Oct. 31, 1961 E. L. SISSON 3,006,282

ALL-PLASTIC HAND PUMP

Filed Oct. 21, 1957 2 Sheets-Sheet 1

Fig. 1

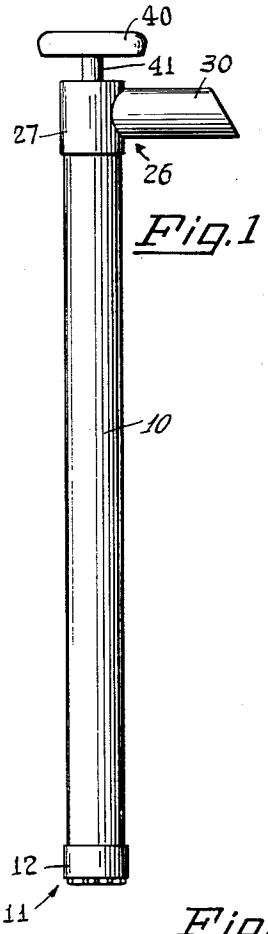


Fig. 2

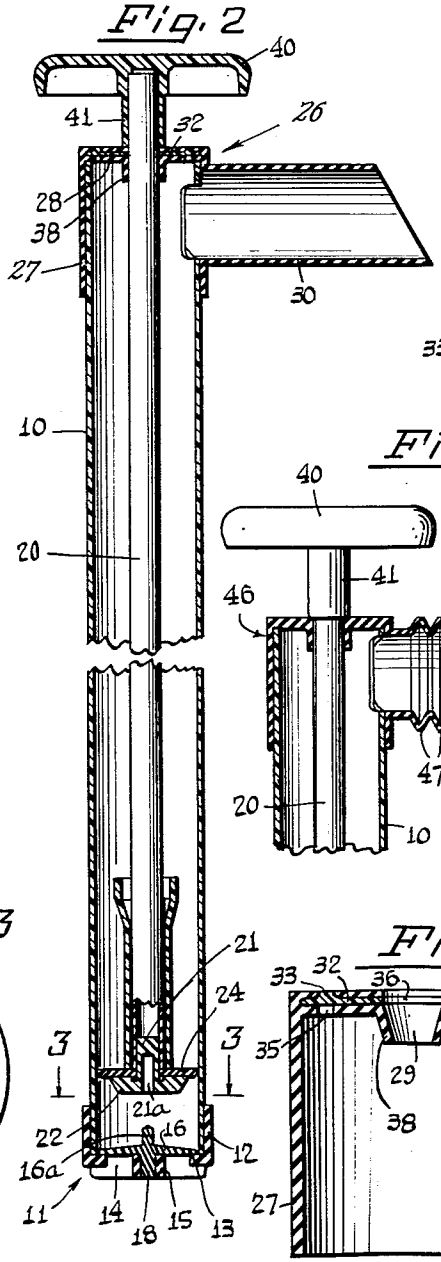


Fig. 6

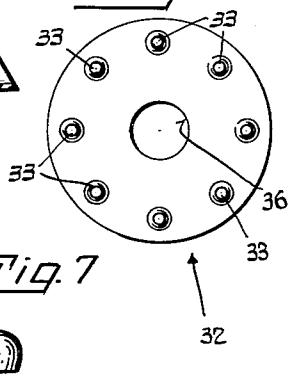


Fig. 7

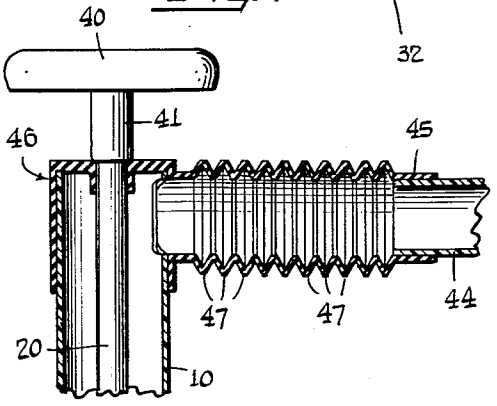


Fig. 3

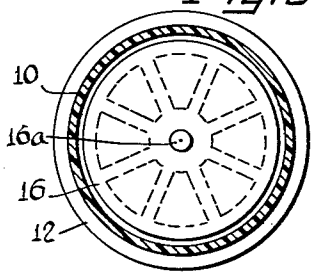


