(54) Titre : BOUTEILLE DE DISTRIBUTION DE REMPLISSAGE
(54) Title: REFILL DISPENSING BOTTLE

(57) Abrégé/Abstract:
A refill dispensing bottle (1), comprising: a container (200) defining a chamber (220) storing a viscous flowable substance and having an opening (240) through which the substance is dispensable from the chamber; and a dispenser (100) comprising a seal (110) sealing the opening, a substance flow passageway fluidly connecting the chamber to an exterior of the container through the seal, and a vent (130) fluidly connecting the chamber to the exterior of the container through the seal in parallel with the substance flow passageway; wherein a cross-sectional area of the substance flow passageway, a cross-sectional area of the vent, and a viscosity of the substance are selected so that the substance at room temperature and atmospheric pressure is dispensed from the substance flow passageway at a rate of less than 35 cc/sec and at least 0.5 cc/sec with the bottle inverted and the vent unblocked.
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FIG. 5
Published:

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REFILL DISPENSING BOTTLE

BACKGROUND

[0001] The present invention relates to refill dispensing bottles.

[0002] A refill dispensing bottle is a bottle from which a flowable substance may be dispensed to refill another container, such as a liquid hand soap pump bottle, a dish liquid bottle, or a reservoir of a dispenser built into a kitchen sink or counter. The flowable substance may be, for example, liquid hand soap or washing-up liquid. Typically, the refill dispensing bottle is of larger volume that the destination container, so that the container may be refilled with flowable substance from the same refill dispensing bottle several times.

[0003] When using a refill dispensing bottle to refill a container with a relatively viscous substance, such as a substance with a higher viscosity than water, it can take several minutes for a sufficient volume of the substance to be dispensed under gravity from the refill dispensing bottle to refill the container. During the whole of this time period, a user holds the refill dispensing bottle above the container in an inverted state with an opening of the refill dispensing bottle lowermost, meaning that they are not free to undertake other tasks during the time period.

[0004] A need exists for a refill dispensing bottle configured to permit a user to carry out other tasks as the bottle is dispensing. There also is a need for a refill dispensing bottle configured to avoid, or minimize, undesired dispensing of a flowable substance from an opening thereof.

BRIEF SUMMARY

[0005] An embodiment of the present invention provides a refill dispensing bottle comprising: a container defining a chamber storing a viscous flowable substance and having an opening through which the substance is dispensable from the chamber; and a dispenser comprising a seal sealing the opening, a substance flow passageway fluidly connecting the chamber to an exterior of the container through the seal, and a vent fluidly connecting the chamber to the exterior of the container through the seal in parallel with the substance flow passageway; wherein a cross-sectional area of the substance flow passageway, a cross-sectional area of the vent, and a viscosity of the substance are selected so that the substance at room temperature and atmospheric pressure is dispensed from the substance flow passageway at a rate of less than 35 cc/sec and at least 0.5 cc/sec with the bottle inverted and the vent unblocked.
Optionally, the cross-sectional area of the substance flow passageway, the cross-sectional area of the vent, and the viscosity of the substance are selected so that the substance at room temperature and atmospheric pressure is dispensed from the substance flow passageway at a rate of at least 0.9 cc/sec with the bottle inverted and the vent unblocked, optionally at least 1.8 cc/sec with the bottle inverted and the vent unblocked.

Optionally, the cross-sectional area of the substance flow passageway, the cross-sectional area of the vent, and the viscosity of the substance are selected so that the substance at room temperature and atmospheric pressure is dispensed from the substance flow passageway at a rate of no more than 31 cc/sec with the bottle inverted and the vent unblocked, further optionally no more than 11 cc/sec with the bottle inverted and the vent unblocked, further optionally no more than 4.2 cc/sec with the bottle inverted and the vent unblocked.

Optionally, the cross-sectional area of the substance flow passageway, the cross-sectional area of the vent, and the viscosity of the substance are selected so that the substance at room temperature and atmospheric pressure is dispensed from the substance flow passageway at a rate of less than 0.1 cc/sec with the bottle inverted and the vent blocked, optionally less than 0.01 cc/sec with the bottle inverted and the vent blocked, further optionally no more than 0.001 cc/sec with the bottle inverted and the vent blocked.

Optionally, the substance at room temperature and atmospheric pressure is more viscous than water.

Optionally, the vent comprises a first pipe extending from the seal into the chamber.

Optionally, the vent comprises a second pipe extending from the seal outside of the container.

Optionally, an opening in the first pipe in the chamber is above a top level of the substance in the chamber when the refill dispensing bottle is inverted.

Optionally, the first pipe extends further from the seal into the chamber than the substance flow passageway.

Optionally, the dispenser is secured to the container, and/or the seal is disposed inside a portion of the container.

Another embodiment of the present invention provides a refill dispensing bottle, comprising: a container defining a chamber for storing a viscous flowable substance and having an opening through which the substance is dispensable from the chamber; and a dispenser
secured to the container and comprising a seal sealing the opening, a substance flow passageway fluidly connecting the chamber to an exterior of the container through the seal, and a vent fluidly connecting the chamber to the exterior of the container through the seal in parallel with the substance flow passageway.

