Dec. 25, 1945. W. F. THOMPSON 2,391,806

PUMP

Filed Dec. 4, 1943

Fig. 1.

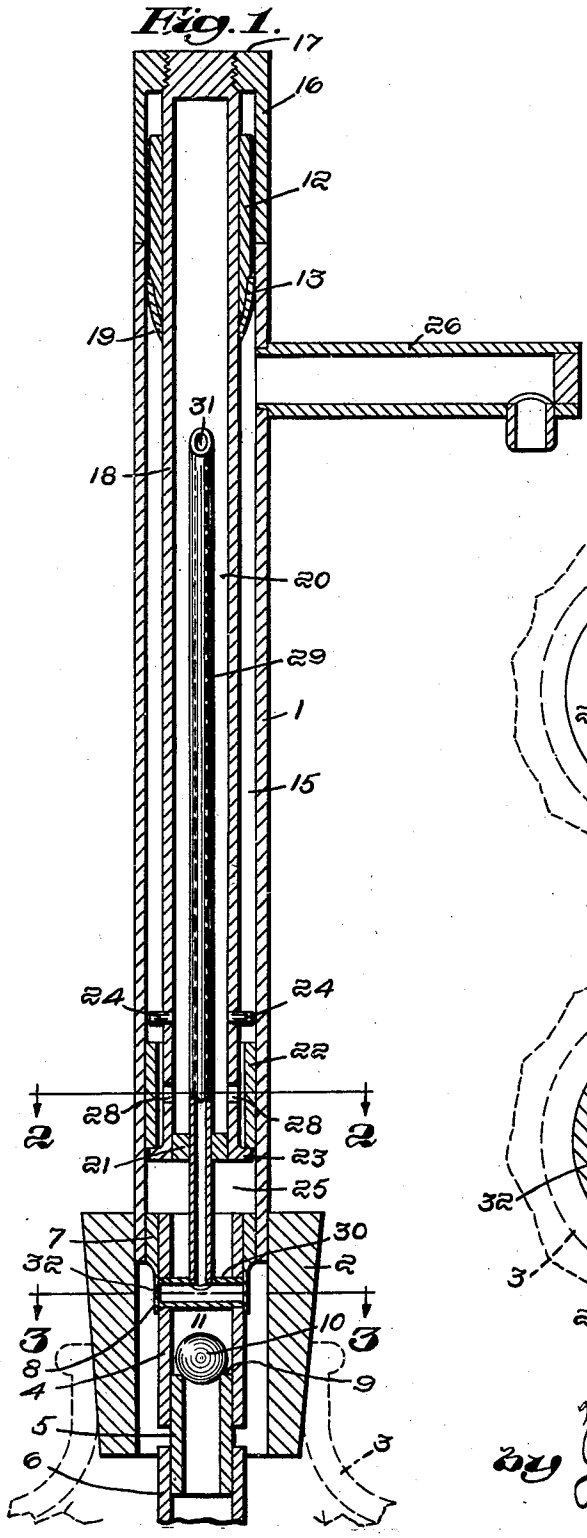


Fig. 2.

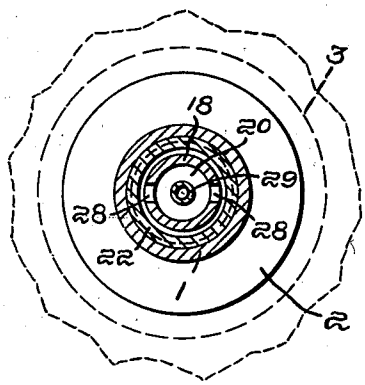
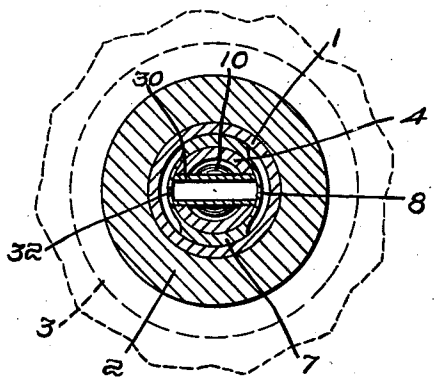


Fig. 3.



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2,391,806

PUMP

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Application December 4, 1943, Serial No. 512,860

7 Claims. (Cl. 222—318)

The invention relates to a pump especially adapted for the delivery of corrosive liquids from containers, or carboys.