Fig. 4

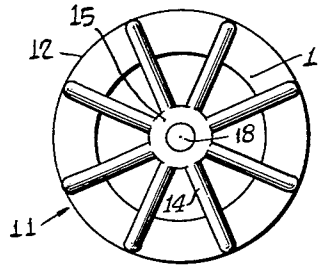
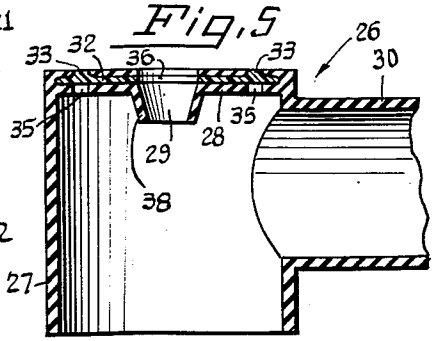


Fig. 5



INVENTOR.
Earl L. Sisson
BY
H. Gibner Lehmann
AGENT

Oct. 31, 1961 E. L. SISSON 3,006,282

ALL-PLASTIC HAND PUMP

Filed Oct. 21, 1957 2 Sheets-Sheet 2

Fig. 8

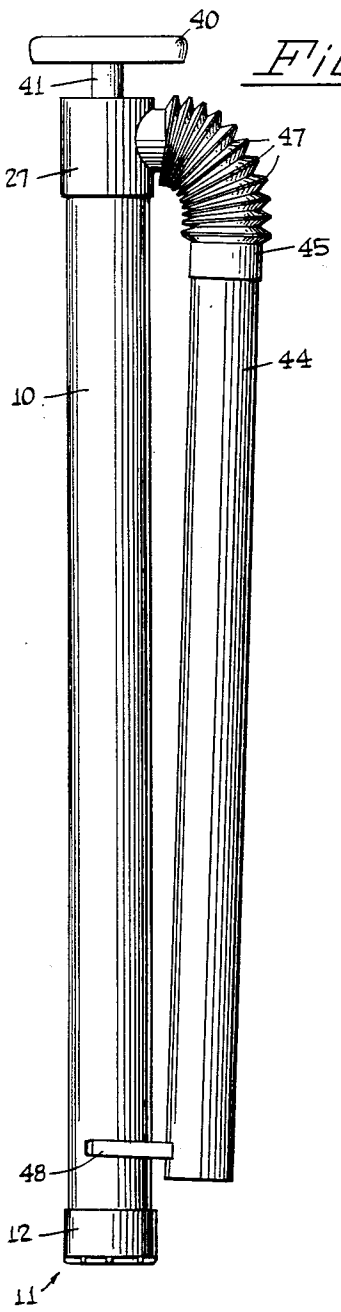
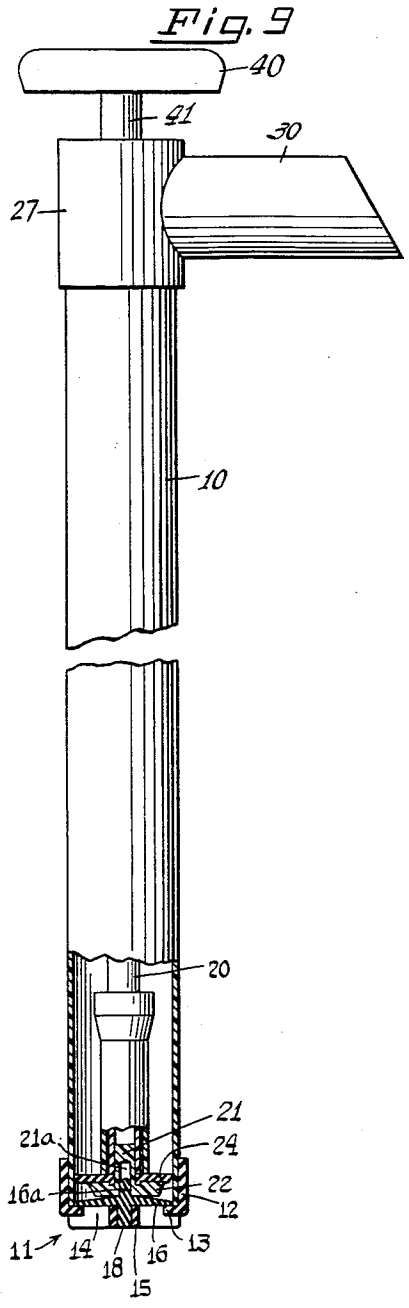