[0016] Optionally, the seal is disposed inside a portion of the container.

[0017] A further embodiment of the present invention provides a refill dispensing bottle, comprising: a container defining a chamber for storing a viscous flowable substance and having an opening through which the substance is dispensable from the chamber; and a dispenser comprising a seal disposed inside a portion of the container and sealing the opening, a substance flow passageway fluidly connecting the chamber to an exterior of the container through the seal, and a vent fluidly connecting the chamber to the exterior of the container through the seal in parallel with the substance flow passageway.

[0018] Optionally, in the refill dispensing bottle of either of the above-described other and further embodiments of the present invention, the vent comprises a first pipe extending from the seal into the chamber. Optionally, the first pipe extends further from the seal into the chamber than the substance flow passageway.

[0019] Optionally, the vent comprises a second pipe extending from the seal outside of the container. Further optionally, the second pipe extends further from the seal outside of the container than the substance flow passageway.

[0020] Optionally, a part of the vent furthest from the seal outside of the container is an open end of the second pipe that is at a greater distance from the seal than any part of the substance flow passageway outside of the container, or an open end of the second pipe is further from the seal outside of the container than an open end of the substance flow passageway outside of the container.

[0021] Optionally, the refill dispensing bottle of either of the above-described other and further embodiments of the present invention comprises the substance in the chamber.

[0022] Optionally, the substance at room temperature and atmospheric pressure is more viscous than water.

[0023] Optionally, the substance at atmospheric pressure and room temperature has a viscosity of between 100 and 25,000 cps, optionally between 1,000 and 14,000 cps, further optionally between 3,000 and 7,000 cps.
[0024] Optionally, an opening in the first pipe in the chamber is above a top level of the substance in the chamber when the refill dispensing bottle is inverted.

[0025] Optionally, in any one of the refill dispensing bottles of the above-described embodiments of the present invention, neither the substance flow passageway nor the vent is disposed within the other of the substance flow passageway and the vent.

[0026] Optionally, in any one of the refill dispensing bottles of the above-described embodiments of the present invention, the extent to which the first pipe extends from the seal into the chamber is adjustable, and/or the extent to which the second pipe extends from the seal outside of the container is adjustable.

[0027] Optionally, in any one of the refill dispensing bottles of the above-described embodiments of the present invention, the first pipe is unitary with the second pipe.

[0028] Optionally, in any one of the refill dispensing bottles of the above-described embodiments of the present invention, the dispenser comprises an annular wall extending from the seal and surrounding a portion of, or all of, the second pipe. Further optionally, the annular wall and the seal together define a basin into which the substance flow passageway opens.

[0029] Optionally, in any one of the refill dispensing bottles of the above-described embodiments of the present invention, the refill dispensing bottle is free of any device for fully or partially blocking the vent.

[0030] Optionally, in any one of the refill dispensing bottles of the above-described embodiments of the present invention, the seal is configured to fit into or receive an opening of a second container defining a second chamber with the chamber of the container in fluid communication with the second chamber via each of the substance flow passageway and the vent. Further optionally, the seal is configured to seal the opening of the second container when the seal is fitted into the opening of the second container or the opening of the second container is received in the seal.

[0031] Optionally, in the refill dispensing bottle of the further embodiment of the present invention, the dispenser is secured to the container.

[0032] Optionally, any one of the refill dispensing bottles of the above-described embodiments of the present invention comprises a cap movable relative to the seal between a first position, at which the cap isolates the substance flow passageway and the vent from the exterior of the
container, and a second position at which the substance flow passageway and the vent are in fluid communication with the exterior of the container.

[0033] A further embodiment of the present invention provides a combination of a refill dispensing bottle according to any one of the above described embodiments of the present invention, and a second container defining a second chamber, wherein the seal is configured to fit into or receive an opening of the second container with the chamber of the container in fluid communication with the second chamber via each of the substance flow passageway and the vent.

[0034] Optionally, the seal is configured to seal the opening of the second container when the seal is fitted into the opening of the second container or the opening of the second container is received in the seal.

[0035] Optionally, the combination comprises a stand for stably holding the second container on a surface when the seal is fitted into the opening of the second container or the opening of the second container is received in the opening.

[0036] Optionally, the dispensing of the flowable substance stops automatically and without user intervention when the flowable substance reaches a predetermined level in the second chamber of the second container.

[0037] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0038] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0039] Figure 1 is a side view of a refill dispensing bottle in accordance with an embodiment of the present invention;

[0040] Figure 2 is a perspective view of the seal of the dispenser of the refill dispensing bottle of Figure 1;

[0041] Figure 3 is a perspective view of the refill dispensing bottle of Figure 1 inverted and being used to fill a second container;
[0042] Figure 4 is a perspective view of a stand for stably supporting on a surface the second container shown in Figure 2; and

[0043] Figure 5 is a perspective view of a refill dispensing bottle in accordance with an embodiment of the present invention inverted and being used to fill a second container while the second container is supported by the stand shown in Figure 4.

