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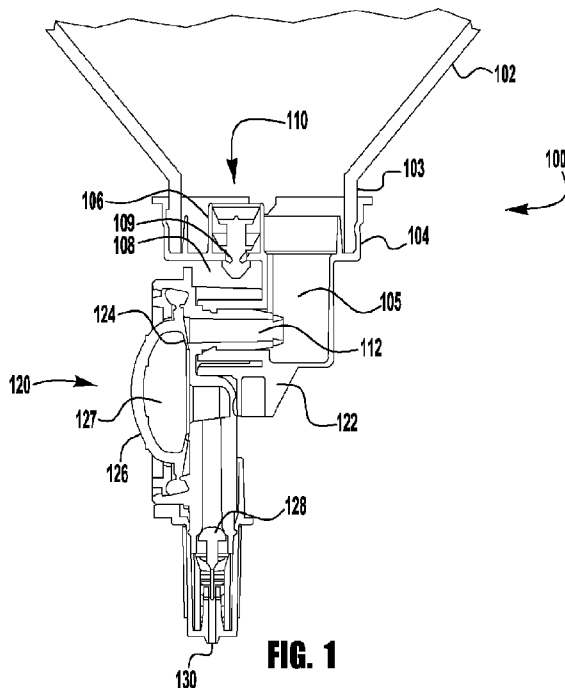
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Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

[Continued on next page]

(54) Title: VENT VALVES AND REFILL UNITS WITH VENT VALVES FOR USE WITH INVERTED NON-COLLAPSING CONTAINERS



(57) Abstract: An exemplary refill unit for a dispenser includes an inverted non-collapsing container for holding a liquid. A pump housing is secured to the bottom of the inverted non-collapsing container. The pump housing includes a pump chamber for pumping fluid out of the inverted non-collapsing container. The pump housing includes an annular venting chamber. The annular venting chamber has a floor with an opening therethrough. A vent valve is located within the venting chamber. The vent valve has a first wiper seal in contact with a wall of the annular venting chamber.

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

**VENT VALVES AND REFILL UNITS WITH VENT VALVES FOR USE
WITH INVERTED NON-COLLAPSING CONTAINERS**

RELATED APPLICATIONS

[0001] This application claims priority to and the benefits of U.S. Non-Provisional Application serial No. 62/180,939, filed on June 17, 2015 and titled VENT VALVES AND REFILL UNITS WITH VENT VALVES FOR USE WITH INVERTED NON-COLLAPSING CONTAINERS, and which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present invention relates generally to vent valves, pumps and refill units, and more particularly to vent valves, pumps and refill units having inverted non-collapsing containers.

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 by use of an air pump or air compressor. Many liquid and foam dispensers use non-collapsing containers. Non-collapsing containers must be vented when fluid is pumped out of the container or the container will collapse and/or prevent the pump from dispensing the fluid. When the non-collapsing containers are used in an inverted position with the pump located at the bottom of the container, prior art vent valves tend to leak or have a high cracking pressure to prevent leaking, which causes collapsing or partial collapsing of thin containers.

[0004] Depending on the type of material the container is made of, certain non-collapsing containers, such as those made from PET, are very sensitive to thickness for collapsing. Accordingly, if the valve has a high cracking pressure, the container either collapses/partially

collapses or has to be made with thick walls. In addition, vent valves with higher cracking pressure may cause inconsistent product output. Collapsed or partially collapsed containers are less aesthetically pleasing and containers with thicker walls are not environmentally friendly.

SUMMARY

[0005] Exemplary embodiments of vent valves, pumps and refill units are disclosed herein. An exemplary refill unit for a dispenser includes an inverted non-collapsing container for holding a liquid. A pump housing is secured to the bottom of the inverted non-collapsing container. The pump housing includes a pump chamber for pumping fluid out of the inverted non-collapsing container. The pump housing includes an annular venting chamber. The annular venting chamber has a floor with an opening therethrough. A vent valve is located within the venting chamber. The vent valve has a first wiper seal in contact with a wall of the annular venting chamber.

