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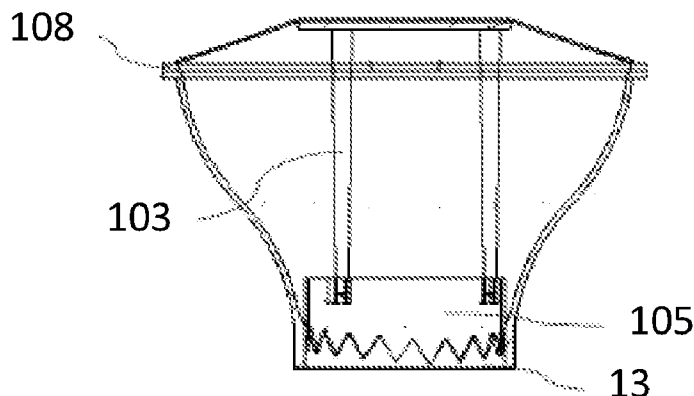


Figure 1C

(57) Abstract: The present invention is related to the field of capsule packaging with an integral opening mechanism containing a powdered or liquid formula, such as baby food formula. The present invention provides a self-opening capsule comprising: (a) an external body; (b) a top cover/lid/cap; (c) a bottom closure; and (d) an integral opening mechanism located within said external body or externally thereto. Liquid is not added to the contents of the capsule but rather directly to a container.

## **BABY FORMULA STERILE CAPSULES WITH AN INTEGRAL OPENING MECHANISM AND METHODS OF USE**

### **FIELD OF THE INVENTION**

**[0001]** The present invention is related to the field of capsule packaging; more specifically, to disposable sterile capsules containing a powdered baby formula; and more particularly to disposable sterile capsules with an integral opening mechanism.

### **BACKGROUND OF THE INVENTION**

**[0002]** In infant feeding, mother's milk is usually recommended. However, in some cases breast feeding is unsuccessful or inadvisable for medical reasons (either the baby's or the mother's), or the mother consciously chooses not to breast feed. For these and other situations, different infant formulae have been developed.

**[0003]** Generally, infant formulas are available in powder form, concentrated liquid form, or ready to feed liquid form. Powdered infant formulas are the most popular form, primarily due to their cost and nutritional quality. One of the disadvantages associated with powdered infant formulae is the inconvenience of preparation: The powdered formula must be carefully measured into a sterilized drinking vessel containing defined amount of water which were pre-boiled and cooled, to reconstitute the formula; the drinking vessel is then sealed and shaken to ensure the powder has been dissolved. To avoid any bacterial growth, the formula should be consumed immediately after reconstitution. After the first use, the remaining, unused powdered formula has a very short shelf life- usually of about a month, and must be discarded if not used.

**[0004]** If prepared and consumed in this manner, powdered infant formulae is considered a safe and nutritionally eligible substitute for mother's milk in the situations described above. However, primarily due to the inconvenient preparation, many parents sometimes inadvertently fail to prepare the formula properly and hence expose the infant to risks of infection or other risks. For example, the water may not be boiled prior to use in which case, any pathogens in the water are fed to the infant. Alternatively, batches of the infant formula may be prepared and then stored until needed. Unfortunately, if any pathogen has contaminated the formula, it then has time to replicate. In addition, open powdered formula container might be used after the

recommended period, which again raises the risk of pathogen growth within the container of said powdered formula.

[0005] In hospitals and other care facilities where infants cannot receive one-to-one attention, the practicalities associated with preparing infant formula for large numbers of infants coupled with concerns about the risk of growth of pathogens in reconstituted formula that is not consumed for several hours have led to drastic measures. For example, some hospitals will not use any powdered products insisting on the use of individual bottles of sterilized ready-to-drink formula. This and other measures are obviously costly.

[0006] US 8,460,732 provides a convenient method and system of preparing a single serving of nutritional composition comprising introducing water into a sealed disposable capsule containing a unit dose of the composition and an operative opening contained within the capsule to permit draining of the resulting liquid directly from the capsule into a receiving vessel. However, mixing an infant powder formula with water in a capsule has several drawbacks, such as lump formation, possible bacteria growth and others.

[0007] On the other hand, as noted above, mixing an infant powder formula with water outside a capsule, i.e. in a bottle, has its own drawbacks, e.g., it requires using a precise amount of water at the right temperature.

[0008] Therefore, there is a need for a sterile and disposable capsule that delivers the correct portion of powdered infant formula into, e.g., a baby feeding bottle, without mixing it first with water and without the need to open a large baby-food container. The present invention provides this and more.

## **SUMMARY OF THE INVENTION**

[0009] The present invention provides a self-opening capsule **100** comprising: (a) an external body **102**; (b) a top cover/lid/cap **101**; (c) a bottom closure **13**; and (d) an integral opening mechanism **110** located within said external body **102** or externally thereto, comprising: (i) a closure opener **105**; and (ii) connecting means **103** connecting said top cover/lid/cap **101** with said closure opener **105**.

[0010] The present invention further provides a method for preparing a baby food formulation using the self-opening capsules of the invention, said method comprising the steps

of: (a) providing a self-opening capsule according to the invention comprising (baby-)food powder/liquid; (b) placing said capsule over a container and manually pressing the top cover thereof to release its content into said container; or placing said capsule inside a designated device designed to hold said capsule and pressing the top cover thereof to release its content into a container; (c) adding water to said container, optionally before step (b); and (d) mixing the baby-food powder and water to prepare said baby food formulation.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0011] **Figs. 1A-1D** schematically show one possible configuration of a capsule having an integral opening mechanism according to the invention.

[0012] **Figs. 2A-2E** schematically show another possible configuration of a capsule having an integral opening mechanism. **Fig. 2A** is a front view; **Fig. 2B** is a perspective view; **Fig. 2C** is a top view; and **Figs. 2D** and **2E** are perspective views including the internal opening mechanism in a closed and open position, respectively.

[0013] **Fig. 3** schematically shows an exploded view of a disposable sterile capsule according to one embodiment of the invention.

[0014] **Figs. 4A-4C** schematically show another possible configuration of a capsule having an integral opening mechanism.

[0015] **Figs. 5A-5C** schematically show another possible configuration of a disposable sterile capsule having a concentric water conduit. **Fig. 5B** is a cut-off view; and **Fig. 5C** is a cut-off view when the capsule's cap is pushed in.

[0016] **Figs. 6A-6C** schematically show one possible configuration of a reusable capsule. **Fig. 6A** is an exploded view; **Fig. 6B** is a cut-off view of a closed capsule; and **Fig. 6C** is a cut-off view when the capsule's cap is pushed in.

[0017] **Figs. 7A-7C** schematically show a disposable sterile baby food capsule which can be filled by the user prior to use. **Fig. 7A** is a side view; **Fig. 7B** is a front view; and **Fig. 7C** is a cutoff view showing the internal opening mechanism.

[0018] **Figs. 8A-8B** schematically show a sterile baby food capsule with a side groove (**8A**) according to one embodiment of the invention, and illustrate placing the same onto a bottle (**8B**) with an external water conduit.

[0019] **Fig. 9** schematically shows the main components of a disposable sterile double-walled capsule according to another embodiment of the invention.

[0020] **Fig. 10** schematically shows a disposable sterile capsule with encoded information on a protruding edge section.

[0021] **Fig. 11** schematically shows a portable dispenser containing a sealed capsule.

[0022] **Fig. 12** schematically depicts a method for opening a capsule having an integral opening mechanism manually.

### **DETAILED DESCRIPTION OF THE INVENTION**

[0023] The present invention provides capsules, both disposable and reusable, and methods of using same for preparing a single serving of a nutritional composition, such as a baby food formulation. The capsules of the invention are constructed as sealed capsules containing a unit dose of the (baby) food composition, optionally in concentrated form, to which pre-boiled water at a desired temperature are added in order to prepare the final food formulation.

