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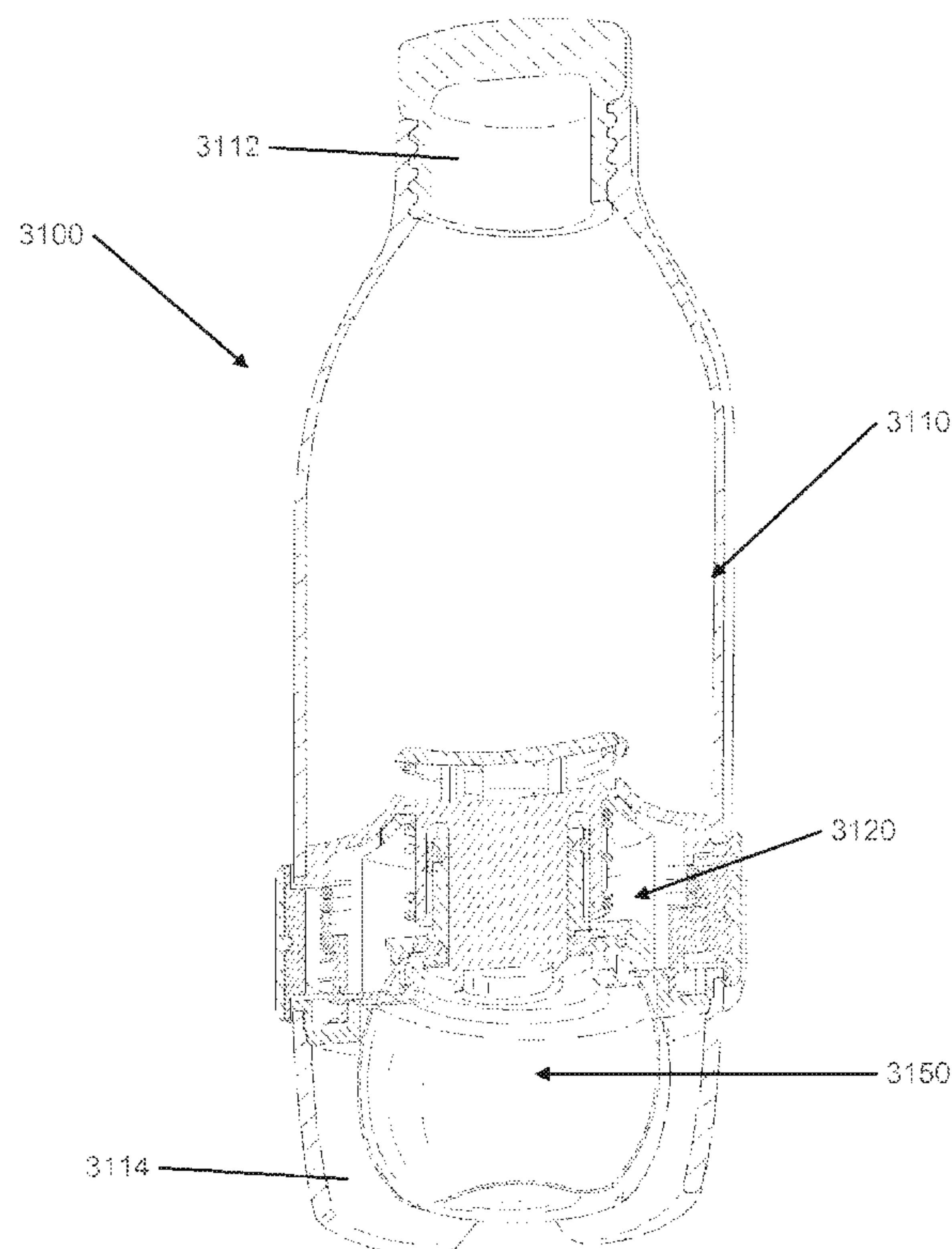


FIG. 32A

(57) Abrégé/Abstract:

A beverage dispensing system (3100) comprises a container (3110), an attachment mechanism (3120), and a cartridge (3150). The container may hold a mixing solution or liquid, such as water, to be mixed with the contents of the cartridge (3150). The

(57) **Abrégé(suite)/Abstract(continued):**

attachment mechanism (3120) is generally located within the container. The attachment mechanism (3120) may comprise an engagement assembly (3122), a piercing portion (3124), and a valve assembly (3126). The engagement assembly (3122) may generally receive the cartridge (3150) within the attachment mechanism (3120). The piercing portion (3124) may generally pierce the cartridge (3150), thereby releasing the contents of the cartridge into the container (3110). The valve assembly (3126) may generally open upon engagement of the cartridge with the attachment mechanism, thereby combining the contents of the cartridge (3150) with the liquid within the container (3110) to create a drinkable beverage.

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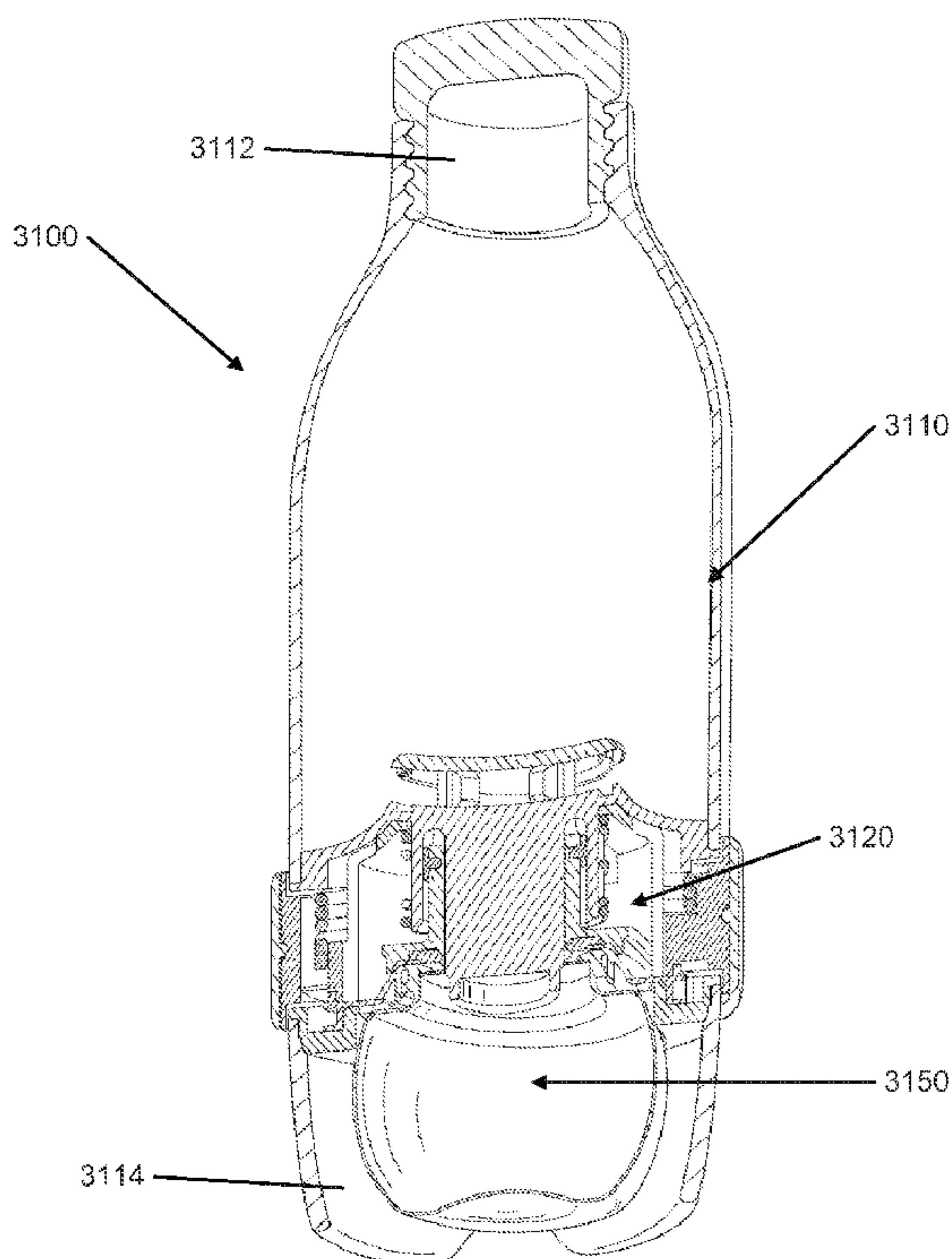
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13/342,550 3 January 2012 (03.01.2012) US(71) Applicant: **PEPSICO, INC.** [US/US]; 700 Anderson Hill Road, Purchase, New York 10577 (US).(72) Inventors: **MARINA, Carlos Hernan**; c/o PepsiCo, Inc., 700 Anderson Hill Road, Purchase, New York 10577 (US). **MAQUITA NAKANO, Jorge Manuel**; c/o PepsiCo, Inc., 700 Anderson Hill Road, Purchase, New York 10577 (US). **ENGA, Agnete**; c/o Smart Design LLC, 601 W. 26th Street, New York, New York 10001 (US). **FAIVRE****D'ARCIER, Vicent**; c/o Smart Design LLC, 601 W. 26th Street, New York, New York 10001 (US). **CONNELLY, Tim**; c/o Smart Design LLC, 601 W. 26th Street, New York, New York 10001 (US). **CEDAR, Jonathan**; c/o Smart Design LLC, 601 W. 26th Street, New York, New York 10001 (US). **FORT, Tucker**; c/o Smart Design LLC, 601 W. 26th Street, New York, New York 10001 (US).(74) Agent: **ROKOS, Rebecca P.**; Banner & Witcoff, Ltd., Ten South Wacker Drive, Suite 3000, Chicago, Illinois 60606-7407 (US).(81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ,

[Continued on next page]

(54) Title: POST-MIX BEVERAGE SYSTEM

**FIG. 32A****(57) Abstract:** A beverage dispensing system (3100) comprises a container (3110), an attachment mechanism (3120), and a cartridge (3150). The container may hold a mixing solution or liquid, such as water, to be mixed with the contents of the cartridge (3150). The attachment mechanism (3120) is generally located within the container. The attachment mechanism (3120) may comprise an engagement assembly (3122), a piercing portion (3124), and a valve assembly (3126). The engagement assembly (3122) may generally receive the cartridge (3150) within the attachment mechanism (3120). The piercing portion (3124) may generally pierce the cartridge (3150), thereby releasing the contents of the cartridge into the container (3110). The valve assembly (3126) may generally open upon engagement of the cartridge with the attachment mechanism, thereby combining the contents of the cartridge (3150) with the liquid within the container (3110) to create a drinkable beverage.

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POST-MIX BEVERAGE SYSTEM

[001] This continuation in part application claims priority to Non-Provisional Application, U.S. Serial No. 12/982,374, filed December 30, 2010, which claims priority to Non-Provisional Application, U.S. Serial No. 12/550,101, filed August 28, 2009, which claims priority to Provisional Application, U.S. Serial No. 61/093,090, filed August 29, 2008, and Provisional Application, U.S. Serial No. 61/146,156, filed January 21, 2009, which are all incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

[002] The present invention relates generally to beverage dispensers and more particularly to post-mix beverage systems.

BACKGROUND

[003] It is known that beverages are marketed, delivered and sold in a variety of different types of containers. The type of container utilized may depend on several factors, including, for example, the consumer for which the beverage is being marketed towards, the distribution channel(s), and/or the quantity of beverage being sold. In this regard, beverages marketed towards consumers are often distributed in plastic bottles. Unfortunately, however, a large portion the plastic bottles are disposed of as waste. While recycling efforts have increased, the bottles are purchased and consumed in areas where recycling is not available or feasible. Furthermore, plastic lids used for sealing the bottles are generally not recyclable and end up as waste, or worse yet, as litter throughout the environment. Additionally, these wasteful plastic bottles are also marketed and sold as “multi-packs” in which further packaging, such as shrink-wrap and/or cardboard must be utilized to contain individual bottles together as a multi-pack. Thus, such prior art delivery mechanisms generate a vast quantity of unwanted and unneeded waste.

[004] In addition to having an adverse environmental impact, most prior art containers use valuable space, both in the retail environment and at the end-users' location, such as their homes. Past systems, known as “post-mix” systems, attempted to alleviate some of these drawbacks by selling concentrated beverage syrups designed to be

diluted with a liquid, such as water. While known post-mix systems reduce waste associated with other delivery mechanisms, such as plastic bottles, these systems require large, expensive systems that are too complicated and cumbersome for use by consumers other than retail establishments that sell large quantities of beverages. Even for such establishments, the knowledge and costs required to maintain these conventional post-mix systems is inconvenient. Furthermore, past systems are known to require calibration on a regular basis to ensure that the correct amount of syrup is properly combined with the liquid. In this regard, any miscalibration or failure of the machine is often only discovered after several customers complain about the taste of the beverage and further time is required to check and fix the ratio of syrup to liquid.

SUMMARY

- [005] The following presents a general summary of aspects of the invention in order to provide a basic understanding of at least some of its aspects. This summary is not intended as an extensive overview of the invention. It is not intended to identify key or critical elements of the invention or to delineate the scope of the invention. The following summary merely presents some concepts of the invention in a general form as a prelude to the more detailed description below.
- [006] Aspects of this invention relate to beverage dispensing system that comprises a container, an attachment mechanism located within the container, and a cartridge adapted to engage the attachment mechanism. The attachment mechanism may comprise an engagement assembly, a piercing portion, and a valve. The cartridge comprises a pod and a cap. The pod includes a chamber, an opening, and a cover located over the opening, wherein the cap is attached to the top of the chamber. Additionally, when the cartridge is engaged with the attachment mechanism, the engagement assembly holds the cartridge within the attachment mechanism, the piercing portion pierces through the cap and the cover, and the valve extends into the container.
- [007] Additional aspects of this invention relate to the cap including a foil retainer, wherein when the cartridge engages the engagement assembly, the piercing portion pushes against the foil retainer, thereby piercing the cover with the foil retainer.

Additionally, the foil retainer may hold the cover over without allowing the cover to close over the opening of the cartridge.

[008] Additional aspects of this invention relate to the cartridge and pod being generally a circular-shaped vessel. Additionally, the cartridge may hold one or more beverage ingredients, wherein the beverage ingredients may be selected from the list comprising: syrup, paste, powder, or granules.

[009] Additional aspects of this invention relate to a method for producing a beverage using a beverage dispensing system. The method comprises the steps of: (a) inserting a cartridge into a container, the cartridge comprising a pod and a cap, wherein the pod includes a chamber, an opening and a cover located over the opening; (b) rotating or positioning the cartridge into an attachment mechanism located within the container, wherein the attachment mechanism comprises an engagement assembly, a piercing portion, and a valve; (c) applying pressure on the cartridge thereby releasing the valve into the container and piercing the cover with the piercing portion; (d) mixing the contents of the container; and (e) releasing the cartridge from the container.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] A more complete understanding of the present invention and certain advantages thereof may be acquired by referring to the following description in consideration with the accompanying drawings, in which like reference numbers indicate like features, and wherein:

[0011] FIG. 1 illustrates a perspective view of a beverage dispensing system in accordance with the present invention;

[0012] FIG. 1A illustrates a cross-sectional view of the beverage dispensing system from FIG. 1 in accordance with the present invention;

[0013] FIGS. 2A1 and 2A2 illustrate a close-up view a portion of the beverage dispensing system from FIG. 1 in accordance with the present invention;

[0014] FIGS. 2B1 and 2B2 illustrate another close-up view a portion of the beverage dispensing system from FIG. 1 in accordance with the present invention;

- [0015] FIGS. 3-3D illustrate an exemplary cartridge for the beverage dispensing system from FIG. 1 in accordance with the present invention;
- [0016] FIGS. 4A-4F illustrate perspective views the operation of the beverage dispensing system from FIG. 1 in accordance with the present invention;
- [0017] FIGS. 5A-8B illustrate various examples of a container for a beverage dispensing system in accordance with the present invention;
- [0018] FIGS. 9A-13B illustrate various examples of an attachment mechanism for a beverage dispensing system in accordance with the present invention;
- [0019] FIGS. 14A-14C illustrate an example half-pod cartridge in accordance with the present invention;
- [0020] FIGS. 15-17 illustrate various examples of an alternative beverage system in accordance with the present invention;
- [0021] FIGS. 18-23 illustrate various examples of beverage systems that may be used in numerous configurations in accordance with the present invention;
- [0022] FIG. 24 illustrates an alternative example of a beverage system in accordance with the present invention;
- [0023] FIG. 25 illustrates an example needle to be used with the beverage system in FIGS. 15 through 17 in accordance with the present invention;
- [0024] FIG. 26 illustrates example powder boosters to be used with any of the beverage systems in accordance with the present invention;
- [0025] FIGS. 27A-27C illustrate an example cartridge and container to be used with any of the beverage systems in accordance with the present invention;
- [0026] FIGS. 28A and 28B illustrate an example digital communication system for the beverage system in accordance with the present invention;
- [0027] FIGS. 29A-30 illustrate various additional examples of beverage systems that may be used in numerous configurations in accordance with the present invention;
- [0028] FIG. 31 illustrates various beverage containers in accordance with the present invention;

- [0029] FIG. 32A illustrates a perspective view of a beverage dispensing system in accordance with the present invention;
- [0030] FIG. 32B illustrates a cross-sectional view of the beverage dispensing system from FIG. 32A in accordance with the present invention;
- [0031] FIG. 33 illustrate an exemplary cartridge for the beverage dispensing system from FIG. 32A in accordance with the present invention; and
- [0032] FIGS. 34A-34F illustrate perspective views the operation of the beverage dispensing system from FIG. 32A in accordance with the present invention; and
- [0033] FIGS. 35A-35D illustrate another exemplary cartridge for the beverage dispensing system in accordance with the present invention.
- [0034] The reader is advised that the attached drawings are not necessarily drawn to scale.

DETAILED DESCRIPTION

- [0035] In the following description of various examples of the invention, reference is made to the accompanying drawings, which form a part hereof, and in which are shown by way of illustration various example structures, systems, and steps in which aspects of the invention may be practiced. It is to be understood that other specific arrangements of parts, structures, example devices, systems, and steps may be utilized and structural and functional modifications may be made without departing from the scope of the present invention. Also, while the terms “top,” “bottom,” “front,” “back,” “side,” and the like may be used in this specification to describe various example features and elements of the invention, these terms are used herein as a matter of convenience, *e.g.*, based on the example orientations shown in the figures. Nothing in this specification should be construed as requiring a specific three dimensional orientation of structures in order to fall within the scope of this invention.
- [0036] FIG. 1 illustrates an example of a beverage dispensing system 100 in accordance with the present invention. The beverage dispensing system 100 includes a container 110, an attachment mechanism 120 and a cartridge 150. The container 110 may hold a mixing solution or liquid, such as water, to be mixed with the contents of the cartridge 150. Other mixing solutions or liquids may include milk,

juices, or tea. The mixing solution or liquid may be cold, warm, or hot in temperature. Additionally, the mixing solution may contain ice, slush, or be an ice/water mixture. The attachment mechanism 120 is generally located within the container 110. The cartridge 150 generally engages with the attachment mechanism 120 to open the cartridge 150 to be dispensed into the container 110, thereby combining the contents of the cartridge 150 with the liquid within the container 110 to create a drinkable beverage.

[0037] The container 110, as illustrated in FIG. 1, may be generally in the shape of a bottle. The container 110 may be a variety of other shapes, without departing from this invention. The container 110 may include a cap 112. The cap 112 may seal an opening at the top of the container 110 where a user can drink from the container 110. Additionally, the container 110 may include a base or bezel 114. The cartridge 150 may be inserted through the base or bezel 114 to engage the cartridge 150 with the attachment mechanism 120. As illustrated in FIG. 1, this base or bezel 114 is located at the bottom of the container 110. The base or bezel 114 may be located at different areas of the container 110 as discussed below without departing from this invention. Additionally, the cartridge 150 may be inserted through the cap 112 of the container 110 to engage the cartridge 150 with the attachment mechanism 120. Furthermore, without departing from the invention, the cap 112 may comprise the cartridge 150, such that when the cap 112 is screwed onto the container 110, the cartridge 150 engages the attachment mechanism 120 and releases the contents of the cartridge 150 as described further below.

[0038] Additionally, as shown in FIG. 31, the container 110 may not only be a variety of other shapes, but the container 110 may also be a variety of other colors and color configurations. Additionally, the container 110 may include a variety of different skin 111 coverings around the container 110. The skins 111 for the containers 110 may vary in design, color, texture, thickness, material, size, and shape without departing from the invention. By using different skins 111 for the containers 110, the containers can be personally customizable. Other examples for skins 111 may include brand names, college names or mascots, professional sport teams, favorite sayings, personal pictures, etc. Additionally, the color and style of the top or cap of the container may differ without departing from the invention.

- [0039] The attachment mechanism 120, as illustrated in FIGS. 1 and 1A, comprises an engagement assembly 122, a piercing portion 124, and a valve assembly 126. The engagement assembly 122 may generally receive the cartridge 150 within the attachment mechanism 120. The piercing portion 124 may generally pierce the cartridge 150, thereby releasing the contents of the cartridge 150 into the container 110. The valve assembly 126 may generally open upon engagement of the cartridge 150 with the attachment mechanism 120 thereby allowing the mixing of the contents of the container 110 with the contents of the cartridge 150.
- [0040] The engagement assembly 122 may include a locking mechanism 128 to engage and hold the cartridge 150 in the container 110. The locking mechanism 128 may include a rib 130 which matches with and engages the cartridge 150. The locking mechanism 128 may also include a spring (not shown in FIG. 1A), such that when the cartridge 150 is inserted into the engagement assembly 122, the spring provides a biasing force to the cartridge 150 to more easily engage the rib 130. Additionally, the locking mechanism 128 may include a cam or a lever 134 such that when the cartridge 150 is snapped into a locked position, the piercing portion 124 and valve assembly 126 are engaged as will be explained below. The spring may also bias against the cartridge 150 as the cartridge 150 is snapped into the locked position.
- [0041] Additionally, the engagement assembly 122 may include a releasing mechanism 136 wherein the releasing mechanism 136 releases the locking mechanism 128 to release the cartridge 150. The releasing mechanism 136 may be in the form of a rotating bezel, wherein the user can release the cartridge 150 by rotating the bezel (as shown in FIG. 4F). The rotation of the bezel may eject the cartridge 150 and return the attachment mechanism 120 to the starting position. Additionally, the releasing mechanism 136 may be in the form of a release button or a release lever, wherein the user may press the release button or slide the release lever to release the cartridge 150. Other means to release the cartridge 150 may be used with the engagement assembly 122 without departing from this invention.
- [0042] The engagement assembly 122 may also include a cartridge sealing portion 138. The cartridge sealing portion 138 seals the area around the top of the cartridge 150 to the engagement assembly 122 when the cartridge 150 is snapped into a locked position. The cartridge sealing portion 138 ensures that the liquid or solution is contained within the cartridge 150 during the mixing process. The cartridge sealing

portion 138 may include a gasket, o-ring, or grommet or other sealing structures in accordance with this invention. The cartridge sealing portion 138 may be made of rubber, plastic, or metal or other materials in accordance with this invention.

[0043] As illustrated in FIG. 1, the piercing portion 124 of the attachment mechanism 120 may include an opening structure 140. The piercing portion 124 may be cooperatively engaged to the cam or lever 134 such that when the cartridge 150 is pressed into the engagement assembly 122, the cartridge 150 is pressed against the piercing portion 124, and the piercing portion 124 slides into the opening 158 of the pod 152. The opening structure 140 may be sharp enough to pierce the cover 160 of the cartridge 150, thereby breaking the cover 160 on the pod 152, and allowing the contents of the cartridge 150 to mix with the contents of the container 110.

[0044] In another example in accordance with this invention, in cooperation with a foil retainer 166 as explained below, the opening structure 140 may be shaped such that it corresponds specifically with the flaps or retaining portions 170 on the foil retainer 166. In this example, when the cartridge 150 is pressed against the piercing portion 124, the opening structure 140 puts pressure against the foil retainer 166, specifically the flaps or retaining portions 170 on the foil retainer 166. The pressure from the opening structure 140 causes the flaps 170 to break open, and fold into the cover 160 (if present), thereby piercing the cover 160 on the pod 152, and allowing the contents of the cartridge 150 to mix with the contents of the container 110. It is important to note that the specific arrangement and configuration of the opening structure 140 must match the flaps 170 on the foil retainer 166 for the opening structure 140 to adequately pressure and break the foil retainer 166. If the opening structure 140 and flaps 170 on the foil retainer 166 do not match, it is possible that the cover 160 will not be broken when the cartridge 150 is pressed into the locked position. In other embodiments without departing from the invention, the flaps 170 on the foil retainer 166 do not need to match the opening structure 140. For example, there may be opening structures 140 which do not match the flaps 170, however the cover 160 is still broken when the cartridge 150 is pressed into the locked position.

[0045] The piercing portion 124 may also include an internal sealing portion 142. The internal sealing portion 142 seals the area around opening structure 140 when the cartridge 150 is snapped into a locked position. The internal sealing portion 142

ensures that the liquid or solution is contained within the cartridge 150 during the mixing process.

- [0046] The valve assembly 126, as illustrated in FIG. 1A, may generally open upon engagement of the cartridge 150 with the attachment mechanism 120 thereby allowing the mixing of the contents of the container 110 with the contents of the cartridge 150. The valve assembly 126 may include a valve 144 and an elevator 146. The valve 144 may be cooperatively engaged with the elevator 146 and with the cam or lever 134 of the engagement assembly 122, such that when the cartridge 150 is snapped into the locked position and engages the cam or lever 134 of the engagement assembly 122, the valve 144 is moved from a closed position to an open position. Generally, as pressure is applied to the cartridge 150 and the cartridge 150 is snapped into the locked position, the elevator 146 moves and thereby engages the valve 144 and moves the valve 144 to the open position.
- [0047] In one example in accordance with this invention, as illustrated in FIG. 2A, the valve assembly 126 may be in the form of a door-type valve 144A. The valve 144A, as illustrated in FIG. 2A may be hinged at one side, such that as pressure is applied to the cartridge 150A and thereby to the elevator 146A and the spring 132A, the valve 144A swings to the open position and into the container 110. Additionally, as the cartridge 150A is pushed, the opening structure 140A moves into the cartridge 150A. As the valve 144A swings to the open position into the container 110, the contents of the cartridge 150A and the contents of the container 110 can then mix.
- [0048] In another example in accordance with this invention, as illustrated in FIG. 2B, the valve assembly 126 may be in the form of a plunger-type valve 144B. The valve 144B, as illustrated in FIG. 2B, may slide into the container 110 as one piece as pressure is applied to the cartridge 150B and thereby to the elevator 146B and to the spring 132B. When the elevator 146B is pushed against the valve 144B, the valve 144B moves from the closed position to the open position and into the container 110. Additionally, as the cartridge 150B is pushed, the opening structure 140B moves into the cartridge 150B. As the valve 144B slides to the open position, the contents of the cartridge 150B and the contents of the container 110 can then mix.

- [0049] The valve assembly 126 may also include a valve sealing portion 148. The valve sealing portion 148 seals the area between the valve 144 and the container 110 when the cartridge 150 is not snapped into the locked position. Prior to the engagement of the cartridge 150 in the engagement assembly 122, the container 110 may contain a liquid and the valve sealing portion 148 ensures that the liquid or solution is contained within the container 110 when there is no cartridge 150 and the valve 144 is in the closed position. The valve sealing portion 148 may include a gasket, o-ring, or grommet or other sealing structures in accordance with this invention. The valve sealing portion 148 may be made of rubber, plastic, or metal or other materials in accordance with this invention.
- [0050] The cartridge 150, as illustrated in FIGS. 3 and 3A, may comprise a pod 152 and a cap 154. The cartridge 150 is adapted to engage the attachment mechanism 120 at the engagement assembly 122. The cartridge 150 may hold one or more beverage ingredients, wherein the beverage ingredients may be selected from the list comprising: syrup, paste, powder, granules, or other compositions. Additionally, the cartridge 150 may hold other ingredients or flavors, such as nutrients or vitamins, in accordance with this invention.
- [0051] In another embodiment in accordance with this invention, the cartridge 150 may include different liquid flavors/ingredients. The liquid flavors/ingredients may be created by condensed liquids that pack the essence of a beverage with the full power of healthy ingredients and nutrients. The liquid flavors/ingredients may include a fruit and/or flavor base such as: plum, blueberry, mango, cherry, grape, kiwi, strawberry, lemon, lime, passion fruit, apple, melon, tangerine, raspberry, orange, pomegranate, pineapple, coconut, grapefruit, acai, watermelon, peach, or any combination thereof. Additionally, the liquid flavors/ingredients may include a functional ingredient that includes herbs and spices or vegetables such as: mint, black tea, green tea, red tea, white tea, celery, chamomile, hibiscus, lavender, carrot, cucumber, yerba mate, coca extract, ginger, chlorophyll, aloe, cinnamon, ginseng, or any combination thereof. Additionally, the liquid flavors/ingredients may include a functional ingredient that includes minerals, vitamins, and other functional ingredients such as: calcium, sodium, potassium, bicarbonate, magnesium, caffeine, fiber, protein, taurine, ribose, omega 3, or any combination thereof. Additionally, without departing from the invention, the liquid flavors/ingredients may include any

combination of fruit or flavor base, functional ingredients with herbs and spices or vegetables, or functional ingredients with minerals and/or vitamins.

- [0052] The pod 152 is generally a vessel capable of holding a syrup, paste, powder, granules or other compositions. The pod 152 as shown in FIGS. 3 and 3A is a circular-shaped structure that includes a chamber 156, an opening 158, and a cover 160. The cover 160 may be located over the opening 158 of the pod 152. An engaging portion 162 may be located near the opening 158, wherein the engaging portion 162 may be a snap structure that engages the cap 154. Additionally, the engaging portion 162 on the pod 152 may include threads that may engage threaded structures on the cap 154.
- [0053] As illustrated in FIGS. 3C and 3D, the cover 160 may be a foil seal located over the opening 158 of the pod 152. The cover 160 may be attached to the edges of the opening 158 of the pod 152. The cover 160 may be made of a variety of different materials in accordance with this invention, such as: aluminum and sealing coatings or laminated with sealing polymers like polyethylene, metalized bioriented polypropylene and sealing coatings or laminated with sealing polymers like polyethylene, or metalized polyester and sealing coatings or laminated with sealing polymers like polyethylene.
- [0054] In an additional example in accordance with this invention, the pod 152 may include a locking portion 164. The locking portion 164 may be engaged with the engagement assembly 122 of the attachment mechanism 120 to snap the cartridge 150 into the attachment mechanism 120.
- [0055] As illustrated in FIG. 3C, the cap 154 may be attached to the top of the chamber 156. The cap 154 may be a snap-on type cap, wherein the cap 154 may snap onto the top of the chamber 156. The cap 154 may also attach to the top of the chamber 156 by screwing onto the top of the chamber 156. The cap 154 may be made of a variety of different materials without departing from this invention, such as: polyethylene, polypropylene, or polyethylene or polypropylene closures with internal liners containing oxygen scavengers like: components of Hyguard™, Celox™, etc.
- [0056] In an additional example in accordance with this invention, the cap 154 may include a foil retainer 166. The foil retainer 166 may be in the shape of a disc located in the

center of the cap 154. The foil retainer 166 may be sealed on one side, such as sealed to the cap 154, or sealed to a top rim of the pod 152. Additionally, the foil retainer 166 may be sealed on both sides, sealed to both the cap 154 and to the top rim of the pod 152. The foil retainer 166 may include cut-out portions 168, thereby creating flaps or retaining portions 170 on the foil retainer 166 that may break-away with pressure. These flaps 170 are designed to cooperate specifically with the opening structure 140 as described above. When the opening structure 140 is pressed against the flaps 170 and the flaps 170 are pressed open, the flaps 170 may pierce the cover 160 and fold into the pod 152, thereby holding the pierced and cut portions of the cover 160 open so that the contents of the cartridge 150 can mix freely with the contents of the container 110. As illustrated in FIG. 3A, the cut-out portion 168 may be in the shape of a cross, thereby creating four triangular flaps 170. In other examples in accordance with this invention, the foil retainers 166A-166H may include cut-out portions 168 and flaps 170 in the shapes as illustrated in FIG. 3B. Additional shapes may be used for the cut-out portions 168 and flaps 170 without departing from this invention. When the foil retainer 166 is used with the cap 154, the cover 160 may be used or it may not be used. The foil retainer 166 may be made of a variety of different materials without departing from this invention, such as: polyethylene, polypropylene, or polyethylene or polypropylene closures with internal liners containing oxygen scavengers like: components of Hyguard™, Celox™, or any other material which is flexible enough to break when pressure is applied from the opening structure 140, and hard enough to cut or pierce the cover 160 and remain in place, thereby keeping the cover 160 open. As shown in FIGS. 3C and 3D, the cartridge 150 may include no cover 160 with a cap 154 or the cartridge 150 may include a cover 160 with no cap 154.

[0057] In an additional example in accordance with this invention, the cap 154 may include a locating portion 172. The locating portion 172, as illustrated on FIG. 3A, engages with the engagement assembly 122 to properly position the cartridge 150 within the attachment mechanism 120.

[0058] The pod 152 may be made of various materials without departing from this invention. For example, the pod 152 may be made of polyethylene terephthalate (PET). Additionally, the pod 152 may be made of PET in combination (by mixing and/or by using multi-layer structures) with passive barrier materials and/or oxygen

scavengers like: plasma-applied coatings of SiO_x or amorphous carbon, polyamides, polyglycolic acid, Amosorb™, DiamondClear™, or components of Hyguard™. Additionally, the pod 152 may be made of polyethylene or polypropylene in combination (by mixing and/or by using multilayer structures) with passive barrier materials and/or oxygen scavengers like: polyamides, ethylene vinyl alcohol. Additionally, the pod 152 may be made of aluminum. Other materials may be used for the pod 152 in accordance with this invention, such that the material alone or in combination with a barrier system protects some beverages or other products that are oxygen sensitive and to avoid excessive loss of water.

[0059] FIGS. 4A through 4F illustrate the operation of the beverage dispensing system according to examples of this invention. The preparation of the beverage dispensing system 100 as described above is shown in FIGS. 4A-4F. As shown in FIG. 4A, the cartridge 150 is inserted into the attachment mechanism 120 as located in the base of the container 110. The cartridge 150 may be inserted with the cap towards the attachment mechanism 120.

[0060] As shown in FIG. 4B, the cartridge 150 may be rotated to make sure the cartridge 150 is located in the proper location. The locating portion 172 located on the cap, engages with the engagement assembly 122 to properly position the cartridge 150 within the attachment mechanism 120. Additionally, the cartridge sealing portion 138 seals the area around the top of the cartridge 150 to the engagement assembly 122 when the cartridge 150 is inserted into the attachment mechanism 120. The cartridge sealing portion 138 ensures that the liquid or solution is contained within the cartridge 150 during the mixing process.

[0061] As shown in FIG. 4C, the cartridge 150 may be pressed into the attachment mechanism 120, thereby engaging the engagement assembly 122 and pressing the cartridge 150 into the locked position. As the cartridge 150 is engaged with the engagement assembly 122, the opening structure 140 of the piercing portion 124 pierces the opening and the cover 160 on the pod 152, thereby releasing the contents of the cartridge 150 into the container 110. Additionally, as the cartridge 150 is engaged with the engagement assembly 122, the valve assembly 126 is engaged and the valve sealing portion 148 is released from the container 110. The valve 144 opens into the container 110. As the opening 158 and cover 160 are pierced and the

valve 144 opens, the contents of the container 110 and the contents of the cartridge 150 are now able to be mixed together.

[0062] As shown in FIG. 4D, the container 110 may be rotated or shaken to mix the contents of the container 110 and the contents of the cartridge 150. This shaking movement causes the contents to mix together, thereby creating a desired beverage. As shown in FIG. 4E, the beverage is now ready to be consumed.

[0063] Once the beverage is consumed by the user, the cartridge 150 can be released from the attachment mechanism 120 by using the releasing mechanism 136. As shown in FIG. 4F, the releasing mechanism 136 is a rotating bezel, which ejects the cartridge 150 and returns the attachment mechanism 120 to the starting position. The releasing mechanism 136 may also be in the form of a release button or a release lever as explained above. Additionally, without departing from the invention, the cartridge 150 may be released from the attachment mechanism 120 prior the beverage being consumed by the user.

[0064] Prior to mixing the contents of the container and the contents of the cartridge, the user may pour a powder booster or additional ingredients via a packet 151. Examples of the packet 151 are illustrated in FIG. 26. The packet may include any of the following powder boosts or ingredients: electrolytes, energy, calm, protein, fiber, vitamins, antioxidants, sweeteners, or any combination thereof. Additional configurations of the packet 151 or other containers to hold the powder boosts may be utilized without departing from the invention.

[0065] In accordance with this invention, a beverage apparatus or machine may perform the same operation as the container 110 as described above (apparatus not shown). The beverage apparatus may include an attachment mechanism 120 similar to as described above, wherein the cartridge 150 may be inserted into the attachment mechanism 120. Additionally, a glass or cup may be placed under or within the beverage apparatus to hold the desired beverage.

[0066] After the cartridge 150 is inserted into the attachment mechanism 120 of the beverage apparatus, the cartridge 150 may then be pressed into the attachment mechanism 120, thereby pressing the cartridge 150 into the locked position. As the cartridge 150 engages the attachment mechanism, the opening structure 140 pierces the cover 160 on the cartridge 150, thereby releasing the contents of the cartridge

150 into the container 110. As the cover 160 is pierced, a metered amount of water or other liquid from a first source may flush through the cartridge 150. Additionally, a metered amount of water or other liquid from a second source may be flushed directly into the glass. These first and second flushes help to ensure the contents of the cartridge 150 are completely emptied into the glass and that the contents of the cartridge 150 and the water or other liquid are completely mixed as required.

[0067] Additionally, the beverage apparatus may have a mechanical means to rotate or shake the glass to assist with mixing the contents of the container 110 and the contents of the cartridge 150. This shaking movement may cause the contents to mix together, thereby creating the desired beverage. Once the beverage is consumed by the user, the cartridge 150 can be removed from the beverage apparatus.

[0068] FIGS. 5A-8B illustrate additional container configuration according to examples of this invention.

[0069] FIGS. 5A and 5B illustrate a beverage dispensing system 500 with a cartridge 550 located at the top of the container 510. FIGS. 5A and 5B illustrate an example according to this invention similar to that described above in conjunction with FIGS. 1 through 4F (the same or similar reference numbers are used in FIGS. 5A and 5B as those used in FIGS. 1 through 4F to denote the same or similar parts). In another example in accordance with this invention, as shown in FIG. 5A, the beverage dispensing system 500 is generally comprised of a container 510, an attachment mechanism 520, and a cartridge 550. The container 510 may hold a mixing solution or liquid, such as water, to be mixed with the contents of the cartridge 550. The cartridge 550 generally engages with the attachment mechanism 520 to open the cartridge 550 to be dispensed into the container 510, thereby combining the contents of the cartridge 550 with the liquid within the container 510 to create a drinkable beverage.

[0070] In this example configuration, the attachment mechanism 520 is located at the top of the container 510, such that the cartridge 550 is inserted into the attachment mechanism 520 at the top of the container 510. Additionally, the container 510 may include an area located around the cartridge 550, such that when the cartridge 550 is

attached to the container 510, the user can drink from the container 510. The container 510 may include an open area around the cartridge 550 for drinking. Additionally, a release mechanism may be located on a side of the container 510. The release mechanism may be in the form of a release button or a release lever, wherein the user may press the release button or slide the release lever to release the cartridge. The attachment mechanism 520 and the cartridge 550 may be any of the configurations as described in this application without departing from the invention.

[0071] FIGS. 6A and 6B illustrate a beverage dispensing system 600 with a cartridge 650 located at the top of the container 610 at an angle. FIGS. 6A and 6B illustrate an example according to this invention similar to that described above in conjunction with FIGS. 1 through 4F (the same or similar reference numbers are used in FIGS. 6A and 6B as those used in FIGS. 1 through 4F to denote the same or similar parts). In another example in accordance with this invention, as shown in FIGS. 6A and 6B, the beverage dispensing system 600 is generally comprised of a container 610, an attachment mechanism 620, and a cartridge 650. The container 610 may hold a mixing solution or liquid, such as water, to be mixed with the contents of the cartridge 650. The cartridge 650 generally engages with the attachment mechanism 620 to open the cartridge 650 to be dispensed into the container 610, thereby combining the contents of the cartridge 650 with the liquid within the container 610 to create a drinkable beverage.

[0072] In this example configuration, the attachment mechanism 620 is located at the top of the container 610 at an angle, such that the cartridge 650 is inserted into the attachment mechanism 620 at the top angle of the container 610. Additionally, the container 610 may include a drinking spout 616 located adjacent to the cartridge 650, such that when the cartridge 650 is attached to the container 610, the user can drink from the container 610 out of the drinking spout 616. Additionally, a release mechanism 636 may be located on a side of the container 610. The release mechanism 636 may be in the form of a release button or a release lever, wherein the user may press the release button or slide the release lever to release the cartridge 650. The attachment mechanism 620 and the cartridge 650 may be any of the configurations as described in this application without departing from the invention.

- [0073] FIGS. 7A and 7B illustrate a beverage dispensing system 700 with a container 710 with a hinge 717 and a cartridge 750 located in middle of the container 710. FIGS. 7A and 7B illustrate an example according to this invention similar to that described above in conjunction with FIGS. 1 through 4F (the same or similar reference numbers are used in FIGS. 7A and 7B as those used in FIGS. 1 through 4F to denote the same or similar parts). In another example in accordance with this invention, as shown in FIGS. 7A and 7B, the beverage dispensing system 700 is generally comprised of a container 710, an attachment mechanism 720, and a cartridge 750. The container 710 may hold a mixing solution or liquid, such as water, to be mixed with the contents of the cartridge. The cartridge generally engages with the attachment mechanism to open the cartridge 750 to be dispensed into the container 710, thereby combining the contents of the cartridge 750 with the liquid within the container 710 to create a drinkable beverage.
- [0074] In this example configuration, the container 710 may have a hinged portion 717, such as a top portion 718 of the container 710, wherein the top portion 718 swings to an open position, as illustrated in FIG. 7B. When the top portion 718 is in the open position, the cartridge 750 can be inserted into the attachment mechanism 720. The attachment mechanism 720 may be located in the middle area of the container 710, such that the cartridge 750 is inserted into the attachment mechanism 720 when the top portion 718 is in the open position. After the cartridge 750 is inserted, the top portion 718 may swing back to a closed position, as illustrated in FIG. 7A. When the top portion 718 is in the closed position, the beverage may be mixed and the user may drink from the container 710. Additionally, the container 710 may include a drinking spout 716 located at the top of the container 710. Additionally, a release mechanism may be located on a side of the container 710. The release mechanism may be in the form of a release button or a release lever, wherein the user may press the release button or slide the release lever to release the cartridge 750. The attachment mechanism 720 and the cartridge 750 may be any of the configurations as described in this application without departing from the invention.
- [0075] FIGS. 8A and 8B illustrate a beverage dispensing system 800 with a container 810 with a hinge 817 and a cartridge 850 located in the hinged portion 818 of the container 810. FIGS. 8A and 8B illustrate an example according to this invention similar to that described above in conjunction with FIGS. 1 through 4F (the same or

similar reference numbers are used in FIGS. 8A and 8B as those used in FIGS. 1 through 4F to denote the same or similar parts). In another example in accordance with this invention, as shown in FIGS. 8A and 8B, the beverage dispensing system 800 is generally comprised of a container 810, an attachment mechanism 820, and a cartridge 850. The container 810 may hold a mixing solution or liquid, such as water, to be mixed with the contents of the cartridge 850. The cartridge 850 generally engages with the attachment mechanism 820 to open the cartridge 850 to be dispensed into the container 810, thereby combining the contents of the cartridge 850 with the liquid within the container 810 to create a drinkable beverage.