DETAILED DESCRIPTION

[0044] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0045] As used throughout, ranges are used as shorthand for describing each and every value that is within the range. Any value within the range can be selected as the terminus of the range. In addition, all references cited herein are hereby incorporated by referenced in their entireties. In the event of a conflict in a definition in the present disclosure and that of a cited reference, the present disclosure controls.

[0046] Figure 1 shows a refill dispensing bottle 1 of a first embodiment of the present invention. Broadly speaking, the bottle 1 comprises a container 200 and a dispenser 100. The container 200 has a body portion 210 defining an internal chamber 220 within which is stored a viscous flowable substance. In this embodiment, the substance is liquid hand soap. In variations to this embodiment, the substance may instead be any one of washing-up liquid, a liquid detergent, or any other home care or personal care product. The substance may be, for example, any one of a liquid, a foam, a gel, an emulsion, and a sol. However, in all embodiments of the present invention, the substance is flowable at room temperature and atmospheric pressure. Herein, by “room temperature” it is meant a temperature of 20 to 25 degrees Celsius, preferably 25 degrees Celsius, and by “atmospheric pressure” it is meant a pressure of 101 kPa. Preferably, at room temperature and atmospheric pressure the substance is more viscous than water. The substance at atmospheric pressure and room temperature preferably has a viscosity of between 100 and 25,000 cps, more preferably between 1,000 and 14,000 cps, and most preferably between 3,000 and 7,000 cps.

[0047] The container 200 further has a narrowed neck portion 230 connected to the body portion 210 and defining an opening 240 through which the substance is dispensable from the chamber 220. The body portion 210 of the container 200 has a flat, or substantially flat, base 250, upon which the container 200 may stand on a surface when not in use.
[0048] The dispenser 100 comprises a seal 110, a substance flow passageway 120 and a vent 130. The seal 110 is disposed inside the neck portion 230 of the container 200, and a plug 140 of the seal 110 seals the opening 240. The seal 110 is an interference fit in the opening 240 of the neck portion 230, whereby the seal 110, and the dispenser 100 as a whole, is secured to the container 200. In some embodiments, the plug 140 of the seal 110 is removable from the opening 240 of the container 200 to unseal the opening 240. Moreover, in variations to the illustrated embodiments, the dispenser 100 may be secured to the container 200 by a mechanism other than an interference fit. For example, in some embodiments, there may be provided a screw-thread on the dispenser 100 that cooperates with a screw-thread on the container 200.

[0049] The substance flow passageway 120 comprises a first passageway that extends through the seal 110 between opposed interior and exterior sides of the seal 110, and that fluidly connects the chamber 220 of the container 200 to an exterior of the container 200 through the seal 110.

[0050] The vent 130 comprises a second passageway through the seal 110, a first pipe 131 extending from the seal 110 into the chamber 220, and a second pipe 132, unitary with the first pipe 131, extending from the seal 110 outside of the container 200 and outside of the bottle 1. More specifically, the first pipe 131 defines a first lumen that opens into the chamber 220 at a first open end 133 of the first pipe 131, the second pipe 132 defines a second lumen that opens to the exterior of the container 200 at a second open end 134 of the second pipe 132, and the lumens of the first and second pipes 131, 132 are in fluid communication with each other through the second passageway through the seal 110. In some embodiments, the first and second pipes 131, 132 are unitary with the seal 110. In other embodiments, the first and second pipes 131, 132 are comprised in a single tube that is discrete from the seal 110 and that extends through the second passageway through the seal 110. The vent 130 fluidly connects the chamber 220 to the exterior of the container 200, and thus to the exterior of the bottle 1, through the seal 110 in parallel with the substance flow passageway 120.

[0051] It will be noted from at least Figure 1 that the first pipe 131 extends further from the seal 110 into the chamber 220 than does the substance flow passageway 120, and that the second pipe 132 extends further from the seal 110 outside of the container 200 than does the substance flow passageway 120. Indeed, in the illustrated embodiments, the substance flow passageway 120 merely extends through the seal 100 between the first interior side of the seal 110 that delimits the chamber 220 and the second exterior side of the seal 110 at the exterior of the container 200.
The part of the vent 130 furthest from the seal 110 outside of the container 200 is the second open end 134 of the second pipe 132, which second open end 134 is at a greater distance from the seal 110 than any part of the substance flow passageway 120 outside of the container 200. Specifically, the second open end 134 of the second pipe 132 is further from the seal 110 outside of the container than an open end of the substance flow passageway 120 outside of the container 200. In a variation to the illustrated embodiments, the second open end 134 of the second pipe 132 may be flush with the seal 110, or the second pipe 132 may be omitted altogether so that the vent 130 comprises just the second passageway through the seal 110 and the first pipe 131 extending from the seal 110 into the chamber 220.

[0052] The volume of the substance provided in the chamber 220 of the container 200, and the distance between the seal 110 and the first open end 133 of the first pipe 131 (i.e. the length of the first pipe 131 present in the chamber 220) preferably are selected so that, when the refill dispensing bottle 1 is inverted as shown in Figure 3, the first open end 133 of the first pipe 131 in the chamber 220 is above a top level 215 of the substance in the chamber 220. The reasons for the first and second pipes 131, 132 extending to the extents shown in Figures 1 and 3 will be explained below.

