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T. B. TYLER ET AL

3,018,779

BODY CAVITY EVACUATING APPARATUS

Filed July 28, 1959

2 Sheets-Sheet 1

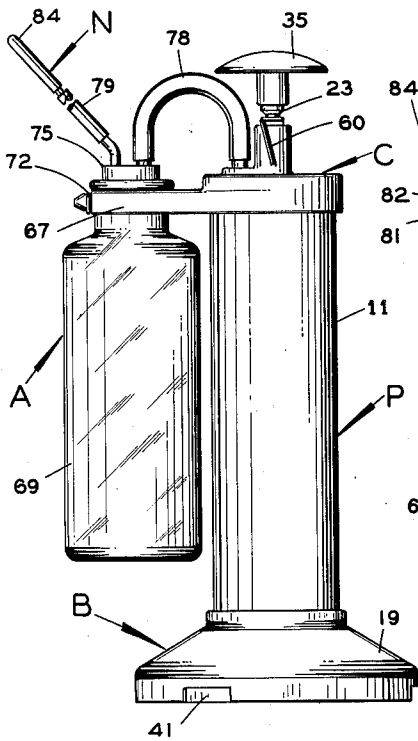


FIG. 1

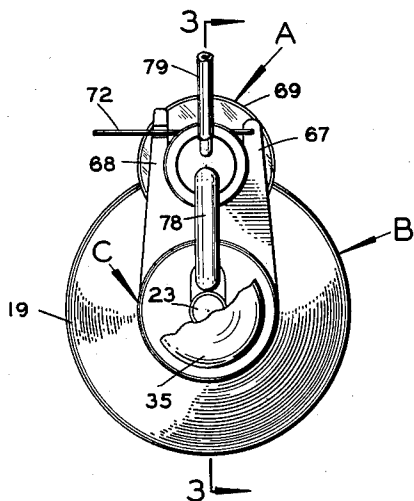


FIG. 2

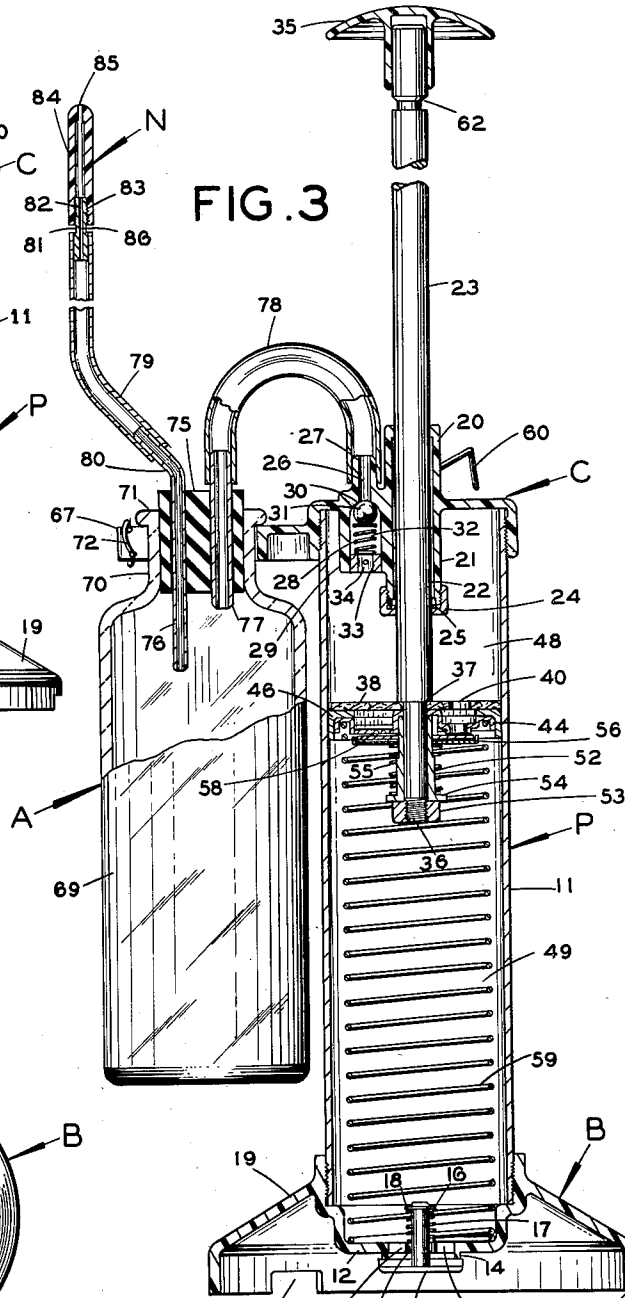


FIG. 3

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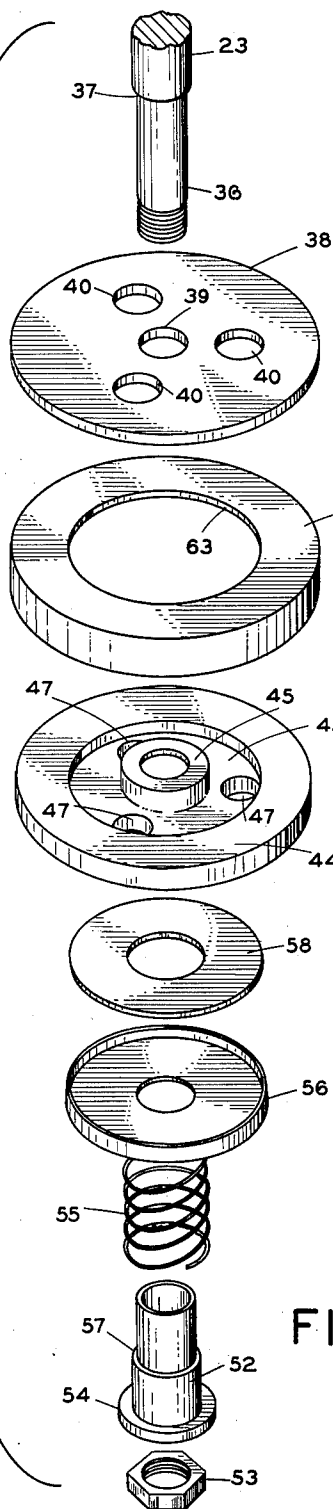


FIG. 4

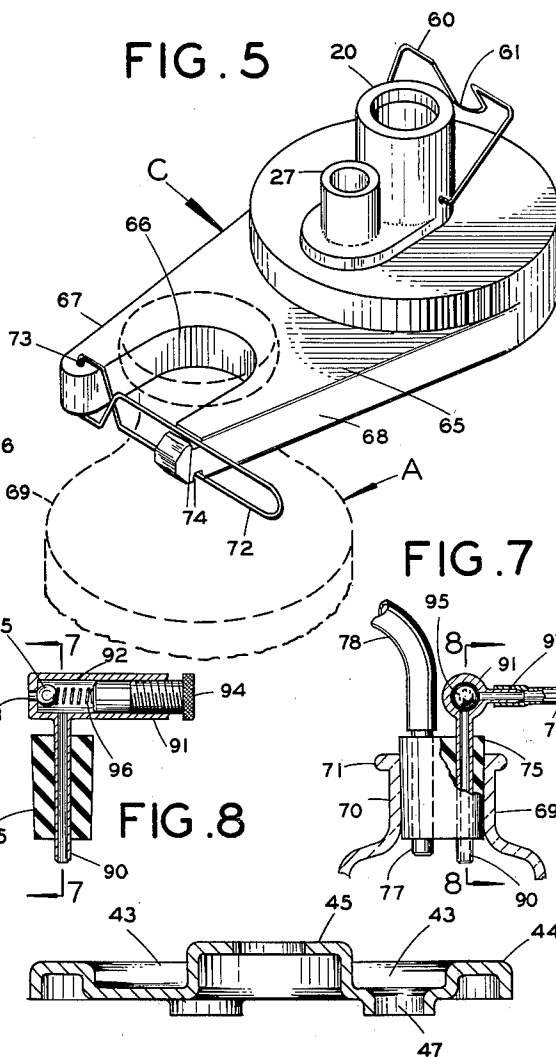


FIG. 5

FIG. 7

FIG. 8

FIG. 6

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1

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BODY CAVITY EVACUATING APPARATUS

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4 Claims. (Cl. 128-278)

This invention relates generally to suction type devices in medical operations for withdrawing matter from body cavities and is more specifically directed to such improved apparatus in portable form and readily operable by manual power.

