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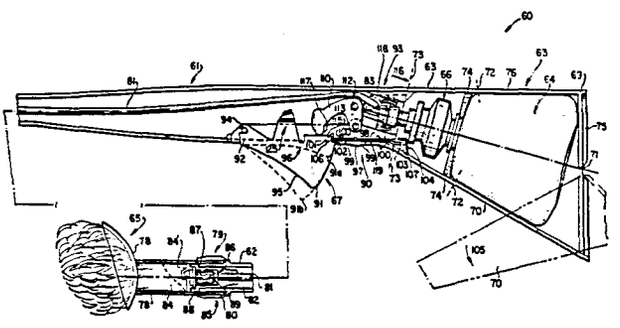
(54) Cleaning system having collapsible cartridge.

(57) A cleaning system utilizing a hollow bodied, disposable dispensing package comprising a storage chamber and integral dispensing chamber. The package is connected to the system handle via a conical protrusion on the package closure. An orifice separating the two chambers is provided with a movable, inlet clapper valve, the dispensing chamber outlet orifice being normally closed by a spring urged valve. Deformation of the elastic walls of the bellows shaped dispensing chamber dispenses a discrete amount of liquid to the system handle without relying on gravity. Compression of the dispensing chamber reduces the volume thereof, closes the inlet clapper valve, and opens the outlet valve to dispense the product. The conically shaped storage chamber provides for ready pumping and evacuation of cleaning fluid therefrom, the flexible walls collapsing inward as a result of the vacuum created by the decompression of the dispensing chamber. A stiffened side wall in the form of a label or longitudinal ribs further controls the collapse of the storage chamber.



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BACKGROUND OF THE INVENTION

The invention relates to a cleaning system having a collapsible fluid cartridge, particularly for use in cleaning bathrooms and bathroom plumbing fixtures.

Typically bathroom fixtures, such as conventional commodes, or water closets, found in the home, or wall-mounted urinals found in such places as commercial building bathrooms, are cleaned with a short handled brush or sponge and a conventional scouring powder contained in a can or with a liquid cleaner which is poured or sprayed from a bottle. Suffice to state that cleaning such plumbing fixtures with the foregoing described brush is an arduous and awkward task.

While numerous bathroom fixture cleaning devices have been developed to eliminate the hygiene and safety problems associated with the use of concentrated cleaning solutions and powders, there has been no cleaning device or system particularly adapted for cleaning bathroom plumbing fixtures which is simple and economical to manufacture, safe to operate and use, and prevents muscle strain to the operator of the system.

SUMMARY OF THE INVENTION

The present invention includes an elongate handle having first and second ends and a cleaning fluid cartridge adapted to contain a cleaning fluid; the handle includes a surface cleaning member disposed at the first end, the cleaning fluid cartridge being disposed at the second end, a mechanism for pumping the cleaning fluid from the fluid cartridge to the surface cleaning member, said pump mechanism being associated wtih the cleaning fluid cartridge, and a pump actuation

member associated with the pump mechanism and the handle. The cleaning fluid cartridge of the invention may be removably attached to the handle. The surface cleaning member may be a mop head disposed on the first end of the handle, the mop head including a fluid passageway to allow the cleaning fluid to be pumped through, and outwardly of, the mop head to a surface to be cleaned. The handle includes a portion for supporting the fluid cartridge, including a housing associated with the handle and the housing has a movable door allowing access to the interior of the housing. A safety switch is associated with the handle, which has a first loading position wherein a pump actuation member is not operable and the housing door is movable to allow the cleaning fluid cartridge to be inserted within the housing; a second locked position wherein the pump actuation member is not operable and the housing door is not movable; and a third operating position wherein the pump actuation member is operable and the housing door is not movable.

The pump member comprises a pump chamber defined by an upper wall and a flexible side wall interconnecting the upper wall to the cleaning fluid cartridge, with a fluid passageway having first and second ends passing through the pump chamber in fluid communication between the cleaning fluid cartridge and the handle, whereby upon movement of the pump actuation member, cleaning fluid is pumped from the cleaning fluid cartridge into the handle. The pump comprises a pump chamber defined by upper and lower end walls and a flexible side wall interconnecting the upper and lower end walls, wherein a fluid passageway having first and

second ends passes through the pump chamber in fluid communication between the cleaning fluid cartridge and the handle, whereby upon movement of the pump actuaion member, cleaning fluid is pumped from the cleaning fluid cartridge into the handle. The foregoing upper and lower end walls of the pump chamber each comprise an annular disk having an outer diameter and an inner diameter; each annular disk having a truncated cone configuration wherein one disk tapers upwardly and one disk tapers downwardly at an acute angle from the outer diameter to the inner diameter.

The cleaning system further includes a means for maintaining pumping of cleaning fluid from the cleaning fluid cartridge after activation of the pump actuation member. The means for maintaining pumping includes a flexible and expandable pump chamber, which is expanded upon operation of the pump actuation member, and a biased support structure cooperating with the pump chamber, which structure is biased against the force exerted upon the pump chamber by the pump actuation member, whereby after the pump actuation member has expanded the pump chamber and applied a force thereto, the biased support structure exerts a force upon the pump chamber to maintain the pumping of cleaning fluid from the cleaning fluid cartridge.

The present invention thus provides a cleaning system utilizing a hollow bodied, disposable dispensing capsule or package comprising a storage chamber and dispensing chamber in a one piece, hollow, blow molded container made of an elastic, resilient, synthetic plastic material. The package is connected to the

system handle via a conical protrusion on the package closure. An orifice separating the two chambers is provided with a movable, inlet clapper valve, the dispensing chamber outlet orifice being normally closed by a spring urged valve. Deformation of the elastic walls of the bellows shaped dispensing chamber dispenses a discrete amount of liquid to the system handle without relying on gravity. Compression of the dispensing chamber reduces the volume thereof, closes the inlet clapper valve, and opens the outlet valve to dispense the product. The conically shaped storage chamber provides for ready pumping and evacuation of cleaning fluid therefrom, the flexible walls collapsing inward as a result of the vacuum created by the decompression of the dispensing chamber. A stiffened side wall in the form of a label or longitudinal ribs further controls the collapse of the storage chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A and 1B present a partial cross-sectional view of a cleaning system in accordance with the present invention.

FIG. 2 is a cross-sectional view of a cleaning fluid cartridge of the present invention.

FIGS. 2A and 2B are cross-sectional views of the cleaning fluid capsule illustrating fluid flow through the cartridge, valves, and pump.

FIG. 3 is a partial front view of a portion of the cleaning system of the present invention taken along lines 3-3 of FIG. 4.

FIG. 4 is a side view of the end cap member

utilized in the present invention.

FIGS. 5-A, 5-B, and 5-C are partial cross-sectional views illustrating the sequential operation of the pump of the present invention.

FIG. 6 is a plan view of a fluid capsule illustrating a side wall thereof having a stiffening member thereon.

FIG. 7 is a perspective view of a fluid capsule illustrating a side wall thereof incorporating an alternate stiffening member.

FIG. 8 is a perspective cut away view illustrating an alternate means of controlling capsule collapse.

FIGS. 9-10 is a sequential view illustrating controlled collapse of a fluid capsule.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIGS. 1-A and 1-B, a cleaning system 60 is shown to generally comprise an elongate handle 61 having first and second ends, 62 and 63, and a cleaning fluid cartridge 64 disposed at the second end 63 and adapted to contain a cleaning fluid. Handle 61 includes a surface cleaning member 65 disposed at the first end 62 of handle 61. Handle 61 further includes a mechanism for pumping 66 the cleaning fluid from the cleaning fluid cartridge 64 to the surface cleaning member 65; and the pump 66 is associated with the cleaning fluid cartridge 64. Further, handle 61 includes a pump actuation member 67 associated with the pump 66 and handle 61.

