insure a properly functioning item which requires only a small force to operate. The use of the suction cup allows the pump to be operated with only one hand, freeing the other hand to direct and control the inlet or outlet tubes, or for other purposes. The pumping apparatus disclosed herein may be made entirely from plastic thereby eliminating all metallic parts and the resultant hazard of sparking. A pump has been devised which is not harmed by contact with corrosive fluids, but maintains its integral and airtight construction throughout.

A novel construction has been utilized for the piston used in the present invention whereby the sliding seal between the piston and the sidewalls of the chamber is maintained and is, in fact, increased at the critical points of contact without the resultant increased force required for the operation of the pump. A pump has been devised, the parts of which are susceptible of being fused together when constructed from the proper materials, whereby no leaks will result. The pumping apparatus is sufficiently light and compact that it may be stored or carried in only a small space, or it may be mounted as an accessory item on the apparatus for which it is to be used to furnish fuel. A novel valve construction has been utilized to provide a long-lasting and trouble-free operation regardless of the substance which is pumped assuming the proper selection of construction materials; and which allows the valve to be constructed quickly and at a reasonable cost per unit.

The present invention, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned as well as others inherent therein. While a presently preferred embodiment of the invention has been given for the purpose of disclosure, numerous changes in the detail of construction and the combination, shape, size and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. A pump for fluids including,

an elongate cylinder,

an inlet valve communicating with a first end of said cylinder,

an outlet valve communicating with the first end of said cylinder,

a piston reciprocally mounted in said cylinder,

the piston being flexible such that it will bow when reciprocated, and including an outer peripheral edge, a first lip extending generally axially from the edge of said piston, at least the outermost rim of which is in constant contact with the chamber,

a second lip extending generally axially from the edge of the piston, and having at least its outermost rim in constant contact with the chamber, wherein,

the lip forwardmost in the direction of movement of the piston being in tighter engagement with the piston when said piston is forced to move and becomes bowed than when the piston is not bowed, thus insuring that the fluid will not bypass the piston, and means for reciprocating the piston.

2. The invention of claim 1, wherein said lips are further defined as extending outwardly from said peripheral edge at divergent angles, each of said lips tapering to a relatively narrow rim, said lips being the only portion of the piston in contact with the chamber thereby forming a seal with the chamber.

3. The invention of claim 2, wherein the piston is further defined as including,
 a central hub,
 said reciprocating means being connected to and exerting a force on the hub to move the piston,
 a body portion extending radially from said hub,
 the body portion having a first configuration when it is not in motion, a second configuration when it is moving in a one direction and a third configuration when moving in the opposite direction,
 said first configuration being essentially flat and lying within the same plane as the hub,
 said second and third configurations being generally convex in the direction of the movement of the piston,
 said edge being substantially perpendicular to said plane when the body portion is flat but being turned slightly away from the direction of movement when the body portion assumes its convex configurations, whereby the lip forwardmost with respect to the direction of movement, is in tighter engagement with the chamber.
 4. The invention of claim 3 wherein:
 said valves comprise flapper valves and including:
 a suction cup extending outwardly from the first end of the cylinder to provide means for stabilizing the pump while in operation,
 and wherein the cylinder has a cylinder head,
 a shaft passing through an opening in the cylinder head connecting the reciprocating means to the piston,
 the shaft and the opening in the cylinder head having a cross-sectional configuration such that rotation of the piston about an axis passing through the shaft is prevented.
 5. The invention of claim 3 wherein the piston is comprised of two elements,
 the first element including the hub, the body portion and the edge,
 the second element being an annular ring, having an inner surface for attachment to the edge of an outer surface for engagement with the chamber, and wherein,
 the outer surface is at least partially comprised of the lips,
 the inner surface has an annular rib portion, and the edge has an annular groove for mating with the rib portion, whereby the annular ring may be securely attached to the edge and from a part of the piston.
 6. A pump including,
 an enclosed piston chamber having an inlet port and an outlet port,
 conveying means for introducing fluid that is to be pumped into the piston chamber through the inlet port, and for removing the fluid from the chamber through the outlet port,
 piston means, a portion thereof being reciprocally mounted in said chamber,
 valve means located in the inlet and outlet ports and being comprised of,
 a collar having a flange extending radially around the inner surface of the collar and forming a restricted opening in said collar for the passage of the fluid,
 a free-hanging disc having a diameter larger than said restricted opening and being rotatably mounted in said collar adjacent the flange for movement into seating engagement with said flange, whereby the restricted opening is closed when the disc is against the flange but open when the disc is away from the flange,
 support surfaces on one of said collar or disc, and shoulders on the other of said collar or disc in supporting contact with said support surfaces, thereby forming means by which the disc is suspended and rotatably mounted in said collar.

7. The invention of claim 6 wherein the collar is further defined as being cylindrical in shape and having a sidewall, and including,
 a slot extending radially into the sidewall, adjacent the flange, and
 said support surfaces are further defined as the portions of the sidewall forming the bottom of the slot.
 8. The invention of claim 7 wherein the portion of the piston means reciprocally mounted within the chamber is further defined as including,
 a flexible body portion,
 a peripheral edge on said body portion which is generally at right angles to the body portion,
 a pair of flexible peripheral lips extending outwardly from the edge, at least a portion of both lips contacting the chamber at all times, whereby each of said lips forms a sliding seal between the piston and the chamber,
 said body portion having a bowed configuration when the piston moves, whereby it has a generally convex shape in the direction of its movement,
 said edge portion being turned slightly away from the direction of movement when said body portion is bowed due to its generally right angle relationship with the body portion, and
 the lip forwardmost to the direction of movement is in greater contact with the compartment when the body portion of the piston is bowed by its motion.
 9. In a reciprocating pump having a piston, cylinder and inlet and outlet valves the improvement in the piston including,
 a central hub,
 a radial flexible disc extending from said hub,
 a peripheral edge surrounding said disc, and
 axial lips extending from said edge sealingly engaging the cylinder,
 said flexible disc bowing as said piston reciprocates, the lip forwardmost in the direction of reciprocation more tightly engaging said cylinder as said disc bows.
 10. In a reciprocating pump having a piston, a cylinder and inlet and outlet valves, the improvement in the valve including;
 a collar, including,
 a radially extending internal flange defining a restricted passage through said collar,
 a slot in the collar adjacent the flange, said slot forming,
 two support surfaces in the collar, and
 a disc,
 two shoulders extending outwardly from the disc and resting on said support surfaces, whereby the disc is suspended within the collar adjacent the flange,
 said disc being rotatable about an axis defined by the shoulders and support surfaces and having a closed position in which the disc seats against said flange and closes said passage and an open position in which the disc is rotated away from the flange.

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