[0076] In this example configuration, the container 810 may have a hinged portion 817, such as a lid 818 on the container 810, wherein the lid 818 swings to an open position, as illustrated in FIG. 8B. The lid 818 may include the attachment mechanism 820 located at the top of the container 810. The cartridge 850 may be inserted into the attachment mechanism 820 when the lid 818 is in the open position. After the cartridge 850 is inserted, the lid 818 may swing back to a closed position, as illustrated in FIG. 8A. When the lid 818 is in the closed position, the beverage may be mixed and the user may drink from the container 810. Additionally, the container 810 may include a drinking area located at the top of the container 810 around the cartridge 850. Additionally, a user may drink from the container 810 when the lid 818 is in the open position. A release mechanism may be located on a top side of the container 810. The release mechanism may be in the form of a release button or a release lever, wherein the user may press the release button or slide the release lever to release the cartridge 850. The attachment mechanism 820 and the cartridge 850 may be any of the configurations as described in this application without departing from the invention.

[0077] Additional container configurations may be utilized without departing from this invention. Containers such as: multi-serve containers which may hold multiple cartridges or bigger cartridges; containers to hold liquid food, such as soup; containers which can be used as a glass by removing the upper portion which contains the attachment mechanism; containers for use in a car or in a sports environment which may have a sports closure, such as a push/pull drinking spout; containers for use in airline flights such that the cartridges and water are used to supply drinks to the passengers; containers which may contain medicated drinks such as an aspirin or

prescription drugs; containers which may fit within a refrigerator that has a tap dispenser and a top that contains the attachment mechanism; containers that may be hand-held; and containers which are much larger that may be located on a counter or shelf, either in a store environment or in a home, to name a few. Again, the teachings and principles of the invention may be applied to any container configuration without departing from the invention.

[0078] FIGS. 9A through 13B illustrate additional attachment mechanism configurations according to examples of this invention.

[0079] FIGS. 9A and 9B illustrate an attachment mechanism 920 with a paddle-type valve assembly 926. FIGS. 9A and 9B illustrate an example according to this invention similar to that described above in conjunction with FIGS. 1 through 4F (the same or similar reference numbers are used in FIGS. 9A and 9B as those used in FIGS. 1 through 4F to denote the same or similar parts). In another example in accordance with this invention, as shown in FIGS. 9A and 9B, the attachment mechanism 920 is generally comprised of an engagement assembly 922, a piercing portion 924, and a valve assembly 926. The engagement assembly 922 may generally receive the cartridge 950 within the attachment mechanism 920. The piercing portion 924 may generally pierce the cartridge 950, thereby releasing the contents of the cartridge 950 into the container 910. The valve assembly 926 may generally open upon engagement of the cartridge 950 with the attachment mechanism 920 thereby allowing the mixing of the contents of the container 910 with the contents of the cartridge 950.

[0080] In this example configuration, the attachment mechanism 920 requires a two-part action to attach the cartridge 950 and open the cartridge 950. First, as shown in FIG. 9A, the cartridge 950 is attached to the engagement assembly 922, wherein the engagement assembly 922 includes a latching structure 928 and a spring 932 to hold the cartridge 950 in a locked position. Once the cartridge 950 is in a locked position, as shown in FIG. 9B, the engagement assembly 922 may be twisted. As the engagement assembly 922 is twisted, the twisting action causes a cam 945 within the valve assembly 926 to rotate a valve 944 in the valve assembly 926 upward into the opening of the cartridge 950, thereby piercing the cover 960. With the valve 944 rotating upward, the valve 944 may also, simultaneously, open the container 910 to the cartridge 950 so that the contents of the container 910 and the

contents of the cartridge 950 can mix. The container 910 and cartridges 950 may be any of the configurations as described in this application without departing from the invention.

[0081] As illustrated in FIGS. 10A and 10B, in a similar configuration to the paddle-type valve assembly 1026 as described above, the attachment mechanism 1020 may be rotated to uncover a hole or a plurality of holes 1021, 1023 if more than one cartridge is used. As shown in FIGS. 10A and 10B, two cartridges 1050A, 1050B are attached to the attachment mechanism 1020 with two holes 1021, 1023 located in the attachment mechanism 1020. The rotation of the attachment mechanism 1020 may enable the mixing of the contents of the container 1010 with the contents of the pod or pods 1050A, 1050B. The attachment mechanism 1020, the container 1010, and the cartridges 1050A, 1050B may be any of the configurations as described in this application without departing from the invention.

[0082] FIGS. 11A and 11B illustrate an attachment mechanism with a piston-type attachment mechanism 1120. FIGS. 11A and 11B illustrate an example according to this invention similar to that described above in conjunction with FIGS. 1 through 4F (the same or similar reference numbers are used in FIGS. 11A and 11B as those used in FIGS. 1 through 4F to denote the same or similar parts). In another example in accordance with this invention, as shown in FIGS. 11A and 11B, the attachment mechanism 1120 is generally comprised of an engagement assembly, a crushing portion, and a valve assembly. The engagement assembly may generally receive the cartridge 1150 within the attachment mechanism. The crushing portion may generally open the cartridge 1150, thereby releasing the contents of the cartridge 1150 into the container. The valve assembly may generally open upon engagement of the cartridge 1150 with the attachment mechanism 1120 thereby allowing the mixing of the contents of the container with the contents of the cartridge 1150.

[0083] In this example configuration, the engagement assembly may include a piston 1122. The attachment mechanism may also include a base 1124 wherein the crushing portion and the valve assembly may be contained. A cartridge 1150 is placed within an opening 1129 in the piston 1122, wherein the opening 1129 is located on the side of the piston 1122. The piston 1122 may then be pushed such that the cartridge 1150 is crushed or squeezed against the base 1124. As the piston 1122 is moved against the base 1124, a valve 1126 opens to the container, thereby allowing

the contents of the container and the contents of the cartridge to mix. Additionally, as the piston 1122 is moved against the base 1124, the cartridge 1150 is crushed or squeezed, thereby causing the cover 1160 to open and discharge the contents of the cartridge 1150 into the container. The container and the cartridge 1150 may be any of the configurations as described in this application without departing from the invention.

[0084] FIGS. 12A and 12B illustrate an attachment mechanism with a rotating cam type attachment mechanism 1220. FIGS. 12A and 12B illustrate an example according to this invention similar to that described above in conjunction with FIGS. 1 through 4F (the same or similar reference numbers are used in FIGS. 12A and 12B as those used in FIGS. 1 through 4F to denote the same or similar parts). In another example in accordance with this invention, as shown in FIGS. 12A and 12B, the attachment mechanism 1220 is generally comprised of an engagement assembly, a crushing portion, and a valve assembly. The engagement assembly may generally receive the cartridge 1250 within the attachment mechanism. The crushing portion may generally open the cartridge, thereby releasing the contents of the cartridge 1250 into the container. The valve assembly may generally open upon engagement of the cartridge 1250 with the attachment mechanism 1220 thereby allowing the mixing of the contents of the container with the contents of the cartridge 1250.

[0085] In this example configuration, the engagement assembly may include a cam assembly 1222 and a base 1224. The cam assembly 1222 may also include two cams 1229. The cartridge 1250 may be inserted in between the two cams 1229 through the top of the attachment mechanism 1220. The two cams 1229 may be attached to the cam assembly 1222, such that as the base 1224 and cam assembly 1222 is rotated, the cams 1229 press inward. As the cams 1229 press inward the cams 1229 crush or squeeze the cartridge 1250 within the cams 1229, thereby causing the cover of the cartridge 1250 to open and discharge the contents of the cartridge 1250 into the container. The container and the cartridge 1250 may be any of the configurations as described in this application without departing from the invention.

[0086] FIGS. 13A and 13B illustrate an attachment mechanism with a plunger-type attachment mechanism 1320. FIGS. 13A and 13B illustrate an example according to this invention similar to that described above in conjunction with FIGS. 1 through

4F (the same or similar reference numbers are used in FIGS. 13A and 13B as those used in FIGS. 1 through 4F to denote the same or similar parts). In another example in accordance with this invention, as shown in FIGS. 13A and 13B, the attachment mechanism 1320 is generally comprised of an engagement assembly, a crushing portion, and a valve assembly. The engagement assembly may generally receive the cartridge 1350 within the attachment mechanism. The crushing portion may generally open the cartridge 1350, thereby releasing the contents of the cartridge 1350 into the container. The valve assembly may generally open upon engagement of the cartridge 1350 with the attachment mechanism thereby allowing the mixing of the contents of the container with the contents of the cartridge 1350.

[0087] In this example configuration, the engagement assembly may include a plunger 1322. The attachment mechanism 1320 may also include a base 1324 wherein the crushing portion and the valve assembly may be contained. A cartridge 1350 is placed in the top of the base 1324. The plunger 1322 may then be pushed such that the cartridge 1350 is crushed or squeezed between the plunger 1322 and the base 1324 of the attachment mechanism 1320. As the plunger 1322 is moved against the base 1324 of the attachment mechanism 1320, a valve 1326 may open to the container, thereby allowing the contents of the container and the contents of the cartridge 1350 to mix. As the plunger 1322 is moved against the base 1324 of the attachment mechanism 1320, the cartridge 1350 is crushed or squeezed, thereby causing the cover to open and discharge the contents of the cartridge 1350 into the container. Additionally, the plunger 1322 may contain a piercing needle (not shown) wherein the piercing needle pierces the cartridge 1350 as the plunger 1322 is pushed into the base 1324 of the attachment mechanism 1320. The container and the cartridge 1350 may be any of the configurations as described in this application without departing from the invention.

[0088] Additional attachment mechanisms may be utilized without departing from this invention. Attachment mechanism such as: threaded connections between the container and the attachment mechanism instead of the snap feature as described above; quarter-turn connections between the container and the attachment mechanism instead of the snap feature as described above; a hand-tool 240 similar to a nut-cracker which holds a cartridge and can pierce and open the cartridge by

use of the hand-tool 240 and thus pouring the contents of the cartridge into a glass 242 (as shown in FIG. 24).

[0089] FIGS. 14A through 14C illustrate additional cartridge configurations according to examples of this invention. As illustrated in FIGS. 14A through 14C, in another example cartridge configuration, the cartridge 1450 may be comprised of multiple pods. As illustrated in FIGS. 14A and 14B, the cartridge may comprise two half pods 1450A, 1450B, wherein each of the half pods 1450A, 1450B can be combined to make one singular pod 1450. The contents of each pod 1450A, 1450B may then be mixed with water or other liquid to form the desired beverage. Each half pod 1450A, 1450B may contain syrup, paste, powder, granules or other compositions that when mixed with water or other liquids will result in a beverage. In an alternative aspect of the invention, the half pod 1450A, 1450B may contain an energy boost, nutrients, or vitamin supplement that can be added to the beverage. The two half pods 1450A, 1450B may be inserted into an attachment mechanism 1420 located at the bottom of a container 1410 as shown in FIG. 14C. Alternatively, the cartridge 1450 may include three or more pods.

[0090] In another example cartridge configuration, the beverage dispensing system may include multiple attachment mechanisms, piercing portions, and valve assemblies, such that multiple cartridges may be inserted for a single container or beverage dispensing system. The contents of each cartridge may then be mixed with water or other liquids to form the desired beverage. Each cartridge may contain syrup, paste, powder, granules or other compositions that when mixed with water or other liquids will result in a beverage. In an alternative aspect of the invention, one or more of the cartridges may contain an energy boost or vitamin supplement that can be added to the beverage. Additionally, one or more of the cartridges may be a different size, such as smaller or larger, than the other cartridges.

[0091] In another example cartridge configuration, the cartridge may be comprised of multiple chambers each containing the same or different beverage-making component. Multiple chambers may be beneficial when there are unstable ingredients that must remain separate as part of the beverage. The contents of each chamber may then be mixed with water or other liquids to form the desired beverage. Each chamber may contain syrup, paste, powder, granules or other compositions that when mixed with water or other liquids will result in a beverage.

In an alternative aspect of the invention, one of the chambers may contain an energy boost or vitamin supplement that can be added to the beverage.

[0092] In another example in accordance with this invention, a beverage dispensing system is directed at a single-serve beverage dispensing system. The beverage dispensing system is directed to overcome the drawbacks and problems with existing beverage dispensing or delivery systems. A single-serve beverage dispensing system is disclosed in FIGS. 15-18C. As illustrated by FIGS. 15-18C, the single-serve beverage dispensing system dispenses a metered amount of water or other liquid through a syrup-containing cartridge having the proper amount of syrup to create a single-serve beverage, for example, a soft drink. As illustrated by FIGS. 15-17, the beverage dispensing system of the invention permits a consumer in a retail environment or at home to create a single-serve beverage by selecting a cartridge containing the desired beverage ingredients and placing the cartridge into the beverage dispensing system. The consumer then presses a button which activates the beverage mixing operation of the system. Once activated, a needle operatively connected to a water or other liquid supply will drop down and puncture the cartridge through the top and bottom of the cartridge. For a predetermined period of time, the needle will remain in and partially extending through the cartridge. While the needle is positioned in the cartridge, water or other liquids are directed to the needle and allowed to pass through an opening in the end of the needle and through a plurality of apertures positioned around the periphery of the needle. The water or other liquids passing through the plurality of apertures will enter the cartridge and mix with the syrup contained in the cartridge. Once mixed, the beverage will pass through the punctured opening created in the bottom of the cartridge and drop into a cup positioned beneath the cartridge. Water or other liquids will additionally flow out through the opening in the end of the needle to further create the proper consistency and flavor of the beverage. After the beverage has been dispensed into the cup, the consumer may remove the cup and enjoy the beverage. The used cartridge may then be discarded.

[0093] More specifically, and referring to FIGS. 15-17, in an exemplary embodiment, the beverage system 1508 includes a dispenser housing 1510 that includes openings 1512 and 1514 formed in the housing. Opening 1512 is sized and shaped to receive a beverage cup 1513 for receiving and containing the created beverage dispensed

from the beverage system. Opening 1514 is sized and shaped to receive a cartridge 1516 that contains syrup, which is mixed with water or other liquids to make the beverage. The opening 1514 and cartridge 1516 define a mating configuration in that the cartridge 1516 is shaped to match the shape of the opening 1514, and vice versa. With this configuration, only cartridges having a shape that matches the shape of the opening 1514 can be inserted into the opening 1514, thereby preventing undesirable or non-matching cartridges or containers from being used with the beverage system. The beverage system further includes a button or switch 1520 that a consumer presses to activate the beverage system.

[0094] Positioned within the housing 1510 is a water (or other liquid) supply system that includes a water supply line 1521 operatively connected at one end to a water source, and at an opposing end to a needle 1523. The water (or other liquid) source may be either carbonated or non-carbonated water, or may be any other suitable liquid that can be mixed with the syrup contained within the cartridge. As illustrated in FIG. 25, the needle 1523 defines a pointed or sharp open end 1525 that as explained above is used to puncture the cartridge 1516. The needle 1523 further defines an elongated tube-like body 1527 that further defines a plurality of apertures 1529 positioned around the periphery of the tube body 1527 of the needle 1523. Once positioned within the cartridge 1516, the apertures 1529 permit water or other liquids traveling through the tube body 1527 to pass into the cartridge 1516 to mix with syrup contained within the cartridge 1516. As should be understood, the needle 1523 may define numerous other configurations that permit the puncturing of the cartridge 1516 and passing of water or other liquids into the cartridge 1516.

[0095] The cartridge 1516 may define a single chamber, or may define multiple chambers each containing the same or different beverage-making component. The contents of each chamber may then be mixed with water or other liquid to form the desired beverage. Each chamber may contain syrup, paste, powder, granules or other compositions that when mixed with water or other liquids will result in a beverage. In an alternative aspect of the invention, the cartridge may contain an energy boost or vitamin supplement that can be added to the beverage.

[0096] As illustrated in FIG. 16, the cartridge may define a dome-shaped configuration made of a plastic material. The dome shape creates the one or more chambers within the cartridge. Aluminum foil 1524 or a similar sealing material may be

positioned across the cartridge to seal the contents within the cartridge. The aluminum foil may include product information or other indicia printed thereon, or may contain instructions as to how to use the cartridge and/or beverage system. The use of aluminum foil and plastic with the cartridge permits the needle to easily penetrate and puncture the foil and plastic. It should be understood that numerous other shapes and configurations of the cartridge are possible and that the depicted dome shape is merely exemplary of the numerous alternative configurations.

[0097] Referring to FIGS. 18A through 18C, the beverage system 1508 may also include a housing 1528 containing numerous cartridges each containing a different beverage flavor or ingredient giving the consumer numerous choices for a beverage, unlike the limited options with existing beverage systems. In one embodiment, the cartridges may be positioned in an array with the product information relating to the cartridge readily visible to the consumer, the array creating an aesthetically pleasing consumer impression. The housing may contain various eye-catching colors and advertisements to attract the attention of the consumers. The beverage system 1508 may also include a cup-holding housing 1530 that contains numerous stacked cups 1513 that are also readily accessible to a consumer. The housing 1530 may include one or more cup-holding openings 1534 to accommodate multiple sized cups. The beverage housings 1510, 1528 and 1530 are all modular to provide flexibility in placing the beverage system within a retail store environment to enhance the visibility of the system, and are sufficiently lightweight and compact to permit each to sit on top of a counter within the store, or at any other desired location within the store.

[0098] Referring to FIGS. 19A-23, the beverage system may be packaged in numerous configurations. FIG. 19A depicts a beverage system 1540A that may be used at home where a cartridge may be placed within the opening 1542A and upon pressing the dispensing button 1544A, water or other liquids stored within water housing 1546A mixes with the contents of the cartridge, similar to the manner described above, to make the desired beverage. FIG. 19B illustrates a similar beverage system 1540B that may be used at home, a small bar, and/or a restaurant where a cartridge or pod 1548B may be placed on the top of the system 1540B. Upon pressing a dispensing button 1544B, water or other liquids stored within or connected to the housing 1546B mixes with the contents of the cartridge 1550 or pod, similar to the

manner described above to make the desired beverage. FIG. 20 depicts yet another beverage system 1550 that operates in the same manner as described herein but utilizes large water containers 1552, similar to those used in drinking coolers. Still other packaging options are possible with the invention.

[0099] Referring to FIGS. 21-23, the beverage system 1560 may be configured with a refrigerator 1562. The beverage system 1560 may be mounted in or to the refrigerator, or attached as a stand-alone unit to the refrigerator. If the beverage system 1560 is mounted in or to the refrigerator, the system 1560 may be accessible from the exterior of the refrigerator (FIGS. 21 and 23) or may be accessible from the interior of the refrigerator (FIG. 22). As illustrated in FIG. 22, the beverage system may be mounted within a compartment located within the refrigerator. As illustrated in FIG. 23, the beverage systems may be incorporated with the ice/water dispensing system of the refrigerator. With each of these alternative embodiments, the beverage system 1560 may be attached to the drinking water supply of the refrigerator. If the beverage system 1560 is attached to the refrigerator as a stand-alone unit, it may be connected to the drinking water supply of the refrigerator. As with the other embodiments described herein, the cartridge 1570 may be placed within an opening 1564 and upon pressing the dispensing button, water from refrigerator 1562 mixes with the contents of the cartridge, similar to the manner described above, to make the desired beverage, which will then be dispensed into a cup 1574.

[00100] Referring to FIGS. 27A-27C, in accordance with this invention, the cartridges or pods 150 as described above may contain a unique identifier. The unique identifier may consist of a bar code 153A, serial characters 153B, RFID tag, near-field communication device, or a device or system similar wherein a user could enter, scan, or read to track the beverage characteristics of the cartridge 150 they just consumed. The beverage characteristics may then be tracked and captured for the user. The beverage characteristics that may be tracked could include: flavor, nutritional content (such as calories, carbohydrates, water intake, sodium), functional ingredients, favorite beverages, plastic bottles “saved”, location or time of day consumed, carbon footprint account, or other information such as the delivery of specific medicines. Additionally, instead of the user entering the unique identifier, the user could capture the unique identifier via a camera 159. An

example bar code identifier 153A on a cartridge 150 is illustrated in FIG. 27A. An example serial character identifier 153B on the cartridge 150 is illustrated in FIG. 27B. The information linked to the bar code 153A and/or serial character 153B could then be uploaded to a personal website 190 linked to the beverage system and the user.

[00101] Additionally, in accordance with this invention, as illustrated in FIG. 27C, a container 110 may capture the information linked to the unique identifier 153 on the cartridge 150 described above. The container 110 may include a capture device 155 that reads the unique identifier 153. Specifically, the capture device 155 may consist of a memory chip to store the information from the bar code 153A or serial characters 153B on the individual cartridges 150. Alternatively, the capture device 155 may include a scanning device to scan the bar code 153A or serial characters 153B on the individual cartridges 150. The capture device 155 may also include an RFID tag reader or a near-field communication device. The memory chip or scanning device may then store the information for future upload. The upload from the container or memory chip may be done through a wireless means, such as a wireless network. This information could then be uploaded to a personal website 190 linked to the beverage system and the user. The capture device 155 may be included within the container 110, the cap 112, the attachment mechanism 120, the engagement assembly 122, or any other portion of the container 110 without departing from this invention.

[00102] For example, a user may select a given flavor or beverage cartridge 150 and connect the cartridge 150 to the container 110 as described above in any of the various embodiments of the cartridge and container. When the cartridge 150 is locked into the container 110, the capture device 155 on the container 110 may scan or read the bar code 153A or the serial character 153B on the cartridge 150. Additionally, without departing from this invention, the cartridge 150 may be positioned within the container 110 such that the bar code 153A, the serial character 153B, or RFID tag is located in the correct location for scanning and reading by the capture device 155 on the container 110. After the capture device 155 scans or reads the bar code 153A or serial character 153B, the unique information 157 linked to the selected flavor or cartridge 150 may be maintained within the container memory chip. When the user wants to download the information 157, the user may “connect” the

container 110 to a computing device 180. The user may connect the container 110 via a wired connection or a wireless connection, such as wireless network, cellular network, wi-fi, Bluetooth, or any other similar wireless-type connection. The container 110 may connect to any computing device 180 that may include, but is not limited to, a cell phone 181, a laptop computer 182, a desktop computer 184, a smart phone 183, etc. Once the container 110 is connected to the computing device 180, the user may then download that unique information 157 (such as flavor, nutritional content, or functional ingredients, etc.) that was stored from the selected beverage cartridge 150. The user may also download any other sets of unique information 157 saved in the memory chip of the container 110 from previous uses and previously used beverage cartridges 150. This information 157 may then be uploaded to a personal website 190 linked to the beverage system and the user.

[00103] Furthermore, in accordance with this invention, the information 157 uploaded from the unique identifiers 153 on the individual beverage cartridges 150 may be used with online applications. These online applications may be included on such devices or locations such as on smart phones, cell phones, personal websites, company websites, beverage system websites, gaming or social networks, etc. The use of such information 157 may be used with an online application for such functions such as tracking water consumed throughout the day, tracking nutrients and/or nutraceuticals consumed, tracking the amount of PET equivalent saved with using the beverage system instead of other drinking methods, tracking of medicine consumption that could be shared with a third party (such as a doctor), updating loyalty programs with points or reward prizes, providing the information sharing with friends or similar people through gaming or social networks, tracking time of day, or tracking geolocation of consumption. Furthermore, additional types of uses that the information could have on an online environment may include games and virtual pets for kids as rewards are granted for drinking healthy beverage options, or applications for carbon footprint tracking, or nutrient consumption for seniors, etc.

[00104] FIGS. 28A and 28B illustrate a beverage system in operation that communicates and transfers the information 157 as described above. FIG. 28A illustrates steps 1 through 3, while FIG. 28B illustrates steps 3 through 5, with step 3 being repeated for illustrative purposes only. As illustrated in FIG. 28A, in step 1, a cartridge 150

includes a unique identifier in the form of a bar code 153A. The cartridge 150 is configured to fit or be connected to a container 110. In step 2, the user inserts the cartridge 150 into the container 110 and the user may then mix and consume the beverage. Following step 2, the user may then track the information from the beverage and the user may do this in one of at least three different ways as illustrated in step 3 in FIG. 28A. First, the user may manually enter the bar code identifier 153A (or serial character identifier 153B, or RFID tag) into a system as was described above. Second, the user may capture the bar code identifier 153A (or serial character identifier 153B or RFID tag) with a camera 159 as was described above. Third, a capture device 155 with the container 110 may scan the bar code identifier 153A or read the bar code identifier 153A. The capture device 155 may read the information 157 from the bar code identifier 153A and/or the cartridge 150.

[00105] As illustrated in FIG. 28B, following step 3, in step 4, the information 157 from the bar code identifier 153A and/or the cartridge 150 is then transmitted or transferred to a computing device 180 or network device. The information 157 may be transmitted over a wired connection. Additionally, as was discussed above, this information 157 may be transmitted wirelessly via any means known and used in the art to transfer information, such as a wireless network, cellular network, Wi-Fi, Bluetooth, or any other similar wireless-type connection. The computing device 180 may include, but is not limited to, a cell phone 181, a laptop computer 182, a personal data assistant (PDA)/smart phone 183, a desktop computer 184, or the internet 185, etc. In step 5, the computing device 180 may consolidate or store this information 157 to be uploaded to a personal website 190 linked to the beverage system and the user, a beverage system website 191 linked to the user with user preferences, or a social network site 192 linked to the beverage system and the user. Online applications may be available on the computing device 180, the personal website 190, the beverage system website 191, and/or the social networking website 192. As discussed above, the online applications may include such functions as tracking water consumed throughout the day, tracking nutrients and/or nutraceuticals consumed, tracking the amount of PET equivalent saved with using the beverage system instead of other drinking methods, tracking of medicine consumption that could be shared with a third party (such as a doctor), updating loyalty programs with points or reward prizes, providing the information sharing

with friends or similar people, tracking time of day, or tracking geolocation of consumption. Furthermore, additional types of uses that the information could have on an online environment may include games and virtual pets for kids as rewards are granted for drinking healthy beverage options, or applications for carbon footprint tracking, or nutrient consumption for seniors, etc. Additionally, the online applications may include tracking favorite beverages, consumption competitions, collecting or providing information for consumer and/or marketing research, or users recommending other beverages or flavors that other users might like.

[00106] FIGS. 29A-30 illustrate various additional examples of beverage systems in accordance with the present invention. Referring to FIGS. 29A-29C, a beverage system 1600 may be configured to be used with a container, such as a tumbler style glass 1610. FIGS. 29A-29C illustrate an example according to this invention similar to that described above in conjunction with FIGS. 1 through 4F (the same or similar reference numbers are used in FIGS. 29A-29C as those used in FIGS. 1 through 4F to denote the same or similar parts). The beverage system 1600 illustrated in FIGS. 29A-29C includes an attachment mechanism 1620. The attachment mechanism 1620 may comprise an engagement assembly 1622 and a piercing portion 1624. The engagement assembly 1622 may generally receive the cartridge 1650 within the attachment mechanism 1620. The piercing portion 1624 may generally pierce the cartridge 1650, thereby releasing the contents of the cartridge 1650 into the glass 1610 and allowing the mixing of the contents of the glass 1610 with the contents of the cartridge 1650. The glass 1610 and the cartridge 1650 may be any of the configurations as described in this application without departing from the invention.

[00107] As illustrated in FIG. 29A, a user may place the attachment mechanism 1620 on top of the glass 1610. The attachment mechanism 1620 may be sized to fit on top of multiple sized glasses 1610 or containers. As further illustrated in FIG. 29B, the user may then place the cartridge onto the attachment mechanism 1620, wherein the cartridge 1650 is engaged by the engagement assembly 1622 of the attachment mechanism 1620. The user may then press or place a force against the cartridge 1650, thereby pressing the cartridge 1650 against the piercing portion 1624. The piercing portion 1624 pierces the cartridge 1650, thereby releasing the contents of

the cartridge 1650 into the glass 1650. As finally illustrated in FIG. 29C, the user may then shake the glass 1610 to mix the contents of the glass 1610 and the contents of the cartridge 1650.

[00108] FIG. 30 depicts a beverage system 1700 that may be configured to dispense and make smoothies and/or frozen beverages. Similar to the description above for FIGS. 18-23, a cartridge 1750 may be placed into the beverage system 1740. While the cartridge 1750 is placed into the front of the beverage system 1700 illustrated in FIG. 30, the cartridge 1750 may be placed at any location within the beverage system 1700 without departing from this invention. Upon pressing a dispensing button 1744 on the front of the beverage system 1700, a frozen mixer may be dispensed. The frozen mixer may take the form of ice, slush, or ice/water mixture, etc. The frozen mixer, which may be stored and/or formed within the housing 1746, may mix with the contents of the cartridge 1750, similar to the manner described above, to make the desired smoothie or frozen drink.

[00109] FIG. 32A illustrates an example of a beverage dispensing system 3100 in accordance with the present disclosure. The beverage dispensing system 3100 includes a container 3110, an attachment mechanism 3120, and a cartridge 3150. The container 3110 may hold a mixing solution or liquid, such as water, to be mixed with the contents of the cartridge 3150. Other mixing solutions or liquids may include milk, juices, or tea. The mixing solution or liquid may be cold, warm, or hot in temperature. Additionally, the mixing solution may contain ice, slush, or an ice/water mixture. The attachment mechanism 3120 is generally located within the container 3110. The cartridge 3150 generally engages with the attachment mechanism 3120 to open the cartridge 3150 to be dispensed into the container 3110, thereby combining the contents of the cartridge 3150 with the liquid within the container 3110 to create a drinkable beverage.

[00110] The container 3110, as illustrated in FIG. 32A, may be generally in the shape of a bottle. The container 3110 may be a variety of other shapes, without departing from this invention. The container 3110 may include a cap 3112. The cap 3112 may seal an opening at the top of the container 3110 where a user can drink from the container 3110. Additionally, the container 3110 may include a base or bezel 3114. The cartridge 3150 may be inserted through the base or bezel 3114 to engage the

cartridge 3150 with the attachment mechanism 3120. As illustrated in FIG. 32A, this base or bezel 3114 is located at the bottom of the container 3110.

- [00111] The attachment mechanism 3120, as illustrated in FIGS. 32A and 32B, comprises an engagement assembly 3122, a piercing portion 3124, and a valve assembly 3126. The engagement assembly 3122 may generally receive the cartridge 3150 within the attachment mechanism 3120. The piercing portion 3124 may generally pierce the cartridge 3150, thereby releasing the contents of the cartridge 3150 into the container 3110. The valve assembly 3126 may generally open upon engagement of the cartridge 3150 with the attachment mechanism 3120 thereby allowing the mixing of the contents of the container 3110 with the contents of the cartridge 3150.
- [00112] The engagement assembly 3122 may include a locking mechanism 3128 to engage and hold the cartridge 3150 in the container 3110. The locking mechanism 3128 may include a rib 3130 which matches with and engages the cartridge 3150. The locking mechanism 3128 may also include a main spring 3131 located around the elevator. The main spring 3131 may be in the form of a torsion spring or any other spring structure capable of providing a biasing force. The main spring 3131 may provide a biasing force to the cartridge 3150 to more easily engage the rib 3130 when the cartridge 3150 is inserted into the engagement assembly 3122. The main spring 3131 may also eject the cartridge 3150 and reset the attachment mechanism 3120. Additionally, the locking mechanism 3128 may include a cam or a lever 3134 such that when the cartridge 3150 is snapped into a locked position, the piercing portion 3124 and valve assembly 3126 are engaged as will be explained below. The main spring 3131 may also bias against the cartridge 3150 as the cartridge 3150 is snapped into the locked position.
- [00113] Additionally, the engagement assembly 3122 may include a release ring 3136 wherein the release ring 3136 releases the locking mechanism 3128 to release the cartridge 3150 from the container 3110. The release ring 3136 may be in the form of a rotating bezel, wherein the user can release the cartridge 3150 by rotating the bezel (as shown in FIG. 4F). Rotating the release ring 3136 may eject the cartridge 3150 and return the attachment mechanism 3120 to the starting position. Rotating the release ring 3136 may also release the main spring 3131 thereby providing a biasing force against the cartridge 3150 to eject the cartridge 3150 and resetting the attachment mechanism 3120. Additionally, a release ring spring 3137 may be

located around the elevator 3146 (as will be defined below). The release ring spring 3137 may be in the form of a torsion spring or any other spring structure capable of providing a biasing force. The release ring spring 3137 may reset the release ring 3136 after the release ring is rotated and the cartridge 3150 is ejected.

[00114] The engagement assembly 3122 may also include a cartridge sealing portion 3138. The cartridge sealing portion 3138 seals the area around the top of the cartridge 3150 to the engagement assembly 3122 when the cartridge 3150 is snapped into a locked position. The cartridge sealing portion 3138 ensures that the liquid or solution is contained within the cartridge 3150 during the mixing process. The cartridge sealing portion 3138 maintains a seal between the cartridge 3150 and the container 3110 during the piercing and during container 3110 use. The cartridge sealing portion 3138 may include a gasket, O-ring, or grommet or other sealing structures in accordance with this invention. The cartridge sealing portion 3138 may be made of rubber, plastic, or metal or other materials in accordance with this invention.

[00115] As illustrated in FIG. 32A and 32B, the piercing portion 3124 of the attachment mechanism 3120 may include an opening structure 3140. The piercing portion 3124 may be cooperatively engaged to the cam or lever 3134 such that when the cartridge 3150 is pressed into the engagement assembly 3122, the cartridge 3150 is pressed against the piercing portion 3124, and the piercing portion 3124 slides into an opening 3158 of the pod 3152. The opening structure 3140 may be shaped such that it corresponds specifically with the flaps or retaining portions 3170 on a foil retainer 3166. When the cartridge 3150 is pressed against the piercing portion 3124, the opening structure 3140 puts pressure against the foil retainer 3166, specifically the flaps or retaining portions 3170 on the foil retainer 3166. The pressure from the opening structure 3140 causes the flaps 3170 to break open, and fold into the cover 3160, thereby piercing the cover 3160 on the pod 3152, and allowing the contents of the cartridge 3150 to mix with the contents of the container 3110. It is preferable, but not required, for the shape of the opening structure 3140 to match the shape of the flaps 3170 on the foil retainer 3166 for the opening structure 3140 to adequately pressure and break the foil retainer 3166.

[00116] The valve assembly 3126, as illustrated in FIG. 32B, may generally open upon engagement of the cartridge 3150 with the attachment mechanism 3120 thereby

allowing the mixing of the contents of the container 3110 with the contents of the cartridge 3150. The valve assembly 3126 may include a valve 3144 and an elevator 3146. The valve 3144 may be cooperatively engaged with the elevator 3146 and with the cam or lever 3134 of the engagement assembly 3122, such that when the cartridge 3150 is snapped into the locked position and engages the cam or lever 3134 of the engagement assembly 3122, the valve 3144 is moved from a closed position to an open position. Generally, as pressure is applied to the cartridge 3150 and the cartridge 3150 is snapped into the locked position, the elevator 3146 moves and thereby engages the valve 3144 and moves the valve 3144 to the open position.

[00117] The valve assembly 3126 may also include an elevator seal 3142. The elevator seal 3142 seals the area around opening structure 3140 when the cartridge 3150 is snapped into a locked position. The elevator seal 3142 may prevent liquid from escaping into the attachment mechanism 3120 when the piercing porting 3124 and the elevator 3146 is raised. The elevator seal 3142 ensures that the liquid or solution is contained within the cartridge 3150 during the mixing process. The elevator seal 3142 may include a gasket, O-ring, or grommet or other sealing structures in accordance with this invention. The elevator seal 3142 may be made of rubber, plastic, or metal or other materials in accordance with this invention.

[00118] The valve assembly 3126 may also include a main chamber seal 3148. The main chamber seal 3147 may seal off the main container 3110 and prevent liquid from leaking prior to the cartridge 3150 being engaged. The main chamber seal 3148 seals the area between the valve 3144 and the container 3110 when the cartridge 3150 is not snapped into the locked position. Prior to the engagement of the cartridge 3150 in the engagement assembly 3122, the container 3110 may contain a liquid and the main chamber seal 3148 ensures that the liquid or solution is contained within the container 3110 when there is no cartridge 3150 and the valve 3144 is in the closed position. The main chamber seal 3148 may include a gasket, O-ring, or grommet or other sealing structures in accordance with this invention. The main chamber seal 3148 may be made of rubber, plastic, or metal or other materials in accordance with this invention.

[00119] The cartridge 3150, as illustrated in FIGS. 33A and 33B, may comprise a pod 3152 and a cap 3154. The cartridge 3150 is adapted to engage the attachment mechanism 3120 at the engagement assembly 3122. The cartridge 3150 may hold one or more

beverage ingredients, wherein the beverage ingredients may be selected from the list comprising: syrup, paste, powder, granules, or other compositions. Additionally, the cartridge 3150 may hold other ingredients or flavors, such as nutrients or vitamins, in accordance with this invention.

[00120] The pod 3152 is generally a vessel capable of holding a syrup, paste, powder, granules or other compositions. The pod 3152 as shown in FIGS. 33A and 33B is a circular-shaped structure that includes a chamber 3156, an opening 3158, and a cover 3160. The cover 3160 may be located over the opening 3158 of the pod 3152. An engaging portion 3162 may be located near the opening 3158, wherein the engaging portion 3162 may be a snap structure that engages the cap 3154. Additionally, the engaging portion 3162 on the pod 3152 may include threads that may engage threaded structures on the cap 3154.

[00121] The cover 3160 may be a foil seal located over the opening 3158 of the pod 3152. The cover 3160 may be attached to the edges of the opening 3158 of the pod 3152. The cover 3160 may be made of a variety of different materials in accordance with this invention, such as: aluminum and sealing coatings or laminated with sealing polymers like polyethylene, metalized bioriented polypropylene and sealing coatings or laminated with sealing polymers like polyethylene, or metalized polyester and sealing coatings or laminated with sealing polymers like polyethylene.

[00122] In an additional example in accordance with this invention, the pod 3152 may include a locking portion 3164. The locking portion 164 may be engaged with the engagement assembly 3122 of the attachment mechanism 3120 to assist with snapping the cartridge 3150 into the attachment mechanism 3120.

[00123] The cap 3154 may be attached to the top of the chamber 3156. The cap 3154 may be a snap-on type cap, wherein the cap 3154 may snap onto the top of the chamber 3156. The cap 3154 may also attach to the top of the chamber 3156 by screwing onto the top of the chamber 3156. The cap 3154 may be made of a variety of different materials without departing from this invention, such as: polyethylene, polypropylene, or polyethylene or polypropylene closures with internal liners containing oxygen scavengers like: components of Hyguard™, Celox™, etc.

[00124] The cap 3154 may include a foil retainer 3166. The foil retainer 3166 may be in the shape of a disc located in the center of the cap 3154. The foil retainer 3166 may

include cut-out portions 3168, thereby creating flaps or retaining portions 3170 on the foil retainer 3166 that may break-away with pressure. These flaps 3170 are designed to cooperate specifically with the opening structure 3140 as described above. When the opening structure 3140 is pressed against the flaps 3170 and the flaps 3170 are pressed open, the flaps 3170 may pierce the cover 3160 and fold into the pod 3152, thereby holding the pierced and cut portions of the cover 3160 open so that the contents of the cartridge 3150 can mix freely with the contents of the container 3110. As illustrated in FIGS. 33A and 33B, the cut-out portion 3168 may be in the shape of a cross, thereby creating four triangular flaps 3170. The foil retainer 3166 may be made of a variety of different materials without departing from this invention, such as: polyethylene, polypropylene, or polyethylene or polypropylene closures with internal liners containing oxygen scavengers like: components of Hyguard™, Celox™, or any other material which is flexible enough to break when pressure is applied from the opening structure 3140, and hard enough to cut or pierce the cover 3160 and remain in place, thereby keeping the cover 3160 open.

[00125] In an additional example in accordance with this invention, the cap 3154 may include a locating portion 3172. The locating portion 3172, as illustrated on FIG. 33A, may engage with the engagement assembly 3122 to properly position the cartridge 3150 within the attachment mechanism 3120.

[00126] The pod 3152 may be made of various materials without departing from this invention. For example, the pod 3152 may be made of polyethylene terephthalate (PET). Additionally, the pod 3152 may be made of PET in combination (by mixing and/or by using multi-layer structures) with passive barrier materials and/or oxygen scavengers like: plasma-applied coatings of SiO_x or amorphous carbon, polyamides, polyglycolic acid, Amosorb™, DiamondClear™, or components of Hyguard™. Additionally, the pod 3152 may be made of polyethylene or polypropylene in combination (by mixing and/or by using multilayer structures) with passive barrier materials and/or oxygen scavengers like: polyamides, ethylene vinyl alcohol. Additionally, the pod 3152 may be made of aluminum. Other materials may be used for the pod 3152 in accordance with this invention, such that the material alone or in combination with a barrier system protects some beverages or other products that are oxygen sensitive and to avoid excessive loss of water.

- [00127] FIGS. 34A through 34F illustrate the operation of the beverage dispensing system according to examples of this invention. The preparation of the beverage dispensing system 3100 as described above is shown in FIGS. 34A-34F. As shown in FIG. 34A, the cartridge 3150 is inserted into the attachment mechanism 3120 as located in the base of the container 3110. The cartridge 3150 may be inserted with the cap towards the attachment mechanism 3120.
- [00128] As shown in FIG. 34B, the cartridge 3150 may be rotated to ensure the cartridge 3150 is located in the proper location. The locating portion 3172 located on the cap, engages with the engagement assembly 3122 to properly position the cartridge 3150 within the attachment mechanism 3120. Additionally, the cartridge sealing portion 138 seals the area around the top of the cartridge 3150 to the engagement assembly 3122 when the cartridge 3150 is inserted into the attachment mechanism 3120. The cartridge sealing portion 3138 ensures that the liquid or solution is contained within the cartridge 3150 during the mixing process.
- [00129] As shown in FIG. 34C, the cartridge 3150 may be pressed into the attachment mechanism 3120, thereby engaging the engagement assembly 3122 and pressing the cartridge 3150 into the locked position. As the cartridge 3150 is engaged with the engagement assembly 3122, the opening structure 3140 of the piercing portion 3124 pierces the opening and the cover 3160 on the pod 3152, thereby releasing the contents of the cartridge 3150 into the container 3110. Additionally, as the cartridge 3150 is engaged with the engagement assembly 3122, the valve assembly 3126 is engaged and the elevator seal 3148 prevents liquid from escaping into the attachment mechanism 3120 when the elevator 3146 is raised. The valve 3144 opens into the container 3110. As the opening 3158 and cover 3160 are pierced and the valve 3144 opens, the contents of the container 3110 and the contents of the cartridge 3150 are now able to be mixed together.
- [00130] As shown in FIG. 34D, the container 3110 may be rotated or shaken to mix the contents of the container 3110 and the contents of the cartridge 3150. This shaking movement causes the contents to mix together, thereby creating a desired beverage. As shown in FIG. 34E, the beverage is now ready to be consumed.
- [00131] Once the beverage is consumed by the user, the cartridge 3150 can be released from the attachment mechanism 3120 by rotating the release ring 3136. Rotating the

release ring 3136 ejects the cartridge 3150 and returns the attachment mechanism 3120 to the starting position. Additionally, without departing from the invention, the cartridge 150 may be released from the attachment mechanism 3120 prior the beverage being consumed by the user.

