



(51) International Patent Classification:

A47K 5/14 (2006.01) A47K 5/12 (2006.01)
A47K 5/16 (2006.01)

(21) International Application Number:

PCT/US2013/040285

(22) International Filing Date:

9 May 2013 (09.05.2013)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/644,784 9 May 2012 (09.05.2012) US
13/792,028 9 March 2013 (09.03.2013) US

(71) Applicant: **GOJO INDUSTRIES, INC.** [US/US]; One Gojo Plaza, Suite 500, P.O. Box 991, Akron, OH 44309 (US).(72) Inventors: **MCNULTY, John, J.**; 8712 Breckenridge Oval, Broadview Heights, OH 44147 (US). **CIAVARELLA, Nick, E.**; 921 Justo Lane, Seven Hills, OH 44131-3818 (US). **QUINLAN, Robert, L.**; 3466 Charring Cross Drive, Stow, OH 44224 (US). **HAYES, David, D.**; 2641 Melrose Drive, Wooster, OH 44691 (US). **SMITH (JAMES), David, J.**; 685 Viridian Drive, Apt. J277, Lafayette, CO 80026 (US). **FAWCETT, Jonathan, E.**; 232 Portage Trail, Suite H, Cuyahoga Falls, OH 44221 (US).(74) Agent: **BONNER, Chet, J.**; Calfee, Halter & Griswold LLP, The Calfee Building, 1405 East Sixth St., Cleveland, OH 44114 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

[Continued on next page]

(54) Title: FOAM DISPENSERS AND REFILL UNITS FOR FOAM DISPENSERS

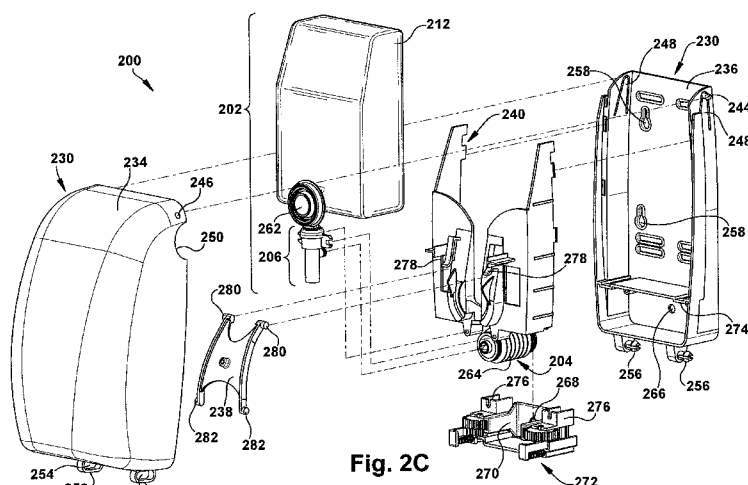


Fig. 2C

(57) Abstract: A refill unit for a foam dispenser that has an air compressor permanently attached to the dispenser is provided herein. The refill unit includes a liquid container and a body portion having a first end and a second end. The first end of the body portion is fluidly coupled to the liquid container. A liquid chamber is located in the pump body, the liquid chamber having an expanded state and a contracted state. An outlet nozzle is located proximate a second end of the body portion. A mixing chamber is located within the body portion. An air inlet is located through the body portion and is in fluid communication with the mixing chamber. A sanitary seal is located proximate the air inlet. The sanitary seal allows air to enter into the mixing chamber and prevents liquid from traveling out of the body portion through the air inlet.



Published:

— with international search report (Art. 21(3))

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

FOAM DISPENSERS AND REFILL UNITS FOR FOAM DISPENSERS

Related Applications

[0001] This application claims priority to ant the benefits of U.S. Non-Provisional Utility Patent Application Serial No. 13/792,028 filed on March 09, 2013 and entitled FOAM DISPENSERS AND REFILL UNITS FOR FOAM DISPENSERS and claims priority to and the benefits of U.S. Provisional Patent Application Serial No. 61/644,784 filed on May 09, 2012, and entitled FOAM DISPENSERS AND REFILL UNITS FOR FOAM DISPENSERS. These applications are incorporated herein by reference in its entirety.

Technical Field

[0002] The present application generally relates to foam dispensers for dispensing liquid material, such as liquid soap in the form of a foam and refill units for foam dispensers.

Background

[0003] Foam dispensers are generally configured to provide a user with an amount of soap or sanitizer in the form of foam upon actuation of the dispenser. Foam dispensers generally convert liquid material, such as liquid soap or sanitizer, into foam by aerating the liquid material as it is dispensed. Air is generally injected into the liquid material to form air bubbles in the liquid, causing the formation of foam. Foam dispensers may include a replaceable refill container that is replaced after the liquid material therein is consumed by the user. Foam dispensers with high usage rates generally require frequent replacement of the refill container.

Summary

[0004] A refill unit for a foam dispenser that has an air compressor permanently attached to the dispenser is provided herein. The refill unit includes a liquid container and a body portion having a first end and a second end. The first end of the body

portion is fluidly coupled to the liquid container. A liquid chamber is located in the pump body, the liquid chamber having an expanded state and a contracted state. An outlet nozzle is located proximate a second end of the body portion. A mixing chamber is located within the body portion. An air inlet is located through the body portion and is in fluid communication with the mixing chamber. A sanitary seal is located proximate the air inlet. The sanitary seal allows air to enter into the mixing chamber and prevents liquid from traveling out of the body portion through the air inlet.

[0005] A foam dispenser for dispensing foam including a housing and an air compressor permanently secured to the housing is disclosed herein. The air outlet is in fluid communication with the air compressor. The air outlet is also in fluid communication with the atmosphere when there is no refill unit installed in the dispenser. A nozzle is connected to the air outlet. The nozzle is configured to releasably mate with a manifold that is part of a refill unit and when the refill unit is installed in the foam dispenser, the air outlet is placed in fluid communication with a mixing chamber in the refill unit. In addition, the dispenser includes a liquid pump actuating member for moving a portion of a liquid pump to pump liquid.

[0006] A foam dispenser including a housing and an air compressor permanently secured to the housing is disclosed herein. The air compressor includes an outlet nozzle. The outlet nozzle is in fluid communication with the atmosphere when no refill unit is installed. A sealing member for sealing the nozzle to a manifold of a refill unit is also provided. The outlet nozzle is releasably sealed to a manifold of a refill unit forming an airtight seal with the manifold when the refill unit is installed in the foam dispenser. Thus, once the refill unit is installed in the foam dispenser, the outlet nozzle is placed in fluid communication with a mixing chamber in the refill unit. In addition, the dispenser includes a liquid pump actuating member for moving a portion of a liquid pump to pump liquid.

Brief Description of the Drawings

[0007] In the accompanying drawings, which are incorporated in and constitute a part of the specification, embodiments of the invention are illustrated, which, together with the general description of the invention given above and the detailed description given below, serve to exemplify the principles of the inventions.

[0008] Fig. 1 illustrates a foam dispenser according to an embodiment of the present application.

[0009] Fig. 2A is a perspective view of a foam dispenser according to an embodiment of the present application.

[0010] Fig. 2B is a partially exploded perspective view of the foam dispenser shown in Fig. 2A, wherein the housing of the dispenser is shown separated from other components of the dispenser.

[0011] Fig. 2C is an exploded perspective view of the foam dispenser shown in Fig. 2A.

[0012] Figs. 3A and 3B are cross-sectional views of a foam dispenser according to an embodiment of the present application.

[0013] Figs. 4A and 4B are partial cross-sectional views of the refill unit and the air pump of the foam dispenser shown in Figs. 3A and 3B.

[0014] Fig. 5 is an exploded perspective view of a carriage assembly according to an embodiment of the present application.

[0015] Figs. 6A and 6B are perspective views of the carriage assembly shown in Fig. 5 including a pump assembly.

[0016] Fig. 7 is a rear perspective view of a first portion of a housing of a foam dispenser according to an embodiment of the present application.

[0017] Fig. 8 is a perspective view of a frame of a foam dispenser according to an embodiment of the present application.

[0018] Fig. 9 illustrates another exemplary embodiment of a foam dispenser.

[0019] Figure 10 illustrates the dispenser of Fig. 9 with the lid raised for removal of the refill unit.

[0020] Figure 11 illustrates yet another exemplary embodiment of a foam dispenser.

[0021] Figure 12 illustrates an exemplary embodiment of a connecting mechanism to connect an air source secured to the foam dispenser to a refill unit.

Description of Embodiments

[0022] As described herein, when one or more components are described as being connected, joined, affixed, coupled, attached or otherwise interconnected, such interconnection may be direct as between the components or may be indirect such as through the use of one or more intermediary components. Also as described herein, reference to a “member,” “component” or “portion” shall not be limited to a single structural member, component or element, but can include an assembly of components, members or elements.

[0023] The foam dispensers generally include a refill portion and an air pump. The refill portion of the foam dispensers generally include a liquid container fluidly coupled to a liquid pump, a mixing chamber, a foam cartridge and an outlet nozzle. The liquid pump is generally configured to draw liquid material from the liquid container into the liquid pump and expel the liquid material from the liquid pump into the mixing chamber. Further, the air pump, which is not part of the refill unit and is fixed to the dispenser housing, is generally configured to draw air into the air pump and expel the air from the air pump into the mixing chamber. The liquid material from the liquid pump mixes with the air from the air pump in the mixing chamber to form a mixture. The mixture is then dispensed out of the outlet of the foam dispenser as foam.

[0024] The refill portion of the foam dispenser is configured to be replaceable. Once the liquid material in the liquid container is consumed, the refill portion may be removed from the foam dispenser and replaced with a another refill portion with

minimal effort. The foam dispenser is configured such that replacement of the refill portion is quick and easily understood upon visual inspection of the foam dispenser. Further, the refill portion of the foam dispenser includes the “wet” components of the foam dispenser. These components may permit the growth of mold or other substances if the wet components were to remain with the dispenser when the refill unit is replaced. Such a result is undesirable and therefore all of the wet parts are discarded with the refill unit.

Detailed Description of the Drawings

[0025] Fig. 1 illustrates a foam dispenser 100 according to an embodiment of the present application. As illustrated, the foam dispenser 100 includes an air pump 104. A refill unit 102 is removably installed in foam dispenser 100. Refill unit 102 includes liquid container 112, liquid pump 116, mixing chamber 106, a screen 108 and an outlet 110. Liquid pump 116 includes a first valve 114 and a second valve 118.

[0026] The liquid container 112 of the foam dispenser 100 may take a variety of shapes, forms or configurations capable holding a liquid material, such as liquid soap, foamable liquid soap, liquid sanitizer or the like. For example, the liquid container 112 may be a bag, a pouch, a gusseted bag or pouch, a bottle or a collapsible bottle. The liquid container 112 may be flexible or rigid, and may be made from a variety of materials. The outlet 122 of the liquid container 112 may be integrally formed with the container or may be a separate component that is attached or otherwise coupled to the container. The outlet 122 of the liquid container 112 may also include a pierceable membrane that is pierced by pump 116 inlet to permit fluid communication between the liquid container 112 and the liquid pump 116.

[0027] Various devices or methods may be used to prohibit usage of a wrong, unintended or otherwise improper liquid container 112 or refill unit 102 with the foam dispenser 100. These devices or methods may be mechanical, electrical and/or chemical in nature. One example of such device or method is “keying” the liquid container 112 or refill unit 102 with one or more other components of the foam dispenser 100. A first portion of the key (not shown) may be attached to the liquid container 112 or refill unit 102. The first portion of the key being configured to mate with a second portion of the

key (not shown) that may be attached to another component, such as the frame, of the foam dispenser 100.

[0028] As illustrated in Fig. 1, the liquid pump 116 of the foam dispenser 100 is configured to draw liquid material from the liquid container 112 into the liquid pump and expel the liquid material from the liquid pump into the mixing chamber 106 of the foam dispenser 100. The liquid pump 116 includes a liquid chamber having a variable volume. Increasing the volume of the liquid chamber creates a vacuum within the liquid chamber that draws liquid material from the liquid container 112 into the liquid pump 116. Decreasing the volume of the liquid chamber expels the liquid material in the liquid chamber into the mixing chamber 106.

[0029] In one embodiment, a flexible member at least partially forms the liquid chamber of the liquid pump 116. The flexible member is configured to expand and collapse between an expanded condition and a collapsed condition to increase and decrease the volume of the liquid chamber. Expansion of the flexible member creates a vacuum within the liquid chamber that draws liquid material from the liquid container 112 past one-way inlet check valve 114 into the liquid pump 116. Collapse of the flexible member expels the liquid material past one-way outlet check valve 118 into the mixing chamber 106. Exemplary flexible members of the liquid pump 116 include a flexible dome or bellow. The flexible member may be made of a variety of materials, such as an elastomeric polymer. The flexible member may also be resilient such that the flexible member expands naturally back to the substantially expanded condition after collapse. In some embodiments, the liquid pump 116 may include a biasing member, such as a spring or elastomeric element (not shown), configured to bias the flexible member toward the substantially expanded condition.

[0030] In another embodiment (not shown), a piston and housing or cylinder forms the liquid chamber of the liquid pump 116. The piston is configured to move within the housing creating a liquid chamber that reciprocates between an expanded condition and a collapsed condition to increase and decrease the volume of the liquid chamber. Moving the piston to increase the volume of the liquid chamber creates a vacuum within the liquid chamber that draws liquid material past one-way inlet check

valve 114 from the liquid container 112 into the liquid pump 116. Moving the piston to decrease the volume of the liquid chamber expels the liquid material in the liquid chamber through one-way outlet check valve 118 and into the mixing chamber 106. In some embodiments, the liquid pump 116 may include a biasing member, such as a spring or elastomeric element (not shown), configured to bias the piston toward the substantially expanded condition to increase the volume of the liquid chamber.

