



(43) International Publication Date
22 October 2015 (22.10.2015)

- (51) International Patent Classification:
B65D 47/06 (2006.01) *A47K 5/12* (2006.01)
- (21) International Application Number:
PCT/CN2015/073262
- (22) International Filing Date:
25 February 2015 (25.02.2015)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
PCT/CN2014/075693 18 April 2014 (18.04.2014) CN
- (71) Applicant: **THE PROCTER & GAMBLE COMPANY** [US/US]; One Procter & Gamble Plaza, Cincinnati, Ohio 45202 (US).
- (72) Inventors; and
- (71) Applicants (for US only): **DAGNELIE, Thierry Christian Francis** [BE/BE]; Temselaan 100, B-1853 Strombeek-Bever Brussels (BE). **DE WILDE, Vincent Hubert M** [BE/BE]; Temselaan 100, B-1853 Strombeek-Bever Brussels (BE). **VAN DEN WOUWER, Chris** [BE/BE]; Tem-

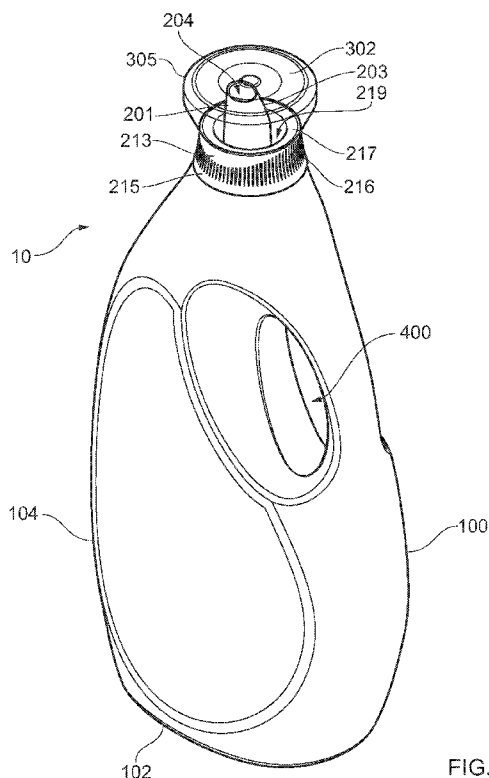
selaan 100, B-1853 Strombeek-Bever Brussels (BE). **NOGUEIRA, Francisco Miguel de Tavares Duarte** [PT/BE]; Temselaan 100, B-1853 Strombeek-Bever Brussels (BE). **OLSEN, Robb Eric** [US/US]; One Procter & Gamble Plaza, Cincinnati, Ohio 45202 (US). **XI, Jie** [CN/CN]; No. 35, Yu'an Road, B Zone, Tianzhu Konggang Development Zone, Shunyi District, Beijing 101312 (CN). **ZHANG, Mengdi** [CN/CN]; No. 35, Yu'an Road, B Zone, Tianzhu Konggang Development Zone, Shunyi District, Beijing 101312 (CN).

(74) Agent: **SHANGHAI PATENT & TRADEMARK LAW OFFICE, LLC**; 435 Guiping Road, Shanghai 200233 (CN).

(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, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, 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, SA, SC,

[Continued on next page]

(54) Title: A PACKAGING ASSEMBLY



(57) Abstract: A packaging assembly (10) comprising a container (100) and a transition piece (200), which comprises a spout (201) with a circumferentially integral opening (204) and a vent (209) located adjacent to the base end (202) of the spout (201). The spout (201) and the vent (209) have a particular ratio in terms of cross-sectional area. The packaging assembly (10) provides a controlled dispensing of a liquid detergent composition, particularly viscous liquid detergent compositions.

FIG. 6



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, ST, 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, KM, ML, MR, NE, SN, TD, TG).

Published:

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

A PACKAGING ASSEMBLY

FIELD OF THE INVENTION

5 The present invention relates to a packaging assembly. The present invention also relates to a liquid detergent product comprising a packaging assembly and a liquid detergent composition contained within the packaging assembly.

BACKGROUND OF THE INVENTION

10 Liquid detergents have been increasingly preferred by users over solid detergents, mainly due to their improved water solubility during a washing cycle. Moreover, viscous liquid detergents (e.g., a liquid detergent composition with a viscosity of 500 centipoise (“cps”) when poured out of a container) are desired as they tend to connote a premium product. However, such viscous liquid detergents pose challenges to packaging due to the increased difficulty in
15 dispensing them out of the packaging along with the increased viscosity. For example, the flow rate of the liquid detergent may become too slow to be acceptable by users, or the liquid detergent may form bulks which then block the opening of the packaging.

 Traditionally, the dispensing issue associated with viscous liquid detergents is solved by providing a container having a spout with a longitudinal slot or trough that runs along the length
20 of the spout, i.e., the spout per se is not circumferentially integral. Admittedly such a slotted opening avoids an unacceptable slow flow rate or the formation of bulks. However, a liquid detergent may flow out of such a slotted spout too fast, thereby causing undesirable turbulence. Moreover, a fast flow rate of the liquid detergent causes insufficient ventilation, i.e., not sufficient air could ventilate into the container at the same time when the liquid detergent is
25 dispensed out of the container. Therefore, the flow may undesirably stop or at least have discontinuous flow during dispensing due to the significantly decreased air pressure in the container. Also, the prior art discloses the combination of a vent with such a spout. But in the art the size and position of the vent are not aligned well with the spout such that the ventilation function of the vent is not consistently reliable, i.e., during dispensing a liquid detergent may
30 flow out of the vent too.

 Thus, there is a need for a packaging assembly that provides a controlled dispensing of a liquid detergent composition, particularly viscous liquid detergent compositions, from the

packaging assembly, i.e., a desired flow of the liquid detergent composition such as a proper flow rate, continuous flow, sufficient ventilation, or no turbulence.

It is an advantage of the present invention to provide a transition piece that accommodates to a wide variety of containers, as well as a packaging assembly comprising the transition piece that allows the combination of a variety of containers and caps whilst maintaining a low variation of cap opening torques.

It is another advantage of the present invention to provide a packaging assembly that allows a residual liquid composition to flow back from its opening to container utterly and efficiently after dispensing, thereby preventing it from accumulating and drying.

It is yet another advantage of the present invention to provide a packaging assembly having several components that serve, independently or in combination with each other, as a visual reminder to users of the most efficient way in dispensing a liquid detergent composition contained in the packaging assembly.

It is even yet another advantage of the present invention to provide a packaging assembly comprising a transition piece and a dispensing cap, which allows for a precise dosing of a liquid composition, particularly concentrated liquid compositions.

SUMMARY OF THE INVENTION

In one aspect, the present invention is directed to a packaging assembly, comprising:

a) a container comprising an orifice and an opposing bottom surface, the bottom surface defining a longitudinal axis perpendicular thereto, wherein the longitudinal axis passes through the orifice; and

b) a transition piece engaged to the orifice, comprising:

i) a spout having a base end proximate to the orifice and an opposing pouring end having a circumferentially integral opening; and

ii) a vent located adjacent to the base end,

wherein the spout and the vent are in fluid communication with the orifice, and the vent has a cross-sectional area that is about 1/20 to about 1/3 of the cross-sectional area of the spout opening.

In another aspect, the present invention is directed to a liquid detergent product comprising the packaging assembly and a liquid detergent composition contained within the packaging assembly, wherein the liquid detergent composition has a viscosity value of about 200

to about 3,000 cps, preferably of about 300 to about 2,000 cps, more preferably of about 500 to about 1,000 cps, at a shear rate of 20/sec and a temperature of 21°C.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Fig. **1** is a front view of a packaging assembly according to one embodiment of the present invention.

Fig. **2A** is a cross-sectional view of a transition piece according to one preferred embodiment of the present invention.

Fig. **2B** is a top view of the transition piece in Fig. **2A**.

10 Fig. **2C** is a bottom view of the transition piece in Fig. **2A**.

Fig. **3** is a cross-sectional view of a transition piece comprising a double sealing system according to another embodiment of the present invention.

Fig. **4** is a perspective view of a transition piece and a cap according to one preferred embodiment of the present invention.

15 Fig. **5** is a perspective view of the transition piece and cap in Fig. **4** when the cap is sealingly engaged to the transition piece.

Fig. **6** is a perspective view of a packaging assembly according to another preferred embodiment of the present invention.

20 Fig. **7** is a top view of the transition pieces of Comparative Examples 2A and 2B and Examples 1B and 1A according to the present invention from left to right (in sequence).

DETAILED DESCRIPTION OF THE INVENTION

The packaging assembly of the present invention provides a controlled dispensing of a liquid detergent composition from the packaging assembly. It has been surprisingly found that, 25 by providing a spout having an opening that is circumferentially integral (i.e., without a longitudinal slot that runs along a partial or the entire length of the spout, in contrast to the spouts having a slot in the art), in combination with a particularly sized vent located at a particular position relative to the opening, the packaging assembly herein addresses the issue associated with ventilation, thereby allowing for a desired, steady flow of the liquid detergent composition. 30 Moreover, by locating the vent adjacent to the base end of the spout, i.e., separate from the spout opening, the liquid composition route (i.e., the spout opening) does not compete with the air route (i.e., the vent), thereby reducing the turbulence while dispensing.

Definitions

As used herein, the term “liquid detergent composition” means a liquid composition relating to cleaning or treating: fabrics, hard or soft surfaces, hair, or any other surfaces in the area of fabric care, home care, and hair care. Examples of the detergent compositions include, but are not limited to: laundry detergent, laundry detergent additive, fabric softener, carpet cleaner, floor cleaner, bathroom cleaner, toilet cleaner, sink cleaner, dishwashing detergent, air care, car care, shaving cream, hair shampoo, hair conditioner, and the like. Preferably, the liquid detergent composition is a liquid laundry detergent composition, a liquid fabric softener composition, a liquid dishwashing detergent composition, or a liquid hard surface cleaning composition, more preferably is a liquid laundry detergent composition or a liquid fabric softener composition, even more preferably is a liquid laundry detergent composition. The liquid detergent composition may be either aqueous or non-aqueous, and may be anisotropic, isotropic, or combinations thereof.