[0053] In variations to the illustrated embodiments, the extent to which the first pipe 131 extends from the seal 110 into the chamber 220 is adjustable. In some variations to the illustrated embodiments, the extent to which the second pipe 132 extends from the seal 110 outside of the container 200 is adjustable. For example, in embodiments in which the first and second pipes 131, 132 are comprised in a single tube that is discrete from the seal 110, the single tube may be movable relative to the seal 110 in the direction of the longitudinal axis of the single tube, thereby to vary the extent to which both the first and second pipes 131, 132 extend from the seal 110. Similarly, in embodiments in which the first pipe 131 is discrete from the second pipe 132, and the first and second pipes 131, 132 are discrete from the seal 110, each of the first and second pipes 131, 132 may be independently movable relative to the seal 110 in the direction of the longitudinal axis of the pipe in question. The second pipe 132 could be movable relative to the seal 110 to a position at which the second open end 134 of the second pipe 132 is flush with the seal 110.

[0054] It will be noted that, in the illustrated embodiments, neither the substance flow passageway 120 nor the vent 130 is disposed within the other of the substance flow passageway
120 and the vent 130. In variations to the illustrated embodiments, the vent 130 may comprise a tube that is disposed within, and in some embodiments is concentric with, the substance flow passageway 120.

[0055] In the illustrated embodiments, the refill dispensing bottle 1 is free of any device for fully or partially blocking the vent 130. In this context, “device” is intended not to include the flowable substance itself. However, in variations to the illustrated embodiments, the bottle 1 may comprise a device, such as a valve or a clamp, which is selectively operable by a user to fully or partially block, the vent 130 and to fully or partially unblock the vent 130.

[0056] With reference to Figure 2, the seal 110 of the dispenser 100 comprises an annular flange 150 with an outside diameter that is greater than an inside diameter of the opening 240 of the container 200, to prevent the dispenser 100 from falling into the chamber 220. Extending in a first direction from the annular flange 150 is the plug 140 of the seal 110, which plug 140 has an outside diameter that is slightly greater than the inside diameter of the opening 240 of the container 200 so that, with the plug 140 disposed in the opening 240 of the neck 230 of the container 200, an interference fit is provided between the plug 140 and the neck 230 to retain the dispenser 100 in position relative to the container 200 and to seal the opening 240 as discussed above. Extending in a second direction, opposite to the first direction, from the annular flange 150 is an outer portion 160 of the seal 110. The outer portion 160 of the seal 110 has a stepped outside diameter. More specifically, the outer portion 160 has a first section 162 that is of a first outside diameter that is less than that of the flange 150, and a second section 164 between the first section 162 and the flange 150 that is of a second outside diameter, which second outside diameter is less than that of the flange 150 but greater than that of the first section 162. The provision of the first and second sections 162, 164 of the outer portion 160 of the seal 110 means that destination containers with openings of a range of different inside diameters are securable to the outer portion 160 of the seal 110, preferably by interference fit, while the plug 140 of the seal 110 is secured to the container 200 as discussed above.

[0057] The dispenser 100 further comprises an annular wall 170 extending from the distal end of the outer portion 160 of the seal 110. The wall 170 surrounds respective exterior openings of the first and second passageways through the seal 110 and, when the second pipe 132 is present as shown in Figure 1, the wall 170 also surrounds a portion of the second pipe 132. Together, the
wall 170 and an end face 180 of the outer portion 160 of the seal 110 define a basin 190 into which the substance flow passageway 130 opens.

[0058] During use of the refill dispensing bottle 1 to fill or refill a destination container, such as the destination container 300 shown in Figures 3 and 5, the refill dispensing bottle 1 of Figure 1 is inverted so that the opening 240 is disposed lowermost and below the chamber 220. The outer portion 160 of the seal 110 is then fitted into an opening in the destination container 300. Preferably there is provided an interference fit between the outer portion 160 of the seal 110 and the portion of the destination container 300 defining the opening of the destination container 300, so as to secure the bottle 1 to the destination container 300, although other mechanisms may instead be provided. In any event, preferably the seal 110 is configured to fit into or receive an opening of the destination container 300 with the chamber 220 of the container 200 in fluid communication with the second chamber of the destination container 300 via each of the substance flow passageway 120 and the vent 130.

[0059] At this stage, the combination of the refill dispensing bottle 1 and the destination container 300 may be unstable, since the refill dispensing bottle 1 may be of much greater mass than the destination container 300, meaning that the combination is top-heavy. Accordingly, in some embodiments of the present invention, there is further provided a stand 400 for stably holding the destination container 300 on a surface when the seal 110 is fitted into the opening of the destination container 300. The example stand 400 shown in Figures 4 and 5 comprises a piece of card, paperboard or plastic, folded into the shape of a triangular prism with a receiving opening 410 formed by two sides 402, 403 of the three sides of the prism. An outer face of the remaining side 401 of the triangular prism lies flat on a substantially horizontal surface. A base of the destination container 300 sits in contact with an inner face of the remaining side 401 of the triangular prism, while sides of the destination container 300 above the base of the destination container 300 are held between edges of the other two sides 402, 403 of the prism, as shown in Figure 5. The stand 400 may be collapsible for storage.