A principal object of the present invention is to provide a body cavity evacuating apparatus which is compact and portable in structure wherein its suction generating device and matter collecting receptacle are constructurally and functionally operative as a unit.

A further object of the present invention is to provide a body cavity evacuating device which can be operated to create a suction with one hand while manipulating with ease a body cavity evacuating instrument connected to the apparatus with the other hand thereby making it possible for one person to operate the instrument with a high degree of efficiency.

Another object of the present invention is to provide a body cavity evacuating device wherein the trapping receptacle or accumulator may be quickly and easily removed from the device for emptying, cleaning and sterilizing as well as being replaced by another empty receptacle when necessary by a quickly releasable spring clip.

Another object of the present invention is to provide a body cavity evacuating device wherein suction is generated by a manual stroke of a single action piston within a cylinder and an automatic return by spring pressure, and wherein this pulsating suction is converted to a continuous suction at a nozzle by a subatmospheric accumulator device.

A further object of the present invention is to provide a body cavity evacuating device described as above wherein the suction device is provided with a piston having a one-way valve and slidably mounted in a vertically disposed cylinder for the discharge of air from the upper to the lower portion of the cylinder as the piston slides upwardly in the cylinder.

A further object of the present invention is to provide a body cavity evacuating device described as above wherein the manually operated piston is return reciprocated by spring pressure and wherein when not in use the piston may be locked fully compressed within the cylinder for compactness in portable or storing condition.

Still another object of the present invention is to provide a body evacuating device described as above wherein the suction device and cylinder stands substantially vertically, intaking air at the top and discharging it at the bottom thereof through a one-way check valve which operates to prevent dirt, moisture or abrasive material from being drawn into the cylinder and also to drain away and eject by gravity and air flow any moisture that may have entered therein or formed by auto-condensation.

Still another object of the present invention is to provide a portable and manually operated suction device for evacuating matter from a body cavity which operates efficiently with slow and easy strokes effected by a downward force on a capped portion of its piston rod.

With these and other objects in view, the invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming a part of this specification, with the understanding, however, that the invention is not confined to any strict conformity with the showing of the drawings but may be changed or modified so long as such

2

change or modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings:

FIGURE 1 is a side elevational view of a body cavity evacuating device embodying our invention.

FIGURE 2 is a top plan view thereof.

FIGURE 3 is a longitudinal cross vertical view.

FIGURE 4 is an exploded view of our piston assembly.

FIGURE 5 is a perspective fragmentary view of a cap and bottle assembly.

FIGURE 6 is a cross sectional view of the piston device.

FIGURE 7 is a fragmentary cross sectional view of a suction control mechanism.

FIGURE 8 is a cross sectional view taken along the line 8-8 of FIGURE 7.

Referring to the drawings, wherein like numerals are used to designate similar parts throughout the several views, there is shown our body cavity evacuating apparatus consisting generally of a suction generating pump P, and accumulator receptacle A and a nozzle device N all of which are operatively connected together, as explained in detail hereinafter, to produce a portable, compact and most efficient apparatus for the purposes intended.

The suction pump P comprises a hollow cylinder 11 threaded at each end for receiving threadedly thereon a base B and a combination cap and holder C. The base B is provided with an outwardly flared side wall which supports an end wall 12 in spaced proximity of the surface upon which the pump P may be resting. The end wall 12 seals off the lower portion of the cylinder 11 and is provided with a plurality of exhaust ports 113 about which a valve seat 14 extends. Valve means which control the flow of air through the exhaust ports 113 consist of a valve head 15 adapted to be normally seated on the valve seat 14, a valve stem 16 secured to the head 15 and extending through a centrally disposed bore 13 to within the cylinder 11 with a coil spring 17 encircling the valve stem 16 to yieldingly maintain the valve head 15 in a normally seated position. The coil spring 17 extends between and exerts a force against the inner surface of the end wall 12 of the base B and a shoulder 18 formed in a conventional manner by force sliding a slotted disk or snap ring 18 in a groove formed about the circumference of the stem 16. To permit the escape of air to the atmosphere that has flowed past the valve 15, there is provided a plurality of openings 41 in the base side wall 19 of the base B.