As used herein, the term “container” refers to packaging suitable for containing compositions, particularly liquid compositions. Non-limiting examples of containers include a bottle, a tottle, a jar, a cup, and the like.

As used herein, when a composition is “substantially free” of a specific ingredient, it is meant that the composition comprises less than a trace amount, alternatively less than 0.1%, alternatively less than 0.01%, alternatively less than 0.001%, by weight of the composition, of the specific ingredient.

As used herein, the articles including “a” and “an” when used in a claim, are understood to mean one or more of what is claimed or described.

As used herein, the terms “comprise”, “comprises”, “comprising”, “include”, “includes”, “including”, “contain”, “contains”, and “containing” are meant to be non-limiting, i.e., other steps and other ingredients which do not affect the end of result can be added. The above terms encompass the terms “consisting of” and “consisting essentially of”.

Packaging Assembly

Fig. 1 illustrates a preferred embodiment of the packaging assembly **10** of the present invention. The packaging assembly **10** comprises a container **100** having an orifice **101** in fluid communication with the interior volume of the container **100** from which contained liquid composition may flow out, and a bottom surface **102** opposing the orifice **101**. The container **100** comprises a peripheral wall **104** extending from the bottom surface **102** to the orifice **101**.

The bottom surface **102** defines a longitudinal axis (“L-Axis” as shown in Fig. **1**) perpendicular thereto, and the longitudinal axis passes through the orifice **101**, preferably intersecting the center point of the orifice **101**. In certain executions (e.g., extrusion blow molding (EBM)), the container **100** has a center line (not shown in the drawings) in its bottom surface **102**. Preferably the longitudinal axis is perpendicular to the center line of the bottom surface **102**, and the longitudinal axis and center line together define a longitudinal section (not shown in the drawings). Preferably, the container **100** is bilaterally symmetrical along the longitudinal section.

The container **100** herein can be of any suitable size known in the art. In one embodiment, the container is configured to have an internal volume of from 250 mL to 8,000 mL, alternatively from 500 mL to 3,000 mL, alternatively from 800 mL to 2,000 mL.

The packaging assembly **10** comprises a transition piece **200** that can be engaged to the orifice **101** of the container **100**, as shown in Fig. **1**. The transition piece **200** can be transparent or translucent or opaque, but preferably is opaque and has the same color as the container **100**, thereby indicating users that it should not be removed from the container **100** under intended usage. The transition piece **200** comprises: a spout **201** having a base end **202** proximate to the orifice **101** and an opposing pouring end **203** having a circumferentially integral opening **204**; and a vent **209** adjacent to the base end **202**. The spout **201** and the vent **209** are in fluid communication with the orifice **101**. The spout **201** is configured to dispense a liquid composition that has flowed from the container **100** via the orifice **101**, and the spout **201** comprises an interior surface **205** in contact with the liquid composition and an opposing exterior surface **206**. Preferably the spout interior surface **205** has one or more ribs **223** (shown in Figs. **2B** and **2C**) extending along the entire length of the spout **201**, thereby enhancing the strength of the spout **201**. The vent **209** is configured to ventilate air into the container **100** during the dispensing and may also function as a drain hole so as to allow a residual liquid detergent composition remaining in the transition piece **200** to flow back into the container **100** after dispensing.

Preferably the spout opening **204** herein is relatively small. In one embodiment, the spout opening **204** has a cross-sectional area of 20 mm² to 400 mm², more preferably of 50 mm² to 300 mm², even more preferably of 100 mm² to 200 mm². Such a relatively small spout opening **204** enables a steady flow of a liquid composition from the container **100**. By contrast, the container spouts having a relatively big opening in the art typically cause severe turbulence during dispensing.

The spout opening **204** has a particular ratio relative to the vent **209** in terms of cross-sectional area. Specifically, the vent **209** has a cross-sectional area that is 1/20 to 1/3, preferably 1/15 to 1/4, more preferably 1/10 to 1/5, of the cross-sectional area of the spout opening **204**. The minimum dimension of a vent **209** is generally interlinked with the liquid composition contained within the container **100**, particularly with the viscosity of the composition. The vent **209** is preferably not so tiny that it could be easily blocked by the liquid composition while dispensing. In one embodiment, the vent **209** has a cross-sectional area of 2 mm² to 50 mm², preferably of 10 mm² to 40 mm², more preferably of 20 mm² to 30 mm². The spout **201** may comprise multiple vents **209**. In the multiple-vent execution, the multiple vents **209** should have a total cross-sectional area that satisfies the ratio requirement relative to the spout opening **204**. These multiple vents **209** could be arranged either separately or side-by-side, but preferably side-by-side adjacent to the base end **202** of the spout **201**.

Referring now to Figs. **2A**, **2B**, and **2C**, there is shown a preferred embodiment of the transition piece **200** of the present invention. The spout **201** and the vent **209** are bilaterally symmetrical along the longitudinal section. Preferably the spout opening **204** is positioned offset from the longitudinal axis within the longitudinal section, and in the same manner the vent **209** is oppositely (relative to the spout opening **204**) offset from the longitudinal axis within the longitudinal section. Thus, by separating as much as possible the positions of the spout opening **204** and the vent **209**, the packaging assembly **10** avoids the competition between the liquid composition route and the air route, thereby reducing the turbulence while dispensing.

The spout opening **204** can be either slanted or perpendicular to the longitudinal axis, but preferably slanted. As illustrated in Fig. **2A**, the spout opening **204** is slanted, comprising a first apex **207** and a first nadir **208** circumferentially opposing along the spout opening **204**. In the slanted execution, the spout opening **204** could be of any acute angle, preferably from 15° to 85°, more preferably from 45° to 80°, relative to the longitudinal axis. The spout **201** can be either parallel to the longitudinal axis or tilted, but preferably tilted towards the first apex **207**. Such a slanted spout opening **204** enables the packaging assembly **10** to provide a clear visual reminder to users of the most efficient way in dispensing a liquid composition contained in the packaging assembly **10**, namely, tilting the packaging assembly **10** towards the first apex **207** of the slanted spout opening **204**. Moreover, by slanting the spout opening **204** and tilting the spout **201** accordingly (i.e., towards the first apex **207** of the slanted spout opening **204**), the packaging assembly **10** of the present invention reduces the angle at which a container has to be tilted to

dispense a liquid composition, thereby facilitating the dosing experience. Additionally, such a slanted spout opening **204** allows for larger cross-sectional dimensions.

In one embodiment, the spout opening **204**, especially at or proximate to the first apex **207**, is sharp so that the flow of a liquid composition being poured from the container **100** can be abruptly stopped in a manner avoiding or reducing residue of the composition that stays on the exterior surface **206** or that flows back into the container **100** through the vent **209**, thereby maintaining cleanliness of the packaging assembly **10** during usage. The sharpness of the spout opening **204** is preferably characterized by a chamfered edge (not shown in the drawings) of the spout opening **204**. Such a chamfered edge is preferably straight at angle of 30° to 90° relative to the longitudinal axis.

The vent **209** and the spout opening **204** are preferably generally aligned with respect to the longitudinal axis. As shown in Figs. **2A** and **2B**, the vent **209** and the spout opening **204** are aligned such that: the vent **209** and the first nadir **208** are within an angle of 0.25π radians, preferably within an angle of 0.1π radians of each other around the longitudinal axis. The vent **209** and the spout opening **204** are preferably also aligned such that: the vent **209** and the first apex **207** are of an angle from 0.75π to 1π radians, preferably of an angle from 0.9π to 1π radians, of each other around the longitudinal axis. Since the vent **209** has a cross-sectional area (i.e., is not a single point but includes multiple points), by definition if any point on the vent **209** satisfies the angle requirement relative to the first nadir **208** or the first apex **207**, then the vent is of the defined angle with the first nadir **208** or the first apex **207**. By aligning the vent **209** with a slanted spout opening **204**, the packaging assembly **10** ensures an immediate, steady flow of a liquid composition from the container **100** once a user intentionally dispenses the composition in accordance with the visual reminder served by the slanted spout opening **204**.

The spout **201** can be of any suitable length measured from the base end **202** to the spout opening **204** along the longitudinal axis, depending on factors such as the viscosity of the liquid detergent composition contained within the container **100**, the sizes of the spout opening **204** and the vent **209**. In one embodiment, the spout has a length of 20 mm to 80 mm, alternatively from 20 mm to 60 mm, alternatively from 20 mm to 40 mm, alternatively from 40 mm to 60 mm, measured from the base end **202** to the spout opening **204** along the longitudinal axis. Moreover, along the longitudinal axis the spout **201** can be of the same or different cross-sectional areas that are perpendicular to the longitudinal axis, but preferably is tapered (i.e., the cross-sectional area perpendicular to the longitudinal axis becomes progressively narrower) towards the spout

opening **204**, as illustrated in Fig. **2A**. Such a tapered spout further reduces the dispensing turbulence.

Both the spout opening **204** and the vent **209** can be of any suitable geometric shape, either symmetrical or asymmetrical. In one embodiment, the spout opening **204** has a shape selected from elliptical, round, semi-circled, triangular, rectangular, trapezoidal, pentagonal, or hexagonal. Preferably the spout opening **204** has an elliptical shape, as shown in Fig. **2B**. Likewise, the vent **209** has a shape selected from annular, annular sector, elliptical, round, semi-circled, triangular, rectangular, trapezoidal, pentagonal, or hexagonal. In the execution when the vent **209** is located in a channel **210** as will be illustrated hereinafter, the vent **209** has a shape aligned with the channel, preferably has an annular sector shape, as shown in Figs. **2B** and **2C**.

As shown in Figs. **2A**, **2B**, and **2C**, the transition piece **200** further comprises a channel **210**, preferably an annular channel **210**, surrounding the base end **202** of the spout **201**; and a radially protruding shroud **213** surrounding the channel **210**. The vent **209** is located in the channel **210**. The shroud **213** comprises an exterior surface **215**, an opposing interior surface **214**, and a shoulder **217** therebetween. The shroud interior surface **214** is facing the spout exterior surface **206**, thereby forming a void **219** between the shroud **213** and the spout **201**. The channel **210** defines the bottom boundary of the void **219**. Preferably, both the channel **210** and the shroud **213** are annular around the longitudinal axis.

