June 13, 1972 F. S. BECKERER 3,669,575

SEALED PLUNGER-TYPE PUMP

Filed March 24, 1970

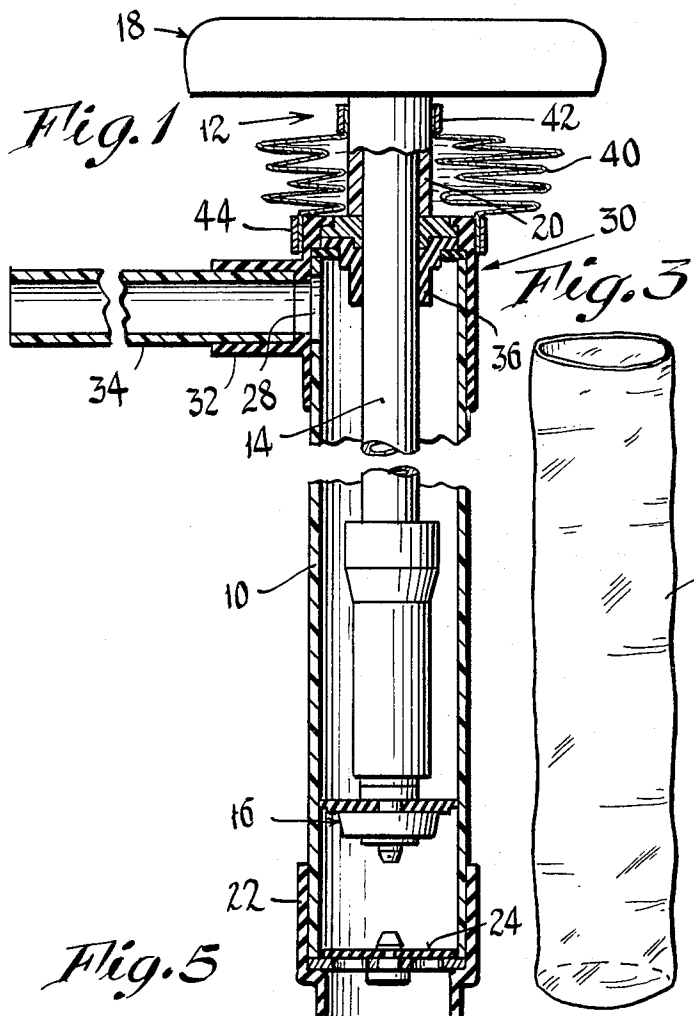


Fig. 1

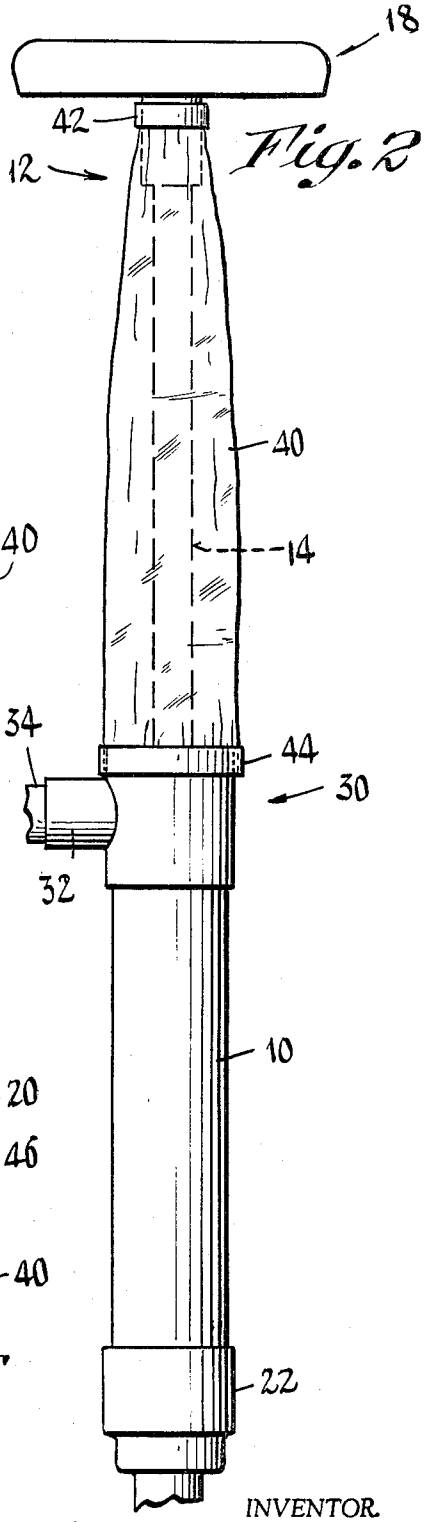


Fig. 2

Fig. 3

Fig. 5

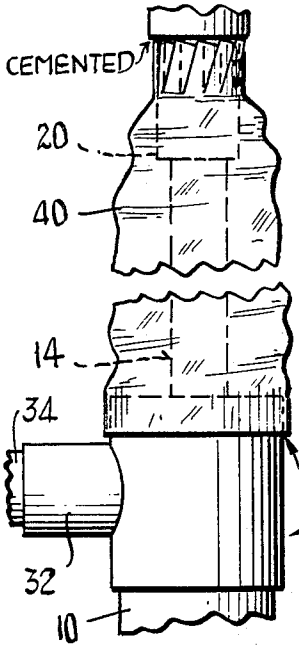


Fig. 4

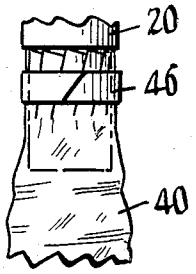
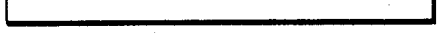


Fig. 6



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SEALED PLUNGER-TYPE PUMP

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ABSTRACT OF THE DISCLOSURE

A hand pump comprising a cylinder and reciprocatable plunger therein, the shank of the plunger passing out through an apertured end fitting of the cylinder. To prevent leakage of liquid past the end fitting between the latter and the shank of the plunger, there is secured to the cylinder end and to the shank adjacent the handle thereof a tough, paper-thin, impervious, flexible and collapsible plastic sleeve having its ends respectively connected to the cylinder and hub of the handle. During reciprocation of the plunger, the sleeve experiences a random folding and unfolding. The sleeve thus acts somewhat like a water-tight container, supplementing the packing around the plunger shank and containing any liquid which seeps past the same. The paper-thin nature of the sleeve enables it to be economically produced in the form of a smooth cylinder, since its thin walls readily permit collapsing. This is in sharp contrast to thick-walled flexible bellows or accordion-like devices which are costly to tool and to produce.

BACKGROUND

This invention relates to small hand pumps, and more particularly to pumps of the kind employing a cylinder and a reciprocatable plunger which is movable back and forth in the cylinder to effect the pumping action.

Small pumps of the cylinder and plunger type, constituted essentially of all plastic components, currently find widespread use in boating, to pump out bilges and otherwise remove unwanted water. These pumps have an internal collar or gland arrangement surrounding the shank, where it emerges from the cylinder end. To minimize friction and make the pumping easier, the collar is not especially tight fitting, and thus permits a slight amount of water to pass the plunger shank. Such small leakage is not especially objectionable in connection with use of the pumps on boats. However, where the all-plastic hand pumps are intended for other uses, as for example in the handling of contaminated liquids, the matter of leakage of even a small amount of liquid past the packing gland or collar becomes undesirable. In some circumstances of this nature, molded rubber or plastic sealing boots having accordion pleats have been proposed and utilized. However, these accordion-type sealing boots involve costly molds and molding procedures, and represent an appreciable additional cost which must be added to that of the pump. This constitutes a distinct disadvantage and drawback, since the matter of cost becomes important if the pumping device is to be used as a "throw-away," or if large sales volume is being considered.

