

[54] **MULTI-PURPOSE PUMP**

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[21] Appl. No.: **387,666**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 143,430, May 14, 1971, abandoned, which is a continuation-in-part of Ser. No. 885,028, Dec. 15, 1969, abandoned.

[52] U.S. Cl. **417/571; 92/85; 92/243; 417/566**

[51] Int. Cl. **F04b 21/04**

[58] Field of Search **417/63, 566, 569, 571; 92/85, 242, 243, 244**

[56] **References Cited**

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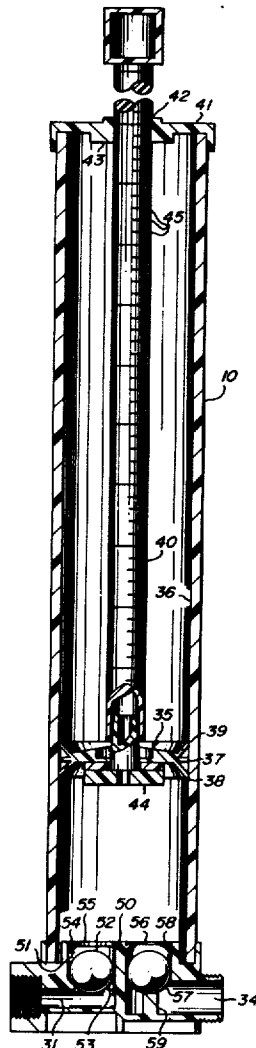
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[57] **ABSTRACT**

A multi-purpose pump for pumping gases and fluids such as air, water and gasoline, including a piston-cylinder combination operated by a hand-actuated handle and provided with inlet and outlet bores at the bottom of the cylinder is provided. Each bore has a check valve assembly to permit fluid to be drawn into the cylinder through the inlet bore when the piston is moved upwardly and to permit fluid to be exhausted from the cylinder through the outlet bore when the piston is moved downwardly. A disk formed integrally with the thermoplastic piston continuously engages the inner wall of the cylinder to prevent cold-flow distortion of the upper and lower sealing lips thereof when the pump is stored in the horizontal position.