Still with reference to FIGS. 1-A and 1-B, the cleaning fluid cartridge 64 is removably attached to

handle 61. Handle 61 includes structure for supporting the fluid cartridge 64, which includes a housing 69 associated with handle 61. Housing 69 has a movable door 70 which allows access to the interior of housing 69. Door 70 is illustrated in FIG. 1-A in its closed position in solid lines, and is illustrated in its open position as illustrated by the dotted lines. Door 70 may be hingedly attached to housing 69 as at pivot or hinge point 71, in any suitable manner. Handle 61 could terminate at the point shown in FIG. 1-A by dotted lines 72, whereby the fluid cartridge 64, including pump 66, could be removably attached to the handle 61 and supported by the handle 61 and cleaning fluid cartridge 64 would be exposed. Preferably support structure 68 would then comprise the portion of handle 61 disposed between dotted lines 72 and 73, including support walls 74. In order to provide for greater support of the cleaning fluid cartridge 64 and to protect it from damage, support structure 68 is comprised of housing 69 which extends from the bottom 74 of housing 69 to the handle 61 at dotted lines 73, and the upper wall 76 of housing 69 is formed integral with handle 61. Handle 61, housing 69, pump actuation member 67, and/or door 70 are all formed of a suitable plastic material having the requisite strength and corrosion resistant characteristics to withstand the forces exerted upon the cleaning system 60 when used, as well as withstand contact with the cleaning fluid (not shown) utilized in cleaning fluid cartridge 64. In this regard, any suitable cleaning fluid could be utilized; however, in the case of cleaning bathroom fixtures, it would be desirable to utilize an acid

solution as the cleaning fluid.

Still with reference to FIGS. 1-A and 1-B, surface cleaning member 65 may comprise a mop head 77 disposed on the first end 62 of handle 61. Mop head 77 could be of any configuration, and made of any material having the requisite properties for rubbing, or scrubbing, against a surface to be cleaned, and having the requisite corrosion resistance properties against deterioration from contact with the cleaning fluid utilized in the cleaning system 60. Alternatively, a suitable brush could be substituted for mop head 77. It should be understood that the term mop head 77 or surface cleaning member 65 encompasses any structure suitable for scrubbing, or rubbing, against a surface to be cleaned. Mop head 77 can be provided wtih a backing structure 78 which may be permanently or removably affixed to the first end 62 of handle 61 as by a press-fit or snap connection as shown at 79, via an annular ring 80 which presses backing structure 78 about the first end 62 of handle 61.

Still with reference to FIGS. 1-A and 1-B, it is seen that handle 61 includes a first fluid passageway 81, having first and second ends 82, 83 in fluid communication between the cleaning fluid cartridge 64 and the first end 62 of handle 61. Fluid passageway 81 may be comprised of a length of tubing of any suitable material compatible with the cleaning fluid. Upon operation of pump actuator 67, cleaning fluid is pumped from cleaning fluid cartridge 64 via pump 66 into the first fluid passageway 81. Mop head 77, including its backing structure 78, may be provided with a second

fluid passageway 84, or as shown in dotted lines 84'. Fluid passageways 84 and 84' are in fluid communication with the first fluid passageway 81, whereby cleaning fluid may be pumped through the mop head 77 via second fluid passageway 84 and out of mop head 77. Alternatively, the cleaning fluid may be pumped from first fluid passageway 81 into the second fluid passageway 84' and pumped outwardly thereof to the surface (not shown) which is desired to be cleaned.

With reference to FIG. 1-B, it is seen that a safety 85 for preventing cleaning fluid from draining from the first fluid passageway 81 is associated with the first end 62 of handle 61. Safety 85 comprises a safety check valve 86 disposed proximate the first end 62 of handle 61. Safety check valve 86 may be biased into a first position, as shown in FIG. 1-B to seal the first end 82 of the first fluid passageway 81, which is adjacent the safety check valve 86, in which position the safety check valve 86 prevents transmission of cleaning fluid outwardly of handle 61. Safety check valve 86 further prevents cleaning fluid from draining outwardly of the second end 83 of the first fluid passageway 81, which is disposed proximate the second end 63 of handle 61. Thus, were cleaning fluid cartridge 64 to be removed from handle 61, the sealing of the first end 82 of fluid passageway 81, in conjunction with surface tension and/or capillary action associated with the cleaning fluid disposed in first fluid passageway 81, would prevent the cleaning fluid from draining from the second end 83 of the first fluid passageway. It should be noted that safety check valve 86 is preferably spring loaded. A plastic

helical spring 87 may bias a sealing disk 88, via shaft member 89 affixed to sealing disk 88, against the first end 62 of handle 61. The safety check valve 86 is movable to a second open position to allow cleaning fluid to be pumped outwardly of the safety check valve 86 upon the cleaning fluid being pumped through the first fluid passageway 81. Thus, upon the fluid pressure of the cleaning fluid disposed within first fluid passageway 81 exceeding the biasing force of the spring 87 of safety check valve 86, sealing disk 88 moves in a direction toward the mop head 77 to allow the cleaning fluid to pass into either second fluid passageway 84 or 84'. FIG. 1-B shows disk 88 in its forward position.

With reference to FIG. 1-A, it is seen that handle 61 may be provided with a safety switch 90, which has a first locked position wherein the pump actuator 67 is not operable and a second operating position wherein the pump actuator 67 may be operated. In this regard, pump actuator 67 may comprise a movable member, or trigger member 91 disposed within a slotted opening 92 in handle 61, which is operatively engageable with pump 66 to exert a force upon pump 66. Preferably, trigger member 91 is operatively engageable with the pump 66 via a movable linkage 93 to exert such force upon the pump 66. Trigger member 91 may be pivoted about pivot point 94 disposed within handle 61, and may have a curved lower surface 95 which may be engaged by a human operator grasping handle 61 with at least one finger against surface 95, whereby trigger member 91 may be depressed and pivoted about pivot point 94 in the direction shown by arrow 96.

Still with reference to FIG. 1-A, it is seen that safety switch 90 may include a button member 97 affixed to an elongate engagement member 98. Button member 97 is disposed within a slot 99 formed in handle 61, and is retained within slot 99 in any suitable manner, such as by pins 100 which engage the underside of elongate engagement member 98 to secure engagement member 98 between pins 100 and the interior of housing 61. Safety switch 90 may further have a first loading position wherein the pump actuator 67 is not operable and the housing door is movable to allow the cleaning fluid cartridge 64 to be inserted within the housing, upon door 70 being opened. A second locked position is provided by safety switch 90 wherein the pump actuator 67 is not operable and the housing door 70 is not movable. Further, safety switch 90 may be provided with a third operating position wherein the pump actuator 67 is operable and the housing door 70 is not movable, whereby trigger member 91 may be depressed, but door 70 may not be opened while cleaning system 60 is being utilized with trigger member 91 being depressed. As shown in FIG. 1-A in solid lines, the elongate engagement member 98 of safety switch 90 is shown disposed in the second locked position wherein the pump actuator 67 and trigger member 91 are not operable and the housing door is not movable. This second locked position corresponds to switch 97 being disposed within the center of slot 99 as illustrated in FIG. 1-A. It should be noted that end 101 of elongate engagement member 98 is disposed over a notch 102 formed in trigger member 91, whereby upon exerting a force on trigger member 91 in the direction shown by

arrow 96, notch 102 would abut against end 101 of elongate engagement member 98. The movement of elongate engagement member 98 into the first loading position would cause end 103 of elongate engagement member 98 to move away from stop 104, whereby the door 70 could be swung open to allow a cleaning fluid cartridge 64 to either be unloaded from housing 69, or to allow a new cleaning fluid cartridge 64 to be inserted within housing 69.