[0024] Accordingly, the present invention provides a self-opening capsule **100** comprising: (a) an external body **102**; (b) a top cover/lid/cap **101**; (c) a bottom closure **13**; and (d) an integral opening mechanism **110** located either within said external body **102** or externally thereto, said integral opening mechanism **110** comprises: (i) a closure opener **105** for opening/cutting/breaking/penetrating said bottom closure **13** to thereby allow the content of the capsule to pour out; and (ii) connecting means **103** connecting said top cover/lid/cap **101** with said closure opener **105**, such that when said cover **101** is pushed in, either manually or mechanically by the aid of a dedicated device, said opener **105** is pushed against said bottom closure **13** and opens it.

[0025] In a specific embodiment, said self-opening capsule **100** of the invention is disposable. Accordingly, said capsule **100** may arrive filled and sealed from the manufacturer (see e.g. Figs. 1-4), or may arrive empty for filling by the end user according to user's desire and need (see e.g. Fig. 7).

[0026] In such a configuration, i.e. when said self-opening capsule **100** is disposable, the opening of said bottom closure **13** by said closure opener **105** can be carried out by any suitable way and according to the material said bottom closure **13** is made of. For instance, the closure opener **105** may be a knife or blade (Figs. 1, 2 and 5) which cuts through said bottom closure **13**,

which is optionally made of aluminum foil, plastic or parchment paper, etc. Alternatively, the closure opener **105** may be blunt and simply push said bottom closure **13** until it ruptures or pushed to an open position (Fig. 4). In a specific embodiment, said integral opening mechanism **110** is designed such that the bottom closure **13** is not completely released from the capsule / external body **102**, but rather remains attached thereto such that it does not fall into the container in which the food formulation is being prepared (see e.g. Fig. 1D).

[0027] In another embodiment, said self-opening capsule **100** of the invention is reusable (see e.g. Fig. 6). Accordingly, said capsule **100** may arrive empty for filling by the end user according to desire and need. In such a configuration, said bottom closure **13** is either connected to or is an integral part of said external body **102**, and is designed such that after being opened for use (i.e. to release the capsule's content), it can be re-closed (preferably after sterilization) as a preparation for the next refill. Alternatively, said bottom closure **13** is part of said integral opening mechanism **110** and replaces said closure opener **105** (see Fig. 6), such that when said connecting means **103** is pushed in, its lower section, which serves as the bottom closure **13** is pushed out thereby allowing the content of the capsule to exit (Fig. 6C).

[0028] In certain embodiments, said external body **102** of the capsule **100** of the invention has a bottom/lower section which is narrower than its upper section. For example, the capsule **100** may have a conic shape. In another example, the capsule **100** comprises a lower part having a substantially concave shape and an upper part having a substantially convex shape.

[0029] In certain embodiments, said top cover/lid/cap **101** constitutes an integral part of said external body **102**. Alternatively, said top cover/lid/cap **101** is an "add-on" that is attached to the external body **102** before or after the capsule has been filled, thereby hermetically sealing the capsule **100**.

[0030] In other embodiments, said bottom closure **13** constitutes an integral part of said external body **102**. Alternatively, said bottom closure **13** is an "add-on" that is attached to the external body **102** before or after the capsule has been filled, thereby hermetically sealing the capsule **100**.

[0031] In a specific embodiment, the self-opening capsule **100** of the invention is designed to enable the passage of an external water conduit **12** for the addition of water into the container in

which the food formulation is made, while the capsule **100** is placed/positioned on said container's opening (see e.g. Fig. 8A).

[0032] Alternatively, in another specific embodiment, the self-opening capsule **100** of the invention further comprises an integral water conduit **12** enabling the addition of water into the container in which the food formulation is made, while the capsule **100** is placed/positioned on said container's opening. For instance, said water conduit **12** may be a part of said external body **102**, e.g. a space between two layers of the external body (see e.g. Fig. 9). Alternatively, said water conduit **12** is located within said integral opening mechanism **110**, e.g. as a passage within said connecting means **103** extending from the lid **101** to the closure opener **105** (see e.g. Fig. 5B).

[0033] The present invention further provides a method for preparing a baby food formulation using the self-opening capsules **100** of the invention, said method comprising the steps of: (a) providing a self-opening capsule according to the invention comprising (baby) food powder; (b) placing said capsule over a container, such as a baby bottle, and manually pressing the top cover thereof to release its content into said container; or placing said capsule inside a designated device designed to hold said capsule **100** and press its top cover to release its content into a container; (c) adding water to said container, optionally before step (b); and (d) mixing the (baby-)food powder and water to prepare said (baby) food formulation.

[0034] In a specific embodiment, when the capsule **100** is constructed as depicted in Figs. 2D-2E, step (b) of the method according to the invention comprises pressing onto the upper part of the capsule **100** such that the entire body of the capsule collapses/squeezed to thereby push said integral opening mechanism against **110** said bottom closure **13**.

[0035] In certain embodiments, the addition of water into said container is carried out via a dedicated water conduit **12**, which is either a part of said capsule **100** or an integral part of said designated device holding said capsule.

[0036] In yet other embodiments, the step of water addition into said container is carried out before the addition of the content of said capsule **100** (i.e. before step (b)). Alternatively, the water is added simultaneously with the pouring of the capsule content into said container.

[0037] In certain embodiments, the capsule **100** of the invention may be configured to suit a chosen capsule dispenser such as to enable opening of the capsule **100** in such a way as to allow

pouring the capsule's content from the capsule **100** into the receiving vessel/container, by activating the integral opening mechanism **110** within said capsule **100**.

[0038] In certain embodiments, the capsule **100** of the invention is made in any manner and using any materials suitable to produce the desired configuration and properties. For example, the capsule **100** may be made of aluminum or other plastic material and thermoformed or injection molded. It may have a single or multi-layer construction. The material of the capsule may be made of an air tight material. If not, in order to protect the contents of the capsule from the environment, other precautions may be made, e.g. by provision of an external seal or by packing under vacuum or in an inert atmosphere in a can or an aluminum pouch or bag.

[0039] If a capsule dispenser is to be used, the external size and configuration of the capsule **100** will be selected with reference to the configuration of such a dispenser. Within these constraints, the amount of space taken up in the capsule **100** by the concentrated composition will be governed by a balance between environmental and economic considerations (capsule should not be too large having regard to the volume occupied by its contents) and safety considerations (possibility of contamination of means for introduction of water by contents of capsule if capsule is completely filled). In any event, a range of capsules may be provided containing different quantities of composition, for example to suit the requirements of different age groups in the case of infant formula.

[0040] A ready to drink nutritional composition may also be prepared according to the method of the present invention using more than one capsule **100** to prepare a single serving. This permits the introduction of a degree of flexibility in the compositions that may be prepared. For example, a range of capsules containing different supplements may be manufactured and consumers may be provided with instructions as to how to combine these to prepare a personalized composition suited to the particular needs of the recipient. Alternatively, the capsule **100** may be a reusable capsule enabling the user to refill each capsule according to one's need and desire.

[0041] For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, purely by way of example, to the accompanying drawings. With specific reference to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of preferred



embodiments of the present invention only, and are presented for the purpose of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the invention. In this regard, no attempt is made to show structural details of the invention in more detail than is necessary for a fundamental understanding of the invention. From the description taken together with the drawings it will be apparent to those skilled in the art how the several forms of the invention may be embodied in practice. Moreover, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting the scope of the invention hereof.

[0042] Figs. 1A-1D schematically show a first possible embodiment of a capsule **100** having a first possible embodiment of an integral opening mechanism **110**. The capsule **100** can be opened either manually by a user or by a machine or a bottle via the integral opening mechanism **110** as further depicted below. As illustrated in the figures, the capsule **100** has a concaved body shape designed to concentrate the extracted material from the capsule **100** into the receiving vessel (e.g. baby bottle) into which the material is extracted after the capsule **100** is opened. In addition, the concaved capsule shape is also useful to fit the capsule **100** into different sized apertures of bottles or machines when bottles or machines are used to extract the capsule's content. The capsule **100** of the invention is configured such that it fits vessels with different apertures.

[0043] In certain embodiments, the cap **101** may be welded onto the capsule's external body **102**. Alternatively, the cap **101** may be constructed to be click-fastened to the capsule's external body **102**, thereby enabling even the end user to fill the capsule as desired and then close it before use.