SUMMARY

The above disadvantage of pumps having accordion-fold type sealing boots or sleeves is obviated by the present invention, which has for one object the provision of an improved, small, all-plastic reciprocative-plunger type hand pump which is effectively sealed at the plunger shank in a very inexpensive yet practical manner. This is accomplished by utilizing a simple, tough, paper-thin impervious flexible and collapsible plastic sleeve initially

formed in a smooth cylindrical shape, said sleeve being located in the area surrounding the exit point of the plunger shank at one end of the cylinder. The two ends of the paper-thin plastic sleeve are secured respectively to the adjoining cylinder end and to the shank adjacent the handle thereof, preferably being secured to the handle hub. During reciprocation of the plunger, the sealing sleeve experiences a random-type folding and unfolding, and effectively contains any liquid which might leak past the shank and packing gland or collar thereof. The paper-thin sealing sleeve, being formed initially to have a smooth cylindrical shape, enables the tooling cost to be held to a low figure, as well as the fabrication cost of the sleeves themselves.

Other features and objects of the invention involve the provision of an improved hand pump and seal as above characterized, wherein simple and effective means are provided to secure and seal the ends of the collapsible sleeve; and a pump construction as above wherein the fastening devices for the sealing boot or sleeve are readily accessible and may be easily and quickly renewed if this should at some time become necessary.

Still other features and advantages will hereinafter appear.

In the accompanying drawings:

FIG. 1 is an axial sectional view of a small sealed-type hand pump constructed in accordance with the invention. The pump plunger is shown in the retracted position.

FIG. 2 is a side elevational view of the hand pump, showing the plunger in the extended position.

FIG. 3 is a perspective view of the paper-thin flexible sealing boot or sleeve utilized in the pump of FIGS. 1 and 2.

FIG. 4 is a plan view of a strip of tape or flattened band constituting a fastening device for securing the ends of the sealing boot.

FIG. 5 is a fragmentary elevational view of the sealing boot, depicting another method of securing the ends thereof to the pump components.

FIG. 6 is a fragmentary elevational view illustrating still another means of securing one end of the sealing boot to the pump.

Referring first to FIGS. 1 and 2, the hand pump shown therein comprises a cylinder **10** in which there is reciprocatively movable a plunger **12** comprising a shank **14**, piston **16** and handle **18**, the latter having a hub **20** which may be affixed to the shank **14** by cement.

At its lower end the cylinder **10** has an inlet fitting **22** provided with a flap (check) valve **24** and forming an inlet passage **25**. Secured to the inlet fitting **22** is an inlet hose **26** of flexible or resilient plastic construction.

At its upper end, the pump cylinder **10** has a side discharge opening or passage **28** and a discharge fitting or cap **30** provided with a nozzle portion **32** in which there is secured a discharge hose **34**, also of resilient plastic construction.

The cap **30** has an annular packing collar or gland portion **36** through which the shank **14** passes, said gland portion constituting a fairly watertight seal which, however, is not always 100% effective since the friction at the seal must not be great.

The pumping action is as follows: During the extending or lifting movement of the plunger **12** the piston **16** will reduce the pressure in the lower end of the cylinder **10** whereby the flap valve **24** will open or move upward to permit ingress of liquid sucked into the inlet tube **26**. On the downstroke of the plunger **12**, the flap valve **24** will close, and the valving action of the piston **16** will enable the sucked-in liquid to bypass it so that the liquid can occupy the upper portion of the cylinder **10**. Repeated reciprocation of the plunger **12** will thus suck liquid into

the inlet hose **26** and force it out of the discharge hose **34** in the well-known manner.

In accordance with the present invention there is provided an extremely simple, inexpensive and yet effective secondary seal comprising a sealing boot or sleeve **40** surrounding portions of the shank **14** and disposed exteriorly of the discharge fitting or cap **30** of the pump cylinder. The boot or sleeve **40** is constituted of paper-thin, tough plastic material and may comprise a polyethylene formulation or be constituted of other material which is resistant to active chemicals. The sleeve **40** is formed as a smooth cylinder as seen in FIG. 3, whereby the tooling and fabrication costs are held to a minimum. For example, it may be made as a plastic extrusion, which is in sharp contrast to thick-walled, accordion-like sealing boots which cannot be extruded but must be molded in expensive mold parts.