Similar to the spout opening **204**, the channel **210** can be either slanted or perpendicular to the longitudinal axis, but preferably is slanted. As illustrated in Fig. **2A**, the channel **210** is slanted, comprising a second apex **211** and a second nadir **212** circumferentially opposing along the channel **210**. In the slanted execution, the channel **210** can be of any acute angle, preferably from 5° to 85° , more preferably from 20° to 70° , relative to the longitudinal axis. The vent **209** is located at the second nadir **212** of the channel **210** as to allow a liquid composition to gravitationally flow back into the container **100** when in an upright position. The vent **209** and the channel **210** are further aligned such that: the vent **209** and the second apex **211** are of an angle from 0.75π to 1π radians, preferably of an angle from 0.9π to 1π radians, of each other around the longitudinal axis. Since the vent **209** has a cross-sectional area (i.e., is not a single point but includes multiple points), by definition if any point on the vent **209** satisfies the angle requirement relative to the second apex **211**, then the vent and the second apex **211** are of the defined angle. In the multiple-vent execution, preferably at least one of the multiple vents **209** is located in the channel **210**, more preferably one of the multiple vents **209** is located at the second nadir **212** of the channel **210**. Even more preferably, the multiple vents **210** are arranged side-by-

side, located in the channel **210**, wherein one of the multiple vents **209** is located at the second nadir **212** of the channel **210**. By slanting the channel **210** (preferably at an appropriate angle) and locating the vent **209** at a particular position, the packaging assembly **10** of the present invention allows the residue of a liquid detergent composition to flow back from its opening to container utterly and efficiently after dispensing, thereby preventing the residue from accumulating and drying.

In one embodiment, the transition piece **200** comprises a double sealing system: a first sealing means **220** configured to seal the transition piece **200** with the container **100**; and a second sealing means **221** configured to seal the transition piece **200** with a cap **300**. The first sealing means **220** and the second sealing means **221** can be located at any suitable positions of the transition piece **200**. Accordingly, the container **100** comprises a corresponding container sealing means **103** disposed on the container peripheral wall **104** proximate to the orifice **101** as shown in Fig. 1, and the cap **300** comprises a corresponding cap sealing means **304** disposed on the cap peripheral wall **305** proximate to the cap opening **301** as shown in Fig. 4.

Fig. 3 illustrates a preferred embodiment of the transition piece **200** having such a double sealing system, sealed with a container sealing means **103** and a cap sealing means **304**. The shroud **213** further comprises a fastener surface **218** on the underside of the shroud exterior surface **215**, and the first sealing means **220** is disposed on the shroud fastener surface **218**. When the transition piece **200** is sealed with the container **100**, a portion of the container peripheral wall **104** proximate to the orifice **101** is inserted between the shroud interior surface **214** and shroud exterior surface **215**, and the container sealing means **103** matches with the first sealing means **220**. The second sealing means **221** is disposed on the shroud interior surface **214**. Preferably the cap sealing means **304** is aligned with the void **219** of the transition piece **200** so as to be inserted into the void **219** and to seal with the second sealing means **221**. In one embodiment, the cap further comprises a shoulder **303** abutting the cap sealing means **304**, and the cap shoulder **303** is preferably aligned with the shroud shoulder **217** such that they connect or parallel to each other, thereby enhancing the connection between the transition piece **200** and the cap **300**.

Each pair of sealing means (namely, the first sealing means **220** and its corresponding container sealing means **103**, and the second sealing means **221** and its corresponding cap sealing means **304**) can be of any suitable sealing technologies in the art, such as interlocking corresponding threads, or a lug and groove combination. Preferably, each pair of sealing means comprises interlocking corresponding threads helically disposed on the shroud fastener surface

218 and the container **100**, or on the shroud interior surface **214** and the cap **300**, as shown in Fig. 3.

In one preferred embodiment, the shroud **213** further comprises an auxiliary sealing means in addition to the first and second sealing means **220**, **221**. The auxiliary sealing means is preferably configured to enhance the connection of the transition piece **200** with the container **100** or the cap **300**. The auxiliary sealing means can be disposed at any suitable position of the shroud **213**, but preferably above the first sealing means **220**. The auxiliary sealing means can be of any suitable sealing technologies in the art, such as a bending surface of any sort. The bending surface can be a bending ring, which connects with the opposing surface in a continuous manner imposing a minimum pressure in all its length, or alternatively be a seal aligning the surfaces of the two opposing parts to be sealed in a parallel manner. An example of the bending ring is known as a plug seal **222** (i.e., an obstruction protruded from the shroud **213**, which bends when sealed with a corresponding sealing means), as shown in Fig. 3. An example of the seal formed between two aligned surfaces is known as a flat wall seal (i.e., a flat wall constituting an integral part of a surface of the shroud **213**, which deforms when sealed with a corresponding sealing means. Not shown in the drawings). Preferably, the auxiliary sealing means is a plug seal **222** disposed on the underside of the shroud shoulder **217**, above the first sealing means **220**, as illustrated in Fig. 3. When sealed with the container **100**, the plug seal **222** bends but its deformation does not expand to any other portions of the transition piece **200**, i.e., without deforming the transition piece **200** except for the plug seal **222**. This is due to the nature of the plug seal **222** where the connecting area between the obstruction and its corresponding part (in this case the transition piece **200**) is thin versus the flat wall seal where the contacting surfaces form the seal and therefore enables bending through the entire transition piece **200**. Thus, the plug seal **222** allows the transition piece **200** to accommodate to multiple dimensions of container necks. This improved applicability of the transition piece **200** to a wide variety of containers **100** significantly reduces the variability of industry process present in large scale production, e.g., dimensional variations when a bottle is produced with multiple plastic resins, which, due to the nature of the plastic resins, has wide dimensional variations. Moreover, the non-deformation of the transition piece **200** ensures a relatively low variation of opening torques in term of the connection with the cap **300** since the second sealing means **221** that is configured to seal with the cap **300** is not negatively impacted by any deformation. Therefore, by adopting a plug seal **222** as an auxiliary sealing means, the packaging assembly **10** of the present invention allows the combination of a variety of containers and caps whilst maintaining a low variation of cap

opening torques. By contrast, in the art such an independent transition piece is not utilized, and accordingly the direct interaction of a container and cap requires the perfect match between the container and the cap and causes an undesired high variation of opening torques when combining different containers and caps.

5 In one embodiment, the shroud exterior surface **215** has a set of linear indentations **216**, as can be seen in Figs. **4** and **5**. Such a set of linear indentations **216** could be present either circumferentially around the shroud exterior surface **215** or at a portion of the shroud exterior surface **215**, but preferably circumferentially around the shroud exterior surface **215**. The provision of the set of linear indentations enables increased friction, which is desired when a user
10 holds the packaging assembly **10** by grasping the transition piece **200** or when he removes the cap **300** (e.g., screw off the cap **300**) by twisting the cap **300** and the transition piece **200** in opposite directions.

Referring now to Figs. **4** and **5**, there is shown a preferred embodiment of the packaging assembly **10** of the present invention, which further comprises a cap **300** removably sealingly
15 engaged to the transition piece **200**. Fig. **4** shows a cap **300** that is disengaged from the transition piece **200**, and Fig. **5** shows a cap that is sealingly engaged to the transition piece **200**. By sealingly engaged, it is meant that the cap **300** does not leak a quantity of a liquid detergent composition from the container **100** or the transition piece **200**, under typical stresses to the cap **300** or the container **100** or the transition piece **200** that occur during manufacturing,
20 packaging, shipping, handling, storage, and use of the packaging assembly **10** and liquid detergent composition contained therein. Typical stress is quantified for example as a drop test of a full capped container, on its side or bottom, from a height of 1.5m or less, preferably 0.8m or less, or alternatively a pressure build inside a capped container below necessary to overcome a seal pressure of 5000 kPa. The cap **300** is configured to enclose the spout **201**, and the cap **300** is in
25 fluid communication with the spout **201** when sealingly engaged to the transition piece **200**.

In one embodiment, the cap **300** is a dispensing cap, i.e., a user first dispenses a liquid detergent composition from the container **100** to the dispensing cap and then dispenses the composition from the dispensing cap to a washing machine or a washing basin. The cap **300** preferably has an internal volume of 10 mL to 250 mL, preferably 30 mL to 150 mL, more
30 preferably 50 mL to 100 mL. The internal volume of the cap **300** can be depending on factors such as the internal volume of the container **100** and/or the concentration of the liquid detergent composition contained within the container **100**. For example, when the liquid detergent composition within the container **100** is highly concentrated and requires only a small amount to

be dosed during a washing cycle, the internal volume of the cap **300** may be small, e.g., 40 mL. In the present invention, it has been surprisingly found that the dispensing cap **300**, in combination with the spout **201** that has a circumferentially integral opening **204**, enables a precise, quick dosing of a liquid detergent composition, particularly of concentrated liquid detergent compositions. At least a portion of the cap **300**, preferably the entire cap **300**, can be transparent or translucent or opaque, but preferably is transparent, thereby allowing for a precise dosing of users. Preferably, the cap **300** is marked with one or more volumetric indicia, such as indicium at 15 mL, 50 mL, and 65 mL.

As seen from Fig. 4, the cap **300** comprises an opening **301**, a base **302**, and a peripheral wall **305** extending from the base **302** to the opening **301**. The cap peripheral wall **305** can comprise an exterior surface and an opposing inner surface. Preferably the cap exterior surface is generally rough, more preferably has a number of dots (not shown in the drawings) to roughen the surface, thereby enabling a desired friction when a user tries to sealingly engage the cap **300** to or remove the cap **300** from the transition piece **200**.