When the button 97 of safety switch 90 is moved to its furthermost position within slot 99 toward the housing 69, the end 101 of elongate engagement member 98 would not abut against notch 102 in trigger 91, whereby trigger 91 could be depressed. In this operating position, end 103 of elongate engagement member 98 would be in a complete abutting relationship with stop 104 as shown by dotted lines 107. Thus, while cleaning system 61 is utilized and trigger 91 is being depressed, an operator would not be able to gain access to the interior of housing 69.

The advantages of having a safety switch 90, such as the three position slide switch of button 97 and elongate engagement member 98, provides important safety factors, particularly when the cleaning fluid utilized in cleaning fluid cartridge 64 is an acid type solution. When an operator is either loading or unloading a cleaning fluid cartridge 64, the pump 66 cannot be actuated in that movement of trigger 91 is restrained, thus preventing accidental discharge of cleaning fluid. When cleaning system 61 has the safety switch 90 disposed in the second locked position, an

operator may safely carry the cleaning system 61 and accidental movement of trigger member 91 is precluded. Accidental opening of door 70 is likewise prevented, which could result in the cleaning fluid cartridge 64 falling from housing 69 and possibly splashing on the floor or the operator. Cleaning fluid can only be pumped from the cleaning system 60 when the safety switch 90 is disposed in the third operating position, at which time accidental opening of door 70 and movement of cleaning fluid cartridge 64 from housing 69 are precluded.

Trigger 91 has a first operating position wherein a force sufficient to actuate pump 66 is generated and transmitted to the pump 66, shown as dashed lines 91a; a second non-operating position wherein a pre-load force not sufficient to actuate pump 66 is generated and transmitted to the pump means 66; and a third non-operating position wherein the pre-load force is relieved to allow a cleaning fluid cartridge to be disposed at the second end of handle 61, shown as dashed lines 91b. The first operating position of trigger 91 corresponds to when trigger 91 has been depressed in the direction shown by arrow 96 whereby movable linkage 93 has exerted a force upon pump 66. Movable linkage 93 may comprise a pivotable swing arm 110 and an end cap 111 (as seen in FIGS. 3 and 4). Swing arm 110 and end cap 111 have a common pivot point, or shaft 112, and swing arm 110 is in turn pivoted about shaft 113 associated with housing 61. Swing arm 110 has a camming surface 114 which is in sliding engagement with surfaces 115 of trigger 91. By movement of trigger 91 in the direction shown by arrow

96, camming surface 114 slides on surfaces 115 and swing arm 110 pivots about shaft 113. This in turn causes movement of end cap member 111 in the direction shown by arrow 116 as end cap 111 pivots about shaft 113. As the trigger 91 is depressed, tip 117 of camming surface 114 of swing arm 110 will engage notch 102 in trigger member 91 and thus will reach the end of its travel. Swing arm 110 is comprised of two spaced plate members having the configuration shown in FIG. 1-A, whereby first fluid passageway 81 may pass through the space between the two plate members and not interfere with the movement of swing arm 110.

As shown in FIGS. 3-4, the interior of handle 61 may be provided with two sets of spaced tracks 118, 119, the tracks 118 and 119 appearing in dotted lines in FIG. 3. The movement of end cap member 111 in the direction shown by arrow 116 is thus obtained by the sliding engagement of a plurality of guide members 120 mounted on end cap member 111, being restrained by the tracks 118 and end cap 111 riding along or on track 119. End cap 111 may further be provided with a nozzle receiving cavity and pressure transmitter 121 which engages the pump 66 of cleaning fluid cartridge 64 as will be further described. End cap 111 further includes a receiver 122 for receiving the second end 83 of the first fluid passageway 81. Receiver 122 has an annular shaped cavity in which the second end 83 of tubing 81 is fixedly secured, and the annular shaped cavity 123 is in fluid communication with the nozzle receiving cavity 121 as by a passageway 124.

It should be noted that trigger member 91 (FIG.

1-A) is illustated in the second non-operating position wherein a pre-load force not sufficient to actuate the pump 66 is generated and transmitted to the pump 66 via movable linkage 93. Trigger member 91 is provided for releasably maintaining the trigger member 91 in the second non-operating position. The means for releasably maintaining trigger member 91 in this position comprises two spaced, flexible arms 126 each having an outwardly extending lip 127 which extends outwardly and overlies a rail 128. Lips 127 may each have a bevelled surface 127A underneath. Two spaced rail members 128 are provided, and they may be integral extensions of the tracks 119. Upon abutment of lip 127 with the rail 128, downward movement of trigger 91 is selectively precluded. However, when lip 127 engages and abuts against rail 128, trigger 91 is still causing movement of end cap member 111 to a limited degree via the abutment of cam surface 114 of swing arm 110 against surface 115 of trigger 91. This force, or pre-load force, resulting from the movement of end cap 111 against pump 66 is not enough force to actuate the pump 66, but assists the trigger 91 to reassume its second non-operating position after the actuation of pump 66. When trigger 91 has reached the limit of its upward travel in the direction shown by arrow 96, trigger 91 is in its first operating position.

Upon grasping trigger 91 and pulling it downwardly with a sufficient force, the flexible arms 126 are forced inwardly by the sliding engagement of bevelled surfaces 127A of lip 127 against the tops of rails 128. Releasable maintaining member 129, for maintaining the trigger member 91 in its third

non-operating position, comprises a pair of spaced arm members 130 having outwardly engageable lip members 131 which abut against rails 128 to prevent trigger 91 from being pulled completely downwardly out of handle 61. When trigger 91 has been pulled downwardly until lip members 131 engage rails 128, the camming surface 114 of swing arm 110 likewise moves downwardly and causes longitudinal movement of end cap 111 away from pump 66 to thus allow either a cleaning fluid cartridge 64, including pump 66, to be inserted or removed from housing 69. After a new cleaning fluid cartridge 64 has been inserted within housing 69, trigger 91 is pushed upwardly in the direction shown by arrow 96 until arm members 126 spring outwardly whereby lip members 127 once again engage rails 128. Further upward movement of trigger 91 is precluded by the abutment of notch 102 of trigger 91 against the elongate engagement member. It should be noted that pump actuator 67, including linkage 93 and safety switch 90, could be manufactured as a single unit and then press-fitted into handle 61.

Turning now to FIG. 2, FIG. 2A, and FIG. 2B, pump 66 may comprise a pump chamber 135 defined by an upper wall 136 and a flexible side wall 137 interconnecting the upper wall 136 to the cleaning fluid cartridge 64. A fluid passageway 138 having first and second ends 139, 140 passes through the pump chamber 135 in fluid communication between the cleaning fluid cartridge 64 and to the handle 61, or nozzle receiving cavity 121 of end cap 111 (as shown in FIG. 1-A). Upon movement of the pump actuator or trigger 91, cleaning fluid is pumped from the cleaning fluid cartridge 64

into the handle 61. Pump chamber 135 further includes a lower end wall 141, with flexible side wall 137 disposed between upper and lower walls 136, 141. It should be noted that if lower end wall 141 is not utilized, flexible side wall 137 could be extended, as shown by dotted lines 142 in FIG. 2, to connect to the fluid cartridge 64. Pump 66 further comprises a stiff flange 66a to connect nozzle 160 thereto and a stiff support flange or pump support 66b.