[0031] As illustrated in Fig. 1, first valve 114 is positioned between the liquid container 112 and the liquid pump 116. The first valve 114 regulates the flow of liquid material between the liquid container 112 and the liquid pump 116. The first valve 114 may be a one-way valve configured to permit the flow of liquid material from the liquid container 112 to the liquid pump 116 and prohibit the flow of liquid material from the liquid pump 116 to the liquid container 112. For example, in one embodiment, the first valve 114 is biased toward a closed position (i.e., normally closed) and configured such that the vacuum created by increasing the volume of the liquid chamber (e.g., when the flexible member of the liquid pump 116 is moved outward) opens the valve to permit the flow of liquid material from the liquid container 112 to the liquid pump 116. Once the liquid chamber is expanded, the first valve closes to prohibit the flow of liquid material from the liquid pump 116 back to the liquid container 112. Further, when the volume of the liquid chamber is decreased (e.g., when the flexible member of the liquid pump 116 is moved inward or collapsed), the first valve 114 is closed to prohibit the flow of liquid material from the liquid pump 116 back to the liquid container 112. The first valve may be a variety of valves such as, for example, a flap valve, a check valve, a poppet valve, a duck-bill valve, a ball and spring valve or any other one-way valve.

[0032] Still referring to Fig. 1, the second valve 118 is positioned between the liquid pump 116 and the mixing chamber 106. The second valve 118 regulates the flow of liquid material between the liquid pump 116 and the mixing chamber 106. The second valve 118 may be a one-way valve configured to permit the flow of liquid material from the liquid pump 116 to the mixing chamber 106 and prohibit the flow of liquid material and/or air from the mixing chamber 106 to the liquid pump 116. For example, in one embodiment, the second valve 118 is biased toward a closed position (i.e., normally closed) and configured such that an expulsion of liquid material created

by decreasing the volume of the liquid chamber (e.g., collapsing the flexible member of the liquid pump 116) opens the valve to permit the flow of liquid material from the liquid pump 116 to the mixing chamber 106. Once the liquid chamber is collapsed, the second valve 118 closes to prohibit the flow of liquid material and/or air from the mixing chamber 106 back to the liquid pump 116. Further, when the volume of the liquid chamber increases (e.g., when the flexible member of the liquid pump moves outward), the second valve 118 is closed to prohibit the flow of liquid material and/or air from the mixing chamber 106 back to the liquid pump 116. The second valve 118 may be a variety of valves such as, for example, a flap valve, a check valve, a poppet valve, a duck-bill valve, a ball and spring valve, a slit valve or any type of one-way valve.

[0033] Mixing chamber 106 includes an air inlet 150 having a one-way air inlet valve 151. One-way air inlet valve 151 allows air to enter the mixing chamber 106 but prevents liquid material from exiting the mixing chamber 106 and contacting air pump 104. One-way air inlet valve 151 may be any one-way inlet valve such as, for example, a flap valve, a check valve, a poppet valve, a duck-bill valve, a ball and spring valve, a slit valve or any type of one-way valve. One-way air inlet valve 151 is a sanitary valve in that it prevents liquid from contaminating air pump 104. If liquid is permitted to contaminate air pump 104, which remains with the dispenser 100 when the refill unit 102 is removed, mold may grow in the air pump 104 and cause the dispenser 104 to dispense contaminated foam. One-way air inlet valve 151 prevents such contamination. One-way inlet air valve 151 is secured to mixing chamber 106 and is disposed of with refill unit 102.

[0034] As illustrated in Fig. 1, the refill unit 102 of the foam dispenser 100 includes the liquid container 112, outlet 122, the first valve 114, the liquid pump 116, the second valve 118, the mixing chamber 106, one-way air inlet valve 151, screen(s) 108 and outlet 110. The refill unit 102 is removably coupled to the air pump 104 of the foam dispenser 100. Once the liquid material in the liquid container 112 is consumed, the refill unit 102 may be removed from the foam dispenser 100 and replaced with another refill unit.

[0035] As illustrated in Fig. 1, the air pump 104 of the foam dispenser 100 is configured to draw air into the air pump and expel the air from the air pump into the mixing chamber 106. The air pump 104 includes an air chamber having a variable volume. Increasing the volume of the air chamber creates a vacuum within the air chamber that draws air into the air pump 104 through an air inlet 128 past one-way air inlet valve 129. Decreasing the volume of the air chamber expels the air in the air chamber into the mixing chamber 106.

[0036] In one embodiment, a flexible member at least partially forms the air chamber of the air pump 104. The flexible member is configured to expand and collapse between an expanded condition and a collapsed condition to increase and decrease the volume of the air chamber. Expansion of the flexible member creates a vacuum within the air chamber that draws air into the air pump 104 through one-way air inlet valve 129. Collapse of the flexible member expels the air in the air chamber through air inlet valve 151 and into the mixing chamber 106. Exemplary flexible members of the air pump 104 include a flexible dome or bellow. The flexible member may also be resilient such that the flexible member expands naturally back to the expanded condition after collapse. In some embodiments, the air pump 104 may include a biasing member (not shown), such as a spring or elastomeric element, configured to bias the flexible member toward the expanded condition.

[0037] In another embodiment, a piston encased within a housing or cylinder forms the air chamber of the air pump 104. The piston is configured to move within the housing between an expanded condition and a collapsed condition to increase and decrease the volume of the air chamber. Moving the piston to increase the volume of the air chamber creates a vacuum within the air chamber that draws air into the air pump 104. Moving the piston to decrease the volume of the air chamber expels the air in the air chamber into the mixing chamber 106. In some embodiments, the air pump 104 may include a biasing member, such as a spring or elastomeric element, configured to bias the piston toward the substantially expanded condition to increase the volume of the air chamber.

[0038] As illustrated in Fig. 1, the foam dispenser 100 includes one or more actuators 124/126 configured to operate the air pump 104 and/or liquid pump 116 of the dispenser 100. The one or more actuators 124/126 may be configured to provide an actuating force to facilitate collapse or expansion of a flexible member, or movement of a piston, of the air pump 104 and/or the liquid pump 116 to increase or decrease the volume of the air or liquid chamber. The one or more actuators 124/126 may also be configured to operate the air pump 104 and liquid pump 116 of the dispenser 100 such that the liquid material from the liquid pump and the air from the air pump enter the mixing chamber 106 at approximately the same time. The one or more actuators 124/126 may be configured to operate the air pump 104 and the liquid pump 116 substantially simultaneously (i.e., at approximately the same time or instant), concurrently (i.e., overlapping in duration), or consecutively (i.e., one after the other), or a combination thereof.

[0039] The one or more actuators 124/126 may include an actuating member configured to operatively engage a flexible member or piston of the liquid pump 116 and/or the air pump 104. For example, the actuating member may include a lever, bracket, plate, protrusion, boss or other engagement member that operatively engages the flexible member or piston of the liquid pump 116 and/or the air pump 104. The actuating member may be configured to be moved by a user of the foam dispenser 100 from a first position to a second position to collapse the flexible member, or move the piston, and decrease the volume of the liquid or air chamber. As such, the liquid material from the liquid pump 116 and the air from the air pump 104 are expelled into the mixing chamber 106 of the dispenser 100 through foam generating member/screen(s) 108 and out of outlet 110. In addition, the actuator may be an electric actuator activating electronically upon detection of a user's hand.

[0040] The actuating member may also be adjustable to control the amount of liquid material and/or air expelled into the mixing chamber 106 of the dispenser 100. For example, the position of the actuating member relative to the liquid pump 116 and/or the air pump 104 may be adjusted such that the amount the flexible member is collapsed or the piston is moved when the actuating member is moved from the first

position to the second position, such as, for example, to increase or decrease the amount of liquid material and/or air expelled into the mixing chamber 106.

[0041] Further, the actuating member may be biased towards the first position such that, upon release, the member moves toward the first position (i.e., from the second position to the first position). A biasing member, such as a spring or elastomeric element, may be used to bias the actuating member toward the first position. The movement of the actuating member toward the first position permits the flexible member to expand, or the piston to move, back to an expanded condition. The actuating member may also be coupled to the flexible member or piston. With the actuating member coupled to the flexible member or piston, the movement of the member towards the first position facilitates the expansion of the flexible member, or movement of the piston, to increase the volume of the liquid or air chamber.

[0042] The one or more actuators 124/126 may also include a mechanism that is configured to facilitate collapse or expansion of a flexible member, or movement of a piston, of the air pump 104 and/or the liquid pump 116 to increase or decrease the volume of the air or liquid chamber. For example, in one embodiment, a flexible member is coupled to a carriage assembly such that movement of the carriage expands and collapses the flexible member. The mechanism may be driven by a variety of manual and/or automated means, such as, for example, a motor, cylinder, lever, actuating member or other actuator. Further, the mechanism may include gearing, such as a rack and pinion assembly, to facilitate movement of the mechanism.

[0043] Figs. 2A-2C illustrate a foam dispenser 200 according to an embodiment of the present application. The foam dispenser 200 includes a refill unit 202, an air pump 204, a manifold 206, a foaming tip 208 (Fig. 3) and a housing 230. The refill unit 202 of the foam dispenser 200 includes a liquid container 212, a liquid pump 262, a manifold 206 that forms a mixing chamber 314, foaming cartridge 208 and an outlet 260. As illustrated, the foam dispenser 200 also includes an actuating lever 238 for the liquid pump 262, air pump 204 and a carriage assembly 272 for actuating the air pump 204. Further, the foam dispenser 200 includes a frame 240 for supporting one or more components of the refill unit 202.

[0044] Housing 230 encases the components of the foam dispenser 200 and includes a first portion 234 removably attached to a second portion 236. The first portion 234 of the housing 230 is movable relative to the second portion 236. As illustrated in Figs. 2A-2C, the first portion 234 of the housing 230 is pivotally attached to the second portion 236 at pivot point 242. The second portion 236 includes one or more pins 244 configured to mate with one or more apertures 246 in the first portion 234 to form the pivot point 242. Further, the pins 244 are attached to flanges 248 of the second portion 236. The flanges 248 are configured such that they may be flexed inward to position the pins 244 for insertion into the apertures 246 and then return to a neutral position when released such that the pins 244 may be inserted into the apertures 246. To remove the first portion 234 from the second portion 236 of the housing 230, the flanges 248 may be flexed inward such that the pins 244 are removed from the apertures 246 of the first portion 234. Further, the first portion 234 includes openings or notches 250 that permit access to the flanges 248 when the first portion is attached to the second portion 236.

[0045] The first portion 234 of the housing 230 also includes one or more guides for directing the movement of the first portion 234 relative to the second portion 236. As illustrated in Figs. 2A-2C, the first portion 234 of the housing includes guide members 252 having openings or slots 254 that are configured to mate with guide pins 256 of the second portion 236. The interaction of the slot 254 with the guide pin 256 restricts the pivotal movement of the first portion 234 relative to the second portion 236. Further, the guide pins 256 of the second portion 236 include flanged ends that secure the guide pins 256 in the slots 254. The guide pins 256 also include a notch in the end such that the sides of the guide pin may be squeezed together to permit insertion and removal of the guide pins 256 in and from the slots 254.

[0046] As illustrated in Fig. 7, the first portion 234 of the housing 230 also includes an opening or notch 710 for the outlet 260 of the dispenser 200 and openings or notches 712 for the support members of the guide pins 256 of the second portion 236. The openings or notches 710 and 712 provide clearance for the outlet 260 and the support members as the first portion 234 is moved relative to the second portion 236 of the housing 230.

[0047] As illustrated in Figs. 2B and 2C, the second portion 236 of the housing 230 includes apertures 258 for mounting the second portion (i.e., to a wall or other upright support). In this regard, the second portion 236 of the housing 230 acts as a mounting bracket for the foam dispenser 200 and the first portion 234 of the housing acts as a movable cover of the foam dispenser. As described below in reference to Figs. 3A and 3B, the first portion 234 of the housing 230 acts as an actuator in that movement of the first portion 234 relative to the second portion 236 causes liquid material from the liquid container 212 to be dispensed out of the outlet 260 of the foam dispenser 200 as foam.

[0048] As illustrated in Figs. 2B, 2C and 8, the frame 240 of the foam dispenser 200 is attached to the second portion 236 of the housing 230. The frame 240 and the second portion 236 of the housing 230 form a cavity for holding the liquid container 212 of the refill unit 202 (see Figs. 3A and 3B). Further, the frame 240 includes an opening or notch 810 that provides access for the body portion 232 of the refill unit 202 and a support member 812 for supporting the body portion 232 of the refill unit 202. When the refill unit 202 of the foam dispenser 200 is installed, the liquid container 212 is placed in the cavity formed by the frame 240 and the second portion 236 of the housing 230. Further, the body portion 232 of the refill unit 202 is placed in the notch 810 such that the liquid pump 262 is accessible outside of the cavity. The body portion 232 of the refill unit 202 is slid into a groove 814 of the support member 812 such that the refill unit 202 is supported or held in place relative to the frame 240 of the foam dispenser 200.

[0049] As illustrated in Figs. 2B and 2C, the manifold 206 is attached to liquid pump 262. As illustrated in Figs. 4A and 4B, and as described below, when the refill unit 202 is installed, the inlet 360 of manifold 206 of the refill unit 202 releasably mates with a first end portion 326 of air pump 204. When refill unit 202 is inserted into dispenser 200, manifold inlet 360 aligns with the opening 327 in first end portion 326 of air pump 204. The air pump 204 may be joined to inlet 360 by pushing manifold 206 towards air pump 204 or by pressing the actuator 238. Manifold 206 includes an annular groove 329 and o-ring 331. O-ring 331 forms a seal between manifold 206 and air pump opening 327.