The cap **300** can be of any suitable height. Preferably the cap **300** has a height with relevant to the length of the spout **201**, particularly a height longer than the length of the spout **201**. In one embodiment, the cap **300** has a height of 20 mm to 100 mm, preferably from 30 mm to 80 mm, more preferably from 40 mm to 70 mm, measured along the longitudinal axis when free standing, i.e., when the cap **300** stands on its base **302**. Preferably the spout **201** has a length of 20 mm to 80 mm measured from the base end **202** to the spout opening **204** along the longitudinal axis, and the height of the cap **300** is longer, preferably slightly longer than the length of the spout **201**.

The cap opening **301** can be of any geometric shape, but preferably is aligned with the void **219** of the transition piece **200** in terms of shape, and more preferably is of a round shape. The cap opening **301** preferably has a cross-sectional area that is larger than the cross-sectional area of the spout opening **204**, thereby ensuring the spout **201** to be inserted into the cap **300** and enclosed when the cap **300** is sealingly engaged to the transition piece **200**. In one embodiment, the spout opening **204** has a cross-sectional area that is less than 50%, preferably less than 40%, more preferably less than 30%, of the cross-sectional area of the cap opening **301**, thus enabling a desired flow of a liquid composition from the transition piece **200** to the cap **100**.

The cap opening **301** can have a weir (not shown in the drawings) configured to provide a more precise delivery of a liquid detergent composition by constricting the flow of the composition from the cap **300**. The weir can be of any common shapes suitable for weirs,

including a V shape, a semicircular shape, a trapezoidal shape, a multilevel weir having discontinuous function describing the hydraulic radius, or any other such shape that constricts flow of liquid detergent compositions.

5 The cap base **302** serves as a stand when the cap **300** is filled with a liquid composition, i.e., the cap **300** is upside down from the embodiment as shown in Fig. **4**. The cap base **302** is preferably generally flat. More preferably, as shown in Fig. **5**, the cap base **302** is slightly concave towards its center, thereby enabling a steady standing of the cap **300**.

10 The cap **300** can be of any suitable shape, such as an obconic shape, a cylindrical shape, a spherical shape, a cubic shape, a cuboid shape. The cap **300** preferably has an obconic shape or a cylindrical shape, more preferably has an obconic shape as shown in Fig. **5**, when sealingly engaged to the transition piece **200** (i.e., when the cap sealing means **304** is hidden from view). Such an obconic shape facilitates disengaging the cap **300** from the transition piece **200** and also enhances a steady standing particularly when the cap **300** is filled with a liquid composition.

15 The packaging assembly **10** of the present invention can further comprise a handle **400**. The handle **400** can be either a through handle (i.e., a completely open space through which fingers and/or thumb can be inserted) or a non-through handle (i.e., certain portion of a container depresses to form a grip without a completely open space). Such a non-through handle is described in U.S. Patent Application No. 2013/0270280A1. Preferably, the handle **400** is a through handle, as shown in Fig. **6**. In one embodiment, the through handle **400** has a cross-sectional area of 5 cm² to 50 cm², preferably 10 cm² to 35 cm², more preferably 15 cm² to 30 cm².
20

The handle **400** can be located at any suitable position of the container **100**, e.g., at the top of the container **100**, at the bottom of the container **100**, at a side of the container **100**. Preferably the handle **400** is located at a side of the container **100**, but bilaterally symmetrical along the longitudinal section. In one embodiment, the handle **400** and the vent **209** are generally aligned with respect to the longitudinal axis, preferably are aligned such that: the handle **400** and the vent **209** are within an angle of 0.25π radians, preferably within an angle of 0.1π radians of each other around the longitudinal axis. Likewise, in the execution of a slanted spout opening **204**, the handle **400** and the spout opening **204** are aligned such that: the handle **400** and the first apex **207** are of an angle from 0.75π to 1π radians, preferably of an angle from 0.9π to 1π radians
25 of each other around the longitudinal axis. Since both the handle **400** and the vent **209** have a cross-sectional area (i.e., are not a single point but includes multiple points), by definition if any point on the handle **400** or the vent **209** satisfies the above angle requirements, then the relevant objects (the handle **400**, the vent **209**, and the first apex **207**) are of the defined angle. Such a
30

side located handle **400** enables the packaging assembly **10** to provide a clear visual reminder to users of the most efficient way in dispensing a liquid composition contained in the packaging assembly **10**, namely, tilting the packaging assembly **10** by lifting the side of the container **100** having the handle **400**. Moreover, by aligning the handle **400** with the vent **209** and the slanted spout opening **204**, the packaging assembly **10** ensures an immediate, steady flow of a liquid composition from the container **100** once a user intentionally dispenses the composition in accordance with the visual reminder served by the slanted spout opening **204**.

Each component of the packaging assembly **10** of the present invention can be made of any suitable material, such as glass, metal, polymer, and the like, but preferably is made of polymer. In particular, the container **100**, the transition piece **200**, and the cap **300** can be made of the same or different materials. Preferably, each of them is independently made of a polymeric material selected from the group consisting of polypropylene (PP), polyethylene (PE), polycarbonate (PC), polyamides (PA) polyethylene terephthalate (PET), polyvinylchloride (PVC), polystyrene (PS), and a combination thereof.

Each component of the packaging assembly **10** of the present invention can be made by any suitable process known in the art, depending on factors like the material of the component or the property criteria required for the component. Non-limiting examples of processes include: extrusion blow molding (EBM), injection molding (IM), injection blow molding (IBM), and injection stretch blow molding (ISBM), thermoforming, compression molding, compression blow molding, injection and blow (I&B). In one embodiment, the container **100** is made by EBM, the transition piece **200** is made by IM, and the cap **300** is made by ISBM.

Preferably the portion of the transition piece **200** that is expected to be in contact with a liquid composition (e.g., the spout interior surface **205**, the vent **209**, the channel **210**), is relatively smooth, and more preferably is produced industrially in a smooth manner. In one embodiment, the mold for producing the transition piece **200** has a suitable mold finish, preferably has a VDI 3400 finish standard of 12 to 35, preferably 20 to 28, more preferably 22 to 26. The term “mold finish” herein refers to the surface texture and/or smoothness of the surface of a mold. VDI 3400 finish standard is a widely accepted standard in the industry for defining the polishing standard on mold finish. VDI 3400 finish standard includes a scale of 0 to 45 for mold finish, and as the number increases, the surface of the indicated mold is rougher. The preferred mold finish enables a transition piece **200** that has reduced friction with a liquid composition and thus less turbulence during dispensing, as well as less residues after the dispensing. Likewise, the portions of the cap **300** and the container **100** that are expected to be in

contact with a liquid composition (e.g., their interior surfaces) are preferably smooth and produced in a relatively smooth mold finish.

Liquid Detergent Composition

5 The packaging assembly of the present invention can contain any common liquid detergent compositions and accommodate to a variety of composition viscosities. In one preferred embodiment, the liquid detergent composition has a certain viscosity so as to be dispensed from the packaging assembly properly. Preferably, the liquid detergent composition has a viscosity value of 200 to 3,000 cps, more preferably 300 to 2,000 cps, even more
10 preferably of 500 to 1,000 cps, at a shear rate of 20/sec and a temperature of 21°C. The viscosity at a shear rate of 20/sec is also referred to as a “pouring viscosity” since the shear rate of dispensing a liquid composition from a container is around 20/sec. In addition, it is worth noting that typically a liquid composition having a pouring viscosity of above 200 cps is referred to as a “viscous liquid composition”.

15 Different from the pouring viscosity, a “resting viscosity” characterizes the viscosity of a liquid composition when resting, i.e., at a shear rate of around 1/sec. The value of the resting viscosity of a liquid composition may be the same or different from that of the pouring viscosity of the composition, depending on ingredients constituting the composition. In one embodiment, the liquid detergent composition herein has a viscosity value of 500 to 6,000 cps, preferably of
20 800 to 3,000 cps, more preferably of 1,500 to 2,500 cps, at a shear rate of 1/sec and a temperature of 21°C.

 The liquid detergent composition herein may comprise one or more ingredients. Suitable materials include but are not limited to: anionic surfactants, cationic surfactants, nonionic surfactants, amphoteric surfactants, fatty acids, builders, rheology modifiers, chelating agents,
25 dye transfer inhibiting agents, dispersants, enzymes, and enzyme stabilizers, catalytic materials, bleach activators, hydrogen peroxide, sources of hydrogen peroxide, preformed peracids, polymeric dispersing agents, clay soil removal/anti-redeposition agents, brighteners, suds suppressors, dyes, photobleaches, structure elasticizing agents, fabric softeners, carriers, hydrotropes, processing aids, solvents, hueing agents, anti-microbial agents, perfume oils,
30 perfume microcapsules, and/or pigments. In addition to the disclosure below, suitable examples of such other adjuncts and levels of use are found in U.S. Patents Nos. 5,576,282, 6,306,812, and 6,326,348. The precise nature of these ingredients and the levels thereof in the liquid detergent

composition will depend on factors like the specific type of the composition and the nature of the cleaning operation for which it is to be used.

In one embodiment, the liquid detergent composition comprises an anionic surfactant. Non-limiting examples of anionic surfactants include: linear alkylbenzene sulfonate (LAS), preferably C₁₀-C₁₆ LAS; C₁₀-C₂₀ primary, branched-chain and random alkyl sulfates (AS); C₁₀-C₁₈ secondary (2,3) alkyl sulfates; sulphated fatty alcohol ethoxylate (AES), preferably C₁₀-C₁₈ alkyl alkoxy sulfates (AE_xS) wherein preferably x is from 1-30, more preferably x is 1-3; C₁₀-C₁₈ alkyl alkoxy carboxylates preferably comprising 1-5 ethoxy units; mid-chain branched alkyl sulfates as discussed in US 6,020,303 and US 6,060,443; mid-chain branched alkyl alkoxy sulfates as discussed in US 6,008,181 and US 6,020,303; modified alkylbenzene sulfonate (MLAS) as discussed in WO 99/05243, WO 99/05242, and WO 99/05244; methyl ester sulfonate (MES); and alpha-olefin sulfonate (AOS). Preferably, the composition comprises an anionic surfactant selected from the group consisting of LAS, AES, AS, and a combination thereof, more preferably selected from the group consisting of LAS, AES, and a combination thereof. The total level of the anionic surfactant(s) may be from 5% to 95%, alternatively from 8% to 70%, alternatively from 10% to 50%, alternatively from 12% to 40%, alternatively from 15% to 30%, by weight of the liquid detergent composition.