The upper and lower end walls 136, 141 of pump chamber 135 each comprise an annular disk 143 having an outer diameter 144 and an inner diameter 145. Each annular disk 143 is in a configuration generally described as a truncated cone, wherein each disk 143 tapers upwardly or downwardly at an acute angle from the outer diameter 144 to the inner diameter 145. The angle θ falls within a range of from 10° to 35°, with angle s15° to 28° being particularly preferred. The outer diameter of each annular disk 143 is joined to the flexible side wall 137 and, as shown in FIG. 2, the inner diameter 145 of one of the annular disks 143 is joined to the cleaning fluid cartridge 64. If the pump chamber is only comprised of the upper wall 136 and the flexible side wall 137, the outer diameter 144 of upper wall 136 is joined to flexible side wall 137, and the lower end of flexible side wall 137 is joined to the cleaning fluid cartridge 64. Pump 66 is thus a unique type of bellows comprising two Belville washers (143) and an integral connecting band (137).

Further, as shown in FIG. 2, FIG. 2A, and FIG. 2B, valve 146, 147 are disposed in the inner diameter of

each annular disk 143, within passages 139 and 140, respectively, and preferably each valve 146, 147 comprises a check valve. Valve means 146 is a spring-biased check valve 148, having a sealing member, or sealing disk, 149 biased downwardly toward pump chamber 135, as by a spring member 150 having an integral flange member 150a connected in a snap fit to a shoulder of nozzle 160. Spring member 150 exerts a biasing force upon a shaft 151 integral with the sealing disk 149 due to the engagement of spring 150 within groove 151a of shaft 151, as illustrated in FIGS. 2A and 2B, and shaft 151 may also be secured to the end of the spring 150 as at 152, as shown in FIG. 2. This valve 146 is similar in construction to the safety check valve 86 described in connection with FIG. 1-B. Check valve 147 may be a clapper check valve 153 which is freely movable within the inner diameter 145 of the annular disk 143 of lower end wall 141. Clapper check valve 153 may have a plurality of wedge members 154 disposed about its outer surface which prevent clapper check valve 153 from passing upwardly into pump chamber 135. Clapper check valve 153 is also provided with a tapered sealing surface 155 disposed about its outer upper circumference, in that clapper check valve 153 has a generally circular cross-sectional configuration when viewed from the top of the pump chamber 135. Sealing surface 155 also serves to prevent clapper check valve 153 from falling into cleaning fluid cartridge means 64. The travel of valve 153 within diameter 145 is thus limited to a distance "D", as illustrated in FIG. 2A.

It should be noted that if lower end wall 141 were

not to be utilized as previously described, an equivalent chamber as shown in FIG. 2 formed by the inner diameter 145 of lower end wall 141 would be provided to cleaning fluid cartridge 64 in order for clapper valve 153 to proper operate. It should also be noted that different types of check valves could be utillized for valve 146, 147 as long as the desired sealing effect is provided for the pump chamber 135. Pump 66 and its pump chamber 135 are integrally formed with cleaning fluid cartridge 64; however, it should be apparent to one of ordinary skill in the art that a connection, such as a threaded connection, could be provided between pump chamber 135 and cleaning fluid cartridge 64 to enable the pump 66, or pump chamber 135, to be removably secured to the cleaning fluid cartridge 64.

Pump 66 is further provided with a nozzle 160. Nozzle 160 mates with the nozzle receiving cavity 121 of end cap 111. When the pump 66 is formed as an integral component with the cleaning fluid cartridge 64, nozzle 160 may be provided with a closure tip 161 which is removably mounted to nozzle 160 as by a frangible connection at 162, whereby closure tip 161 remains on the pump 66 and cleaning fluid cartridge 64 while it is being stored. When it is desired to insert the cleaning fluid cartridge 64 and pump 66 into the cleaning system 60, the closure tip 161 is removed from nozzle 160. All of the components of the cleaning fluid cartridge 64 and pump 66 are manufactured of a suitable plastic material; however, valve 146, 147 could also be manufactured of a suitable corrosion-resistant metallic material. In the

preferred embodiment, however, spring 150 is plastic to eliminate deterioration of a metal spring caused by the acidic cleaning solution. Plastic coil spring check valve 146 is thus able to function in an eighteen percent (18%) hydrochloric acid (HCL) solution without deterioration or significant creep.

With reference to FIG. 2, FIG. 2A, and FIG. 2B, when check valve 146 is in its open position, as illustrated in FIG. 2A, cleaning fluid from within pump chamber 135 may pass throug the fluid passageway 138 from cleaning fluid cartridge 64 and into nozzle 160, and then into first fluid passageway 81 disposed within handle 61.

The inner diameter 145 of one annular disk 143 is larger than the inner diameter 145 of the other annular disk 143. The inner diameter 145 of the annular disk 143 which is joined to the cleaning fluid cartridge 64 is smaller than the inner diameter of the annular disk 143 which forms upper end wall 136. If cleaning system 60 is provided with the safety check valve 86 at the first end 62 of handle 61, it is possible to delete check valve 146 disposed in the upper end of pump chamber 135 in that its sealing action is provided by the safety check valve 86, as will be apparent from the description of the operation of pump 66.

As shown in FIG. 2, cleaning fluid cartridge 64 is preferably a flexible plastic bottle 165 having a plurality of wall surfaces 166-169 having varying wall thicknesses. For example, wall 166 is thicker than the upper portion of wall 167, whose thickness becomes thinner as wall 167 approaches the intersection between

wall 167 and 168. Wall 168 is thinner at its intersection with the lower end of wall 167, and in turn becomes thicker as it approaches its intersection with lower wall 169. Further, wall 169 is thicker than wall 168 and the lower portion of wall 167. It has been found that by varying the wall thicknesses of the walls associated with cleaning fluid cartridge 64, when cleaning fluid cartridge 64 is a flexible bottle, satisfactory evacuation of the cleaning fluid contained within bottle 165 is obtained upon successive actuations of pump 66, in that the various wall surfaces of bottle 165 collapse upon one another due to the pumping out of cleaning fluid from bottle 165 from the suction force created by pump 66. Bottle 165 generally has the configuration substantially that of a truncated cone. Alternatively, cleaning fluid cartridge 64 could be a flexible plastic bag or film pouch which is formed integral with pump 66, or is secured thereto in any suitable manner, such as by an ultra sonic seal. Further, due to the collapsing of the walls of cleaning fluid cartridge 64, it should be noted that the pump 66 will pump fluid when the handle is disposed in any angular orientation, in that the operation of pump 66 does not rely upon gravity forces for successful operation.