The object of the invention is to provide a pump of the specified character which will inherently function to safeguard the operator whatever may be the degree of internal pressure developed within the pump. For effecting the pumping operation, the pump is provided with a piston operated by a piston rod. The piston operates within a cylinder, with the piston rod, which actuates the piston, extending outside the cylinder through a joint open to the atmosphere and through which joint the piston rod slides. It is the especial object of my invention to prevent the escape of liquid through this joint by relieving the joint of all pressure which might effect an escape of the liquid through it however fast the pump may be operated, and this without affecting the proper action of the pump.

A further object of the invention is to improve upon the pump shown and described in my United States Patent No. 2,360,085; this especially from a manufacturing standpoint by providing a pump of more simple construction and having less parts than the pump shown in my application.

The invention can best be seen and understood by reference to the drawing in which—

Fig. 1 is a vertical cross section of the pump embodying my invention.

Fig. 2 is a section on line 2—2 of Fig. 1; and

Fig. 3 is a section on the line 3—3 of Fig. 1.

Referring to the drawing 1 represents an outside tubular casing or cylinder, the top end of which is closed in a manner later to be described.

At its bottom end the tubular casing fits tightly within the top end of a hollow stopper 2. This stopper is tapered and fits snugly within the open top end or mouth of a container or carboy 3, and provides the means by which the pump is attached to and makes closed connection with the container during the operation of the pump.

Connecting with the interior to the bottom end of the casing and protruding therefrom through the hollow of the stopper is a short pipe 4. This pipe is secured by an internal tubular coupling 5 to a pipe extension 6 of sufficient length to extend to the bottom of the container when the pump has been attached to it. Connection between the pipe 5 and the interior to the bottom end of the casing is secured by a packing 7 of some more or less elastic material unaffected by acid. This packing is provided with a thin tubular web or apron 8 which extends for a short distance downwardly over the side of the pipe 4 and serves a valvular purpose later to be referred to.

The top end 9 of the internal coupling 5 provides a valve seat for an inwardly opening ball valve 10 which is caged within the chamber 11 of the coupling.

Fitting within the top end of the tubular casing 1 is a tubular head piece 12 which has an upward extension from the top end of the casing. A packing 13 fills the joint between the bottom end portion of the head piece and the adjacent top end portion of the casing, thus sealing this joint from the chamber 15 of the casing. This packing is formed of any suitable more or less elastic material unaffected by acid, and which will make a tight joint.

Surmounting the top end of the casing and slidable upon the head piece 12 is a cap 16, to the top end 17 of which is threaded the top end of a piston rod 18, the cap forming a hand grip by which the piston rod is reciprocated. The cap is of substantially the same diameter as the casing 1 and the top end of the casing forms a stop for limiting the down thrust of the piston rod through engagement of the bottom edge of the cap with the top edge of the casing. The piston rod fits slidably within the head piece. The joint between it and the head piece is closed at the bottom end of the head piece by a valve 19 with which the piston rod has sliding engagement. This valve is preferably formed of the same packing material as fills the joint 13, this material in fact being brought down to wrap around the bottom end portion of the head piece, which end portion is preferably made tapered, and thence continued beyond the bottom end of the head piece onto the side of the piston rod, thus closing the joint between the piston rod and the head piece and sealing it from the chamber 15 of the casing. The piston rod is a tubular rod with chambered interior 20 closed at its top end, where the rod is made solid, and at its bottom end closed by a plug 21 which fits within the bottom end of the piston rod.

The piston comprises an internal sleeve 22 slidable within the casing 1 and with which cooperates both an annular head 23, on the lower end of the piston rod, and pins 24 laterally projecting from the piston rod. These pins lie above the sleeve 22; the head below it. The head is of lesser diameter than the interior diameter of the casing. Both the head and the combined pins are of such diametrical extension and length, respectively, that they will engage the sleeve for moving it within the casing when the

piston is reciprocated. The head is spaced from the pins a distance longer than the length of the sleeve so that when the piston rod is raised its annular head will be brought into engagement with the bottom end of the sleeve and make closed engagement therewith. Accordingly as the piston rod is drawn up the sleeve will be moved upwardly within the casing by the drawing engagement of the head. The combined head and sleeve will then operate as a piston and induce a partial vacuum in the chamber **25** of the casing below the piston, causing liquid in the container or carboy to enter this chamber by way of the pipe connection leading into the container **3**, the valve **10** then being drawn open, and filling the chamber of the casing up to the point of the ascending piston.

