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RECIPROCATING PUMP FOR MARINE TOILETS

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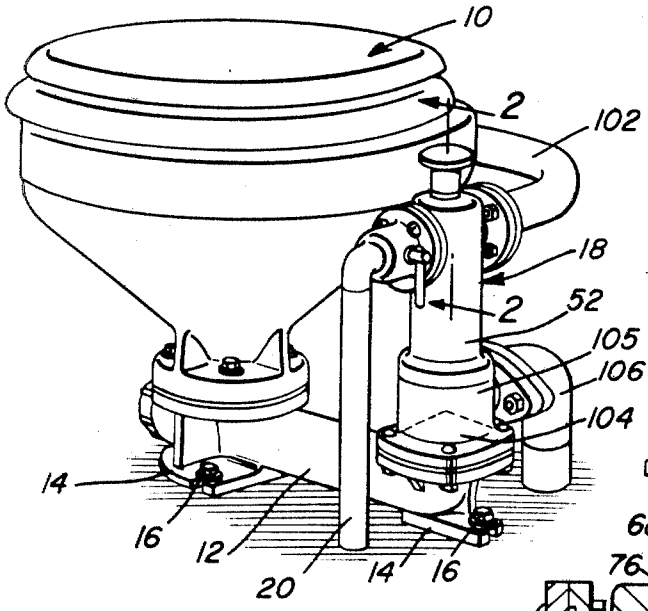


Fig. 1

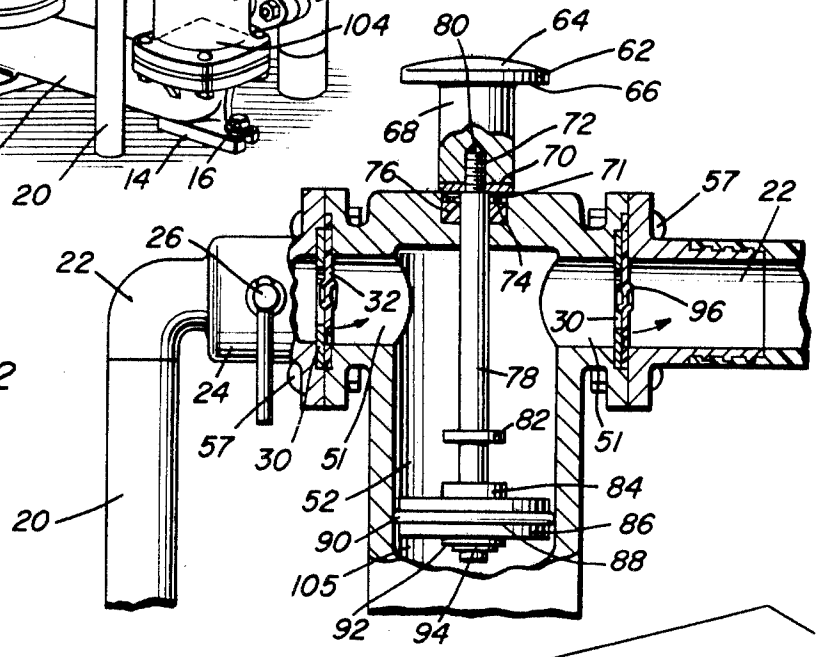
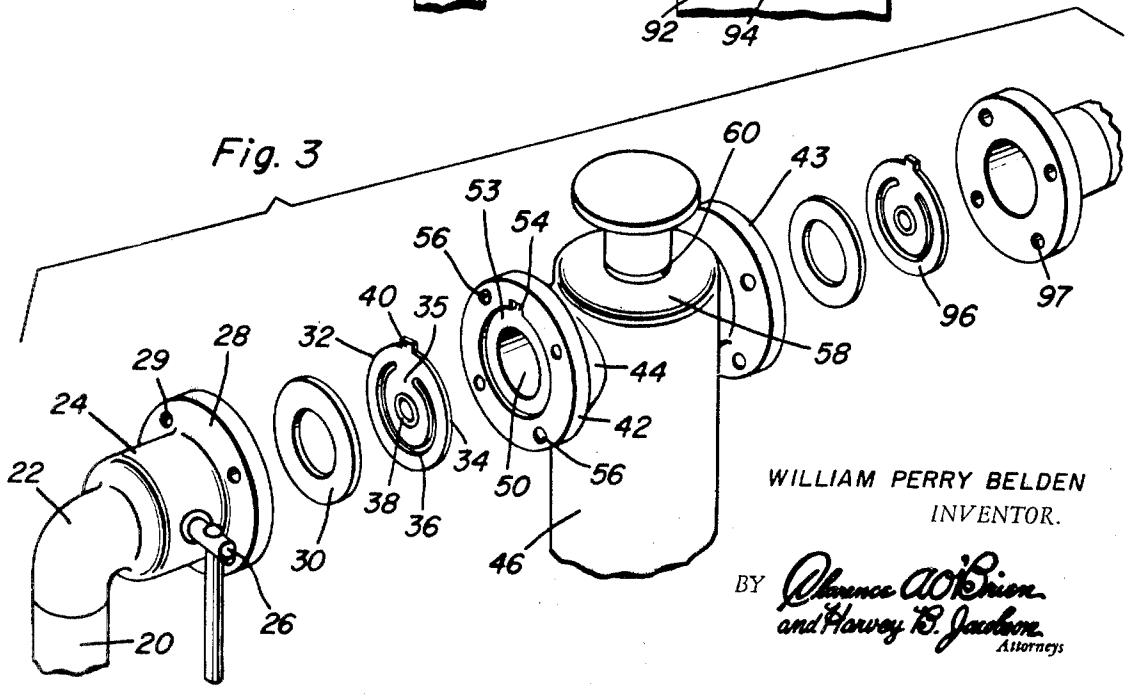