Fig. 9



INVENTOR.
Earl L. Sisson
BY
H. Gebruer Schumann
AGENT

United States Patent Office 3,006,282 Patented Oct. 31, 1961

3,006,282

ALL-PLASTIC HAND PUMP

Earl L. Sisson, Stratford, Conn., assignor to Beckson Manufacturing Co., Easton, Conn., a partnership

Filed Oct. 21, 1957, Ser. No. 691,193
9 Claims. (Cl. 103—153)

This invention relates to small hand pumps of the type used for pumping liquids and the like, and more particularly to small bilge or sump pumps such as are commonly employed on boats or in other places where it is desired to remove or pump off water which has collected.

The present invention relates to improvements in the hand pumps illustrated and described in my copending applications identified as follows: (1) Hand Pump for Liquids, Serial No. 505,748, filed May 3, 1955, now Patent No. 2,915,986; (2) Hand Pump and Foldable Spout, Serial No. 606,107, filed August 24, 1956, and now abandoned; and (3) Unitary Hand Pump and Discharge Line, Serial No. 597,395, filed July 12, 1956, now Patent No. 2,915,-984.

In my prior copending applications above referred to and identified, I provide novel and unique pump structures by which a great simplification of components and assemblies is effected, and provide an improved, elongate discharge line combined with the pump structure in a useful and advantageous manner. In these prior pump and discharge line construction certain metal parts were utilized, as for example the plunger rod which actuated the plunger in the cylinder, the cylinder itself, and various joining components and structural parts associated not only with the pump but also with the elongate discharge line. While this has been satisfactory in general, the presence of the metal necessarily imposed certain restrictions as regards manufacture, cost, and performance.

One object of the present invention is to provide a novel and improved small hand pump suitable for pumping liquids for the purposes above mentioned, wherein all of the major and functional pump parts and components are formed of rigid and/or flexible plastic of a type adapted to withstand the corrosive action of salt water or other active fluids or liquids.

A further object of the invention is to provide an improved all-plastic hand pump and discharge spout which is particularly resistant to wear and deterioration, whereby the entire structure will have a long and useful life unless abused or handled improperly.

A still further object of the invention is to provide an improved all-plastic hand pump and discharge spout in accordance with the above, wherein the spout may be elongate and have an appreciable length, yet is readily foldable against the pump body when not in use, thereby to enable the entire asesmblage to occupy but relatively little space.

Yet another object of the invention is to provide a novel and improved all-plastic hand pump as above set forth, wherein appreciable mechanical strength is incorporated in the working parts, together with a desirable lightness and saving of materials, thereby to prevent the likelihood of breakage during use while still retaining the desirable latter properties.

A feature of the invention resides in the provision of an improved all-plastic hand pump and discharge spout as above characterized wherein there is provided a novel combination of plastic cylinder and plastic discharge fitting combined with a bearing means for the plunger rod of the pump, to the end that a sturdy and wear-resistant bearing is had for such plunger rod, and also a bearing which is especially resistant to leakage of fluid or liquid therethrough.

Another feature of the invention resides in the provision of an improved all-plastic hand pump having a discharge fitting and bearing means as above set forth, wherein a novel and simplified yet strong and effective stop is provided for halting the plunger and plunger rod at the proper point during its working stroke.

Still another feature of the invention resides in the provision of a novel and simplified plunger assembly constituted entirely of plastic parts, which assembly is extremely effective in its operation yet constituted of few components of simple manufacture.

Yet another feature of the invention resides in the provision in an improved all-plastic hand pump of a novel inlet fitting and valve carried thereby, constituted entirely of few and simple plastic components which may be easily and quickly assembled and are effective in their operation.

A still further object of the invention is to provide an improved all-plastic hand pump in accordance with all of the foregoing, wherein relatively few components of simple structure are provided, such components being susceptible of quick and easy asesmbly, thereby to effect a desirable economy of manufacture.