[00132] FIGS. 35A through 35D illustrate another embodiment of this disclosure. In FIGS. 35A through 35D, a cartridge 2150 includes a first chamber 2180 and a second chamber 2181. As illustrated in FIG. 35A, the first chamber 2180 may be defined by the pod 2152 and a foil retainer 2166 on the top of the pod 2152. The first chamber 2180 may include a first ingredient 2181, such as syrup, powder, granules or other compositions that when mixed with water or other liquids will result in a beverage. The second chamber 2182 may be defined by the foil retainer 2166 and the cap 2154. The second chamber 2182 may also be defined by the foil retainer 2166 or the cap 2154. The second chamber 2182 may include a second ingredient 2183, such as an energy boost, nutrients, or vitamin supplement that can be added to the beverage. The second ingredient may also be a different syrup, powder, granules, or other compositions than the first ingredient.

[00133] FIG. 35B illustrates the piercing action on the cartridge 2150. As the cartridge 2150 is engaged with the container, a piercing portion pierces the cap 2154 on the pod 2152 and pierces the second chamber 2182. FIG. 35C illustrates the piercing portion piercing through not only the cap 2154 but also through the foil retainer 2166, thereby releasing the contents of the second chamber 2182 into the first chamber 2180. The second ingredient 2183 located in the second chamber 2182 will then mix with the first ingredient 2181 located in the first chamber 2180. FIG. 35D illustrates the mixing of the first ingredient 2181 and the second ingredient 2183, thereby releasing the mixed beverage ingredients into the container to be mixed with the liquid.

[00134] Described below is a detailed description of additional aspects of this invention, specifically a method of producing a beverage using a beverage dispensing system. Additional aspects of this disclosure relate to methods of producing a beverage using a beverage dispensing system in accordance with examples of this disclosure. Such methods may include, for example, one or more of the following steps in any desired order and/or combinations: (a) inserting a cartridge into a container; (b) rotating or positioning the cartridge into location within an attachment mechanism;

(c) pressing on the cartridge thereby engaging the cartridge with the engagement assembly, releasing the valve assembly, and piercing the foil seal with the piercing portion; (d) mixing the contents of the container; (e) drinking the beverage from the container; and (f) releasing the cartridge from the container.

[00135] One of the benefits of this invention is the improvement and impact on the environment through reusing, recycling, and reducing. For example, this beverage system may reduce dramatically the water usage index from 2.4L/L to 1.3 L/L. Additionally, for the environmental impact on land and packaging: the beverage system packaging may be approximately 5 grams, which is approximately 75% less than packaging for other comparable-use beverage system; all of the beverage system packaging may be 100% recyclable; and the container of the beverage system may be reusable eliminating post-consumer bottles. Additionally, for the environmental impact on climate change: the transportation for the beverage system components, etc. is approximately 17% of the carbon footprint of a comparable-use product, thereby reducing the carbon footprint by approximately 90%; and the containers are approximately 40% of the carbon footprint of comparable-use product containers, thereby reducing the carbon footprint by approximately 75%. Finally, for the environmental impact on the community: recycling facilities and device stations may be provided for the beverage system of the present invention; social online platform to track contributions such as water, energy and/or carbon footprint savings.

[00136] It is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth herein. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Variations and modifications of the foregoing are within the scope of the present invention. It should be understood that the invention disclosed and defined herein extends to all alternative combinations of two or more of the individual features mentioned or evident from the text and/or drawings. All of these different combinations constitute various alternative aspects of the present invention. The embodiments described herein explain the best modes known for practicing the invention and will enable others skilled in the art to utilize the invention.

We claim:

1. A beverage dispensing system comprising:
 - a container;
 - an attachment mechanism coupled to the container, the attachment mechanism comprising an engagement assembly, a piercing portion, and a valve; and
 - a pod adapted to engage the attachment mechanism at the engagement assembly,wherein when the pod is engaged with the attachment mechanism, the engagement assembly engages the pod within the attachment mechanism, the piercing portion pierces through the pod, and the valve extends into the container, and further wherein the engagement assembly includes a biasing member that provides a biasing force to the pod when the pod is engaged with the attachment mechanism.
2. The beverage dispensing system according to claim 1, wherein the pod holds one or more beverage ingredients.
3. The beverage dispensing system according to claim 2, wherein the one or more beverage ingredients are selected from the list comprising: syrup, paste, powder, or granules.
4. The beverage dispensing system according to claim 3, wherein the container holds a mixing solution.
5. The beverage dispensing system according to claim 4, wherein the mixing solution is water.
6. The beverage dispensing system according to claim 5, wherein when the valve extends into the container, the pod is opened into the container thereby allowing the one or more beverage ingredients to mix with the mixing solution.
7. The beverage dispensing system according to claim 1, wherein the pod includes a first chamber defined by the pod and a foil retainer and a second chamber defined by the foil retainer and a cap to the pod.

8. The beverage dispensing system according to claim 1, wherein the attachment mechanism includes a seal that seals between around piercing portion when the pod is engaged with the engagement assembly.

9. The beverage dispensing system according to claim 1, wherein the attachment mechanism includes an seal that provides a seal between the container and the attachment mechanism and prevents a liquid in the container from leaking prior to the pod being engaged with the engagement assembly.

10. The beverage dispensing system according to claim 1, wherein the attachment mechanism includes a pod sealing portion between the pod and the engagement assembly.

11. The beverage dispensing system according to claim 1, wherein the container includes a release mechanism that releases the pod from the attachment mechanism.

12. The beverage dispensing system according to claim 11, wherein the release mechanism includes a release ring spring that resets the release mechanism after the pod is ejected.

13. The beverage dispensing system according to claim 1, wherein attachment mechanism includes an elevator cooperatively engaged with the valve.

14. A beverage dispensing system comprising:

a container;

an attachment mechanism coupled to the container, the attachment mechanism comprising an engagement assembly and a valve; and

a pod adapted to engage the attachment mechanism at the engagement assembly,

wherein when the pod is pressed into the attachment mechanism, the engagement assembly engages the pod within the attachment mechanism, and wherein when the pod is twisted within the attachment mechanism, the valve rotates into the pod piercing the cover, thereby opening the pod to the container, and further

wherein the engagement assembly includes a spring that provides a biasing force to the pod when the pod is engaged with the attachment mechanism.

15. The beverage dispensing system according to claim 14, wherein the pod holds one or more beverage ingredients.

16. The beverage dispensing system according to claim 15, wherein the one or more beverage ingredients are selected from the list comprising: syrup, paste, powder, or granules.

17. The beverage dispensing system according to claim 16, wherein the container holds a mixing solution.

18. The beverage dispensing system according to claim 17, wherein the mixing solution is water.

19. The beverage dispensing system according to claim 18, wherein when the valve extends into the container, the pod is opened into the container thereby allowing the one or more beverage ingredients to mix with the mixing solution.

20. A method for producing a beverage using a beverage dispensing system, the method comprising:

(a) inserting a pod holding one or more beverage ingredients into an attachment mechanism coupled to a container holding a mixing solution, the attachment mechanism comprising an engagement assembly, a piercing portion, and a valve;

(b) pressing on the pod thereby engaging the pod with the engagement assembly, releasing the valve into the container, and piercing the cover with the piercing portion, wherein the engagement assembly includes a spring that provides a biasing force to the pod when the pod is engaged with the attachment mechanism; and

(c) mixing the one or more beverage ingredients with the mixing solution in the container.

21. The method for producing a beverage according to claim 20, further comprising the step of rotating the pod into the attachment mechanism.

22. The method for producing a beverage according to claim 21, further comprising the step of releasing the pod from the container.

23. The method for producing a beverage according to claim 22, wherein the spring ejects the pod to release the pod from the container and the spring further resets the attachment mechanism.

24. The beverage dispensing system according to claim 20, wherein the one or more beverage ingredients are selected from the list comprising: syrup, paste, powder, or granules.

25. The beverage dispensing system according to claim 20, wherein the attachment mechanism includes a pod sealing portion between the pod and the engagement assembly.

26. A beverage dispensing system comprising:

a container;

an attachment mechanism coupled to the container; and

a cartridge adapted to engage the attachment mechanism, wherein the cartridge holds one or more beverage ingredients, the cartridge including a unique identifier to track a set of beverage characteristics associated with the one or more beverage ingredients of the cartridge,

wherein when the cartridge is engaged with the attachment mechanism, the attachment mechanism opens the cartridge to the container.

27. The beverage dispensing system according to claim 26, wherein the set of beverage characteristics includes one or more of the following: flavor of the beverage ingredients, nutritional content of the beverage ingredients, functional ingredients of the beverage ingredients and location or time of day consumed.

28. The beverage dispensing system according to claim 27, wherein the nutritional content of the beverage ingredients includes one or more of the following: calories, carbohydrates, water intake, sugar content, and sodium.

29. The beverage dispensing system according to claim 26, wherein the unique identifier is a bar code identifier.

30. The beverage dispensing system according to claim 26, wherein the unique identifier is a serial character identifier.

31. The beverage dispensing system according to claim 26, wherein the container captures the unique identifier and the set of beverage characteristics.

32. The beverage dispensing system according to claim 31, wherein the container stores the set of beverage characteristics.

33. The beverage dispensing system according to claim 31, wherein the container transfers the set of beverage characteristics over a wireless network to a computing device or a network.

34. The beverage dispensing system according to claim 26, wherein the set of beverage characteristics is used with a software application on a computing device or a network.

35. The beverage dispensing system according to claim 34, wherein the computing device includes one of the following: a cellular phone, a laptop computer, a desktop computer, the internet, a smart phone, a personal data assistant (PDA), and a tablet computer.

36. The beverage dispensing system according to claim 34, wherein the software application performs at least one of the following functions: tracking water consumed throughout the day, tracking nutrients, tracking the amount of PET equivalent saved with using the beverage system instead of other drinking methods, tracking of medicine consumption that is shared with a doctor, updating a loyalty program with points or reward prizes, providing the information sharing with friends or similar people through social network websites, tracking time of day, or tracking geolocation of consumption.

37. The beverage dispensing system according to claim 26, wherein the set of beverage characteristics is transferred to a website.

38. A method for managing information associated with a beverage dispensing system, the method comprising:

inserting a cartridge holding one or more beverage ingredients into an attachment mechanism coupled to a container holding a mixing solution, wherein the cartridge includes a unique identifier associated with a set of beverage characteristics associated with the one or more beverage ingredients of the cartridge;

engaging the cartridge with the attachment mechanism, thereby releasing the one or more beverage ingredients into the container and the mixing solution;

capturing the unique identifier of the cartridge; and

transferring the set of beverage characteristics associated with the unique identifier to a computing device.

39. The method for managing information associated with a beverage dispensing system according to claim 38, wherein the method further comprises the step of: consolidating the beverage characteristics associated with the unique identifier with beverage characteristics from previously consumed beverages on a website.

40. The method for managing information associated with a beverage dispensing system according to claim 38, wherein the method further comprises the step of: storing the beverage characteristics associated with the unique identifier on a website.

41. The method for managing information associated with a beverage dispensing system according to claim 38, wherein the set of beverage characteristics includes one or more of the following: flavor of the beverage ingredients, nutritional content of the beverage ingredients, functional ingredients of the beverage ingredients, and location or time of day consumed.

42. The method for managing information associated with a beverage dispensing system according to claim 38, wherein the unique identifier is a bar code identifier.

43. The method for managing information associated with a beverage dispensing system according to claim 38, wherein the unique identifier is a serial character identifier.

44. The method for managing information associated with a beverage dispensing system according to claim 38, wherein the unique identifier is captured by a capturing device associated with the container.

45. The method for managing information associated with a beverage dispensing system according to claim 38, wherein the container stores the set of beverage characteristics associated with the unique identifier.

46. The method for managing information associated with a beverage dispensing system according to claim 38, further including the step of: tracking water consumed throughout the day on the computing device.

47. The method for managing information associated with a beverage dispensing system according to claim 38, further including the step of: tracking nutrients associated with the one or more beverage ingredients on the computing device.

48. The method for managing information associated with a beverage dispensing system according to claim 38, further including the step of: updating a loyalty program with points or reward prizes on the computing device based on the set of beverage characteristics.

49. The method for managing information associated with a beverage dispensing system according to claim 38, further including the step of: providing information associated with the beverage characteristics for sharing with friends or similar people through a social network website.

50. The method for managing information associated with a beverage dispensing system according to claim 38, further including the step of: tracking favorite beverages.

51. The method for managing information associated with a beverage dispensing system according to claim 38, further including the step of: collecting information about the beverage characteristics for consumer research.

52. The method for managing information associated with a beverage dispensing system according to claim 38, wherein the computing device includes one of the following: a

cellular phone, a laptop computer, a desktop computer, the internet, a smart phone, a personal data assistant (PDA), and a tablet computer.

53. A cartridge for use with a beverage dispensing system that includes a container and an attachment mechanism coupled to the container, the cartridge comprising:

- a pod that includes a chamber;
 - a cap attached to the top of the chamber; and
 - a unique identifier, wherein the unique identifier is associated with a set of beverage characteristics, and
- the cartridge engages the attachment mechanism.

54. The cartridge according to claim 53, wherein the pod is generally a circular-shaped structure.

55. The cartridge according to claim 53, wherein the set of beverage characteristics includes one or more of the following: flavor of the beverage ingredients, nutritional content of the beverage ingredients, functional ingredients of the beverage ingredients and location or time of day consumed.

56. The beverage dispensing system according to claim 55, wherein the nutritional content of the beverage ingredients includes one or more of the following: calories, carbohydrates, water intake, sugar content, and sodium.

57. The beverage dispensing system according to claim 53, wherein the unique identifier is a bar code identifier.

58. The beverage dispensing system according to claim 53, wherein the unique identifier is a serial character identifier.

59. The beverage dispensing system according to claim 53, wherein the set of beverage characteristics is transferred over a wireless network to a computing device or a network.

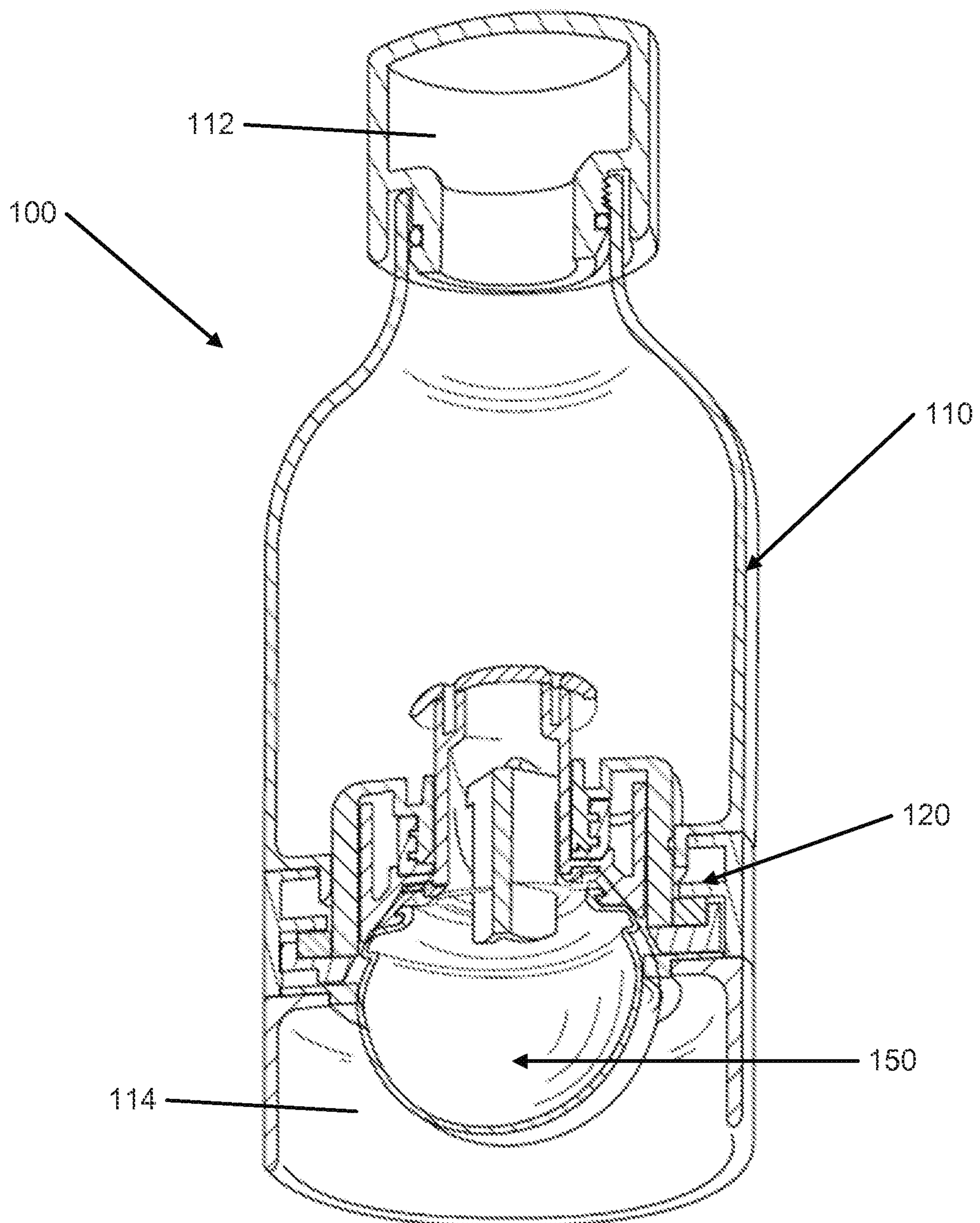
60. The beverage dispensing system according to claim 53, wherein the set of beverage characteristics is used with a software application on a computing device or a network.

61. The beverage dispensing system according to claim 60, wherein the computing device includes one of the following: a cellular phone, a laptop computer, a desktop computer, the internet, a smart phone, a personal data assistant (PDA), and a tablet computer.

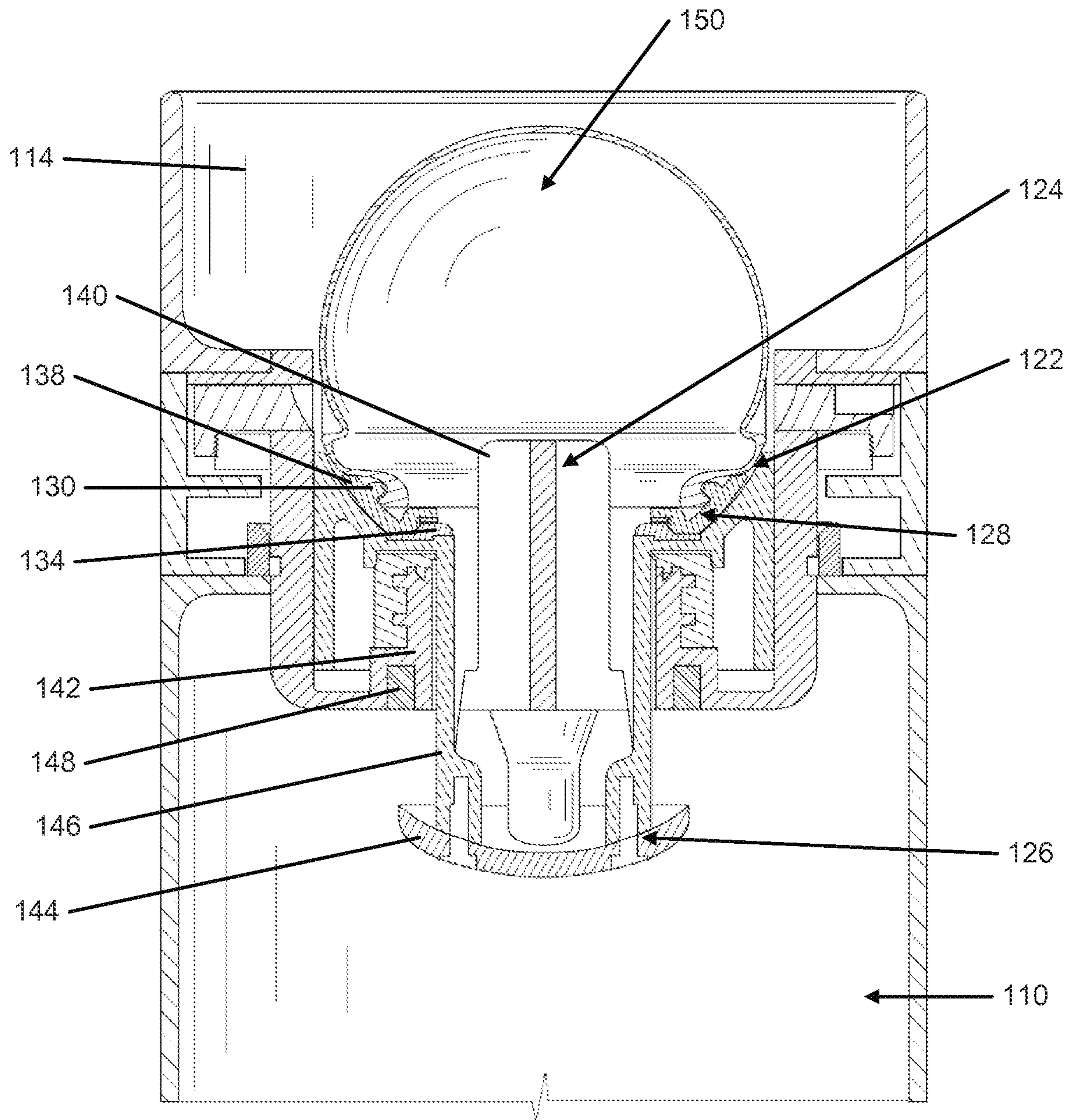
62. The beverage dispensing system according to claim 60, wherein the software application performs at least one of the following functions: tracking water consumed throughout the day, tracking nutrients, tracking the amount of PET equivalent saved with using the beverage system instead of other drinking methods, tracking of medicine consumption that is shared with a doctor, updating a loyalty program with points or reward prizes, providing the information sharing with friends or similar people through social network websites, tracking time of day, or tracking geolocation of consumption.

63. The beverage dispensing system according to claim 53, wherein the set of beverage characteristics is transferred to a website.

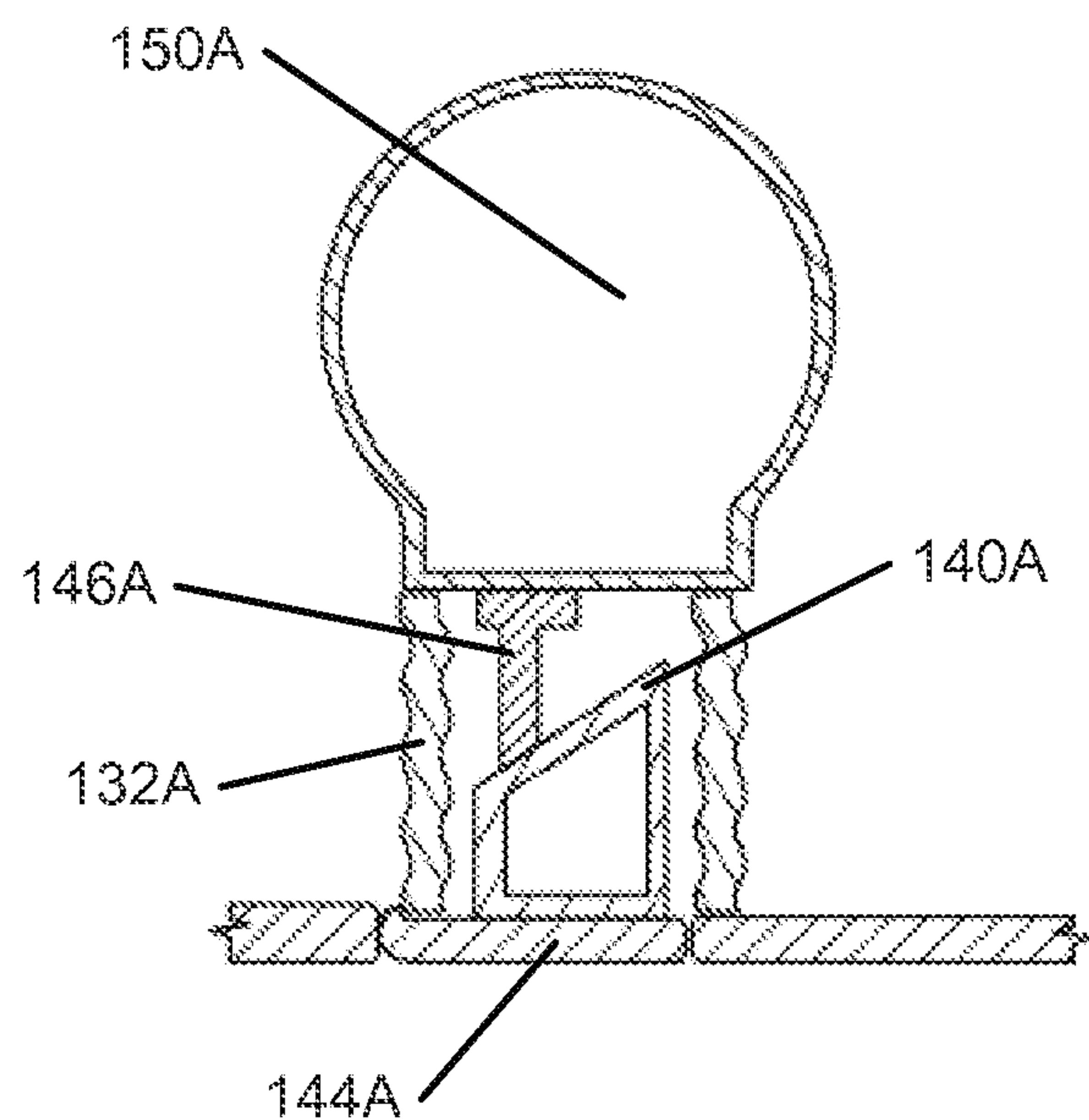
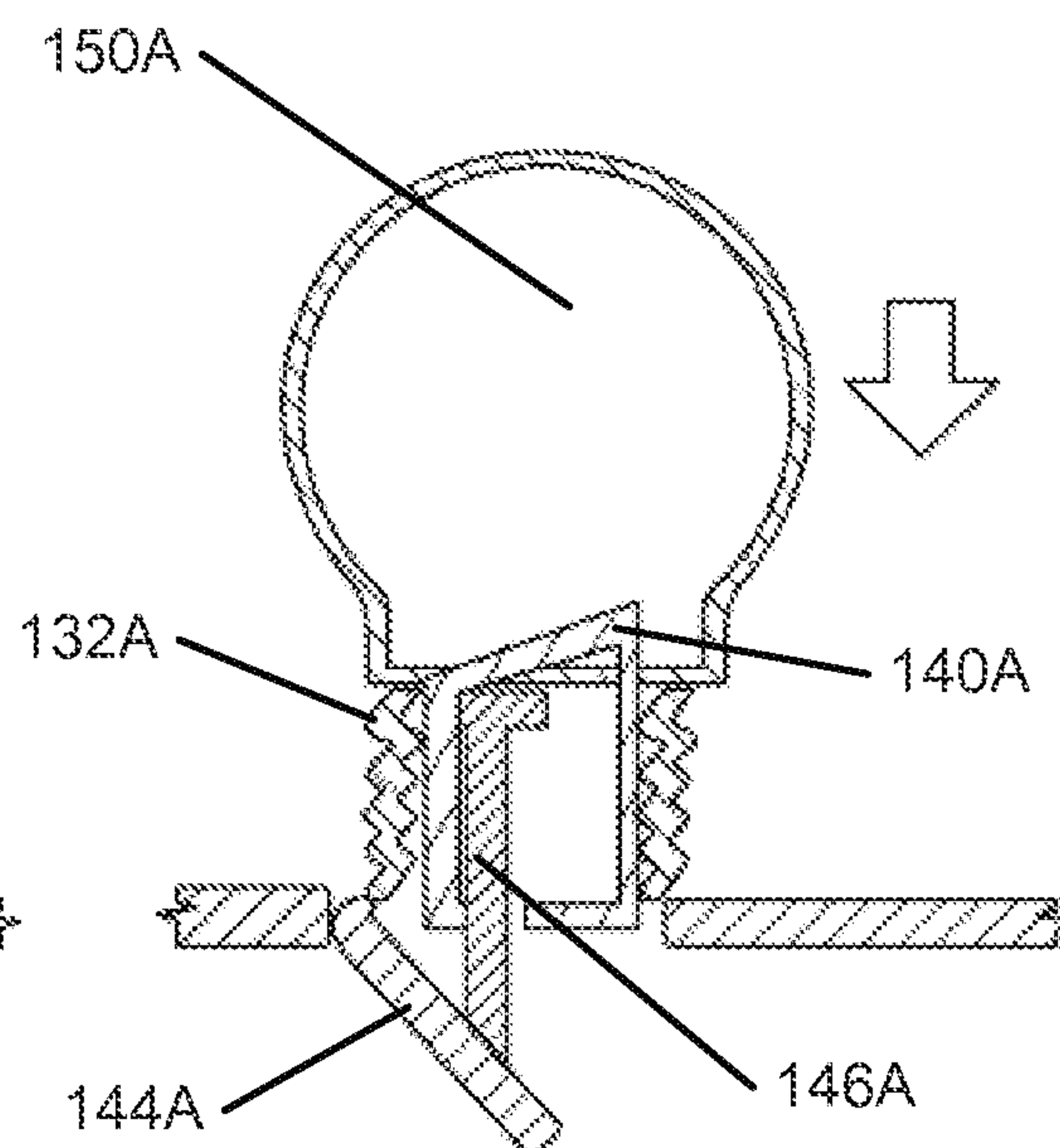
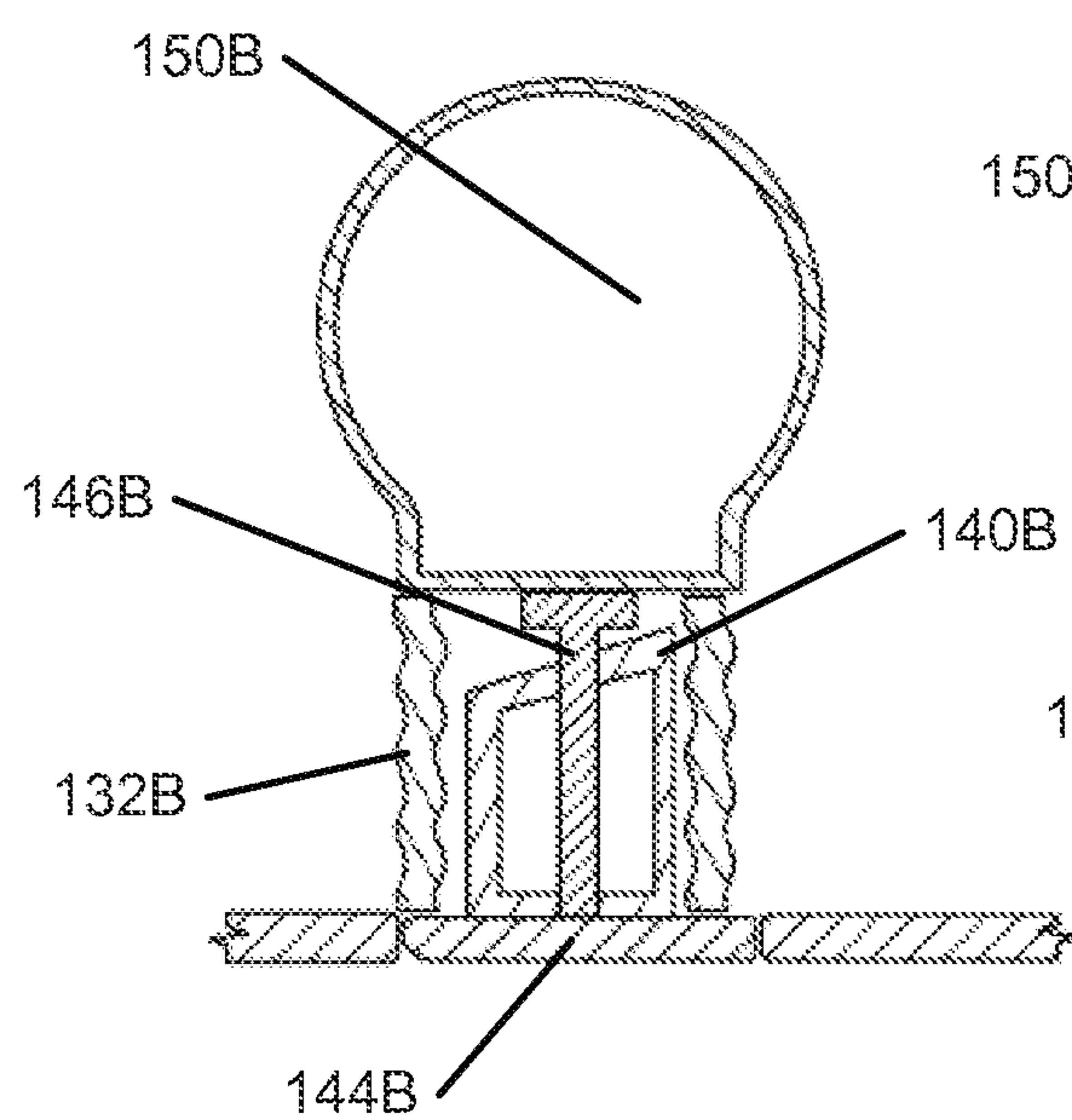
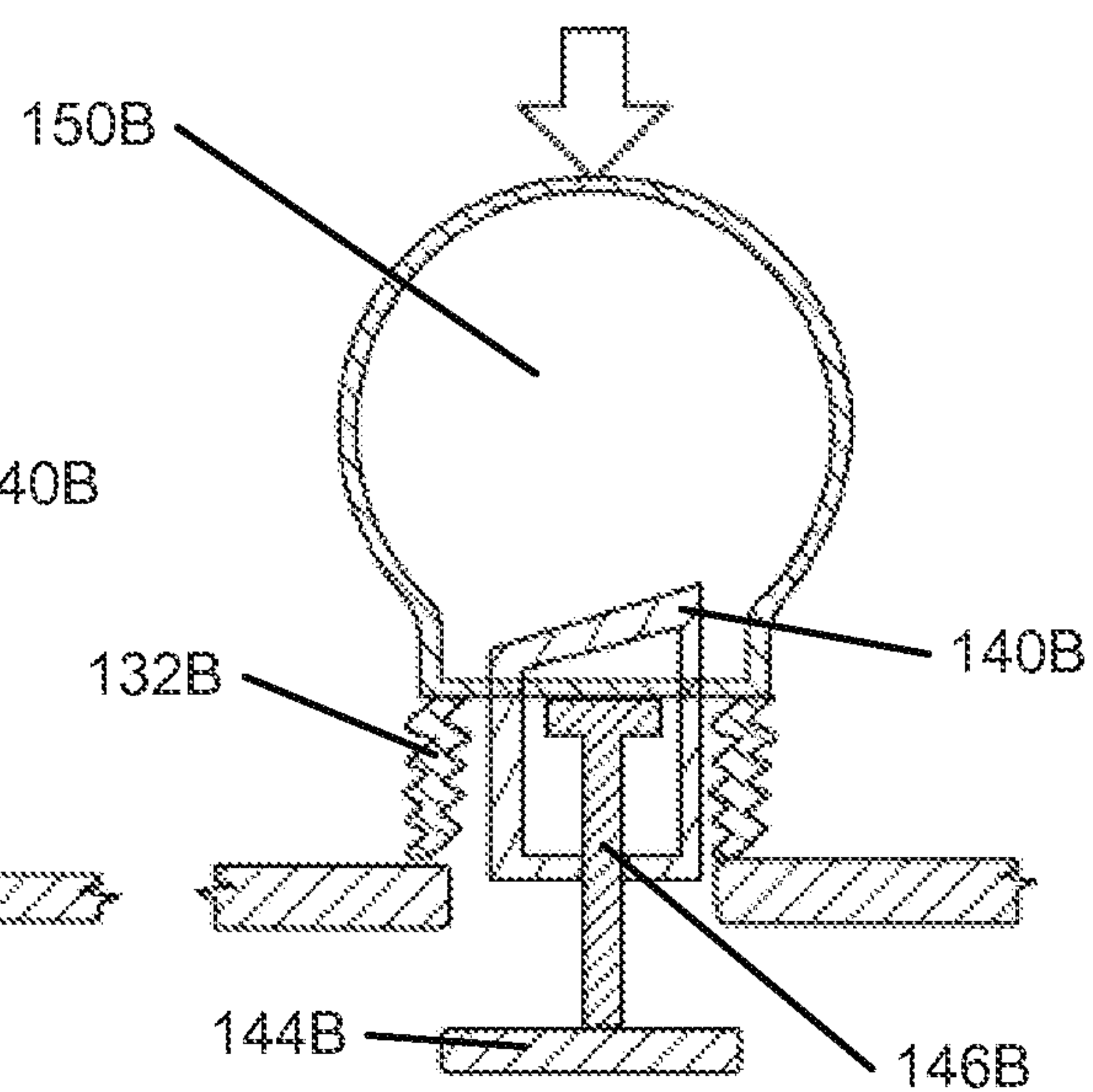
1/40

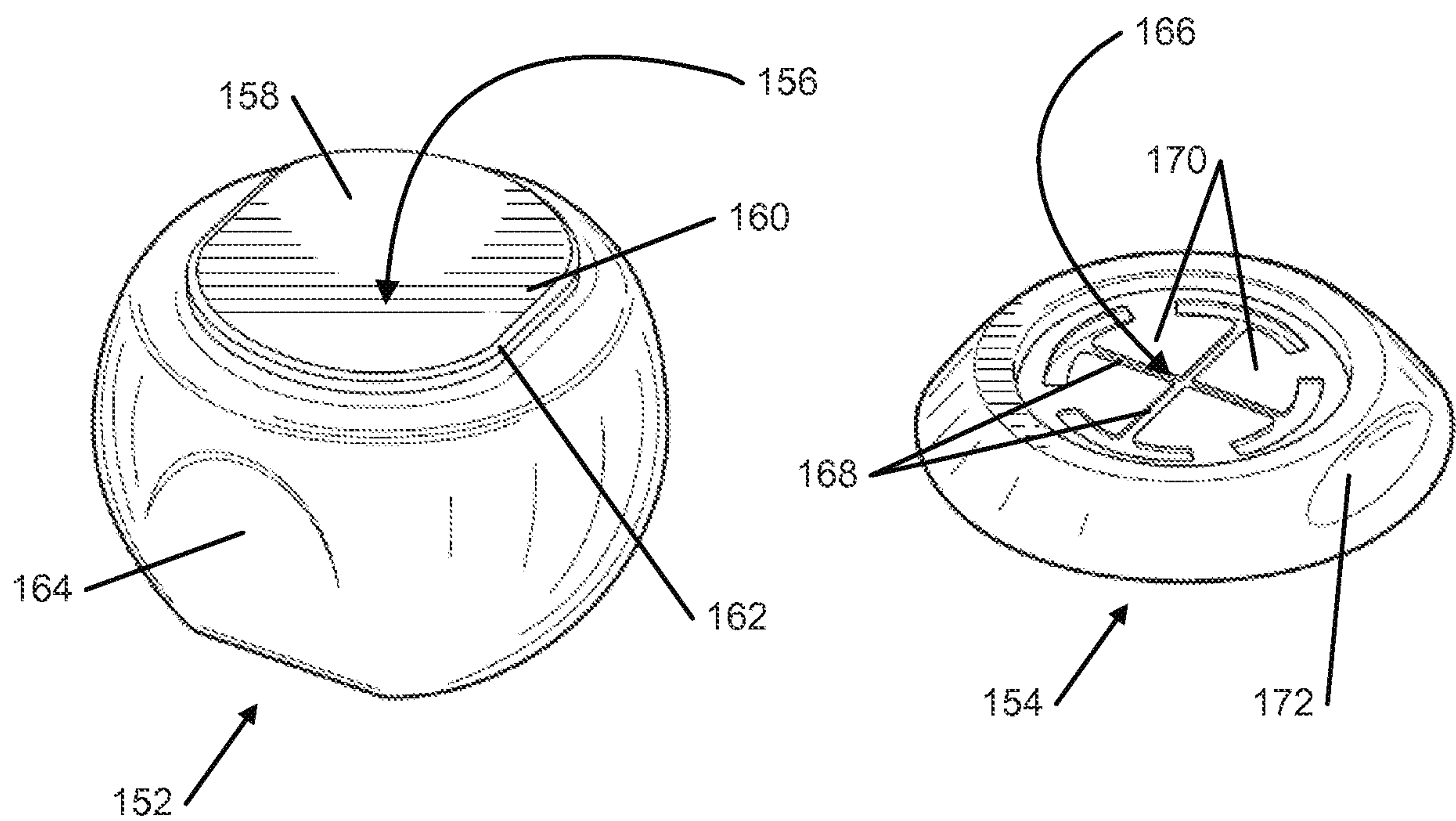
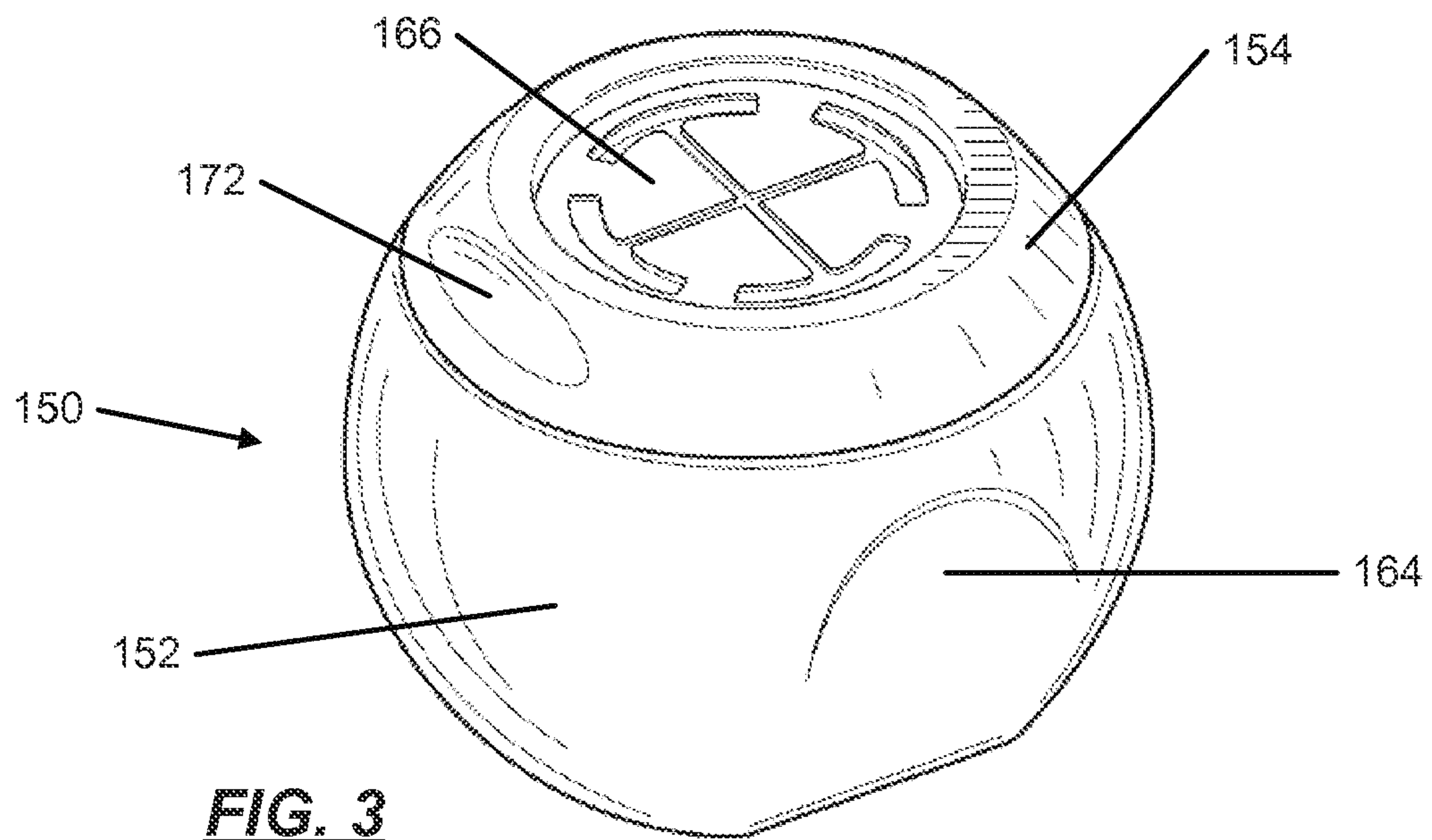
**FIG. 1**