The cap C which seals off the upper portion of the cylinder 11 is provided at the mid-portion with upwardly and downwardly extending sleeve portions 20 and 21 to form a bore 22 in which a piston rod 23 is slidably mounted. The lower portion of the depending sleeve 21 is threaded to receive a cap 24 thereon which secures a gasket 25 tightly about the piston rod 23 so that air will not leak therethrough. Adjacent to the sleeves 20 and 21 is a duct 26 formed in an upwardly extending neck portion 27 in communication with an enlarged duct 28 formed in a check valve body 29. The sloping side walls of the ducts 28 and 26 at their juncture form a valve seat 30 for a ball check valve 31 which is yieldingly maintained in a closed position by a coil spring 32 held in position against the ball check valve 31 by a plug 33 secured at the lower end of the valve body 29. The plug 33 is provided with a bore 34 to permit the flow of air from the duct 28 to the cylinder 11.

The upper end of the piston rod 23 has fitted thereon a capped portion 35 to permit the easy application of a downward force thereon in the manipulation of the pump P, while the lower end of the piston rod 23 is reduced in diameter as at 36 to form a shoulder 37 against which a

piston backing plate 38 abuts. The backing plate 38 is provided with a centrally disposed bore 39 through which the stem 36 extends and a plurality of ports 40. The ports 40 communicate with a circular channel or groove 43 formed in a piston 44. At the mid-portion of the piston 44 is a hub portion 45 which engages the backing plate 38 while clamped between the latter at the outer periphery of the piston 44 is a cup washer 46 which engages the inner wall of the cylinder 11. The cup washer 46 is provided with a centrally disposed bore 63. The piston 44 is provided with a plurality of ports 47 at the position of the groove or channel 43 for the free flow of air from that portion of the cylinder 11 which is above the piston 44 indicated by the numeral 48 to the chamber 49 which is below the piston 44. A sleeve 52 and nut 53 mounted on the stem 36 maintain the piston backing plate 38, piston 44 and cup washer 46 in position thereon. The sleeve 52 has a peripheral flange 54 at its lower end, which acts as a shoulder for a coil spring 55 whose other end engages a plate valve 56 which is slidably mounted on the sleeve 52. The sleeve 52 is provided with a stop or shoulder 57 to limit the downward sliding movement of the plate valve 56. The plate valve 56 is cup shaped, as shown best in FIGURE 3, to retain a resilient disc 58 for resting on the ports 47 of the piston 45 in order to seal same against upward passage of air when the piston is depressed to create suction. It is to be noted that the provision of the circular channel or groove 43 in the piston 44 permits the proper assembly of the piston backing plate 38, cup washer 46 and piston 44 without the necessity of aligning the ports 40 with the ports 47. Although there are shown three ports in the piston 44 and the backing plate 38, any number of such ports may be used.

A coil spring 59 is mounted within the chamber 49 of the cylinder 11. It extends between the end wall 12 of the base B and the piston 44 yieldingly urging the piston 44 to its upward position ready to be actuated. To secure the piston 44 and the piston rod 23 in their lowered or housed position, there is provided a wire latch 60 formed as shown best by FIGURE 5 and whose ends are received in bores formed in the sleeve portion 20 for swinging its rod engaging portion 61. The latter engages a groove 62 about the periphery of the piston rod 23 to prevent the rod 23 from sliding upwardly due to the upward force being exerted on the piston 44 by the coil spring 59.