[0050] As illustrated in Figs. 2B-3B and 6A-6B, the air pump 204 of the foam dispenser 200 is coupled to the carriage assembly 272. The carriage assembly 272 facilitates the collapse and expansion of a flexible member 264 of the air pump 204 to increase and decrease the volume of the air chamber. An aperture 266 in the second portion 236 of the housing 230 and an aperture 268 in the carriage 270 of the carriage assembly 272 form a conduit for air to enter the air pump 204. As shown, the carriage assembly 272 is attached to the second portion 236 of the housing 230 with fasteners; however, other methods of attachment may be used such as, for example, an adhesive, weld or the like. The carriage assembly 272 may also be attached to the frame 240 of the foam dispenser 200. Further, the second portion 236 of the housing 230 includes alignment members 274 configured to mate with brackets 276 of the carriage assembly 272 to facilitate proper placement and alignment of the carriage assembly 272.

[0051] As illustrated in Figs. 2B-3B, a first end of the actuating lever 238 of the foam dispenser 200 is secured to the frame 240 by one or more clips 278. The clips 278 are snapped over protrusions 280 on the first end of the actuating lever 238. The clips 278 are configured to permit limited movement of the first end of the actuating lever 238 relative to the frame 240. As illustrated in Figs. 3A-3B and 7, a second end of the actuating lever 238 of the foam dispenser 200 is secured to the first portion 234 of the housing 230. Protrusions 282 on the second end of the actuating lever 238 are inserted into apertures 714 in the first portion 234 of the housing 230. Further, as illustrated in Figs. 3A-3B, the actuating lever 238 includes an engagement member 310 configured to operatively engage a flexible member 312 of the liquid pump 262. Engagement member 310 is adjustable. In one embodiment the body of engagement member 310 has threads and screws into actuator lever 238. Thus, engagement member 310 can be adjusted to fully collapse the liquid chamber or to partially collapse the liquid chamber. Thus, output of pump 262 may adjusted.

[0052] As illustrated in Figs. 3A and 3B, the body portion 232 of the refill unit 202 includes a first member 316 coupled to a second member 318. The first member 316 includes a first end 302 and a second end 340. Further, the first member 316 is coupled to the flexible member 312 and at least partially forms the liquid pump 262 of the dispenser 200. The second member 318 of the body portion 232 includes a first end

342 and a second end 344. As shown, the second end 340 of the first member 316 is coupled to the first end 342 of the second member 318 with a snap fit connection. However, other types of connections may be used such as, for example, a press fit or threaded connection. Further, the body portion 232 of the refill unit 202 may be formed from one or more components; for example, the body portion may be formed from a single piece of material.

[0053] The first end 302 of the first member 316 is fluidly connected to the liquid container 212. As shown, the first end 302 is inserted through the liquid container 212 and extends into the liquid container. The first end 302 may also be configured to pierce the liquid container 212 to permit fluid communication between the liquid container and the liquid pump 262. A ridge or notch 320 on the first member 316 forms a fluid tight seal with the liquid container 212 to prohibit liquid material from leaking between the liquid container and the first member 316.

[0054] The body portion 232 of the refill unit 202 is shaped and configured to mate with a socket or opening 418 in the first end 414 of the manifold 206 to form a fluid tight connection. As illustrated in Fig. 4A, the opening 418 in the manifold 206 has a first portion 420 and a second portion 416. The second portion 416 of the opening 418 has a smaller interior diameter than the first portion 420. A radial flange 480 of the body portion 232 contacts a sealing element 410 coupled to the first end 414 of the manifold 206. The flange 480 and the sealing element 410 form a fluid tight seal that prohibits liquid material from leaking out between the body portion 232 and the manifold 206.

[0055] Figs. 3A and 3B illustrate the operation of the foam dispenser 200 according to an embodiment of the present application. Fig. 3A illustrates the components of the foam dispenser 200 in a first position in which the flexible member 312 of the liquid pump 262 and the flexible member 264 of the air pump 204 are in an expanded condition. Fig. 3B illustrates the components of the foam dispenser 200 in a second position in which the flexible member 312 of the liquid pump 262 and the flexible member 264 of the air pump 204 are in a collapsed condition. As shown, the flexible member 312 of the liquid pump 262 is configured as a dome made of a resilient

material and the flexible member 264 of the air pump 204 is configured as a bellows made of a resilient material.

[0056] When the housing 230 of the foam dispenser 200 is in the first position, the lower end of first portion 234 of the housing is moved away from the second portion 236. The first portion 234 of the housing 230 pivots about the pivot point 242 (Fig. 2A) and is moved toward the second portion 236 when the first portion 234 is moved from the first position to the second position. The guides of the housing 230 limit the movement of the first portion 234 relative to the second portion 236.

[0057] As the first portion 234 of the housing 230 is moved from the first position to the second position, the engagement member 310 of the actuating lever 238 engages the flexible member 312 of the liquid pump 262 to collapse the flexible member 312. When this occurs, an inlet valve 304 is closed to prohibit the flow of liquid material from the liquid pump 262 to the liquid container 212. As shown in Figs. 3A and 3B, the inlet valve 304 is a flap valve integrally formed with the flexible member 312 of the liquid pump 262 and coupled to the first member 316 of the body portion 232. However, a variety of other valves may be used, such as, for example, a check valve, poppet valve, flap valve, ball and spring and ball valve, mushroom valve, umbrella valve or other one-way check valve or the like. Further, as illustrated in Figs. 3A and 3B, the flexible member 312 of the liquid pump 262 is coupled to the first member 316 of the body portion 232.

[0058] When the flexible member 312 of the liquid pump 262 is collapsed, the liquid material in the liquid pump 262 is forced out of the liquid pump and through an outlet valve 306. The outlet valve 306 is opened to permit flow of the liquid material from the body portion 232 and into the mixing chamber 314 of the manifold 206. As illustrated in Figs. 3A and 3B, the outlet valve 306 is a slit valve coupled to the second end 344 of the second member 318 of the body portion 232; however, a variety of other valves may be used such as, for example, a check valve, a flap valve, poppet valve, ball and spring valve, mushroom valve, umbrella valve or other one-way check valve, or the like.

[0059] The liquid pump 262 and/or the outlet valve 306 may be configured to deliver the liquid material to the mixing chamber 314 at a pressure sufficient to permit conversion of the liquid material to foam.

[0060] As illustrated in Figs. 3A and 3B, the air pump 204 of the foam dispenser 200 includes a first end portion 326 and a second end portion 328. The first end portion 326 forms a first end of the air pump 204 and is configured to couple with the flexible member 264 to an inlet 360 of the manifold 206. Manifold 206 includes a one-way check valve 322. One-way check valve 322 is a sanitary valve and prevents liquid from contaminating air pump 204. Further, a nozzle 308 is coupled to the first end portion 326 of the air pump 204 and is in fluid communication with the air chamber of the air pump 204. The second end portion 328 forms a second end of the air pump 204 and is configured to couple the flexible member 264 to the carriage 270 of the carriage assembly 272. The second end portion 328 is coupled to the aperture 268 in the carriage 270. The second end portion 328 also includes an inlet valve 324 that is in fluid communication with the air chamber of the air pump 204.

[0061] As the first portion 234 of the housing 230 is moved from the first position to the second position, the carriage assembly 272 collapses the flexible member 264 of the air pump 204. Engagement members 372 formed on the inside of the first portion 234 of the housing 230 (see Figs. 3B and 7) contact actuating members 370 of the carriage assembly 272 (see Figs. 3B and 5-6B). As illustrated in Figs. 6A and 6B, and as described below, the movement of the actuating members 370 from the first position to the second position moves the carriage 270 of the carriage assembly 272 to collapse the flexible member 264 of the air pump 204. When this occurs, the inlet valve 324 of the air pump 204 is closed to prohibit the flow of air from the air pump 204 to outside the foam dispenser 200. As illustrated in Figs. 3A and 3B, the inlet valve 324 is a mushroom valve; however, a variety of other valves may be used such as, for example, a check valve, flap valve, slit valve, ball and spring valve, etc.

[0062] As the flexible member 264 of the air pump 204 collapses, the air in the air pump is forced out of the air pump and into the mixing chamber 314 of the manifold 206 through the one-way check valve 322 of manifold 206.

[0063] The air from the air pump 204 mixes with the liquid material from the liquid pump 262 in the mixing chamber 314 to form a pre-foam mixture. The pre-foam mixture is delivered from the mixing chamber 314 to the foaming cartridge 208. As illustrated in Figs. 3A and 3B, the foaming cartridge 208 includes one or more screens 308. The pre-foam mixture passes through the screens 308 to create a foam that is dispensed out of the outlet 260 of the foam dispenser 200.

[0064] When the first portion 234 of the housing 230 is released, biasing members 380 move the actuating members 372 of the carriage assembly 272 from the second position to the first position. As illustrated in Figs. 3A-3B and 5-6B, the biasing members 380 of the carriage assembly 272 are springs; however, other biasing members may be used such as, for example, an elastomeric element. When this occurs, the actuating members 372 of the carriage assembly 272 move the first portion 234 of the housing 230 from the second position to the first position.

[0065] As the first portion 234 of the housing 230 is moved from the second position to the first position, the engagement member 310 of the actuating lever 238 moves away from the flexible member 312 of the liquid pump 262 and the flexible member is permitted to expand back to the substantially expanded condition. The inlet valve 304 of the refill portion 202 is configured such that the vacuum created by the expansion of the flexible member 312 opens the inlet valve to permit the flow of liquid material from the liquid container 212 into the liquid pump 262. Further, the outlet valve 306 of the refill portion 202 is configured such that the vacuum created by the expansion of the flexible member 312 closes the outlet valve 306 to prohibit the flow of liquid material from the liquid pump 262 to the mixing chamber 314.

[0066] Furthermore, the movement of the actuating members 370 of the carriage assembly 272 from the second position to the first position expands the flexible member 264 of the air pump 204 back to an expanded condition. As illustrated in Figs. 6A and 6B, and as described below, the movement of the actuating members 370 from the second position to the first position moves the carriage 270 of the carriage assembly 272 to expand the flexible member 264 of the air pump 204. The inlet valve 324 of the air

pump 204 is configured such that the vacuum created by the expansion of the flexible member 264 opens the inlet valve to permit the flow of air into the air pump 204.

[0067] Figs. 4A and 4B illustrate installation and removal of the refill unit 202 of the foam dispenser 200 according to an embodiment of the present application. Fig. 4A illustrates the refill unit 202 removed from the air pump 204 of the foam dispenser 200. Fig. 4B illustrates the refill unit 202 coupled to the air pump of the foam dispenser 200.

[0068] Fig. 5 is an exploded view of the carriage assembly 272 and Figs. 6A and 6B illustrate the operation of the carriage assembly of the foam dispenser 200. As shown, the carriage assembly 272 includes a frame 502, a carriage 270, gear assemblies 504, biasing members 380 and actuating members 370. The frame 502 of the carriage assembly 272 includes brackets 276 that facilitate proper placement and alignment of the carriage assembly relative to the second portion 236 of the housing 230. The frame 502 also includes two sets of openings or notches 506 configured to hold the gear assemblies 504 in place relative to the frame and permit rotation of the gear assemblies relative to the frame. Further, the frame 502 includes a set of protrusions 508 configured to hold the biasing members 380 in place relative to the frame.

[0069] As illustrated in Figs. 5-6B, the gear assemblies 504 of the carriage assembly 272 include an upper gear wheel 510 and a lower gear wheel 512. The upper gear wheels 510 are configured to mesh with gear racks 514 on the outer sides of the carriage 270. As such, rotation of the gear assemblies 504 rotates the upper gear wheels 510 and moves the carriage 270 relative to the frame 502. Further, the lower gear wheels 512 are configured to mesh with gear racks 516 on the inner sides of the actuating members 370. As such, movement of the actuating members 370 rotates the lower gear wheels 512 and the gear assemblies 504. As illustrated in Figs. 5-6B, the biasing members 380 are disposed between the actuating members 370 and the frame 502 of the carriage assembly 272. The biasing members 380 are held in place by protrusions 518 on the actuating members and the protrusions 508 on the frame 502.

[0070] Fig. 6A illustrates the carriage assembly 272 in the first position in which the flexible member 264 of the air pump 204 is in a substantially expanded condition.

Both Figures 6A and 6B illustrate the pump 262 of the refill unit 202 connected to air pump 204. Fig. 6B illustrates the carriage assembly 272 in a second position in which the flexible member 264 of the air pump 204 is in a substantially collapsed condition. When the actuating members 370 are moved from the first position to the second position, the gear racks 516 of the actuating members 370 rotate the lower gear wheels 512, which in turn rotate the upper gear wheels 510 and move the carriage 270 to collapse the flexible member 264 of the air pump 204. When the biasing members 380 move the actuating members 370 from the second position to the first position, the gear racks 516 of the actuating members rotate the lower gear wheels 512, which in turn rotate the upper gear wheels 510 and move the carriage 270 to expand the flexible member 264 of the air pump 204.

[0071] Figure 9 illustrates an embodiment of a foam dispenser 900 having air compressor 910 permanently affixed thereto. The term “permanently” means that the air compressor 910 remains with the dispenser 900 when the refill unit 901 is removed. The term permanently does not mean that air compressor 910 cannot be removed from dispenser 900. In some circumstances, air compressor 910 may be removed from the dispenser 900 and replaced; however, such replacement is not undertaken each time a refill unit 901 is removed or installed in dispenser 900.

[0072] In one embodiment, refill unit 901 includes container 920, pump 924, foaming cartridge 956 and outlet nozzle 958. Pump 924 includes many of the same features described with respect to liquid pump 262. Pump 924 includes a flexible member 932. In one embodiment, flexible member 932 is a resilient dome that may be compressed to reduce the volume of liquid chamber 925. Located proximate the inlet of liquid chamber 925 is a one-way inlet valve 930. One-way inlet valve 930 may be any type of one-way valve such as, for example, a ball valve (as shown) a slit valve, a poppet valve, an umbrella valve, a flap valve or any other type of one-way valve. Upstream of the liquid chamber 925 is passage 928 and inlet 926 that places liquid chamber 925 in fluid communication with container 920. Downstream of liquid chamber 925 is a one-way outlet valve 938. One-way outlet valve 938 may be any type of one-way valve such as, for example, a slit valve, a poppet valve, an umbrella valve, a

flap valve or any other type of one-way valve. Downstream of one-way outlet valve 938 is passage 950 which leads to mixing chamber 952.