1 Claim, 6 Drawing Figures



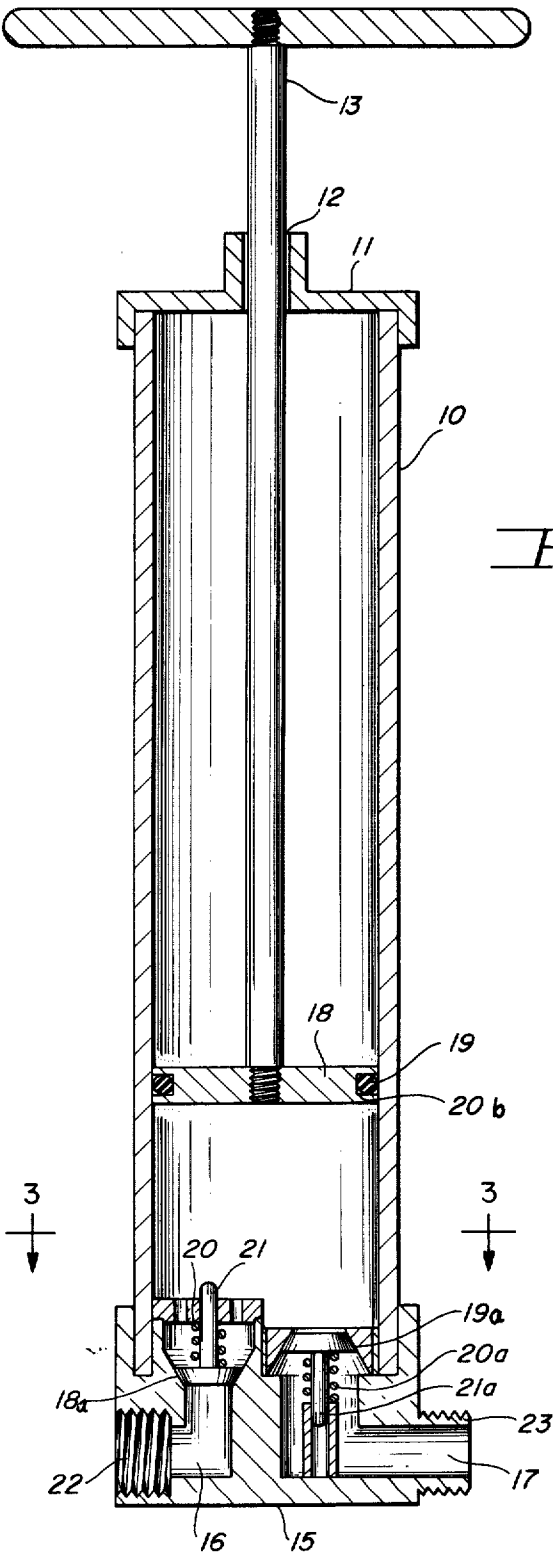


FIG. 2

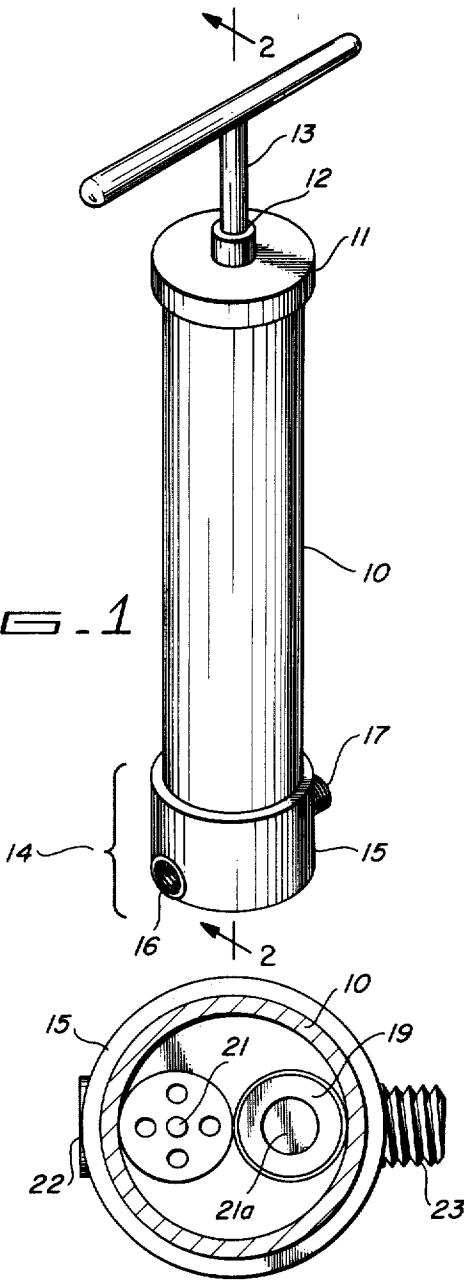


FIG. 1

FIG. 3

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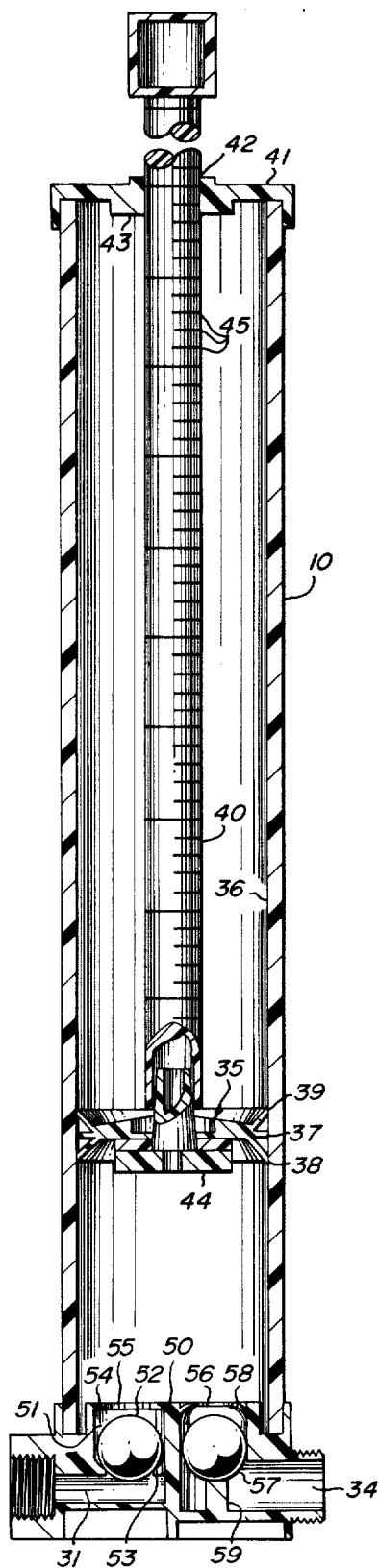