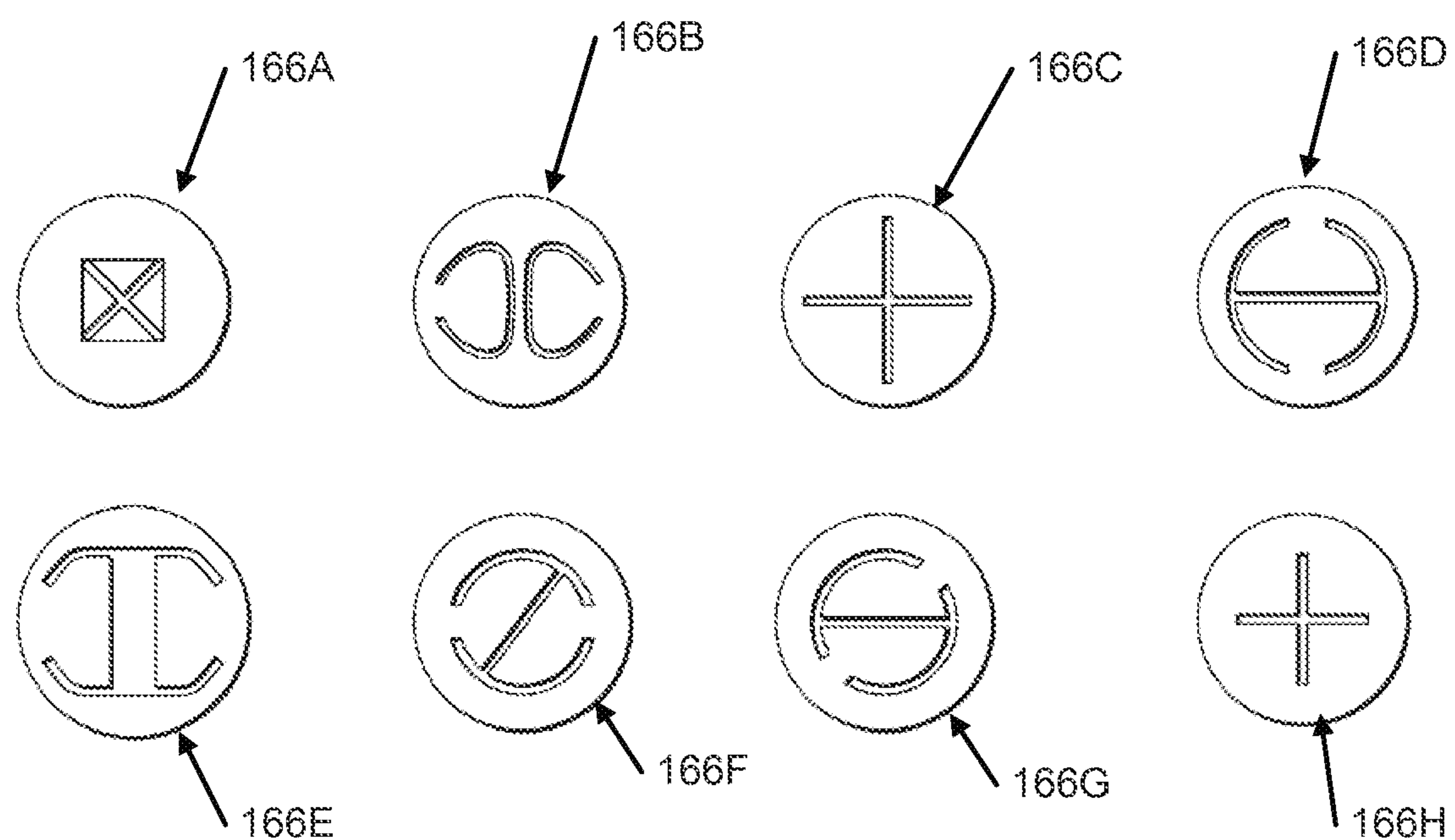
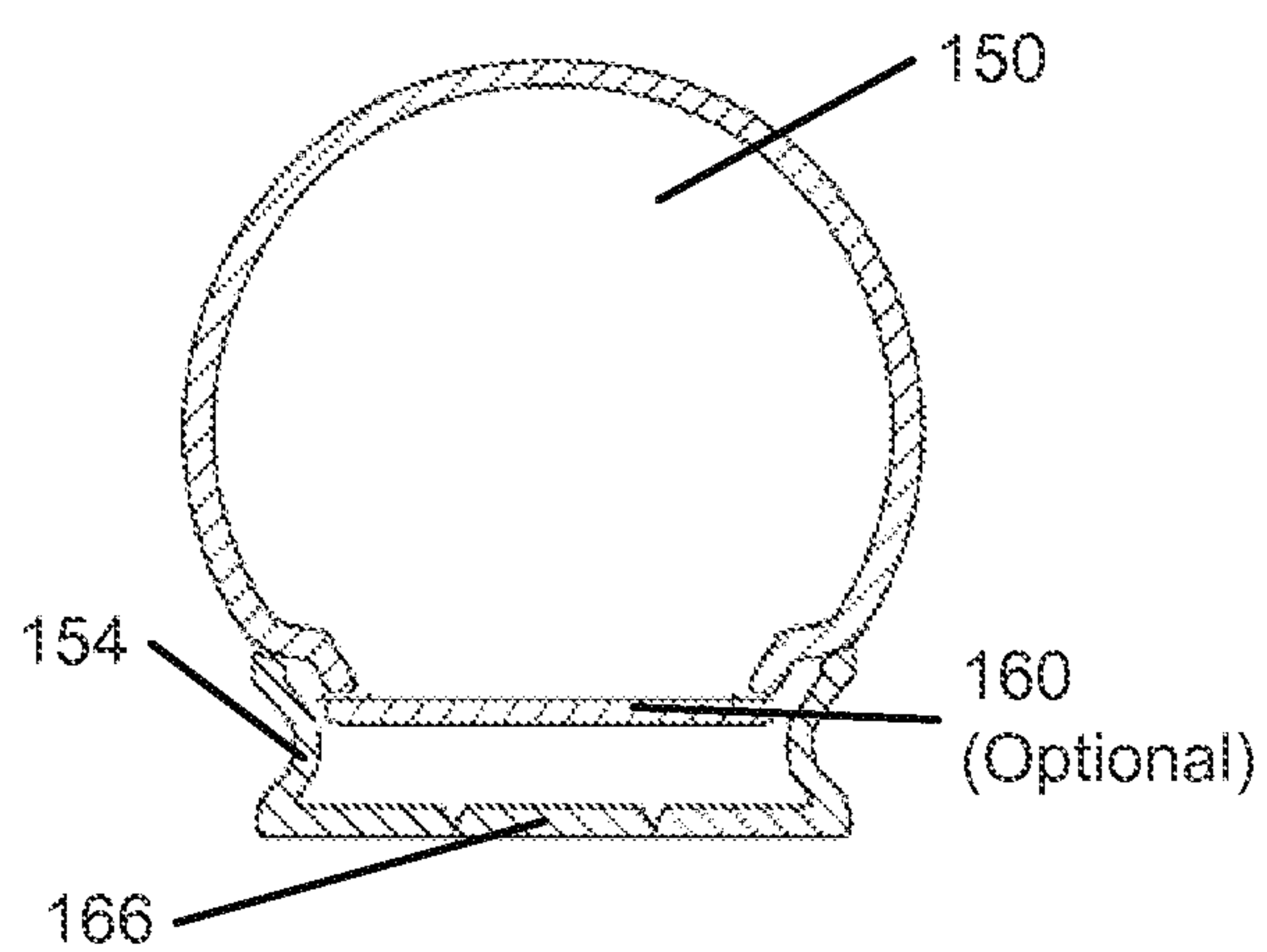
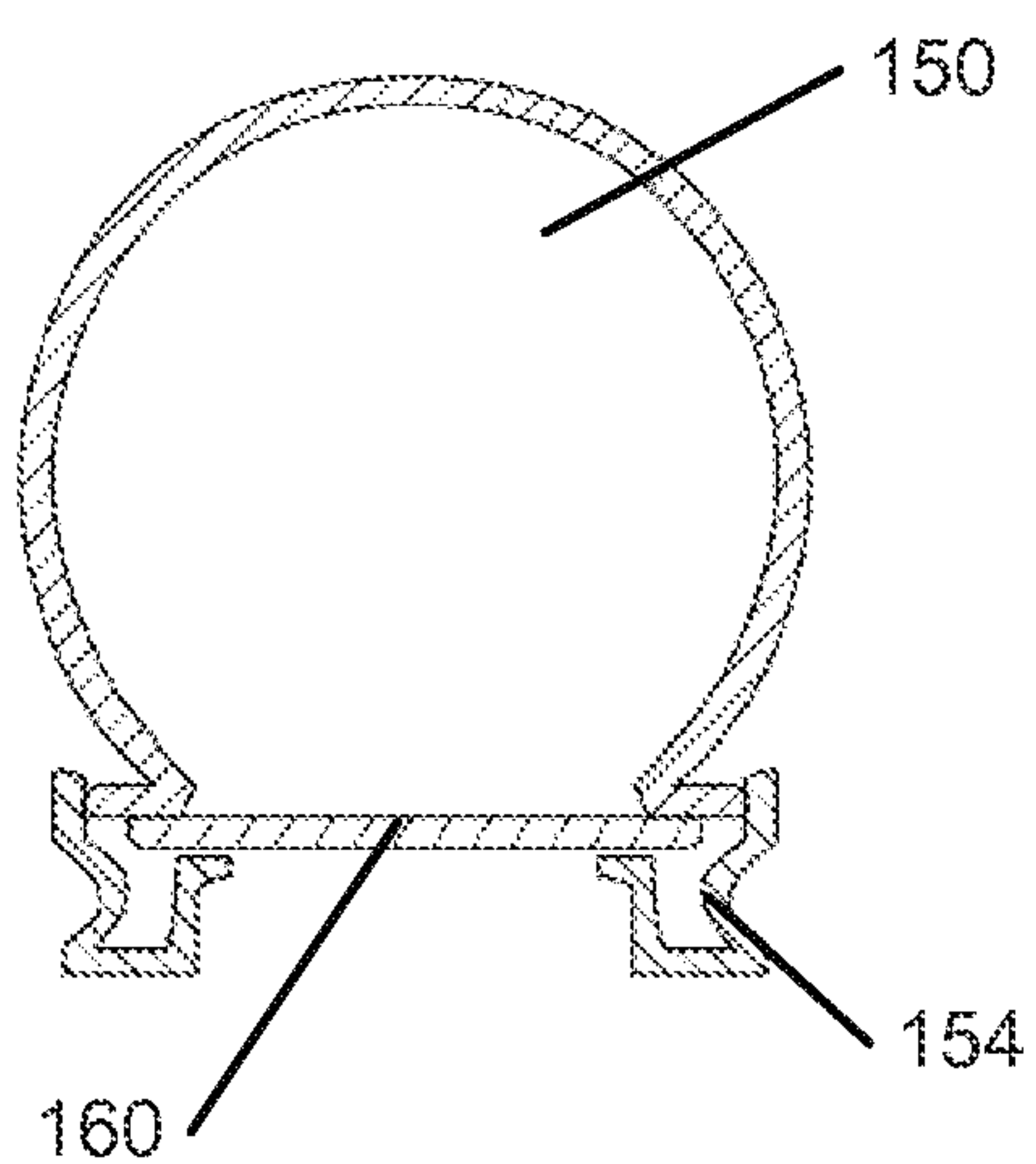
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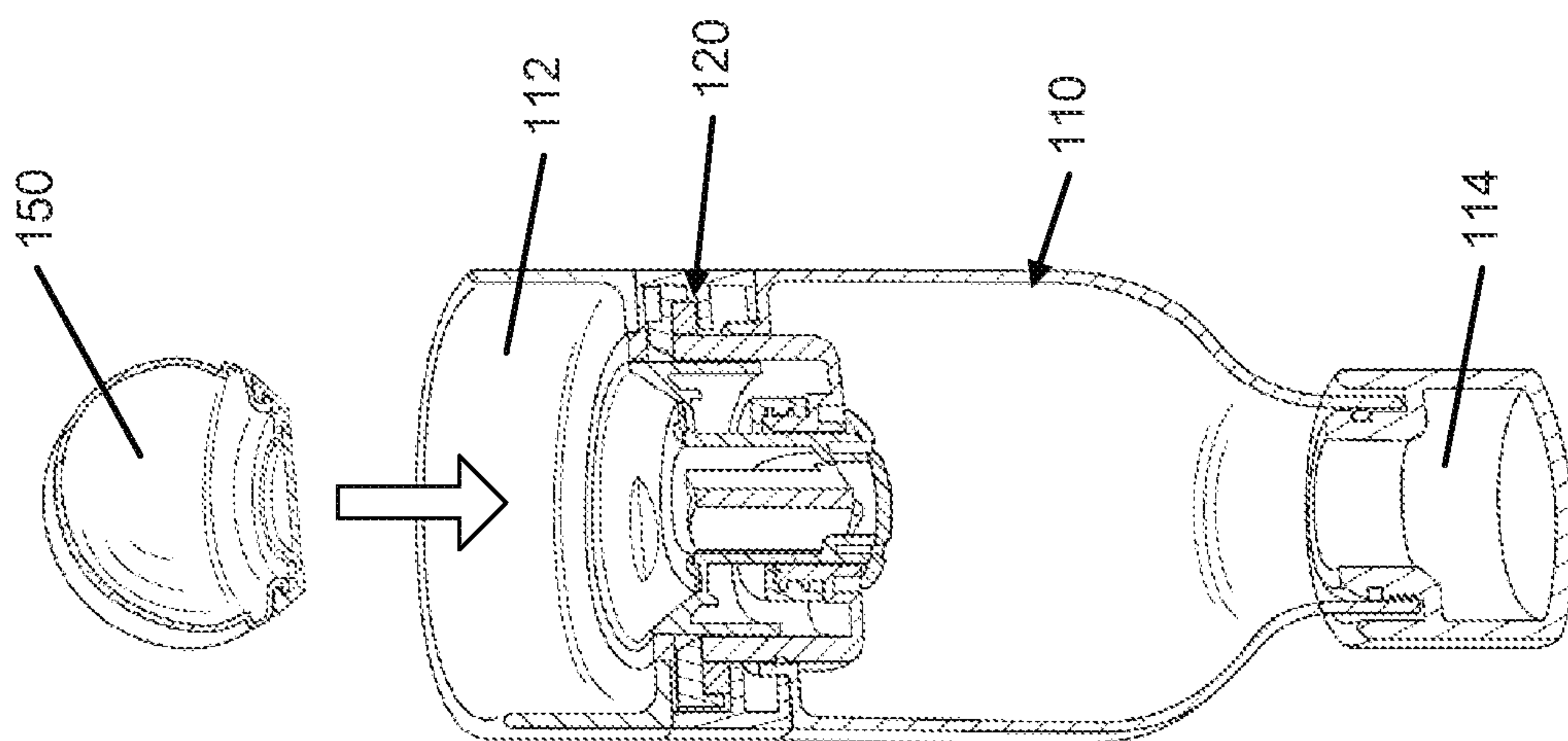
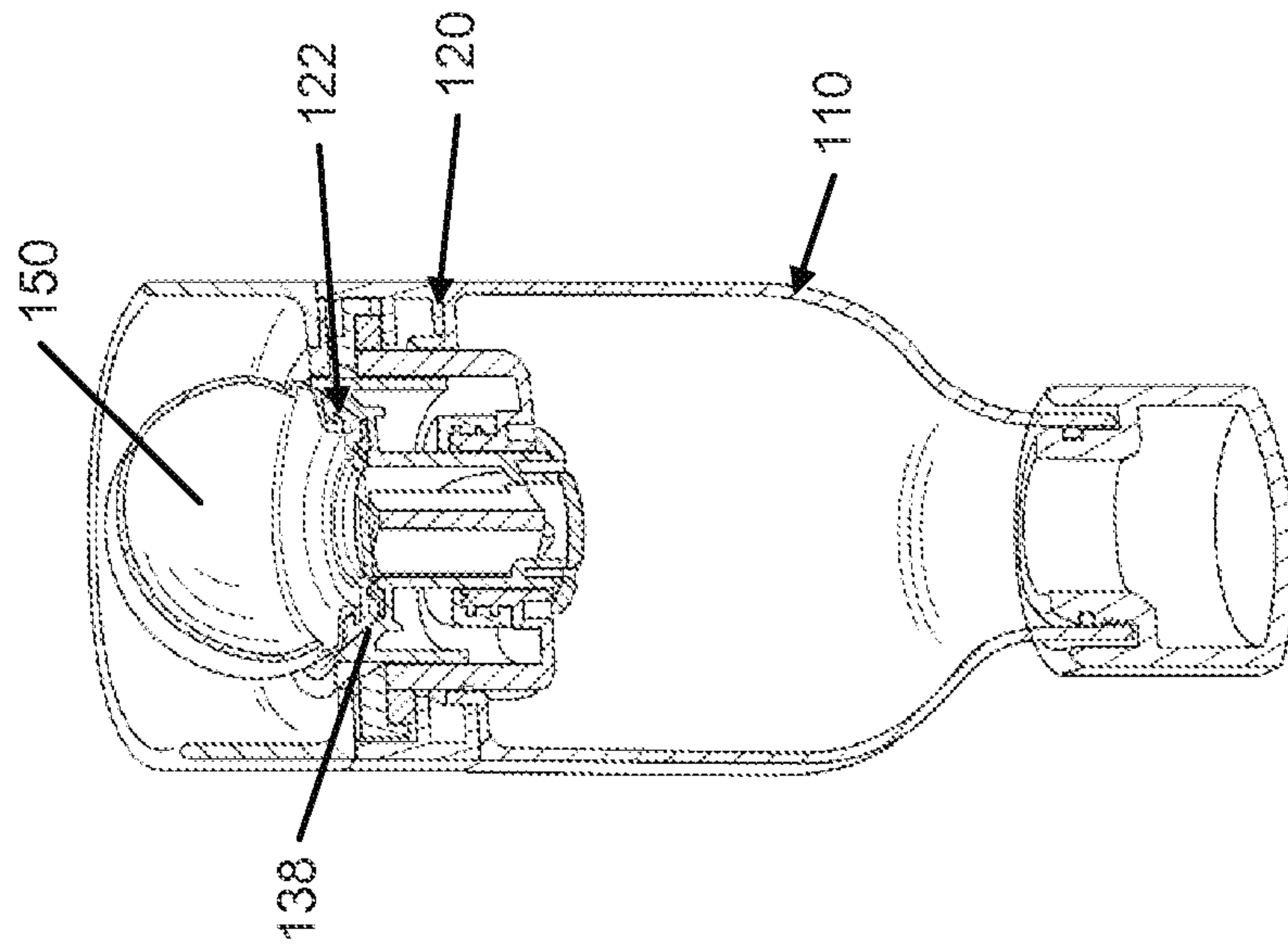
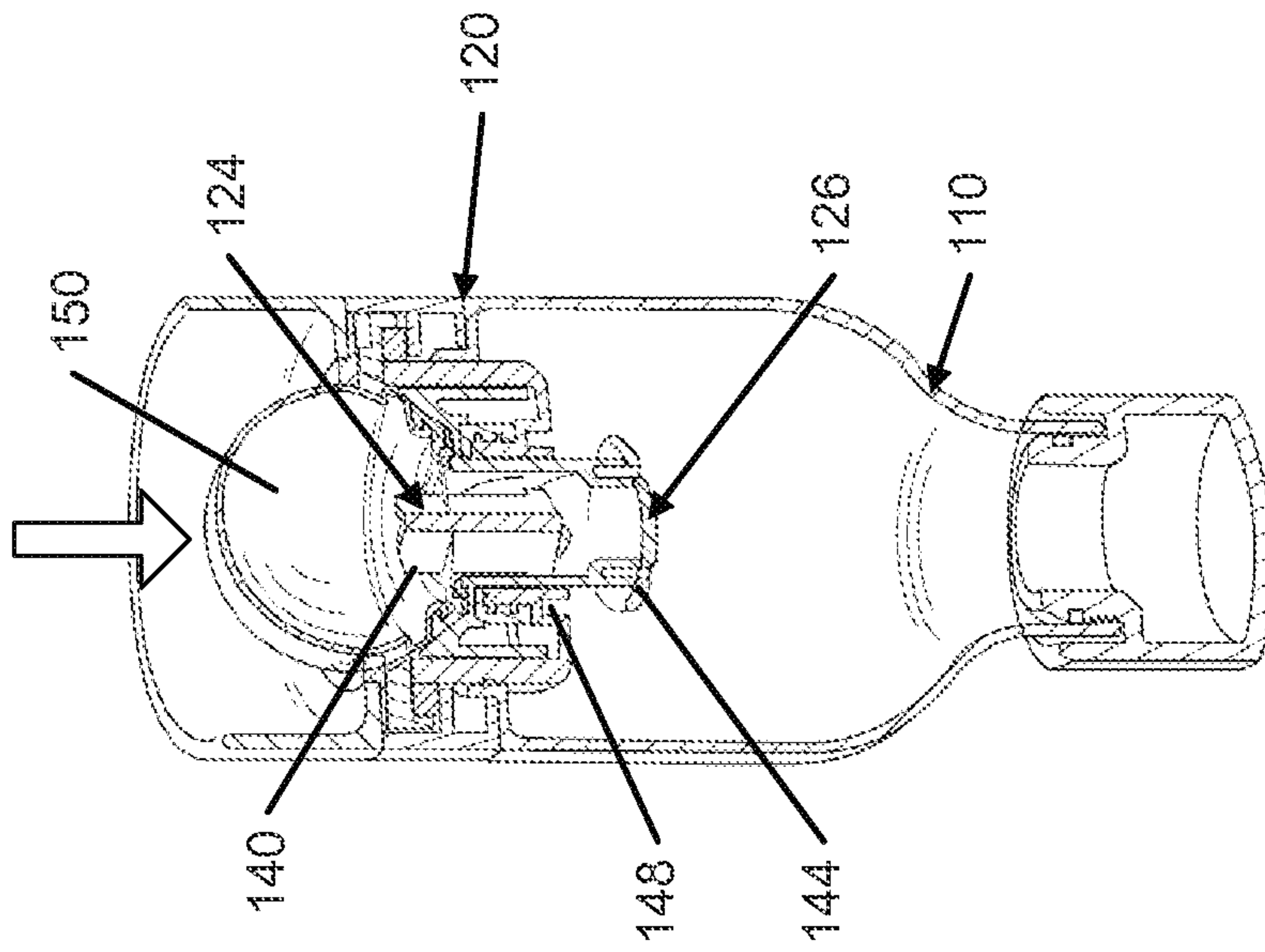
**FIG. 1A**

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**FIG. 2A1****FIG. 2A2****FIG. 2B1****FIG. 2B2**