[0073] Flexible member 932 includes a flap 934. Flap 934 acts as a one-way air inlet valve that allows air from air compressor 910 to flow through opening 934 into mixing chamber 952. Preferably flap 934 is integrally formed with flexible member 932; however, in one embodiment, flap 934 is a separate piece. Flap 934 is a sanitary seal in that it prevents liquid from contaminating the air compressor 910 which remains with the dispenser 900 when the liquid refill 901 is removed. One or more additional on-way valves may be added, in for example, passage 935, to ensure that liquid may not contaminated air compressor 910.

[0074] Downstream of mixing chamber 952 is mixing cartridge 956 and outlet nozzle 958. Mixing cartridge 956 includes screens 957. In one embodiment, mixing cartridge 956 includes, or is replaced with a porous member such as, for example a sponge.

[0075] Dispenser 900 includes a housing 902. A lid 904 is pivotally attached to housing 902 by a hinge 906. Lid 904 includes actuator 908 and annular projection 911. Annular projection 911 engages with the wall 912 of air compressor 910 and retains or secures air compressor 910 to lid 904 of dispenser 900. The wall 912 of air compressor 910 may be connected to annular projection 911 with an adhesive, with a threaded connection or any other suitable means. Annular projection 911 includes an air inlet opening 913 and a one-way check valve 914 to allow air to enter the air compressor 910. In one embodiment, a vapor barrier, such as a one-way woven vapor barrier, e.g. Gortex®, is provided over the air inlet 913 to prevent moisture from entering into air compressor 910. In addition, a biasing member (not shown) is included to move lid 904 to the position shown in Figure 9.

[0076] Air compressor 910 includes a female receptacle for receiving nozzle 960. Nozzle 960 is secured to seat 962 on liquid pump 925. The nozzle 960 forms a seal with air compressor 910 when the refill unit 901 is inserted in dispenser 900 and the lid 904 is moved into its operating position. Air compressor 910 may include a biasing member (not shown) such as a spring, which may be located inside air compressor 910

to bias air compressor 910 in an expanded position and to ensure that nozzle 960 seals against the female receptacle of air compressor 910. Thus, air traveling from air compressor 901 is forced through opening 936 and does not escape around the nozzle 960 and seat 962.

[0077] During operation, force F is applied to lid 904. Lid 904 rotates toward the back of the housing 902. Actuator 908 engages flexible member 932 causing the liquid chamber 925 to compress. One-way liquid inlet valve 930 seals and liquid is forced out of liquid chamber 925 past one-way outlet valve 938 through passage 950 and into mixing chamber 952. Simultaneously, air compressor 910 is compressed. One-way air inlet valve 914 closes and air is forced out of passage 935 and the air pressure causes flap 934 to flex and allow air to pass and travel through opening 936 into mixing chamber 952 where it mixes with the liquid to form a pre-foam mixture. The mixture is forced through mixing cartridge 956 and is dispensed through outlet 958 as a foam.

[0078] When force F is removed, a biasing member (not shown) such as, for example, a spring, moves lid 904 back to its resting position (shown in Figure 9). The air compressor 910 expands. Flap 934 seals passage 935 and air inlet valve 914 opens allowing air to flow into, and recharge, air compressor 910. Flexible member 932 is resilient and moves back to the position shown in Figure 9 causing the volume of liquid chamber 925 to expand to its largest volume. The vacuum pressure caused by the expansion of liquid chamber 925 causes one-way outlet valve 938 to close and one-way inlet valve 930 to open drawing in liquid from container 920 to charge the liquid chamber 925. The dispenser 900 is charged and ready to dispense another shot of foam.

[0079] When all of the liquid is drained from container 920, it is time to replace refill unit 901. Lid 904 is rotated up as shown in Figure 10. The refill unit 901, which includes container 920, liquid pump 924, passageway 950, foaming cartridge 956, outlet nozzle 958 and flap 952, is removed from the dispenser 900. A new refill unit 901 is installed. Lid 904 is rotated back down and air compressor 910 and the nozzle 960 of air compressor 910 seals against seat 962.

[0080] Figures 11 and 12 illustrate another dispenser 1100 in accordance with an embodiment of the present invention. The refill unit 1101 is similar to refill unit 202.

Refill unit 1101 differs from refill unit 202 in that manifold 206 has been replaced with manifold 1106. Manifold 1106 connects to liquid pump 1102 by, for example, a snap fit connection. Manifold 1106 has a housing that includes a longitudinal passageway 1110 therethrough. In addition, manifold 1106 includes a funnel shaped air inlet opening 1108. Air inlet opening 1108 is in fluid communication with longitudinal passageway 1110.

[0081] A sanitary valve 1113 is inserted in longitudinal passageway 1110. Sanitary valve 1113 is a flexible resilient cup shaped valve that has an opening 1114 in the bottom to allow passage of fluid through passageway 1110. Sanitary valve 1113 includes an annular extension. The annular extension covers the air inlet opening 1108 in passageway 1110. During operation, air under pressure that enters air inlet opening 1108 deflects the annular extension and enters longitudinal passageway 1110. When the air pressure is removed the resilient annular extension seals air inlet opening 1108 and prevents liquid or foam from passing through air inlet opening 1108 toward air compressor 1102. A mixing cartridge 1116 is also located in longitudinal passageway 1110. Mixing cartridge 1116 may include one or more porous members, such as, for examples, screens or sponges. An outlet nozzle 1120 is attached to the end of manifold 1106 by any means such as, for example, a snap fit connection. Outlet nozzle 1120 retains mixing cartridge 1116 and sanitary valve 1112 within manifold 1106.

[0082] Air compressor 1102 is similar to air compressor 910. Air compressor 1102 has a different air outlet nozzle 1104. Outlet nozzle 1104 is made from a material that is selected to provide a seal against funnel shaped air inlet opening 1108 when the liquid refill unit 1101 is inserted into dispenser 1100 and the lid is closed. The operation of the dispenser 1100 is substantially the same as the operation described above with respect to Figure 9. During operation, force applied to activate dispenser 1100 also aids in sealing of air compressor 1102 to funnel shaped manifold air inlet 1108.

[0083] In some embodiments, the air pump includes an anti-microbial substance molded into the air pump housing. One suitable anti-microbial substance contains silver ions and or copper ions. A silver refractory, such as, for example, a glass, oxide, silver

phosphate may be used. One suitable commercially available product is Ultra-Fresh, SA-18, available from Thomson Research Associates, Inc. The anti-microbial substance prevents mold or bacteria from growing inside of the air pump.

[0084] In addition, in some embodiments, a vapor barrier, such as a one-way woven vapor barrier, e.g. Gortex®, is provided over the air inlet into the air compressor to prevent moisture from entering the air compressor.

[0085] 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 applicants to restrict or in any way limit the scope of the invention to such details. Additional advantages and modifications will readily appear to those skilled in the art. For example, where components are releasably or removably connected or attached together, any type of releasable connection may be suitable including, for example, locking connections, fastened connections, tongue and groove connections, etc. Still further, component geometries, shapes and dimensions can be modified without changing the overall role or function of the components. Therefore, the inventive concept, 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 applicants' general inventive concept.

[0086] While various inventive aspects, concepts and features of the inventions may be described and illustrated herein as embodied in combination in the exemplary embodiments, these various aspects, concepts and features may be used in many alternative embodiments, either individually or in various combinations and sub-combinations thereof. Unless expressly excluded herein, all such combinations and sub-combinations are intended to be within the scope of the present invention. Still further, while various alternative embodiments as to the various aspects, concepts and features of the inventions -- such as alternative materials, structures, configurations, methods, devices and components; alternatives as to form, fit and function, and so on -- may be described herein, such descriptions are not intended to be a complete or exhaustive list of available alternative embodiments, whether presently known or later developed.

Those skilled in the art may readily adopt one or more of the inventive aspects, concepts or features into additional embodiments and uses within the scope of the present invention even if such embodiments are not expressly disclosed herein. Additionally, even though some features, concepts or aspects of the invention may be described herein as being a preferred arrangement or method, such description is not intended to suggest that such feature is required or necessary unless expressly so stated. Still further, exemplary or representative values and ranges may be included to assist in understanding the present disclosure; however, such values and ranges are not to be construed in a limiting sense and are intended to be critical values or ranges only if so expressly stated. Moreover, while various aspects, features and concepts may be expressly identified herein as being inventive or forming part of an invention, such identification is not intended to be exclusive, but rather there may be inventive aspects, concepts and features that are fully described herein without being expressly identified as such or as part of a specific invention, the inventions instead being set forth in the appended claims. Descriptions of exemplary methods or processes are not limited to inclusion of all steps as being required in all cases, nor is the order in which the steps are presented to be construed as required or necessary unless expressly so stated.

Claims

We claim:

1. A refill unit (102, 202, 901, 1101) for a foam dispenser that has an air compressor (104, 204, 910, 1102) permanently attached to the dispenser, comprising:
 - a liquid container (112, 212, 920) for holding liquid material;
 - a body portion having a first end and a second end, the first end of the body portion (302, 926, 1101) fluidly coupled to the liquid container (112, 212, 920);
 - a resilient member (312, 932) secured to the body portion;
 - a liquid chamber (925) formed at least partially by the resilient member (312, 932), the liquid chamber (925) having a first expanded state and a second contracted state;
 - an outlet nozzle (308, 958, 1120) located proximate the second end of the body portion;
 - a mixing chamber (106, 314, 952) located within the body portion in fluid communication with the liquid chamber (925);
 - an air inlet (150, 360, 935, 1104) located through a wall of the body portion in fluid communication with the mixing chamber (925);
 - the air inlet (150, 360, 935, 1104) configured to releasably connect to an air compressor that is permanently attached to a dispenser;
 - a sanitary seal (151, 322, 934, 1113) located proximate the air inlet (150, 360, 935, 1104);
 - the air inlet (150, 360, 935, 1104) opens to the atmosphere prior to being installed in a dispenser;
 - wherein the sanitary seal (151, 322, 934, 1113) allows air into the mixing chamber and prevents liquid from traveling out of the body portion through the air inlet (150, 360, 935, 1104).
2. The refill unit of claim 1 wherein the sanitary seal (934) is formed at least in part by the resilient member (932) that forms also forms dome.

3. The refill unit of claim 1 wherein the sanitary seal (322, 1113) is located within the interior of the pump body.
4. The refill unit of claim 3 wherein the sanitary seal (1113) is a cup shaped member.
5. The refill unit of claim 1 wherein the air inlet (150, 360, 935) is cylindrical.
6. The refill unit of claim 1 wherein the air inlet (1104) is funnel shaped.
7. The refill unit of claim 1 further comprising a dispenser (100, 200, 900, 1100).
8. The refill unit of claim 7 wherein the dispenser comprises an air compressor (104, 204, 910, 1102) secured thereto.
9. The refill unit of claim 8 wherein the air compressor (104, 204, 910, 1102) is secured to a lid (904) of the dispenser (900, 1100).
10. The refill unit of claim 8 further comprising an adjustable actuator (310, 1117) so that can be adjusted to adjust the volume of fluid moved by compressing the liquid chamber.
11. A foam dispenser for dispensing foam, comprising:
 - a housing (230, 902);
 - an air compressor (104, 204, 910, 1102) permanently secured to the housing (230, 902);
 - the air compressor (104, 204, 910, 1102) being compressible along a substantially horizontal axis;
 - an air outlet (327) in fluid communication with the air compressor (104, 204, 910, 1102);
 - the air outlet in fluid communication with the atmosphere when there is no refill unit installed in the dispenser;
 - a nozzle (327, 1104) connected to the air outlet, the nozzle (327, 1104) configured to releasably mate with a manifold that is part of a refill unit; and
 - a liquid pump activating member (310, 908, 1117) that moves a portion of a liquid pump (262, 924, 1102) to pump a liquid.
12. The foam dispenser of claim 11 wherein the air compressor (104, 204, 910, 1102) comprises a bellows.

13. The foam dispenser of claim 11 wherein the air compressor (910, 1102) is attached to a lid (904) of the dispenser (900, 1100).
14. The foam dispenser of claim 12, further comprising a sealing member (331, 1108) secured to the nozzle, for providing an air tight seal with a refill unit (102, 202, 901, 1101).
15. A foam dispenser comprising:
 - a housing (230, 902);
 - an air compressor (104, 204, 910, 1102) permanently secured to the housing (230, 902);
 - the air compressor (104, 204, 910, 1102) being compressible along a substantially horizontal axis;
 - the air compressor (104, 204, 910, 1102) comprising an outlet nozzle (327, 1104), the outlet nozzle (327, 1104), in fluid communication with the atmosphere;
 - a sealing member 1108 for sealing the nozzle to a manifold of a refill unit, wherein the nozzle (327, 1104), is releasably sealed to a manifold of a refill unit forming an airtight seal with the manifold when the refill unit is installed in the foam dispenser and
 - a liquid pump (310, 908, 1117) activating member that moves a portion of a liquid pump (262, 924, 1102) to pump.
16. The foam dispenser of claim 15 further comprising a refill unit (102, 202, 901, 1101) comprising a manifold having an air inlet (360, 935,).
17. The foam dispenser of claim 15 further comprising an adjustable actuator (310, 1117) that may be adjusted to adjust the volume of liquid dispensed by the dispenser during actuation.
18. The foam dispenser of claim 16 wherein the refill unit (102, 202, 901, 1101) comprises a sanitary seal (151, 306, 934, 1113), wherein the sanitary seal (151, 306, 934, 1113) allows air to enter the manifold air inlet and prevents liquid from exiting the manifold through the air inlet.
19. The foam dispenser of claim 16 comprising a liquid pump chamber formed at least in part by a resilient member (312, 932).