Other features and advantages will hereinafter appear.

In the drawings accompanying this specification, similar characters of reference indicate corresponding parts wherever possible in the several views, in which:

FIGURE 1 is a side elevational view on a reduced scale, of an improved all-plastic hand pump made in accordance with the present invention.

FIG. 2 is an axial sectional view on a larger scale, of the hand pump shown in FIG. 1.

FIG. 3 is a transverse section taken on the line 3—3 of FIG. 2.

FIG. 4 is a bottom end view of the cylinder portion of the pump.

FIG. 5 is a fragmentary sectional view, further enlarged, of the discharge fitting of the pump.

FIG. 6 is a top plan view of a plastic insert member as employed in the fitting shown in FIG. 5.

FIG. 7 is a fragmentary view partly in section and partly in side elevation, showing another embodiment of the invention wherein an elongate, bendable discharge spout or line is provided.

FIG. 8 is a side elevational view of the complete pump and discharge line of FIG. 7.

FIG. 9 is a view partly in elevation and partly in axial section, of a slightly modified form wherein the shaft of FIG. 2 is made longer, and the plunger is engaged with the bottom inlet fitting. Otherwise the pump structure is the same.

It is at present preferred to form all of the parts and components of the pump structures illustrated herein of a corrosion-resistant plastic substance such as polyvinyl chloride. Some of said parts or components have a composition such that they remain flexible or rubber-like, whereas other components exhibit rigid structural characteristics. While in the present specification and claims the term "plastic" is used in connection with the polyvinyl chloride, it should be understood that this is in no way limiting, as such term is intended to cover all non-metallic materials of a plastic or rubber-like nature which may be suitable for the purposes intended.

Referring now to FIGS. 1 and 2, the all-plastic hand pump shown therein comprises an elongate, tubular plastic cylinder 10 which is constituted of a relatively rigid plastic substance such as the polyvinyl chloride mentioned. The cylinder 10 may be formed in any suitable manner, preferably by an extrusion process, and is of a composition which enables it to have appreciable rigidity although a slight degree of flexibility is apparent due to its appreciable length as compared with its diameter.

As seen in FIG. 2, the cylinder 10 is virtually com-

pletely cylindrical, with cylindrical inner and outer surfaces devoid of any projections whatsoever. Thus, the cylinder may be readily fabricated by the above-mentioned extrusion process.

At its lower end, the cylinder **10** is provided with an inlet fittting and valve assembly **11** which may be adhered to the cylinder by a suitable cement, if so desired. However, the fitting and valve assembly **11** is adapted to frictionally grip the lower extremity of the cylinder **10** and be retained thereon, and under certain circumstances the use of an adhesive or cement could be optional.

As shown, the assembly **11** comprises a plastic fitting member having a tubular body portion **12**, an inwardly extending annular flange or shoulder portion **13** carried at the lower end of the body portion **12**, and a perforated transverse wall **14** which, in the illustrated embodiment, is constituted in the form of a spider having a plurality of radial spokes as shown in FIGS. 3 and 4. The spokes of the spider **14** at their inner ends terminate in a central apertured hub **15**, and at their outer ends join to the annular flange or shoulder **13** which constitutes a valve seat in the assemblage **11**.

Cooperable with the spider **14** and valve seat **13** is a flexible plastic valve disc **16**, said disc being disposed within the tubular body portion **12** and having one face engaging the annular shoulder or valve seat **13** and also the spider **14**. The valve disc **16** has a centrally located downward projection **18** disposed within and gripped by the apertured hub **15** of the fitting, and by this connection the valve disc **15** is mounted and held in its operative position within the assemblage **11**.