**FIG. 3A**

**FIG. 3B****FIG. 3C****FIG. 3D**

**FIG. 4A****FIG. 4B****FIG. 4C**

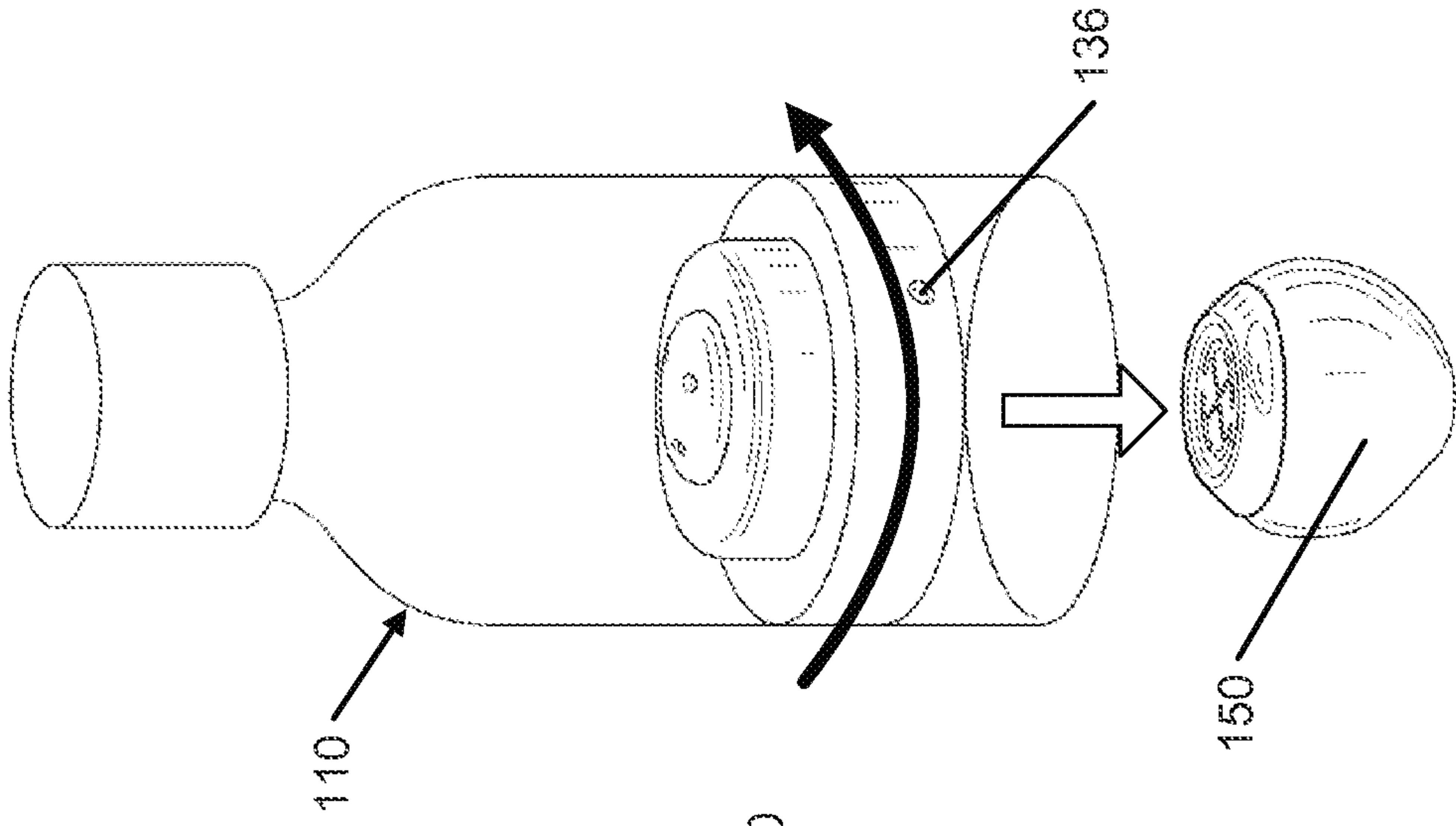


FIG. 4F

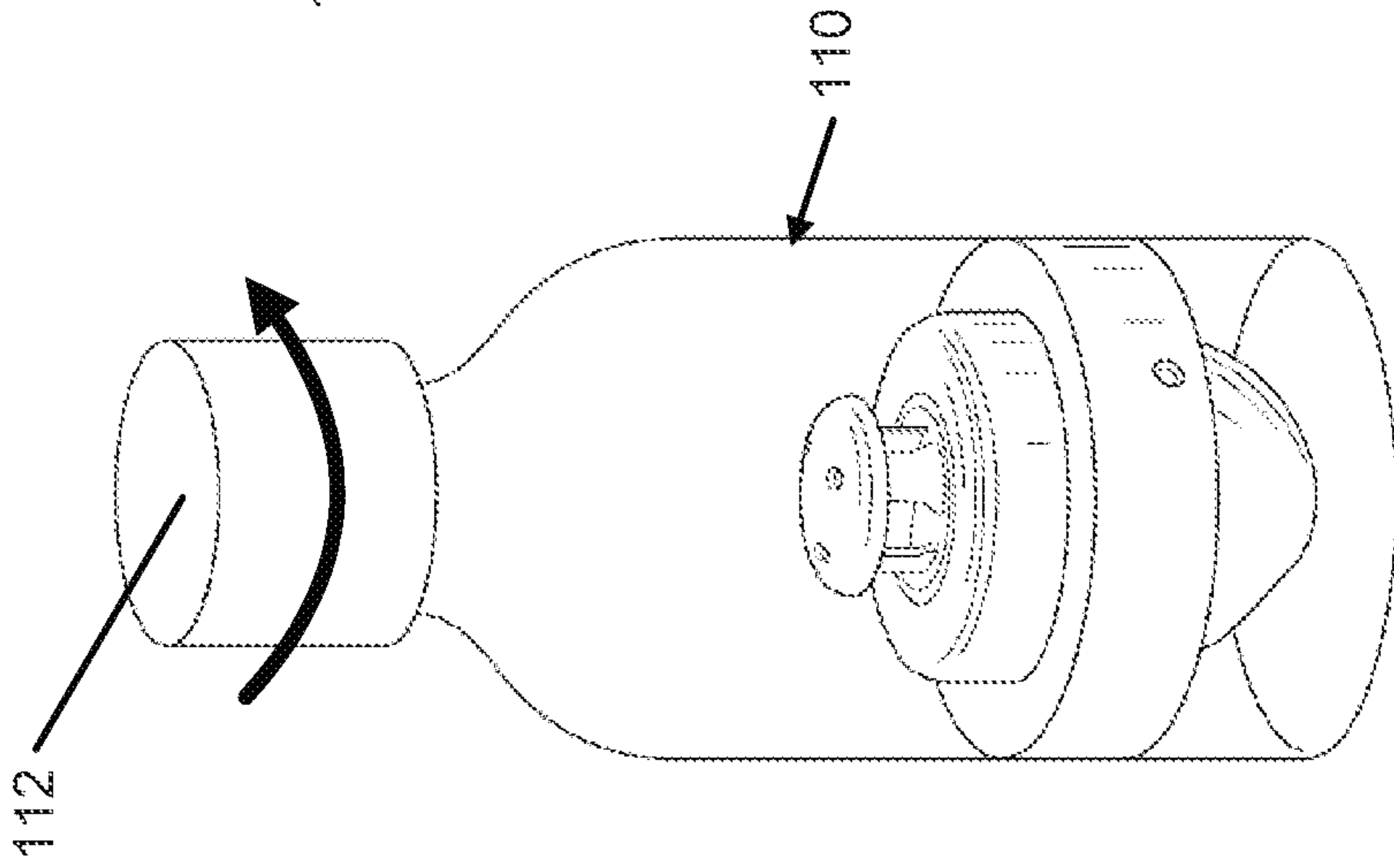


FIG. 4E

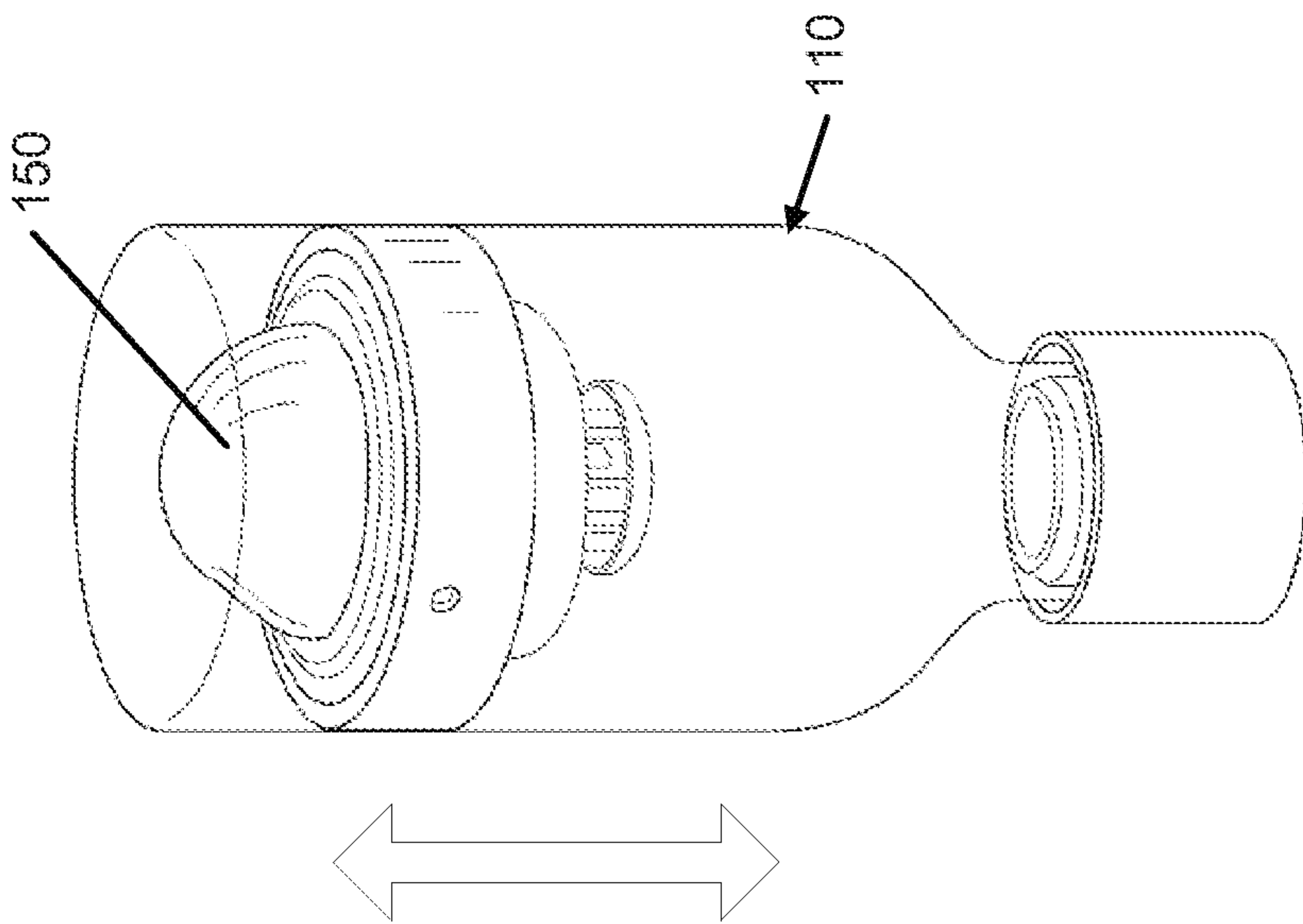
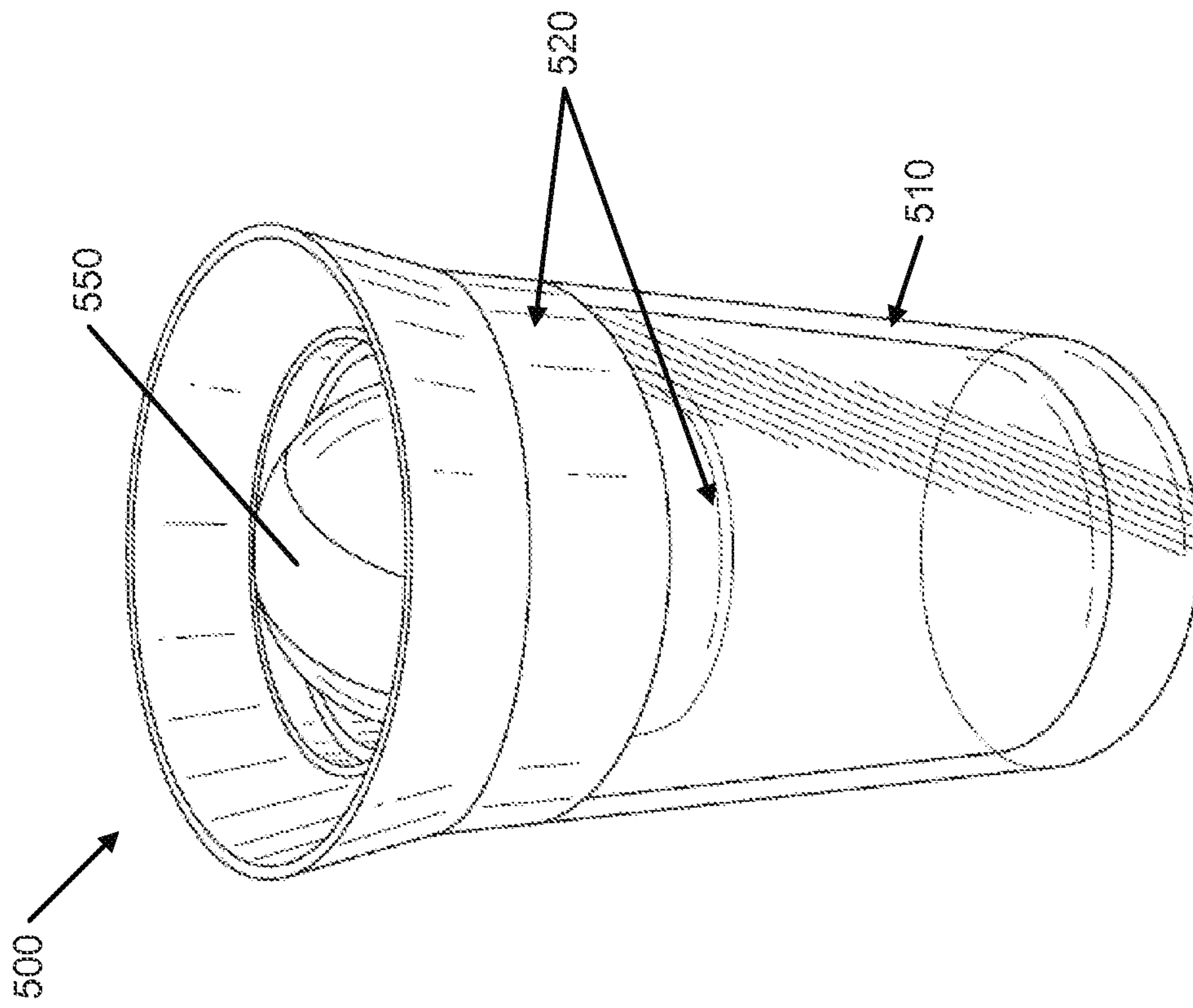
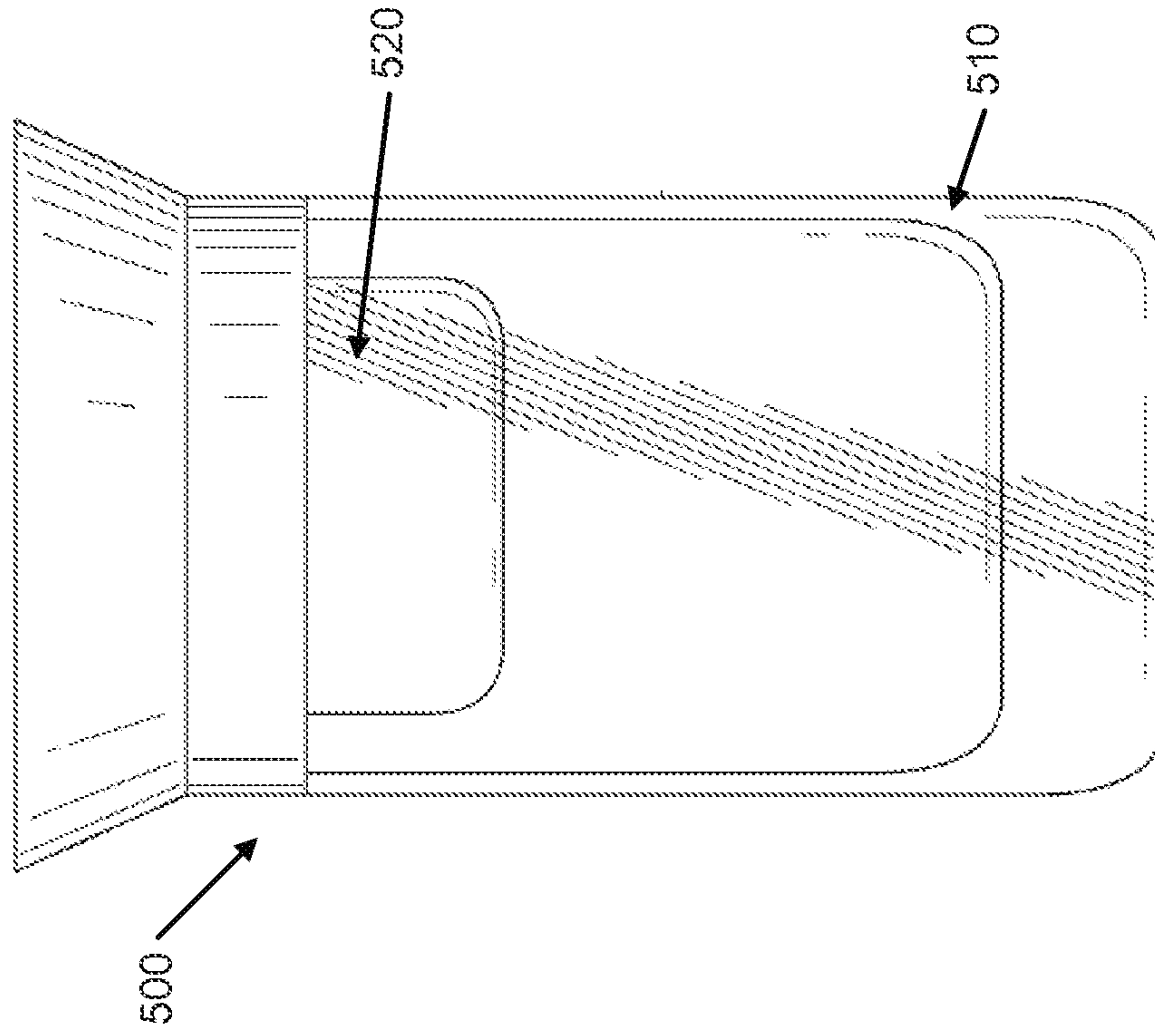
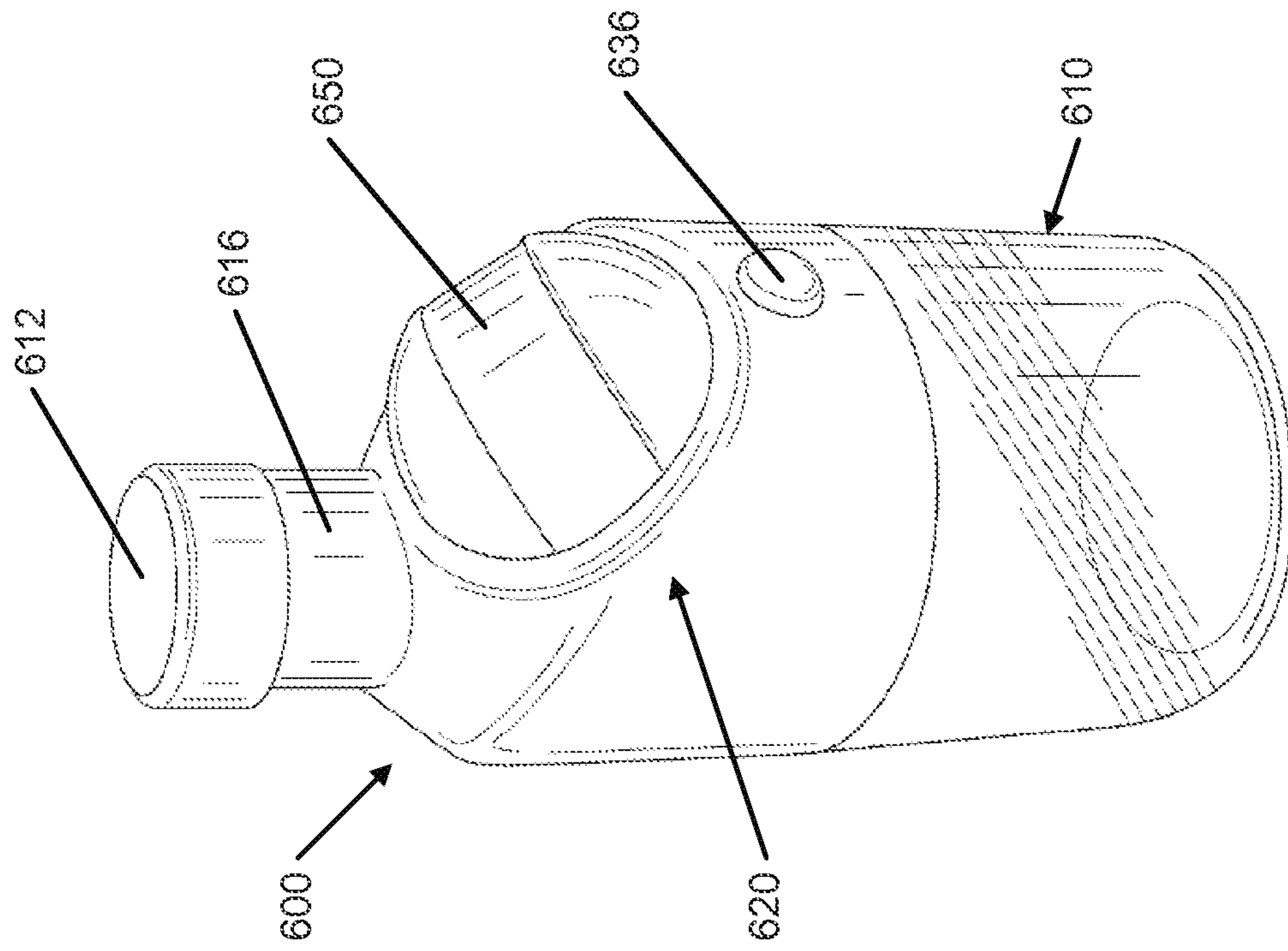
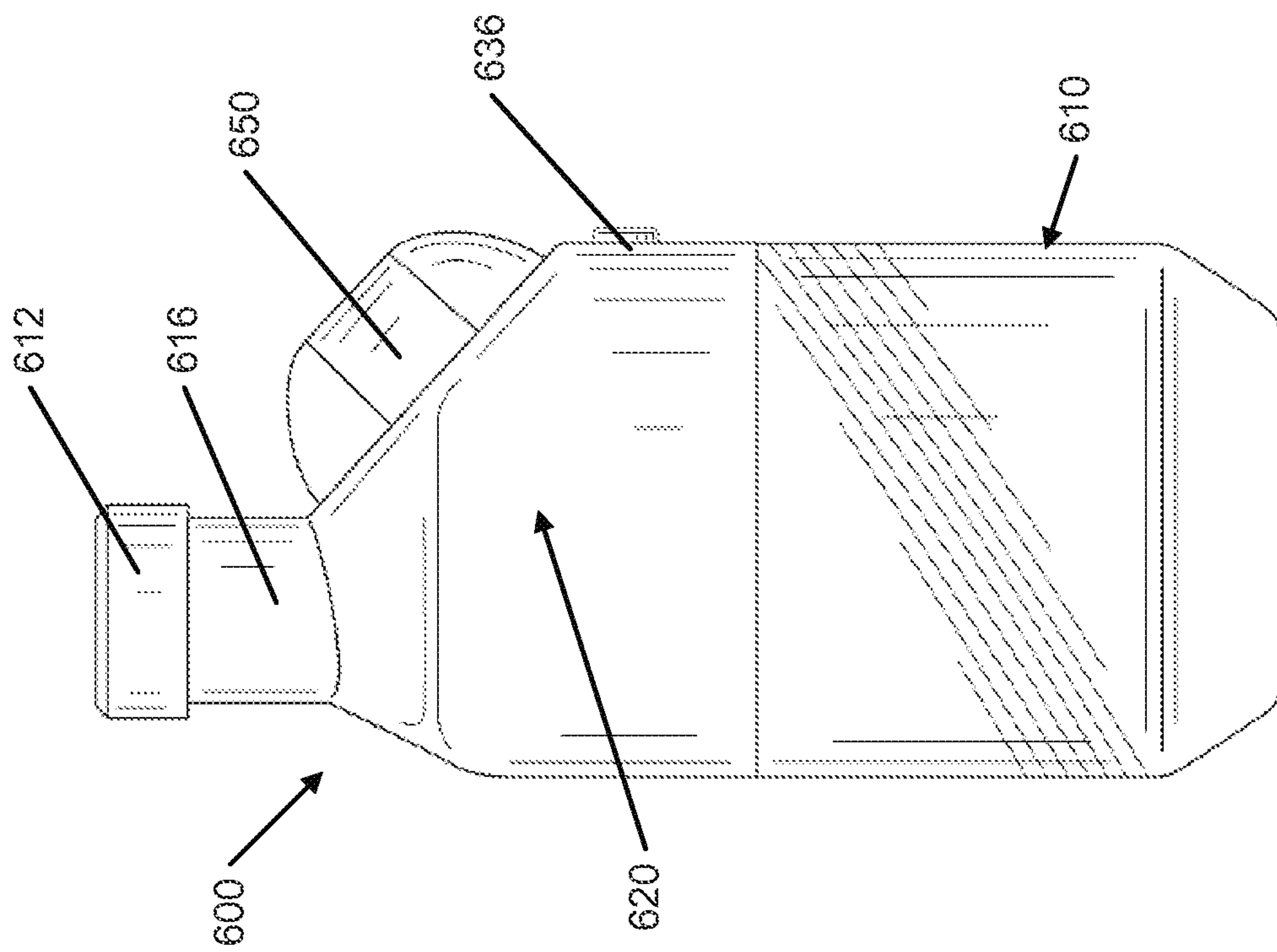
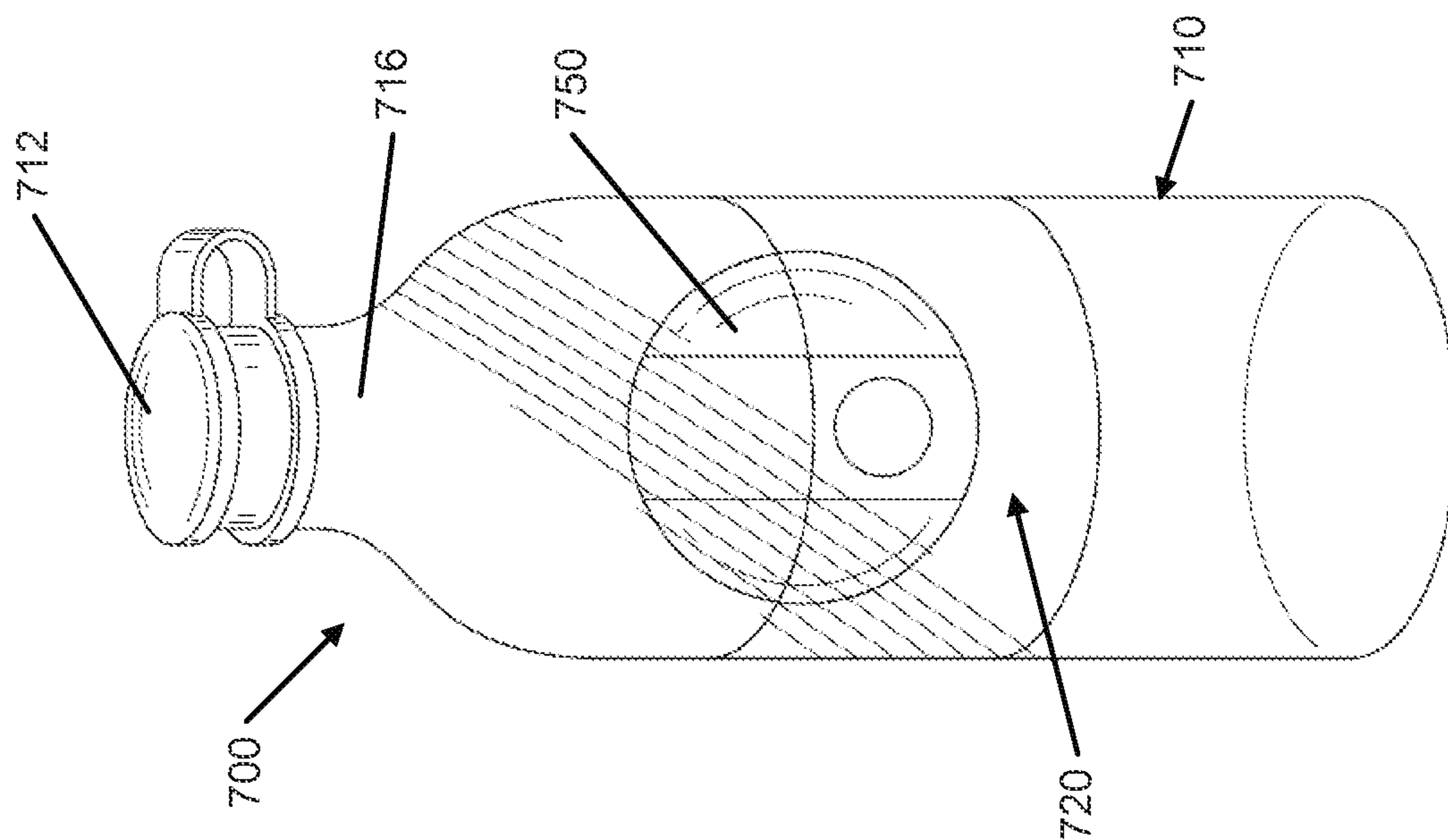
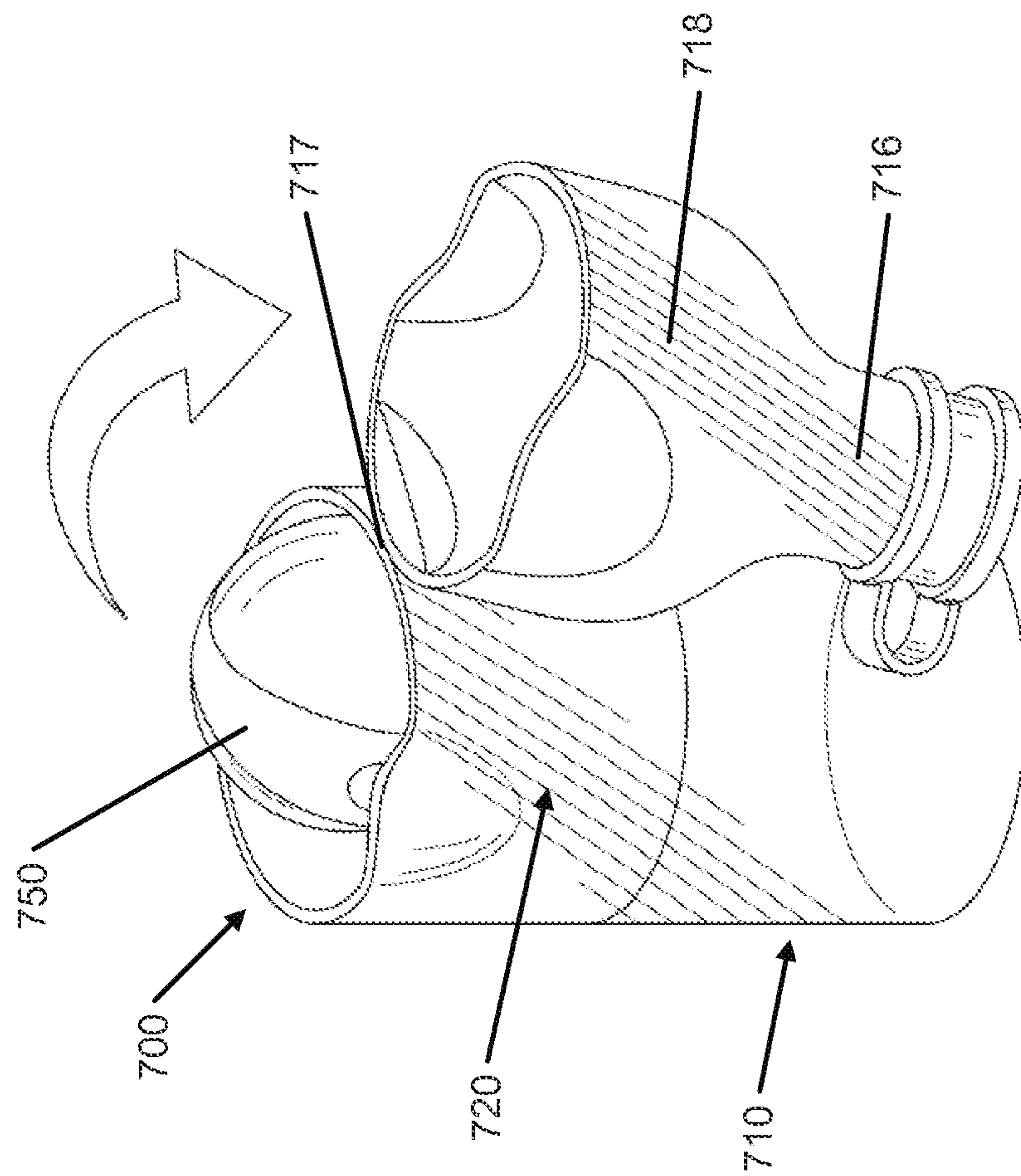
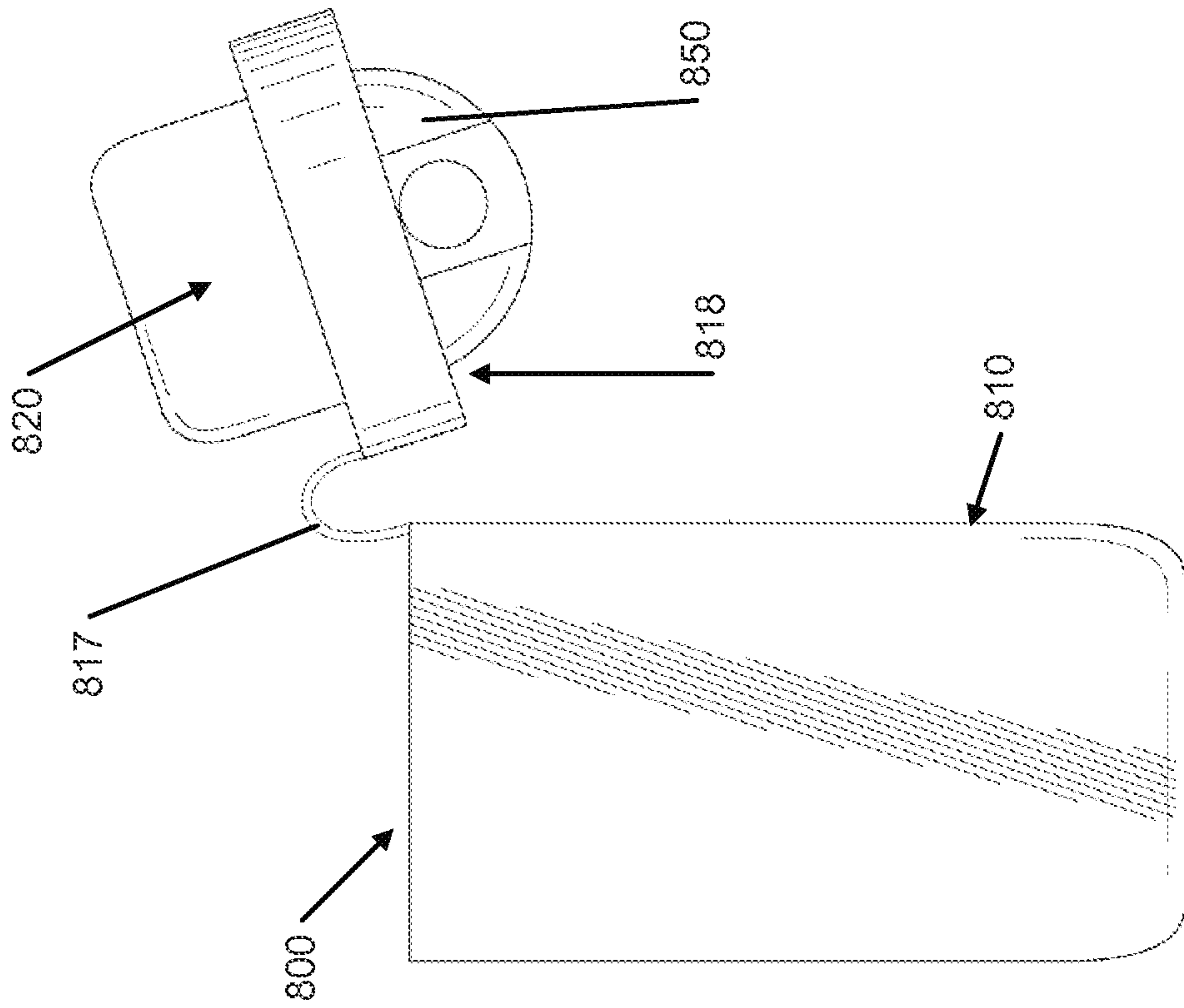
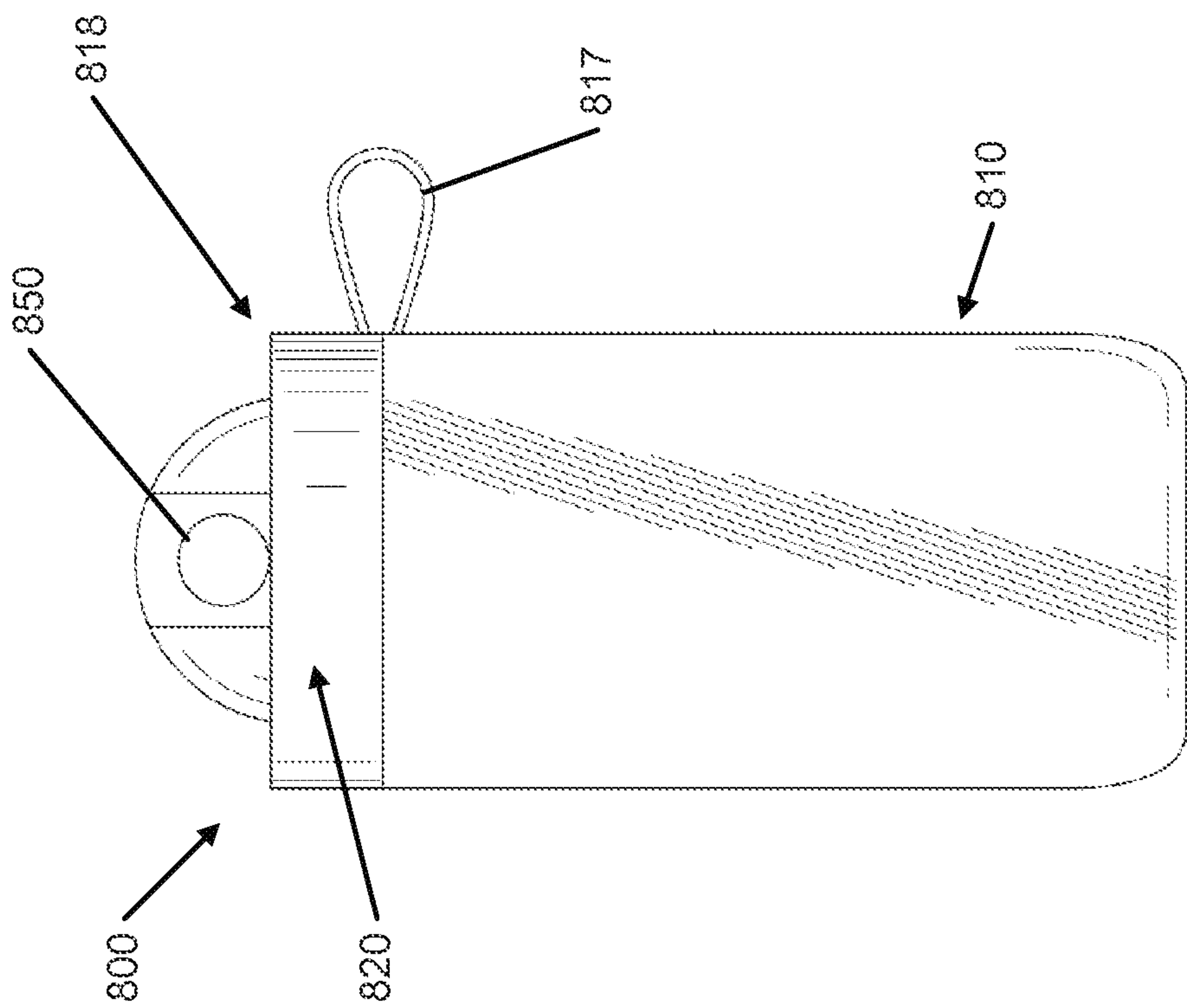


FIG. 4D

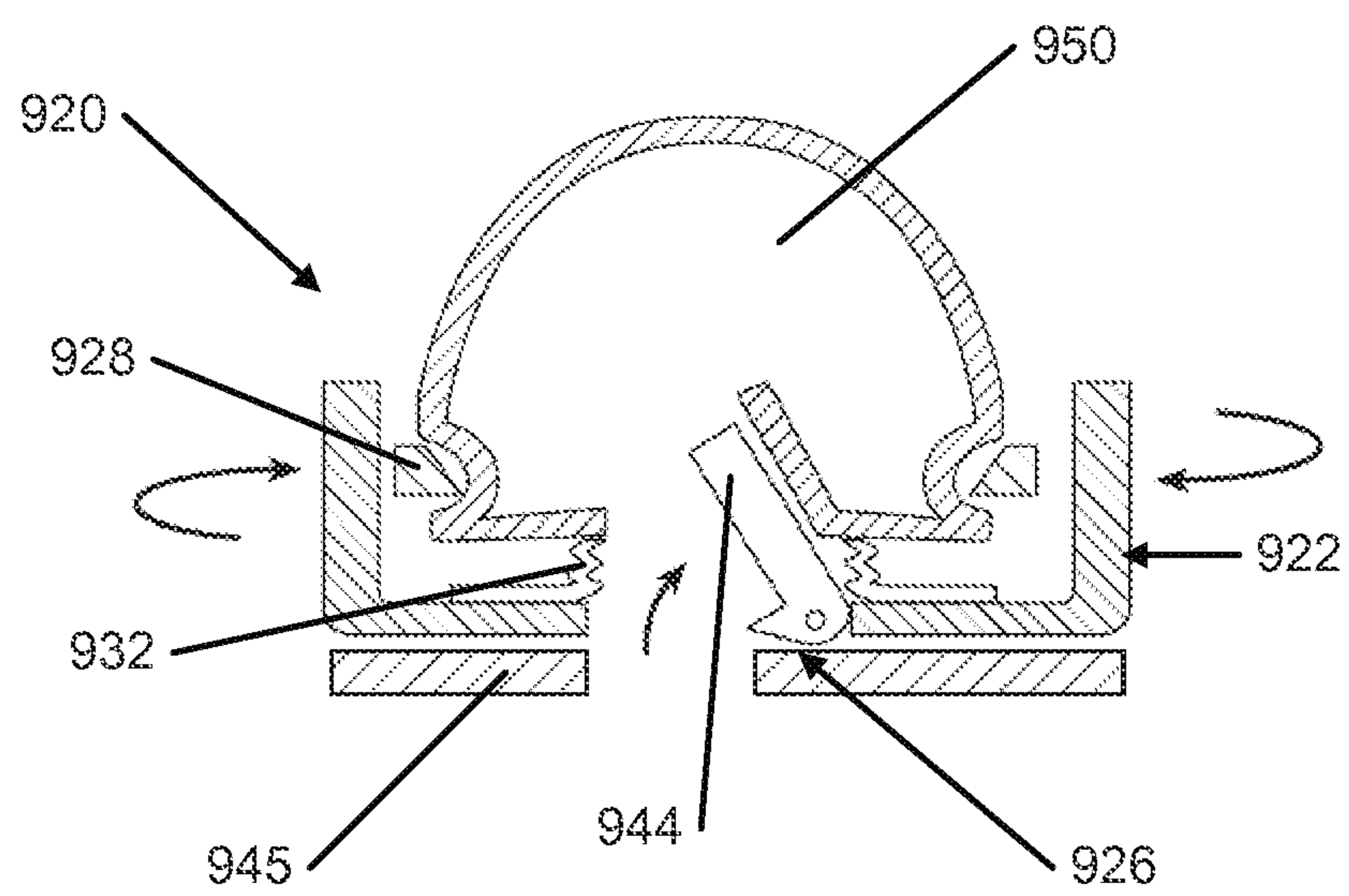
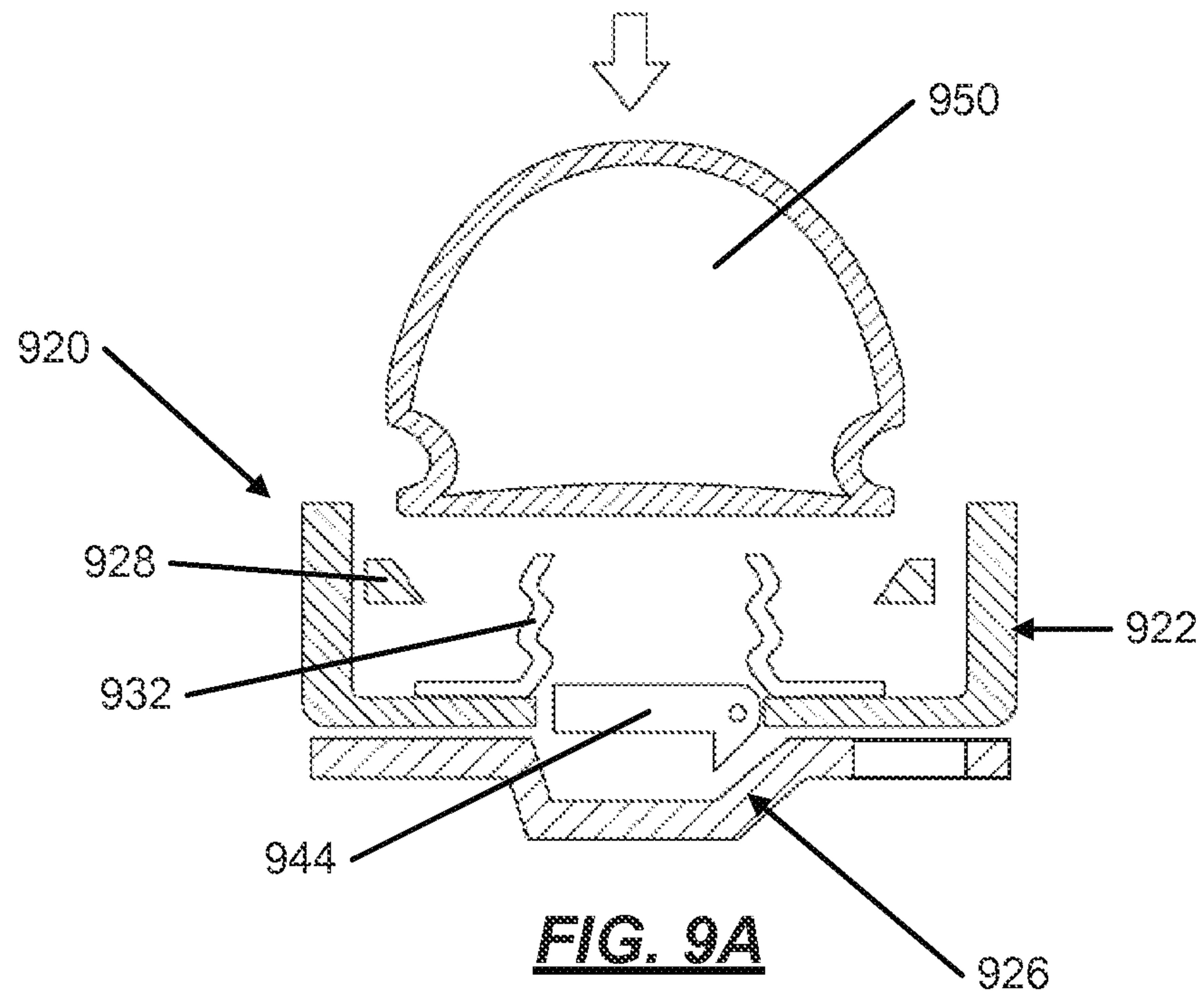
**FIG. 5A****FIG. 5B**

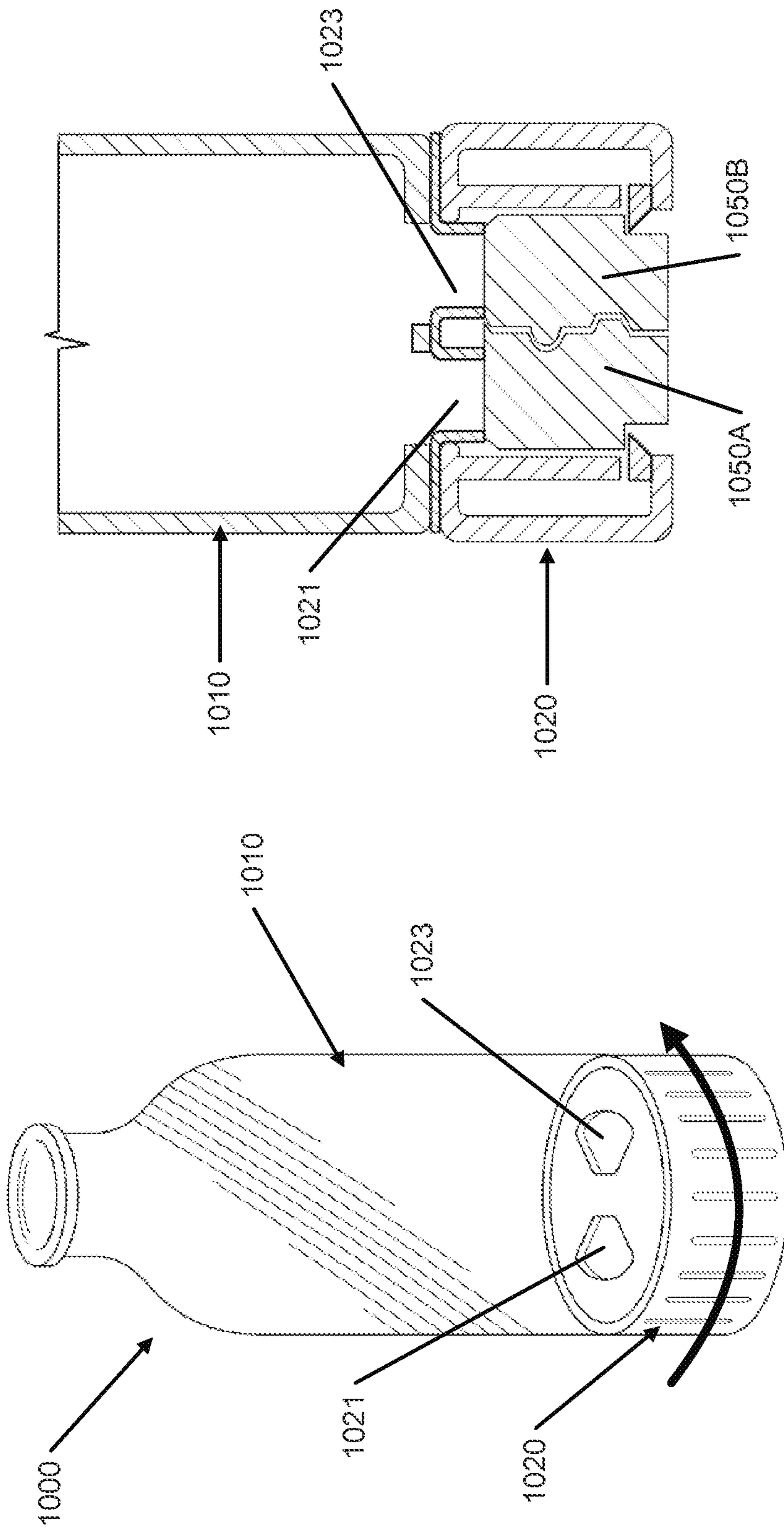
**FIG. 6B****FIG. 6A**

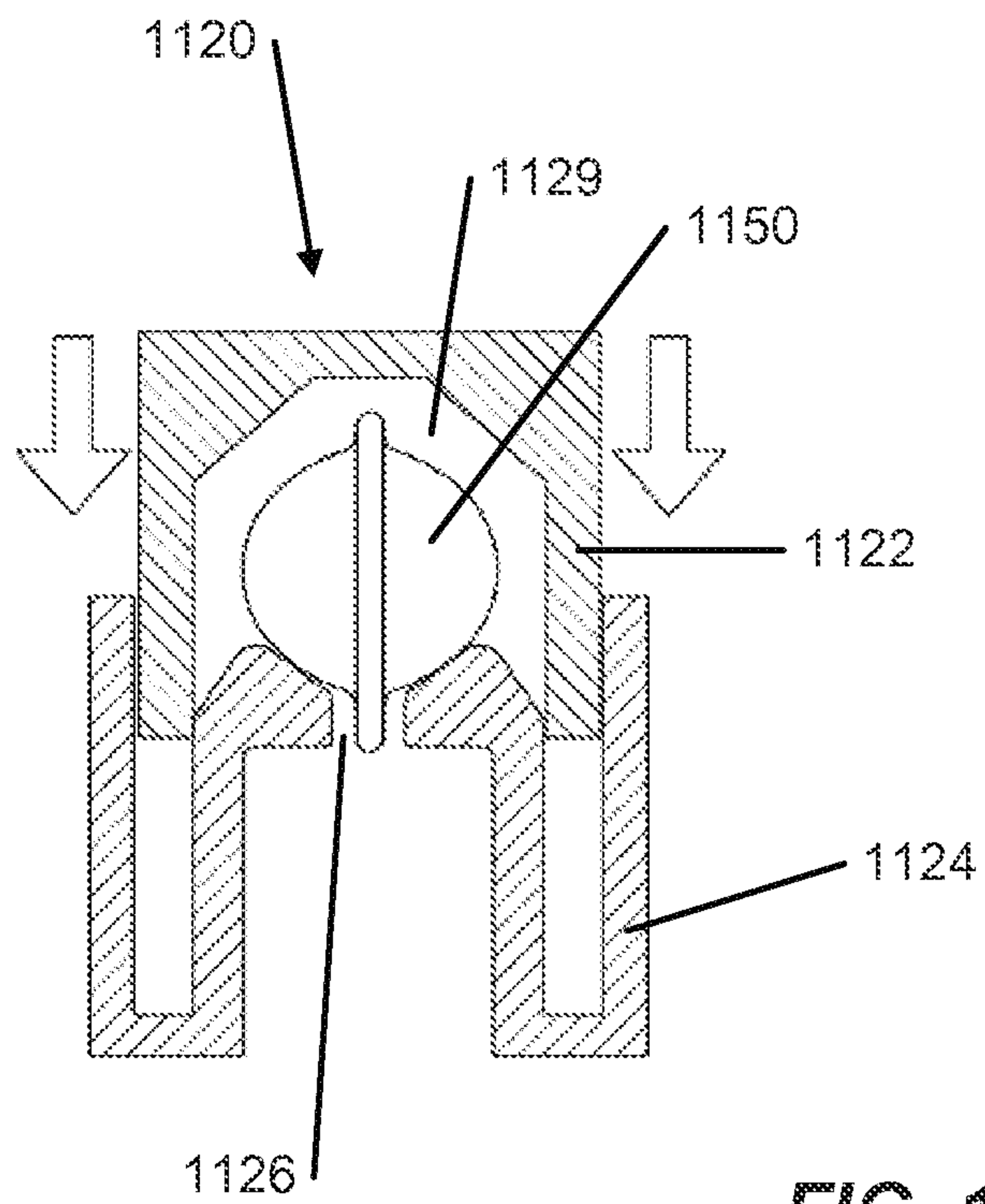
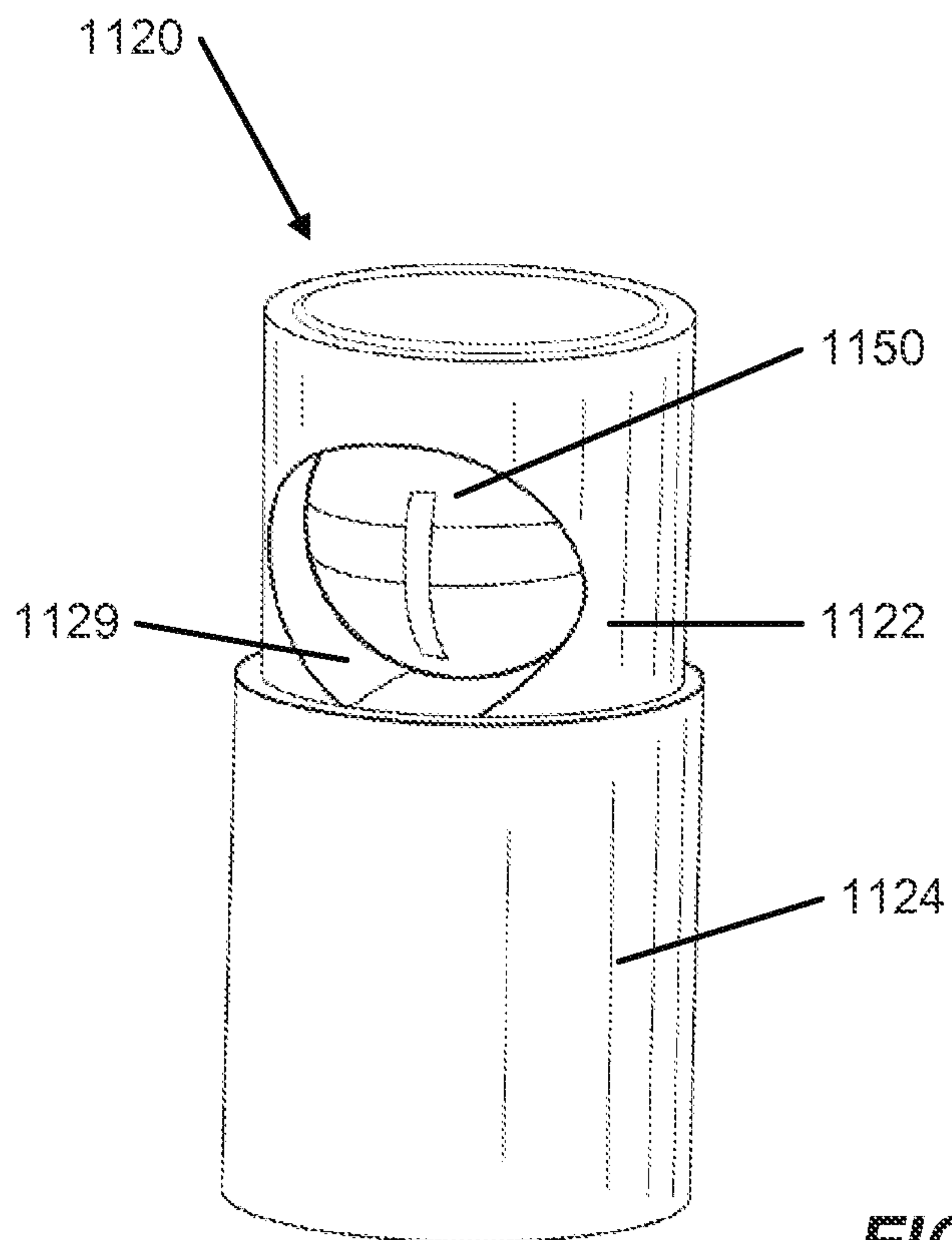
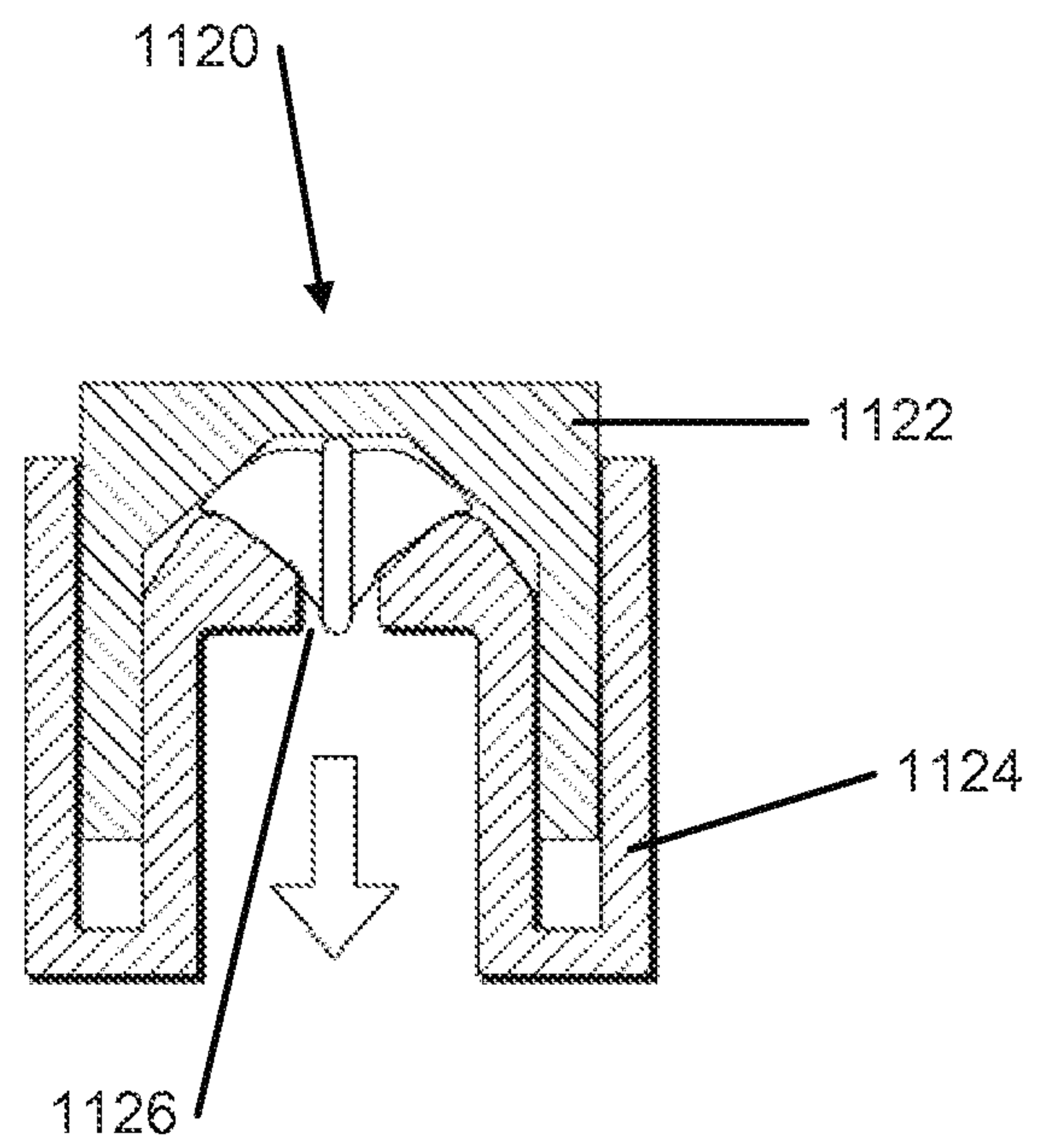
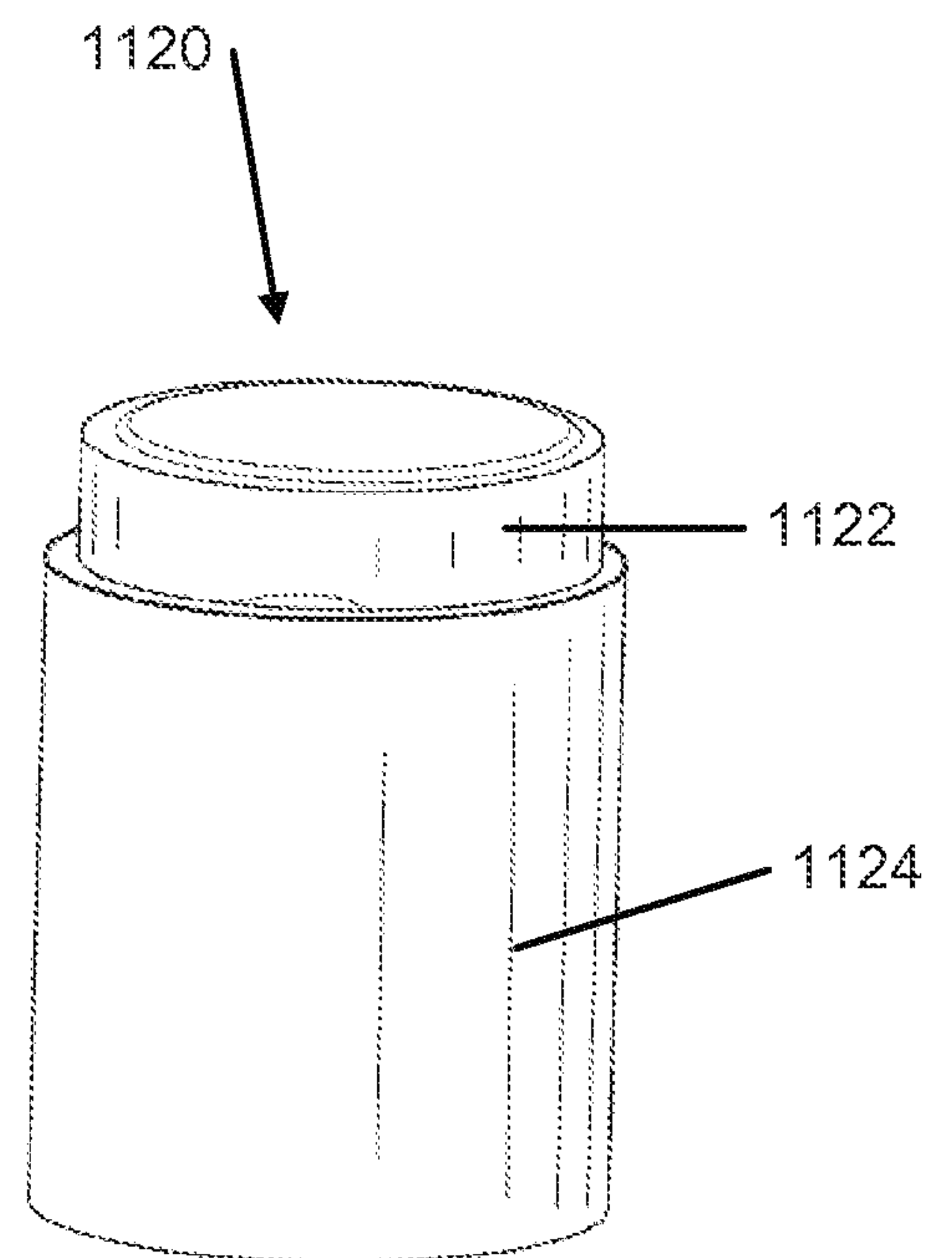
**FIG. 7A****FIG. 7B**