During this operation undisplaced liquid contained in the chamber **15** of the casing above the ascending piston will be forced to outlet through a spout **26** which is connected to the upper end portion of the casing below the joints closed by the packing **13**, and the valve **19**, respectively.

Upon the return of the piston through lowering of the piston rod all upward flow of liquid from the container will cease. The valve **10** will resume its normal closed position. The head **23** will separate from the sleeve thereby forming a communication through the piston so that liquid in the chamber **15** of the casing lying below the piston may enter that portion of the chamber of the casing lying above the piston. The pins **24** will be brought into engagement with the sleeve moving it downwardly through the chamber of the casing to the limit of the downward stroke of the piston rod.

During this downward movement of the piston rod the piston rod and piston will pass through the column of liquid which has been drawn into the chamber of the casing and which is kept therein by the closure of the valve **10**. This column of liquid will be displaced by the descending parts including especially the piston rod, and liquid so displaced will flow out of the chamber of the casing through the spout. Thus the pump is a double acting pump causing flow of liquid from the spout during both the upward and downward strokes of the piston.

During these operations of the piston, especially if the piston rod is rapidly reciprocated for operating the pump, considerable liquid pressure will be formed in the chamber of the casing with possibility that liquid might escape through the joint between the piston rod and the head piece **12** within which the piston rod is slidable even though this joint is closed by the valve **19**, and the pressure acting to effect a better closure of this valve for sealing the joint. It is to safeguard the pump against any such escape of liquid that further provision is made that no such pressure will ever be obtained within the chamber **15** of the casing as will produce an escape of liquid by the joint through which the piston rod is passing.

To this end an opening or openings **28** are formed in the piston rod affording communication from out of the chamber **15** of the casing into the interior **20** of the piston rod. These openings are located adjacent the bottom end of the piston rod. Contained within the interior of the piston rod and leading out of this chamber through the plug which closes the bottom end of the piston rod is a drainage tube **29**. This tube extends downwardly through the bottom end portion of the casing with extension into the pipe **4** where it connects with a tube section **30**. This tube section extends laterally through the pipe **4** at a point above the chamber **11** for the ball valve **10**, so as not to interfere with the free opening of this valve. The opposite ends of the tube section **30** are in open communication with the interior of the container so that liquid entering the interior of the piston rod will escape through the drainage tube and pipe section **30** and be returned to the container. In order to prevent a too free escape of liquid from the chamber of the casing back to the container the ends of the pipe section **30** are preferably closed by the web **8** previously referred to, which functions as a valve for normally closing these ends. This web or valve, however, offers but slight resistance to the escape of liquid through the ends of the pipe section **30**, the valve being opened by the liquid upon the development of slight pressure within the pump.

The drainage tube **29** is of such length that the open top end **31** of the tube will occupy a position slightly below the entrance to the spout **26**. Accordingly, upon the cessation of the pumping operation, liquid in the casing will escape back through the drainage tube, and the drop of the liquid in the casing below the entrance to the spout will clear the spout of any liquid remaining in it, and thereby prevent drip. In some cases if the piston has been rapidly reciprocated the interior of the piston rod may have become filled with liquid up to a point above the opening into the drainage tube. If this condition prevails at the end of a pumping operation then, before there can be any drop in the liquid in the casing for eliminating drip from the spout, the liquid within the interior of the piston rod must have been lowered to the level of the opening into the drainage tube. This effect, however, will be quickly obtained owing to the fact that when the liquid in the interior of the piston rod is forced to rise above the opening to the drainage tube air will be compressed within the top of the interior of the piston rod. This compressed air will, at the end of any pumping operation, tend to quickly lower the liquid in the interior of the piston rod to the level of the opening to the drainage tube and clear this tube, thus enabling such gravitational flow back from the chamber of the casing as will prevent drip from the spout. In order that this result may be obtained it is at least desirable, if not necessary, that the web or valve **8** should be arranged to normally have some opening, as small opening **32** for the free passage of liquid from the end or ends of the tube section **30**. In any event, the drainage opening should not be so large as to interfere with a proper functional operation of the pump.

I claim:

1. In a pump through the operation of which liquid may be drawn from a container source the combination comprising a chambered casing with delivery outlet, means whereby liquid may be drawn into the casing from the source comprising a hollow piston and piston rod, the interior of the rod communicating with the chamber of the casing, means whereby excess liquid within the rod will be directed back to the source including a drainage tube in open communication with the interior of the rod and connections leading from the tube to the source, and means for controlling the passage of liquid through the tube and connections back to the source whereby liquid from the casing will be permitted to pass through the tube and connections back to the source upon the

development of pressure within the casing for relieving such pressure.