FIG. 5

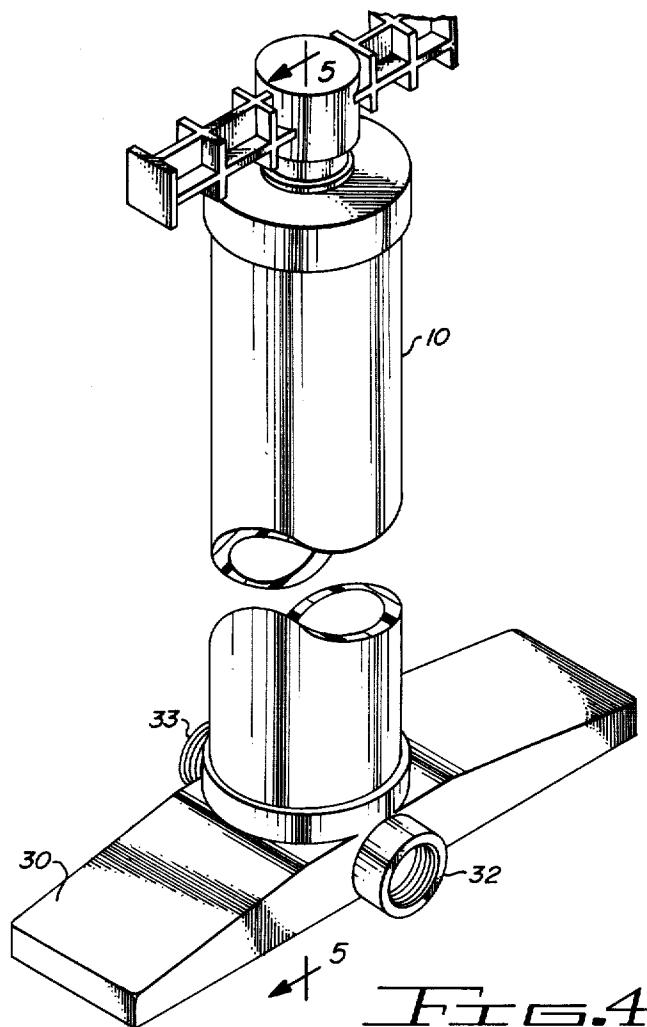


FIG. 4

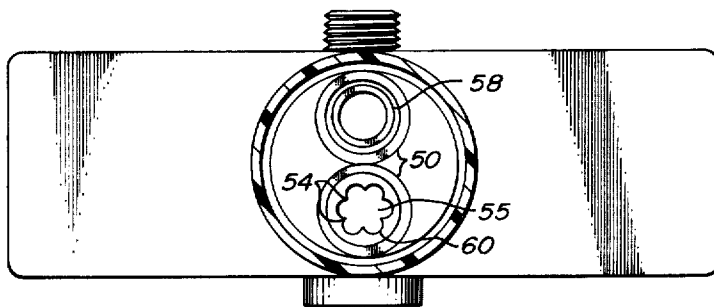


FIG. 6

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MULTI-PURPOSE PUMP

The instant application is a continuation-in-part application of my co-pending application entitled "Multi-Purpose Pump", Ser. No. 143,430, filed May 14, 1971, and now abandoned, which application is in turn a continuation-in-part application of the then co-pending application entitled "Multi-Purpose Emergency Pump", Ser. No. 885,028, filed Dec. 15, 1969, and now abandoned.

This invention relates to improved pump apparatus. More specifically, the invention concerns a multi-purpose pump especially adapted for general use and for use in emergencies to pump either liquid or gaseous fluids.

In another respect, the invention relates to a pump which is specially adapted for use in various situations where electrically powered pumps have been rendered inoperative because of the interruption of power supplies due to natural or man-made disasters and in various situations which arise in remote areas where one does not have access to power-driven pumps.