Fig. 2

Fig. 3



WILLIAM PERRY BELDEN
INVENTOR.

BY Lawrence O'Brien and Harvey B. Jackson
Attorneys

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RECIPROCATING PUMP FOR MARINE TOILETS

Perry Belden, Millville, N.J.; Katherine Arnel Belden, executrix of said William Perry Belden, also known as Perry Belden, deceased

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ABSTRACT OF THE DISCLOSURE

A commode water inlet supply is delivered through a reciprocating pump section, the intake and exhaust ports of the pump include a circular diaphragm valve. A ring shaped slit is formed within the body of the diaphragm valve concentric with the center thereof. A first washer is positioned against the outward surface of the intake diaphragm valve and a second washer is positioned against the inward surface of the exhaust diaphragm valve thereby rendering alternate valves operative during the intake and exhaust cycles.

The present invention relates to the field of reciprocating pumps and more particularly to a check valve assembly for insuring efficient operation during pump intake and exhaust cycles.

Prior art devices have utilized various check valve assemblies as well as leather washers, packing nuts or glands which tend to dry up due to environmental conditions thereby requiring frequent replacement or adjustment. Prior check valve assemblies under some conditions decrease the efficiency of the pumping operation. Accordingly, a flow rate through the pump is established which is below an optimum level. Mechanically speaking, the inefficient operation of these devices is caused by the deteriorating efficiency of the check valve structures thus permitting undesirable backflow through the pump. Moreover, prior check valve assemblies have been constructed in such a manner as to partially occlude the intake and exhaust ports which decreases the efficiency of the pump during its operation. Further, prior pump structures have been fabricated to include housings, and fittings of a material which require maintenance thereof such as frequent paintings.

In summary, the present invention includes a pump with an upper cylinder chamber containing intake and exhaust ports. Diaphragm valve members are inserted in these ports, each member including a circular slit therein. A blocking washer is positioned adjacent one surface of each diaphragm valve member so that only one valve operates at a time. The diaphragm valve members are fabricated from an inert resilient material which eliminates the deterioration thereof. Thus, these members retain a flexible state thereby preventing backflow through the check valve members. The central portion of the pump includes a cylinder which receives a piston, the latter including a piston rod having a bearing and packing assembly fabricated from a low friction plastic. The present pump assembly includes a housing, base and fittings made of plastic fabricated by precision injection molding. This plastic material eliminates frequent maintenance such as repainting of exterior surfaces. Accordingly, among the salient objects of the present invention are to provide:

A reciprocating pump for marine toilets which flushes faster and more easily and handles a relatively large quantity of water per stroke;

A reciprocating pump structure requiring a minimum of maintenance and which never needs painting, priming or lubrication;

A check valve assembly which prevents backflow therethrough and

A reciprocating pump including a piston rod bearing fabricated from a low friction plastic.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIG. 1 is a perspective view illustrating the present reciprocating pump in conjunction with a marine toilet.

FIG. 2 is a fragmentary sectional view along a plane passing through section 2—2 of FIG. 1.

FIG. 3 is an exploded group perspective view illustrating the essential components of the pump water delivery assembly.