[0060] With the refill dispensing bottle 1 inverted so that the opening 240 is disposed lowermost and below the chamber 220, the flowable substance in the chamber 220 tends to move towards the seal 110 under the influence of gravity. In preferred embodiments of the present invention, as discussed above and as shown in Figure 3, the first open end 133 of the first pipe 131 in the chamber 220 is above a top level 215 of the substance in the chamber 220. This causes the
creation of a potential difference that encourages the flowable substance to leave the chamber 220 through the substance flow passageway 120, and means that little or none of the flowable substance enters the vent 130 from the chamber 220, permitting air from the second chamber of the destination container 300 to travel via the vent 130 to the chamber 220 of the container 200 of the bottle 1.

[0061] When the flowable substance reaches the seal 110, it enters the substance flow passageway 120 to pass through the seal 110. Since the entrance to the substance flow passageway 120 is at a far end of the chamber 220, all of the flowable substance is dispensable from the chamber 220 via the substance flow passageway 120 when the bottle 1 is inverted. Movement of the flowable substance from the chamber 220 through the substance flow passageway 120 causes the creation of a slight vacuum in the chamber 220, which draws air up the vent 130 from the second chamber of the destination container 300 and into the chamber 220. Preferably, the body portion 210 of the container 200 is sufficiently rigid to resist significant collapse as the flowable substance leaves the chamber 220 through the substance flow passageway 120, so as to maintain the slight vacuum in the chamber 220. Preferably, any (if any) of the flowable substance present in the vent 130 is evacuated from the first end 133 of the first tube 131 by the rising air. When the vent 130 is clear of the flowable substance, there is then unrestricted air flow into the chamber 220 from the second chamber of the destination container 300, which allows the flow rate of the flowable substance from the chamber 220 and through the substance flow passageway 120 to reach a maximum. Accordingly, the provision of the vent 130 in parallel to the substance flow passageway 120 permits quicker dispensing of the flowable substance from the bottle 1 into the destination container 300 than a comparable bottle 1 lacking the vent 130.

[0062] In the illustrated exemplary embodiments, a cross-sectional area of the substance flow passageway 120 and a cross-sectional area of the vent 130 are selected so that, were water (which has a viscosity of 1 cp) present in the chamber 220 rather than the viscous flowable substance, at room temperature and atmospheric pressure the water would dispense from the substance flow passageway 120 at a rate of 35 cc/sec with the bottle 1 inverted and the vent 130 unblocked. With the viscous flowable substance in the chamber 220 instead of water, the cross-sectional area of the substance flow passageway 120, the cross-sectional area of the vent 130, and the viscosity of the flowable substance are selected so that the substance at room temperature
and atmospheric pressure is dispensed from the substance flow passageway 120 at a rate of less than 35 cc/sec and at least 0.5 cc/sec with the bottle 1 inverted and the vent 130 unblocked.

[0063] Preferably, the cross-sectional area of the substance flow passageway 120 and the cross-sectional area of the vent 130 are selected so that, with the bottle 1 inverted and the vent 130 unblocked, different respective viscous flowable substances having the viscosities shown in Table 1, below, would be dispensed from the substance flow passageway 120 at the associated flow rate shown in Table 1:

<table>
<thead>
<tr>
<th>Viscosity (cp)</th>
<th>Flow rate (cc/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
</tr>
<tr>
<td>100</td>
<td>31</td>
</tr>
<tr>
<td>1,000</td>
<td>11</td>
</tr>
<tr>
<td>3,000</td>
<td>4.2</td>
</tr>
<tr>
<td>7,000</td>
<td>1.8</td>
</tr>
<tr>
<td>14,000</td>
<td>0.9</td>
</tr>
<tr>
<td>25,000</td>
<td>0.5</td>
</tr>
</tbody>
</table>

[0064] It will be seen that, when the viscosity of the substance is between 100 and 25,000 cps, preferably the flow rate is between 0.5 and 31 cc/sec. When the viscosity of the substance is between 1,000 and 14,000 cps, preferably the flow rate is between 0.9 and 11 cc/sec. When the viscosity of the substance is between 3,000 and 7,000 cps, preferably the flow rate is between 1.8 and 4.2 cc/sec. Accordingly, preferably, when the bottle 1 is inverted prior to dispensing, the user is given sufficient time to correctly position the open end of the substance flow passageway 120 outside of the container 200 above the opening of the destination container 300 before the flowable substance begins to be dispensed from the bottle 1, so that the bottle 1 is configured to avoid, or minimize, undesired dispensing of the flowable substance.