In the event of a natural or man-made disaster, electric power is usually interrupted, frequently for extended periods of time. While many of the interruptions caused by power failure can be classed as mere inconveniences, other interruptions can have more serious and pronounced consequences. As the complexity of modern distribution and transportation systems is increased, the effect of an electric power failure becomes increasingly severe. For example, in the recent hurricane disaster in Mississippi, it took many days to restore electric power to large areas of the storm-ravaged area. As one result, it was practically impossible to obtain gasoline for emergency vehicles even though large stocks of gasoline were on hand because there was no power for the pump-driving motors which were almost invariably electrically operated. The same situation is often encountered in remote areas where it may take a considerable length of time to repair a disrupted electrical power supply, again making it practically impossible to obtain gasoline for a vehicle for extended periods of time.

In addition to the inconveniences and sometimes serious consequences of the disruption of the electric power supply for a gasoline service station, it also frequently occurs that a vehicle will run out of fuel or water in a remote location in which no service station facilities are available. In such instances, it is frequently possible to obtain a temporary supply of gasoline or water from another passing vehicle but many times the equipment for effecting such a transfer is unavailable at the remote location.

Accordingly, it would be highly desirable to provide a small, lightweight, economically constructed pump which could be carried in each vehicle and which was capable of pumping either liquid or gaseous fluids such as gasoline, water, air, etc., such that power failures in populated areas or emergencies arising in remote areas away from service station equipment would not result in completely disabling the vehicle.

Similarly, it is desirable to have a compact lightweight hand-operated pump for use in convenience and utility applications unrelated to emergency situations. Campers and other persons pursuing outdoor activities, often in remote areas, frequently have need of such a pump to inflate rubber mattresses, or rubber boats, to

bail the water from a boat, or to pump water from a natural source such as a stream or lake, into containers for general camp use. A portable pump, particularly one calibrated to indicate the volume of fluid transferred, has special application in proportioning fluid mixtures such as cleaning solvents and fertilizer solutions where the concentrate is withdrawn from a storage tank and transferred to another vessel for mixing with a carrier fluid such as water.

It is therefore a principal object of the present invention to provide a multi-purpose pump.

Another object of the invention is to provide a multi-purpose pump adapted for pumping both liquid and gaseous fluids.

Still another object of the present invention is to provide such a pump having general utility application and in which the volume of fluid transferred is controllable.

Yet another object of the invention is to provide a multi-purpose emergency pump of the type described which is of rugged, lightweight and economical construction, thus making it practical for each vehicle to carry one such pump.

A further object of the invention is to provide a multi-purpose pump of the above type which may be constructed entirely of plastic and has provisions therein to prevent distortion of the piston due to cold flowing, heat or other forces during extended periods of storage.

These and other, further and more specific objects and advantages of the invention will become apparent to those skilled in the art from the following detailed description of the invention taken in conjunction with the drawings, in which:

FIG. 1 is a perspective view of a multi-purpose emergency pump incorporating the features of one presently preferred embodiment of my invention;

FIG. 2 is a cross-sectional view of the pump apparatus of FIG. 1 taken along section line 2—2 thereof;

FIG. 3 is a cross-sectional view of the pump apparatus of FIGS. 1 and 2 taken along section line 3—3 of FIG. 2;

FIG. 4 is a perspective view of a multi-purpose pump incorporating the features of an alternate preferred embodiment of my invention;

FIG. 5 is a cross-sectional view of the pump apparatus of FIG. 4 taken along section line 5—5 thereof; and

FIG. 6 is a cross-sectional view of the pump apparatus of FIGS. 4 and 5 taken along section line 6—6 of FIG. 5.

Briefly, in accordance with my invention, I provide a multi-purpose emergency pump apparatus which is specially adapted to pump both liquid and gaseous fluids. My pump comprises, in combination, a hollow elongate cylinder member having an upper and lower end; a piston which is sealingly disposed transversely within the cylinder member for reciprocal movement therewithin from a position proximate the upper end of the cylinder member to a position proximate the lower end of the cylinder member; an elongate piston operating rod member is provided having its lower end operatively connected to the piston and its upper end operatively connected to a manually operable handle. An operating rod positioning means is associated with the upper end of the cylinder member and defines an aperture shaped to receive the operating rod extending therethrough to position the operating rod substantially vertically and in substantially parallel relationship to the longitudinal axis of the cylinder member. Valve as-

sembly means are located in the lower end of the hollow cylinder member and form with the cylinder member and the piston a fluid-tight chamber. The valve assembly means comprise a block member sealingly engaged with the periphery of the cylinder member and having an inlet bore and an outlet bore, the bores communicating between the exterior and the interior of the chamber.