In a preferred embodiment of the present invention and with reference to the drawings, reference numeral **10** generally denotes a commode which is supplied with a flow of water via the reciprocating pump of the present invention. The base of the commode **10** communicates with a drain pipe **12** which includes an appending attachment flange **14** usually fastened to the deck of a boat or other suitable surface by means of appropriate fasteners **16**. The reciprocating pump is generally denoted by the reference numeral **18** and is supplied with water by a supply pipe **20**, the latter including a right angle elbow joint **22** communicating at the outward end thereof with an enlarged hollow cylindrical section enclosing a shut off valve assembly of a conventional type controlled by an externally disposed valve handle **26**.

A centrally apertured disk-like flange **28** appends from the outward edge portion of the cylindrical section **24**, the flange including smaller apertures **29** disposed peripherally therearound. The interior of the flange **28** includes a circular recess for accommodating a washer **30**. A circular diaphragm valve member **32** is positioned in an overlying relation with the inward surface of the washer **30**. This valve member includes a disk-like body **34** including a circular slit **36** disposed concentric with the center of the body **34** and extending along the major portion of the periphery thereof thus leaving a connecting portion **35** defining a hinge to enable the central portion of body **34** to swing. The central portion of the valve **32** includes an integrally formed raised ring surface **38** concentric with the center of the valve and disposed inwardly of the circular slit **36**. The raised ring **38** rigidifies the valve member so as to improve the valve's mechanical response to pressure forces exerted thereon. A small rectangular locating tab **40** appends from the circumferential edge of the valve in adjacent relation to connecting portion **35** and provides a means for keying the position of the valve within the pump assembly as explained hereinafter so that the central portion of the body **34** depends from the connecting portion **35** so that gravity will assist the memory characteristics of the plastic material of the body **34** to retain the central portion thereof normally adjacent the washer or valve seat **30**. A centrally apertured disk-like flange **42** depends from the body of the pump by means of a hollow cylindrical web member **44**, one end of which is integrally connected to the body **46** of the reciprocating pump **18**, the other end of the web integrally connected with the inward circular surface of the disk flange **42**. A bore **50** is formed concentrically with the central portion of the flange-web structure and forms a left intake port **51** into the cylinder **52** of the pump as viewed in FIG. 2. A concentric circular recess **53** is disposed outwardly of the central bore **50** and includes a rectangularly appending recess **54** for accommodating the rectangular tab **40** on the diaphragm valve **32**. The lateral-

ly outward surface of the flange **42** includes apertures **56** bored therethrough, the latter mating with the apertures **29** formed within the inlet pipe flange **28**. In the assembled position, the washer **30** and the diaphragm check valve **32** are sandwiched between the confronting recessed surfaces of the flanges **28** and **42** as shown in FIG. 2 of the drawings. Suitable fasteners **57** are passed through the communicating apertures in these flanges for holding them in abutting engagement. As will be appreciated by viewing FIGS. 2 and 3 of the drawings, a similarly constructed disk flange structure **43** appends from the body **46** of the pump on a diametrically opposite side and in axial alignment with the disk flange **42**. This latter flange structure **43** includes washer and diaphragm check valve members identical with those previously mentioned. These components cooperate with a right outlet port **51**, both ports being in concentric alignment.

Referring to FIG. 3 of the drawings, it is seen that the pump body **46** includes a bored top surface **58**, the bore extending longitudinally of the pump body **46** and receiving a plunger handle **60** therein. This handle includes a knob-like member **62** characterized by a convex top surface **64** and a circular planar base **66** which appends to a cylindrical shaft **68**. A washer **70** is positioned in concentric underlying relation with the bottom end portion of the handle shaft **68**. A threaded bore **72** is formed within the interior portion of the shaft **68** extending upwardly from the bottom end portion for receiving a piston rod. A cylindrical recess **71** is formed within the top **58** of the pump body, the central portion of said recess communicates with a cylindrical bore orienteted longitudinally through the top **58** of the pump. The base of the recess **71** includes a resilient cylindrical grommet **76**, the axis of the grommet being collinear with the axis of the pump body. A circular lock washer **74** is disposed in overlying relation with the grommet, the combination of washers **70**, **74** and the grommet **76** providing a means for absorbing shock upon reciprocating contact of the plunger handle **60** with the top **58** of the pump body as well as providing a pump seal. A rod **78** being threaded at the upward end thereof is concentrically disposed within the cylinder **52** of the pump. The threaded portion **80** is engaged with the threaded aperture **72** in the plunger handle **60**. A washer **82** is concentrically mounted upon an intermediate length of the rod **78** and provides a mechanical stop for the upward displacement of the rod. The rod **78** serves as a piston rod for the reciprocating pump. The lower end portion of the rod **78** includes a washer **84** concentrically mounted thereon and disposed in overlying relation with a cylindrical disk **86** likewise concentrically disposed within the cylinder **52** and characterized by a diameter slightly less than the diameter of the cylinder. This disk serves as a piston for the pump. A concave recess **88** is formed within the peripheral edge of the piston. An O-ring **90** fabricated from a low friction plastic being inserted within the recess to form a tight seal between the walls of the cylinder **52** and the piston **86**. A washer **92** is disposed in underlying relation with the piston **88** and maintained in an abutting relation thereto by means of a circular spring clip **94** mounted outwardly of the latter mentioned washer.