20. The foam dispenser of claim 19 further comprising a sanitary seal (934) formed at least in part by the resilient member (932).

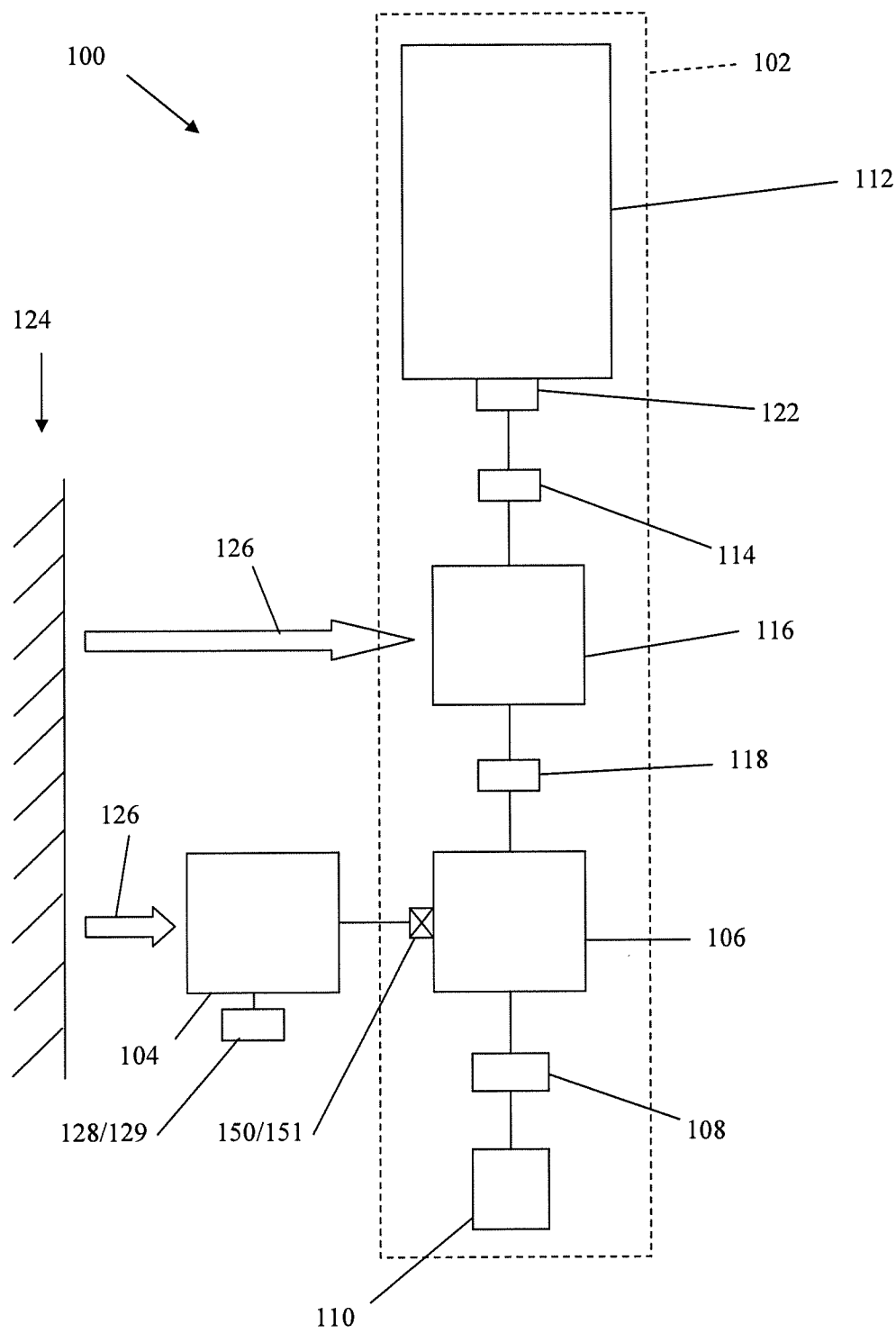


Fig. 1

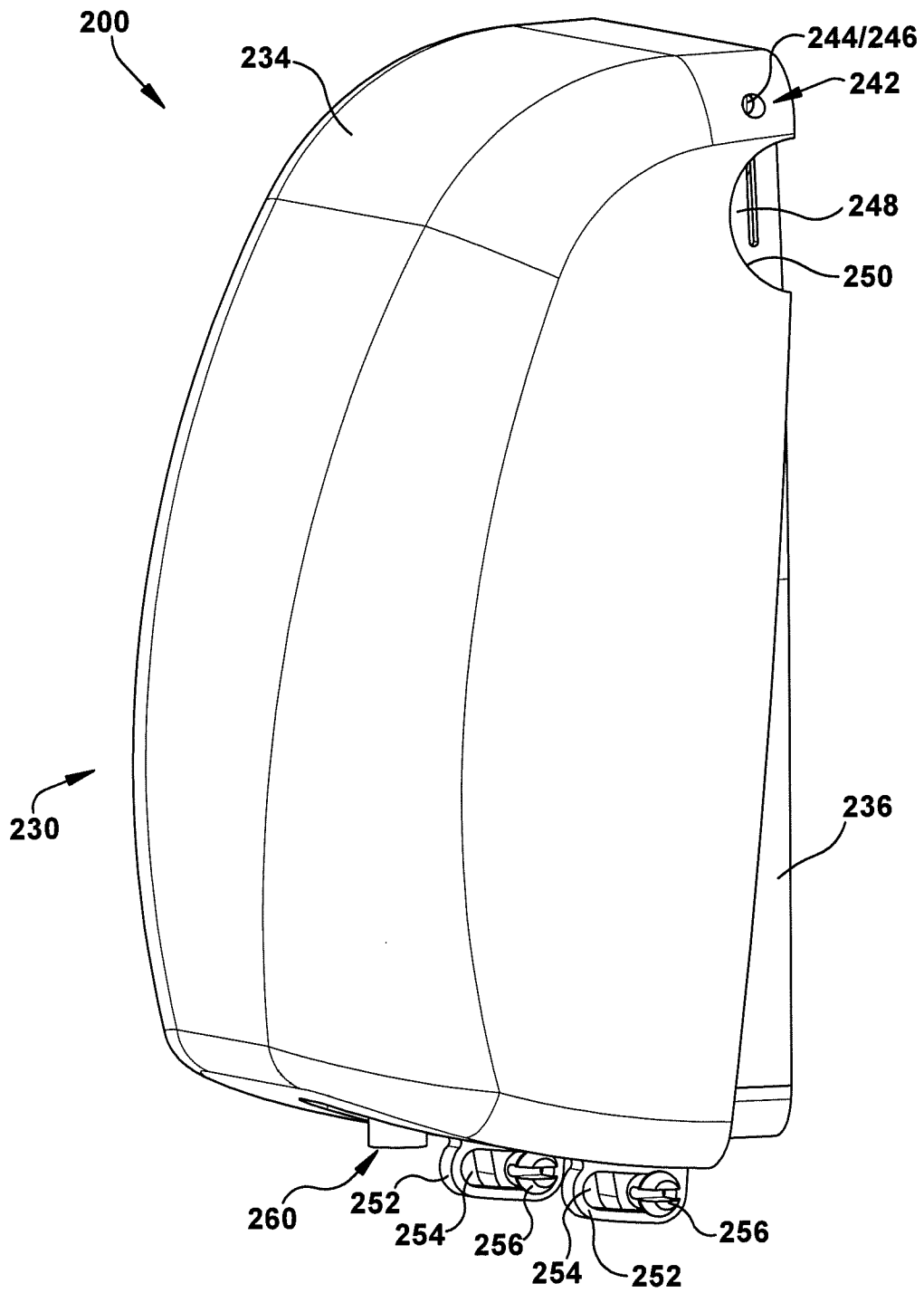


Fig. 2A