[0044] In certain embodiments, the integral opening mechanism **110** includes a cap **101** which is welded to the capsule body **102** by projection ring **108**. Accordingly, the capsule body **102** may include a corresponding projection ring, to allow the capsule **100** and the integral opening mechanism **110** to be manufactured by two separate molds which are later welded or attached to each other. Connecting means **103**, such as rods, are attached to a closure opener **105** (e.g. circular cutter as shown in Fig. 1), which cuts the bottom closure **13** at the bottom of the capsule **100**.

[0045] As seen in Fig. 1B, a protrusion **106** at the circular closure opener **105** ensures that the bottom closure **13** will remain hanging attached to said capsule **100** after it is opened by said integral opening mechanism **110** as depicted in Fig. 1D.

[0046] The integral opening mechanism **110** can be manually activated by applying pressure over said cap **101** by the user's hand. The user can apply pressure over said cap **101** by pressing it, e.g., with his fingers or with his palm. The pressure which is applied onto said cap **101** is transmitted to said closure opener **105** via connecting means **103**, such that the closure opener **105** presses against the bottom closure **13** thus cutting it open. After the bottom closure **13** is cut, the content of the capsule **100** falls through its bottom into the receiving vessel.

[0047] The pressure which is used to open the bottom closure **13** can be selectively designed by few factors, one of which is the materials and the thickness from which the bottom closure **13**, the closure opener **105** and the capsule cap/lid **101** are made of. For instance, the closure opener **105** can be made of plastic or from thinner sharper metal. The capsule **100** can be made of plastics having different elasticity. Another factor can be the shape of the closure opener **105** itself, for instance the opener **105** can have teeth at a nonlinear design **107** to pierce the bottom closure **13** gradually.

[0048] It should be noted that the design of the closure opener **105** is dependent on the bottom closure **13** being used, as well as the content of the capsule. For instance, when using aluminum foil for the bottom closure **13**, the closure opener **105** may be made in the form of blades (e.g. Fig. 2A) made of metal or sharp plastic; when the content of the capsule is a liquid, the closure opener **105** may be made in the form of a pointed blade (e.g. Figs. 2A) to break open the middle of said closure; when the content of the capsule is a powder, the closure opener **105** may be made in the form of a round blade (e.g. Figs. 1B and 3) to open the surroundings of said closure, optionally while keeping it attached to the capsule's external body at a specific point; when using a rigid plastic bottom closure **13**, the closure opener **105** may be made in the form of a rigid pushing unit that pushes said bottom closure **13** into an open position; etc.

[0049] In certain embodiments, a reinforcement ring is attached to the inner surface of the cap **101** to evenly transmit the pressure applied over the outer surface of the cap **101** through said connecting means **103** to the opener **105**. The circular opener **105** shown in Fig. 1 cuts the bottom closure **13** in a circle shape leaving an edge attached to the capsule's body (Fig. 1D). It

should be noted that a circular cut is useful especially when the material inside the capsule is of granular nature, since the relatively large cut allows the granular content of the capsule to fall through the opening provided by the cut while minimizing the amount of material remaining adhered to the inner walls of the capsule **100** or to the internal opening mechanism **110**. In addition, such a cut allows for effective extraction of the content inside the capsule by utilizing gravitational force eliminating the need to build pressure by external source as often used by machines building water pressure to extract contents from capsules, or air pressure. Due to the elasticity of capsules cap **101**, after the pressure over the cap **101** is stopped, the capsule's cap **101** may pop back into place, thereby slightly shaking the capsule **100** causing any remainings of the capsule content to be extracted from the capsule, as well as retrieving the opener **105** back into the capsules body, to avoid unnecessary exposure of the opener **105** to the user or to others.

[0050] Figs. 2A-2C schematically show a second integral opening mechanism **110** which includes a cap **101** that is welded to a capsule body by projection ring **108**. The integral opening mechanism **110** can be manufactured by a separate mold which is welded or attached to a capsule **100**. Alternatively, the integral opening mechanism **110** can be implemented in a capsule **100** mutatis mutandis to the implementation of integral opening mechanism **110** or to other capsules further depicted. As illustrated in this configuration, the closure opener **105** is constructed of trilateral blades which are attached directly to the capsule's cap **101** and thus constitute also the connecting means. The integral opening mechanism **110** can be manually activated by applying pressure over the cap **101** by the user's hand. The user can apply pressure over the cap **101** by pressing it with his fingers or with his palm or by using a designated machine. The pressure which is applied over the cap **101** presses the trilateral blades **103** against a foil as the bottom closure **13** thus piercing the foil. The content of the capsule **100** can then fall/poured or drop through the pierced foil. Said trilateral blades **105** coincide to a sharp tooth which gradually pierces the foil **13**, thereby allowing an easy piercing of the foil **13**. It should be noted that the integral opening mechanism **110** is especially useful for capsules containing liquid material. This is since the liquid material flows or drops through the pierced foil by gravitational force as the pierced foil remains hanging on the edges of the bottom of the capsule. Although reference is made to trilateral blades **105** which coincide to a tooth, other sharp designs of

various kinds of blades, teeth, other sharp shapes or any combinations thereof, can also be utilized to pierce the bottom closure **13**.

[0051] Fig. 2D and 2E schematically show another possible embodiment of a capsule **100** having a collapsible structure with an integral opening mechanism **110**. Fig. 2D shows a perspective view including the internal opening mechanism of capsule in a closed position: the capsule **100** has a collapsible external body **102**, where sufficient pressure applied on top of the capsule **100** will cause the capsule's body **102** to collapse as shown in Fig. 2E. As the capsule **100** collapses, the blades **105** press against a bottom closure foil **13** attached to the bottom of the capsule. The foil **13** is pierced by said blades **105** and the content of the capsule is extracted through the pierced foil **13**. Due to the elasticity of the capsule's external body **102**, after the pressure is removed from the capsule, the collapsed capsule pops back into place, thereby slightly shaking the capsule **100** and causing any remaining content to be released and extracted from the capsule **100**, while retrieving the blades **105** back into the capsules body **102** to avoid unnecessary exposure of the blades to the user or to others.

[0052] Fig. 3 schematically shows another configuration of a disposable sterile capsule according to yet another embodiment of the invention. In this configuration, the connecting means **103** is shaped similarly to the external body **102**, and the closure opener **105** is a round blade, which once pressure is applied onto the cap/lid **101**, designed to cut open the bottom closure **13** while leaving it attached to the external body **102**. After the pressure is removed from the cap **101**, the connecting means **103** slides back up into the external body **102**. As illustrated in Fig. 3, when pressure is applied onto the cap/lid **101**, a rigid disk **101'** attached to the upper section of said connecting means **103**, said cap/lid **101** along with said rigid disk **101'** are pressed/pushed in and thereby the bottom closure **13** is pushed down against the bottom closure **13** and opens it.

[0053] Figs. 4A-4C schematically show another possible embodiment of a capsule **100** having yet another possible integral opening mechanism **110**. Fig. 4A shows a front view of a capsule **100** with an integral opening mechanism that is external to the capsule **100**: as pressure is applied on top of the capsule **100** against the opening mechanism **110**, circular ring **303** of the capsule's body slides down with respect to peripheral ring **304** as cutter **301** cuts the bottom

closure foil **13** and enters corresponding cutters groove **306**. The bottom closure foil **13** remains hanging on a portion of circular ring **303** as shown in Figure 4C.

[0054] Figs. 5A-5C depict another embodiment of a disposable sterile (baby) food capsule **100** of the invention. In this embodiment, the capsule **100** comprises a lower part **102'** having a substantially concave shape and an upper part **102''** having a substantially convex shape. The lower part **102'** has a width that allows it to snugly fit into the bottle opening, while the upper part **102''** has a width that prevents its entering into the bottle opening.