In a first embodiment, an inlet valve seat is formed in the inlet bore and an outlet valve seat is formed in the outlet bore. An inlet valve is operatively associated with the inlet valve seat and an outlet valve is operatively associated with the outlet valve seat. Spring means are provided which urge the valves into sealing engagement with their respective valve seats such that the inlet valve is yieldably positionable out of sealing engagement against the action of its said spring to an open position in response to upward movement of the piston, and the outlet valve member is yieldably positioned out of sealing engagement against the action of its spring to an open position in response to downward movement of the piston.

In the second embodiment of my invention, the necessity for utilizing springs to urge the valves into sealing engagement with their respective seats is obviated by utilizing a pair of ball valves in which each of a pair of resilient balls have a limited degree of freedom within vertical bores in which they are captivated. The valve seats are oriented such that one of the balls is seated downwardly when the operating rod is pushed down, and the other ball is seated upwardly when the operating rod is pulled upwardly, thereby alternately expelling fluid from the cylinder and pulling fluid into the cylinder. The piston has a lower relatively thin resilient annular ceiling lip and an upper relatively thin resilient annular ceiling lip and a relatively stout disk disposed there between to prevent distortion of the annular lips due to cold flowing, heat, weight and other forces of the plastic material when the pump is stored in a horizontal position for extended periods.

Turning now to the drawings in which two presently preferred embodiments of the invention are depicted, FIG. 1 is a perspective view of a first multi-purpose pump incorporating my invention. The pump consists of a hollow, cylindrical member 10 provided with a cap 11 having a central aperture 12 which positions the operating rod 13. The hollow cylindrical member 10 is provided at its lower end with a valve assembly, generally indicated by reference numeral 14, comprising a block member 15 sealingly disposed and engaged with the periphery of the cylinder member 10 and having an inlet bore 16 and an outlet bore 17 communicating between the exterior of the pump and the interior of the cylindrical member 10.

As shown in FIG. 2, piston member 18 is transversely disposed within the cylindrical member 10 and sealingly engaged to the inner walls of the cylinder 10 by means of an O-ring seal 19 disposed in an annular peripheral notch 20b in the piston member 18. The inlet bore 16 of the block member 15 has a valve seat 18a formed integrally in the inner end of the bore 16, and an outlet valve seat 19a is provided in the inner end of the outlet bore 17. Spring means 20 and 20a are provided to respectively urge valves 21 and 21a into contact with their respective valve seats formed in the bores 16 and 17. A threaded recess 22 is provided for the purpose of connecting an inlet hose to the inlet

bore 16 and a threaded nipple 23 is provided for the purpose of connecting a discharge hose to the outlet bore 17.

In operation, the inlet and outlet valves 21 and 21a are normally closed and the movement of the piston 18 within the cylinder 10 causes the valves to alternatively open and close. When the piston member 18 is moved upwardly by means of the operating rod 13, the inlet valve 21 opens against the action of its associated spring 20 to allow fluid to be drawn into the interior of the cylindrical member 10 below piston 18. At the top of the stroke of the piston 18, the inlet valve 21 closes and, as the piston 18 is moved downwardly in response to pressure on the operating rod 13, the outlet valve 21a opens against the action of its associated spring 20a, allowing the fluid within the cylinder 10 below the piston 18 to be expelled through the valve seat 19 and into and out of the outlet bore 17.

Attention is now directed to FIGS. 4, 5 and 6 which illustrate an alternate preferred embodiment of my invention. The cylindrical member 10 is supported in the vertical position by a base 30 which extends, wing-like to stabilize the pump in the obvious manner. As with the above-described embodiment, an inlet bore 31 is provided, preferably through an outwardly extending nipple 32 which is threaded on its inside surface to receive a male threaded member. Similarly, a second, diametrically opposed nipple 33 is threaded about its outer surface to receive an outlet hose or the like. An outlet bore 34 passes through the nipple 33 in a manner corresponding to the outlet bore 17 shown in FIG. 2.

Attention is now more specifically invited to FIG. 5 in which the internal differences from the earlier described embodiment may be readily perceived by comparing against FIG. 2. First, with respect to the piston member 35, the seal against the inner wall 36 of the cylinder 10 comprises a centrally disposed disc 37, a first annular lip 38 which is directed generally downwardly and outwardly, and a second annular lip 39 directed generally upwardly and outwardly. The disc 37 and the annular lips 38 and 39 comprise an integral unit, and the peripheries of each of the elements are dimensioned for sealing engagement with the inner wall 36 of the cylinder 10 to effect a labyrinth seal which is simple, but very effective, easy to fabricate, and further requires no O-ring. It being understood that the annular lips 38 and 39 taper outwardly to a relatively thin resilient edge to effect an adequate seal with the inner wall 38 of the cylinder 10.