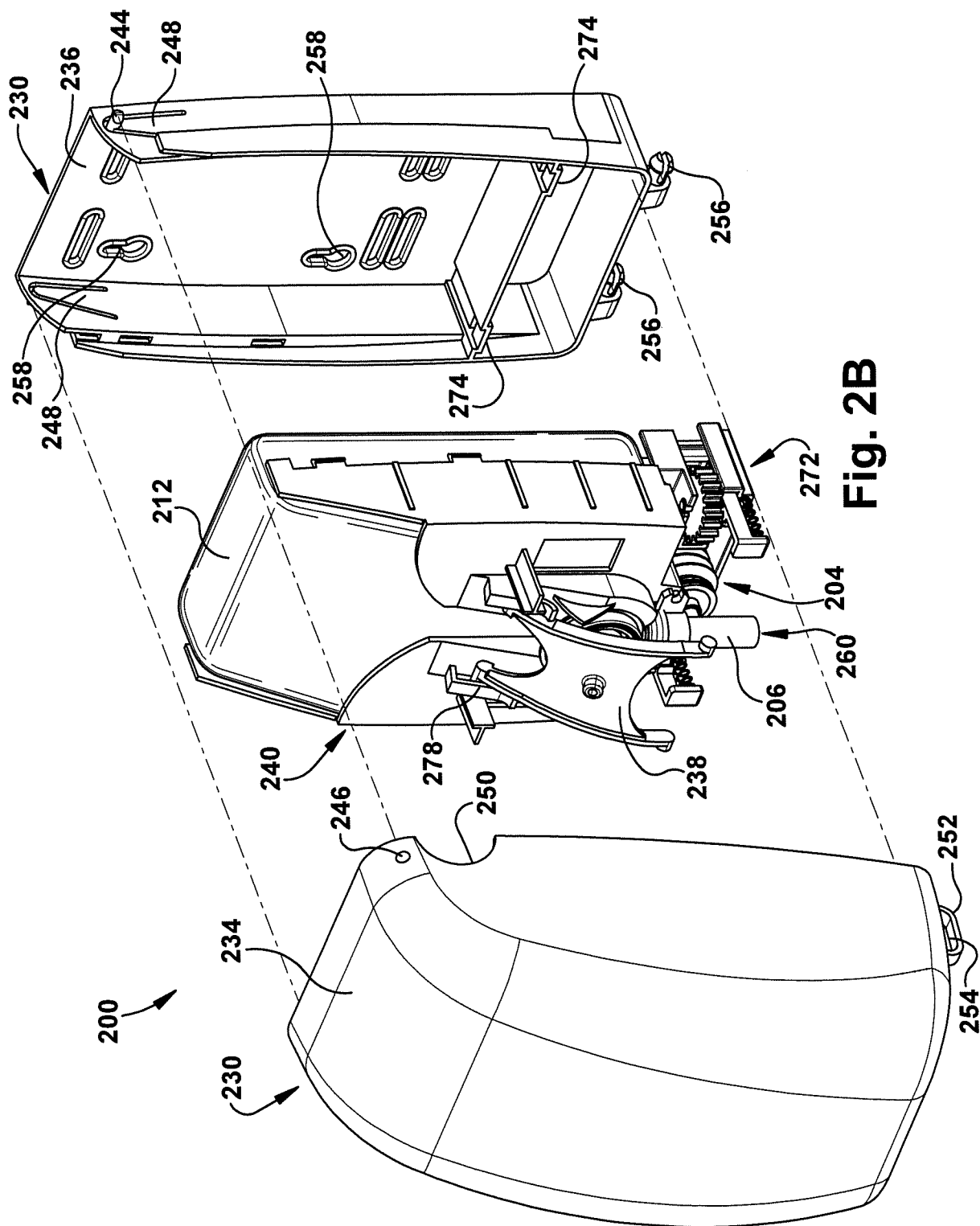


Fig. 2B

4/13

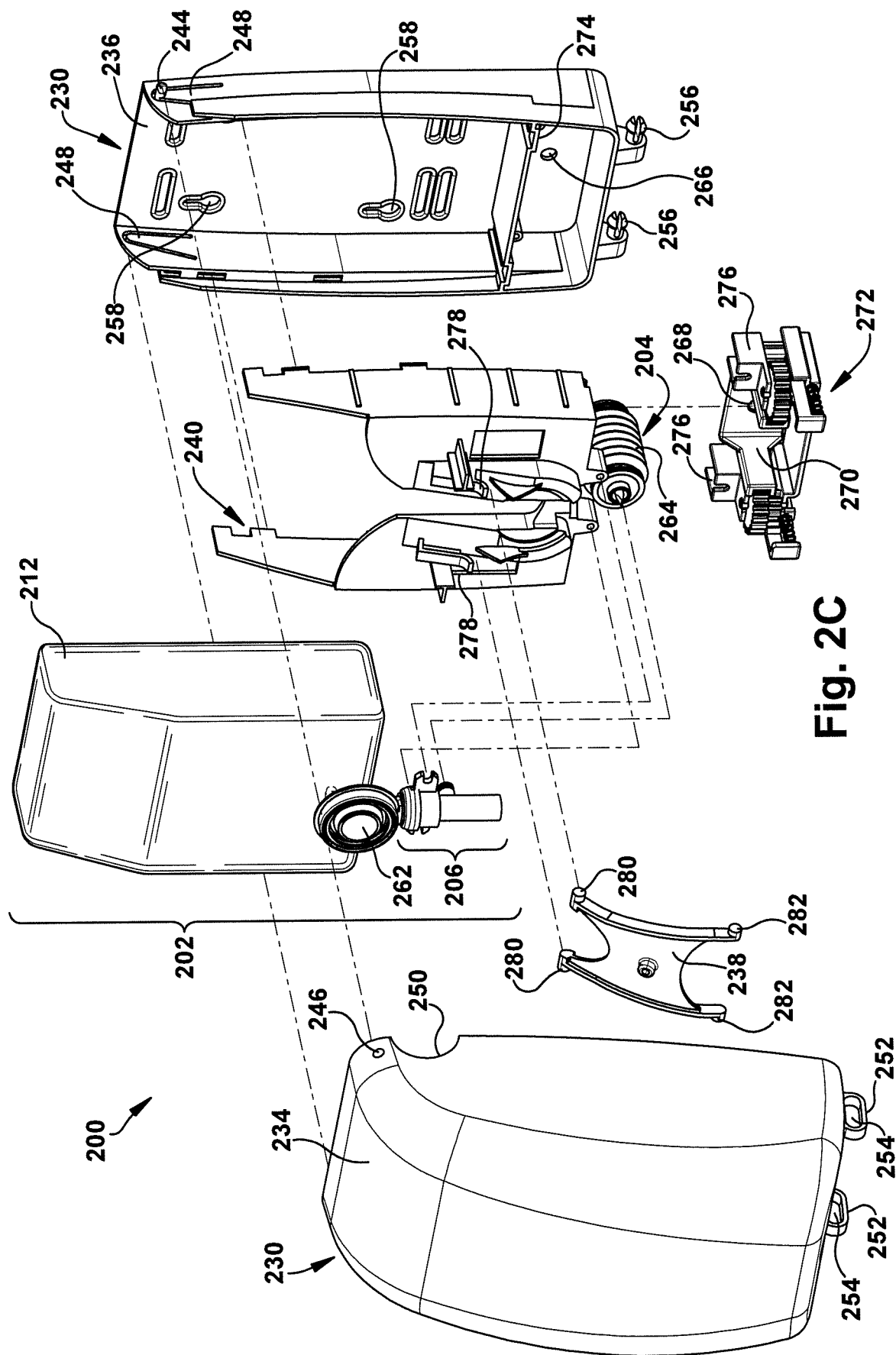


Fig. 2C

5/13

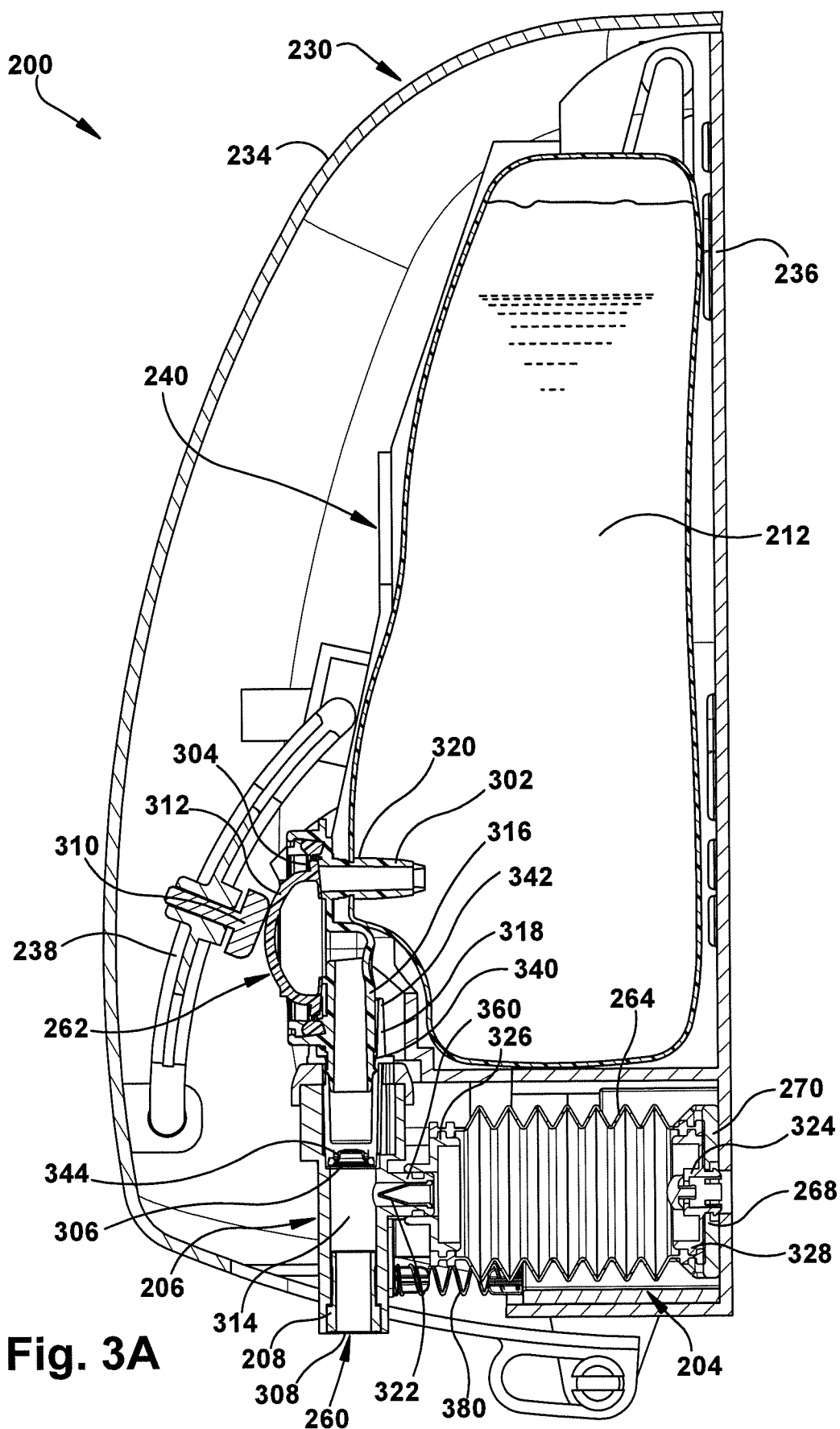


Fig. 3A

6/13

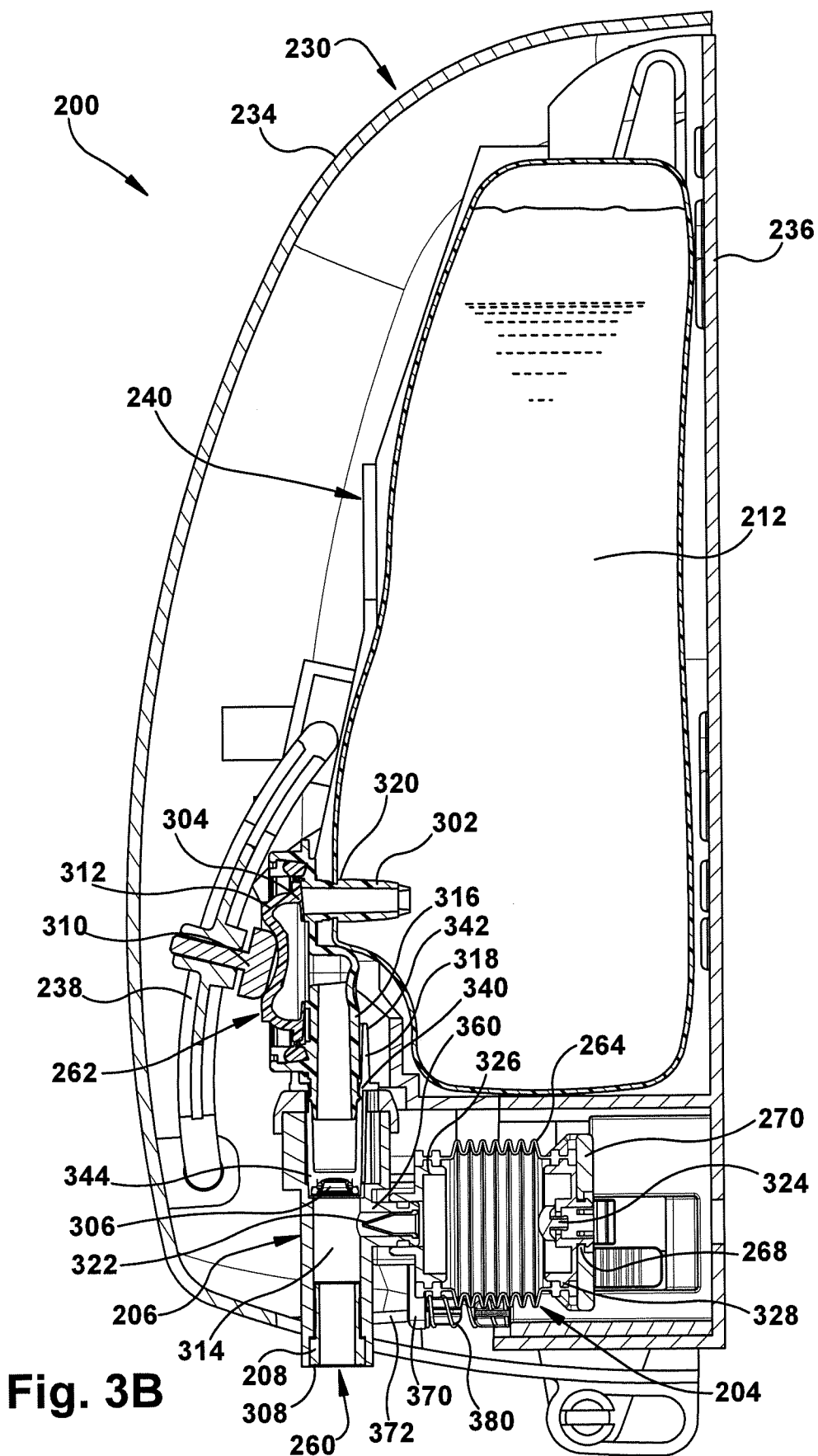


Fig. 3B

7/13

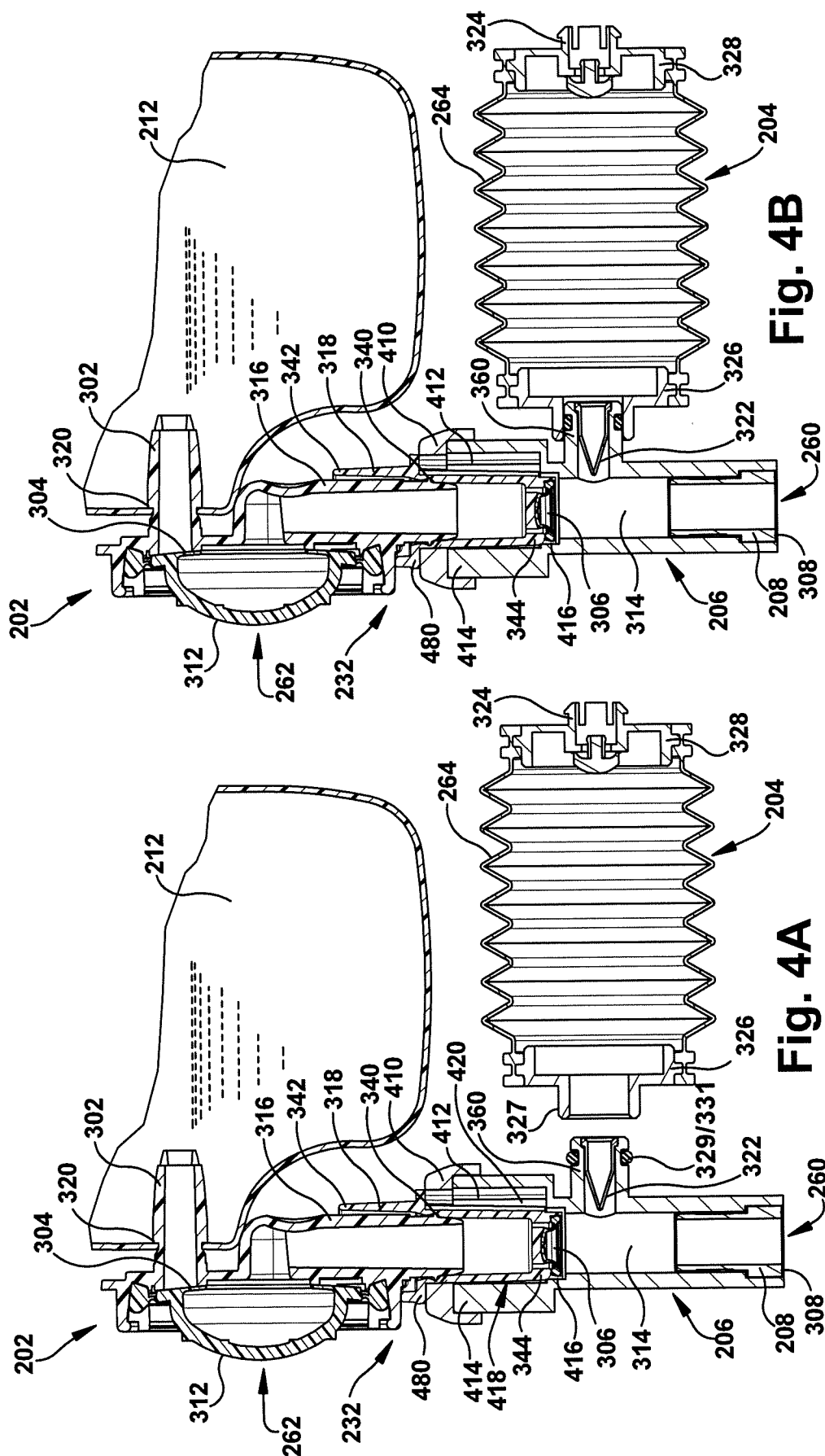