Means are provided for supporting the accumulator receptacle A comprising a shelf portion 65 extending horizontally of the cap C. The shelf portion 65 is bifurcated as at 66 forming outwardly extending arms 67 and 68 both of which serve as a support for a bottle 69. The receptacle 69 may be such as a conventional bottle provided with a neck 70 which is slid into the slot 66 and with a peripheral lip 71 which is engaged by the arms 67 and 68 for supporting the bottle 69 adjacent to the cylinder 11. A retaining clip 72 constructed of a length of wire is pivoted at its ends in a bore 73 formed at the terminus of the arm 67. The terminus of the arm 68 is tapered as shown by FIGURE 5 to permit the clip 72 to slide into a pair of transverse slots 74 which engage the wire retaining clip 72. Upon spreading the leg portion of the clip 72 slightly, the clip 72 may be freed of the grooves or slots 74 and pivoted on the arm 67 away from the arm 68, thereby permitting the bottle 69 to be removed from the cap C and a new bottle replaced thereon.

A stopper 75 which is positioned in the neck 70 of the bottle 69 is provided with relatively short tubular members 76 and 77 which extend into the bottle 69, the tubular member 76 extending to a lower level therein than the tubular member 77 to prevent liquid and other matter which is being discharged into the bottle 69 by the tubular member 76 from being drawn across into the tubular

member 77 rather than being deposited and accumulated within the bottle 69.

A flexible tubing 78 is connected at one end to the upper end of the tubular member 77 and at its other end to the neck portion 27 of the duct 26 so that air may flow from the bottle 69 into the chamber 48 of the cylinder 11, but cannot flow in a reverse direction. A second flexible tubing 79 is connected to the upper end of the tubular member 76 which is bent as at 80 in a direction away from the pump P for convenience. The other end of the flexible tubing 79 is connected to the nozzle N which consists of a connector 81 that is threaded as at 82 for engaging the threaded portion 83 at the base of the body 84 of the nozzle N at the forward end of which is an opening 85. The nozzle connector 81 is provided with a duct 86 for the flow of fluid from the nozzle body 84 to the flexible tubing 79.

From the above description it is readily noted that the apparatus consisting of the pump P, accumulator A and nozzle device N forms a unitary and compact device. When the apparatus is being stored, or carried in a physician's bag, the piston rod 23 will be in its completely downward or housed position with the latch 60 engaged in the slot 62. The flexible tube 79 may be wound about the cylinder 11 and bottle 69.

When the apparatus is to be used for evacuating matter from body cavities, all that the physician or operator need do is swing the latch 60 outwardly away from piston rod 23 thereby releasing the latter. The coil spring 59 then causes the piston 44 and the piston rod 23 to slide upwardly until the backing plate 38 abuts against the cap 24. The air that had been in the chamber 48 of the cylinder 11 flowed through the ports 40 in the backing plate 38, into the channel 43, through the ports 47 past the plate valve 56 and into the chamber 49. The valve 15 remains in its closed position due to the coil spring 17.

Now, with one hand the operator takes the nozzle N and places it in that portion of a person's body where matter has accumulated and is to be withdrawn therefrom. With his other hand he pushes downwardly on the handle 35 forcing the piston 44 to slide downwardly to the lower portion of the cylinder 11. The coil spring 55 and the suction being created in chamber 48 cause the plate valve 56 to remain closed shutting off any flow of air between the chambers 48 and 49. The compressive force imparted to the air in the chamber 49 causes the check valve 15 to open against the pressure of the coil spring 17 to permit air in the chamber 49 to flow out to the atmosphere through exhaust ports 113 and the openings 41 in the base B.

The partial vacuum created in the chamber 48 forces the ball valve 31 to move in a direction away from the seat 30 against the coil spring 32 to effect the flow of air from the receptacle 69 through the duct 77, flexible tubing 78, past the ball valve 31 and into the chamber 48 of the cylinder 11. The partial vacuum now created within the accumulator A causes a suctioning of matter through the opening 85 of the nozzle tip 84, connector duct 86, flexible tubing 79, tube 76 and receptacle 69 where the matter is deposited and accumulated. The operator continues to stroke downwardly at regular intervals on the piston rod 23. Although the suction effect is created by the periodic downward stroking of the piston 44, this suction effect becomes continuous and non-pulsating by the volume of air contained in the accumulator A and a metering effect obtained by providing a relatively small or restricting bore in the tube 76.