[0006] Another exemplary refill unit for a dispenser includes an inverted non-collapsing container for holding a liquid and a pump housing secured to the bottom of the inverted non-collapsing container. The pump housing has a pump chamber for pumping fluid out of the inverted non-collapsing container. In addition, the pump housing has an annular venting chamber. The annular venting chamber has a floor with an opening therethrough. A vent valve is located within the venting chamber. The vent valve has a first wiper seal in contact with a wall of the annular venting chamber and a second wiper seal in contact with the wall of the annular venting chamber.

[0007] Another exemplary refill unit for a dispenser includes an inverted non-collapsing container for holding a liquid and a pump housing secured to the bottom of the inverted non-collapsing container. The pump housing has a pump chamber for pumping fluid out of the inverted non-collapsing container. In addition, the pump housing has an annular venting chamber. The annular venting chamber has a floor with an opening therethrough. A vent valve is located within the venting chamber. The vent valve has a wiper seal in contact with a wall of the annular venting chamber and an annular base in contact with the floor of the annular venting chamber. The annular base extends outward from the base of the wiper seal.

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 illustrates a cross-section of an exemplary embodiment of a refill unit having a vent valve;

[0010] Figure 2 is an isometric view of the exemplary vent valve of Figure 1;

[0011] Figure 3 illustrates a cross-section of another exemplary embodiment of a refill unit having a vent valve;

[0012] Figure 4 is an isometric view of the exemplary vent valve of Figure 3;

DETAILED DESCRIPTION

[0013] Exemplary embodiments of vent valves, pumps and refill units having inverted non-collapsing containers are disclosed herein. The exemplary embodiments of vent valves may be used in conjunction with liquid pumps, foam pumps, refill units with non-collapsing containers and other applications.

[0014] Figure 1 is a partial cross-section of an exemplary embodiment of a refill unit 100. Refill unit 100 includes a non-collapsing container 102 that is in an inverted position and has a neck 103 (and opening) located at the bottom. The top portion (not shown) of container 102 is closed and the only opening is located at the bottom of the container 102.

[0015] Secured to the neck 103 of container 102 is pump housing 104. Pump housing 104 is secured to container neck 103 by a snap-fit connection. However, pump housing 104 may be connected to container neck 103 by any means, such as, for example, a threaded connection, a welded connection, a friction fit connection or the like.

[0016] Pump housing 104 includes a liquid inlet passage 105. In addition, pump housing 104 includes an annular venting chamber 106 and an opening 109. A vent air passage 108 extends from the open atmosphere to opening 109. Vent valve 110 is located within venting chamber 106 and includes a first wiper seal 202 (Figure 2), a second wiper seal 204 and a valve retention member 206. Valve retention member 206 includes one or more recess 208 to

allow air to flow up through opening 109. Retention member 206 is forced through opening 109 to retain vent valve 110 in place.

[0017] First wiper seal 202 and second wiper seal 204 contact the walls of venting chamber 106 and provide a liquid tight seal that prevents liquid from flowing out of the container 102 through opening 109 and vent air passage 108.

[0018] Depending on the type of material the container is made of, certain non-collapsing containers, such as those made from PET, are very sensitive to thickness for collapsing. Vent valves, such as umbrella vent valves, have high cracking pressures and may cause collapsing of the container. Thus, either the container will collapse or the walls of the container must be made of thicker material.

[0019] Exemplary embodiments of the vent valves disclosed herein have low cracking pressures. In some embodiments, the cracking pressure is less than about 30 millibar. In some embodiments the cracking pressure is less than about 25 millibar. In some embodiments the cracking pressure is less than about 20 millibar.