In one preferred embodiment, the liquid detergent composition of the present invention comprises a rheology modifier (also referred to as a "structurant" in certain situations), which functions to adjust the viscosity of the composition so as to be more applicable to the packaging assembly. The rheology modifier herein can be any known ingredient that is capable of adjusting rheology to a liquid composition, such as those disclosed in U.S. Patent Application Nos. 2006/0205631A1, 2005/0203213A1, and U.S. Patent Nos. 7294611, 6855680. Preferably the rheology modifier is selected from the group consisting of hydroxy-containing crystalline material, polyacrylate, polysaccharide, polycarboxylate, amine oxide, alkali metal salt, alkaline earth metal salt, ammonium salt, alkanolammonium salt, C₁₂-C₂₀ fatty alcohol, di-benzylidene polyol acetal derivative (DBPA), di-amido gallant, a cationic polymer comprising a first structural unit derived from methacrylamide and a second structural unit derived from diallyl dimethyl ammonium chloride, and a combination thereof.

Preferably, the rheology modifier is a hydroxy-containing crystalline material generally characterized as crystalline, hydroxyl-containing fatty acids, fatty esters and fatty waxes, such as castor oil and castor oil derivatives. More preferably the rheology modifier is a hydrogenated castor oil (HCO).

The rheology modifier can be present at any suitable level in the liquid detergent composition. Preferably, the rheology modifier is present from 0.05% to 5%, preferably from 0.08% to 3%, more preferably from 0.1% to 1%, by weight of the composition, in the composition.

5

Liquid Detergent Product

Another aspect of the present invention is directed to a liquid detergent product comprising the packaging assembly and the liquid detergent composition as discussed above. Preferably, the liquid detergent composition is able to be flowed out of the packaging assembly at a desired flow rate, preferably at a flow rate of 10 mL/s to 40 mL/s, alternatively of 15 mL/s to 38 mL/s, alternatively of 20 mL/s to about 35 mL/s.

Preferably, the packaging assembly herein is designed as to dispense a liquid detergent composition with a certain viscosity value (pouring viscosity) from the packaging assembly at the most desirable flow rate. Without wishing to be bound by theory, it is believed that generally the lower the viscosity of the liquid detergent composition, the faster the flow rate, the longer the spout, and the bigger the vent. On the contrary, the higher the viscosity of the liquid detergent composition, the slower the flow rate, the shorter the spout, and the smaller the vent. In other words, the liquid detergent product of the present invention is configured to match a liquid detergent composition having a certain viscosity value with a packaging assembly having a suitable design.

In one embodiment, the liquid detergent composition has a viscosity value of 300 to 800 cps at a shear rate of 20/sec and a temperature of 21°C (i.e., a relatively low pouring viscosity), the spout has a length of 40 mm to 60 mm measured from the base end to the spout opening along the longitudinal axis, and the vent has a cross-sectional area of 25 mm² to 50 mm², wherein the liquid detergent composition is able to be flowed out of the packaging assembly at a flow rate of 30 mL/s to 40 mL/s.

Alternatively, the liquid detergent composition has a viscosity value of 800 to 3,000 cps at a shear rate of 20/sec and a temperature of 21°C (i.e., a relatively high pouring viscosity), the spout has a length of 30 mm to 40 mm measured from the base end to the spout opening along the longitudinal axis, and the vent has a cross-sectional area of 15 mm² to 25 mm², wherein the liquid detergent composition is able to be flowed out of the packaging assembly at a flow rate of 15 mL/s to 30 mL/s.

Method for Determining of Viscosity for Liquid Compositions

Unless otherwise specified, the viscosity is measured using an AR G2 rheometer (TA Instrument Ltd.), with a truncated cone spindle having an angle of 1°59'24" and a gap of 49 microns. The shear rate increases from 1 s⁻¹ to 500 s⁻¹, and the rheology is read when the measurement achieves <5% variation at each shear rate. All the measurements are done at 21°C.

Examples

The Examples herein are meant to exemplify the present invention but are not used to limit or otherwise define the scope of the present invention. Examples 1A – 1B are packaging assemblies according to the present invention, Examples 3A – 3D are liquid laundry detergent composition examples according to the present invention, and Examples 2A – 2B are comparative examples of certain packaging assemblies in the art. Fig. 7 illustrates the transition pieces of Comparative Examples 2A and 2B and Examples 1B and 1A in sequence (from left to right).

Examples 1A – 1B: Packaging assemblies of the present invention

Example 1A is the packaging assembly as shown in Fig. 6. Specifically, the container of Example 1A has an internal volume of 2000mL, and the cap of Example 1A has an internal volume of 80 mL. The transition piece as used in Example 1A is exactly the same as the one shown in Figs. 2A, 2B, and 2C. The spout opening of the transition piece has a cross-sectional area of about 177mm², and the vent has a cross-sectional area of about 30 mm². The spout has a length of about 55 mm measured from its base end to the spout opening along the longitudinal axis.

The packaging assembly of Example 1B comprises the same container and cap as Example 1A, but has a slightly different transition piece. The 3rd transition piece (from left) as illustrated in Fig. 7 is the one used for Example 1B. This transition piece has a circumferentially integral spout opening and 5 tiny vents arranged side-by-side. The spout opening therein has a cross-sectional area of about 154mm², and the 5 vents have a total cross-sectional area of about 12 mm². The spout has a length of about 45 mm measured from its base end to the spout opening along the longitudinal axis.

In Example 1, the container is made by EBM, the transition pieces are made by IM, and the cap is made by ISBM.

Comparative Examples 2A – 2B: Packaging assemblies in the art

The packaging assemblies of Comparative Examples 2A – 2B comprise the same container and cap as Example 1, but have different transition pieces, as shown in Fig. 7. Specifically, the transition piece of Example 2A has a relatively large spout opening (having a cross-sectional area of about 320 mm²), and the opening spout therein has a longitudinal slot along the entire length of the spout, i.e., the spout per se is not circumferentially integral. Similar to Example 2A, the transition piece of Example 2B has a longitudinal slot along the entire length of its spout albeit having a relatively small spout opening (having a cross-sectional area of about 110 mm²). Each of the transition pieces of Examples 2A and 2B has a vent abutting the slot of the spout therein, as shown in Fig. 7, in contrast to a vent separated from a spout as in Examples 1A and 1B. The lengths of the spouts of the transition pieces of Examples 2A – 2B measured from their base end to the spout opening along the longitudinal axis are about 45 mm and 50 mm, respectively. Both the transition pieces of Examples 2A – 2B are made by IM.

Example 3: Formulations of liquid laundry detergent compositions

The following liquid laundry detergent compositions shown in Table 1 are made comprising the listed ingredients in the listed proportions (weight %).

Table 1

	3A	3B	3C	3D
C ₁₂₋₁₄ AE ₁₋₃ S	13	8.3	10	6
C ₁₁₋₁₃ LAS	3	5.5	6.5	6
Neodol®25-7 <i>a</i>	1.4	1.2	1.4	4.2
C ₆ -C ₁₅ dimethyl amine oxide	0	0	0	0.5
Citric acid	0	2	1.7	1.2
Boric acid	0	2	1.9	1.9
C ₁₂ -C ₁₈ fatty acid	1.5	1.2	1.3	1
Na-DTPA <i>b</i>	0.06	0.2	0.4	0.2
1, 2 propanediol	0	1.2	2.5	2
Calcium chloride	0	0	0.06	0.03
Sodium cumene sulphonate	0	0	0	0.2
Silicone emulsion	0	0.0025	0.0025	0.0025
Monoethanolamine	0.07	0	0	0.096

Sodium polyacrylate	1.4	0	0	0
NaOH	Up to pH 8	Up to pH 8	Up to pH 8	Up to pH 8
Brightener	0	0.06	0.06	0.06
Protease	0	0	0.45	0
Amylase	0	0	0.08	0
Dye	0	0.002	0.002	0.002
Perfume oil	0	0.6	0.6	0.6
Hydrogenated castor oil	0	0	0	0.12
Water	Add to 100	Add to 100	Add to 100	Add to 100

*a*Neodol®25-7 is C₁₂-C₁₅ alcohol ethoxylated with an average of 7 moles of ethylene oxide as a nonionic surfactant, available from Shell

*b*penta sodium salt diethylene triamine pentaacetic acid as a chelant

5 Preparation of the liquid laundry detergent compositions of Examples 3A – 3D

The liquid detergent compositions of Examples 3A – 3D are prepared by the following steps:

- a) mixing a combination of NaOH and water in a batch container by applying a shear of 200 rpm;
- 10 b) adding citric acid (if any), boric acid (if any), C₁₁-C₁₃ LAS, and NaOH into the batch container, keeping on mixing by applying a shear of 200 rpm;
- c) cooling down the temperature of the combination obtained in step b) to 25°C;
- d) adding C₁₂₋₁₄AE₁₋₃S, Na-DTPA, Neodol®25-7, C₁₂-C₁₈ fatty acid, 1,2 propanediol (if any), monoethanolamine, C₆-C₁₅ dimethyl amine oxide (if any), and calcium chloride (if any),
- 15 sodium cumene sulphonate (if any), silicone emulsion (if any), sodium polyacrylate (if any) into the batch container, mixing by applying a shear of 250 rpm until the combination is homogeneously mixed, and adjusting pH to 8;
- e) adding brightener (if any), protease (if any), amylase (if any), dye (if any), and perfume oil (if any) into the batch container, mixing by applying a shear of 250 rpm; and
- 20 f) adding hydrogenated castor oil (if any) into the batch container, thus forming a liquid laundry detergent composition,

wherein each ingredient in the composition is present in the level as specified for Examples 3A – 3C in Table 1.