[0055] The capsule **100** also comprises a convex cap **101**. The cap **101** is used to activate the integral opening mechanism inside the capsule to release the powdered/liquid food from the bottom of capsule **100**. Pushing the cap **101** inwards and changing its shape to a concave one, causes a connecting means **103** to press knives as the closure opening **105**, located inside the capsule **100**, against the bottom closure foil **13** and to cut said bottom closure to thereby release the powdered/liquid (baby) food from within the capsule **100** and into a receiving vessel, such as a bottle or a baby bottle.

[0056] In a specific embodiment, the capsule **100** further comprises a water conduit **12** located concentrically in the middle of the capsule **100**; said water conduit **12** stretches from the cap **101** to the lower end of the capsule and it may be secured by connectors **103'** to the inner lower part of the capsule **100** or the closure opening **105**. The conduit **12** is adapted to receive water from a water dispenser, through a capsule cap opening **120**, and deliver it directly to the bottle without mixing it with the content (e.g. baby powder) of the capsule **100**.

[0057] Figs. 6A-6C illustrate a multi-use capsule according to one embodiment of the invention: The external body **102** and the cap **101** are configured essentially the same as previously described. However, in this exemplified example, the internal opening mechanism also constitutes the bottom closure: as shown in Fig. 6B, before pressure is applied onto the capsule **100**, i.e. when it is closed, the closure opener **105** is actually blocking the bottom of the capsule and acts as the bottom closure. Once pressure is applied onto the cap **101**, the closure opener **105** is pushed out (Fig. 6C) by the connecting means **103**, thus opening the capsule and enabling its content to exit. Once the pressure is released, the cap **101** returns to its place and pulls the internal opening mechanism back with it, thereby returning the closure opener **105** into place to re-close the capsule. Now, the capsule **100** is ready for refiling before the next use. Said

refiling is carried out, e.g., by opening the cap **101** and filling the desired amount and type of (baby) food formula, followed by closing the cap **101**. If desired, the user may first sterilize the empty capsule prior to its refiling.

[0058] Figs. 7A-7C illustrate yet another disposable capsule according to one embodiment of the invention, which can be filled by the end user. In this configuration, the external body **102**, the cap **101**, the bottom closure **13**, and the internal opener mechanism **110**, are configured essentially the same as previously described. However, in this example the capsule **100** is provided empty for the user to fill- either the food formulation producer or the end user at home. In both cases, the user may insert the capsule **100**, via the opened cap **101**, any desired amount and type of food formula, such as a measured amount of baby food powder, and subsequently hermetically, and optionally irreversibly, close the cap **101** to thereby obtain the ready-to-use capsule **100**.

[0059] Fig. 8B illustrates a baby feeding bottle **300** and a (disposable) sterile baby food capsule **100** according to an embodiment of the invention. As seen in Fig. 8A, the capsule **100** comprises a groove **204** located at the side of the capsule **100**. The groove **204** stretches from the top to the bottom of the capsule **100** and has a shape that is adapted to contain a water conduit **12**. Fig. 8A illustrates that the capsule **100** comprises a lower part **102'** having a substantially concave shape and an upper part **102''** having a substantially convex shape. The lower part **102'** has a width that allows it to snugly fit into the bottle opening, while the upper part **102''** has a width that prevents its entering into the bottle opening.

[0060] The capsule **100** also comprises a convex cap **101**, which is used to activate the integral opening mechanism inside the capsule **100** to release the powdered/liquid food from the bottom of capsule **100** as detailed herein. The powdered/liquid baby food is released from the capsule **100** when a force exerted over the cap **101** pushes the cap **101** inwards. Said pushing the cap **101** inwards causes a dedicated knife or other closure opener **105**, located inside the capsule **100**, to cut the bottom closure **13** (e.g. a foil) of the capsule to thereby release the powdered/liquid baby food into the baby bottle by a gravity assisted falling.

[0061] Fig. 9 depicts yet another embodiment of a disposable sterile baby food capsule **100** of the invention. In this embodiment, the capsule **100** has a double walled structure and the space between the walls of the capsule is used as a water conduit **12**, which is adapted to receive water

from a water dispenser and to deliver it directly to the baby bottle without mixing it with the baby powder inside the capsule **100**. In this configuration, the water passing through said water conduit **12** do not contact the content of the capsule or the opened bottom closure **13**.

[0062] Similarly to the previous embodiments, the capsule **100** comprises a lower part **102'** having a substantially concave shape and an upper part **102''** having a substantially a convex shape. The lower part **102'** has a width that allows it to snugly fit into the bottle opening, while the upper part **102''** has a width that prevents its entering into the bottle opening.

[0063] The capsule **100** further comprises a convex cap **101**, which is used to activate the integral opening mechanism **110** inside the capsule to release the powdered/liquid food from the bottom of the capsule. Pushing the cap **101** inwards changes it to a concave cap, and causes a dedicated knife, acting as the closure opener **105**, to penetrate the bottom closure foil **13** and to release the content of the capsule into a (baby) bottle.

[0064] As illustrated in Fig. 10, a disposable sterile baby food capsule **100**, according to yet another embodiment of the present invention, comprises encoded information **505** located on an edge **506**, optionally protruding from the top surface of the capsule **100**. The encoded information **505** pertains to the preparation of the food formula, such as baby food powder composition, its weight, nutritional values, the water volume needed for formula preparation, manufacturer's name, production batch, etc. The encoded information **505** may be optically encoded as perforations on the edge **506** surface. In other embodiments, the encoded information **505** may be encoded and read by an RF, magnetic, or any other suitable technology. It should be stressed that the encoded information **505** may be encoded in any suitable way, such as by RF, color index, barcode, QR code, etc.

[0065] Fig. 11 illustrates an exemplary portable dispenser **600** that may be used for discharging (baby) food powder/liquid from a (baby) food capsule **100** of the present invention. The portable dispenser **600** comprises a piston **605** that pushes a convex capsule cap **101** inwards, thus causing a dedicated closure opener **105**, such as a knife, located inside the capsule **100**, to penetrate the bottom closure **13** (e.g. a foil) and to release the capsule's content (e.g. a powdered baby food) into a vessel, such as a baby bottle. The food powder/liquid is then mixed with water inside the vessel, wherein said water is supplied separately from a water container

**604** of said dispenser **600**, through an electrically controlled water passage lock **601** via a water conduit **12**.

[0066] It should be noted that the integral opening mechanisms described above can be manually activated by applying pressure over the capsule's cap **101** by the user's hand. The user can apply pressure over the capsule's cap **101** by pressing the cap with his fingers or with his palm. Thus the capsules **100** described herein are suitable to be opened both manually or by a dedicated dispensing machine, thereby enabling the user to choose whether to take capsules "on the go" to be used outdoors with or without a dedicated dispensing machine.

[0067] Accordingly, in certain embodiments, the capsule **100** of the invention with its integral opening mechanism may be ergonomically designed to be opened manually. For instance, such a capsule **100** may comprise protrusions and/or grooves for assisting holding the capsule. Thus a user can hold the capsule **100** and open it using a single hand over a vessel of his choice. As noted above, the capsule **100** may contain food additives, sports nutrition, spices, juice, syrup, protein shake, etc., and the content of the capsules can be extracted into any vessel, such as glass, shakers, pots, baby bottles or any other adequate vessel.

[0068] Fig. 12 schematically depicts a manual method for opening a capsule having an integral opening mechanism: a user first takes a capsule and holds it in his palm, e.g. in between the index and the middle finger **80**. Then, the user holds/places the capsule over a vessel into which the capsule's content should be extracted **81**. Now the user opens the capsule by pressing its cap, e.g. with the thumb of the hand of which the capsule is held **82**. Finally, the user waits until the content of the capsule drops down by gravity **83**. The user may slightly shake the capsule to ensure that almost all the content of the capsule is extracted. In cases where the capsule is disposable, the user can dispose of the capsule, in such cases the capsule may be made by disposable materials or biodegradable materials. Alternatively, the capsule can be refilled and/or reused by the user, in such cases the capsule can be made by materials capable of being dish washed and/or sterilized.