[0020] A vent valve that has a single wiper seal and a low cracking pressure may tilt when inserted into the venting chamber 109 and leak during shipping. The two wiper seal 202, 204 provides a number of advantages. First, the potential tilt issue is eliminated due to additional surface contact between the two wiper seals 202, 204 and the walls of the venting chamber 109. In addition, the two wiper seals 202, 204 cause the vent valve 110 to self center and properly align. If some fluid leak past first wiper seal 202 it is trapped by wiper seal 204 and does not leak out of the refill unit 100. In addition, if fluid is trapped between wiper seal 202 and wiper seal 204 the fluid tends to be drawn back into container 102 the next time container 102 builds up enough pressure to break the cracking pressure of vent valve 110 and vent. Vent valve 110 results in a uniform seal pressure and leads to consistent cracking pressures.

[0021] Secured to pump housing 104 is a liquid pump 120. Liquid pump 120 is a dome pump; however, as described below, venting valve 110 may be used with any pumps, such as a foam pump, a piston pump, a bellows pump and the like. Liquid pump 120 includes a liquid inlet 122 in fluid communication with liquid inlet chamber 105. Liquid pump 120 includes a liquid inlet valve 124, a liquid outlet valve 128 and a liquid outlet 130. A compressible pump chamber 127 is formed in part by resilient dome 126. Resilient dome 126 may be compressed to close liquid inlet valve 124, open liquid outlet valve 128 and dispense

liquid. As liquid is removed from the container, vacuum pressure builds up. Once the vacuum pressure is higher than the cracking pressure of vent valve 110, vent valve 110 opens and allows air to vent container 102. Resilient dome 126 returns to its uncompressed position to draw liquid into the compressible pump chamber 127.

[0022] Figure 3 is a partial cross-section of an exemplary embodiment of a refill unit 300. Refill unit 300 includes a non-collapsing container 302 that is in an inverted position with the neck 303 (and opening) located at the bottom. The top portion (not shown) of container 302 is closed and the only opening is located at the bottom of the container 302.

[0023] Secured to the neck 303 of container 302 is pump housing 304. Pump housing 304 is secured to container neck 303 by a snap-fit connection, however, pump housing 304 may be connected to container neck 303 by any means, such as, for example, a threaded connection, a welded connection, a friction fit connection or the like.

[0024] Pump housing 304 includes a liquid inlet passage 305. In addition, pump housing 304 includes an annular venting chamber 306 and an opening 309. A vent air passage 308 extends from the open atmosphere to opening 309. Vent valve 310 is located within venting chamber 306 and includes a wiper seal 402 (Figure 4), an annular base 404, a vent opening 406, and a valve retention member 408. The annular base 404 extends outward from the base of the wiper seal. Retention member 408 is forced through opening 309 to retain vent valve 310 in place and ensures the annular base 404 is flush against the floor around opening 309.

[0025] Wiper seal 402 contacts the wall of venting chamber 306. Provided that valve 310 is properly positioned and has even contact pressure entirely around wiper seal 402, valve 310 provides a liquid tight seal that prevents liquid from flowing out of the container 302 through opening 309 and the vent air passage 308.

[0026] Annular base 404 contacts the floor of pump housing around opening 309 and ensures that valve 310 is properly positioned in venting chamber 306 and that there is even contact pressure entirely around wiper seal 402. Annular base 404 also prevents tilting of valve 310 and ensures a liquid tight seal. In addition, annular base 404 includes one or more air passages 406 to allow air to flow through opening 309 past annular base 404.

[0027] Exemplary embodiments of the vent valve 310 have low cracking pressures. In some embodiments, the cracking pressure is less than about 30 millibar. In some

embodiments the cracking pressure is less than about 45 millibar. In some embodiments the cracking pressure is less than about 40 millibar. The design of vent valve 310 results in a uniform seal pressure and leads to consistent cracking pressures.