When the receptacle 69 has become approximately filled, the operator will cease operating the pump P, disconnect the flexible tubing 78 and 79 from the tubes 76 and 77, then swing the wire retaining clip 72 out of the grooves 74 and away from the arm 68. The receptacle 69 is then removed from its position on the slot 66 and now cleaned and sterilized or a fresh receptacle similar

5

to that receptacle 69 just removed is now replaced on the arms 67 and 68. The wire retaining clip 72 is swung back to its locked position on the arm 68 and the flexible tubing 78 and 79 reconnected to the upper ends of the tubes 76 and 77. The apparatus is now ready for further use as an evacuation device. If any moisture or liquid should form in the lower chamber 49 of the cylinder 11, it will be ejected together with the air through the check valve 15 upon the downward stroke of the piston rod 23. Upon the piston 44 reaching the end of its downstroke and commencing to slide upwardly in the cylinder 11, the coil spring 17 and suction force will urge the valve 15 to its closed position thereby preventing the inflow of any dust, grit, etc. Instead, as explained hereinbefore, the plate valve 56 will open and the air in the upper chamber 48 will flow into the lower chamber 49.

The device, constituted as thus far disclosed and described, is primarily designed for operation by a physician, ambulance attendant, or other reasonably well trained operator, for in the operation of this device too much suction force could tend to draw in the tissue of the walls of the body cavity being evacuated. In use by the trained operator the proper suction may be generated and maintained by the manual pressure exerted on the plunger cap 35. However, since in some instances it may be necessary for a novice to operate this device, it is then advisable to provide auxiliary means to automatically restrict the suction force effected at the cavity instrument tip. Such means is illustrated in FIGURES 7 and 8. The only change to be made in the device shown and described hereinabove is the removal of the tubular member 76 from its position in the stopper 75 and replacing it with a tubular member 90 which has mounted thereon a valve casing 91 provided with a valve chamber 92 which communicates with the tubular member 90. A second tubular member 97 is mounted on the casing 91 and communicates with the chamber 92. An adjusting screw 94 is threadedly received at one end of the casing 91. The flexible tubing 79 is connected to the tubular member 97 so that matter being drawn through the nozzle N and the flexible tubing 79 will flow through the chamber 92 of the valve casing 91, through the tubing 90 and into the receptacle 60 where it is accumulated.

Means are provided for limiting suction to the maximum desired suction pressure at the nozzle tip 85 comprising a ball valve 95 seated on the inner portion of a port 93 for controlling the flow of air from the atmosphere into the chamber 92. A coil spring 96 which extends between the ball valve 95 and the adjusting screw 94 yieldingly retains the ball valve 95 on the seat of the port 93. The amount of spring pressure on the coil spring 96 may be varied as desired upon rotation of the screw 94. By turning the screw 94 to move it inwardly, the spring pressure 96 is increased and the maximum suction pressure which may be generated in the system will be increased. To decrease the maximum suction pressure to a certain desired degree, the screw 94 is turned to move it outwardly in a direction away from the ball valve 95, so as to reduce the force exerted by the coil spring 96 on the ball valve 95. Now when the suction pressure being generated by the pump P at the accumulator A is greater than that desired at the nozzle N and for which the valve device 95, 96 and 94 has been set, the ball valve 95 will become unseated to permit atmospheric air to infiltrate past the ball valve 95 and into the chamber 92 to reduce the suction pressure therein. At the moment the suction pressure has been reduced to the prescribed degree, the ball valve 95 will become seated by virtue of the pressure of the coil spring 96. The intermittent opening and closing of the ball valve 95 will not interfere with the flow of matter being suctioned into the accumulator 69 as the suction pressure is maintained at a constant desired level or degree.