With reference now to FIGS. 2, 2A, 2B, and 5-A, 5-B, 5-C, and 1-A, the operation of cleaning system 61 will be described, including a feature of the present invention wherein a means for maintaining the pumping of cleaning fluid from the cleaning fluid cartridge 64 is obtained after operation of the pump actuator 67 has ceased movement to apply a force to the pump 66. With

reference to FIGS. 1-A and 5-A, it should be noted that pump support walls 74 are flexibly associated with handle 61, as by flexibly mounting one pump support wall 74 to the interior of housing 69, and flexibly mounting the lower support wall 74 to the interior surface of door 70. Pump support walls 74 may be provided with the requisite flexibility as by: manufacturing them of a flexible plastic material; joining the support walls 74 along housing 69 and door 70 in continuous integral connection; having the support walls 74 have a reduced wall thickness at their intersection with capsule 64; or in any other suitable fashion so that the support walls 74 can flex and not be completely rigid. In general, a force is transmitted to the upper end wall 136 of pump chamber 135, as by depressing trigger member 91, which causes longitudinal movement of end cap member 111 upon nozzle 160, which in turn transmits a force to pump chamber 135 in the direction shown by arrow 170 in FIGS. 2 and 2A. The fluid, whether air or cleaning fluid, contained in pump chamber 135 is then compressed. This compression would cause check valve 147 to assume a sealed position within inner diameter 145 of the annular disk 143 which forms lower end wall 141, as illustrated in FIG. 2A. The pressure build-up within pump chamber 135 then causes the spring-biased check valve 146 to open and the fluid contained within pump chamber 135 is pumped through nozzle 160, and into first fluid passageway 81 of handle 61 and then outof the first end 62 of handle 61. Upon release of trigger 91, pump chamber 135 would seek to assume its original configuration as shown in FIG. 2. Check valve 146

would close and a partial vacuum would be created within pump chamber 135 whereby fluid contained in fluid cartridge 64 would be sucked through check valve 147 into pump chamber 135, as illustrated in FIG. 2B. Successive actuations of trigger 91 causes all air, if any, in pump chamber 135 and/or cleaning fluid cartridge 64 to be expelled, whereupon cleaning fluid fills pump chamber 135 and the first fluid passageway 81 up to the safety check valve 86 in handle 61. Thereafter, each time trigger 91 is depressed, cleaning fluid will be pumped from, or sucked out of, cleaning fluid cartridge 64.

By utilizing a flexible and expandable pump chamber 135 which is expanded upon operation of the pump actuator 67, and utilizing a biased support structure 74 which cooperates with the pump chamber 135, cleaning system 60 will continue to pump cleaning fluid from the pump chamber 135 and outwardly of safety check valve 86 after trigger 91 has been depressed to its maximum upward travel and/or assumed its second non-operating position previously described in connection with FIG. 1-A. It should be noted that the support structure 74 biases pump chamber 135 against the force exerted upon the pump chamber 135 by the pump actuator 67. This means for maintaining the pumping of cleaning fluid from the cleaning fluid cartridge 64 after operation of the pump actuator 67 is an important feature of the present invention in that a delayed discharge of cleaning fluid may be provided. In a situation where an operator of the cleaning system 60 is using the cleaning system 60 to clean a bathroom fixture, or other surface desired to be cleaned, the

operator is able to move, or depress, the pump actuator 67, while at the same time moving the handle in a direction across the surface to be cleaned to spray the cleaning fluid onto the desired surface. In other words, the operator does not have to be constantly actuating the cleaning system 60.

For example, the operator could depress trigger 91 whereby during the depression of trigger 91, cleaning fluid would be expelled from handle 61 during that step. For approximately one second thereafter, cleaning fluid will continue to be pumped from the cleaning system 60, whereby the operator may merely move the handle 61 to direct the cleaning fluid to the surface to be cleaned. In situations wherein an operator is cleaning a multitude of bathroom fixtures, such as a member of a cleaning staff for a hospital, it is a significant advantage to reduce the number of times the operator must depress the trigger 91.

Throughout FIGS. 5-A through 5-C, pump chamber 135, as previously described in connection with FIGS. 2, 2A, and 2B, including flexible side wall 137 and upper and lower end walls 136, 141, are shown. Further, the flexible pump support walls 74 are also illustrated. The arrow A of FIG. 5-A illustrates the length of flexible and expandable pump chamber 135 at its rest position when disposed in cleaning system 61 with pump actuator 67,or trigger 91, being disposed in the position illustrated in FIG. 1-A. Arrow F represents the pre-load force on pump 66, or pump chamber 135, as previously described. With reference to FIG. 5-B, the configuration of flexible and expandable pump chamber 135 is illustrated after pump

chamber 135 has been compressed due to the transmission of the force from the depression of trigger 91 which is transmitted to pump chamber 135 via swing arm 110, end cap 111, and nozzle 160. The arrow E denotes the pump chamber stroke length due to the force applied by the pump actuator 67, and the resulting movement of end cap 111. Letter B denotes the pump length immediately after actuation of pump actuator 67, or the depression of trigger 91. Letter G denotes the expansion of pump chamber 135 due to the flexibility of the flexible side wall 137 of pump chamber 135, as well as the flexing of upper and lower end walls 136 and 141 of pump chamber 135. The expansion is caused by the pressure build-up within pump chamber 135 from the fluid contained within pump chamber 135 and initially confined therein by check valves 146 and 147. After valves 146 and 147 are opened, pressure within chamber 135 is maintained by pressure drop across the exit hole. It should be noted that immediately after actuation of trigger 91, the force exerted upon pump chamber 135 has caused the flexing, or movement, of the flexible pump chamber support walls 74, and the pump support flex distance is denoted by letter D.

With reference to FIG. 5-C, the arrow C denotes the pump length when delivery of the cleaning fluid has ceased and the trigger is still depressed. Arrow E once again represents the pump stroke length supplied by the movement of end cap 111 from the depression of trigger 91, and arrow D represents the movement of the flexible pump chamber support walls 74 as they reassume their normal disposition as illustrated in FIG. 5-A. Even though trigger 91 has ceased to be pressed,

cleaning fluid is expelled from the pump chamber 135 because of the forces exerted by the contraction of pump chamber 135, in particular the contraction of the flexible side wall 135, and the biasing force exerted by flexible pump chamber support walls 74 upon pump chamber 135. It is believed that the delayed or continuous discharge feature of the present invention (continuous discharge of fluid for approximately one second after trigger 91 has ceased to be pressed) is thus supplied by energy stored within the pump chamber 135 by the expansion of the flexible side wall 137 and by the spring deflection of the flexible pump chamber support walls 74. It is further believed that another factor affecting the delayed discharge of the cleaning fluid from the cleaning system 60 is the fluid pressure drop across the exit hole, or safety check valve 86 associated with first fluid passageway 81, in that this pressure drop is a function of the viscosity of the cleaning fluid and the diameter of the exit hole of the cleaning system 60.

Referring to FIGS. 6-10, alternate means for controlling the collapse of the cartridge 64 are shown. It is to be understood that as fluid is pumped from cartridge 64, it will gradually collapse or deform and that such collapse is effectuated in part by the varying wall thicknesses of cartridge 64. It is important, however, that cartridge 64 deform in a controlled manner, otherwise, some of the fluid within cartridge 64 may become trapped therein. Accordingly, a stiffened side wall or side member 180 is provided which may be in the form of a stiff label 182 or longitudinal, integral ribs 184 located along a wall of

container or cartridge 64, as illustrated in FIG. 6 and FIG. 7, respectively. In the preferred embodiment, label 182 or ribs 184 cover approximately one hundred and fifty degrees (150°) of the circumference of cartridge 64.

Referring to FIG. 8, the cartridge 64 may also be provided with a hook 186, which may be blow molded on the lowermost side of cartridge 64. Hook 186 may be linked to a clip (not shown) within housing 69, thereby to form a hinge for cartridge bottom 169 to pivot about. Such controlled pivoting thereby effectuates the collapse of cartridge 64 against the side thereof where hook 186 is located.

Due to the stiff side member, illustrated as a label 182 (FIGS. 9 and 10), bottom 169 collapses or folds upward and the side of cartridge 64 opposite label 182 collapses or folds inward, both against the side of cartridge 64 having label 182 thereon. Cartridge 64 can thus be substantially evacuated of cleaning fluid by means of the aforementioned controlled collapse or deformation.