[0028] Secured to pump housing 304 is a liquid pump 320. Liquid pump 320 is a dome pump; however, as described below, venting valve 310 may be used with any pumps, such as a foam pump, a piston pump, a bellows pump and the like. Liquid pump 320 includes a liquid inlet 322 in fluid communication with liquid inlet chamber 305. Liquid pump 320 includes a liquid inlet valve 324, a liquid outlet valve 328 and a liquid outlet 330. A compressible pump chamber 327 is formed in part by resilient dome 326. Resilient dome 326 may be compressed to close liquid inlet valve 324, open liquid outlet valve 328 and dispense liquid. Once enough liquid is pumped out of container 302 and a high enough vacuum pressure is achieved, valve 310 cracks and vents container 302. Resilient dome 326 returns to its uncompressed position to draw liquid into the compressible pump chamber 327.

[0029] In addition to providing a leak free refill unit with an inverted non-collapsing container, the exemplary vent valves 110, 310 allow for the inverted non-collapsing containers to be made thinner thereby reducing the amount of plastic material used, which results in a more cost effective product and is more environmentally friendly.

[0030] Although the vent valves 110, 310 are shown and described in conjunction with dome pumps 120, 320 that pump liquid, the exemplary vent valves 110, 310 may be used with many types of conventional pumps used today for the dispensing of soap and sanitizers. Exemplary embodiments of liquid and foam pumps that may be used with, or modified to be used with the exemplary embodiments of vent valves include, for example, U.S. Patent Application No. 13/208,076, titled Split Body Pumps for Foam Dispensers and Refill Units, filed on August 11, 2011; U.S. Provisional Patent Application No. 13/792,034, titled Horizontal Pumps, Refill Units and Foam Dispensers With Integral Air Compressors, filed on March 9, 2013; U.S. Provisional Patent Application No. 13/792,115, titled Horizontal Pumps, Refill Units and Foam Dispensers, filed on March 10, 2013; U.S. Patent No. 7,303,099, titled Stepped Pump Foam Dispenser filed on June 6, 2005; U.S. Patent No. 8,272,539, titled Angled Slot Foam Dispenser file on December 3, 2008; and U.S. Patent No. 8,360,286, titled Draw Back Push Pump, filed on July 7, 2010, each of which is incorporated herein by reference.

[0031] Similarly, the exemplary vent valves 110, 310 may be used in any dispenser system, such as, for example, US 8,668,116, titled Pump Having A Flexible Mechanism For Engagement With A Dispenser filed on September 11, 2009 and US 7,086,567, titled Wall-Mounted Dispenser Assembly With Transparent Window, filed on July 25, 2002, which are incorporated herein by reference.

[0032] 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. Moreover, elements described with one embodiment may be readily adapted for use with other embodiments. 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

I/we claim:

1. A refill unit for a dispenser comprising:
 - an inverted non-collapsing container for holding a liquid;
 - a pump housing secured to the bottom of the inverted non-collapsing container;
 - the pump housing having a pump chamber for pumping fluid out of the inverted non-collapsing container;
 - the pump housing having an annular venting chamber;
 - the annular venting chamber having a floor with an opening therethrough;
 - a vent valve located within the venting chamber;
 - wherein the vent valve has a first wiper seal in contact with a wall of the annular venting chamber; and
 - wherein a surface of the first wiper seal is in contact with fluid when fluid is in the non-collapsing container.
2. The refill unit of claim 1 further comprising a second wiper seal in contact with the wall of the annular venting chamber.
3. The refill unit of claim 1 further comprising a valve retention member.
4. The refill unit of claim 1 wherein the vent valve includes an annular base in contact with the floor of the annular venting chamber and wherein the annular base extends outward from the base of the wiper seal.
5. The refill unit of claim 4 wherein the annular base comprises one or more air passage therethrough.
6. The refill unit of claim 1 wherein vent valve has a cracking pressure of less than about 30 millibar.
7. The refill unit of claim 1 wherein vent valve has a cracking pressure of less than about 25 millibar.
8. The refill unit of claim 1 wherein vent valve has a cracking pressure of less than about 20 millibar.