[0069] The capsules with the opening mechanisms and methods shown in the figures provide sterile extraction of the capsules content into a vessel. A capsule can be taken both "on-the-go" to be opened when pressed against baby bottles for example, or capsules can be taken to be opened single handed over any vessel of choice. Alternatively, although the capsules are designed to



work manually and on the go, these capsules can also be inserted into dedicated capsule dispensing machines and the pressure applied over the capsule's cap can be applied by, e.g. an actuator within said machine, which may also provide the needed water.

**WHAT IS CLAIMED IS:**

1. A self-opening capsule comprising:
  - a) an external body;
  - b) a top cover/lid;
  - c) a bottom closure; and
  - d) an integral opening mechanism located either within said external body or externally thereto, comprising:
    - i) a closure opener; and
    - ii) connecting means connecting said top cover/lid/cap with said closure opener.
2. The self-opening capsule of claim 1 which is disposable.
3. The self-opening capsule of claim 1 which is reusable.
4. The self-opening capsule of claim 1, wherein said external body has a bottom section which is narrower than the upper section.
5. The self-opening capsule of claim 1 further comprising an integral water conduit.
6. The self-opening capsule of claim 5, wherein said water conduit is part of said external body.
7. The self-opening capsule of claim 5, wherein said water conduit is part of said integral opening mechanism.
8. A method for preparing a baby food formulation using the self-opening capsules of any of the preceding claims, said method comprising the steps of:
  - a) providing a self-opening capsule according to any one of the preceding claims comprising baby-food powder;

- b) placing said capsule over a container and manually pressing the top cover thereof to release its content into said container; or  
placing said capsule inside a designated device designed to hold said capsule and pressing the top cover thereof to release its content into a container;
- c) adding water to said container, optionally before step (b); and
- d) mixing the baby-food powder and water to prepare said baby food formulation.

9. The method of claim 8, wherein the addition of water into said container is carried out via a dedicated water conduit, which is either a part of said capsule or an integral part of said designated device.

10. The method of claim 8, wherein the addition of water into said container is carried out before the addition of the content of the capsule (i.e. before step (b)), or simultaneously therewith.

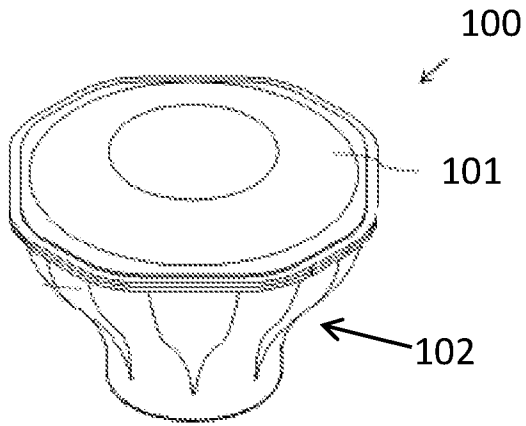


Figure 1A

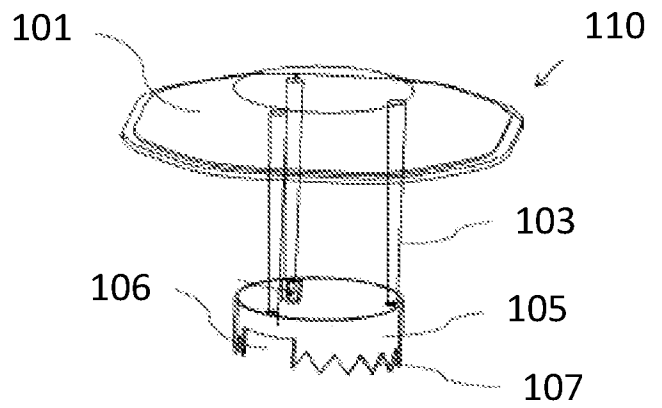


Figure 1B

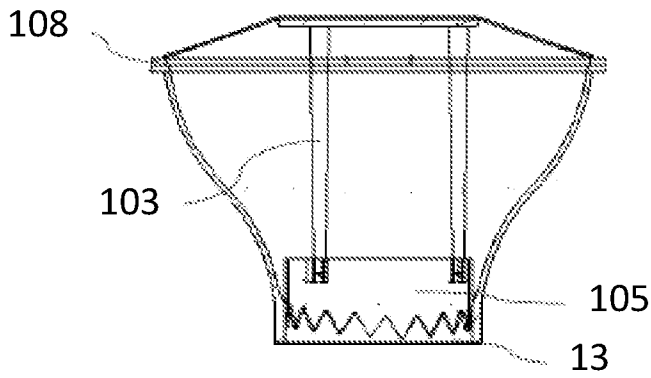


Figure 1C

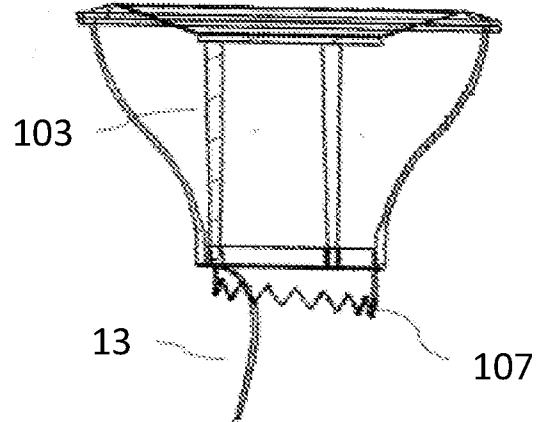


Figure 1D

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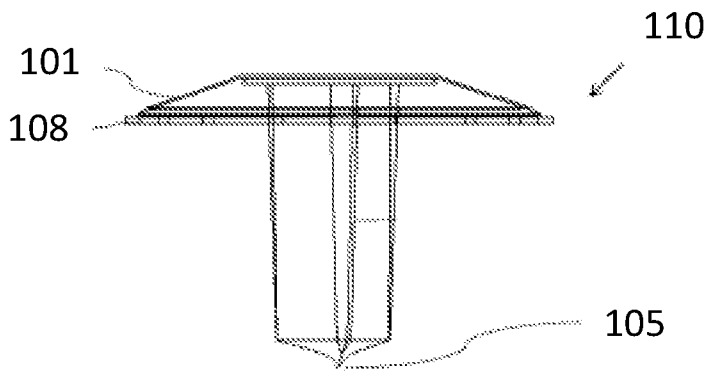