Comparative data of Examples 1 – 2 on flow rate of dispensing

Comparative experiments of assessing the flow rates of the liquid laundry detergent compositions of Examples 3A – 3C by dispensing them from the packaging assemblies of Examples 1A – 1B and Examples 2A – 2B, respectively, are conducted. Specifically, the containers are full of a liquid laundry detergent composition. The liquid laundry detergent composition is dispensed from the container (particularly from each transition piece) to the cap. During dispensing the container is tilted at an angle of about 30° relative to the longitudinal axis.

The flow rates of the dispensing, as well as the viscosity of the compositions, are shown in Table 2. The viscosity is measured at a shear rate of 20/sec and a temperature of 21°C, according to the method for determining of viscosity for liquid compositions as described hereinabove.

Table 2

		3A	3B	3C
	Viscosity/cps	450	570	1200
Example 1A	Flow rate/mL/s	36.1	32.5	16.3
Example 1B		24.1	21.7	13.3
Comparative Example 2A		46.4	40.6	32.5
Comparative Example 2B		14.1	12.0	5.4

As shown in Table 2, the packaging assemblies according to the present invention (Examples 1A and 1B) demonstrate desired flow rates (e.g., a flow rate of 10 mL/s to 40 mL/s) across all tested liquid laundry detergent compositions. By contrast, the packaging assembly of Comparative Example 2A provides a dispensing flow rate that is too fast, thereby causing undesired turbulence during the dispensing. And the packaging assembly of Comparative Example 2B shows an unacceptable slow flow rate.

Unless otherwise indicated, all percentages, ratios, and proportions are calculated based on weight of the total composition. All temperatures are in degrees Celsius (°C) unless otherwise indicated. All component or composition levels are in reference to the active level of that component or composition, and are exclusive of impurities, for example, residual solvents or by-products, which may be present in commercially available sources.

It should be understood that every maximum numerical limitation given throughout this specification includes every lower numerical limitation, as if such lower numerical limitations were expressly written herein. Every minimum numerical limitation given throughout this specification will include every higher numerical limitation, as if such higher numerical limitations were expressly written herein. Every numerical range given throughout this specification will include every narrower numerical range that falls within such broader numerical range, as if such narrower numerical ranges were all expressly written herein.

The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm.”

Every document cited herein, including any cross referenced or related patent or application is hereby incorporated herein by reference in its entirety unless expressly excluded or otherwise limited. The citation of any document is not an admission that it is prior art with respect to any invention disclosed or claimed herein or that it alone, or in any combination with any other reference or references, teaches, suggests or discloses any such invention. Further, to the extent that any meaning or definition of a term in this document conflicts with any meaning or definition of the same term in a document incorporated by reference, the meaning or definition assigned to that term in this document shall govern.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

CLAIMS

What is claimed is:

1. A packaging assembly (10), comprising:
 - a) a container (100) comprising an orifice (101) and an opposing bottom surface (102), said bottom surface (102) defining a longitudinal axis perpendicular thereto, wherein said longitudinal axis passes through said orifice (101); and
 - b) a transition piece (200) engaged to said orifice (101), comprising:
 - i) a spout (201) having a base end (202) proximate to said orifice (101) and an opposing pouring end (203) having a circumferentially integral opening (204); and
 - ii) a vent (209) located adjacent to said base end (202),wherein said spout (201) and said vent (209) are in fluid communication with said orifice (101), and said vent (209) has a cross-sectional area that is 1/20 to 1/3 of the cross-sectional area of said spout opening (204).
2. The packaging assembly according to Claim 1, wherein said spout opening (204) has a cross-sectional area of 20 mm² to 400 mm².
3. The packaging assembly according to any one of the preceding claims, wherein said transition piece (200) further comprises an annular channel (210) surrounding said base end (202) and a radially protruding shroud (213) surrounding said channel (210), wherein said vent (209) is located in said channel (210).
4. The packaging assembly according to any one of the preceding claims, wherein said channel (210) is slanted, comprising a second apex (211) and a second nadir (212) circumferentially opposing along said channel (210), wherein said vent (209) is located at said second nadir (212), wherein said channel (210) is of an angle from 5° to 85° relative to the longitudinal axis.
5. The packaging assembly according to any one of the preceding claims, wherein said shroud (213) comprises an exterior surface (215), an interior surface (214) opposing to said exterior surface (215), a shoulder (217) therebetween, and a fastener surface (218) on the underside of said exterior surface (215), wherein said shroud exterior surface (215) has a set of linear indentations (216), said shroud fastener surface (218) has a first sealing means (220) configured to seal said transition piece (200) with said container (100), and said shroud

interior surface (214) has a second sealing means (221) configured to seal said transition piece (200) with a cap.

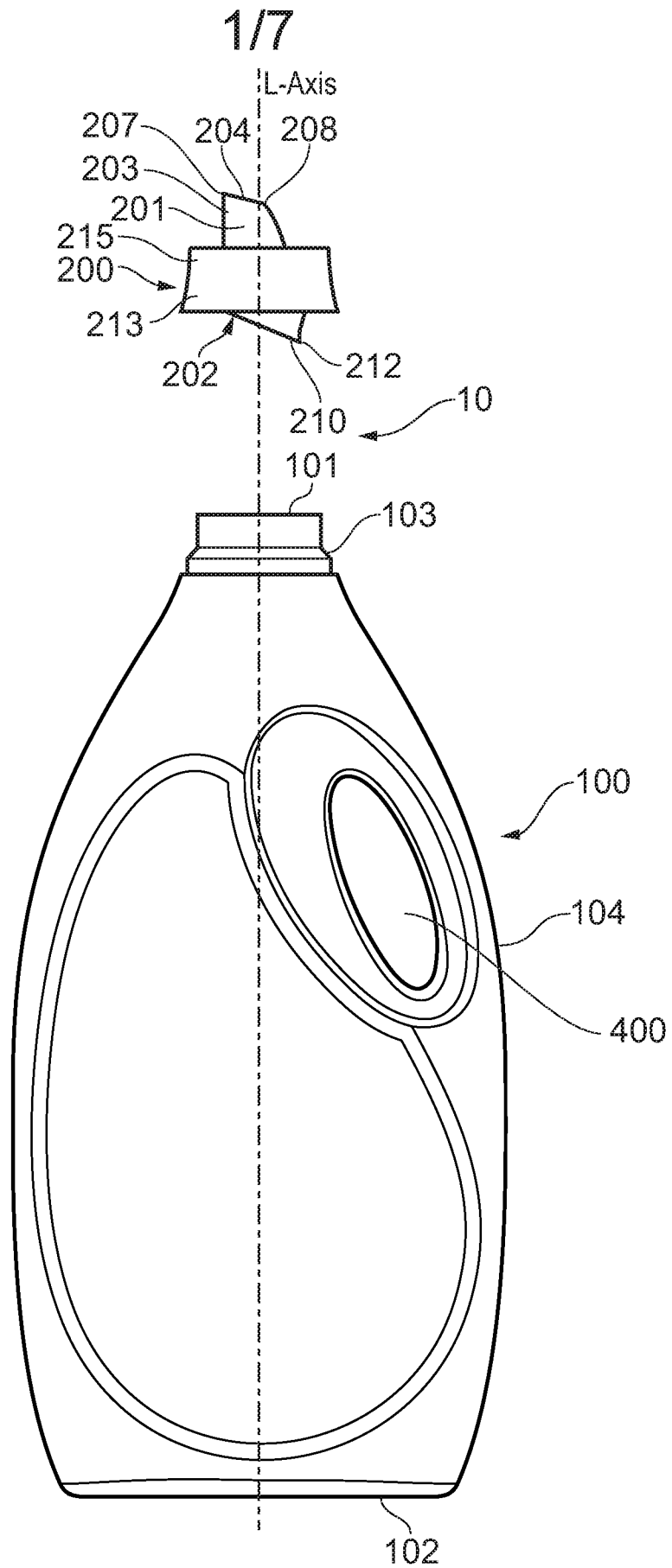
6. The packaging assembly according to any one of the preceding claims, wherein said shroud (213) further comprises a plug seal (222) disposed on the underside of said shroud shoulder (217).
7. The packaging assembly according to any one of the preceding claims, wherein said container (100) is bilaterally symmetrical along a longitudinal section comprising the longitudinal axis, wherein both said spout (201) and said vent (209) are bilaterally symmetrical along the longitudinal section and oppositely offset from the longitudinal axis within the longitudinal section.
8. The packaging assembly according to any one of the preceding claims, wherein said spout opening (204) has a shape selected from elliptical, round, semi-circled, triangular, rectangular, trapezoidal, pentagonal, or hexagonal.
9. The packaging assembly according to any one of the preceding claims, said spout opening (204) is slanted, comprising a first apex (207) and a first nadir (208) circumferentially opposing along said spout opening (204), wherein said spout opening (204) is of an angle from 15° to 85° relative to the longitudinal axis, and said spout (201) is tapered towards said spout opening (204) and tilted towards said first apex (207).
10. The packaging assembly according to any one of the preceding claims, wherein said vent (209) and said spout opening (204) are aligned such that: said vent (209) and said first nadir (208) are within an angle of about 0.25π radians of each other around the longitudinal axis, and said vent (209) and said first apex (208) are of an angle from 0.75π to 1π radians of each other around the longitudinal axis.
11. The packaging assembly according to any one of the preceding claims, further comprising: c) a cap (300) removably sealingly engaged to said transition piece (200), configured to enclose said spout (201), wherein said cap (300) is in fluid communication with said spout (201) when sealingly engaged to said transition piece (200);

preferably wherein said cap (300) is characterized by one or more of the following, more preferably wherein said cap (300) is characterized by two or more of the following, yet more preferably wherein said cap (300) is characterized by three or more of the following, yet still even more preferably wherein said (cap) is characterized by all four of the following:

- a) wherein said cap (300) is a dispensing cap and has an interval volume of 10 mL to 250 mL, and said cap (300) is at least partially transparent and marked with one or more volumetric indicia;
 - b) wherein said cap (300) has a height of 20 mm to 100 mm measured along the longitudinal axis when free standing, said spout (201) has a length of 20 mm to 80 mm measured from said base end (202) to said spout opening (204) along the longitudinal axis, and the height of said cap (300) is longer than the length of said spout (201);
 - c) wherein said cap (300) comprises a cap opening (301), wherein said spout opening (204) has a cross-sectional area that is less than 50% of the cross-sectional area of said cap opening (301); and
 - d) wherein said cap (300) has an obconic shape when sealingly engaged to said transition piece (200).
12. The packaging assembly according to any one of the preceding claims, further comprising a handle (400), wherein said handle (400) is aligned with said vent (209) such that said handle (400) and said vent (209) are within an angle of about 0.25π radians of each other around the longitudinal axis.
13. The packaging assembly according to any one of the preceding claims, wherein the packaging assembly (10) comprises multiple vents (209) located side-by-side adjacent to said base end (202), and said multiple vents (209) have a total cross-sectional area that is 1/20 to 1/3 of the cross-sectional area of said spout opening (204).
14. A liquid detergent product comprising the packaging assembly according to any one of the preceding claims and a liquid detergent composition contained within the packaging assembly, wherein the liquid detergent composition has a viscosity value of 200 to 3,000 centipoise ("cps") at a shear rate of 20/sec and a temperature of 21°C, and the liquid detergent composition is able to be flowed out of the packaging assembly at a flow rate of 10 mL/s to 40 mL/s;

preferably wherein the liquid detergent composition comprises a rheology modifier selected from the group consisting of hydroxy-containing crystalline material, polyacrylate, polysaccharide, polycarboxylate, amine oxide, alkali metal salt, alkaline earth metal salt, ammonium salt, alkanolammonium salt, C₁₂-C₂₀ fatty alcohol, di-benzylidene polyol acetal derivative, di-amido gallant, a cationic polymer comprising a first structural unit derived from methacrylamide and a second structural unit derived from diallyl dimethyl ammonium chloride, and a combination thereof.

15. Use of either the packing assembly of any one of claims 1-12 or the liquid detergent product of claim 13 or 14, in cleaning fabric.