[0065] Preferably, one or both of the minimum and maximum cross-sectional areas of one or both of the substance flow passageway 120 and the vent 130, as well as the viscosity of the flowable substance, are selected so that the substance at room temperature and atmospheric pressure is dispensed from the substance flow passageway 120 at a rate of less than 35 cc/sec and at least 0.5 cc/sec with the bottle 1 inverted and the vent 130 unblocked.
[0066] In some embodiments of the present invention, rheological parameters of the flowable substance are measured at atmospheric pressure and at 25 degrees Celsius in a rotational rheometer, such as ARG2 by TA Instruments, using Couette, cone-plate or other geometry. These parameters include: viscosity, shear rate (SR) and shear stress (SS), the latter being a product of the former two. Depending on how viscosity behaves as SR decreases, the flowable substance may follow one of the following two types of rheological behavior: either its viscosity levels off at a low-shear viscosity limit (LSVL), or goes to infinity. In the former case the flowable substance will be hereafter referred to as having LSVL. In the latter case, the flowable substance will be referred to as having yield stress (YS).

[0067] More specifically, LSVL should be measured at low enough SR so as to have viscosity independent of SR. YS should be defined by fitting SS(SR) data with the Herschel-Bulkley equation: \( SS = YS + K \times SR^n \), where YS, K and n are fitting parameters. With the LSVL between 100 and 25,000 cps, optionally between 1,000 and 14,000 cps, further optionally between 3,000 and 7,000 cps, and with the initial height of the flowable substance in the container 200 being not more than 15 cm from the open end of the substance flow passageway 120 outside of the container 200, preferably the flowable substance is dispensed from the substance flow passageway 120 at an initial rate of at least 0.5 cc/sec, optionally at least 0.9 cc/sec, further optionally at least 1.8 cc/sec with the bottle 1 inverted and the vent 130 unblocked. In some embodiments, if the flowable substance does not have LSVL and therefore is considered as having YS, its YS should not exceed 50 Pa and the height of the residual flowable substance in the container 200 should not drop below 5 cm from the open end of the substance flow passageway 120 outside of the container 200.

[0068] In a variation to the embodiment shown in Figure 3, in Figure 5 the first open end 133 of the first pipe 131 in the chamber 220 is below the top level 215 of the substance in the chamber 220. Accordingly, before the maximum flow rate of the flowable substance through the substance flow passageway 120 is reached, flow of the flowable substance through the substance flow passageway 120 occurs at a lower rate, while air passing up the vent 130 breaks into bubbles within the flowable substance in the chamber 220 after leaving the first open end 133 of the first pipe 131, until the first open end 133 of the first pipe 131 in the chamber 220 protrudes above the top level 215 of the substance in the chamber 220. Depending on the nature of the
flowable substance, such bubbling could cause foaming of the flowable substance in the chamber 220, which may not be desirable.

[0069] The flow rate of the flowable substance through the substance flow passageway 120 slowly reduces from the maximum flow rate as the volume of flowable substance in the chamber 220 reduces. When the level of the flowable substance in the second chamber of the destination container 300 rises to block the second open end 134 of the second tube 132 of the vent 130, air is prevented from rising up the vent 130 to the chamber 220. The product flow rate then reduces significantly, as flowable substance in the second chamber of the destination container 300 begins to be drawn up the vent 130. When the level of the flowable substance in the vent 130 reaches the level of the flowable substance remaining in the chamber 220, equilibrium is reached and flow of the flowable substance stops. Accordingly, through selection of an appropriate distance between the second end 134 of the second tube 132 and the seal 110, dispensing of the flowable substance stops automatically and without user intervention when the flowable substance reaches a predetermined level in the second chamber of the destination container 300. Therefore, the risk of overfilling the destination container 300 is reduced or avoided, and the user is free to carry out other tasks while the bottle 1 is dispensing.

[0070] In the illustrated embodiments, the cross-sectional area of the substance flow passageway 120, the cross-sectional area of the vent 130, and the viscosity of the flowable substance are selected so that the substance at room temperature and atmospheric pressure is dispensed from the substance flow passageway 120 at a rate of no more than 0.001 cc/sec with the bottle 1 inverted and the vent 130 blocked. When dispensing of the flowable substance to the predetermined level in the second chamber of the destination container 300 is complete, a user is given sufficient time to remove the dispenser 100 from the destination container 300 while the bottle 1 is still inverted without a further quantity of the flowable substance being dispensed from the bottle 1. Accordingly, the bottle 1 is still further configured to avoid, or minimize, undesired dispensing of the flowable substance. In variations to the illustrated embodiments, this flow rate with the bottle 1 inverted and the vent 130 blocked may be less than 0.1 cc/sec, or less than 0.01 cc/sec. These flow rates with the vent 130 blocked are measured with there being no leaks in the system, so that the only route for air into the chamber 220, as the flowable substance is dispensed though the substance flow passageway 120, is via the vent 130.
[0071] Preferably, one or both of the minimum and maximum cross-sectional areas of one or both of the substance flow passageway 120 and the vent 130, as well as the viscosity of the flowable substance, are selected so that the substance at room temperature and atmospheric pressure is dispensed from the substance flow passageway 120 at a rate of less than 0.1 cc/sec, preferably less than 0.01 cc/sec, further preferably no more than 0.001 cc/sec, with the bottle 1 inverted and the vent 130 blocked. Again, these flow rates with the vent 130 blocked are measured with there being no leaks in the system, so that the only route for air into the chamber 220, as the flowable substance is dispensed though the substance flow passageway 120, is via the vent 130.