Figure 2A

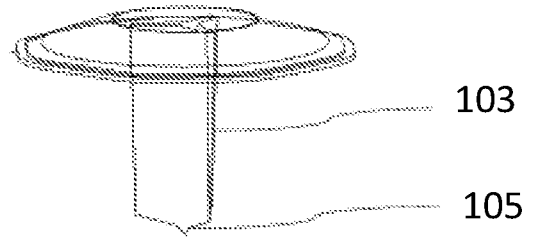


Figure 2B

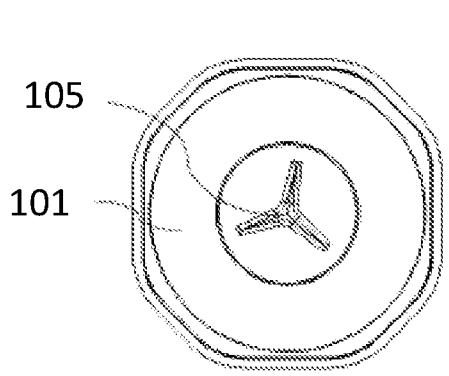


Figure 2C

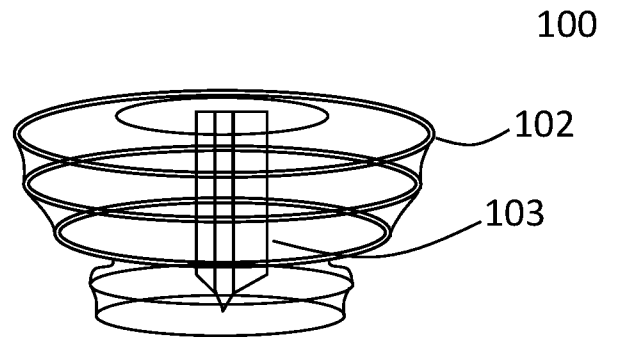


Figure 2D

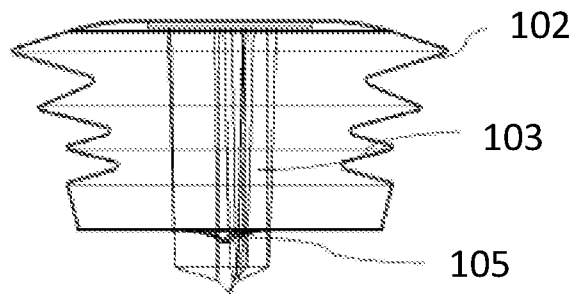


Figure 2E

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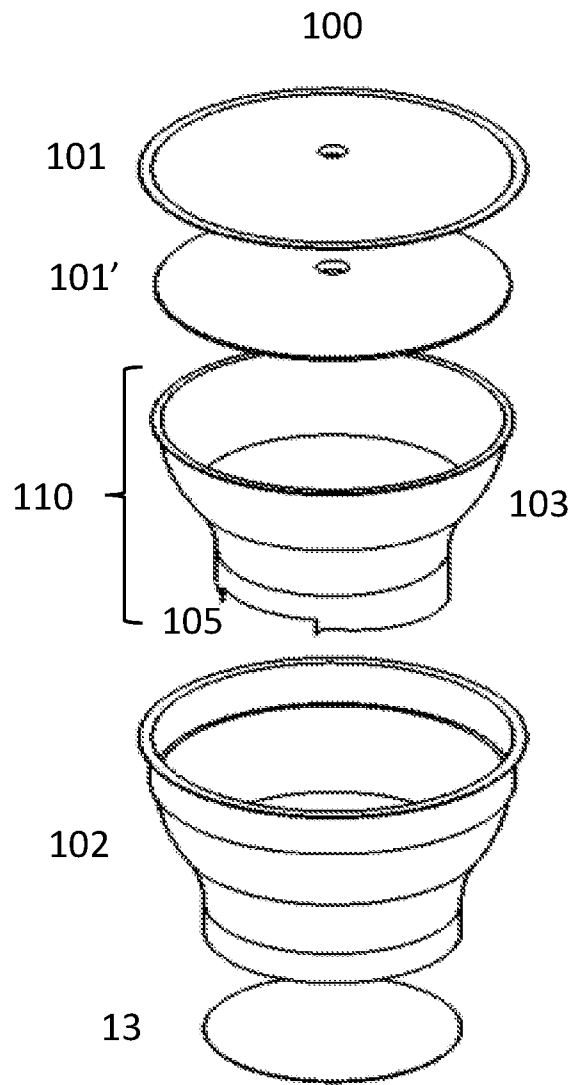


Figure 3

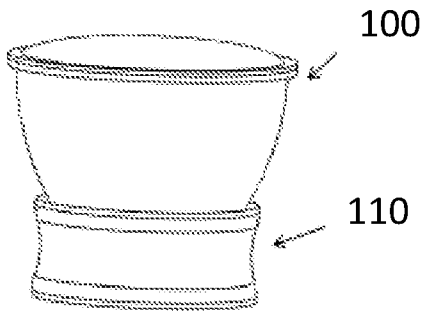


Figure 4A

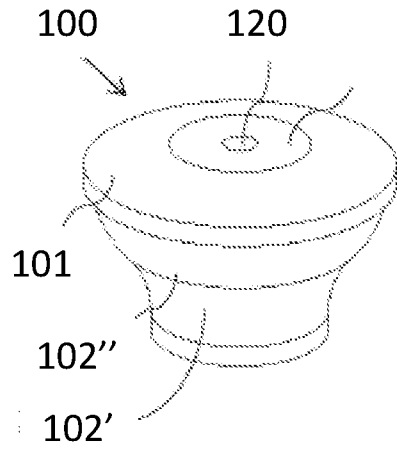


Figure 5A

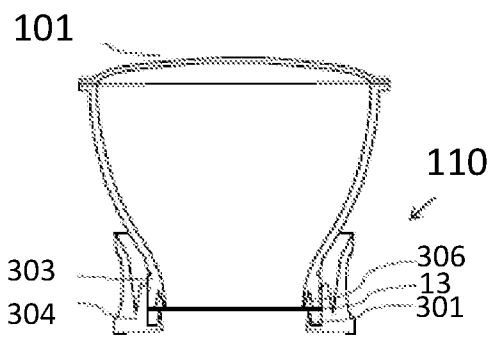


Figure 4B

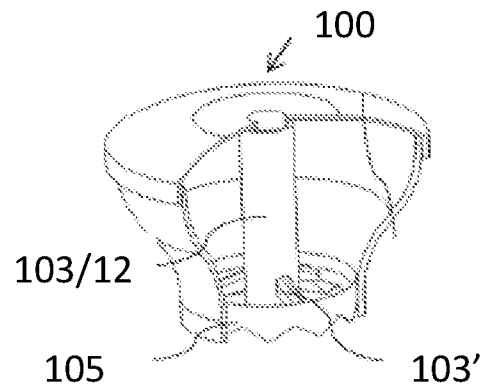


Figure 5B

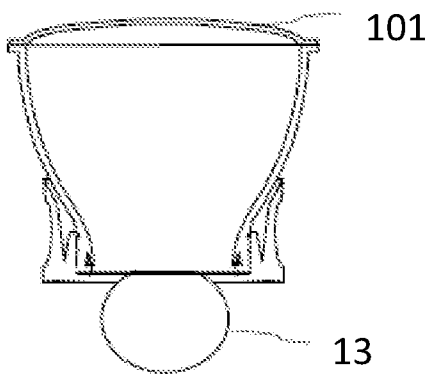


Figure 4C

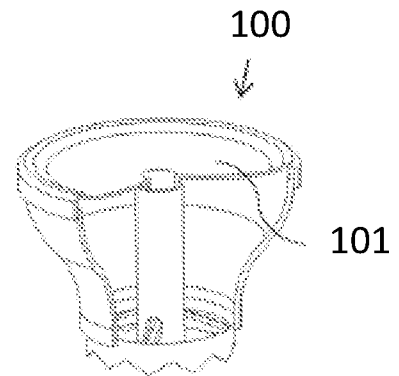


Figure 5C

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100

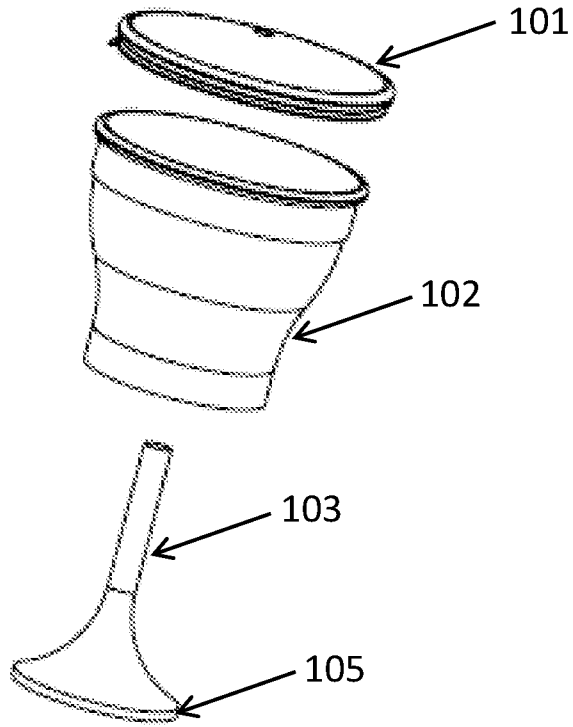


Figure 6A

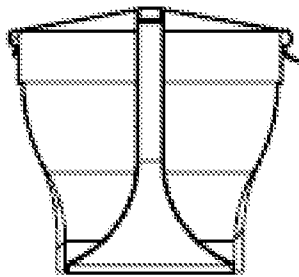


Figure 6B

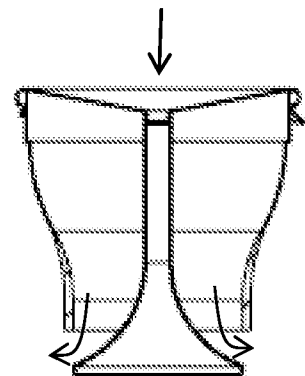


Figure 6C



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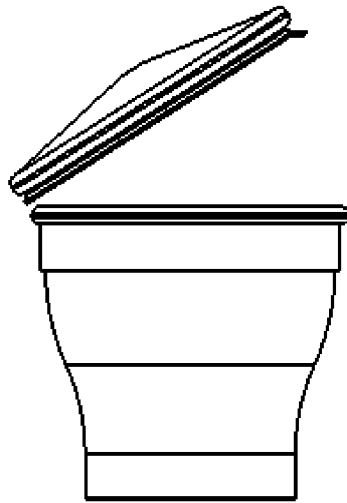