What we claim as new and desire to secure by Letters Patent of the United States is:

6

1. A suction pump for evacuating body cavities comprising a substantially vertically disposed cylindrical body member, a closure cap mounted on the top portion of said cylindrical body member, said closure cap having a centrally disposed bore and a second bore, a piston rod slidably mounted in said centrally disposed bore, check valve means mounted in said second bore, said check valve means comprising a valve seat, a ball valve, a coil spring yieldingly urging said ball valve onto said valve seat and securing means for said coil spring, said piston rod having a peripheral shoulder adjacent its lower end within said cylindrical member, a backing plate mounted on said piston rod in abutting relation with said peripheral shoulder, said backing plate having a plurality of bores, a valve body having a hub portion in contact relation with said backing plate, a peripheral portion in spaced relation to said backing plate, a cup washer mounted between said backing plate and said valve body, said valve body having a substantially circular channel portion connecting said hub portion and said peripheral portion and communicating with said bores in said backing plate, a plurality of vents in said channel portion, a valve plate, spring means urging said valve plate into contact relation with said valve body for closing said vents, a base closure member mounted at the bottom portion of said cylindrical body member, said base closure member comprising a substantially cup-shaped body portion extending across said cylindrical member, said body portion having a substantially centrally disposed bore and an exhaust port, an outwardly extending and downwardly flared side wall for supporting said body portion in a plane above the bottom portion of said side wall, a valve stem slidably mounted in said bore, a valve head mounted on said valve stem and normally in contact relation with the lower surface of said body portion for closing said exhaust port, a coil spring mounted on said valve stem extending upwardly of the upper surface of said body portion and yieldingly urging said valve head to its closed position, said side wall having a plurality of openings for the discharge of air to the atmosphere, said closure cap means having a pair of spaced apart arm portions, a receptacle having a neck portion insertably mounted between said arm portions and supported by a flared lip portion, a spring clip pivotally mounted on one of said arm portions, the other of said arm portions having means for engaging said spring clip and securing said receptacle on said closure cap means, duct means connecting said receptacle and second bore in said closure cap means, nozzle means and a flexible conduit connecting said receptacle and said nozzle means for evacuating a body cavity, said piston rod having an annular groove at its upper portion, pivoted latch means mounted on said closure cap engaging said annular groove for securing said piston rod at its lower position on said cylindrical body member.

2. The structure defined in claim 1 wherein said nozzle means comprises a substantially cylindrical wall portion open at one end and having an arcuate end wall at the other end, said arcuate end wall having a port, a threaded portion formed at the inner surface of said cylindrical wall portion at said open end, a connector threadedly retained on said threaded portion, said connector having a bore for communicating with said cylindrical wall portion and a stem portion extending outwardly of said cylindrical wall portion for connecting said nozzle.

3. A closure cap for a body evacuating pump comprising a substantially cup shaped body portion, said body portion having oppositely extending sleeves forming a centrally disposed bore for receiving a piston rod, said body portion having a second bore, a valve seat mounted on the lower surface of said body portion about said second bore, a ball valve, a coil spring urging said ball valve in contact relation with said valve seat, means retaining and supporting said coil spring, an upwardly extending nipple disposed on the upper surface of said body portion about said second bore, a pair of spaced apart arm

portions extending substantially horizontally of said body portion for supporting a receptacle, a spring clip pivotally mounted on one of said arm portions, the other of said arm portions having a pair of grooves adjacent the free end for engaging said spring clip when pivoted to its closed position, and a latch mounted on one of said sleeves for securing said piston rod in a depressed position.

4. A combination piston and valve for a pump comprising a rod having a peripheral shoulder adjacent one end, a backing plate mounted on said rod abutting against said shoulder, said backing plate having a plurality of bores, a valve body having a hub portion in contact relation with said backing plate and a peripheral portion in spaced relation to said backing plate, a cup washer mounted between said backing plate and said valve body, said valve body having a substantially circular channel portion connecting said hub portion and said peripheral portion and communicating with said bores in said backing plate, a plurality of vents in said channel portion, a sleeve mounted on said rod, a valve plate slidably mounted

on said sleeve, said sleeve having a shoulder for limiting the sliding movement of said valve plate in a direction away from said valve body, a coil spring mounted about said sleeve for yieldingly urging said valve plate into contact with said valve body for closing said vents and a nut threadedly mounted on said rod for securing said sleeve.

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