Both the end fitting and the valve disc of the assemblage **11** are constituted of relatively flexible plastic, such as the polyvinyl chloride mentioned above. I have found this to be advantageous in that the valve disc **16** may readily yield along its peripheral portions in an upward direction, to permit the ingress of fluid or liquid into the lower portion of the cylinder **10**. Also, the tubular body portion **12** of the fitting may be stretched slightly and forced over the lower extremity of the cylinder **10**, thereby to firmly frictionally grip the latter for purposes of retention of the fitting and valve assembly **11** on the cylinder. At the same time, the spider **14**, especially the spokes thereof as seen in FIG. 2, may have an appreciable depth or thickness, thereby to provide a certain degree of stiffness to the spider in spite of the resilience of the plastic polyvinyl chloride. I have found that by such construction there is provided an extremely desirable and advantageous inlet fitting and valve assembly in that a secure retention thereof may be had on the lower end of the cylinder **10**, either with the use of a suitable adhesive or cement or else without such adhesive, and also that there is not the necessity for maintaining close fits or tolerances between the cylinder **10** and the fitting of the assembly **11**. Moreover, by making the fitting of the assembly **11** of flexible or yieldable plastic there is not the tendency for such part to scratch or mar any surfaces with which it comes in contact. Additionally, by making the fitting of a flexible or yieldable plastic there is no likelihood of the fitting cracking if it should be struck a sudden blow, or suffer other hard usage. Also, the assembly of the valve disc **16** to the fitting is facilitated, by virtue of the yieldable or flexible nature of the components since the projection **18** of the valve disc may be readily inserted in the hub of the spider and retained thereby. If desired, a suitable adhesive or cement may be applied at this point, to render the connection permanent.

The valve disc **16** may be advantageously formed with an upstanding nib **16***a*, FIG. 2, and such nib is then loosely receivable in the bore **21***a* of the hollow boss **21** of the plunger where the plunger rod **22** is made sufficiently long to cause said plunger to bottom against the valve disc. As shown in FIG. 2, the plunger body **22** does not engage the valve disc **16** at the lower end of its stroke, since it is held spaced therefrom by a stop collar arranged on the operating handle, as will be later more fully set forth. However, such showing of FIG. 2 is made for purposes of convenience of illustration, and the invention also embraces a construction where the plunger is brought fully to the bottom of the cylinder, thereby to take full advantage of the maximum working stroke permitted by such cylinder.

Within the cylinder **10** I provide a novel and improved, unique all-plastic plunger and plunger rod assembly which has been found to be extremely effective in its action, to be corrosion and wear resistant, and reliable in operation throughout an extended period of use. The plunger and plunger rod assembly comprises an elongate, hollow tubular rod **20** which is preferably also constituted of rigid polyvinyl chloride plastic substance. The plunger rod **20** may be conveniently produced by the well-known extrusion process, and may have a diameter, as compared with its bore, to provide an appreciable degree of rigidity and strength, and resistance to bending or deformation.

At its lower end, the plunger rod **20** receives an upwardly projecting hollow boss **21** of a resilient plastic plunger member or body **22**, said body being constituted in the shape of a frustrum of a cone. The plunger body **22** may have appreciable thickness, as shown in FIG. 2, and the sloping peripheral walls thereof are shown as extending upward and outward from a smaller flat bottom face to a larger flat upper face. The sharp peripheral edge portions of the conical walls of the plunger body **22** are spaced an appreciable distance from the inner wall surfaces of the cylinder **10**. Resting on its upper or larger flat surface, the plunger body **22** carries a flexible plunger element or washer **24** which is also preferably formed of a flexible or resilient polyvinyl chloride plastic. The plunger element **24** has a central opening, through which the upstanding boss **21** of the plunger body extends. The plunger element **24** also engages the bottom edge of the plunger rod **20**, and has a tapered or conical peripheral edge extending upward and outward, as viewed in FIG. 2. Thus, the sharp periphery of the plunger element **24** is disposed in the same plane as the upper surface of such element, and engages the inner walls of the cylinder **10** under a certain amount of pressure, whereby a slight deformation or compression of said sharp periphery occurs. Whereas the plunger element **24** is quite flexible and rubber like in its quality, the plunger body **22** and boss **21** are somewhat more rigid although not sufficiently so that they do not yield. Thus the plunger body **22** constitutes essentially an unyielding backing for the element **24**.

It will now be understood that as the plunger rod **20** and plunger are made to descend in the cylinder **10**, the plunger element **24** will yield along its peripheral portions, thereby to enable the fluid or liquid to pass by the plunger from the lower side thereof to the upper side. However, upon the plunger rod **20** and plunger being raised, the substantially unyielding backing provided by the plunger body **22** will not permit any appreciable downward flexing of the plunger element **24**, and in consequence a check valve action is obtained whereby fluid or liquid is not permitted to pass downwardly past the edges of the plunger from the upper chamber of the cylinder to the lower chamber. In consequence of this, a reciprocatory movement of the plunger rod **20** and plunger carried thereby will result in fluid being pumped into the upper portion of the cylinder **10**. It will be further understood that such fluid may readily enter through the spider **14** of the lower fitting assembly **12**, but that such fluid may not be discharged out of the cylinder **10** through the said fitting assembly due to the valve disc **16**.