CLAIMS

1. A cleaning wand comprising:

an elongate housing having a first end, a second end, and a cavity therein adapted to receive a cleaning fluid capsule therein at said second end of said housing;

a surface cleaning head connected to said housing at said first end thereof;

a trigger pivotally connected to said housing within a slot in said housing;

a movable linkage mechanism within said cavity of said housing in operative engagement with said trigger and being adapted to impinge against said cleaning fluid capsule; and

a tube disposed within said cavity of said housing, said tube having a first end proximate said first end of said housing and a second end connected to said linkage mechanism, said tube permitting fluid communication between said capsule and a discharge orifice in said

housing proximate said first end of said tube, said linkage mechanism impinging against said capsule to discharge cleaning fluid from said capsule through said tube and outward from said housing through said discharge orifice upon depression upon said trigger.

2. The cleaning wand of claim 1 further characterized in that said linkage mechanism comprises a pivotal spring arm and an end cap member and wherein said pivotal swing arm is in operative engagement with said trigger and said end cap member.

3. The cleaning wand of claim 2 further characterized in that said end cap member further comprises a pressure transmitting member having a nozzle receiving cavity therein adapted to receive a nozzle of said capsule therein and wherein said end cap member further comprises a tube receiving cavity adapted to receive said second end of said tube therein, said end cap member further comprising a liquid passage intermediate said nozzle receiving cavity and said tube receiving cavity.

4. The cleaning wand of claim 1 further characterized in that it includes a safety locking mechanism comprising:

a slide switch mounted in said housing for alternately engaging or disengaging with or from said trigger and a door in said housing movable to allow access to said cavity, whereby said slide switch is in a first

position, said slide switch is engaged with said trigger and said door when said slide switch is in a second position, and said slide switch is engaged with said door and disengaged from said trigger when said slide switch is in a third position.

5. The cleaning wand of claim 1 further characterized in that it includes a safety lock mechanism comprising:

a button having an elongate engagement member connected thereto in operative engagement therewith, said button connected to said engagement member in approximately the center of said engagement member, said engagement member having a first end toward said cleaning head and a second end toward an end of said housing opposite said cleaning head, said button received within a button slot within said housing, said button alternately slidable within said button slot to a first position toward said cleaning head, a second position in approximately the center of said button slot, and a third position toward said end of said housing opposite said cleaning head;

said trigger pivotally mounted within a trigger slot of said housing, said trigger having a notch therein for alternate engagement with or disengagement from said first end of said engagement member; and

a pivotal door in said end of said housing opposite said cleaning head, said door having a stop member for alternate engagement with or

disengagement from said second end of said engagement member, said first end of said engagement member engaging said notch and said second end of said engagement member being disengaged from said stop member when said button is in said first position, to impede pivoting of said trigger and permit opening of said door, said first end of said engagement member engaging said notch and said second end of said engagement member engaging said stop member when said button is in said second position, to impede pivoting of said trigger and impede opening of said door, and said first end of said engagement member being disengaged from said notch and said second end of said engagement member being engaged with said stop member when said button is in said third position, to permit pivoting of said trigger and impede opening of said door.

6. A cleaning fluid capsule for use with a cleaning wand according to any of the preceding claims, characterized in that it comprises: a pump integral with a cleaning fluid cartridge, a first fluid passage between said cartridge and said pump, and a second fluid passage for discharging cleaning fluid from said capsule.

7. The capsule of claim 6 further characterized in that said pump comprises a pump chamber defined by upper and lower end walls and a flexible side wall interconnecting said upper and lower end walls, said upper and lower end walls of said pump chamber each comprise an annular disk having an outer diameter and an inner diameter, each annular disk having a truncated cone configuration, wherein each disk tapers at an acute angle from the outer diameter to the inner diameter; said outer diameter of each annular diskis joined to said flexible side wall and said inner diameter of one of said annular disks is joined to said cleaning fluid cartridge and defines said first fluid passage.

8. The capsule of claim 6 characterized in that it further includes a collapsible control member on said cartridge.

9. The capsule of claim 8 characterized in that said collapsible control member includes a side wall stiffener on said cartridge.

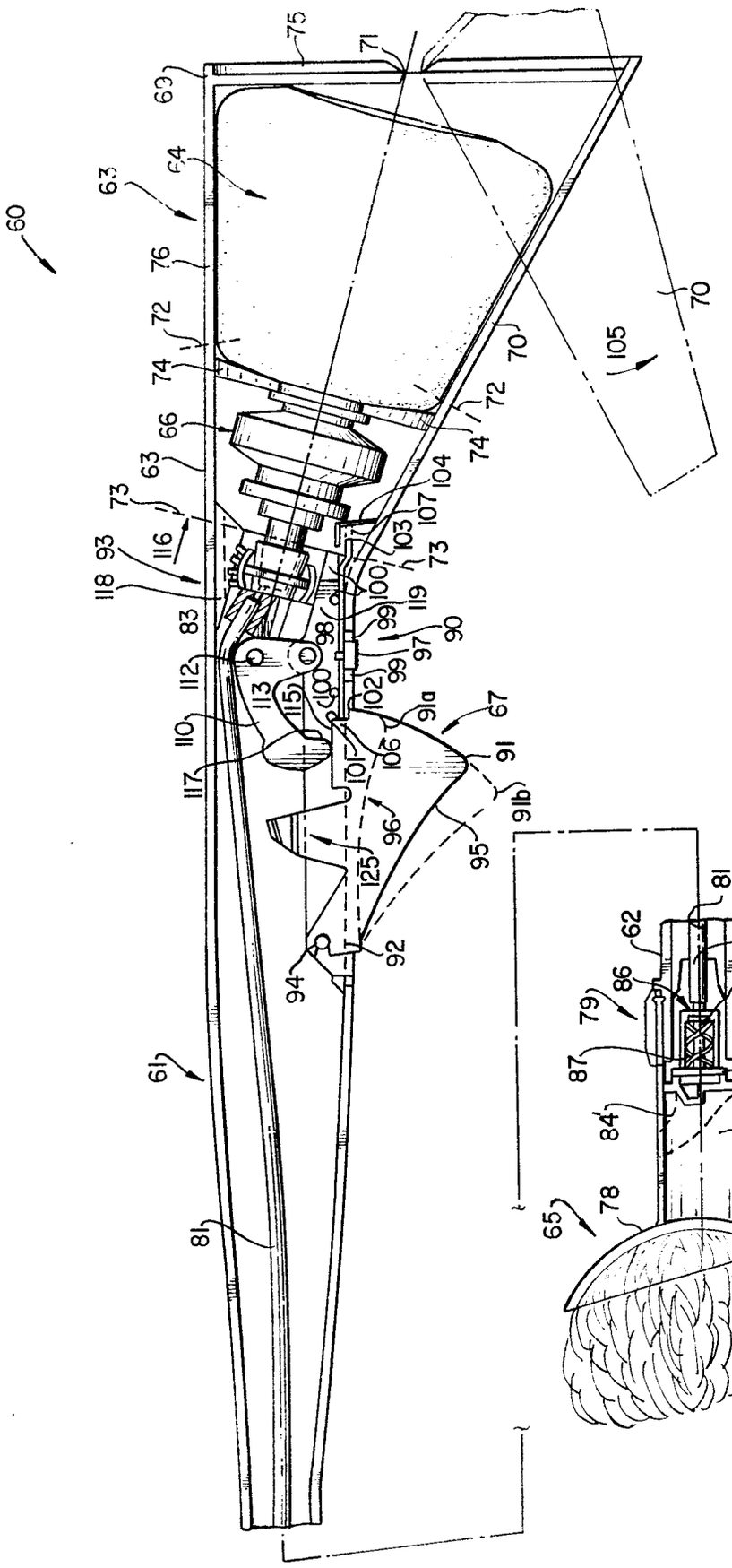
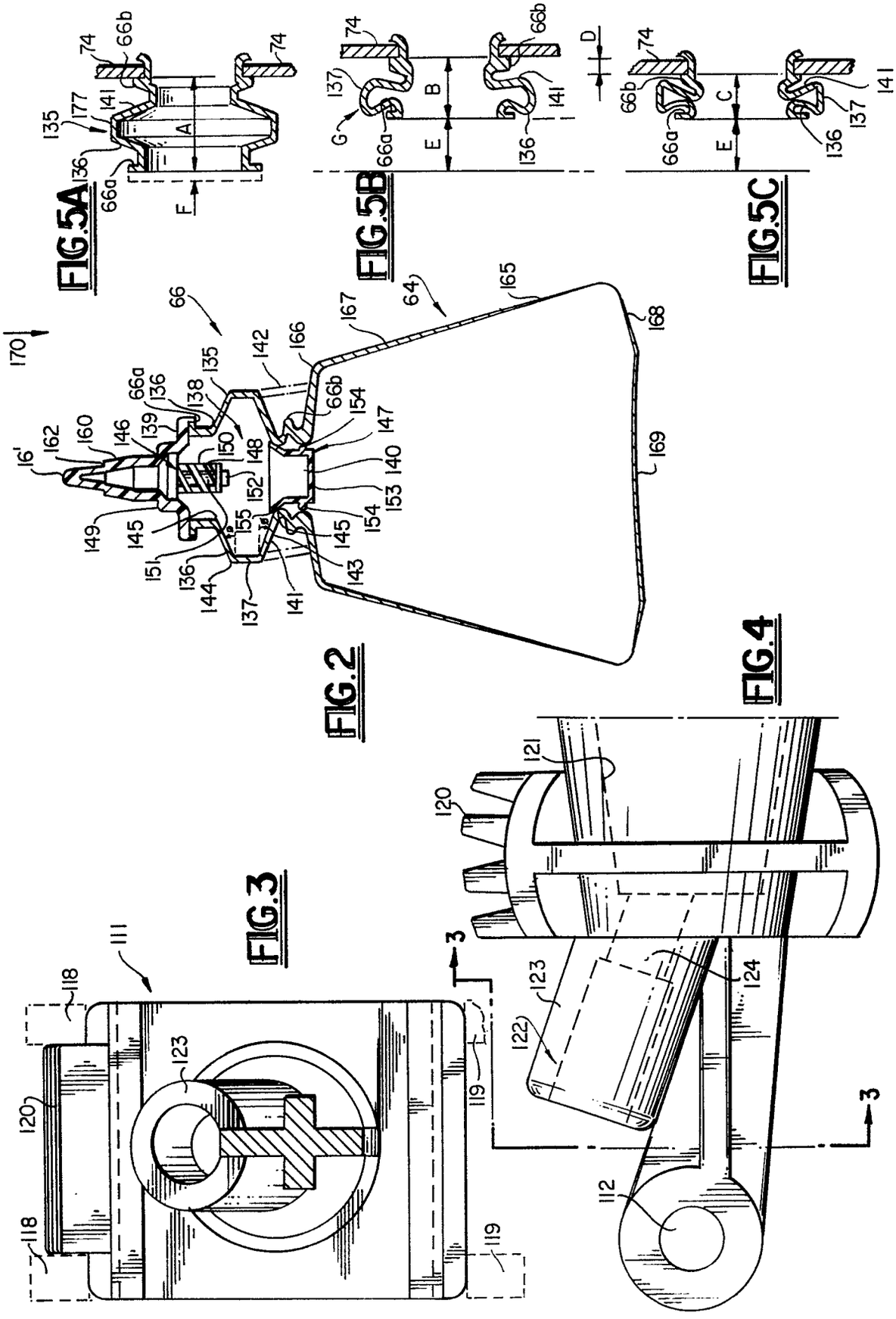