9. A refill unit for a dispenser comprising:
 - an inverted non-collapsing container for holding a liquid;
 - a pump housing secured to the bottom of the inverted non-collapsing container;
 - the pump housing having a pump chamber for pumping fluid out of the inverted non-collapsing container;
 - the pump housing having an annular venting chamber;
 - the annular venting chamber having a floor with an opening therethrough;
 - a vent valve located within the venting chamber;
 - wherein the vent valve has a first wiper seal in contact with a wall of the annular venting chamber; and
 - a second wiper seal in contact with the wall of the annular venting chamber.
10. The refill unit of claim 9 wherein a surface of the first wiper seal is in contact with fluid when fluid is located in the non-collapsing container.
11. The refill unit of claim 9 further comprising a valve retention member.
12. The refill unit of claim 9 wherein vent valve has a cracking pressure of less than about 30 millibar.
13. The refill unit of claim 9 wherein vent valve has a cracking pressure of less than about 25 millibar.
14. The refill unit of claim 9 wherein vent valve has a cracking pressure of less than about 20 millibar.
15. A refill unit for a dispenser comprising:
 - an inverted non-collapsing container for holding a liquid;
 - a pump housing secured to the bottom of the inverted non-collapsing container;
 - the pump housing having a pump chamber for pumping fluid out of the inverted non-collapsing container;
 - the pump housing having an annular venting chamber;
 - the annular venting chamber having a floor with an opening therethrough;
 - a vent valve located within the venting chamber;
 - wherein the vent valve has a first wiper seal in contact with a wall of the annular venting chamber; and

an annular base in contact with the floor of the annular venting chamber;
wherein the annular base extends outward from the base of the wiper seal.

16. The refill unit of claim 15 wherein the annular base includes one or more air passages.
17. The refill unit of claim 15 wherein a surface of the first wiper seal is in contact with fluid located in the non-collapsing container.
18. The refill unit of claim 15 wherein vent valve has a cracking pressure of less than about 30 millibar.
19. The refill unit of claim 15 wherein vent valve has a cracking pressure of less than about 25 millibar.
20. The refill unit of claim 15 wherein vent valve has a cracking pressure of less than about 20 millibar.