Fig. 4B

Fig. 4A

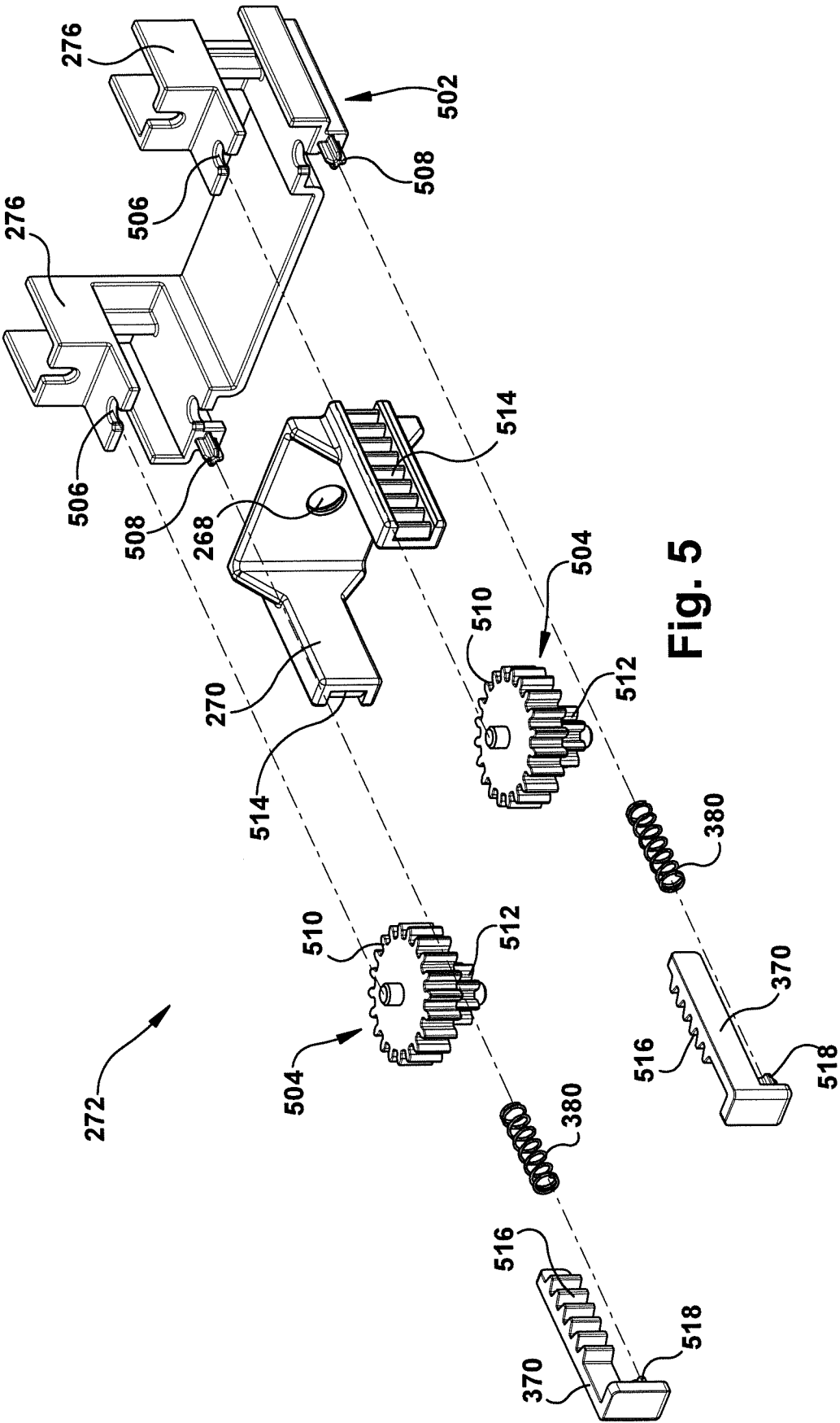
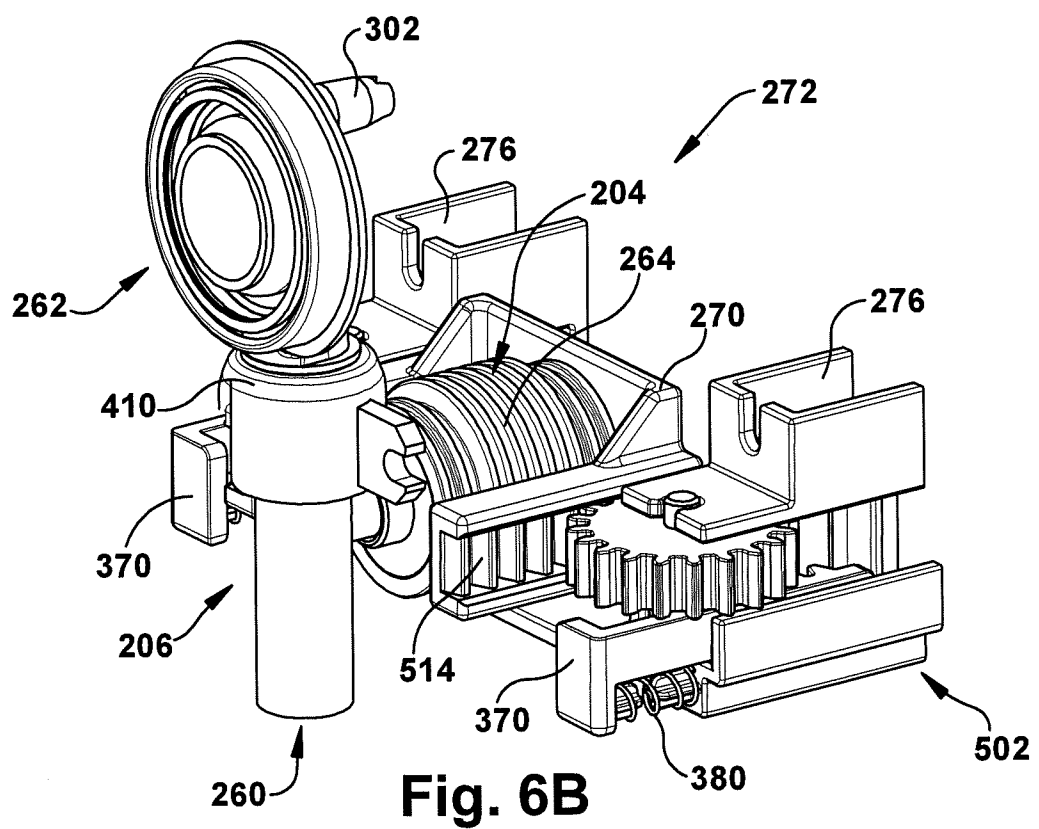
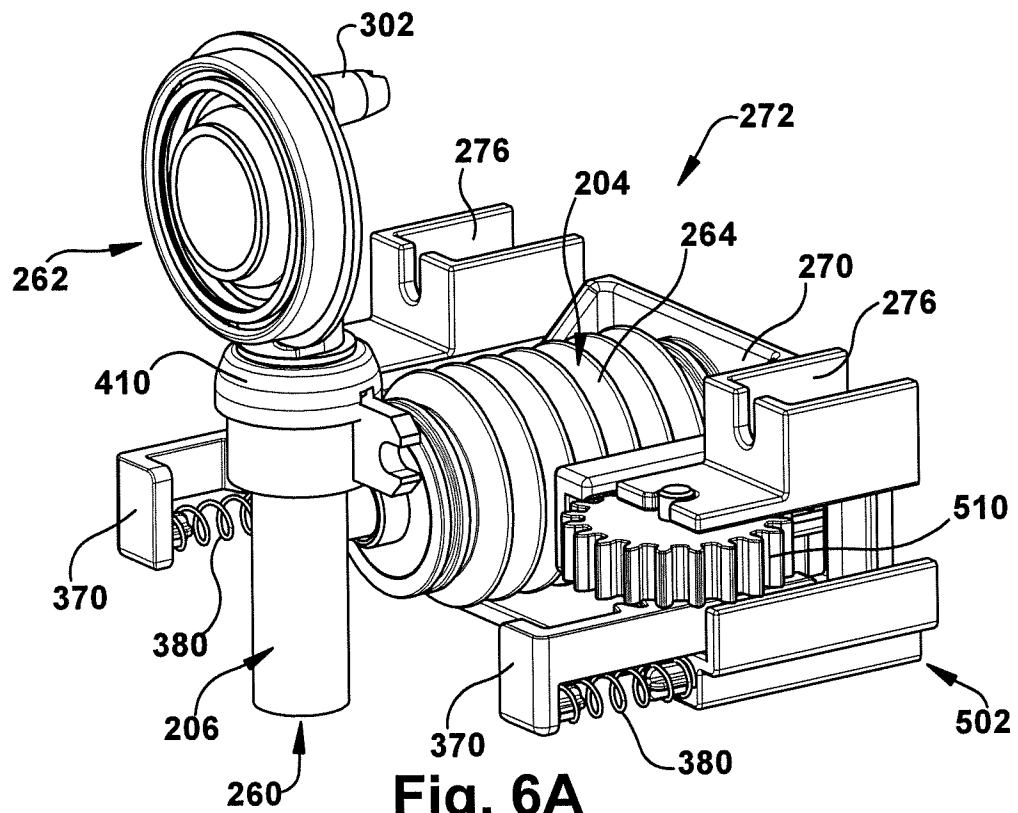
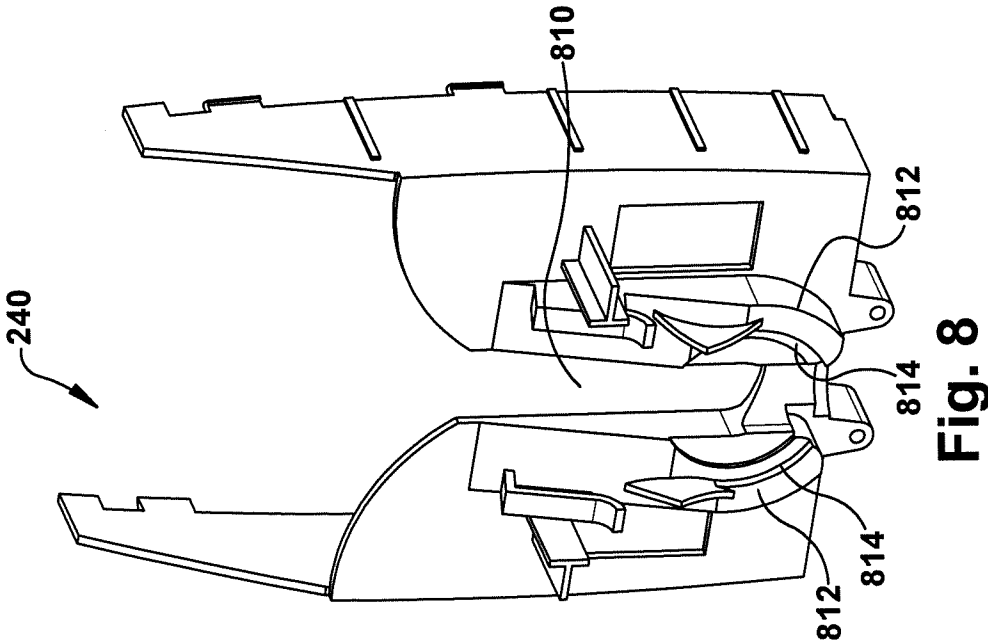
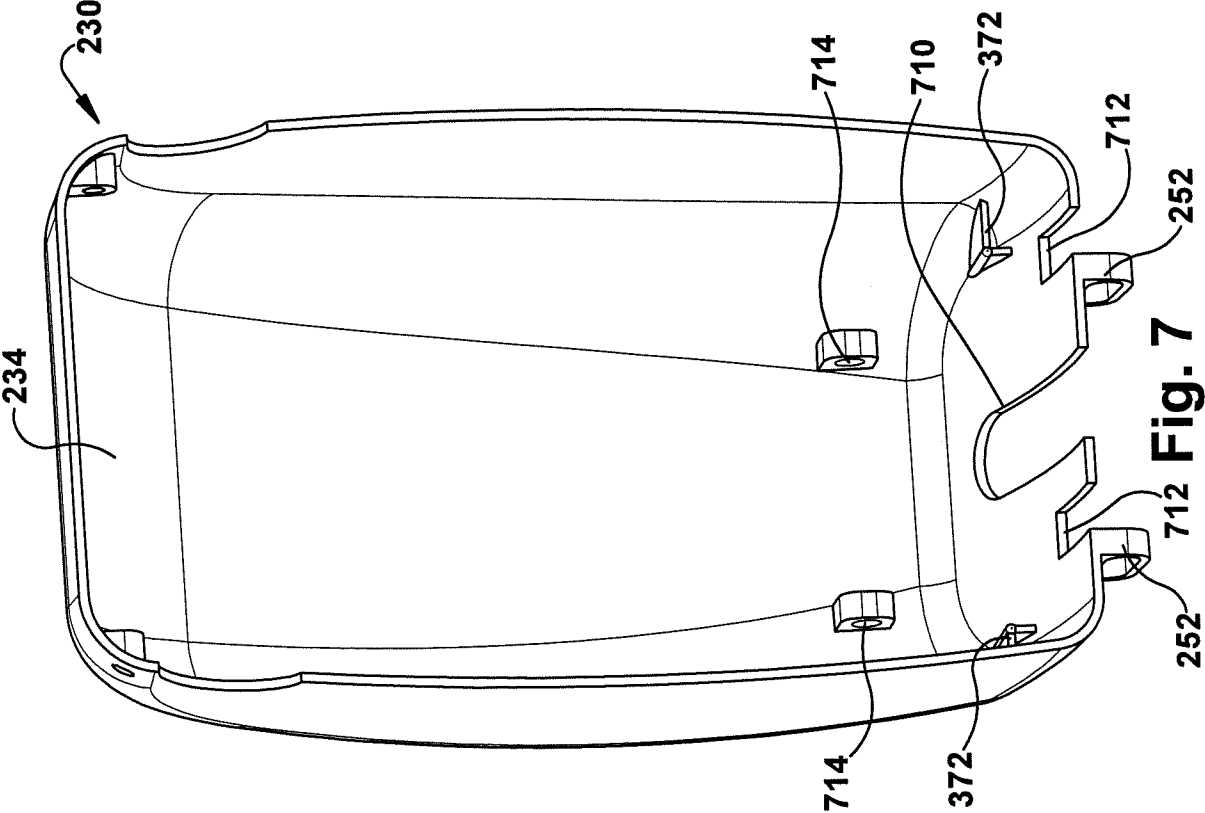