I have found that a plunger rod and plunger assembly constituted completely of both flexible and rigid plastic such as polyvinyl chloride in accordance with the above structure, is eminently satisfactory for use in a hand pump for the purposes intended.

There is satisfactory resistance to corrosion from the action of sea water or other active fluids or liquids, and adequate mechanical strength, while at the same time the plunger assembly exhibits a marked efficiency in pumping a large volume of liquid or fluid. Moreover, the plunger rod and plunger assembly are constituted of relatively few parts, and such parts may be economically fabricated of plastic substance and easily and quickly assembled at low cost.

It has been found after exhaustive tests that a plunger assembly as above constituted, in conjunction with the plastic cylinder **10**, is extremely wear resistant, and will operate through a very large number of cycles under normal conditions of use. Moreover, use of the hollow plastic plunger rod **20** in a pump wherein the working stroke constitutes a pull on the plunger rod, and wherein a pushing force does not encounter appreciable resistance and is required only to return the rod is wholly satisfactory and there is no likelihood of breaking of the plunger rod, bending or other failure of the same.

The present invention further provides a novel and improved discharge fitting and bearing assembly at the upper extremity of the cylinder **10**. Referring again to FIG. 2, the discharge fitting and bearing assembly shown therein and indicated generally by the numeral **26** comprises a tubular body portion **27** adapted to snugly fit around and grip this upper end portion of the cylinder **10**. The fitting **26** further has a transverse end wall **28** provided with an opening **29** through which the plunger rod **20** extends, FIG. 5. Extending laterally or radially from a side wall of the tubular body portion **27** is a tubular spout portion **30** which as shown is formed integral with the body portion **27** and end wall **28**. Preferably, the combination discharge and bearing fitting **26** is molded of flexible polyvinyl chloride plastic or the equivalent, such that the portion **27** may be stretched and caused to snugly fit over the upper end portion of the rigid cylinder **10**.

In accordance with the invention, I provide a novel reinforcing means in the transverse wall **28** of the fitting **26**, in the form of a rigid plastic disc or washer **32**, FIGS. 5 and 6, which is used as an insert for said end wall during the molding of the fitting. The reinforcing washer **32** preferably is provided with a plurality of small nibs or projections **33** by which it may be held in spaced relation to the walls of the mold, in which the fitting **26** is formed. Also, the usual positioning pins (not shown) may be provided in an opposite wall of the mold, to engage and position the reinforcing disc **32**, and such pins when withdrawn or when the molded fitting **26** is stripped from the mold, will leave the characteristic recesses **35** as shown in FIG. 5.

I have found that by making the reinforcing disc **32** of polyvinyl chloride having a composition providing a rigid end product, in conjunction with the flexible polyvinyl chloride of the fitting **26** an adhesion is obtained between the insert (especially if the latter is not completely cured) and the transverse wall **28** whereby the said components become virtually integral with each other even though the insert retains its rigid characteristic. Thus, I am enabled to reinforce and make rigid the transverse wall **28** in an economical and inexpensive manner during the fabrication of the fitting **26**, without introducing any metallic or other components which would have a lesser adhesion and which might have an adverse action with respect to corrosive liquids or fluids. As seen in FIG. 5, the central recess **36** of the reinforcing insert **32** becomes aligned with the central opening **29** in the transverse wall **28**, thus to constitute a passage for the plunger **20**. In consequence of such construction the fitting **26**, while being formed of a flexible plastic, has a rigid transverse wall **28** which is advantageous in supporting the plunger rod **20** and providing an adequate bearing therefor.