[0072] Following disconnection of the dispenser 100 from the destination container 300, the bottle 1 preferably is reverted to its storage orientation with the base 250 lowermost and the opening 240 above the chamber 220. Any of the flowable substance within the vent 130 and the substance flow passage 120 returns to the chamber 220, and any of the flowable substance on the outside of the second tube 132 of the vent 130 moves under the influence of gravity into the basin 190 and subsequently into the substance flow passage 120.

[0073] Although not shown in the enclosed Figures, the bottle 1 may further comprise a cap that is movable relative to the seal 110 between a first position, at which the cap isolates the substance flow passageway 120 and the vent 130 from the exterior of the container 200, and a second position, at which the substance flow passageway 120 and the vent 130 are in fluid communication with the exterior of the container 200. Such a cap preferably has a mechanism for securing the cap to the container 200. For example, the cap may have an internal thread for mating with a thread on an exterior of the neck 230 of the container 200. Moreover, such a cap preferably is sized to accommodate the second tube 132 of the vent 130 when the cap is secured to the container 200.

[0074] Such a cap may have a flat top so that, when the cap is secured to the container, the bottle 1 may be placed with the flat top on a horizontal surface to store the bottle 1 in its inverted state. The top of the cap may be wider than the rest of the cap and/or wider than the neck 230 of the container 200, to increase stability of the bottle 1 when so stored in its inverted state. Furthermore, the cap may have an angled rim usable to collect in the cap excess flowable substance from the exterior of a dip tube connected to a pump that is removed from the destination container 300 prior to securing the bottle 1 to the destination container 300.

The
interior of the top of the cap may comprise geometry for supporting such a dip tube, e.g. geometry that fits snug with one or both of the inside diameter and the outside diameter of the dip tube.

[0075] In a variation to the illustrated embodiments, the substance flow passageway 120 may comprise a substance flow tube extending from the seal 110 in parallel to the second tube 132 of the vent 130. In such a variation, preferably the second open end 134 of the second pipe 132 still is at a greater distance from the seal 110 than any part of the substance flow passageway 120 outside of the container 200.

[0076] In further variations to the illustrated embodiments, there may be provided a plurality of the substance flow passageways 120 through the seal 110 in parallel to the vent 130.
CLAIMS

WHAT IS CLAIMED IS:

1. A refill dispensing bottle, comprising:
   a container defining a chamber storing a viscous flowable substance and having an
   opening through which the substance is dispensable from the chamber; and
   a dispenser comprising a seal sealing the opening, a substance flow passageway fluidly
   connecting the chamber to an exterior of the container through the seal, and a vent fluidly
   connecting the chamber to the exterior of the container through the seal in parallel with the
   substance flow passageway;
   wherein a cross-sectional area of the substance flow passageway, a cross-sectional area of
   the vent, and a viscosity of the substance are selected so that the substance at room temperature
   and atmospheric pressure is dispensed from the substance flow passageway at a rate of less than
   35 cc/sec and at least 0.5 cc/sec with the bottle inverted and the vent unblocked.

2. The refill dispensing bottle of claim 1, wherein the cross-sectional area of the substance
   flow passageway, the cross-sectional area of the vent, and the viscosity of the substance are
   selected so that the substance at room temperature and atmospheric pressure is dispensed from
   the substance flow passageway at a rate of at least 0.9 cc/sec with the bottle inverted and the vent
   unblocked, optionally at least 1.8 cc/sec with the bottle inverted and the vent unblocked.

3. The refill dispensing bottle of claim 1 or claim 2, wherein the cross-sectional area of the
   substance flow passageway, the cross-sectional area of the vent, and the viscosity of the
   substance are selected so that the substance at room temperature and atmospheric pressure is
   dispensed from the substance flow passageway at a rate of no more than 31 cc/sec with the bottle
   inverted and the vent unblocked, further optionally no more than 11 cc/sec with the bottle
   inverted and the vent unblocked, further optionally no more than 4.2 cc/sec with the bottle
   inverted and the vent unblocked.

4. The refill dispensing bottle of any preceding claim, wherein the cross-sectional area of
   the substance flow passageway, the cross-sectional area of the vent, and the viscosity of the
substance are selected so that the substance at room temperature and atmospheric pressure is dispensed from the substance flow passageway at a rate of less than 0.1 cc/sec with the bottle inverted and the vent blocked, optionally less than 0.01 cc/sec with the bottle inverted and the vent blocked, further optionally no more than 0.001 cc/sec with the bottle inverted and the vent blocked.

5. The refill dispensing bottle of any preceding claim, wherein the substance at room temperature and atmospheric pressure is more viscous than water.

6. The refill dispensing bottle of any preceding claim, wherein the substance at atmospheric pressure and room temperature has a viscosity of between 100 and 25,000 cps, optionally between 1,000 and 14,000 cps, further optionally between 3,000 and 7,000 cps.