Figure 7A

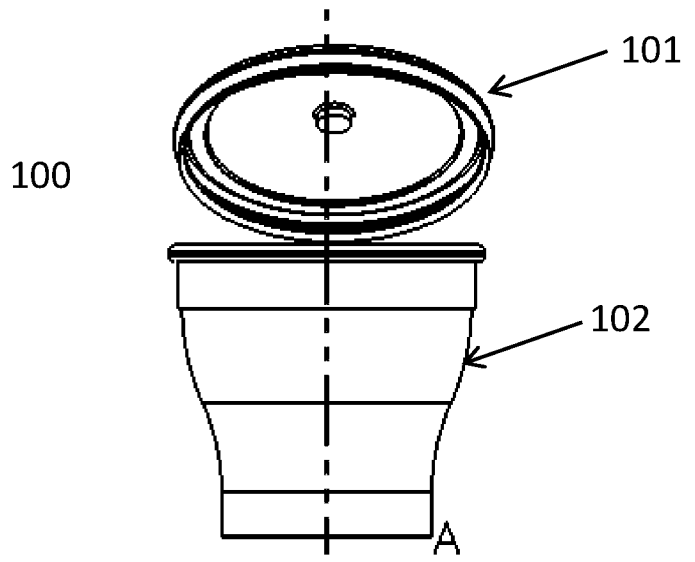


Figure 7B

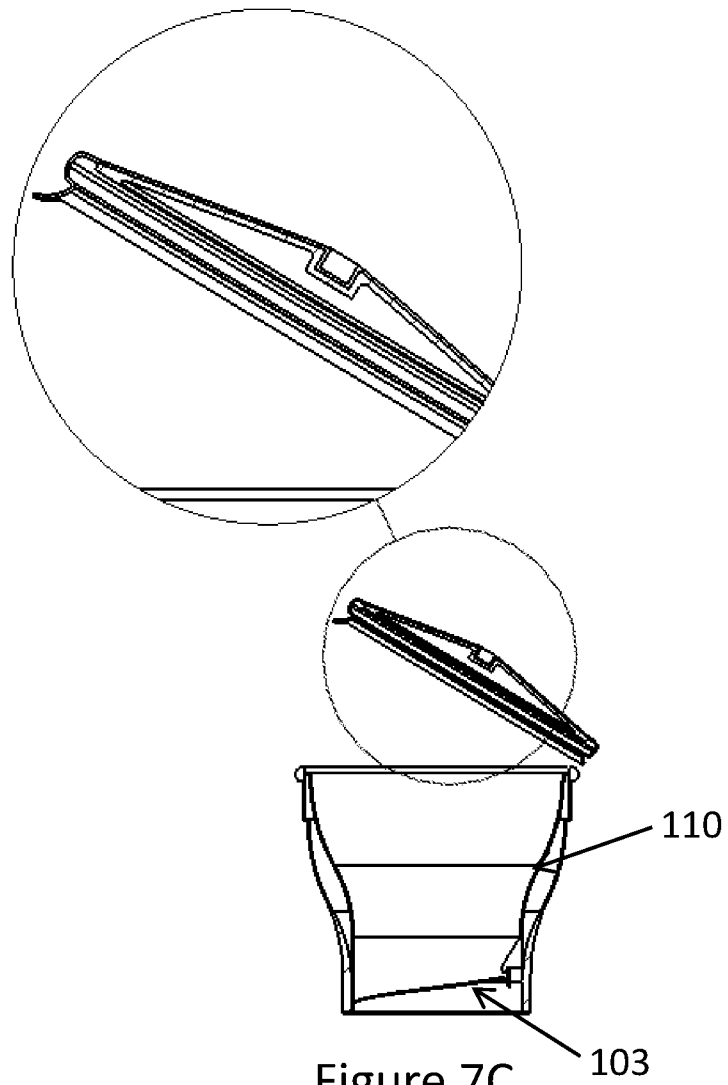


Figure 7C

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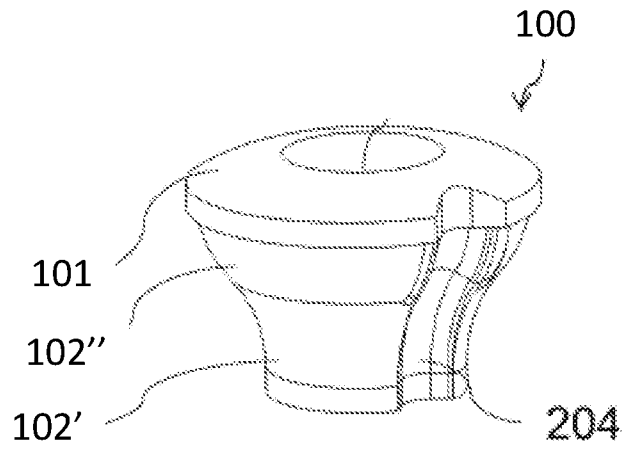