Moreover, in accordance with the invention I further provide an elongate combination bearing sleeve and sealing element, on the transverse wall **28**, in the form of an integral bushing or collar **38** formed on said wall at the time of the molding of the fitting **26**. The collar **38** is preferably formed to have a tapered conical shape as shown in exaggerated form in FIG. 5, with its smaller diameter at the free or lower end of the collar. It is preferred that the said lower or smaller end of the collar has normally a diameter only very slightly less than the outside diameter of the plunger rod **20**, and that the upper end of the collar **38** have a diameter larger than the outside diameter of the plunger rod **20**. Since the collar **38** is also of flexible plastic substance it may stretch very slightly to accommodate the plunger rod **20**, and will in consequence be tightly fitted to the said rod. I have found, however, that such a fit will not impede the reciprocatory movements of the rod **20**, nor deform the collar **38** and cause any failure of the structure thereof. Instead, there is advantageously provided a large bearing surface which reduces to a minimum the wear between the plunger rod **20** and the transverse bearing wall **28** of the fitting **26**, and further provide a tight seal which virtually eliminates any leakage of liquid through the wall **28** past the plunger rod. Such seal remains effective even for elevated pumping pressures, inasmuch as such pressures, existing in the upper portion of the cylinder **10**, will tend to cause the collar **38** to more tightly cling about the plunger rod **20** as the latter is being raised. I have found, in accordance with the above, that it is much easier for such liquid to be discharged through the discharge portion **30** of the fitting **26**, rather than escape through the wall **28** past the plunger rod **20**, and this constitutes an important and advantageous feature of the present invention.

The upper extremity of the plunger rod **20** may be provided with a molded plastic handle **40** of rigid polyvinyl plastic, said handle preferably having a depending elongate hollow spacer and attaching boss **41** which receives and is secured to the upper extremity of said rod. Preferably, the boss **41** and the rod **20** are adhered together by a suitable plastic adhesive or cement.

In FIGS. 1 and 2 I have shown a discharge portion **30** of the discharge fitting **26** which is straight and normally not readily bendable. In another embodiment of the invention, illustrated in FIGS. 7 and 8, I provide an elongate discharge line **44** which is preferably also formed of rigid polyvinyl chloride plastic as by an extrusion process, said line being secured to an extension portion **45** of a plastic discharge fitting **46**. The extension **45** is generally tubular, and is provided with a plurality of accordion folds or pleats **47** which are circular or annular, extending completely around the extension and giving it great flexibility. The discharge line **44** may be adhered to the extension **45** in any suitable manner, as by a friction fit or by the use of suitable adhesive or cement.

As shown, the tubular, pleated extension **45** is molded as an integral part of the discharge fitting **46**, and the entire fitting including the extension is formed of flexible plastic whereby the extension may readily bend in all directions, to enable the discharge line **44** to be directed where desired.

When the pump is not in use and is to be stored away, the discharge line **44** may be readily folded, and by the use of a spring clip **48** on its free extremity the latter may be clipped to the lower portion of the cylinder **10**, for retention of the line thereto.

It will now be understood from the foregoing that I have provided a novel and improved all-plastic hand pump and discharge spout or line which is extremely simple in its construction and employs relatively few, easily fabricated parts which may be easily assembled. The pump is extremely light in weight, resistant to corrosive liquids such as sea water or the like, and yet is very effective in moving a large volume of water.

Moreover, the moving parts of the pump are resistant to wear to an exceptional degree, and are relatively strong

and sturdy whereby they will not fail under normal conditions of use. As above constituted, using light and flexible plastic components, the pump of this invention will not scratch or mar finished surfaces with which it comes in contact. Moreover, the pump is capable of fabrication at an extremely low cost, thereby enabling it to be brought within the reach of all owners of water craft, even those of modest means.

Variations and modifications may be made within the scope of the claims, and portions of the improvements may be used without others.

I claim:

1. In a hand pump, a cylinder having a discharge opening at one end; a plunger movable in said cylinder in a path toward and away from said discharge opening, said plunger having one-way check valve means by which it impels fluid toward the discharge opening when the plunger is moved in the direction thereof; a hollow rigid plastic plunger rod connected to said plunger and extending therefrom inside the cylinder past the discharge opening thereof, said plunger rod having an extremity disposed exteriorly of the cylinder and provided with a handle by which pulling force may be exerted on the rod, thereby to move the plunger in a direction toward the said discharge opening for the purpose of forcing fluid from the cylinder out through the said opening; an end cap on the cylinder adjacent the said discharge opening thereof, through which the said plunger rod extends; and annular means carried by said end cap and movable radially inward in response to hydraulic pressure within the cylinder, for slidably gripping with a force proportional to said hydraulic pressure the said plunger rod, thereby to increase the effective seal with said rod and minimize leakage of fluid from the cap past the rod, said means comprising a flexible bearing bushing carried by the said end cap and constituting a yieldable sleeve bearing for the said plunger rod.