To provide a light weight pump which is substantially durable and maintenance free the cylindrical body 10 and the base 30 are fabricated from a plastic such as poly-vinyl chloride while the piston member 35 to provide a fluid tight seal for extended service life is fabricated from a thermoplastic such as polyethylene and polypropylene. However, thermoplastics are readily susceptible to distortion due to heat, weight, cold flowing and other forces. While these forces present no problem when the pump is in the vertical position, extended periods of storage in which the pump is placed horizontally will cause the lower portion of the lips 38 and 39 to expand outwardly and concurrently retracting the upper portion of the lips 38 and 39 from the inner wall 36 of the cylinder 10 thereby ruining the sealing engagement between the piston 35 and the cylinder 10.

Applicant is familiar with prior art pump utilizing plastic pistons such as that described in U.S. Pat. No.

3,391,645. To overcome the deficiencies of such prior art devices and to prevent distortion of the piston, as above described in the instant invention it has been determined that a reinforcing member of substantially the same size as the inside diameter of the piston cylinder is necessary that the ceiling lips rest only slightly on the inner wall of the cylinder during horizontal storage of the pump. The relatively stout reinforcing member carries the combined weight of the piston and the end of the operating rod when the pump is placed horizontally. The reinforcing member of the instant invention is the disc 37 disposed between the annular lips 38 and 39 of the piston member 35.

The operating rod 40 is positioned coaxially by the cap 41 which has a centrally disposed aperture 42 through which the operating rod 13 passes. The cap 41 has a downwardly extending shoulder portion 43 which functions as a stop member against which the piston member abutts when the operating rod 40 is withdrawn to its uppermost position. The stop 43 insures that the sealing periphery of the piston 35 stops a predetermined minimum distance from the cap 41 to prevent damage to the upper lip 39. Similarly, a second stop means 44 is fixed in position beneath the piston member 35 and may conveniently take the shape of a cross. When the operating rod 40 is pushed down to its lowermost position, the cross-shaped stop member 44 abutts the upper surface 50 of the valve structure, which will be described in further detail below, to prevent damage to the lower lip 38 by assuring that the piston member stops a predetermined minimum distance from the valve structure.

It will also be observed that the operating rod 40 carries calibrated indicia 45 which are indicative of the volume within the cylinder 10 below the piston member 35.

The valve structure of the second preferred embodiment of the invention may best be appreciated by referring simultaneously to FIGS. 5 and 6. The inlet bore 31 leads to a first vertically oriented bore 51 which communicates with the interior of the cylinder 10, specifically, the volume below the piston 35. A first resilient ball valve 52 normally rests, as a result of gravity, on a conforming valve seat 53 and has a diameter somewhat less than the diameter of the vertical bore 51 but greater than that of the valve seat 53 and also greater than that of the inner points 54 of the scalloped opening 55 which serves to constrain the ball valve 52 within the vertical bore 51 in a manner which will become apparent as the description proceeds.

Similarly, the outlet bore 34 opens into a second vertically oriented bore 56 which contains a second resilient ball valve 57. A valve seat 58 at the top of the bore 56 conforms to the second resilient ball valve 57; however, the ball valve 57 normally rests on a pedestal 59 extending vertically into the bore 56 a sufficient distance to captivate the ball valve 57 in the bore. The diameter of the ball 57 is somewhat smaller than that of the bore 56 to allow the passage of fluids around the ball and into the outlet bore 34 as will be described below.

In operation, when the operating rod 40 is pulled upwardly, a subatmospheric (or subambient) pressure is created in the volume defined by the interior of the cylinder 10, the bottom of the piston 35, and the valve structure disposed in the bottom of the pump. As a result, the resilient ball 57 moves upwardly and sealingly

engages its seat 58 to close off communication with the outlet bore 34. Simultaneously, the resilient ball valve 52 moves upwardly and is constrained in its uppermost position within the vertical bore 51 by the inner points 54 of the scalloped opening 55. In this position, communication between the inlet bore and the volume within the cylinder 10 beneath the piston 35 is maintained across the unoccupied valve seat 53, around the resilient ball 52 and through the areas 60 between the inner points 54 of the scalloped opening 55. Thus, fluid is drawn through the inlet bore 31 and into the cylinder 10 beneath the piston 35.