FIG. 1A

FIG. 1B


74
66b
135
177
141
A
136
66a
F
FIG.5A
74
66b
137
G
B
D
66a
E
136
141
FIG.5B
74
66b
C
66a
E
136
137
141
FIG.5C
66
64
165
167
168
170
135
142
166
66a
136
138
66b
154
147
160
146
139
150
148
140
162
16'
152
153
169
149
145
155
154
145
151
136
144
143
137
141
FIG.2
111
118
123
120
119
FIG.3
121
120
3
123
124
122
112
FIG.4

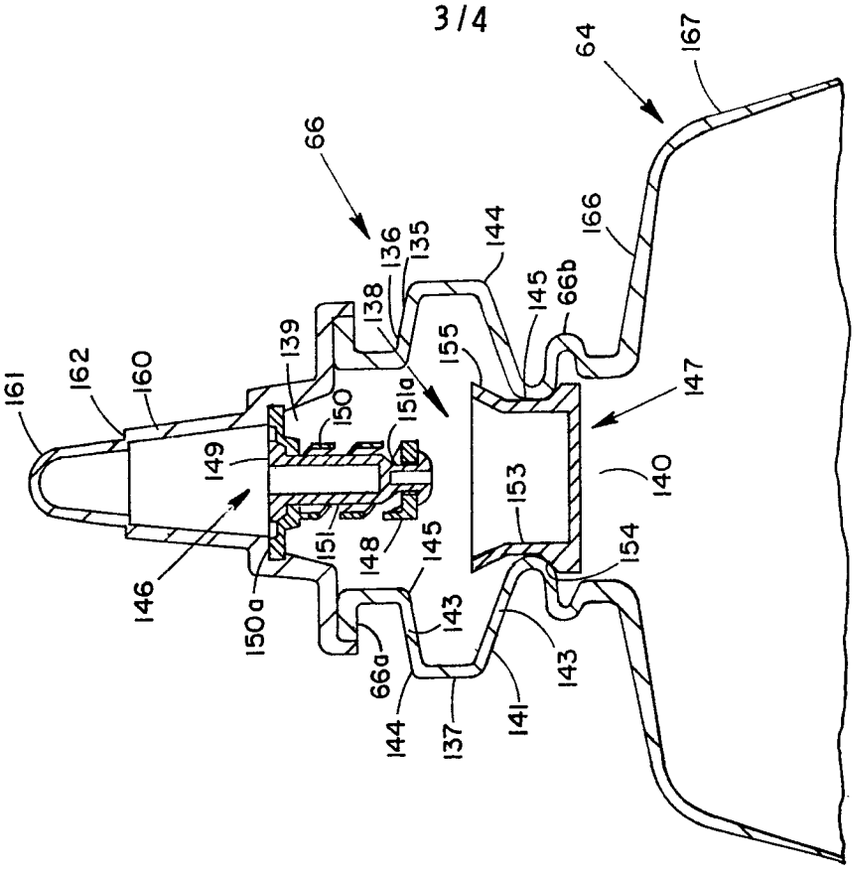

64
167
66
166
136
135
144
138
145
66b
139
155
161
162
160
150
151a
147
149
153
140
151
148
145
154
146
143
150a
66a
144
137
141
143

FIG 2B

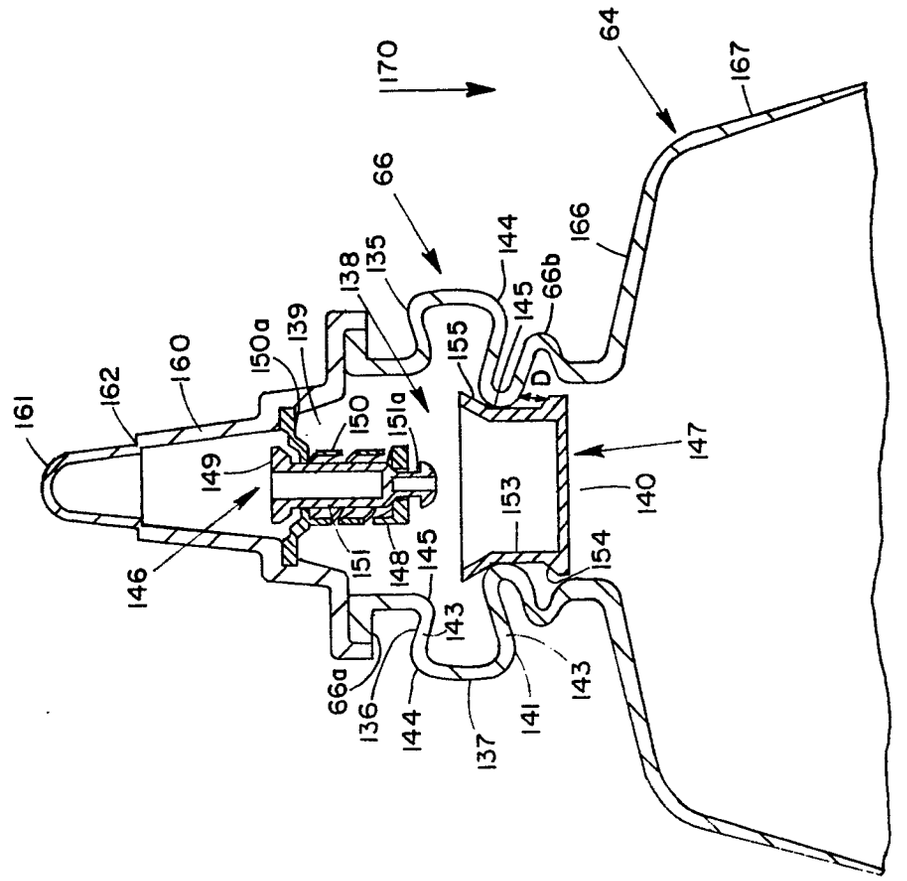

170
64
167
66
166
144
138
135
145
66b
150a
139
155
D
161
162
160
150
151a
147
149
153
140
151
148
145
154
146
143
66a
136
144
137
141
143

FIG 2A

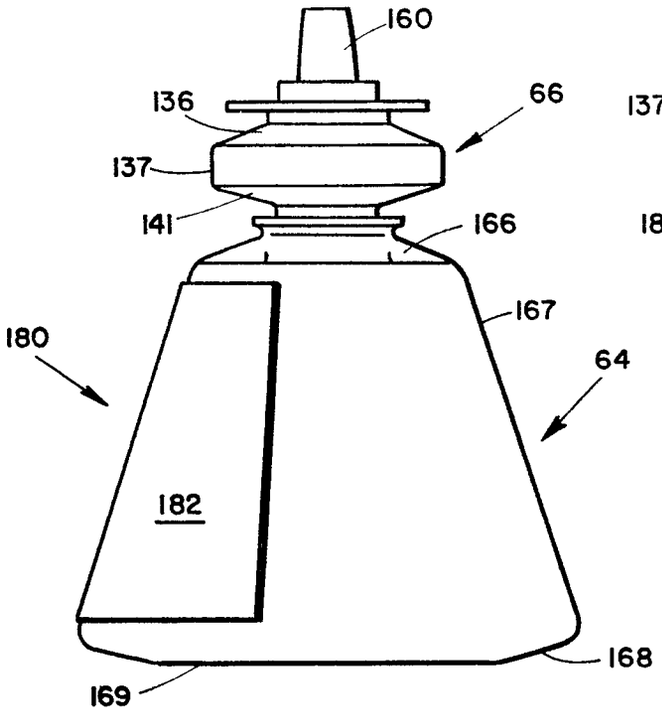


FIG.6

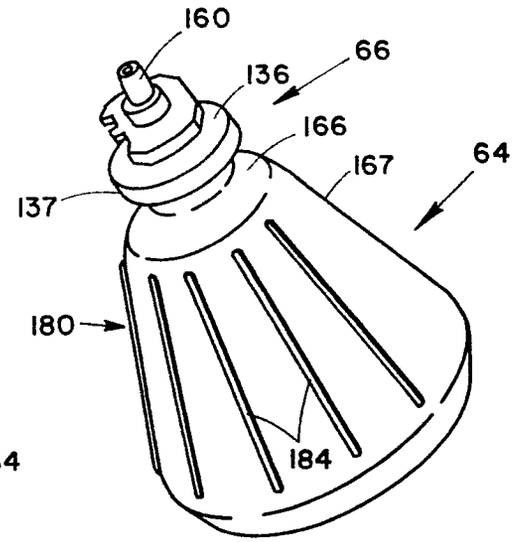


FIG.7

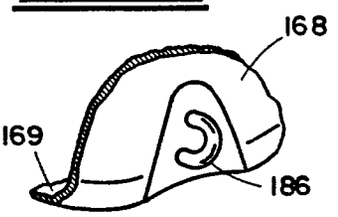


FIG.8

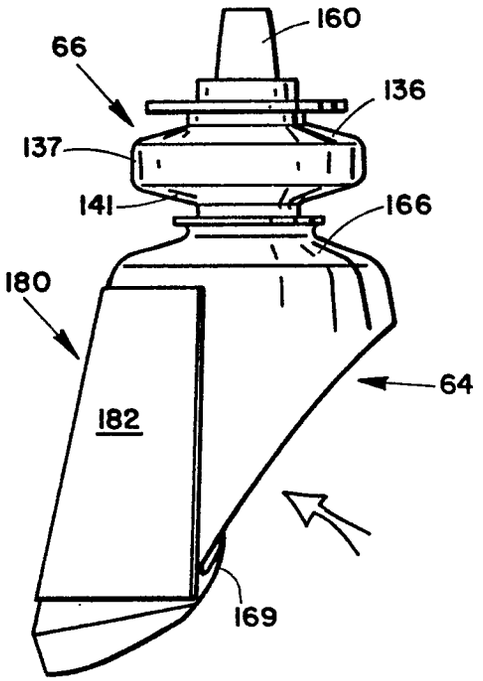


FIG.9

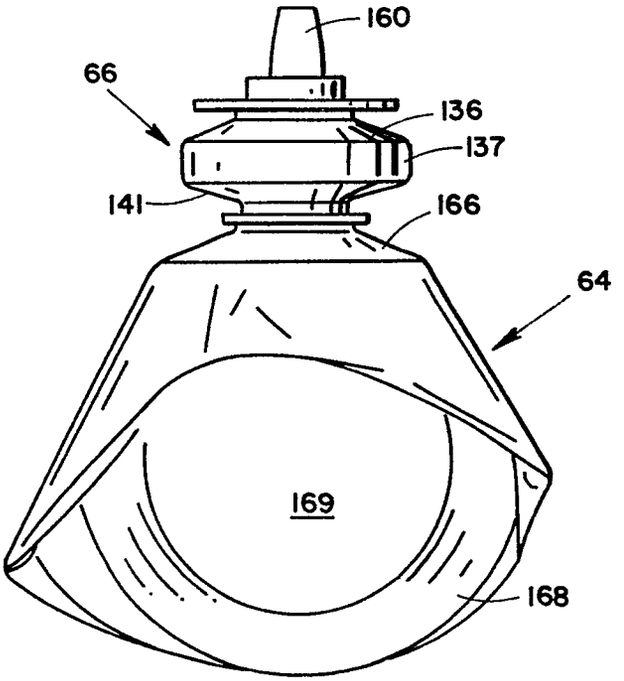


FIG.10