To explain the operation of the instant invention reference is made to FIG. 2 of the drawing. In the figure, the piston is shown in the intake position. As the knob **62** is lifted, the piston compresses the fluid located in the upper portion of the chamber **52** thereby exerting a pressure upon the left intake check valve **32**. However, as clearly seen from FIG. 3 of the drawing, the valve will be unable to open due to the restraining surface of washer **30** which forms a valve seat. However, the right exhaust check valve **96** is free to move outwardly because of the absence of a restraining surface on one outwardly confronting flange surface **97** which includes a central bore of sufficiently large diameter permitting passage of the central portion of the exhaust check valve **96** into the bore thereby permitting the exit of fluid therethrough and into the commode supply pipe section **102** shown in FIGURE 1.

The base portion of the pump body **46** includes a flapper valve of conventional design disposed below the piston **86** and further disposed between the commode drain pipe **12** and the pump outflow pipe **106**, indicated in FIG. 1 of the drawing. The flapper valve **104** indicated diagrammatically in phantom lines in FIG. 1, cooperates with the check valves so that during a piston exhaust cycle, the flapper valve opens allowing drainage of the commode into the lower cylinder chamber **105** at the same time that water flow is directed into the commode via pipe section **102**. Likewise, during an intake cycle, the fluid drained from the commode into the lower cylinder chamber **105** is exhausted through the pipe section **106** at the same time water flow is directed into the upper cylinder chamber **52** from the water supply pipe **20**. In other words, the pump cylinder may be thought of as two cooperating chambers, the upper chamber **52** including intake and exhaust ports for supplying the commode with a water supply while the lower chamber **105** includes intake and exhaust ports accomplishing the drainage of the commode. It is appreciated that the operation of the single piston **86** achieves cooperating operations in the upper and lower chambers of the cylinder.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A reciprocating pump including an internally bored cylinder, a piston inserted within said cylinder, means for reciprocating said piston, means for selectively supplying an upper cylinder chamber with fluid, means intermediate said supplying means and said cylinder chamber for controlling the supply of flow therein, means for selectively exhausting said fluid from said upper cylinder chamber, and means intermediate said cylinder and said exhausting means for controlling the flow of fluid thereout, each of said means for controlling the flow of fluid to and from said cylinder including a circular diaphragm valve body, characterized by an arcuate slit formed through said valve body and concentric with the circumference thereof, the periphery of said slit extending substantially around an entire circumference of said body thereby forming two confronting slit ends, a portion of the diaphragm body disposed between said ends serving as a hinge for a central portion of the valve enclosed inwardly of said slit, said central portion serving as a valve flap, a small tab appending from the peripheral edge of the valve body, said central portion of said valve body including a ring-like rib concentric with the center of said valve body and appending from both circular surfaces thereof, said means for controlling the supply flow further including a washer member disposed in an outwardly overlying relation with said valve body, said washer characterized by a central aperture therethrough, the diameter of said aperture being smaller than the diameter of said flap and wherein said means for supplying said cylinder with fluid includes a separable fitting characterized by a recessed interior surface for retaining said means for controlling the supply flow perpendicularly of said flow, said recess further including a portion for receiving said valve body tab, said recess communicating with an inward bore of larger diameter than the diameter of said flap.

2. The apparatus as set forth in claim **1** wherein said means for regulating the exhausting flow includes a washer member disposed in an inwardly overlying relation with said valve body, said washer characterized by a central aperture therethrough, the diameter of said aperture being

smaller than the diameter of said flap and wherein said means for exhausting said fluid from said cylinder further includes a separable fitting characterized by a recessed interior surface for retaining said means for regulating the exhaust flow perpendicularly of said flow, said recess further including a portion adapted to receive said valve body tab, said recess communicating with an outward bore of larger diameter than the diameter of said flap.

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HENRY F. RADUAZO, Primary Examiner

U.S. Cl. X.R.

137—525.7; 4—10; 417—566