2. In a pump through the operation of which liquid may be drawn from a container source the combination comprising a chambered casing with delivery outlet, means whereby liquid may be drawn into the casing from the source comprising a hollow piston and piston rod, the interior of the rod communicating with the chamber of the casing, means whereby excess liquid within the rod will be directed back to the source including a drainage tube and connections leading from the tube to the source, said tube being provided with an opening to the interior of the rod which opening is located below the delivery outlet from the casing whereby liquid remaining in the casing and delivery outlet after the pumping operation will drain through the tube and connections and drip from the delivery outlet be thereby obviated, and means for controlling the passage of liquid through the tube back to the source whereby drainage will be effected as aforesaid without preventing a proper functional operation of the pump.

3. In a pump through the operation of which liquid may be drawn from a container source the combination comprising a chambered casing with delivery outlet, means whereby liquid may be drawn into the casing from the source comprising a hollow piston and piston rod, the interior of the rod communicating with the chamber of the casing, means whereby excess liquid within the rod will be directed back to the source including a drainage tube in open communication with the interior of the rod and connections leading from the tube to the source, and means displaceable to an open position by pressure generated within the casing for restricting the passage of liquid through the tube and connections back to the source.

4. In a pump through the operation of which liquid may be drawn from a container source the combination comprising a chambered casing with delivery outlet, means whereby liquid will be drawn into the casing from the source comprising a hollow piston and piston rod, the interior of the rod communicating with the chamber of the casing, means whereby excess liquid within the rod will be directed back to the source including a drainage tube and connections leading from the tube to the source, said tube being provided with an opening to the interior of the rod which opening is located below the delivery outlet from the casing whereby liquid remaining in the casing and delivery outlet after the pumping operation will drain through the tube and connections and drip from said delivery outlet be thereby obviated, and means for controlling the passage of liquid through the tube and connections back to the source whereby drainage will be effected as aforesaid without preventing a proper functional operation of the pump and the passage of liquid to the source be augmented upon the development of pressure within the casing.

5. In a pump through the operation of which liquid may be drawn from a container source the combination comprising a chambered casing with delivery outlet, means whereby liquid may be drawn into the casing from the source comprising a hollow piston and piston rod, the interior of the rod communicating with the chamber of the casing, means whereby excess liquid within the rod will be directed back to the source including a drainage tube and connections leading from the tube to the source, said tube being provided with an opening to the interior of the rod which opening is located below the delivery outlet from the casing whereby liquid remaining in the casing and delivery outlet after the pumping operation will drain through the tube and connections and drip from the delivery outlet be thereby obviated, and displaceable means for controlling the passage of liquid through the tube and connections back to the source whereby drainage will be effected as aforesaid without preventing a proper functional operation of the pump and the passage of liquid to the source be augmented upon the development of pressure within the casing.

6. In a pump through the operation of which liquid may be drawn from a container source the combination comprising a chambered casing with delivery outlet, means whereby liquid may be drawn into the casing from the source comprising a hollow piston and piston rod, the interior of the rod communicating with the chamber of the casing, means whereby excess liquid within the rod will be directed back to the source including a drainage tube and connections leading from the tube to the source, said tube being provided with an opening to the interior of the rod which opening is located below the delivery outlet from the casing whereby liquid remaining in the casing and delivery outlet after the pumping operation will drain through the tube and connections and drip from the delivery outlet be thereby obviated, and a valve displaceable to an open position by pressure generated within the casing for restricting the passage of liquid through the tube and connections back to the source, the valve having an opening in it allowing the drainage of liquid as aforesaid without preventing a proper functional operation of the pump.

7. In a pump through the operation of which liquid may be drawn from a container source the combination comprising a chambered casing with delivery outlet, means whereby liquid may be drawn into the casing from the source comprising a hollow piston and piston rod, the interior of the rod communicating with the chamber of the casing, means whereby excess liquid within the rod will be directed back to the source including a drainage tube and connections leading from the tube to the source, the tube being located within the rod and in open communication with the interior thereof, and means for controlling the passage of liquid through the tube and connections back to the source whereby liquid from the casing will be permitted to pass through the tube and connections back to the source upon the development of pressure within the casing for relieving such pressure.

WILLIS F. THOMPSON.