7. The refill dispensing bottle of any preceding claim, wherein the vent comprises a first pipe extending from the seal into the chamber.

8. The refill dispensing bottle of any preceding claim, wherein the vent comprises a second pipe extending from the seal outside of the container.

9. The refill dispensing bottle of claim 7 or claim 8, wherein an opening in the first pipe in the chamber is above a top level of the substance in the chamber when the refill dispensing bottle is inverted.

10. The refill dispensing bottle of any one of claims 7 to 9, wherein the first pipe extends further from the seal into the chamber than the substance flow passageway.

11. The refill dispensing bottle of any preceding claim, wherein the dispenser is secured to the container and/or the seal is disposed inside a portion of the container.
12. A refill dispensing bottle, comprising:
   a container defining a chamber for storing a viscous flowable substance and having an
   opening through which the substance is dispensable from the chamber; and
   a dispenser secured to the container and comprising a seal sealing the opening, a
   substance flow passageway fluidly connecting the chamber to an exterior of the container
   through the seal, and a vent fluidly connecting the chamber to the exterior of the container
   through the seal in parallel with the substance flow passageway.

13. The refill dispensing bottle of any preceding claim, wherein the seal is disposed inside a
    portion of the container.

14. A refill dispensing bottle, comprising:
   a container defining a chamber for storing a viscous flowable substance and having an
   opening through which the substance is dispensable from the chamber; and
   a dispenser comprising a seal disposed inside a portion of the container and sealing the
   opening, a substance flow passageway fluidly connecting the chamber to an exterior of the
   container through the seal, and a vent fluidly connecting the chamber to the exterior of the
   container through the seal in parallel with the substance flow passageway.

15. The refill dispensing bottle of any one of claims 12 to 14, wherein the vent comprises a
    first pipe extending from the seal into the chamber, optionally wherein the first pipe extends
    further from the seal into the chamber than the substance flow passageway.

16. The refill dispensing bottle of any one of claims 12 to 15, wherein the vent comprises a
    second pipe extending from the seal outside of the container, optionally wherein the second pipe
    extends further from the seal outside of the container than the substance flow passageway.

17. The refill dispensing bottle of claim 16, wherein a part of the vent furthest from the seal
    outside of the container is an open end of the second pipe that is at a greater distance from the
    seal than any part of the substance flow passageway outside of the container, or wherein an open
end of the second pipe is further from the seal outside of the container than an open end of the substance flow passageway outside of the container.

18. The refill dispensing bottle of any one of claims 12 to 17, comprising the substance in the chamber, optionally wherein the substance at room temperature and atmospheric pressure is more viscous than water.

19. The refill dispensing bottle of claim 18, wherein the substance at atmospheric pressure and room temperature has a viscosity of between 100 and 25,000 cps, optionally between 1,000 and 14,000 cps, further optionally between 3,000 and 7,000 cps.

20. The refill dispensing bottle of any one of claims 18 to 19, when dependent on claim 13, wherein an opening in the first pipe in the chamber is above a top level of the substance in the chamber when the refill dispensing bottle is inverted.

21. The refill dispensing bottle of any preceding claim, wherein neither the substance flow passageway nor the vent is disposed within the other of the substance flow passageway and the vent.

22. The refill dispensing bottle of any one of claims 16 to 21, wherein the extent to which the first pipe extends from the seal into the chamber is adjustable, and/or wherein the extent to which the second pipe extends from the seal outside of the container is adjustable.

23. The refill dispensing bottle of any one of claims 16 to 22, wherein the first pipe is unitary with the second pipe.

24. The refill dispensing bottle of any one of claims 16 to 23, wherein the dispenser comprises an annular wall extending from the seal and surrounding a portion of, or all of, the second pipe, optionally wherein the annular wall and the seal together define a basin into which the substance flow passageway opens.
25. The refill dispensing bottle of any preceding claim, wherein the refill dispensing bottle is free of any device for fully or partially blocking the vent.

26. The refill dispensing bottle of any preceding claim, wherein the seal is configured to fit into or receive an opening of a second container defining a second chamber with the chamber of the container in fluid communication with the second chamber via each of the substance flow passageway and the vent.

27. The refill dispensing bottle of any preceding claim, comprising a cap movable relative to the seal between a first position, at which the cap isolates the substance flow passageway and the vent from the exterior of the container, and a second position at which the substance flow passageway and the vent are in fluid communication with the exterior of the container.

28. A combination of the refill dispensing bottle of any preceding claim, and a second container defining a second chamber, wherein the seal is configured to fit into or receive an opening of the second container with the chamber of the container in fluid communication with the second chamber via each of the substance flow passageway and the vent.

29. A combination according to claim 28, comprising a stand for supporting the second container on a surface when the seal is fitted into the opening of the second container or the opening of the second container is received in the opening.

30. A combination according to claim 28, wherein dispensing of the flowable substance stops automatically and without user intervention when the flowable substance reaches a predetermined level in the second chamber of the second container.