Figure 8A

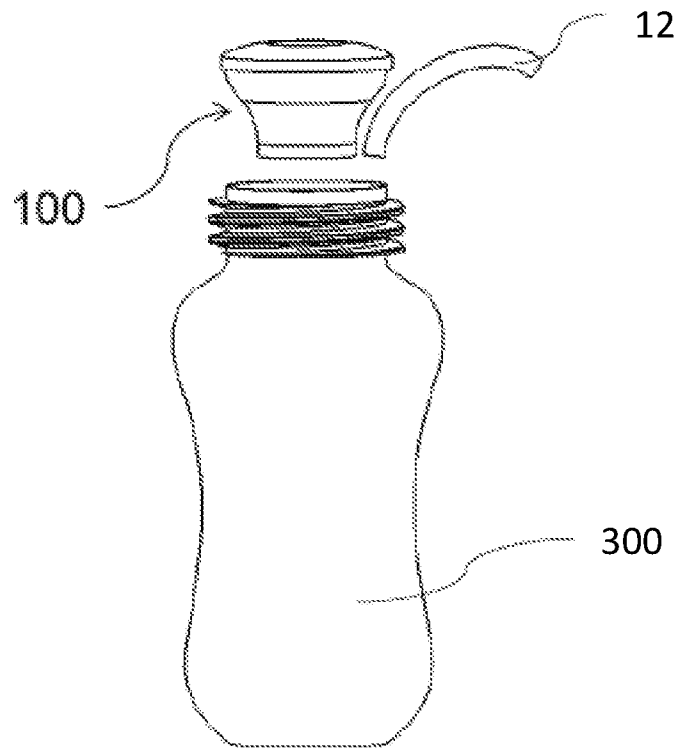


Figure 8B

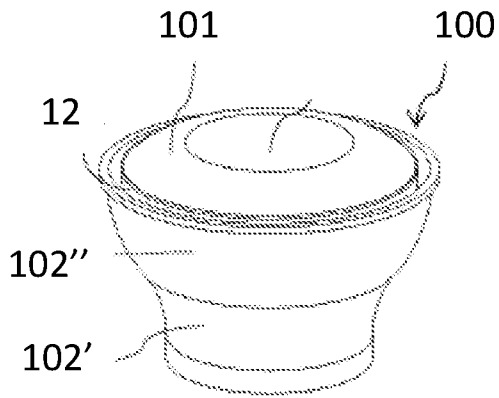


Figure 9

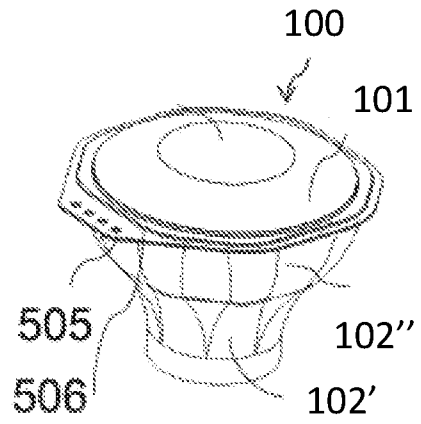


Figure 10

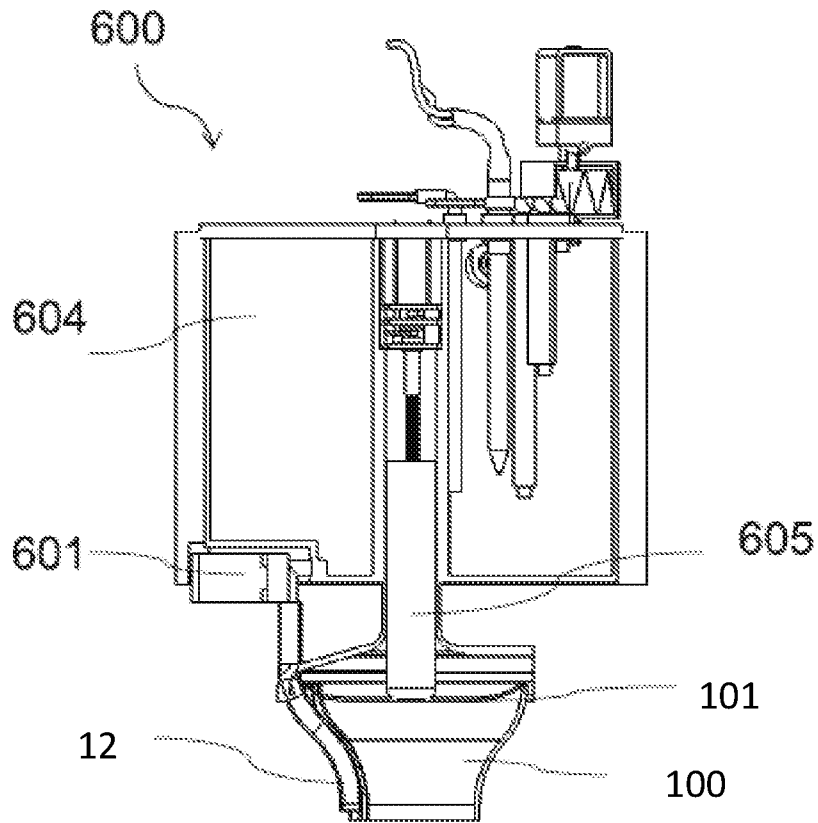


Figure 11

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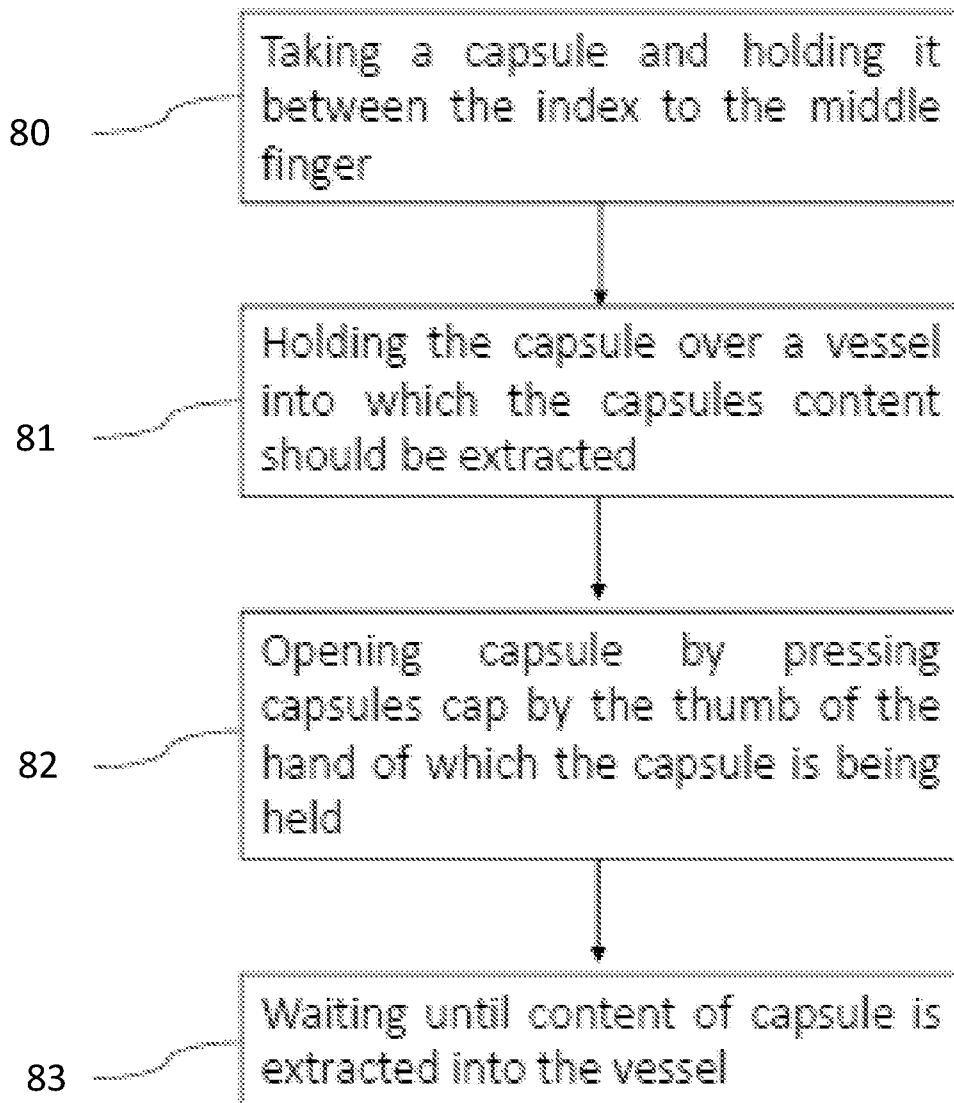


Figure 12

**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/IL2016/050901

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC (2016.01) B65D 83/06

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)

IPC (2016.01) B01F, A61K, A47J, A23F, B65D

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)

Databases consulted: THOMSON INNOVATION, Google Patents, DWPI

Search terms used: self, opening, capsule, internal, pierce, integrated, puncture, cartridge, inner, interior, crack, open, cut, penetrate, rupture.

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011110180 A1 (SNIDER DOUGLAS) 12 May 2011 (2011/05/12) Para. 0045; Fig. 6-9; claim 21-25;	1-5,7-10
A	Whole document.	6
X	US 2005238708 A1 (JONES ANDREW e.t. al.) 27 Oct 2005 (2005/10/27) Fig. 2B	1-4
A	Whole document.	5-10
X	US 2012258210 A1 (WONG KON EUAN GERARD et. al.) 11 Oct 2012 (2012/10/11) Fig. 3A-3D	1-5,7-10
A	Whole document.	6

Further documents are listed in the continuation of Box C.

See patent family annex.

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

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

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

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

“&” document member of the same patent family

Date of the actual completion of the international search

15 Dec 2016

Date of mailing of the international search report

15 Dec 2016

Name and mailing address of the ISA:

Israel Patent Office  
Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel  
Facsimile No. 972-2-5651616

Authorized officer

AGMAIL Waleed Ibrahim Ramadan

Telephone No. 972-2-5651626

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	JP 2009006184 A (HALLIDAY ANDREW et. al.) 15 Jan 2009 (2009/01/15) Whole document.	1-10
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