On the downward stroke of the operating rod 40, a superatmospheric (or superambient) pressure is created beneath the piston 35 which immediately forces the resilient balls 52 and 57 into their lowermost position at which the resilient ball 52 sealingly engages its seat 53 to close off fluid communication between the inlet bore 31 and the volume beneath the piston 35. However, since the resilient ball 57 has a smaller diameter than the vertical bore 56, and rests on the pedestal 59, fluid communication is established between the volume beneath the piston 35 and the outlet bore 34 such that the fluid previously drawn into the cylinder by raising the operating rod 40 is now expelled through the outlet bore 34.

It is sometimes desirable to transfer a known amount of fluid through the pump as, for example, when the pump is being utilized to proportion fluid mixtures such as cleaning solvents and fertilizer solutions where the concentrate is withdrawn from a storage tank and transferred to another vessel for mixing with a carrier fluid such as water. The calibrated indicia 45 on the operating rod 40 may readily be utilized to carry out this function by observing the number of calibration marks passing the upper surface of the cap 41 as the operating rod 40 is pulled upwardly to draw in the fluid. When the desired amount of fluid is within the volume beneath the piston 35, which may result from a measured partial stroke, the operating rod may then simply be pushed downwardly to expel the measured volume of fluid.

From the foregoing description, it will be recognized that my pump, in either preferred embodiment, provides a convenient, economical and reliable method for transferring various liquid and gaseous fluids in emergency and non-emergency situations. The pump is readily adapted to be used as an ordinary tire pump by connecting a discharge hose to the threaded nipple 23 or 33, which discharge hose is provided at its outer end with an appropriate connection fitting which mates with the air valve of a tire. Alternatively, by connecting a suction hose into the threaded recess 22 or 32 and an outlet hose to the male threaded fitting 23 or 33 the pump can be used to transfer gasoline from one vehicle to another or to pump water into a vehicle radiator. When provided with appropriate accessories, the pump can be used to provide artificial resuscitation to an injured person, and many other similarly useful functions will readily occur to those skilled in the art.

While the principles of the invention have now been made clear in an illustrative embodiment, there will be immediately obvious to those skilled in the art many modifications of structure, arrangement, proportions, the elements, materials, and components, used in the practice of the invention which are particularly

adapted for specific environments and operating requirements without departing from those principles.

I claim:

1. A multi-purpose pump for liquid and gaseous fluids, comprising in combination:
 - a. a hollow, elongate cylinder having an upper end and a lower end;
 - b. a piston fabricated from a thermoplastic material disposed transversely within said cylinder for reciprocal movement therewithin between positions proximate said upper and lower ends of said cylinder, said piston including
 - i. a lower annular lip directed downwardly outward and having a relatively thin resilient edge in sealing engagement with the inner surface of said cylinder,
 - ii. an upper annular lip directed upwardly outward and having a relatively thin resilient edge in sealing engagement with the inner surface of said cylinder,
 - iii. a disc formed integrally with and disposed between said upper lip and said lower lip and having the periphery thereof continuously engaging the inner surface of said cylinder, said disc hav-

- ing substantial strength to support said piston when said pump is positioned horizontally for storage thereby preventing cold-flow distortion to said upper and lower lips;
- c. an elongate piston operating rod having the lower end thereof connected to said piston and the upper end thereof spaced above the upper end of said cylinder;
 - d. a handle connected to the upper end of said operating rod;
 - e. an end cap carried by the upper end of said cylinder and having an aperture therein for slidably guiding said operating rod therethrough;
 - f. a block sealingly engaged with the lower end of said cylinder and having an inlet bore and an outlet bore, said bores communicating between the interior and exterior of said cylinder; and
 - g. valve means associated with said inlet bores and said outlet bore to permit fluid flow through said inlet bore in response to upward movement of said piston and to permit fluid flow through said outlet bore in response to downward movement of said piston.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,904,326 Dated September 9, 1975

Inventor(s) Clyde H. Clement

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8, sub-paragraph d, line 10, change "ord"
to --rod--.

Signed and Sealed this

sixteenth Day of December 1975

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks