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(54) **Title:** DISPENSERS, REFILL UNITS AND PUMPS HAVING SUCK-BACK FEATURES

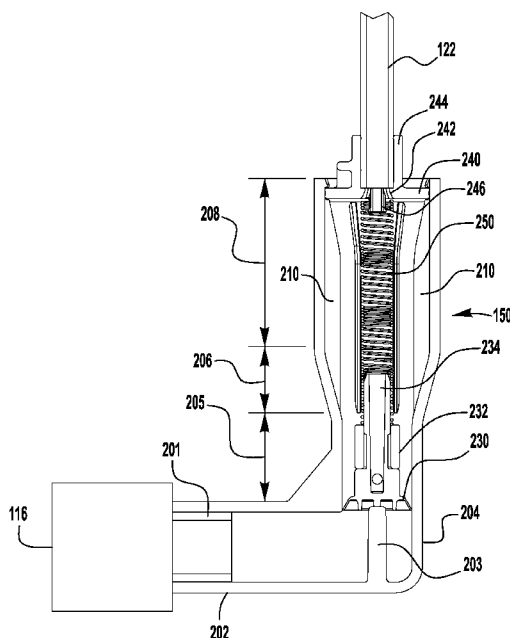


FIG. 2A

(57) **Abstract:** Exemplary embodiments of dispensers and refill units having suck-back mechanisms are disclosed herein. An exemplary refill unit includes a container, a pump connected to the container, and an outlet passage. The outlet passage includes a first cylindrical portion and a second portion. The diameter of the second portion is larger than the diameter of the first cylindrical portion. An inline suck-back valve is located in the outlet passage. The inline-suck-back valve moves within the first cylindrical portion and the second portion of the outlet passage. Movement of the inline suck-back valve in a first direction while the inline suck-back valve is located within the first cylindrical portion causes fluid in the outlet passage to be drawn back into the outlet passage.



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DISPENSERS, REFILL UNITS AND PUMPS HAVING SUCK-BACK FEATURES**RELATED APPLICATIONS**

[0001] This non-provisional utility patent application claims priority to and the benefits of U.S. Provisional Patent Application Serial No. 61/884,508 filed on September 30, 2013 and entitled DISPENSERS, REFILL UNITS AND PUMPS HAVING SUCK-BACK FEATURES. This application is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present invention relates generally to pumps, refill units for dispensers and dispensers, and more particularly inline suck-back mechanisms for such pumps and refill units.

BACKGROUND OF THE INVENTION

[0003] Liquid dispenser systems, such as liquid soap and sanitizer dispensers, provide a user with a predetermined amount of liquid upon actuation of the dispenser. In addition, it is sometimes desirable to dispense the liquid in the form of foam by, for example, injecting air into the liquid to create a foamy mixture of liquid and air bubbles. Often after the liquid or foam is dispensed and a user moves her hands away from the dispenser outlet, residual foam or liquid in or near the outlet drips onto the counter or into the sink.

SUMMARY

[0004] Exemplary embodiments of dispensers and refill units having suck-back mechanisms are disclosed herein. An exemplary refill unit includes a container, a pump connected to the container, and an outlet passage. The outlet passage includes a first cylindrical portion and a second portion. The diameter of the second portion is larger than the diameter of the first cylindrical portion. An inline suck-back valve is located in the in the outlet passage. The inline-suck-back valve moves within the first cylindrical portion and the

second portion of the outlet passage. Movement of the inline suck-back valve in a first direction while the inline suck-back valve is located within the first cylindrical portion causes fluid in the outlet passage to be drawn back into the outlet passage.

[0005] Another exemplary refill unit includes a container, a pump connected to the container and an outlet passage. The outlet passage includes a first cylindrical portion and a second portion. An inline suck-back valve is located in the in the outlet passage. Fluid flowing from the pump causes the inline suck-back valve to move away from its rest position and when fluid stops flowing out of the pump, the inline suck-back valve moves back to its rest position and draws residual fluid in the outlet passage back.

[0006] Another exemplary refill unit includes a container, a foam pump secured to the container and an outlet passage. The outlet passage is located downstream of the foam pump. An inline suck-back valve is located in the outlet passage. The inline suck-back valve has a sealing member. A first portion of the outlet passage engages with the sealing member and fluid cannot pass by the sealing member when the sealing member is located in the first portion of the outlet passage. The exemplary refill unit also includes an outlet. Movement of the sealing member in the first outlet passage toward the foam pump draws fluid away from the outlet.

[0007] In this way, simple and economical liquid dispensers and refill units are provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] These and other features and advantages of the present invention will become better understood with regard to the following description and accompanying drawings in which:

[0009] Figure 1 is an schematic view of an exemplary embodiment of a counter mount dispenser system having a refill unit with an inline suck-back mechanism;

[0010] Figures 2A and 2B are cross-sectional views of an exemplary embodiment of an inline suck-back mechanism;

[0011] Figures 3 is a cross-sectional view of an exemplary embodiment of a dispenser having an inverted refill unit with a suck-back mechanism;

[0012] Figure 4 is a cross-sectional view of another exemplary embodiment of an inline suck-back mechanism; and

[0013] Figure 5 is a schematic view of another exemplary embodiment of a system having an inline suck-back mechanism.

DETAILED DESCRIPTION

[0014] Figure 1 is a schematic view of an exemplary embodiment of a dispenser system 100. Dispenser system 100 is a counter-mount dispenser system, however, any type of dispenser may be used, such as, for example, a wall mounted dispenser, a stand mounted dispenser, a standalone dispenser, or the like.

[0015] Dispenser 100 includes a spout 104, which is mounted to a countertop 102. Spout 104 includes an object sensor 196, such as, for example, an infrared sensor, a motion sensor, a capacitance sensor or the like. Sensor 106 is in circuit communication with controller 110. Controller 110 may include a processor, a microprocessor or the like. Controller 110 also includes any necessary memory or circuitry required to perform the functions described herein. In addition, in some embodiments, spout 104 includes feedback indicator 108. Feedback indicator 108 may provide a visual and/or an audible feedback to a user. Exemplary visual feedback indicators may be, for example, one or more light emitting diodes (LEDs). In addition, controller 110 is in circuit communication with pump actuator 114. Pump actuator 114 may be, for example, a motor that rotates to actuate pump 116.

[0016] "Circuit communication" indicates a communicative relationship between devices. Direct electrical, electromagnetic and optical connections and indirect electrical, electromagnetic and optical connections are examples of circuit communication. Two devices are in circuit communication if a signal from one is received by the other, regardless of whether the signal is modified by some other device. For example, two devices separated by one or more of the following -- amplifiers, filters, transformers, optoisolators, digital or analog buffers, analog integrators, other electronic circuitry, fiber optic transceivers or satellites -- are in circuit communication if a signal from one is communicated to the other, even though the signal is modified by the intermediate device(s). As another example, an electromagnetic sensor is in circuit communication with a signal if it receives electromagnetic radiation from the signal. As a final example, two devices not directly connected to each other, but both capable of interfacing with a third device, such as, for example, a CPU, are in circuit communication.

[0017] A power source 112 provides power to the controller 110, pump actuator 114 and any other components that require power. Power supply 112 may be one or more batteries, or may be a hard wired power source and draw power, from for example, an 120 VAC line. In such case, power supply 112 may include any necessary transformers, rectifiers, or power conditioning devices to obtain suitable power for the components described herein. Pump actuator 114 actuates foam pump 116.

[0018] Foam pump 116 is connected to inlet dip tube 120, which is located in container 118; an in-line suck-back mechanism 150 and an outlet tube 122 that extends up through spout 104 to outlet 124. In some embodiments, the in-line suck-back mechanism 150 is located under the counter, in some embodiments the inline suck-back mechanism 150 is located in the spout 104, and in some embodiments, the inline suck-back mechanism is located near the outlet 124. In some embodiments, container 118, foam pump 116, dip tube 120 and outlet tube 122 form a refill and may be replaced when container 118 runs out of fluid or stops working. Container 118 contains a fluid, such as, for example, a foamable soap or sanitizer. In some embodiments, foam pump 116 may be just a liquid pump. In such embodiments, the fluid may be soap, lotion, sanitizer or the like.

[0019] Controller 110 includes logic or circuitry for operating pump actuator 114 that operates pump 116. “Logic” is synonymous with “circuit” or “circuitry” and includes, but is not limited to hardware, firmware, software and/or combinations of each to perform a function(s) or an action(s). For example, based on a desired application or needs, logic may include a software controlled microprocessor or microcontroller, discrete logic, such as an application specific integrated circuit (ASIC) or other programmed logic device. Logic may also be fully embodied as software. The circuits identified and described herein may have many different configurations to perform the desired functions.

[0020] Figures 2A and 2B illustrate an exemplary embodiment of an inline suck-back mechanism 150. Inline suck-back mechanism 150 includes a valve body 204. Valve body 204 includes a cylindrical projection 202 that connects to annular projection 201 of foam pump 116 and secures inline suck-back mechanism 150 to foam pump 116. The connection may be a friction fit connection, a threaded connection, a snap-fit connection, an adhesive connection, a welded connection or the like. Valve body 204 has a lower cylindrical portion 205, an outwardly tapered portion 206 and an upper cylindrical portion 208. In some embodiments, the tapered portion 206 and upper cylindrical portion 208 may be referred to as

an upper cylindrical portion. The purpose of the upper cylindrical portion 208 and tapered portion 206 is to have a larger cross-section than the lower cylindrical portion 205 to allow fluid to flow past the seal 230 of valve 232. In addition, valve body 204 includes a plurality of guide ribs 210 and an outlet post 203.

[0021] Located at the outlet of valve body 204 is a fitment 240. Fitment 240 is secured to valve body 204 by any means, such as for example, a friction fit connection, a threaded connection, a snap-fit connection, an adhesive connection, a welded connection or the like. Fitment 240 includes a cylindrical projection 244. Outlet tube 122 fits over cylindrical projection 244 and secures outlet tube 122 to inline suck-back mechanism 150. Fitment 240 also includes a plurality of passageways 242. In addition, fitment 240 includes a spring retaining projection 246 that connects to a spring 250.

[0022] Located inside of valve body 204 is a valve 234. Valve 234 includes a seal 230 that seals against the inside of lower cylindrical portion 205. Valve 234 is connected to spring 250 which is also connected to spring retaining projection 246 of fitment 240. In some embodiments, valve 234 includes a plurality of grooves 232 that engage guide ribs 210 to maintain alignment of valve 234. In such a case, guide ribs 210 may need to protrude further into the valve body 204.

[0023] During operation, foam from foam pump 116 is forced into valve body 204. The foam causes valve 234 to move upward compressing spring 250. When seal 230 moves up past the upper portion of lower cylindrical portion 205 (illustrated in Figure 2B) the foam travels past valve 234 through passageways 242 in fitment 240 and up through outlet tube 122 where it is dispensed. When foam pump 116 stops forcing foam into inline suck-back mechanism 150, spring 250 forces valve 234 back to its rest position on post 203. When seal 230 moves down to lower cylindrical portion 205, seal 230 contacts the inside wall of cylindrical portion 205. As seal 230 continues to move downward (fluidically toward pump 116) a vacuum is created behind valve 234, which pulls residual foam, liquid and air back down outlet tube 122. Pulling residual foam, liquid and air back down outlet tube 122 reduces or eliminates dripping of foam or liquid at the end of outlet tube 122 when the dispenser 100 is not in use. The suck-back volume may be adjusted by increasing or decreasing the length of lower cylindrical portion 205. The longer the length of lower cylindrical portion 205 the greater the volume of fluid that is sucked back.

[0024] Figure 3 illustrates a cross-section of an exemplary embodiment of a foam dispenser 300. The cross-section of Figure 3 is taken through the housing 302 to show the foam pump 320 and container 316. Foam dispenser 300 includes a disposable refill unit 310. The disposable refill unit 310 includes a container 316 connected to a foam pump 320. The foam dispenser 300 may be a wall-mounted system, a counter-mounted system, an un-mounted portable system movable from place to place or any other kind of foam dispenser system.

[0025] The container 316 forms a liquid reservoir that contains a supply of a foamable liquid within the disposable refill unit 310. In various embodiments, the contained liquid could be for example a soap, a sanitizer, a cleanser, a disinfectant or some other foamable liquid. In the exemplary disposable refill unit 310, the container 316 is a collapsible container and can be made of thin plastic or a flexible bag-like material. In other embodiments, the container 116 may be formed by a rigid housing member, or have any other suitable configuration for containing the foamable liquid without leaking. The container 316 may advantageously be refillable, replaceable or both refillable and replaceable. In other embodiments, the container 316 may be neither refillable nor replaceable.

[0026] In the event the liquid stored in the container 316 of the installed disposable refill unit 310 runs out, or the installed refill unit 310 otherwise has a failure, the installed refill unit 310 may be removed from the foam dispenser 300. The empty or failed disposable refill unit 310 may then be replaced with a new disposable refill unit 310.

[0027] The housing 302 of the foam dispenser 300 contains one or more actuating members 304 to activate the pump 320. As used herein, actuator or actuating members or mechanism includes one or more parts that cause the dispenser 300 to move liquid, air or foam. Actuator 304 is generically illustrated because there are many different kinds of pump actuators which may be employed in the foam dispenser 300. The actuator of the foam dispenser 300 may be any type of actuator such as, for example, a manual lever, a manual pull bar, a manual push bar, a manual rotatable crank, an electrically activated actuator or other means for actuating the foam pump 320 which includes a liquid pump portion 324, air compressor portion 322 and a suck-back mechanism 350. Electronic actuators may additionally include a sensor to provide for a hands-free dispenser system with touchless operation.

[0028] In one embodiment, actuator 304 is connected to housing 302 by a hinge member 306. Various intermediate linkages, such as for example linkage 305, connect the actuator member 304 to the foam pump 320 within the system housing 302. In one embodiment, linkage 305 has a socket 307 that snaps onto a ball 441 (Fig. 4) at the proximate end of piston 440. An aperture 315 in bottom plate 303 of housing 302 allows foam dispensed from the suck-back nozzle 325 of foam pump 320 to be dispensed to a user.

[0029] Figure 4 is a cross-sectional view of an exemplary embodiment of a refill unit 400 with an inline suck-back mechanism 350 suitable for use in foam dispensers. Refill unit 400 includes a container 421 for holding a foamable liquid connected to a pump 401. Pump 401 includes a housing 402. Housing 402 receives inlet plate 416. Inlet plate 416 includes an annular projection 418. A neck of a container 421 is received within an annular groove 422 formed between annular projection 418 and housing 402. Housing 402 may be connected to the container 421 by any means such as, for example, a threaded connection, a welded connection, an adhesive connection or the like. Optionally a gasket may fit in annular groove 422 to help form a liquid tight seal with the container. Inlet plate 416 may be integrally formed with housing 402. Inlet plate 416 includes one or more inlet apertures 424 located therethrough. In addition one-way inlet valve 426 is secured to inlet plate 416. One-way inlet valve 426 may be any type of one-way valve such as, for example, a ball and spring, a poppet valve, a flapper valve, an umbrella valve, a slit valve, a mushroom valve, a duck-bill valve or the like.

[0030] Pump housing 402 includes a liquid chamber 404. In one embodiment liquid chamber 404 is cylindrical. Located at least partially within liquid chamber 404 is a sleeve 432. Housing 402 includes an annular projection 410 at one end of the liquid chamber 404. Sleeve 432 is secured to annular projecting member 410 by collar 411. Collar 411 includes an aperture 412.

[0031] A piston 440 includes a shaft 441 that projects through aperture 412. Piston 440 is slideable in a reciprocating manner within sleeve 432. Piston 440 includes a piston head having a double wiper seal 444 located at the distal end. Movement of piston 440 causes the volume of liquid chamber 404 to expand and contract. Double wiper seal 444 may be any type of sealing member such as, for example, an o-ring, a single wiper seal or the like. Housing 402 includes a projecting member 406 that contacts an end 407 of piston 440 to stop movement of piston 440 when it reaches the end of its stroke.

[0032] In addition, piston 440 includes a second piston head and sealing member 442 located at the proximal end. Second sealing member 442 engages the inside of the air compressor housing 430. The term “air compressor” may be used interchangeably herein with the term “air pump.” In one embodiment, air compressor housing 430 and sleeve 432 are formed as one piece. Movement of piston head 442 expands and contracts air chamber 443. Air chamber 443 includes an air outlet 436, which is also an air inlet to mixing chamber 496. In one embodiment, air outlet 436 is integrally formed with both sleeve 432 and air compressor housing 430.

[0033] A liquid inlet passageway 450 is formed between sleeve 432 and the wall of liquid chamber 404. The inlet passageway 450 may extend entirely around sleeve 432 or may be enclosed by one or more rib projections (not shown) that cause liquid in inlet passageway 450 to flow through passage 450 and passage 452 into the interior of sleeve 432. Outlet passages 454, 456 also exist between sleeve 432 and liquid chamber 404. Outlet passageway 456 may extend entirely around sleeve 432 or may be enclosed by one or more rib projections (not shown) that cause liquid to flow through passageways 454, 456 from the interior of sleeve 432. Passageway 454 and passageway 450 may be connected to form a common passageway.

[0034] Housing 402 includes a liquid outlet opening 408 and valve seat 466. Connected to housing 402 is lower housing 470. Housing 402 includes projecting member 409 that engages with projecting member 467 of lower housing 470 to form a snap-fit connection. Optionally, lower housing 470 may be connected to housing 402 by any means such as, for example, a threaded connection, a press-fit connection, a welded connection, an adhesive connection or the like. Lower housing 470 has an interior cavity 473. Lower housing 470 also includes a first annular projection 465 that forms an air inlet 436.

[0035] Located within cavity 473 is an insert 490. Insert 490 may be made of one or more components. Insert 490 includes an interior cavity 496 formed by annular member 492. Interior cavity 496 retains one-way outlet valve 464 and biasing member 468. Interior cavity 496 is also the mixing chamber. One-way outlet valve 464 seals against valve seat 466. One-way outlet valve 464 may be any type of one-way valve such as, for example, a ball and spring valve, a poppet valve, a flap valve, an umbrella valve, a slit valve or the like.

[0036] Insert 490 includes an opening 494 to allow liquid and air to flow down and through foaming media 475 secured therein. Foaming media 475 may be one or more screens, porous members, baffles, sponges, foaming cartridges, a combination thereof or the like. Foaming media 475 may be an integral part of insert 490 or may be a separate part.

[0037] In addition, located within cavity 473 is a suck back valve 507. Suck-back valve 507 includes sealing member 509 and spring retention member 508. A spring 506 secures suck-back valve 507 to disk 500. Disk 500 is secured to lower pump housing 470. Disk 500 may be secured to lower pump housing 470 by a friction fit connection, a snap fit connection, an adhesive connection, a welded connection or the like. In some embodiments, disk 500 may be a part of insert 490. In some embodiments, disk 500 retains insert 490 in place. In addition, disk 500 one or more passages 502 therethrough. Disk 500 includes a spring retention member 504 for retaining an end of spring 506.

[0038] Lower pump housing 470 includes a first cylindrical portion 520 and an outwardly tapered portion 522. Seal 509 of suck-back valve 507 is sized to engage the inside walls of first cylindrical portion 520 and disengage from the tapered portion 522 when suck-back valve 507 is located within or above the tapered portion 522.

[0039] Secured to lower pump housing 470 is outlet nozzle 510. Outlet nozzle 510 includes an annular projection 512 that connects to annular projection 511 of lower pump housing 470. In addition, outlet nozzle 510 includes an annular projection 513 that extends upward and acts as a drip catcher preventing residual fluid in the nozzle 510 from dripping out while waiting for the next dispense. In some embodiments, annular projection 513 has a conical shape. In some embodiments, annular projection 513 has a cylindrical shape.

[0040] In addition, although the pump 401 has been described as being made of selected sub-parts, pump 401, as well as the other embodiments of pumps disclosed herein, may be made from more sub-parts or fewer sub-parts.

[0041] During operation, movement of piston 440 from the charged position (not shown) to the discharged position (shown in Figure 4) causes fluid to flow out of the liquid chamber 404 (including the center of the sleeve 432) through passages 454, 456 past liquid outlet valve 464 into mixing chamber 496. Simultaneously, the volume of air chamber 443 is reduced and air flows out of air outlet 436 into cavity 473, up around annular projection 492 and mixes with the liquid in mixing chamber 496. The air and liquid mixture is forced

through opening 494 and through foam media 475 to create a rich foam. The rich foam flows through the one or more apertures 502 in disk 500 and pushes suck-back valve 507 downward out of first cylindrical portion 520 as illustrated in Figure 4. As suck-back valve 507 passes out of first cylindrical portion 520 into tapered portion 522, the foam flows around suck-back valve 507 and is dispensed through outlet 520.

[0042] As piston 440 of pump 401 moves from a discharged position shown in Figure 4 to a charged position or primed state, liquid flows in through liquid inlets 424, past one-way inlet valve 426 into liquid chamber 404 and through passages 450, 452 and into the interior of sleeve 432 (which also forms a portion of the liquid chamber 404). In addition, spring 506, which was placed in tension when suck-back valve 507 was moved downward through cylindrical portion 520, draws suck-back valve 507 upward along cylindrical portion 520 causing a vacuum below suck-back valve 507 which sucks any residual foam or fluid upward past annular projection 513. Any residual foam or liquid that is sucked back up is trapped by projection 513 which acts as a drip catcher.

[0043] Figure 5 is a schematic view of an exemplary embodiment of a dispenser system 500. Dispenser system 500 is a counter-mount dispenser system, however, any type of dispenser may be used, such as, for example, a wall mounted dispenser, a stand mounted dispenser, a standalone dispenser, or the like.

[0044] Dispenser 500 includes a spout 504, which is mounted to a countertop 502. Spout 504 includes an object sensor 506, such as, for example, an infrared sensor, a motion sensor, a capacitance sensor or the like. Sensor 506 is in circuit communication with controller 510. Controller 510 may include a processor, a microprocessor or the like. Controller 510 also includes any necessary memory or circuitry required to perform the functions described herein. In addition, in some embodiments, spout 504 includes feedback indicator 508. Feedback indicator 508 may provide a visual and/or an audible feedback to a user. Exemplary visual feedback indicators may be, for example, one or more light emitting diodes (LEDs). In addition, controller 510 is in circuit communication with pump actuator 514. Pump actuator 514 may be, for example, a motor that rotates to actuate pump 516.

[0045] A power source 512 provides power to the controller 510, pump actuator 514 and any other components that require power. Power supply 512 may be one or more batteries, or may be a hard wired power source and draw power, from for example, an 520 VAC line. In

such case, power supply 512 may include any necessary transformers, rectifiers, or power conditioning devices to obtain suitable power for the components described herein. Pump actuator 514 actuates liquid pump 516 and air pump 517

[0046] Liquid pump 116 is connected to inlet dip tube 520, which is located in container 518, an in-line suck-back mechanism 550 and a liquid outlet tube 518 that extends up to mixing chamber 522. Air pump 517 is connected to air line 519 that is connected to mixing chamber 522. Inline suck-back mechanism 550 may be located in air line 519 as illustrated by phantom lines identified as 550', or may be located in foam dispense tube 523 as illustrated by phantom lines identified as 550'. In addition, the inline suck-back mechanism 550, 550'; or 550 ' may be located anywhere along the desired lines, including below counter 502, above counter 502 in spout 504 or near outlet 524. In some embodiments, container 518, foam pump 516, dip tube 520 and outlet tube 523 form a refill and may be replaced when container 518 runs out of fluid or stops working. In some embodiments, container 518 is refillable and the container 518 and pump s 516, 517 remain in place. In some embodiments, mixing chamber 522 is located below the counter, in some embodiments mixing chamber is located above the counter, and in some embodiments, mixing chamber 522 is located near outlet 524. Container 518 contains a fluid, such as, for example, a foamable soap or sanitizer.

[0047] Controller 110 includes logic or circuitry for operating pump actuator 114 that operates pump 116. "Logic" is synonymous with "circuit" or "circuitry" and includes, but is not limited to hardware, firmware, software and/or combinations of each to perform a function(s) or an action(s). For example, based on a desired application or needs, logic may include a software controlled microprocessor or microcontroller, discrete logic, such as an application specific integrated circuit (ASIC) or other programmed logic device. Logic may also be fully embodied as software. The circuits identified and described herein may have many different configurations to perform the desired functions.

[0048] The exemplary embodiments of suck-back mechanisms disclosed herein may be used in counter mount applications, inverted applications and in upright applications.

[0049] While the present invention has been illustrated by the description of embodiments thereof and while the embodiments have been described in considerable detail, it is not the intention of the applicant to restrict or in any way limit the scope of the appended claims to

such detail. Additional advantages and modifications will readily appear to those skilled in the art. Therefore, the invention, in its broader aspects, is not limited to the specific details, the representative apparatus and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of the applicant's general inventive concept.

CLAIMS

We claim:

1. A refill unit comprising:
 - a container;
 - a pump connected to the container; and
 - an outlet passage;
 - the outlet passage includes a first cylindrical portion and a second portion;
 - wherein the diameter of the second portion is larger than the diameter of the first cylindrical portion;
 - an inline suck-back valve located in the in the outlet passage;
 - wherein the inline-suck-back valve moves within the first cylindrical portion and second portion of the outlet passage; and
 - wherein movement of the inline suck-back valve in a first direction while the inline suck-back valve is located within the first cylindrical portion causes fluid in the outlet passage to be drawn back into the outlet passage.
2. The refill unit of claim 1 wherein the pump is a foam pump.
3. The refill unit of claim 1 wherein the refill unit is for an under-counter mount refill.
4. The refill unit of claim 1 further comprising a biasing member to bias the suck-back valve toward the pump.
5. The refill unit of claim 4 wherein the biasing member compresses when fluid is forced through the outlet by the pump.
6. The refill unit of claim 1 wherein the pump is located below the container.
7. A refill unit comprising:
 - a container;
 - a pump connected to the container;
 - an outlet passage having a first cylindrical portion and a second portion;
 - an inline suck-back valve located in the in the outlet passage;
 - wherein fluid flowing from the pump causes the inline suck-back valve to move away from its rest position; and

wherein when fluid stops flowing out of the pump, the inline suck-back valve moves back to its rest position and draws residual fluid in the outlet passage back.

8. The refill unit of claim 7 wherein the first cylindrical portion has a smaller diameter than the second portion.
9. The refill unit of claim 7 further comprising an outlet tube extending upward from the inline suck-back valve.
10. The refill unit of claim 7 further comprising a spring for biasing the suck-back to its rest position.
11. The refill unit of claim 10 wherein the spring compresses to allow fluid to flow past the suck-back valve and expands to move the suck-back valve to its rest position.
12. The refill unit of claim 7 wherein the refill unit is an under-counter mount refill unit.
13. The refill unit of claim 7 wherein the pump is located below the container.
14. The refill unit of claim 7 further comprising one or more guide ribs to guide the suck-back valve.
15. The refill unit of claim 7 further comprising an outlet nozzle having a drip catcher located proximate the outlet nozzle.
16. A refill unit comprising:
 - a container;
 - a foam pump secured to the container;
 - an outlet passage downstream of the foam pump;
 - an inline suck-back valve located in the outlet passage;
 - the inline suck-back valve having a sealing member;
 - a first portion of the outlet passage engages with the sealing member and fluid cannot pass by the sealing member when the sealing member is located in the first portion of the outlet passage; and
 - an outlet;wherein movement of the sealing member in the first outlet passage toward the foam pump draws fluid away from the outlet.

17. The refill unit of claim 16 further comprising an outlet tube located between the outlet passage and the outlet.
18. The refill unit of claim 16 wherein the refill unit is an under counter mount refill unit.
19. The refill unit of claim 16 further comprising a biasing member to bias the sealing member toward to foam pump.
20. The refill unit of claim 19 wherein the biasing member compresses to let fluid flow from the foam pump to the outlet and expands to suck fluid back from the outlet when the foam pump is at rest.
21. A dispenser system:
 - a container;
 - a pump secured to the container;
 - an outlet passage downstream of the pump;
 - an inline suck-back valve located in the outlet passage;
 - the inline suck-back valve having a sealing member;
 - a first portion of the outlet passage engages with the sealing member and fluid cannot pass by the sealing member when the sealing member is located in the first portion of the outlet passage; and
 - an outlet;
 - wherein movement of the sealing member in the first outlet passage toward the foam pump draws fluid away from the outlet.
22. The refill unit of claim 21 wherein the outlet passage is a foam outlet passage.
23. The refill unit of claim 21 wherein the outlet passage is a liquid outlet passage.
24. The refill unit of claim 21 wherein the outlet passage is an air outlet passage.

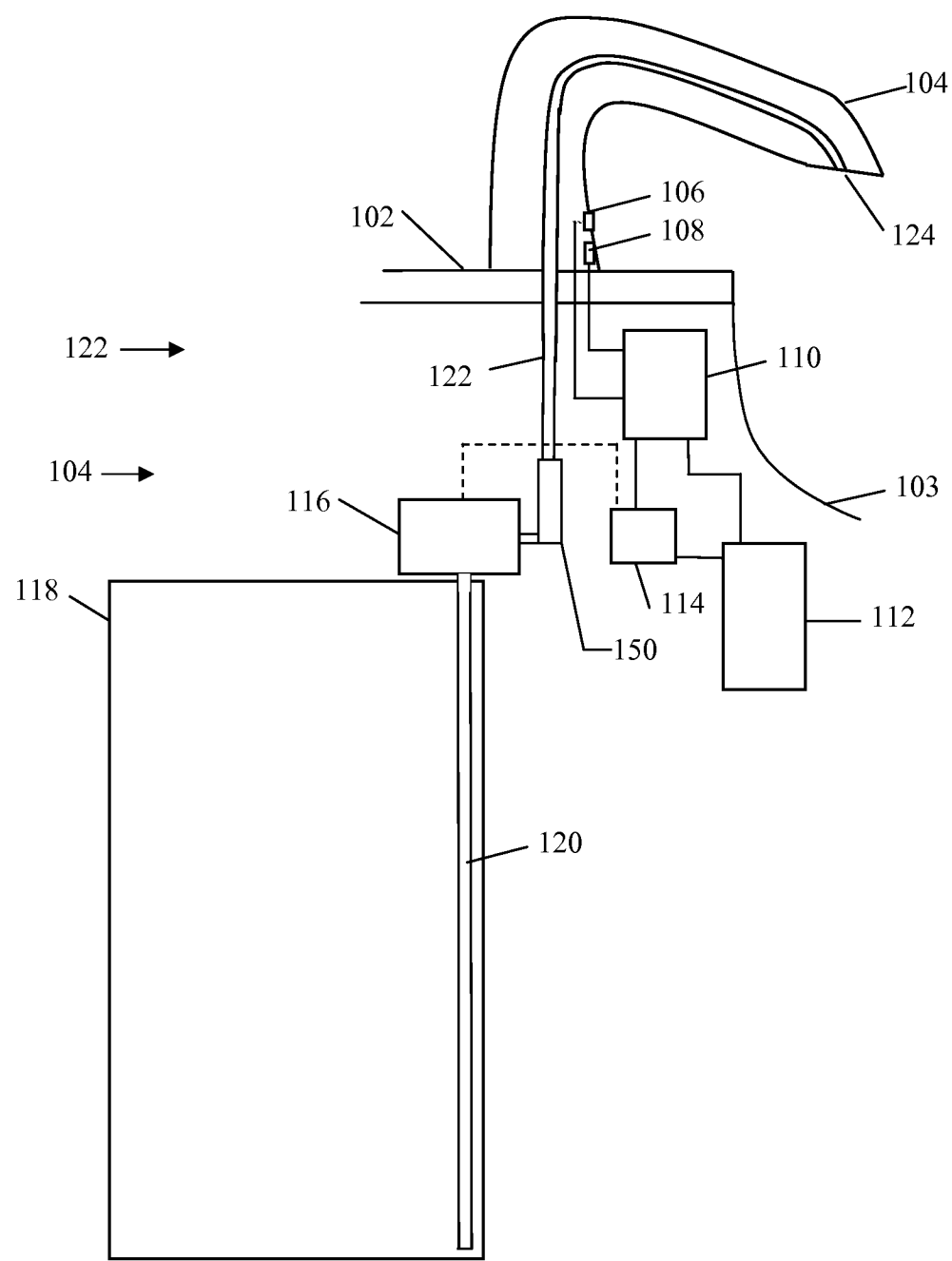
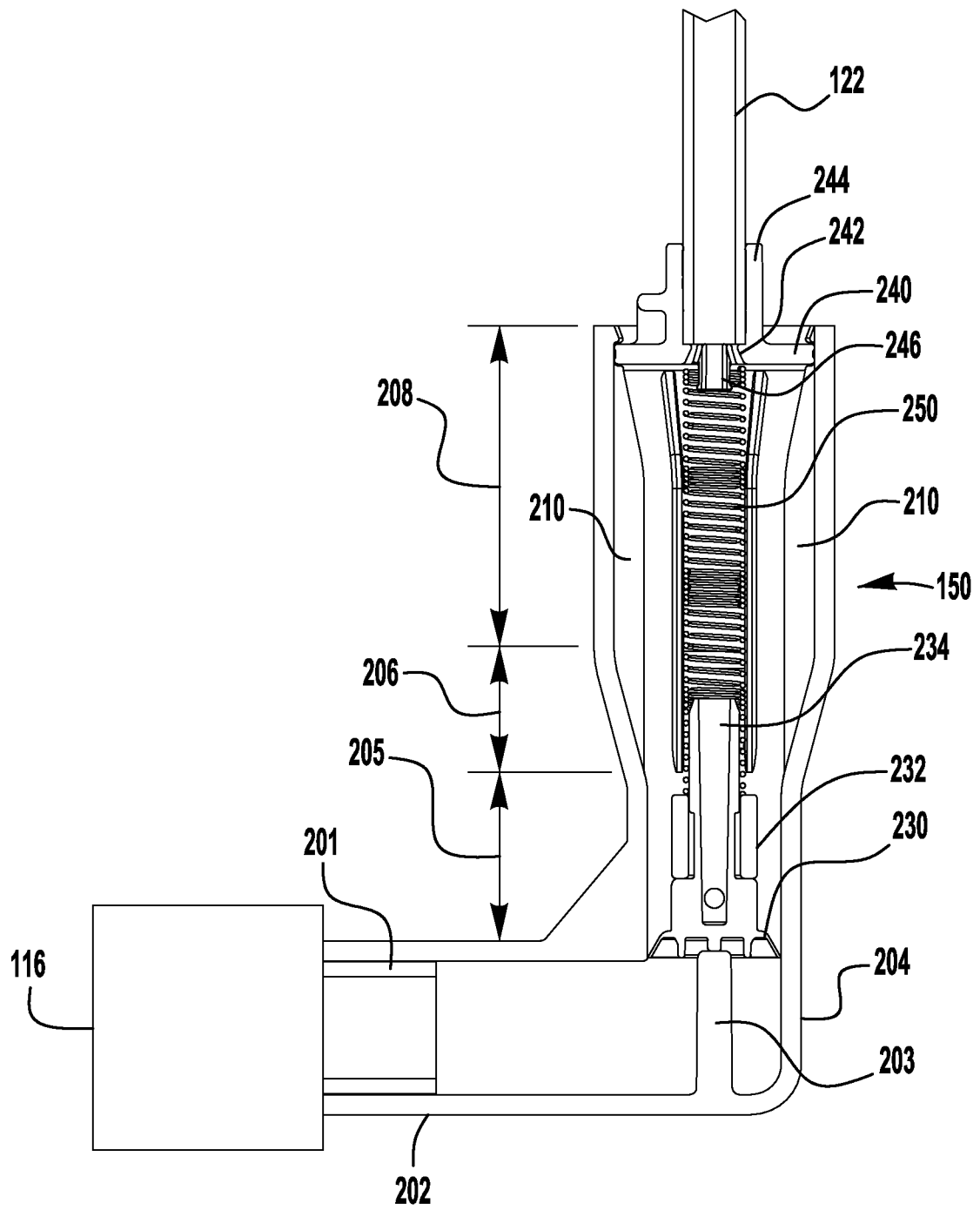
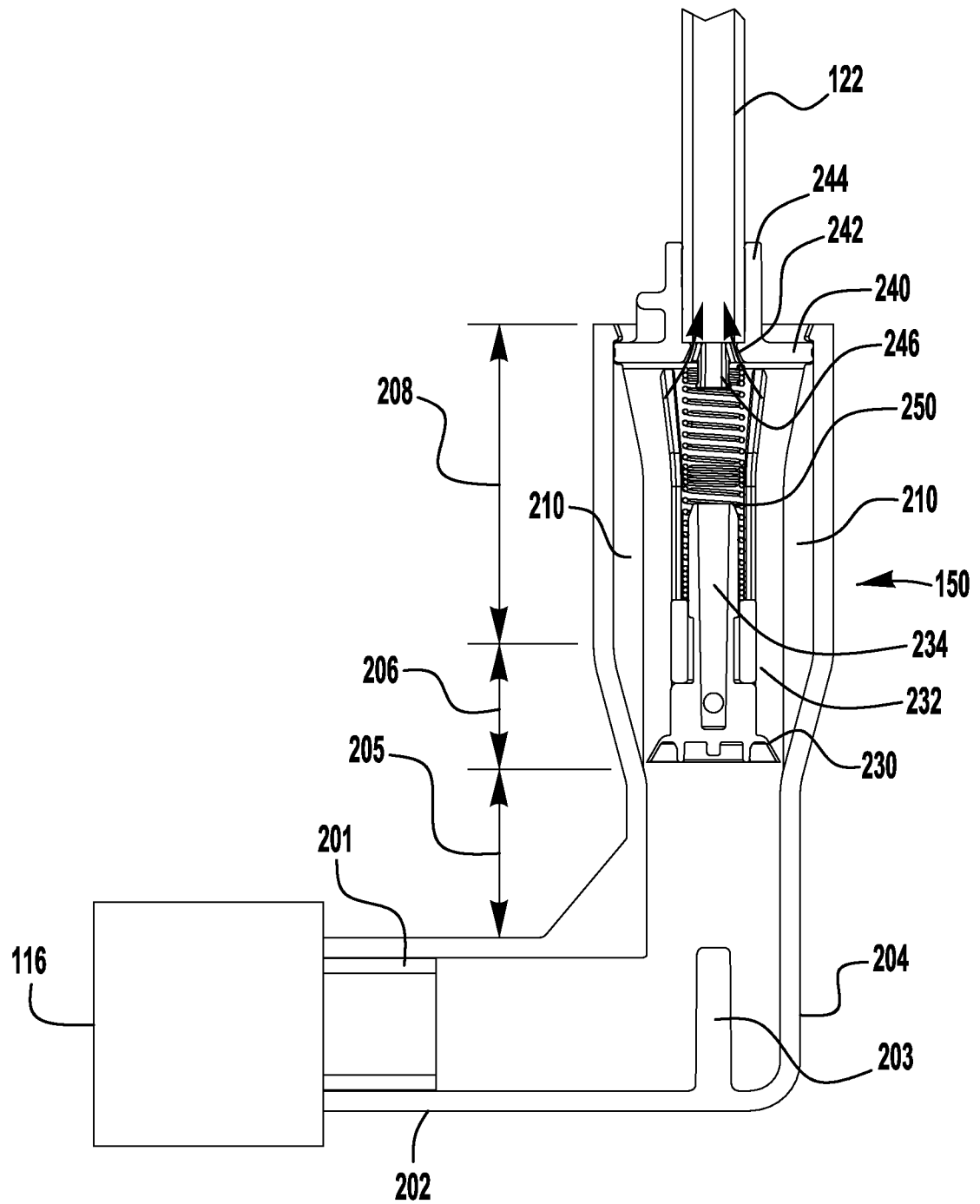


FIG. 1

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**FIG. 2A**

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**FIG. 2B**

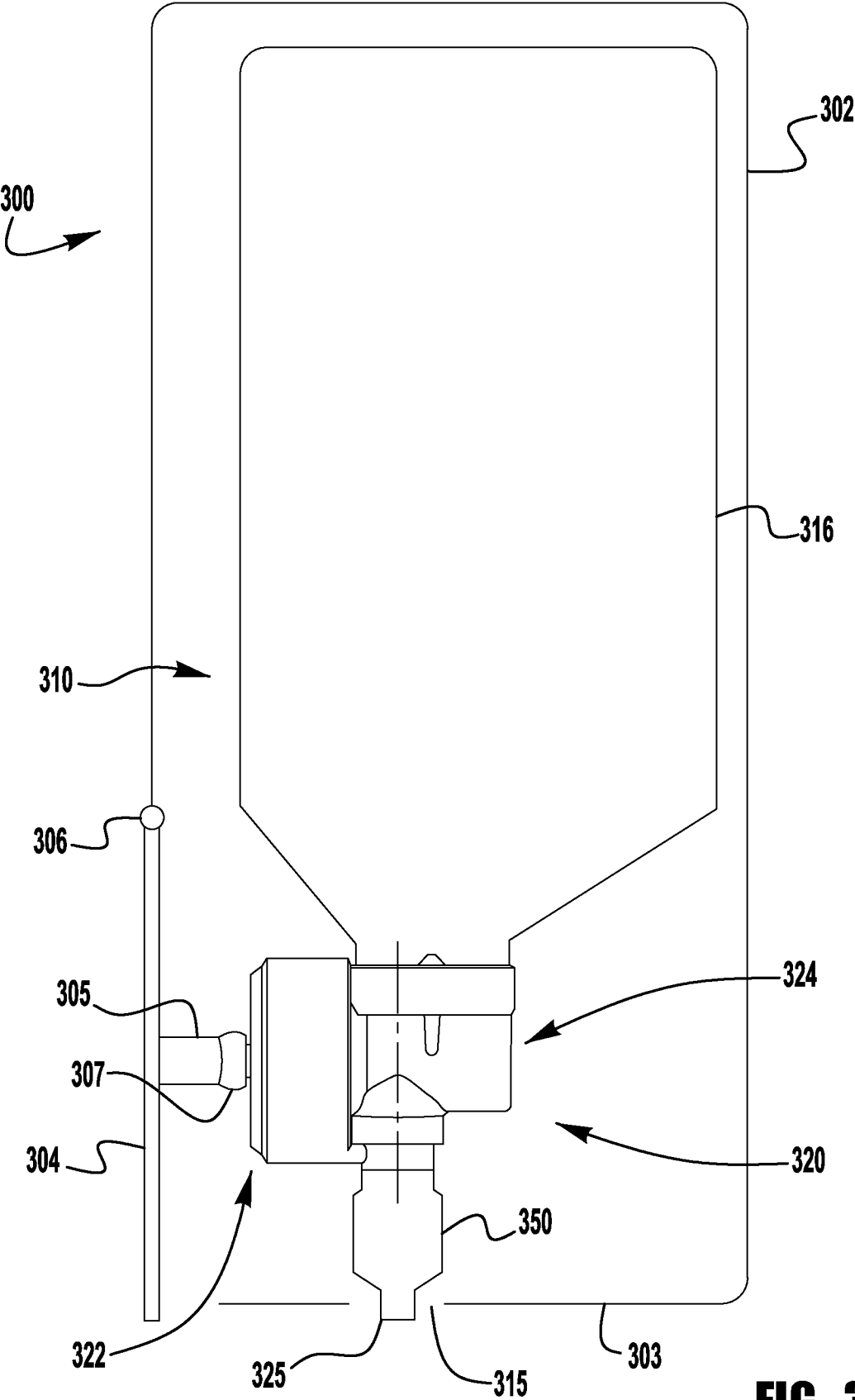


FIG. 3

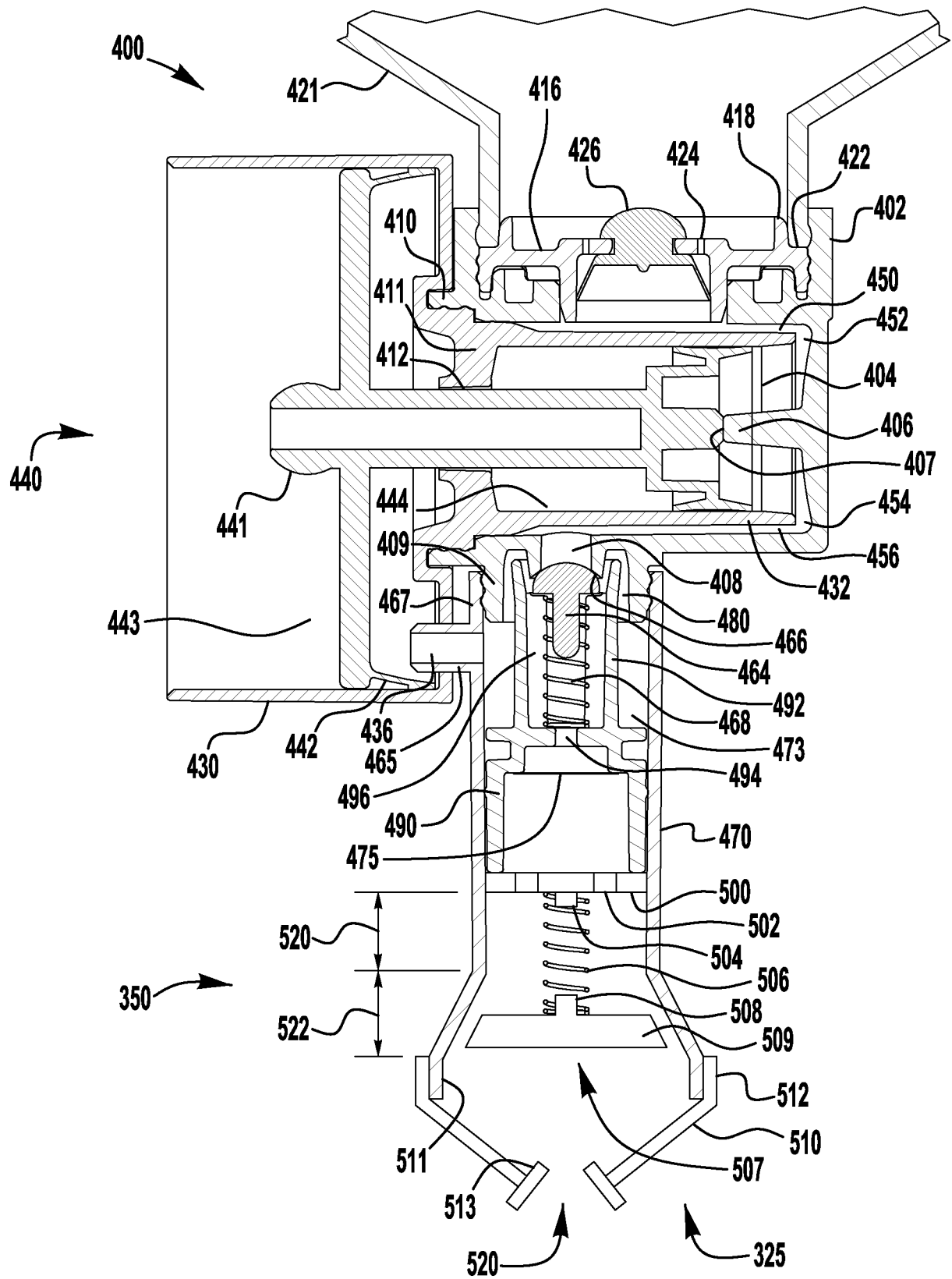


FIG. 4

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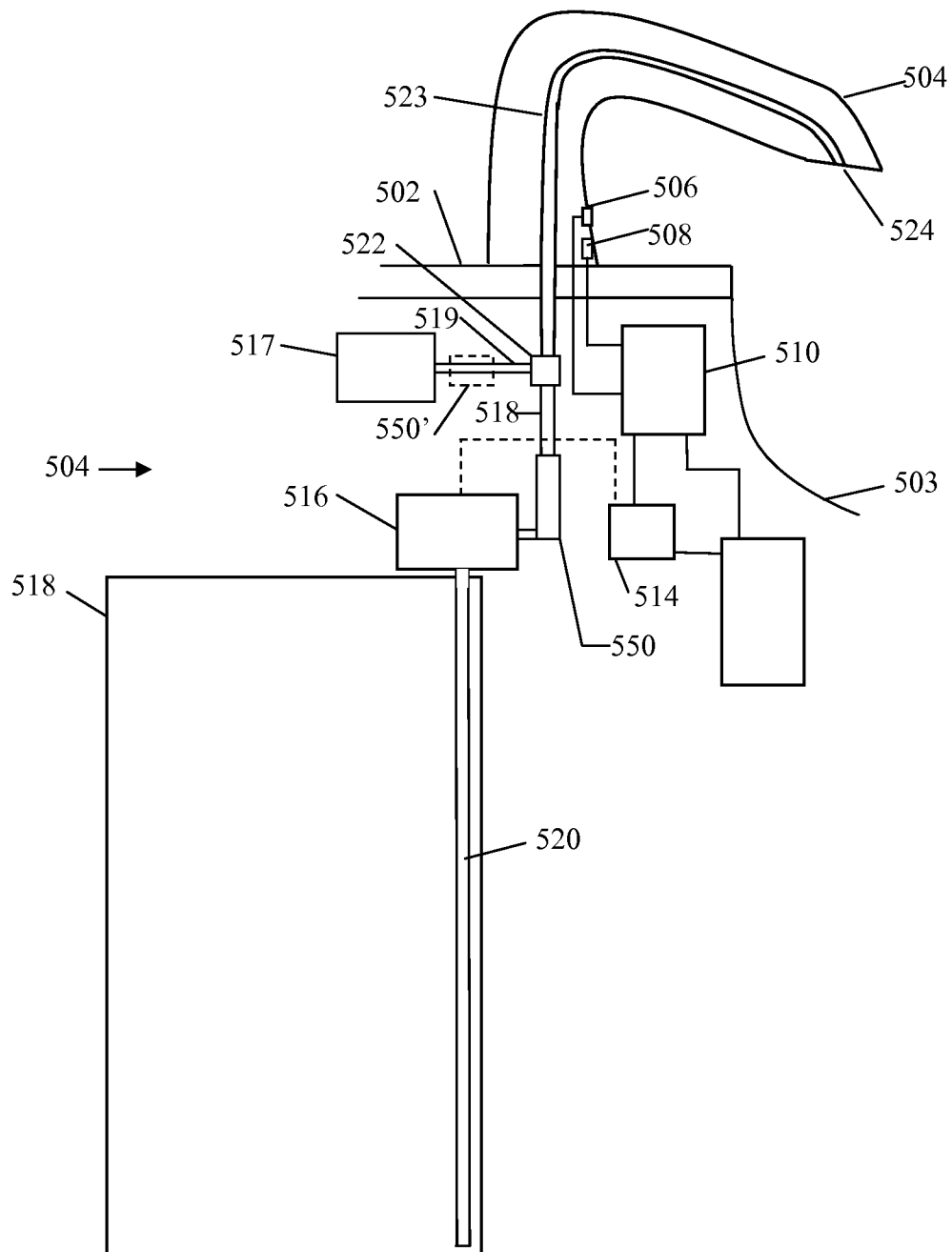


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/058150

A. CLASSIFICATION OF SUBJECT MATTER
INV. B05B11/00 A47K5/12
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B05B A47K B67D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 2002/166880 A1 (TAYLOR-MCCUNE CHRISTOPHER J [US]) 14 November 2002 (2002-11-14) paragraph [0035] - paragraph [0125]; figures -----	1,3-8, 10-14, 21-24
X	US 6 422 434 B1 (LAMMOND WASS ANTHONY CHARLES [GB] ET AL) 23 July 2002 (2002-07-23) column 6, line 45 - column 10, line 51; figures ----- -/--	1,4-11, 13-15, 21-24



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

28 January 2015

Date of mailing of the international search report

05/02/2015

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Endrizzi, Silvio

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International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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