2/7

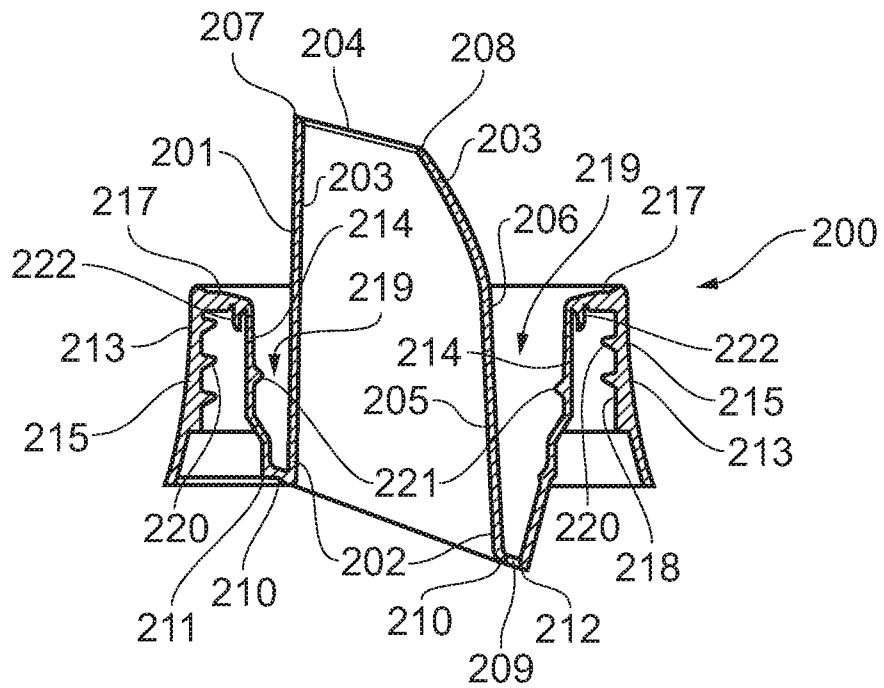


FIG. 2A

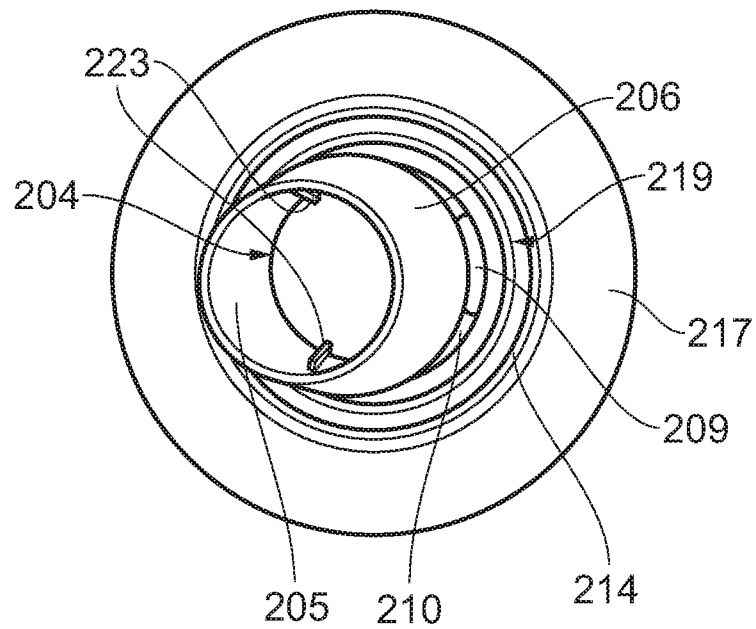


FIG. 2B

3/7

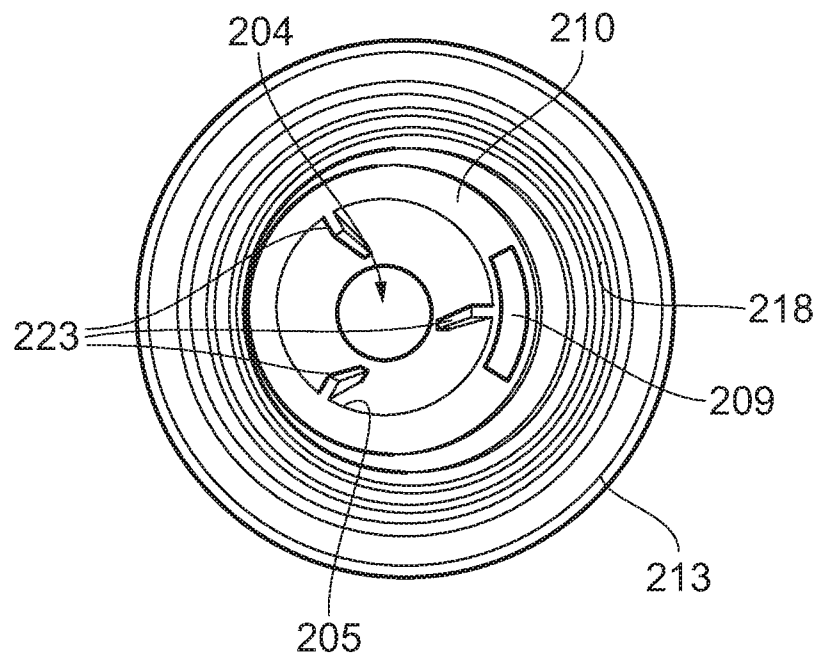


FIG. 2C

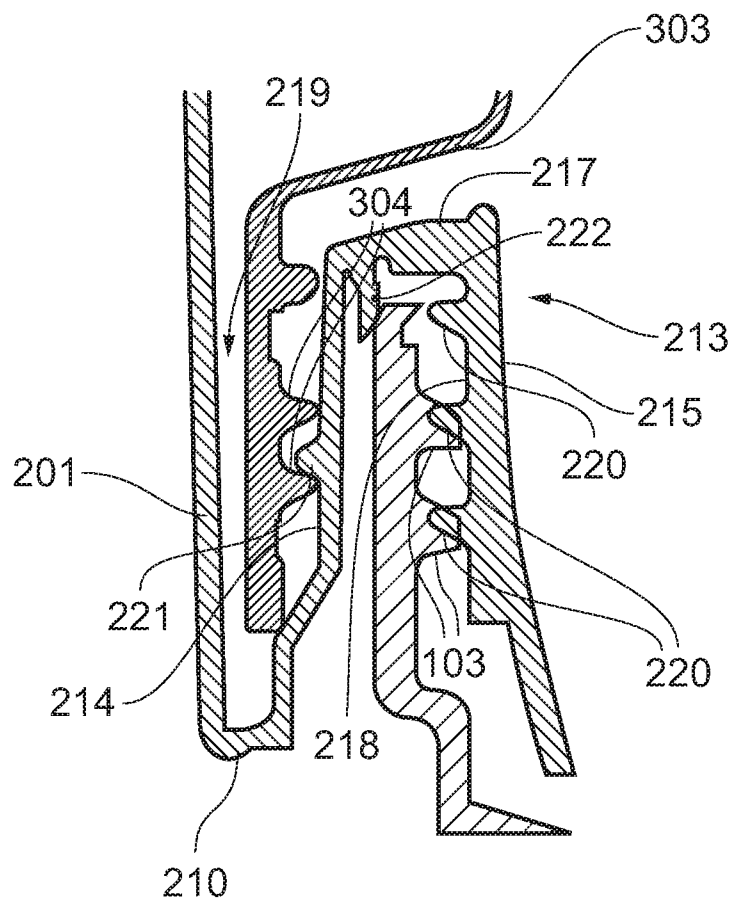


FIG. 3

4/7

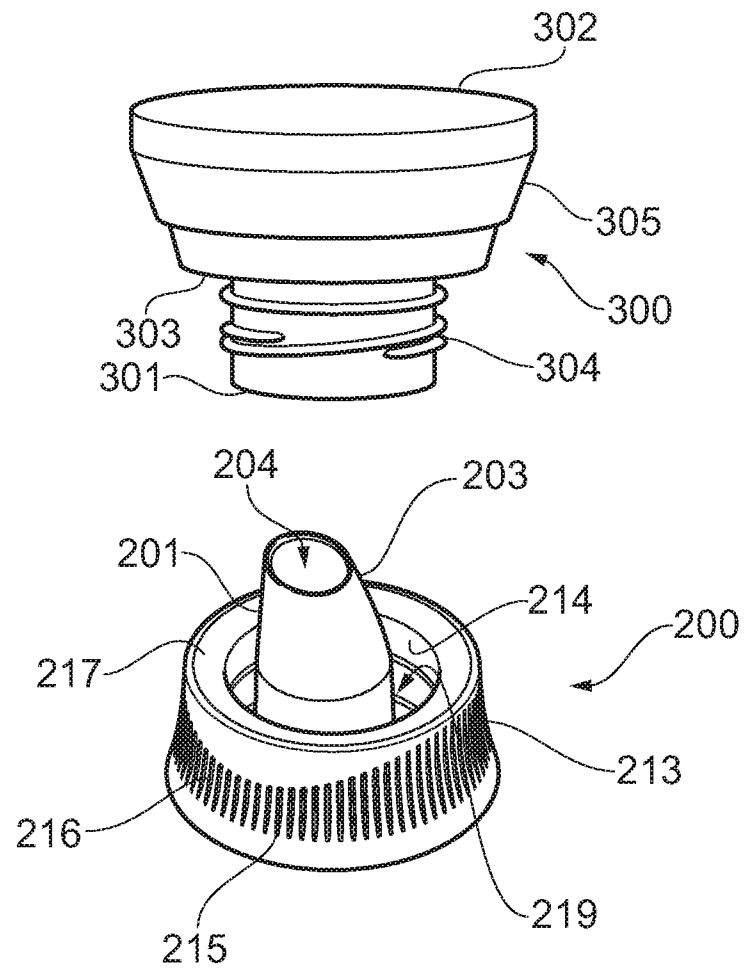


FIG. 4

6/7

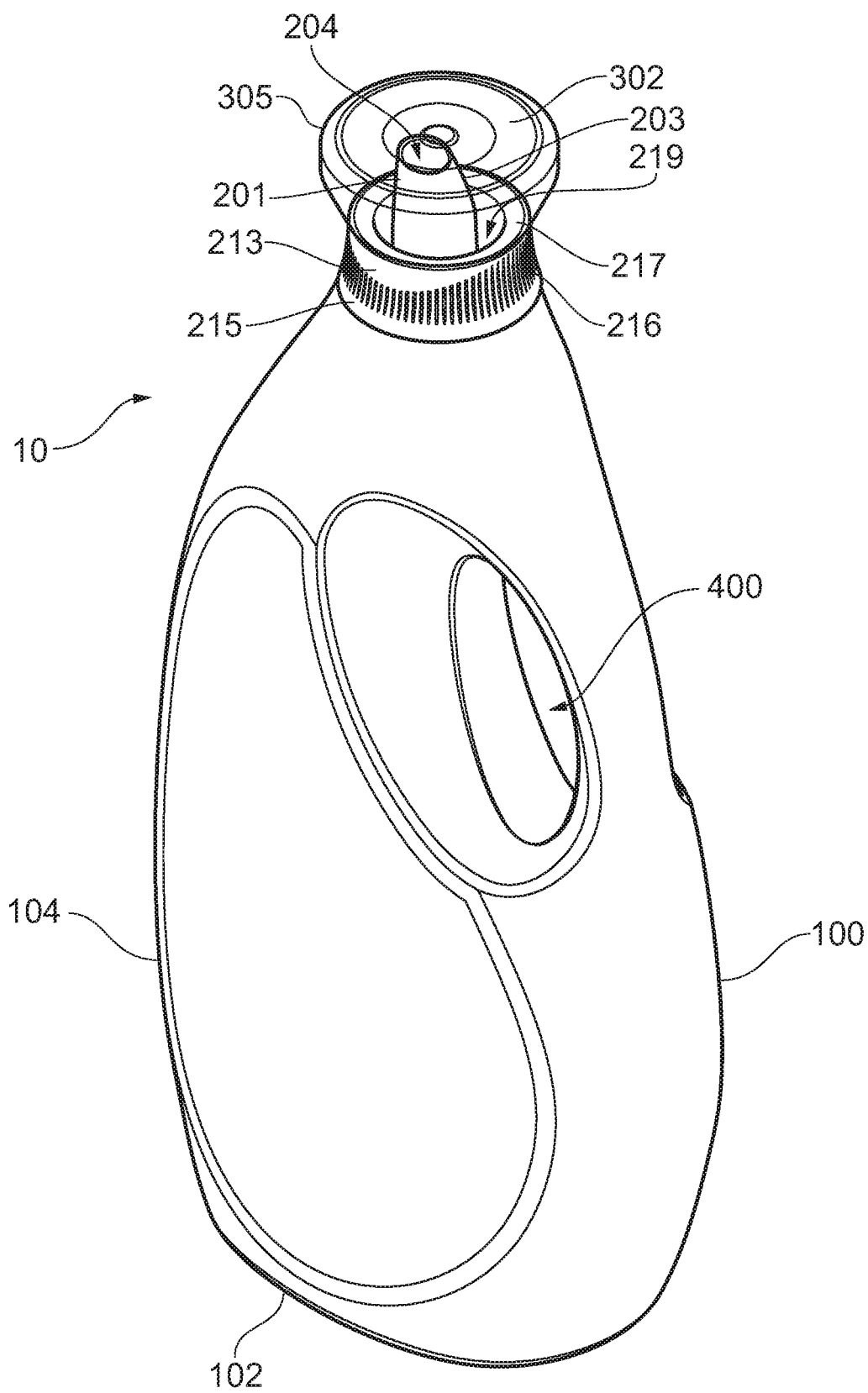


FIG. 6

7/7

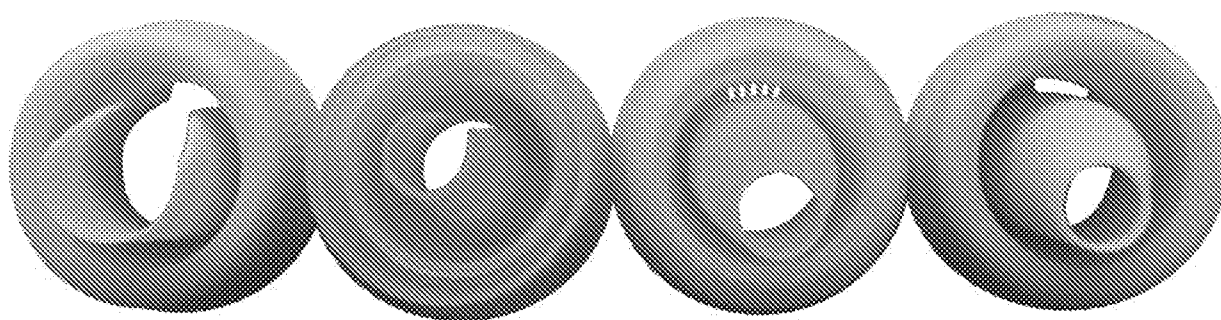


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2015/073262

A. CLASSIFICATION OF SUBJECT MATTER

B65D 47/06(2006.01)i; A47K 5/12(2006.01)i

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)

B65D,; 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)

CNKI,CNPAT,EPODOC,WPI,packaging,spout,vent,hole,opening

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5431306 A (INNOVATIVE MOLDING INC) 11 July 1995 (1995-07-11) embodiments	1-15
A	CN 101258233 A (PROCTER & GAMBLE CO) 03 September 2008 (2008-09-03) the whole document	1-15
A	EP 0417954 A1 (GRAHAM ENG CORP) 20 March 1991 (1991-03-20) the whole document	1-15
A	EP 1120354 A1 (PROCTER & GAMBLE) 01 August 2001 (2001-08-01) the whole document	1-15
A	US 5251788 A (PHOENIX CLOSURES INC) 12 October 1993 (1993-10-12) the whole document	1-15



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

13 May 2015

Date of mailing of the international search report

20 May 2015

Name and mailing address of the ISA/CN

STATE INTELLECTUAL PROPERTY OFFICE OF THE
P.R.CHINA
6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing
100088, China

Facsimile No. (86-10)62019451

Authorized officer

GUO,Huiyong

Telephone No. (86-10)62085490

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2015/073262

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
US	5431306	A	11 July 1995	US	5603787	A	18 February 1997
CN	101258233	A	03 September 2008	ES	2345456	T3	23 September 2010
				RU	2008107402	A	20 November 2009
				AU	2006287554	A1	15 March 2007
				NO	20081630	A	06 June 2008
				US	2007072785	A1	29 March 2007
				AR	055153	A1	08 August 2007
				JP	2009507129	A	19 February 2009
				NO	20081630	B	06 June 2008
				CA	2619388	A1	15 March 2007
				ZA	200801512	A	26 November 2008
				EP	1922402	A1	21 May 2008
				MX	2008003183	A	18 March 2008
				AT	466925	T	15 May 2010
				WO	2007030511	A1	15 March 2007
				EP	1922402	B1	05 May 2010
				RU	2392301	C2	20 June 2010
				DE	602006014169	D1	17 June 2010
				US	7790662	B2	07 September 2010
				BR	PI0615698	A2	24 May 2011
EP	0417954	A1	20 March 1991	US	5071037	A	10 December 1991
				AU	6243890	A	21 March 1991
EP	1120354	A1	01 August 2001	AT	263076	T	15 April 2004
				DE	60009438	T2	03 March 2005
				ES	2214990	T3	01 October 2004
				EP	1120354	B1	31 March 2004
				DE	60009438	D1	06 May 2004
				JP	2003520742	A	08 July 2003
				AU	3309601	A	07 August 2001
				EP	1120354	A9	14 November 2001
				WO	0155002	A1	02 August 2001
US	5251788	A	12 October 1993	None			