1/2

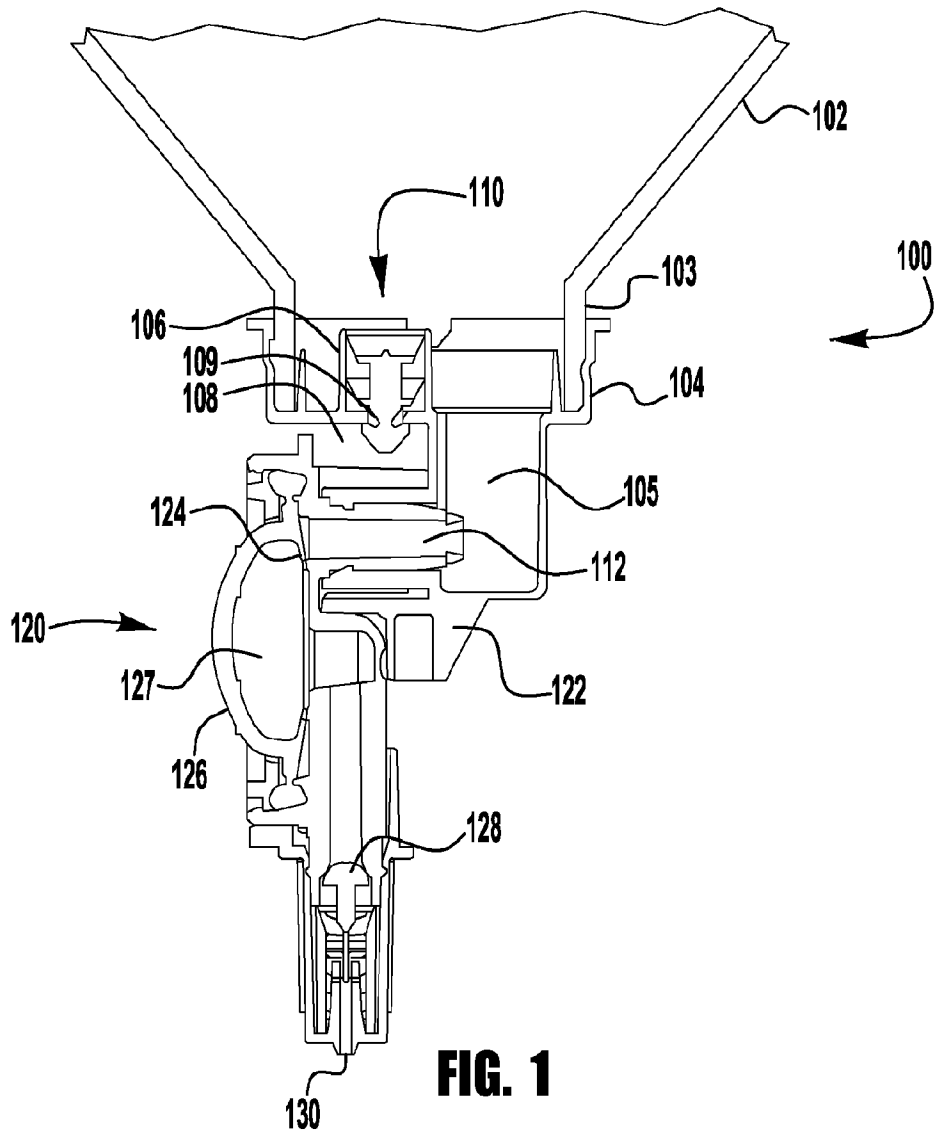


FIG. 1

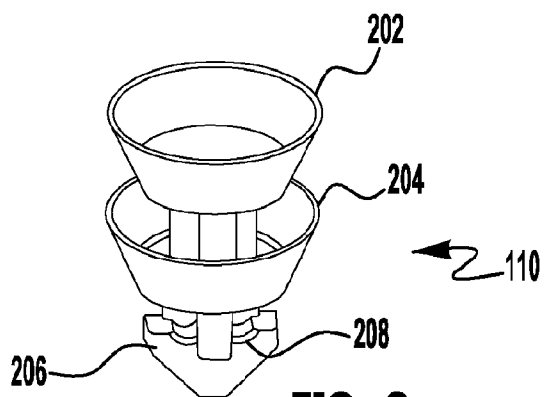


FIG. 2

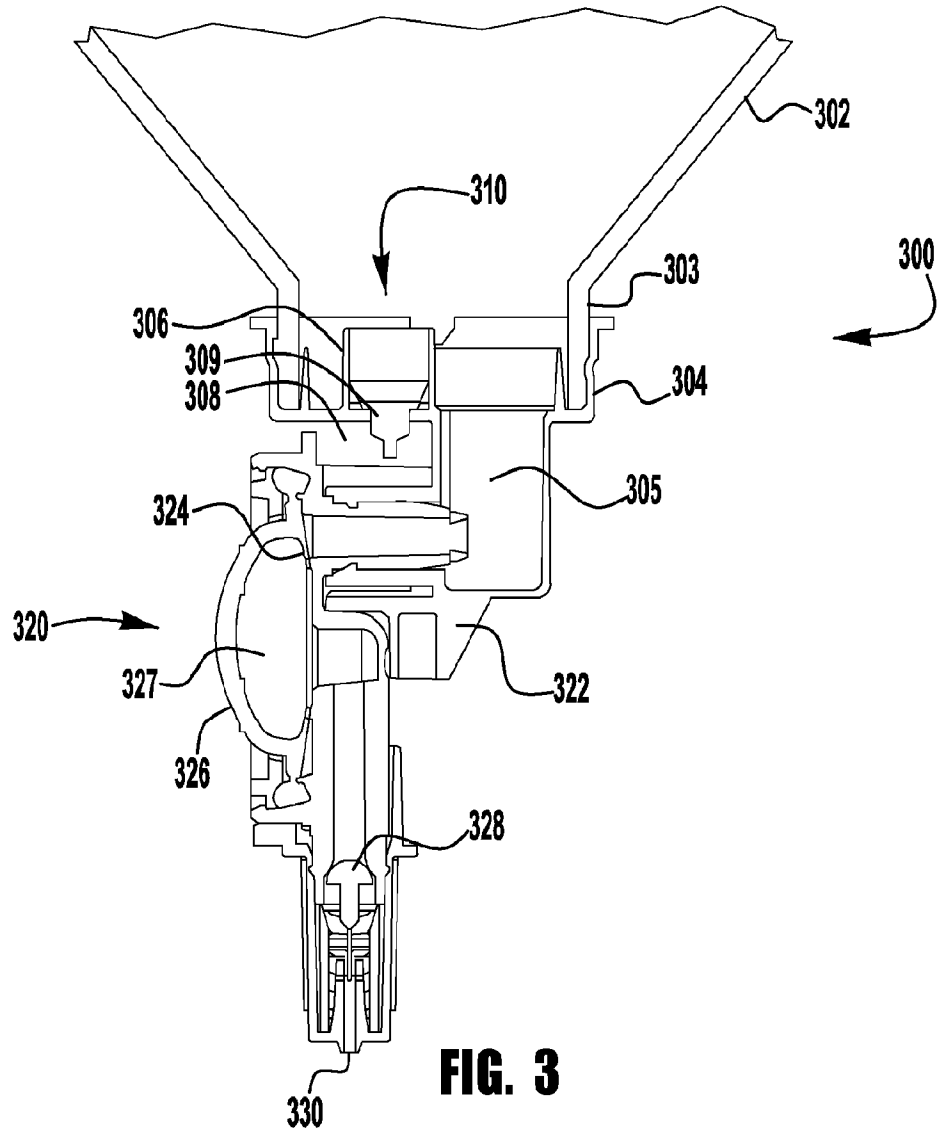


FIG. 3

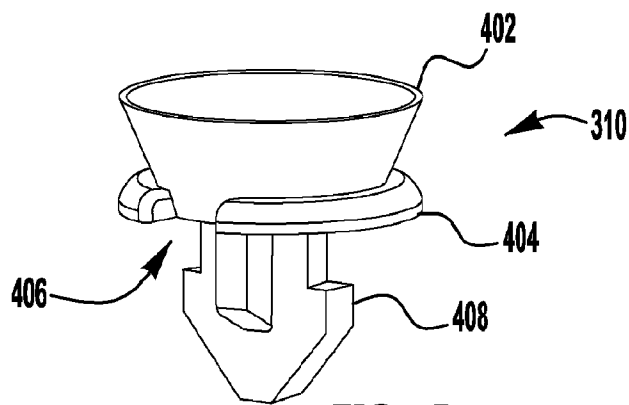


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/037317

A. CLASSIFICATION OF SUBJECT MATTER
INV. B05B11/00
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

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.
X	US 2014/158715 A1 (WELLS JESSE D [US]) 12 June 2014 (2014-06-12)	1,3
A	paragraph [0015] - paragraph [0026]; figures	2,4-20

X	US 2014/203047 A1 (MCNULTY JOHN J [US] ET AL) 24 July 2014 (2014-07-24)	1,3
A	paragraph [0019] - paragraph [0043]; figures	2,4-20

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 14 September 2016	Date of mailing of the international search report 21/09/2016
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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 Krysta, Dieter
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/037317

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-20

A refill unit

1.1. claims: 1-8

Claims 1-8 refer to a refill unit having a vent valve, wherein a first wiper seal of said vent valve is in contact with fluid.

1.2. claims: 9-14

Claims 9-14 refer to a refill unit having a vent valve, wherein a second wiper seal of said vent valve is in contact with an annular venting chamber.

1.3. claims: 15-20

Claims 15-20 refer to a refill unit having a vent valve, wherein an annular base of said vent valve is in contact with the floor of an annular venting chamber, and wherein the annular base extends outward from the base of said wiper seal.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/037317

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