2. The invention as defined in claim 1, in which the said bushing extends inwardly of the end cap, into the interior of the cylinder.

3. The invention as defined in claim 2, in which there is a stop sleeve carried by the plunger rod adjacent the plunger thereof, said stop sleeve having an end diameter large enough to receive the said bearing bushing and to engage the end cap for the purpose of halting the plunger rod and plunger at the end of their working stroke.

4. In an all-plastic hand pump, a rigid plastic cylinder; a plastic plunger disposed in said cylinder; a rigid plastic plunger rod connected with said plunger and extending through the cylinder and beyond one end thereof; and a plastic end cap secured to the said end of the cylinder and having an opening through which the said plunger rod extends, said end cap having a transverse wall surrounding the plunger rod and being constituted of flexible plastic material, and having a rigid insert washer mainly in a plane disposed wholly within the said transverse end wall, said rigid washer being constituted of a plastic material similar to that of the end cap, and being bonded to the said end wall to constitute virtually an integral part thereof.

5. The invention as defined in claim 4, in which the plastic insert washer has laterally extended nibs disposed in portions of the said transverse end wall, for positioning the said washer therein.

6. The invention as defined in claim 2, in which the bushing is constituted of flexible plastic material and is of conical shape, having a free end of reduced diameter closely fitting the said plunger rod.

7. The invention as defined in claim 6, in which there is a stop sleeve carried by the plunger rod adjacent the plunger thereof, said stop sleeve having an enlarged end adapted to receive the bushing of the end cap and engage the inner surface of said cap when the plunger and plunger rod are moved along the cylinder toward the said cap.

8. In an all-plastic hand pump, an elongate rigid plastic cylinder; and a combined plastic plunger rod bearing and discharge fitting carried by one end of said cylinder, said fitting comprising a tubular body portion encircling and gripping the end of said cylinder, a transverse end wall extending across the end of the tubular body portion and provided with a central bearing opening through which a plunger rod may extend, and a tubular discharge spout extending radially from the side wall of the tubular body, said discharge spout including a plurality of annular accordion bends to enable the spout to be readily swung at different angles, said spout, transverse wall, and tubular body portion being molded as a single piece, from plastic material.

9. An all-plastic hand pump comprising an elongate rigid plastic cylinder having plastic inlet and discharge fittings secured to its opposite ends, said fittings comprising tubular body portions and perforated transverse end walls secured to said body portions; a flexible plastic valve carried in the inlet fitting and controlling the flow of fluid through the perforated transverse wall thereof; a plastic plunger carried in the said cylinder, having valve means to enable the passage of liquid past it in the direction of the discharge fitting; and a hollow plastic plunger rod extending along the inside of the cylinder and secured to the said plastic plunger, said rod passing through the perforated transverse wall of the discharge fitting, and said discharge fitting having a tubular nozzle extending radially from a side wall of the tubular body portion thereof, said nozzle portion being provided with a plurality of annular accordion pleats thereby to enable it to be readily bent in all directions.

References Cited in the file of this patent

UNITED STATES PATENTS

35,829	McPherson	July 8, 1862
148,775	Steward	Mar. 17, 1874
297,076	Hardie	Apr. 15, 1884
518,356	Selzer	Apr. 17, 1894
693,920	Sterrett	Feb. 25, 1902
1,431,355	Andrews	Oct. 10, 1922
1,657,469	Heston	Jan. 31, 1928
1,904,926	Peters	Apr. 18, 1933
2,044,594	Scholfield	June 16, 1936
2,345,482	Keith	Mar. 28, 1944
2,371,991	Harding	Mar. 20, 1945
2,577,417	Halpin	Dec. 4, 1951
2,793,089	Anderson	May 21, 1957
2,883,939	Russell	Apr. 28, 1959

FOREIGN PATENTS

2,152	Great Britain	of 1869