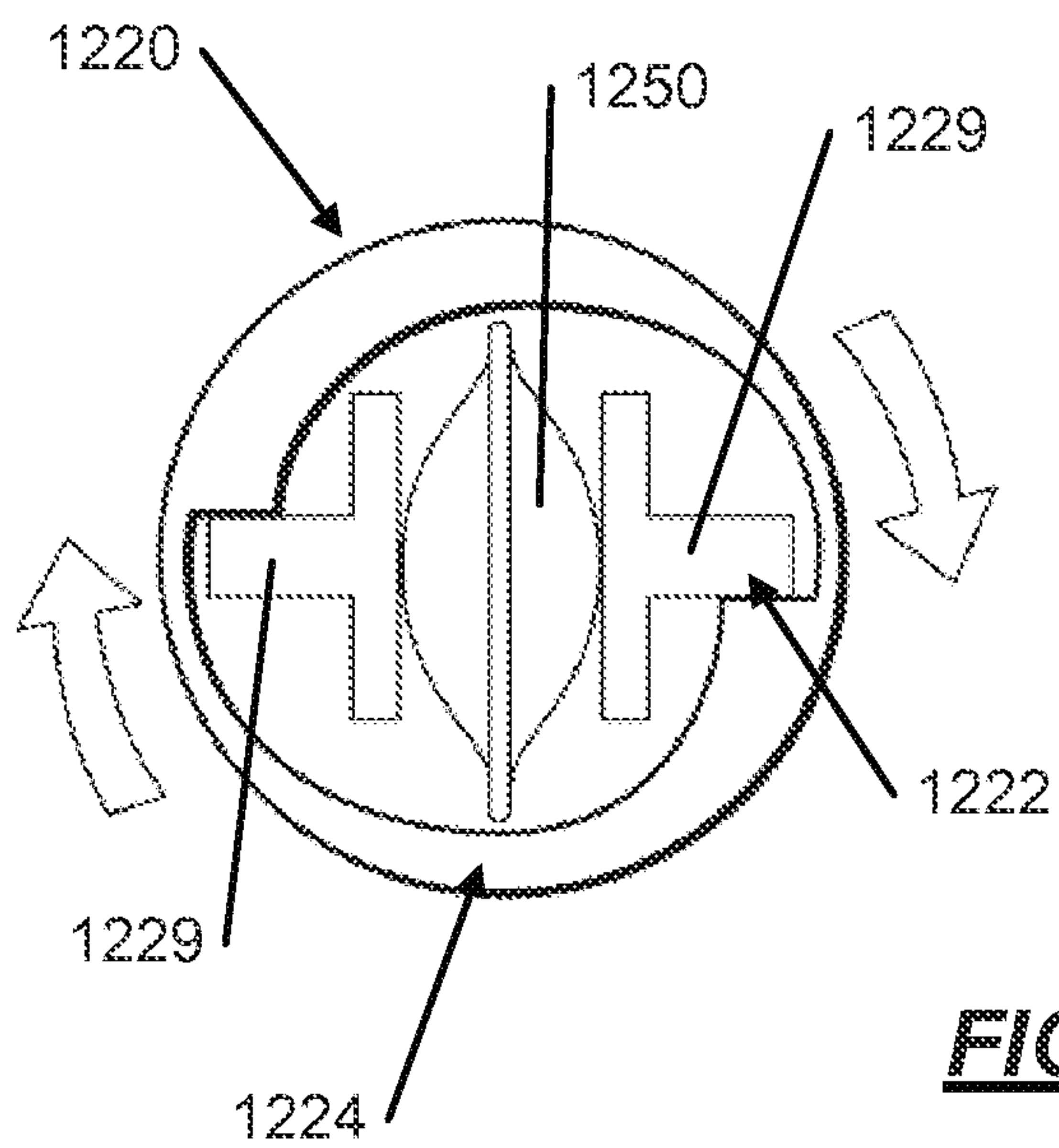
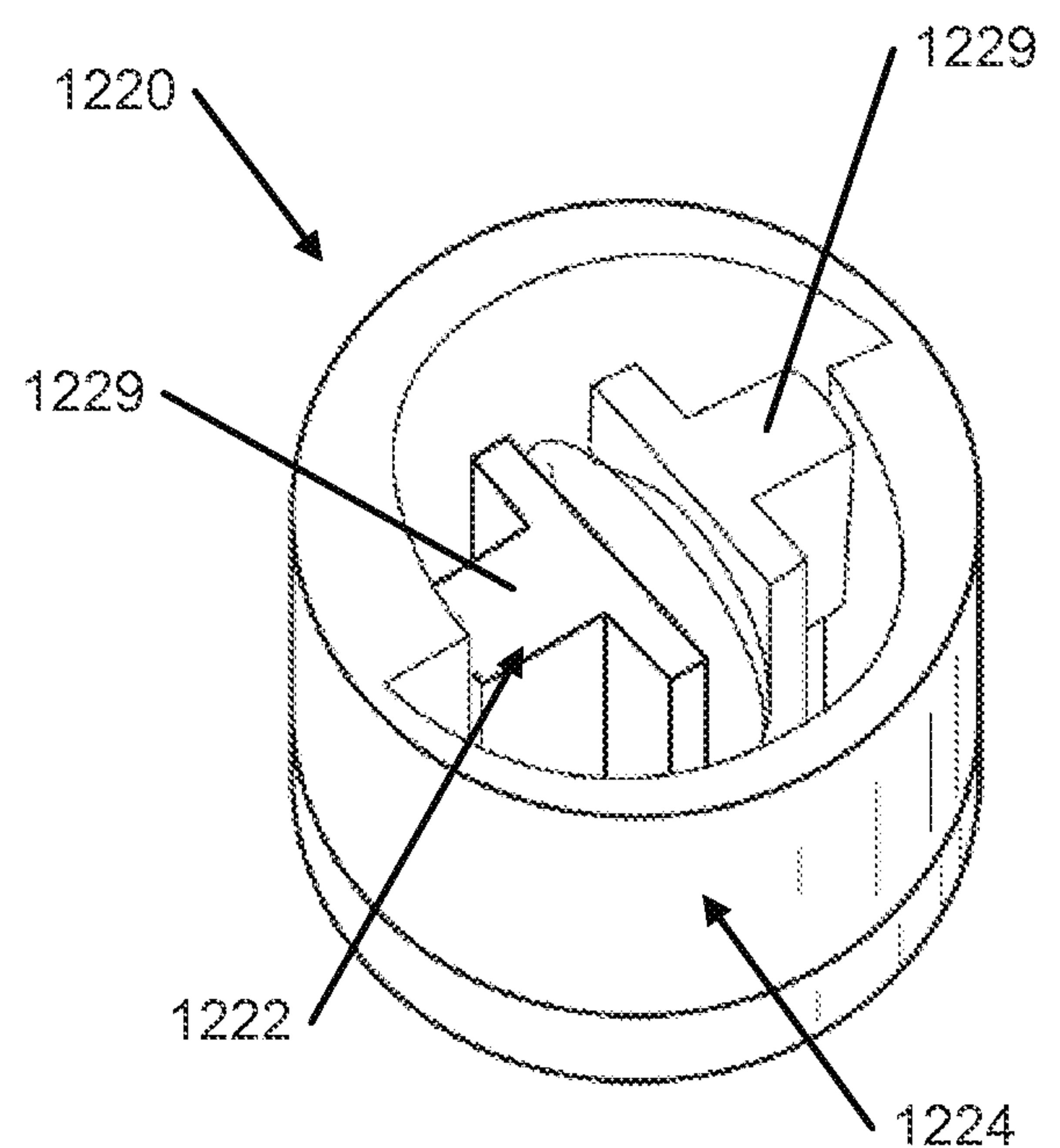
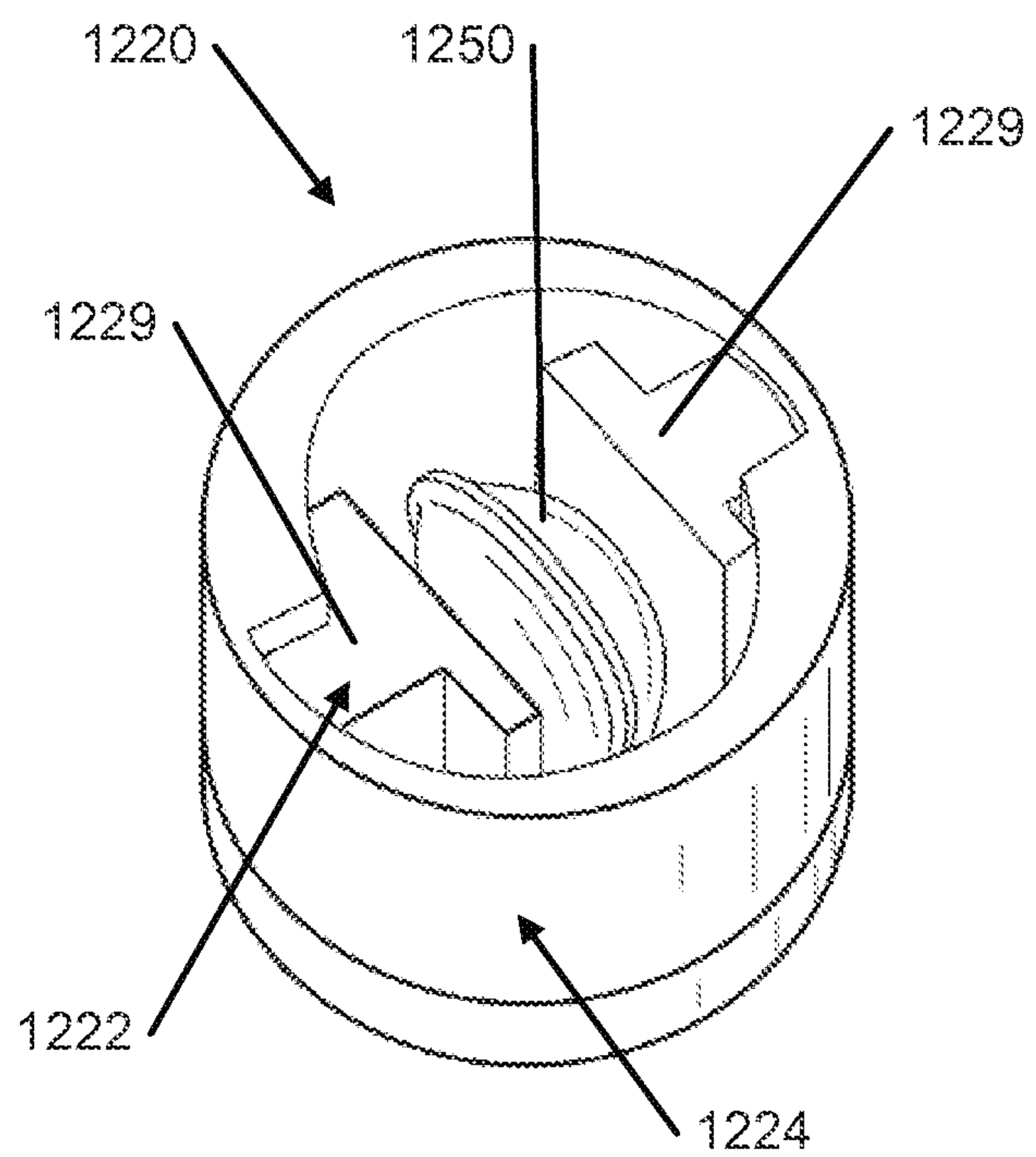
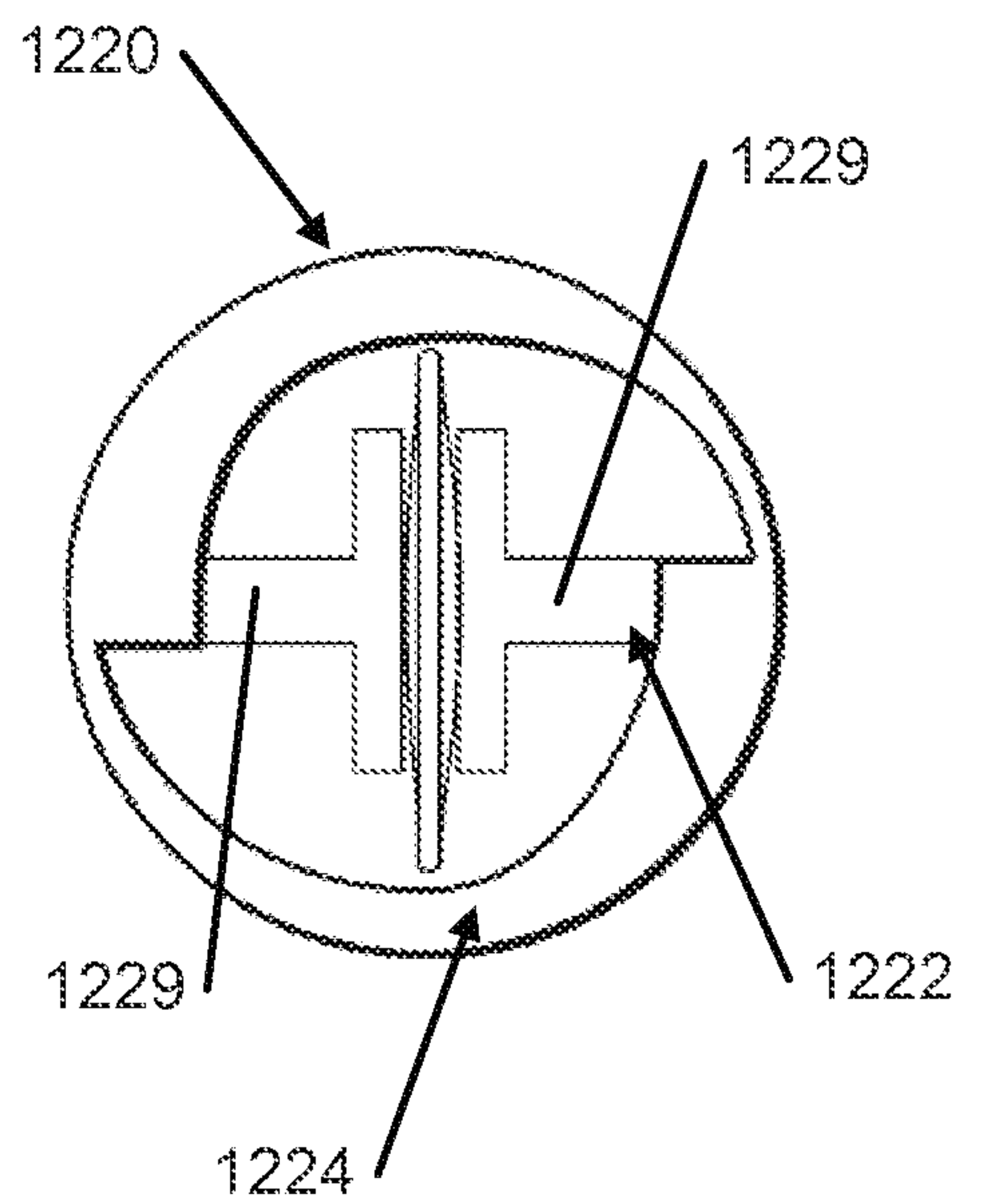
**FIG. 8B****FIG. 8A**

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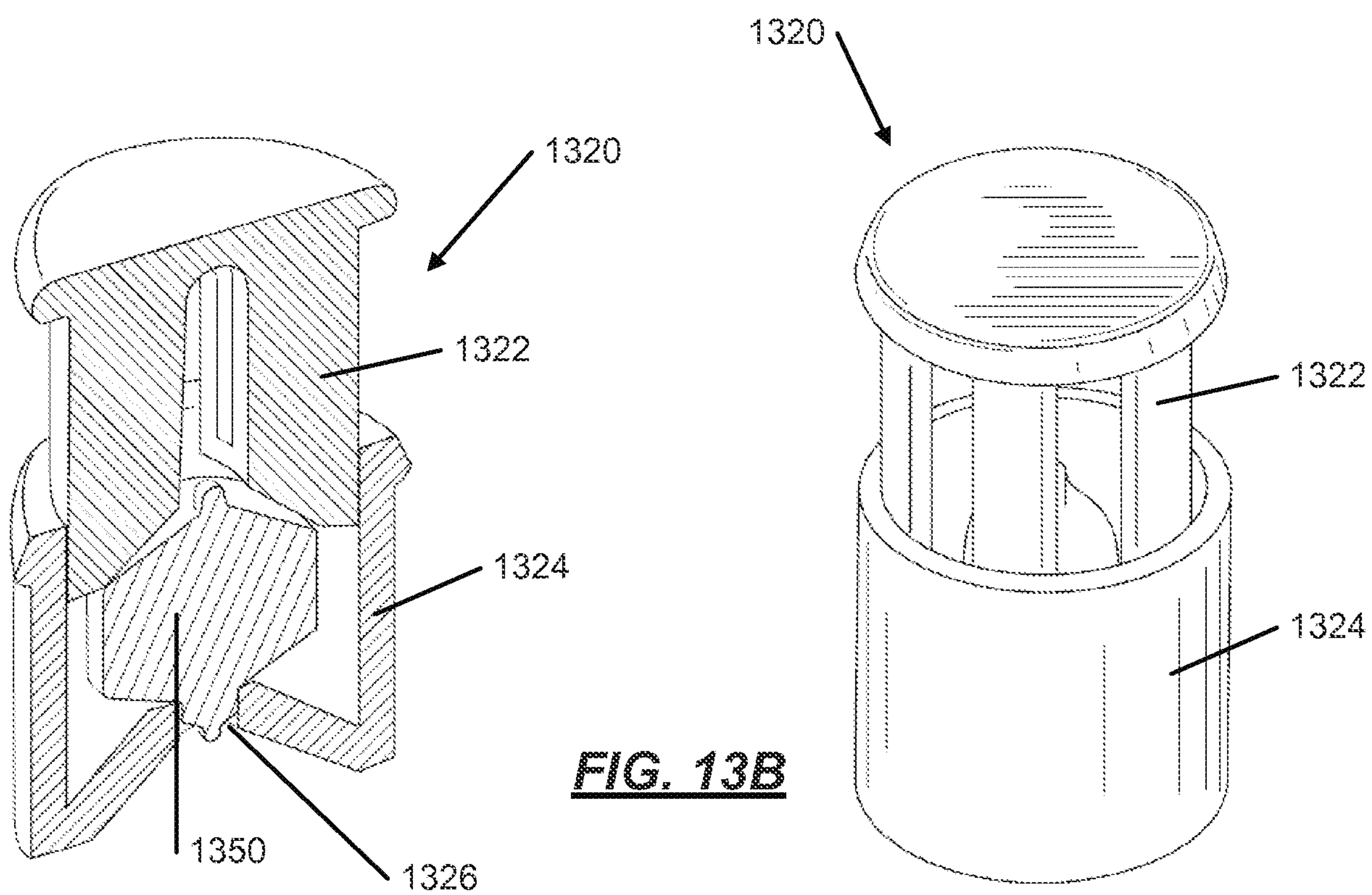
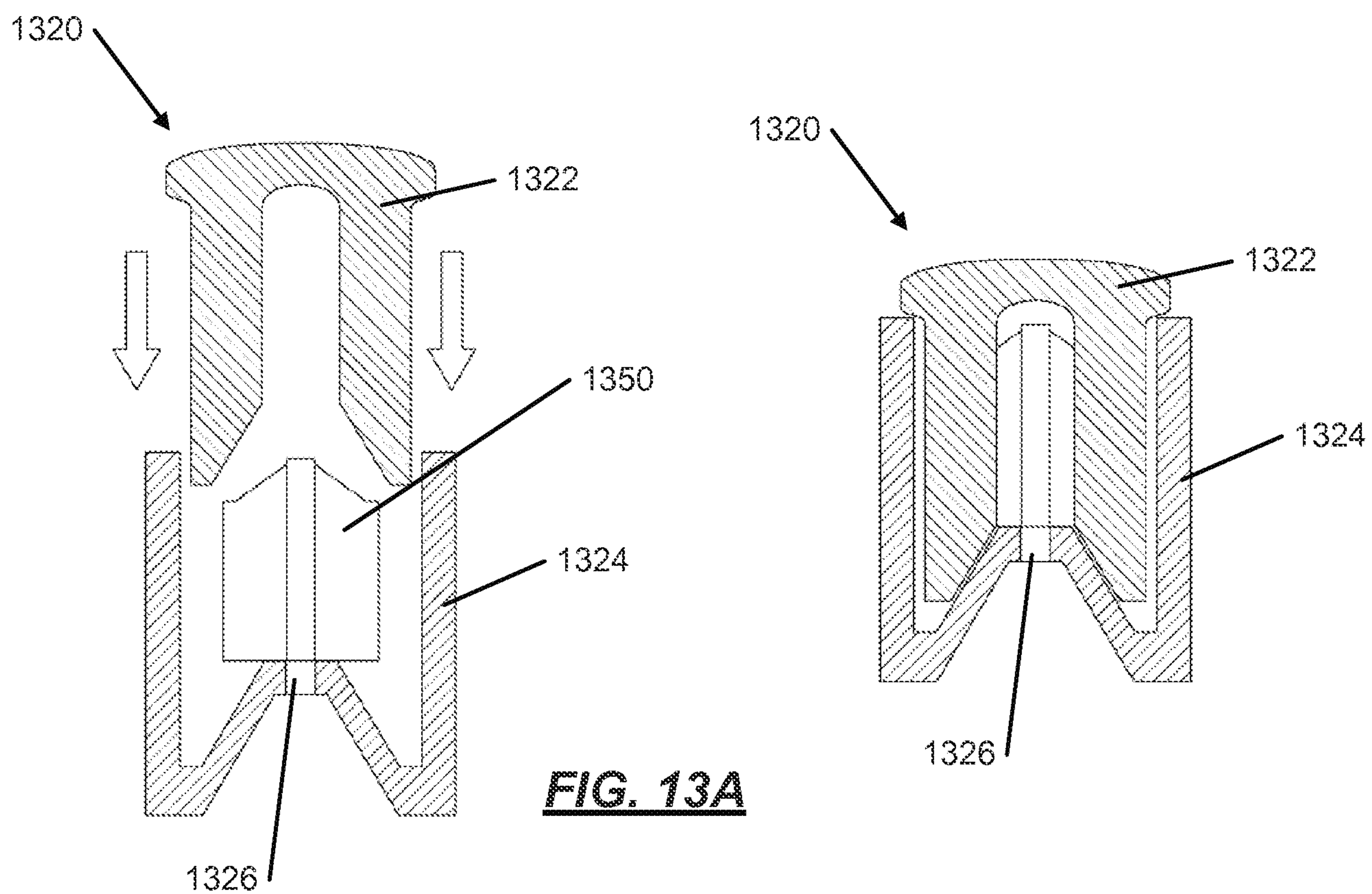


**FIG. 10B****FIG. 10A**

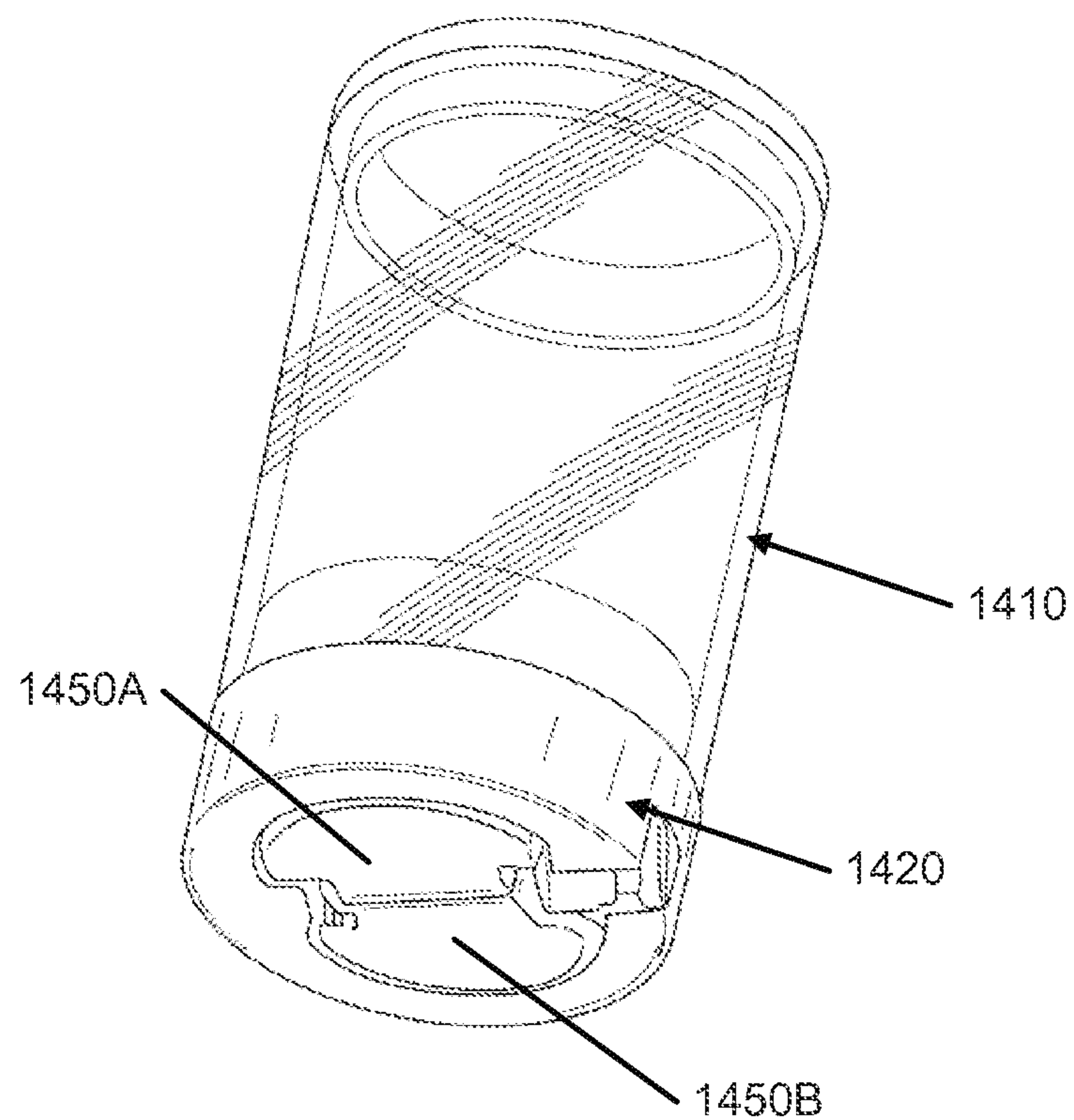
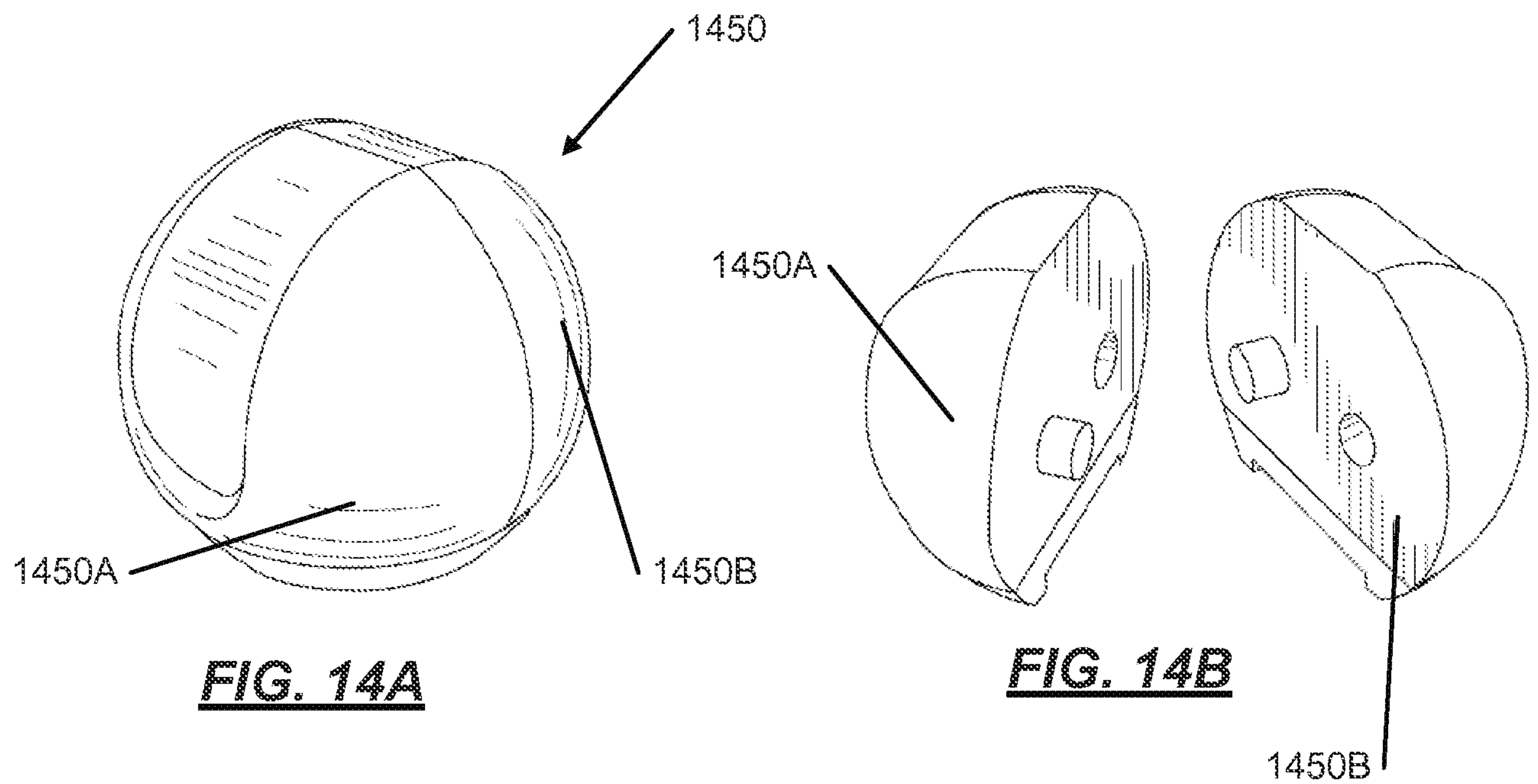
**FIG. 11A****FIG. 11B**

**FIG. 12A****FIG. 12B**

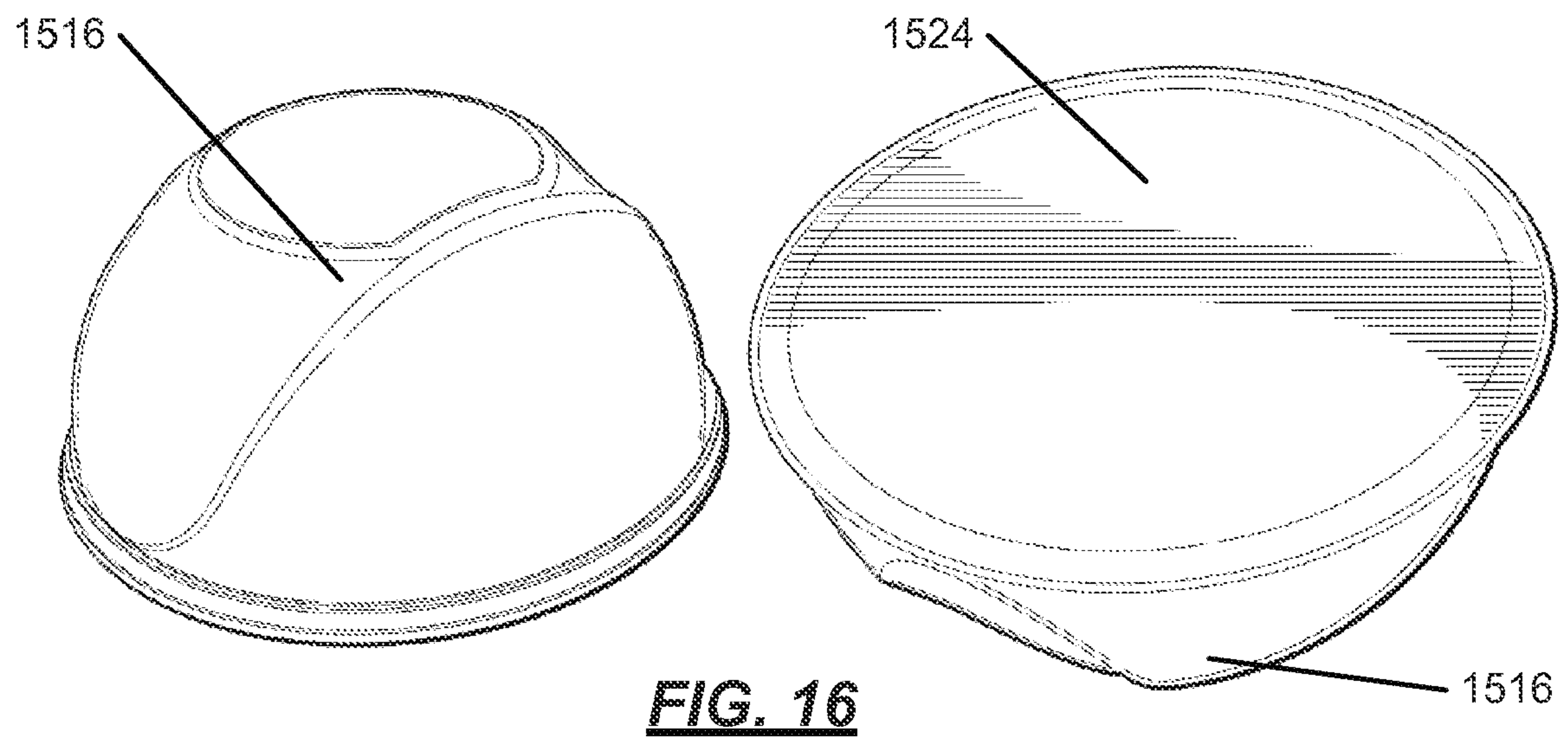
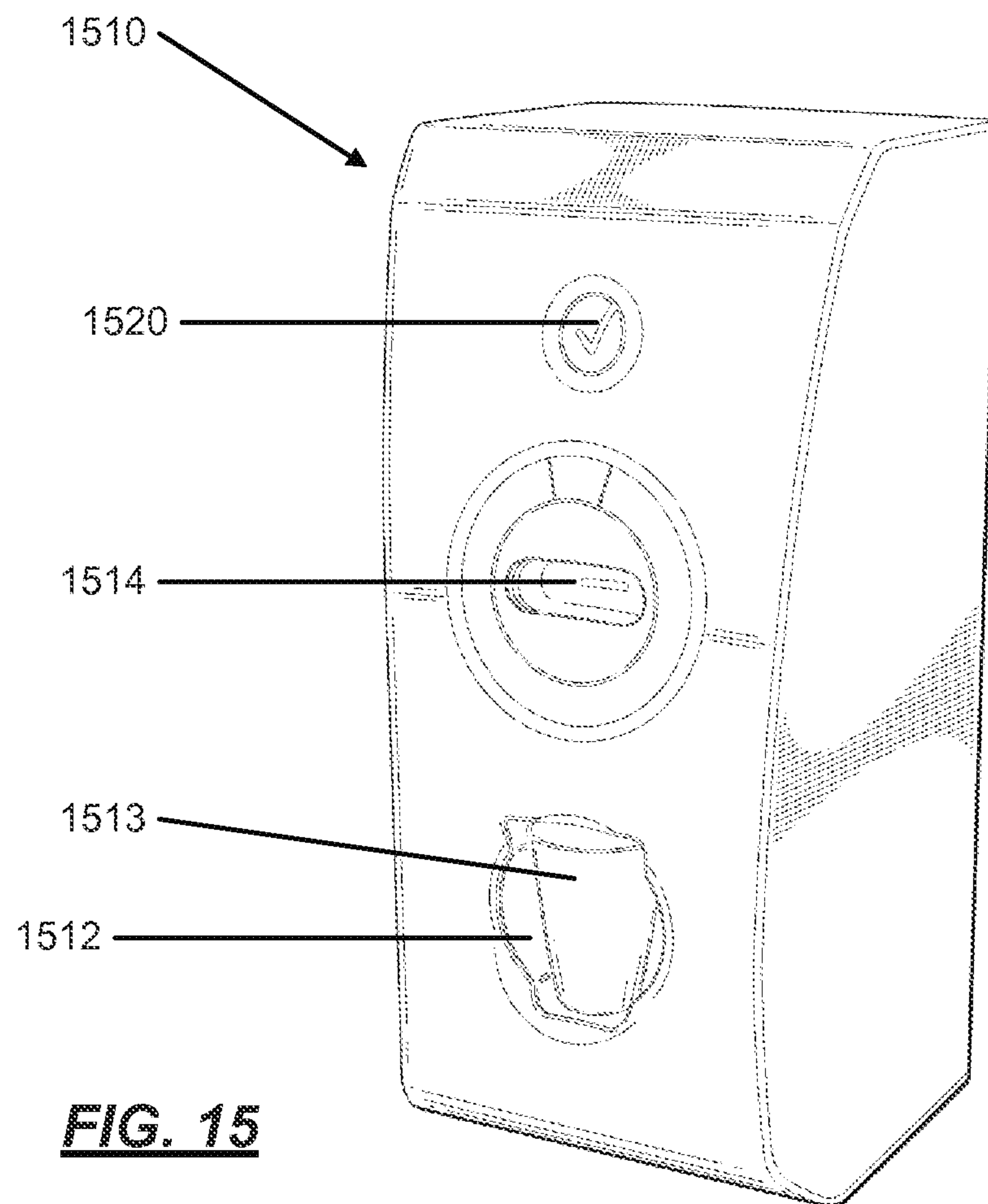
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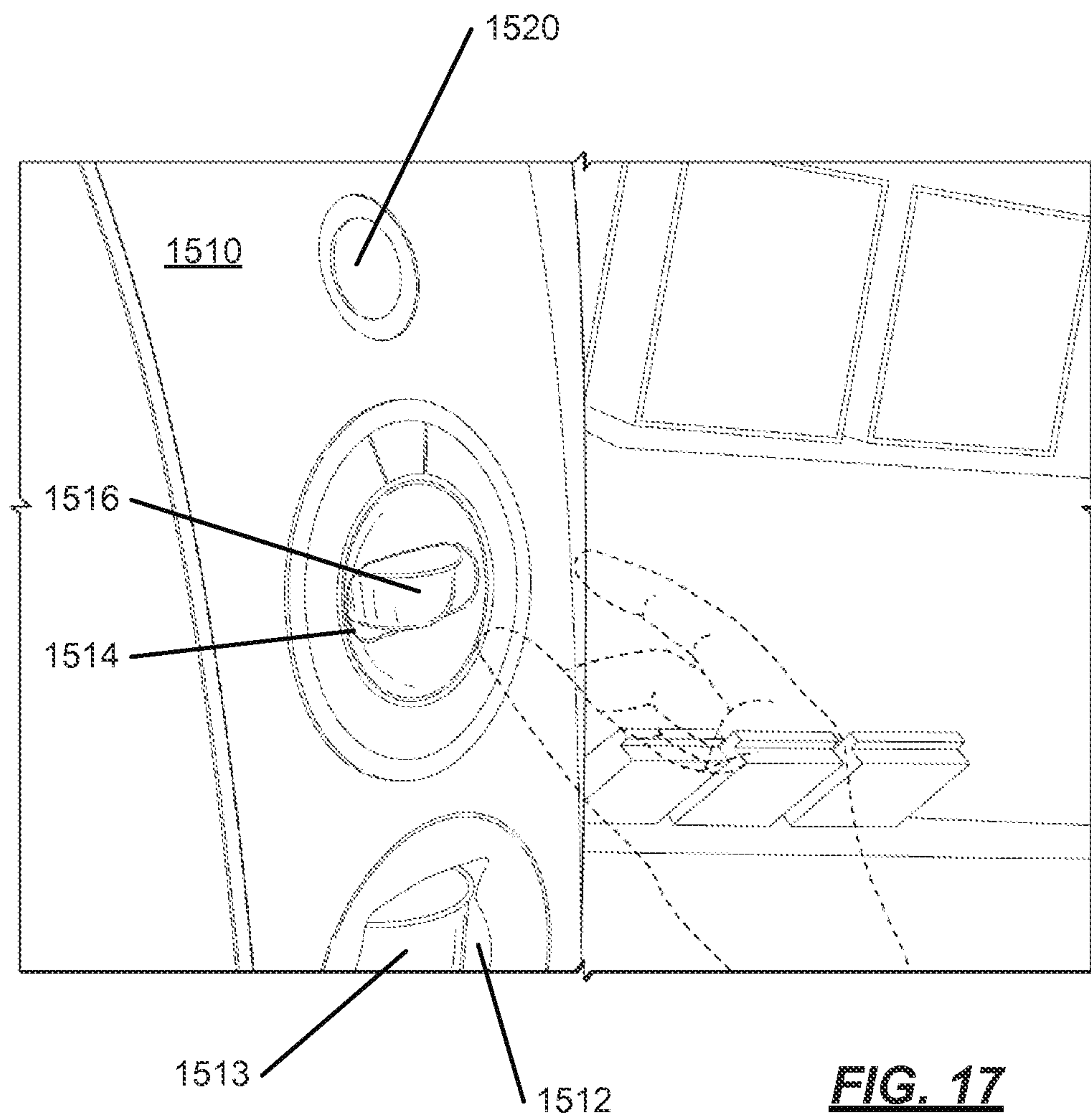