Fig. 5

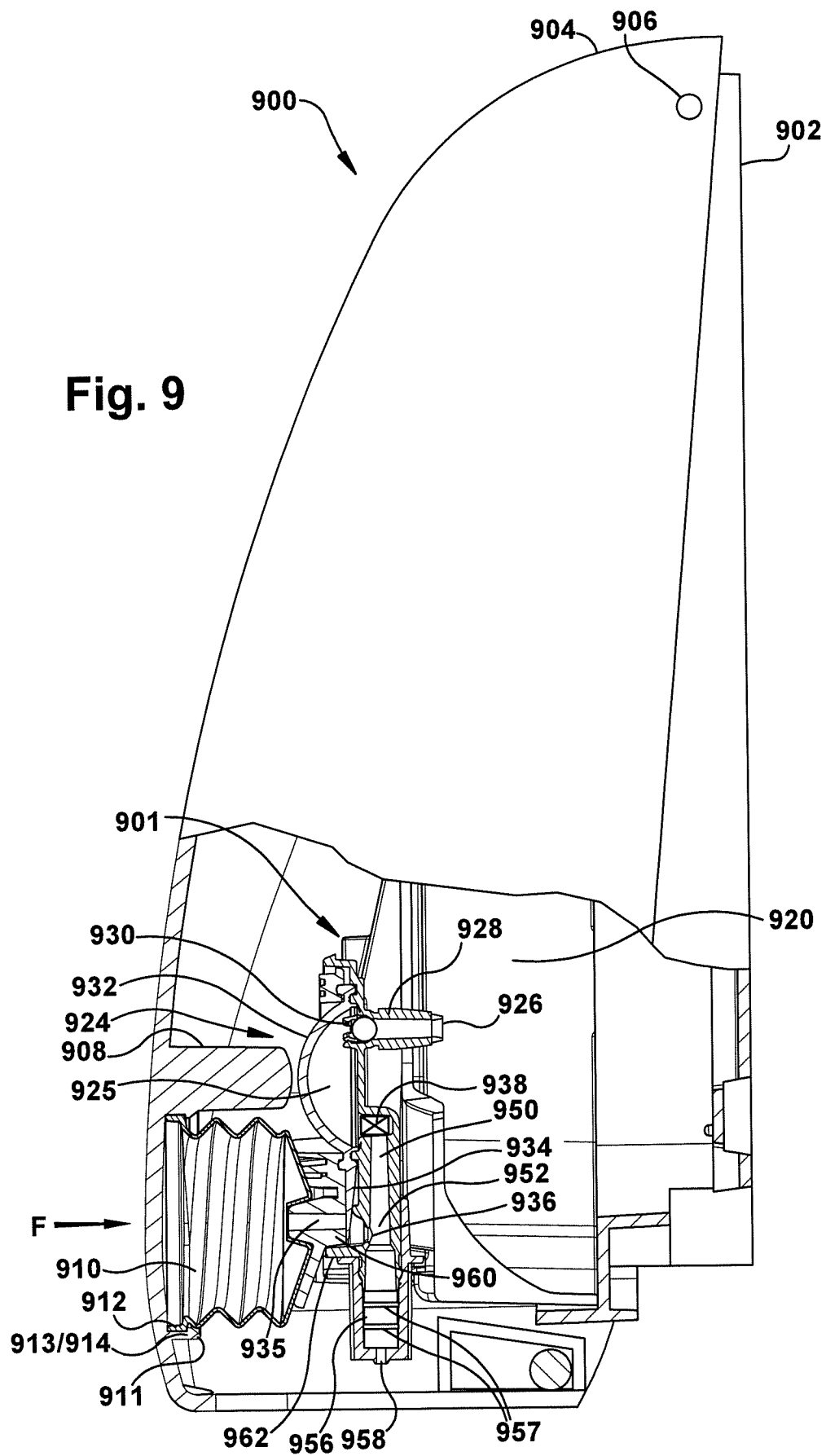
9/13

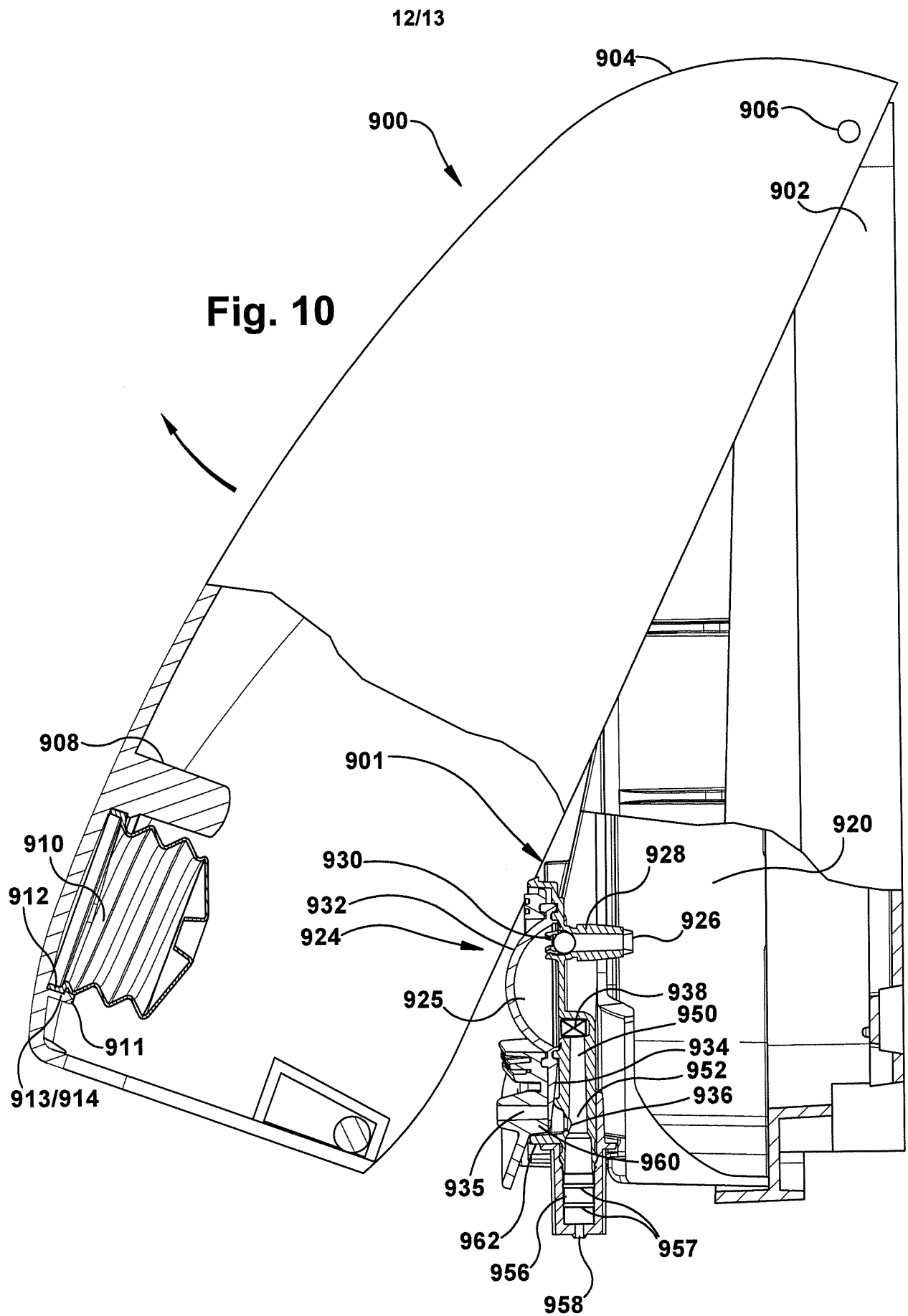




11/13

Fig. 9





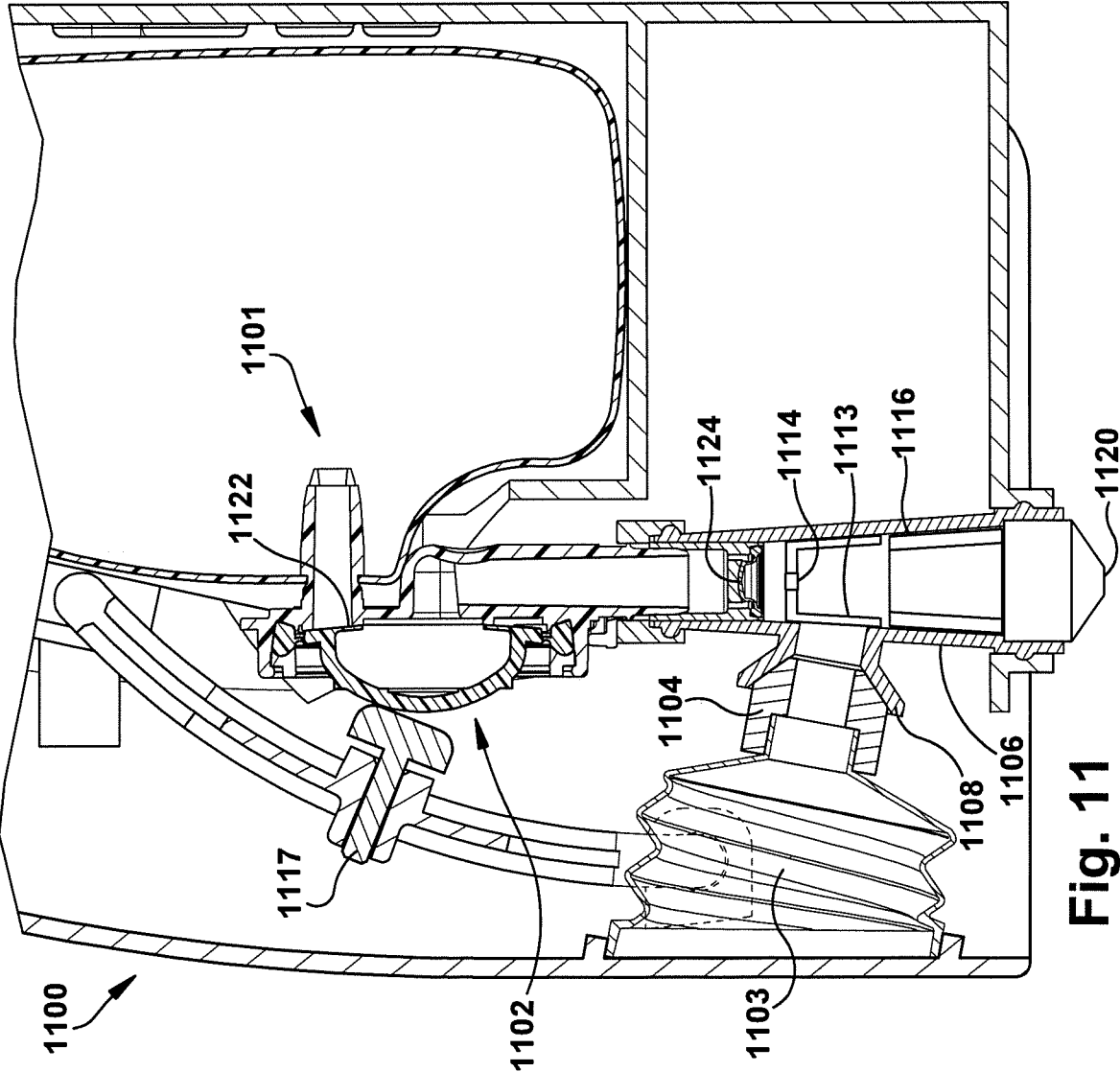


Fig. 11

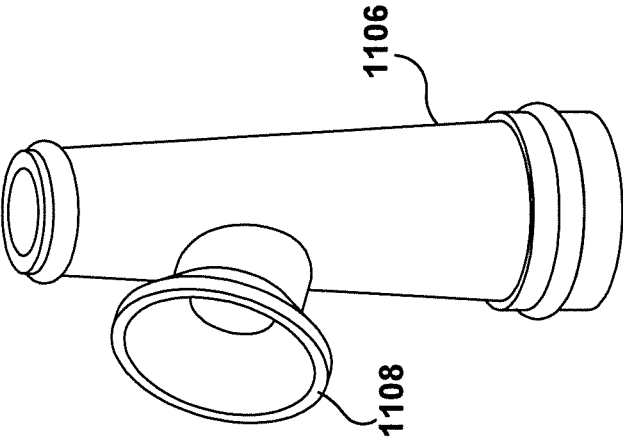


Fig. 12

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/040285

A. CLASSIFICATION OF SUBJECT MATTER

INV. A47K5/14 A47K5/16 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)

A47K

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)

EP0-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.
X	EP 2 080 560 A1 (GOJO IND INC [US]) 22 July 2009 (2009-07-22) the whole document	1-20
A	----- US 7 806 301 B1 (CIAVARELLA NICK E [US] ET AL) 5 October 2010 (2010-10-05) the whole document -----	2

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

15 October 2013

Date of mailing of the international search report

23/10/2013

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Delzor, François

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2013/040285

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2080560	A1	22-07-2009	AT 518600 T 15-08-2011
			AU 2009200193 A1 06-08-2009
			BR PI0900068 A2 17-11-2009
			CA 2649717 A1 18-07-2009
			DK 2080560 T3 21-11-2011
			EP 2080560 A1 22-07-2009
			ES 2368310 T3 16-11-2011
			JP 2009168030 A 30-07-2009
			PT 2080560 E 16-09-2011
			US 2009184134 A1 23-07-2009

US 7806301	B1	05-10-2010	NONE