As seen in FIGS. 1 and 2, the ends of the sealing boot **40** are secured by strips of tape **42, 44** respectively to the hub **20** of the handle **18** and to the upper peripheral portion of the cylinder cap **30**. Pressure-sensitive tape in straight strips, such as that illustrated in FIG. 4, may be utilized for this purpose. Instead of fastening the ends of the sealing boot **40** with tape, the ends may be cemented, and appropriate folds may be made in the upper end of the boot prior to the cementing as illustrated in FIG. 5.

In place of the cementing, or in addition thereto, a split plastic fastening band **46** as shown in FIG. 6 may be utilized, such band being heat-fastened after it is put in place. Other securing devices may also be utilized. As above described, due to the paper-thin nature of the sealing sleeve the securing means utilized, whether it be cement or an encircling strap or a metal clamp will have a securing and sealing strength which is greatly in excess of the stiffness or structural strength of the paper-thin end portions of the sealing sleeve.

It will be readily understood that the sealing boot **40**, since it is initially formed as a smooth cylinder and since it has paper-thin walls, will fold in a random and unsymmetrcal manner when the plunger **12** is shifted to the retracted position illustrated in FIG. 1. The sealing boot **40** is thus seen to be devoid of all parmanent uniform creases and all permanent non-uniform creases, according to the invention. As the plunger **12** is withdrawn or extended, the sealing boot **40** will unfold, and for intermediate positions of the plunger the boot will be more or less folded depending on the relative positions of its ends. The boot **40** will effectively contain seepage liquid which may be forced past the packing or gland **36** during the reciprocation of the plunger, such liquid having the opportunity to reenter the cylinder **10** during the downward or retracting plunger movements.

It will now be seen from the foregoing that I have provided a novel and improved, extremely simple and inexpensive combination hand pump and sealing boot wherein the cost represented by the sealing means is but a very small fraction of the cost of the pump unit while at the same time there is effectively prevented any loss or escape of the liquid being pumped.

Variations and modifications are possible without departing from the spirit of the invention.

I claim:

1. A leakproof pump comprising, in combination:

(a) a pump cylinder having spaced-apart discharge and intake passages, and having at one of its ends a packing collar serving as a seal and constituting a plunger guide, said packing collar being provided with an aperture,

(b) a reciprocatable plunger, including a piston movable in the cylinder and a shank connected with the piston and extending outward through the aperture of the plunger guide, and

(c) a paper-thin impervious, flexible and collapsible plastic secondary seal comprising a sleeve having paper-thin end portions and being disposed exteriorly of said pump cylinder and devoid of all permanent uniform creases and all permanent non-uniform creases, said sleeve surrounding the shank and being normally constituted as a smooth cylinder when undistorted, and having one end connected to the cylinder and its other end connected to the shank, thereby to contain any liquid which might leak past the shank and plunger guide, through the aperture of the latter,

(d) said sleeve experiencing random and unsymmetrical folding when the plunger is moved to a deep position in the cylinder,

(e) securing means extending along the paper-thin end portions of the sleve and intimately sealingly attaching the same to the cylinder and the plunger,

(f) said securing means having a securing and sealing strength greatly in excess of the stiffness and structural strength of said paper-thin end portions.

2. A pump as in claim **1**, wherein:

(a) the plunger shank and cylinder have annular surfaces engaged by the ends of the sleeve,

(b) said sleeve ends being cemented to said surfaces.

3. A pump as in claim **1**, wherein:

(a) the plunger shank and cylinder have annular surfaces engaged by the ends of the sleeve, and

(b) binding strips securing the sleeve ends to said surfaces.

4. A pump as in claim **3**, wherein:

the binding strips comprise adhesive tape.

5. A pump as in claim **1**, and further including:

(a) a handle having a hub fitted on the plunger shank,

(b) said plunger guide comprising a cap fitted to the end of the cylinder,

(c) the ends of said sleeve being secured respectively to the hub of the handle and the end cap of the cylinder.

6. A pump as in claim **5**, and further including:

bands encircling and securing the ends of sleeve to the hub and end cap.

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74—18.2