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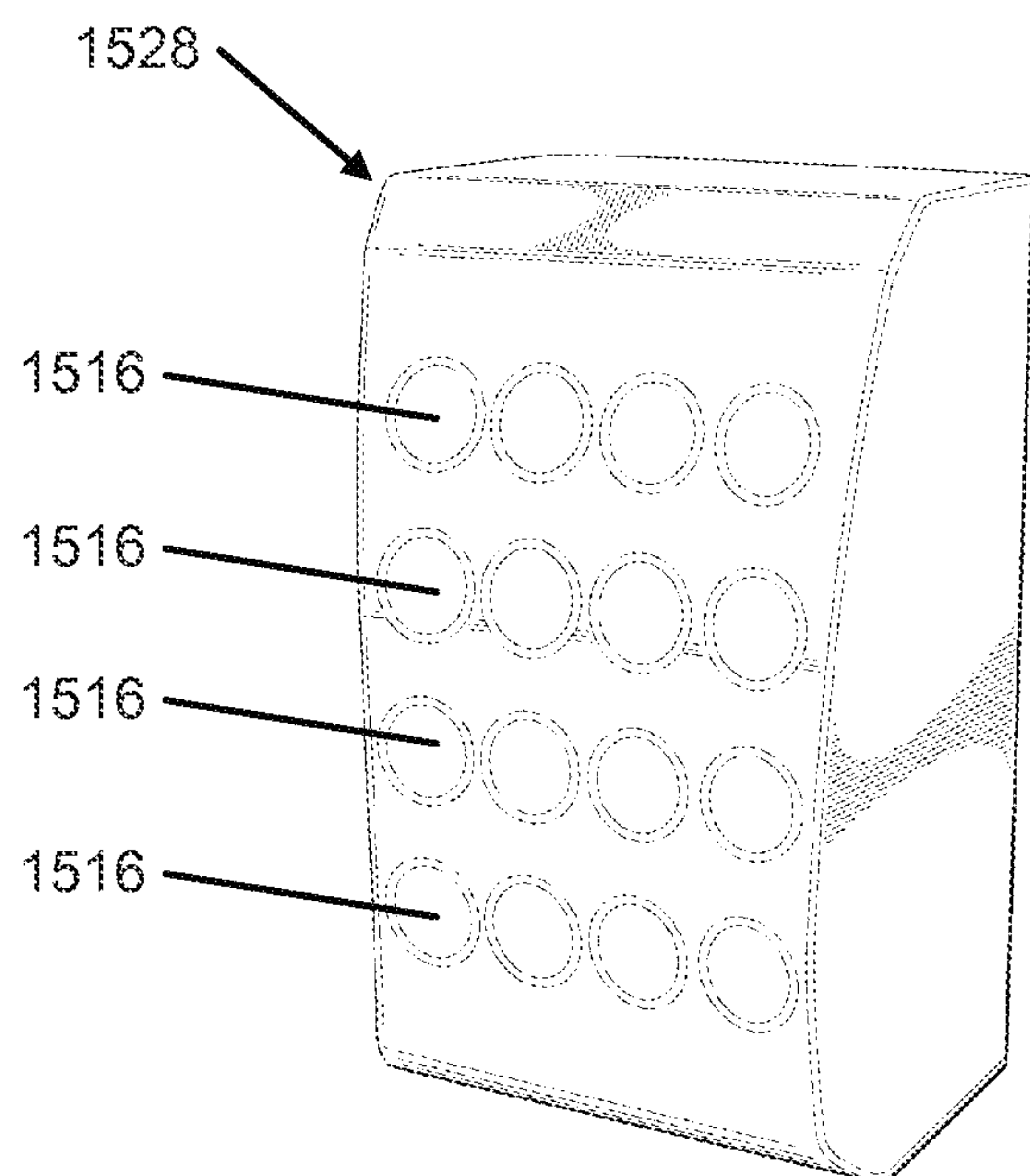
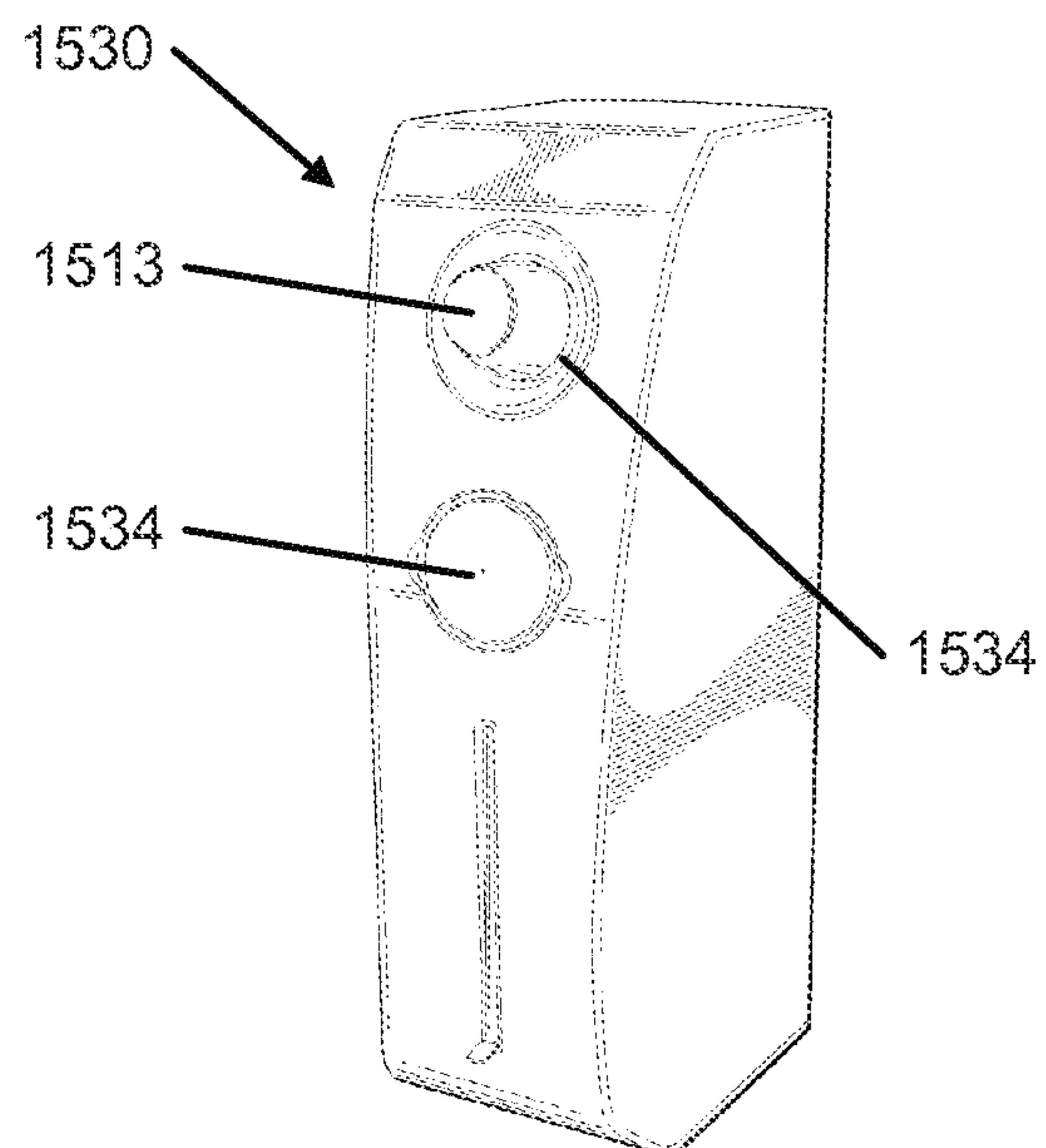
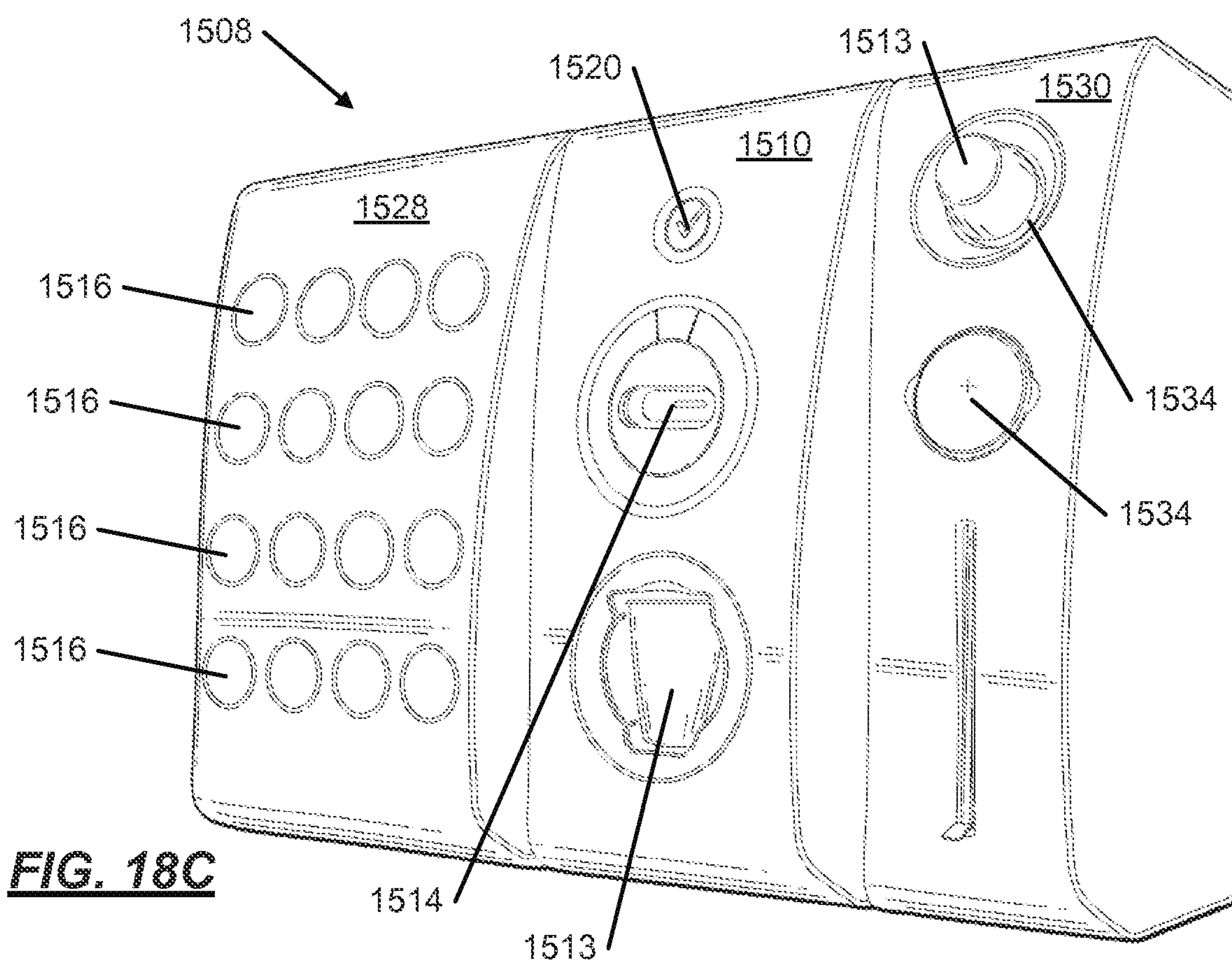
**FIG. 14C**

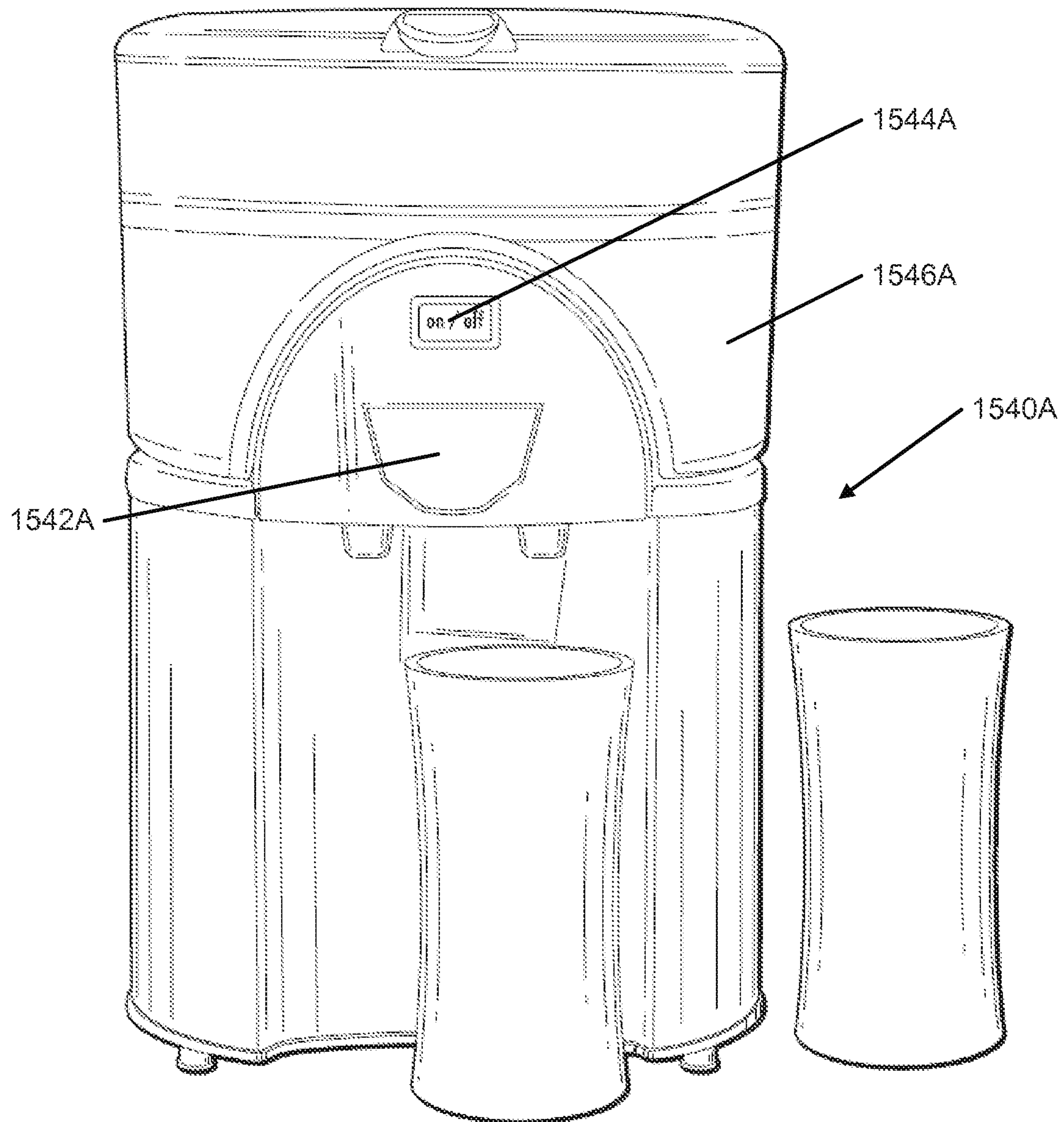
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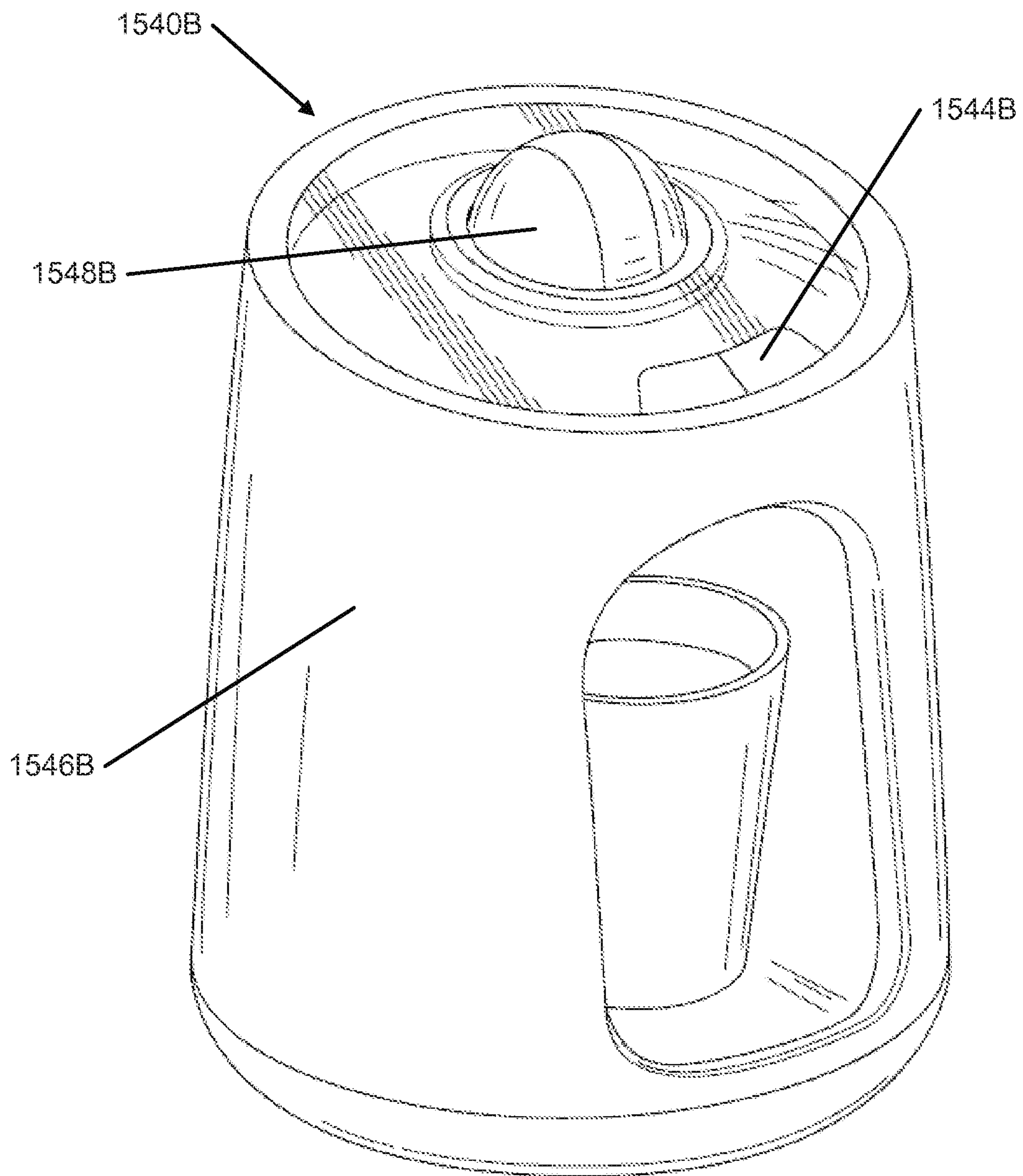


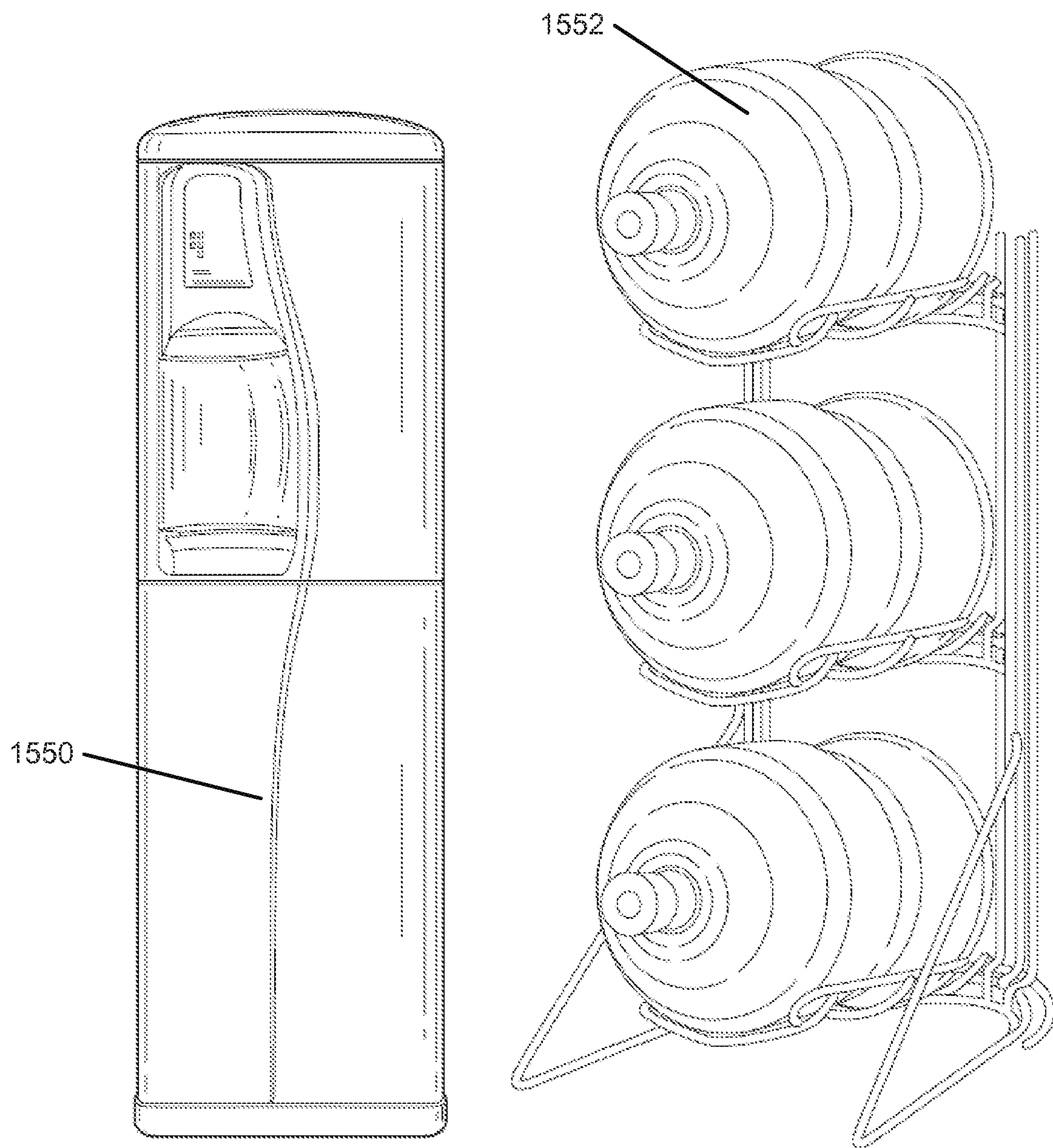


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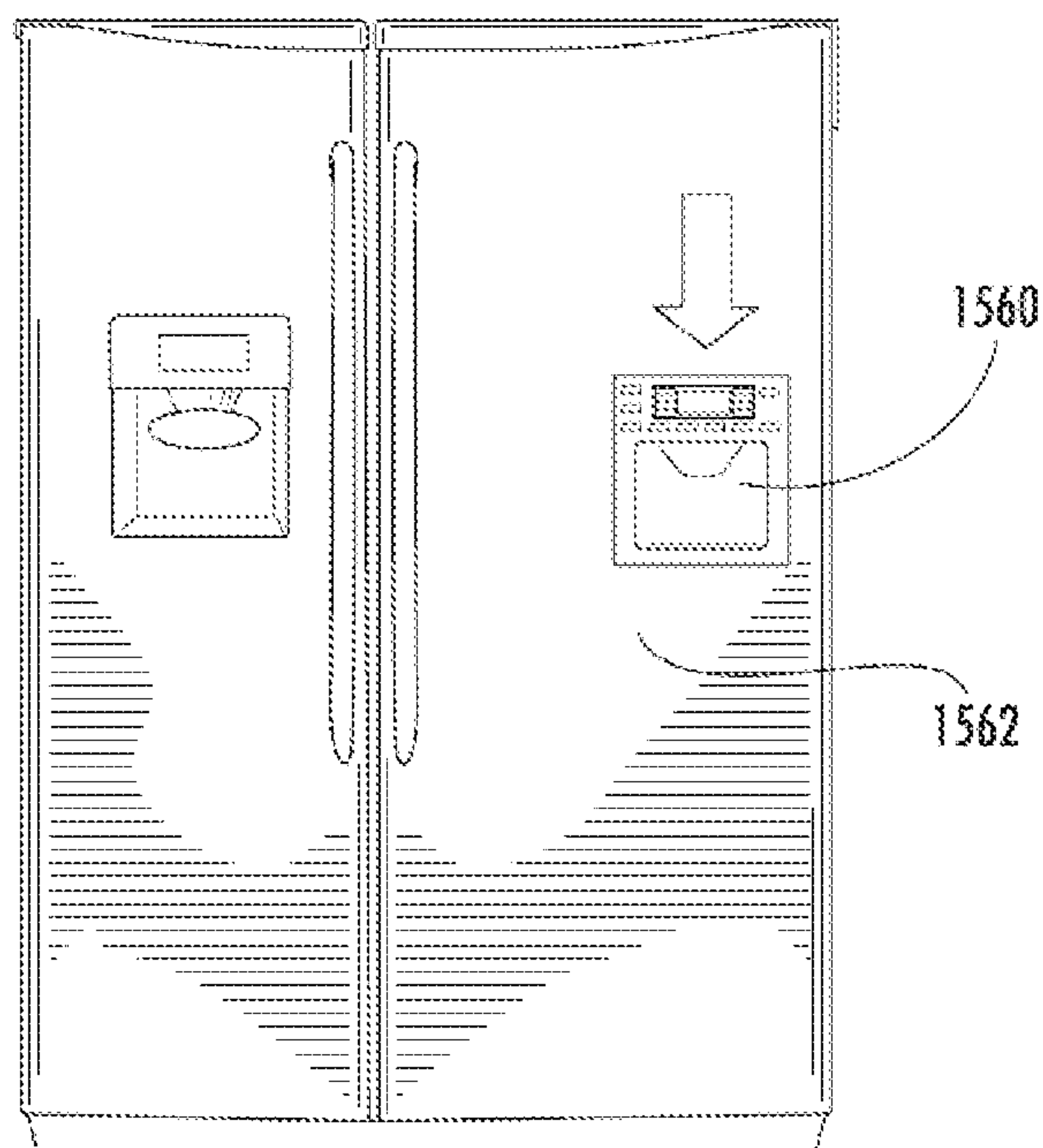
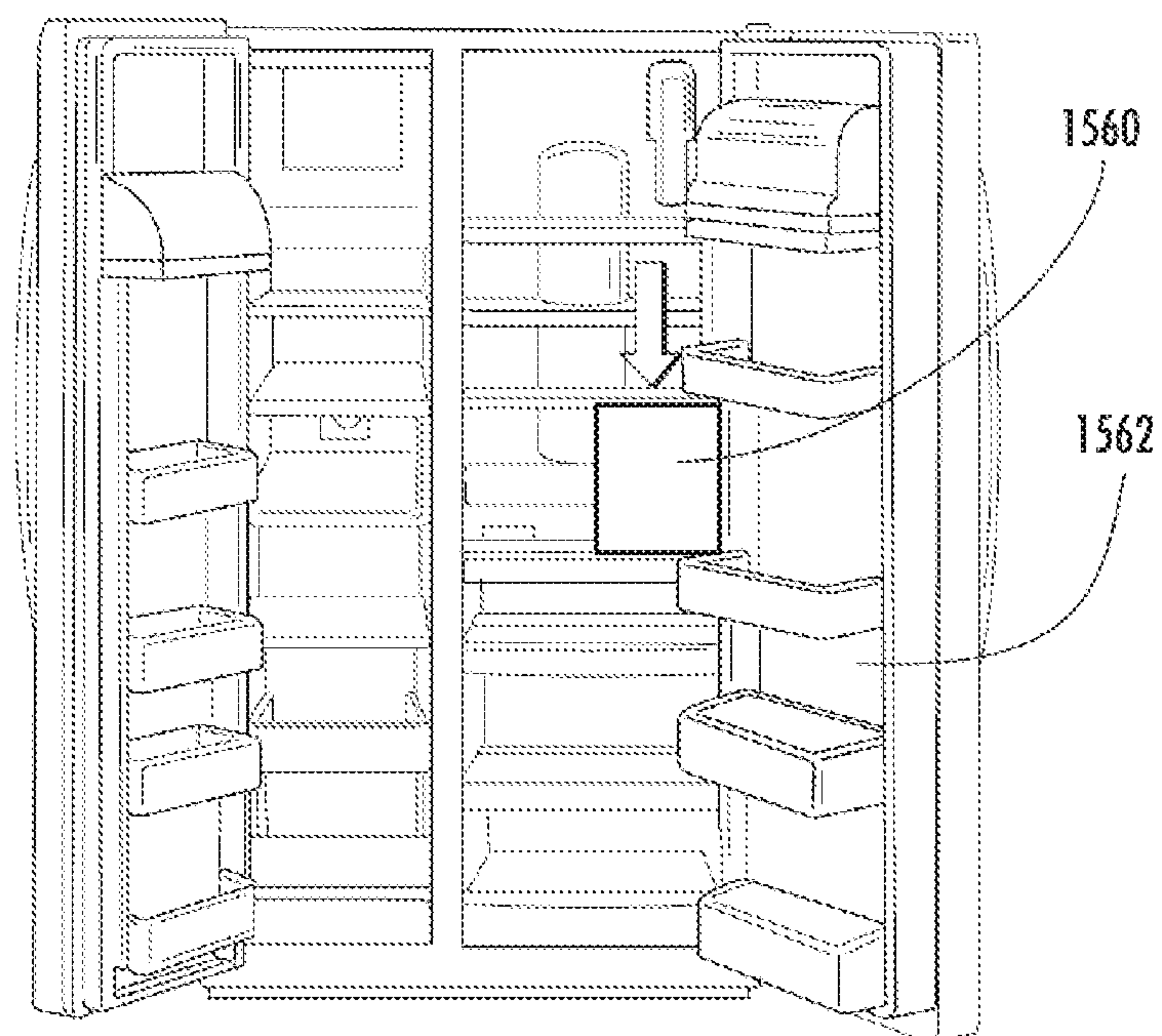
**FIG. 18A****FIG. 18B****FIG. 18C**

**FIG. 19A**

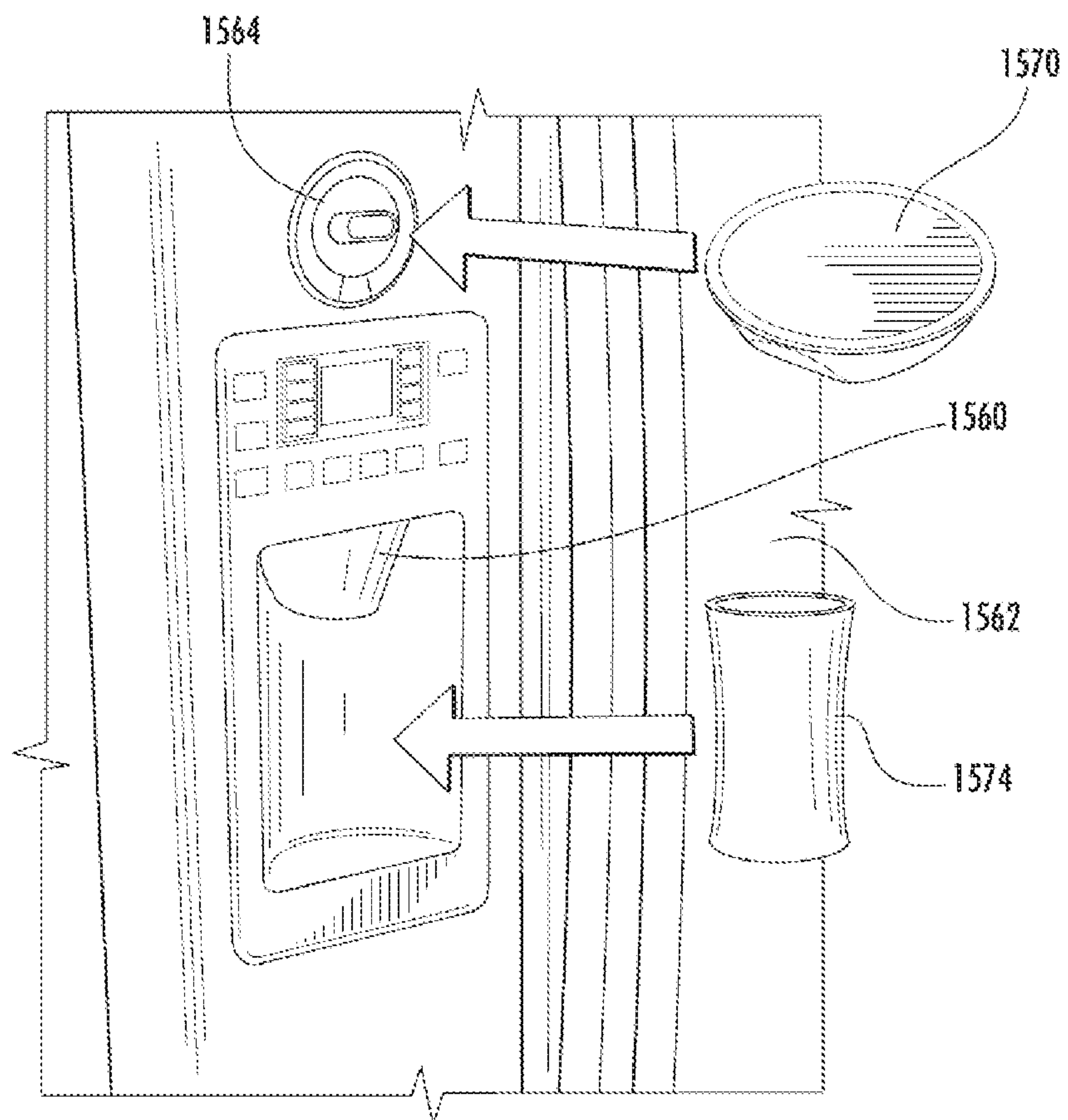
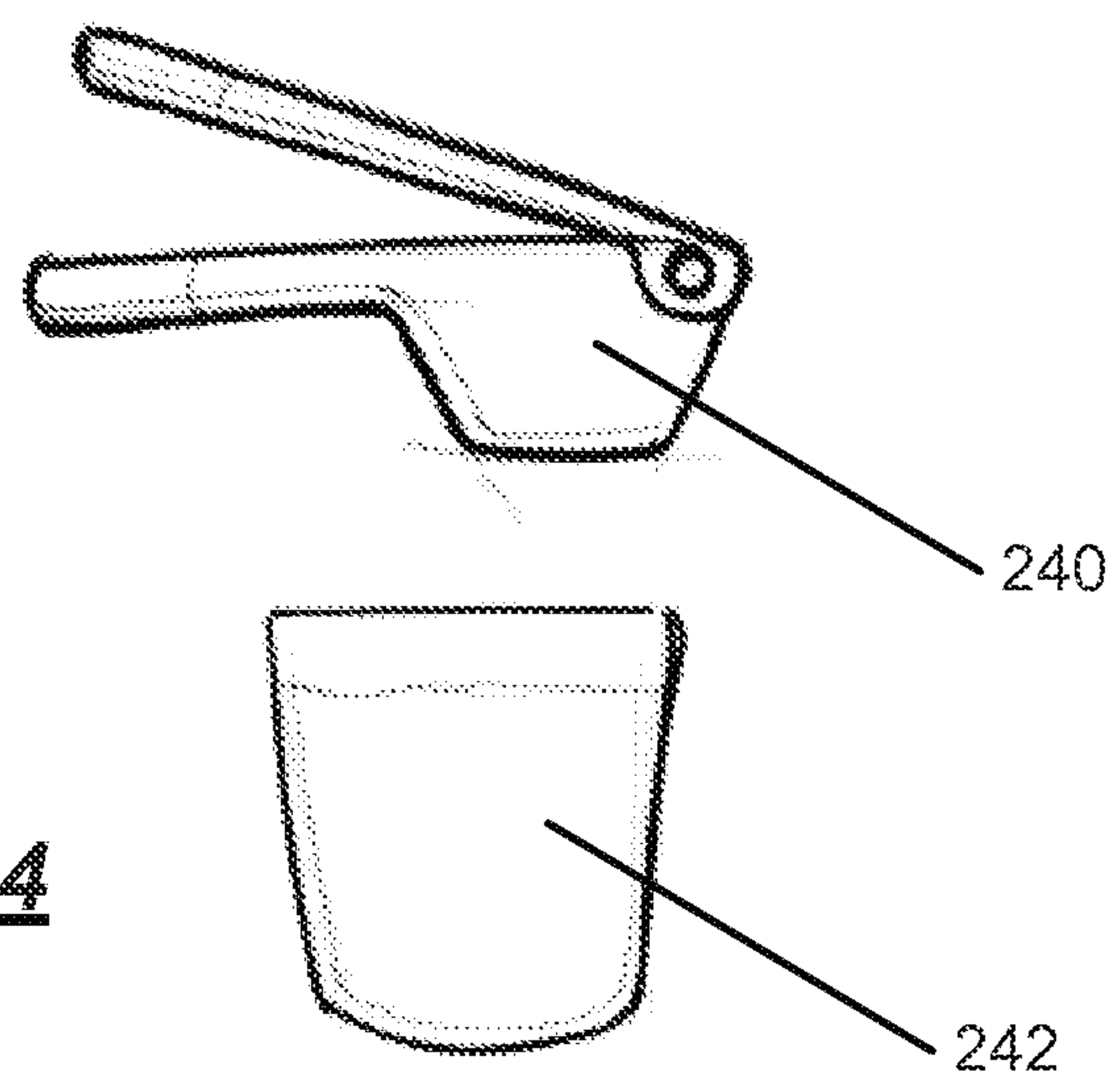
**FIG. 19B**

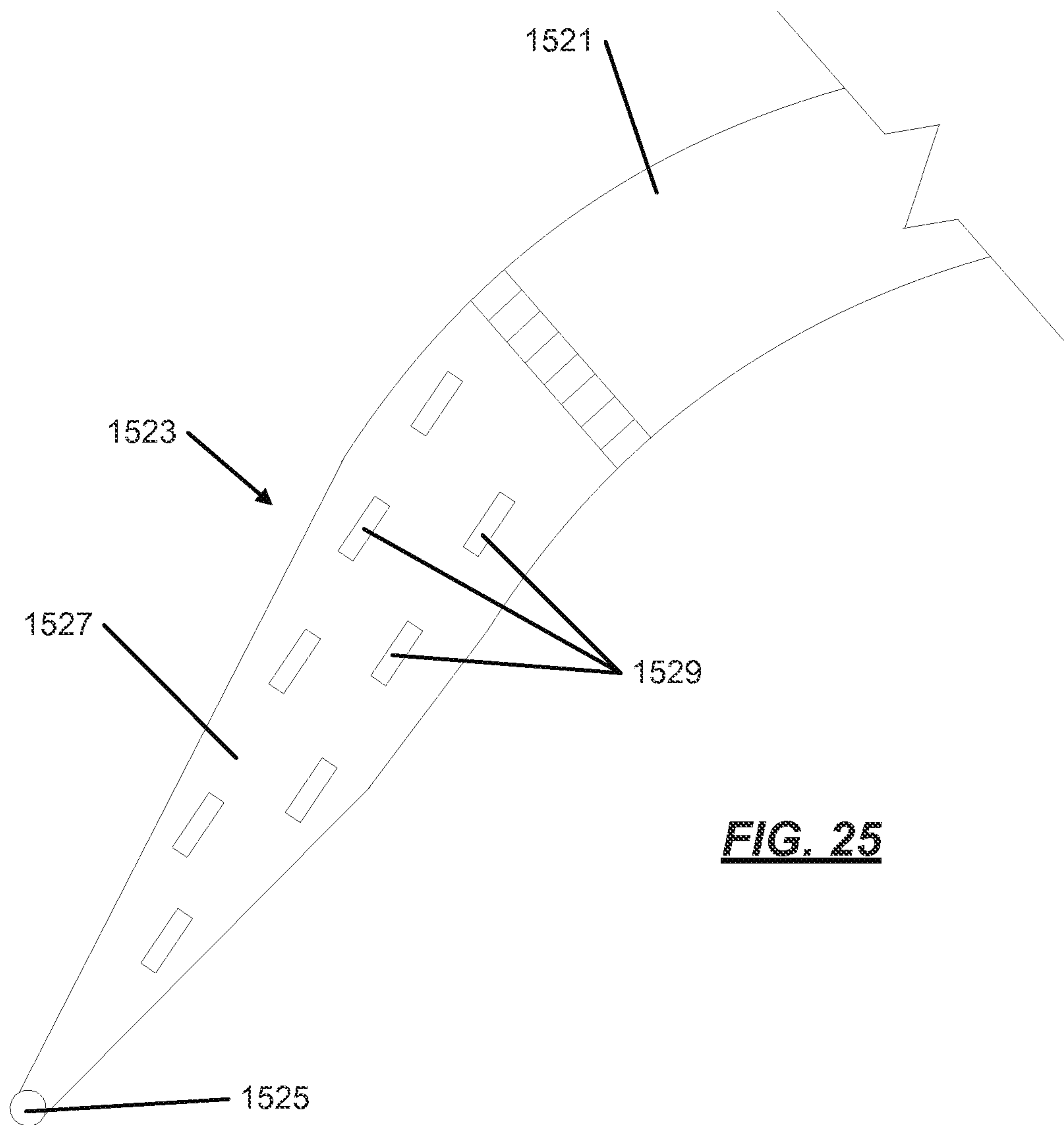
**FIG. 20**

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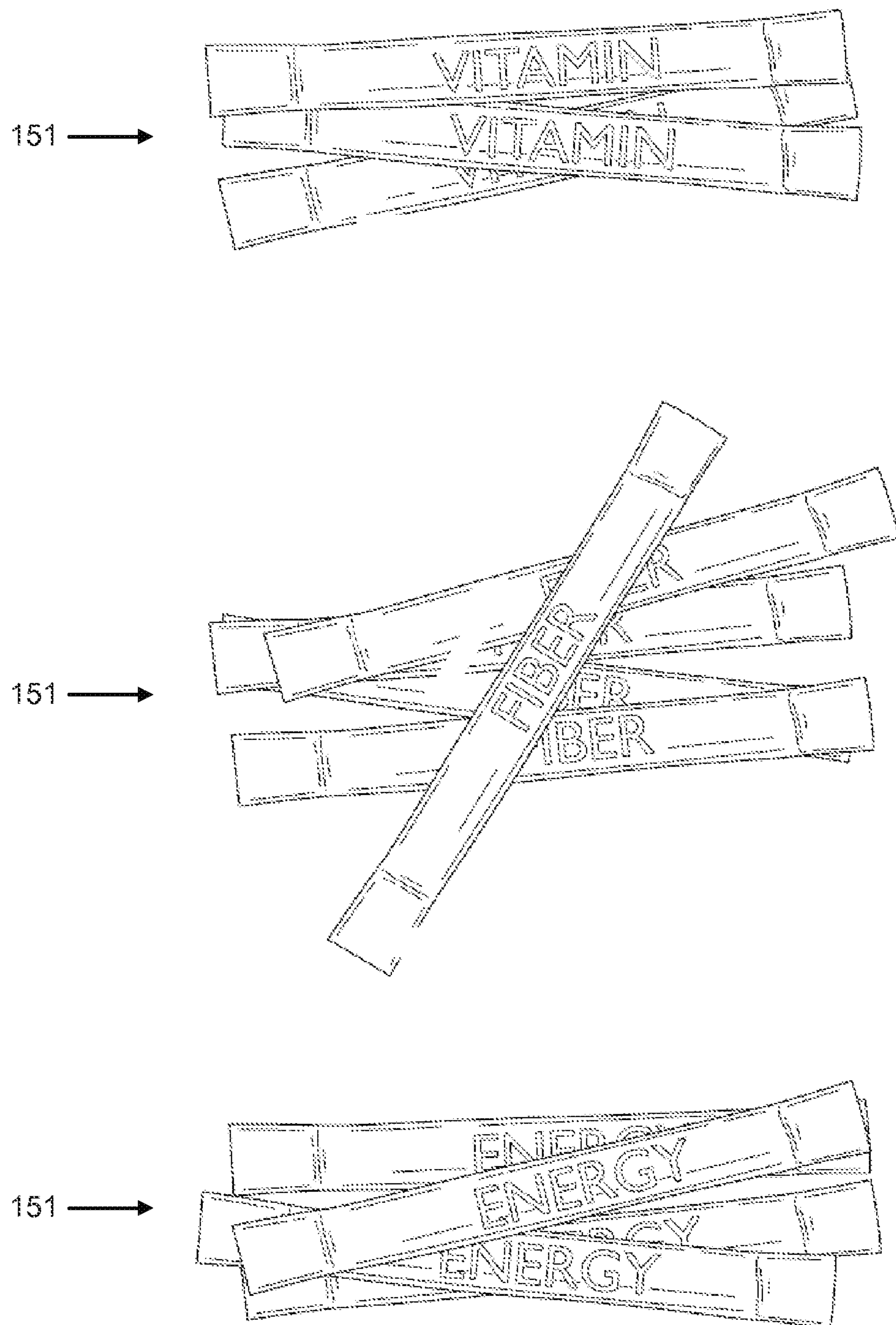
**FIG. 21****FIG. 22**

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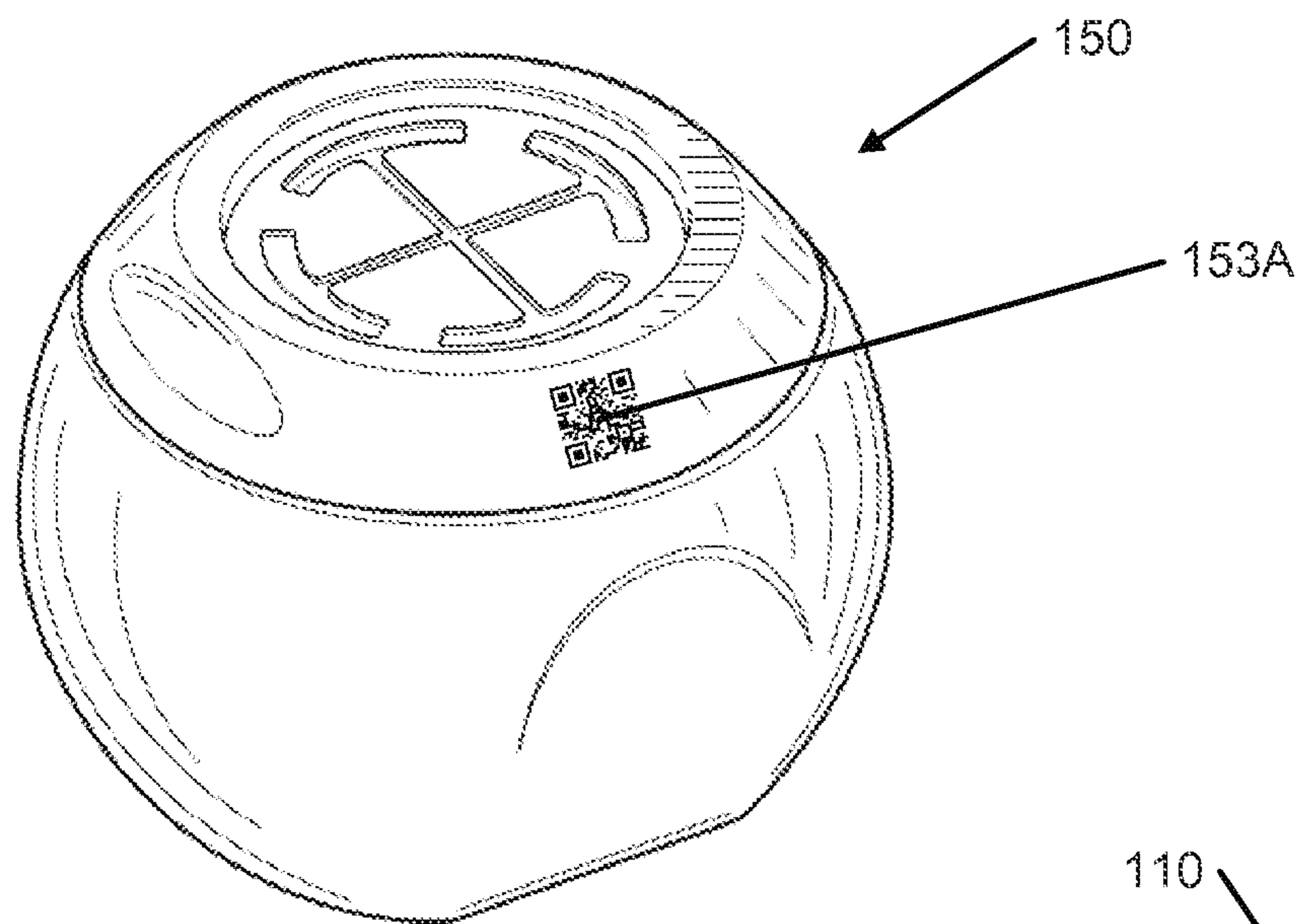
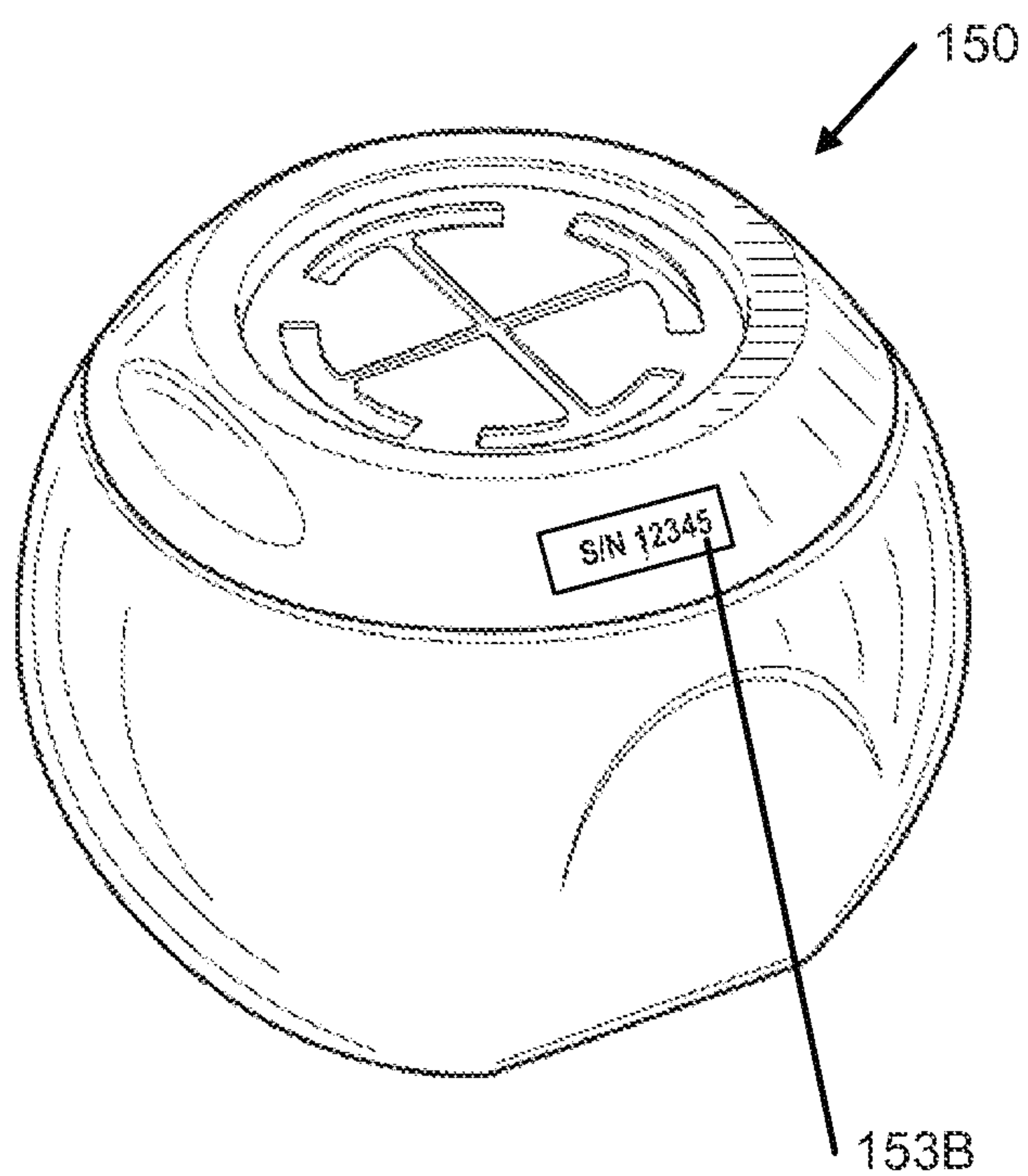
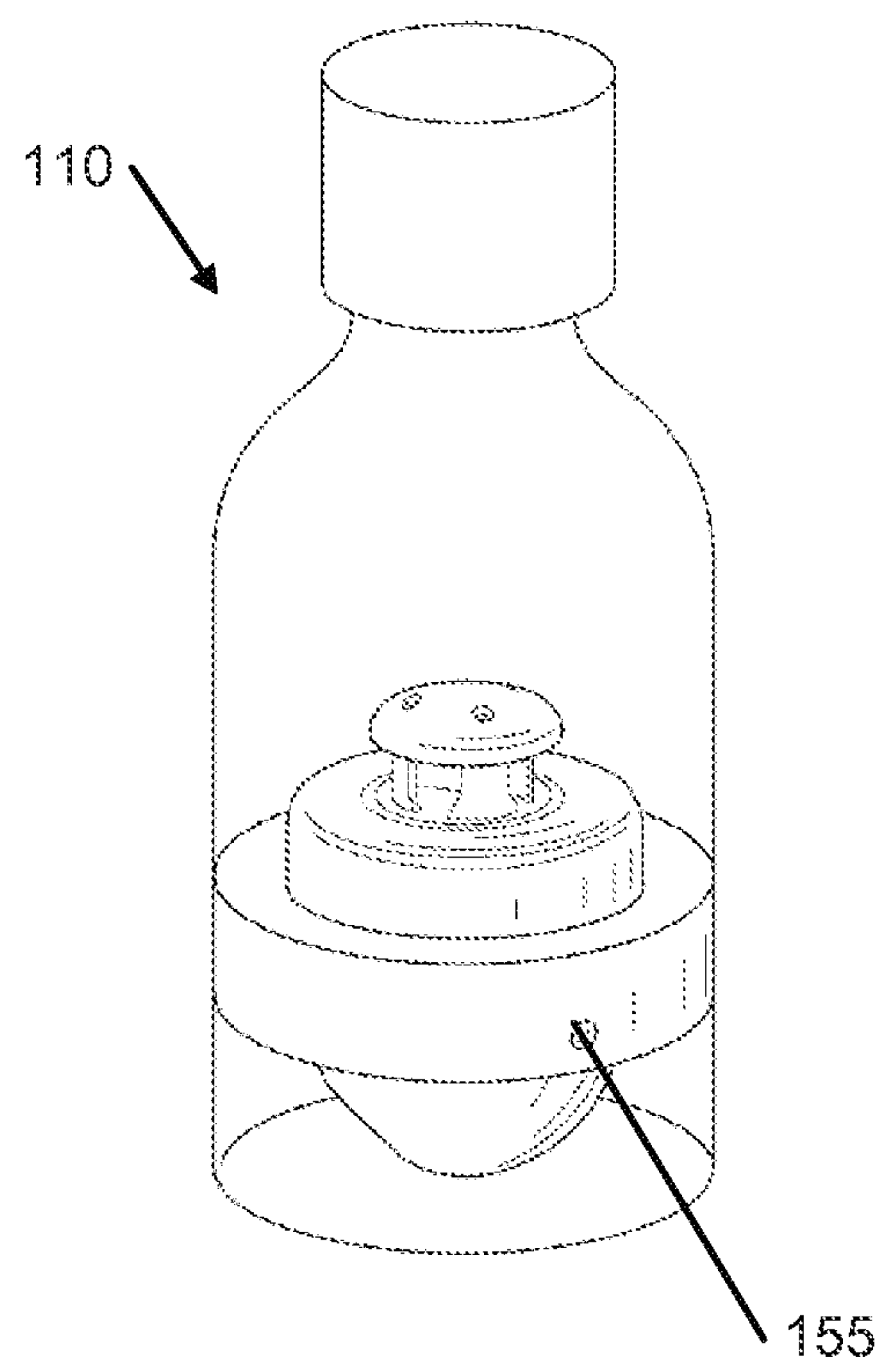
FIG. 23**FIG. 24**

**FIG. 25**

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**FIG. 26**

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**FIG. 27A****FIG. 27B****FIG. 27C**

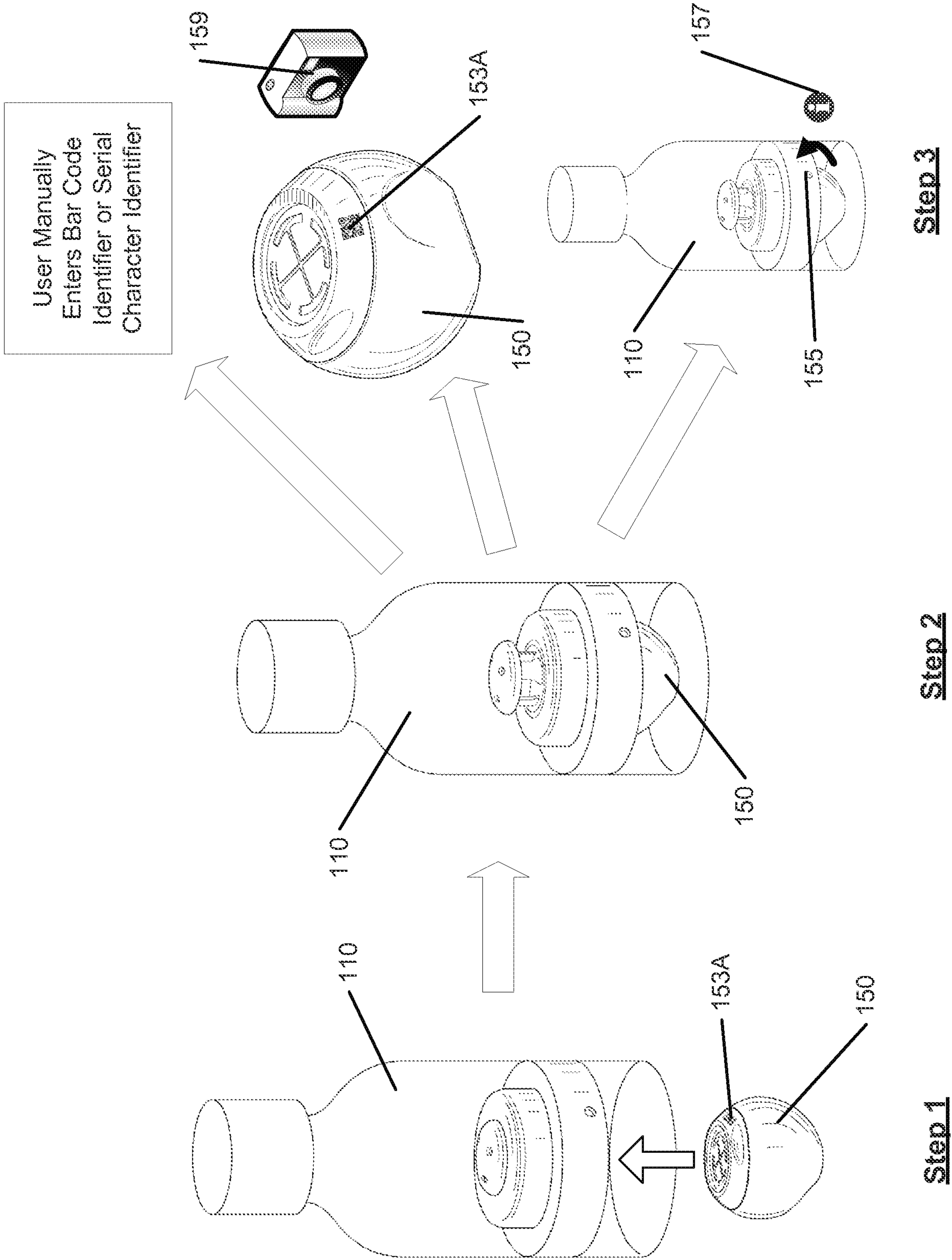
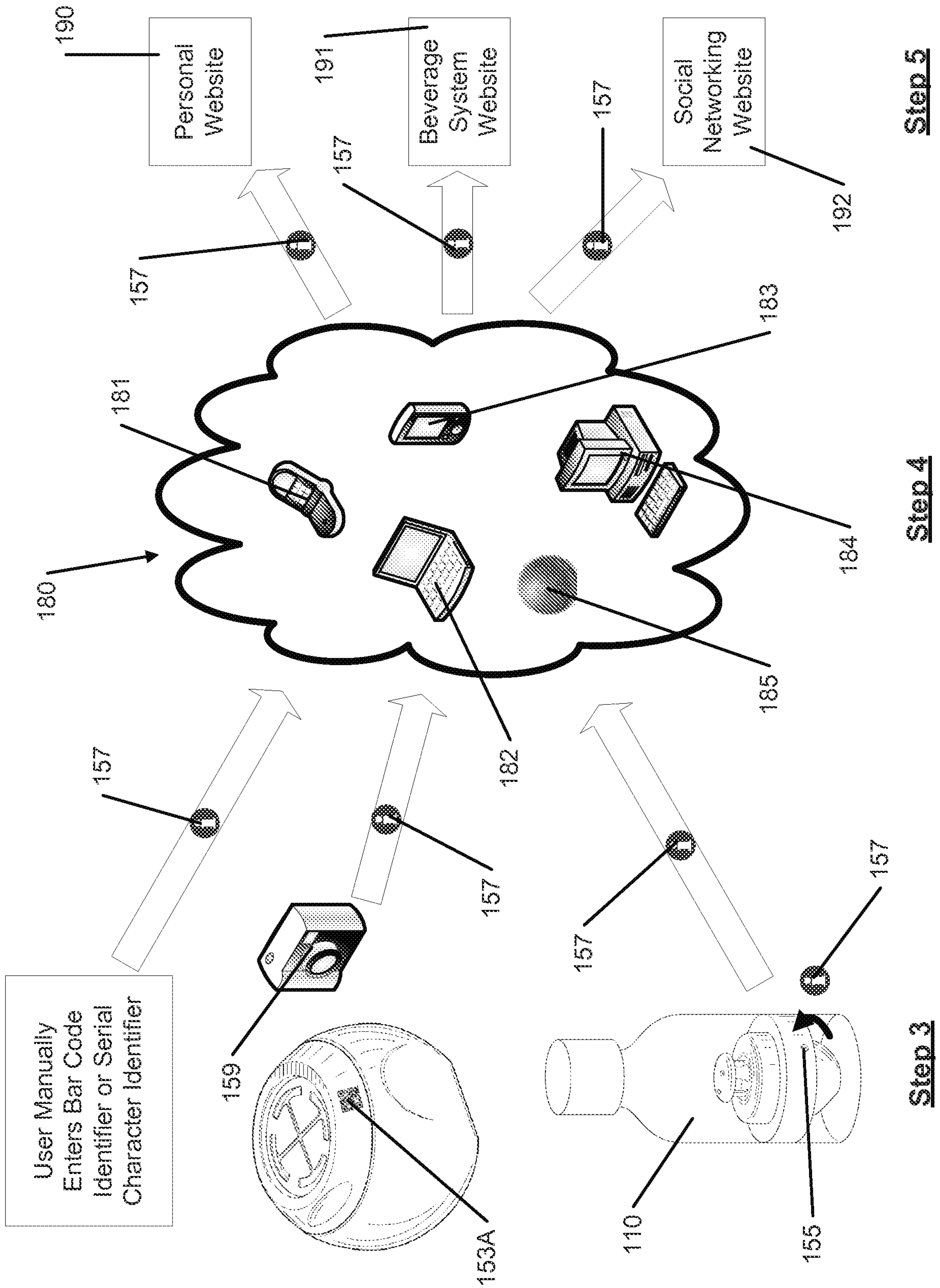
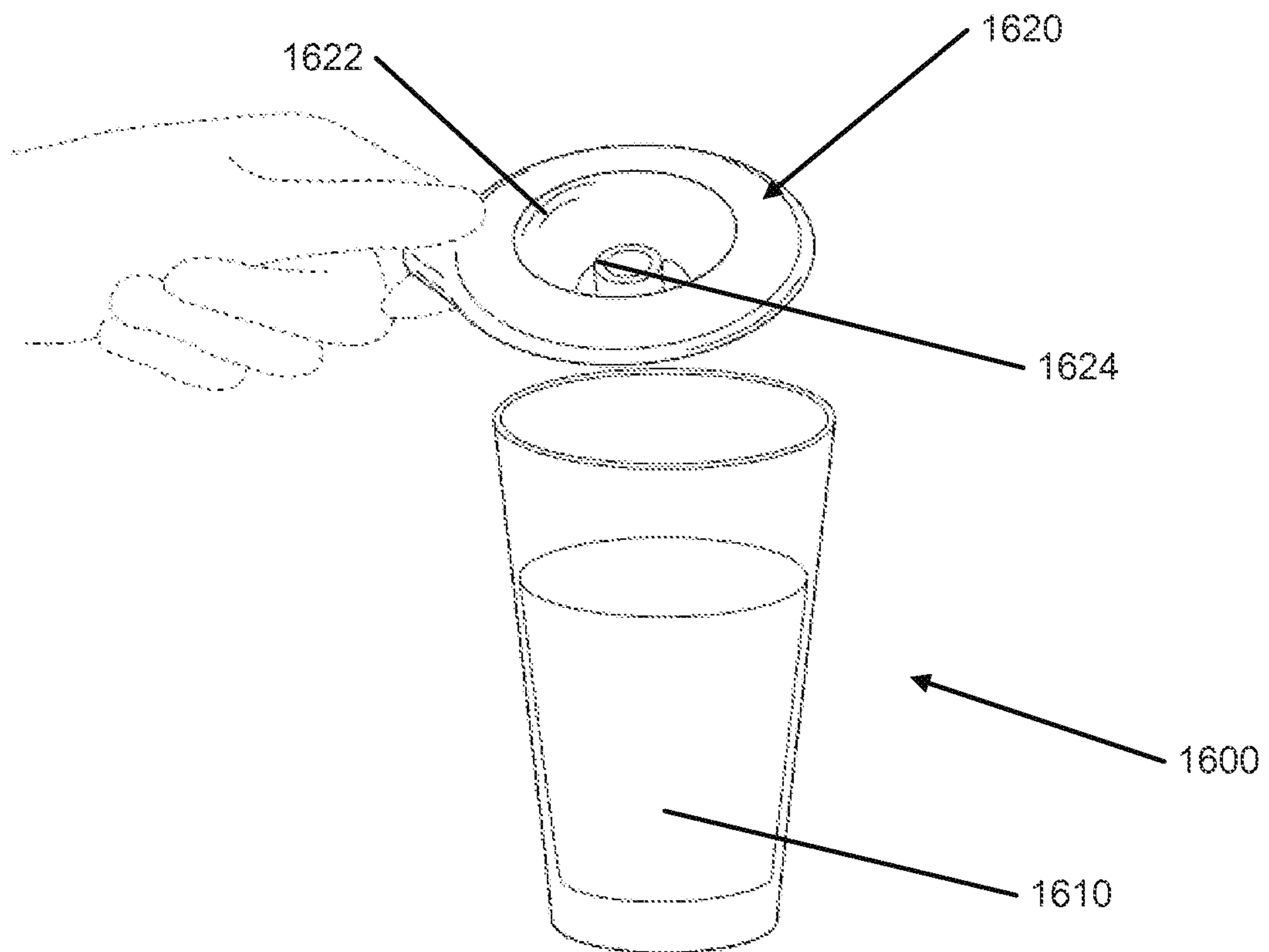
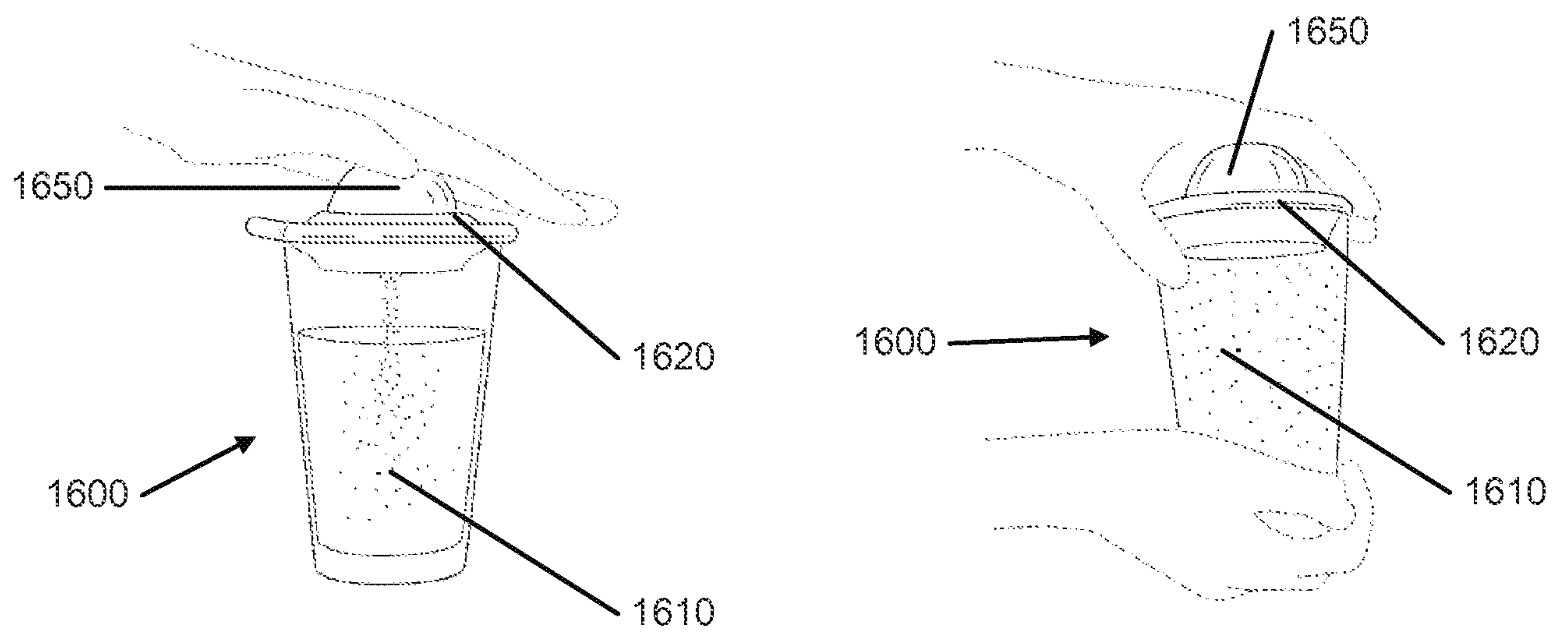
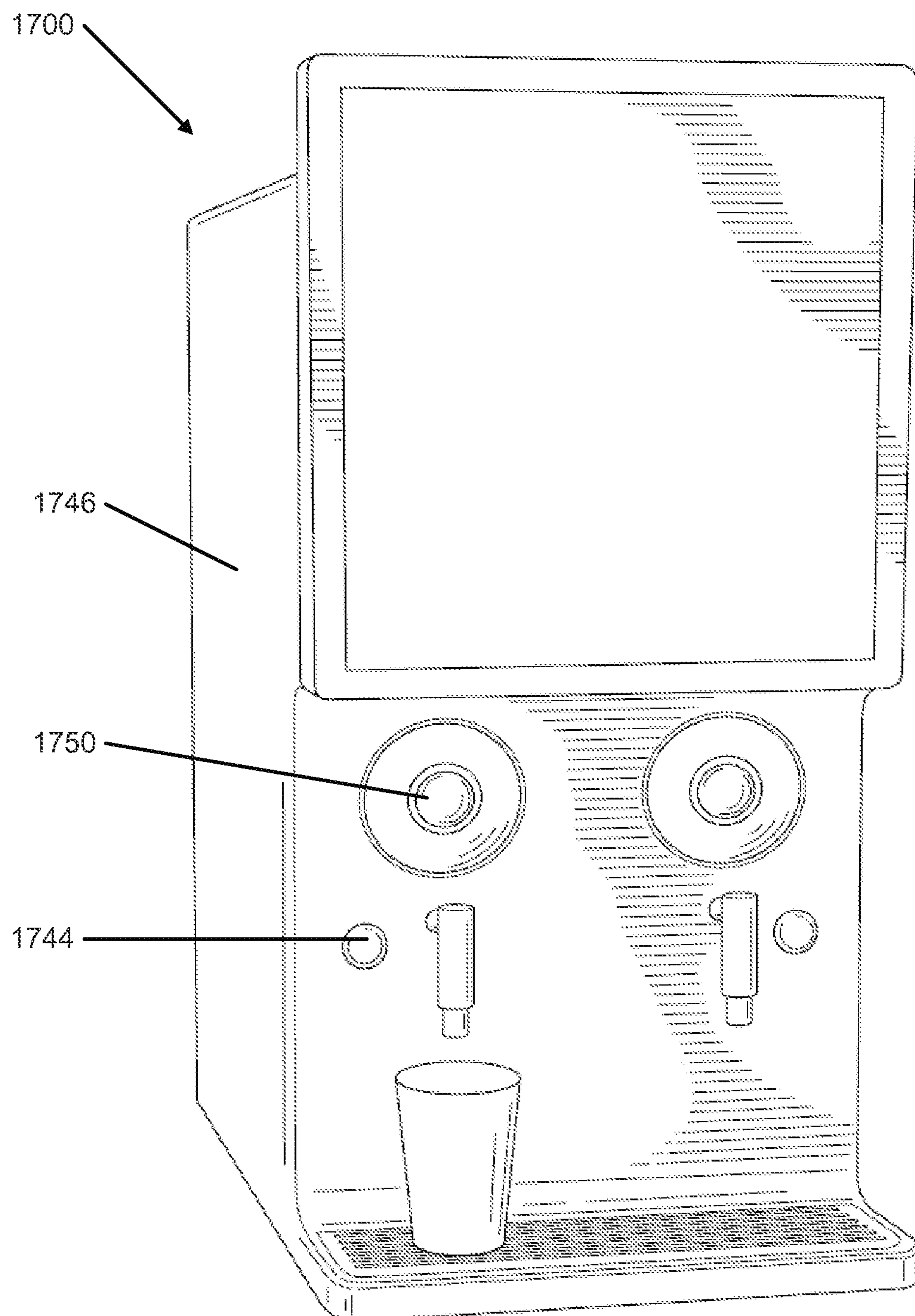


FIG. 28A

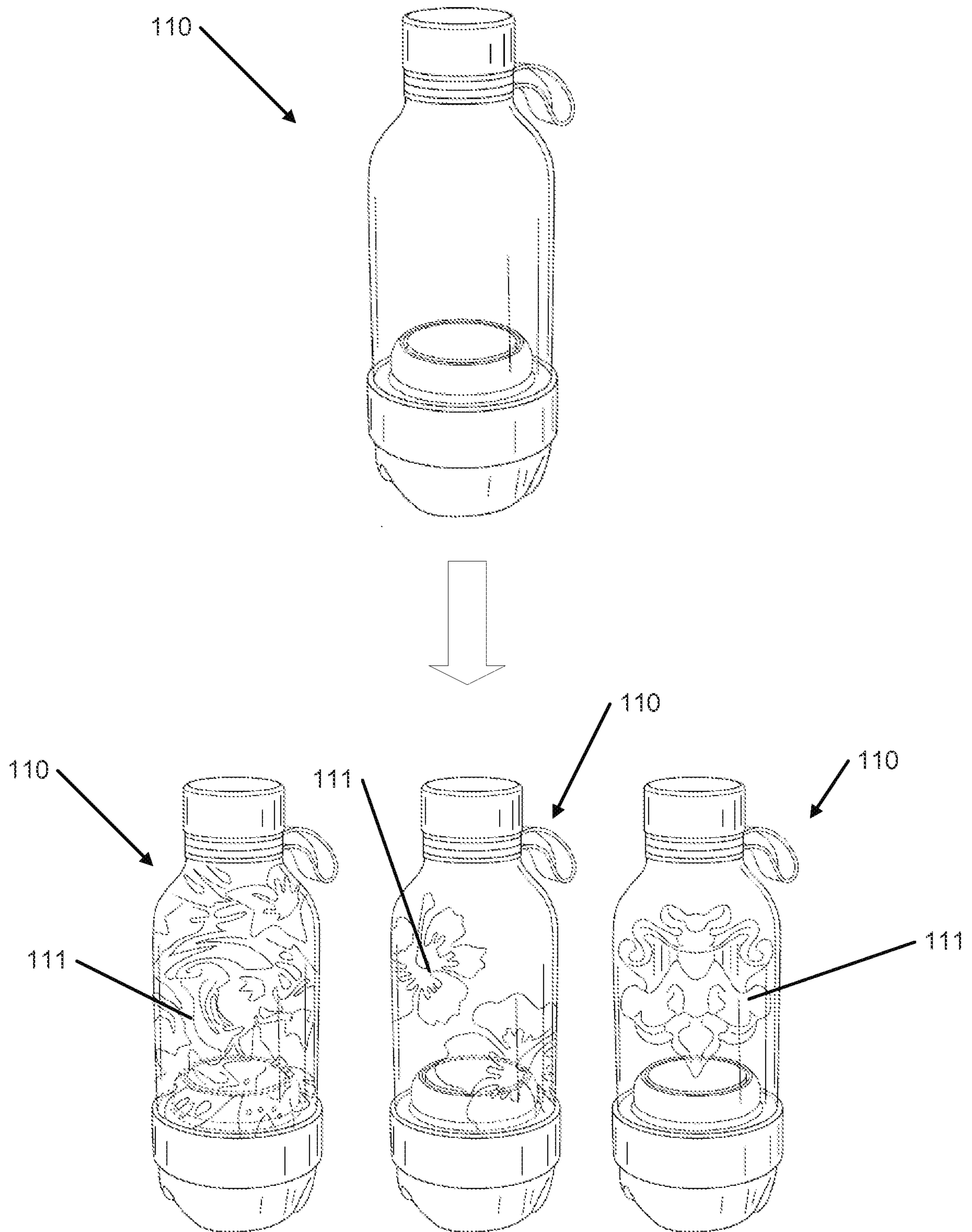


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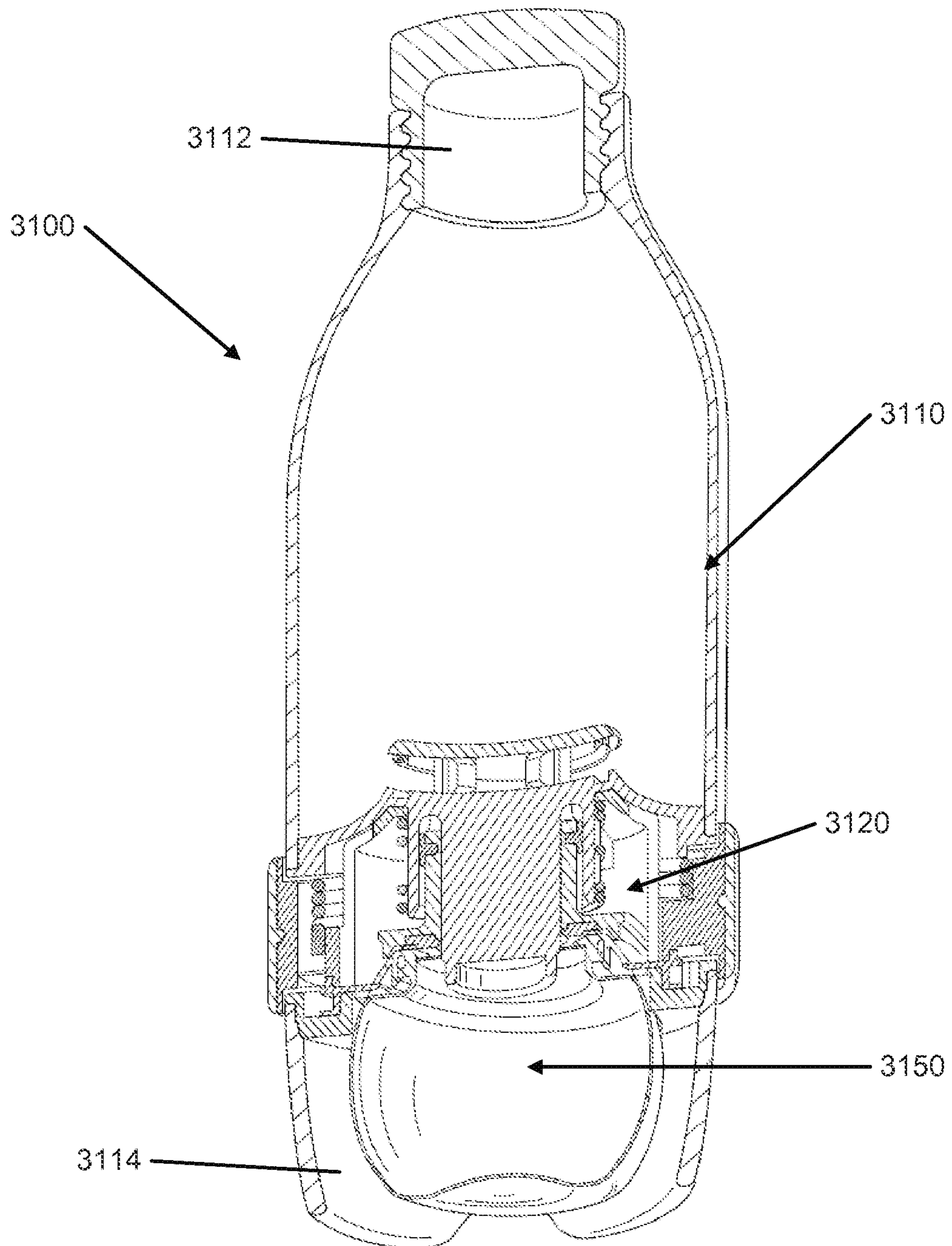
**FIG. 29A****FIG. 29B****FIG. 29C**

**FIG. 30**

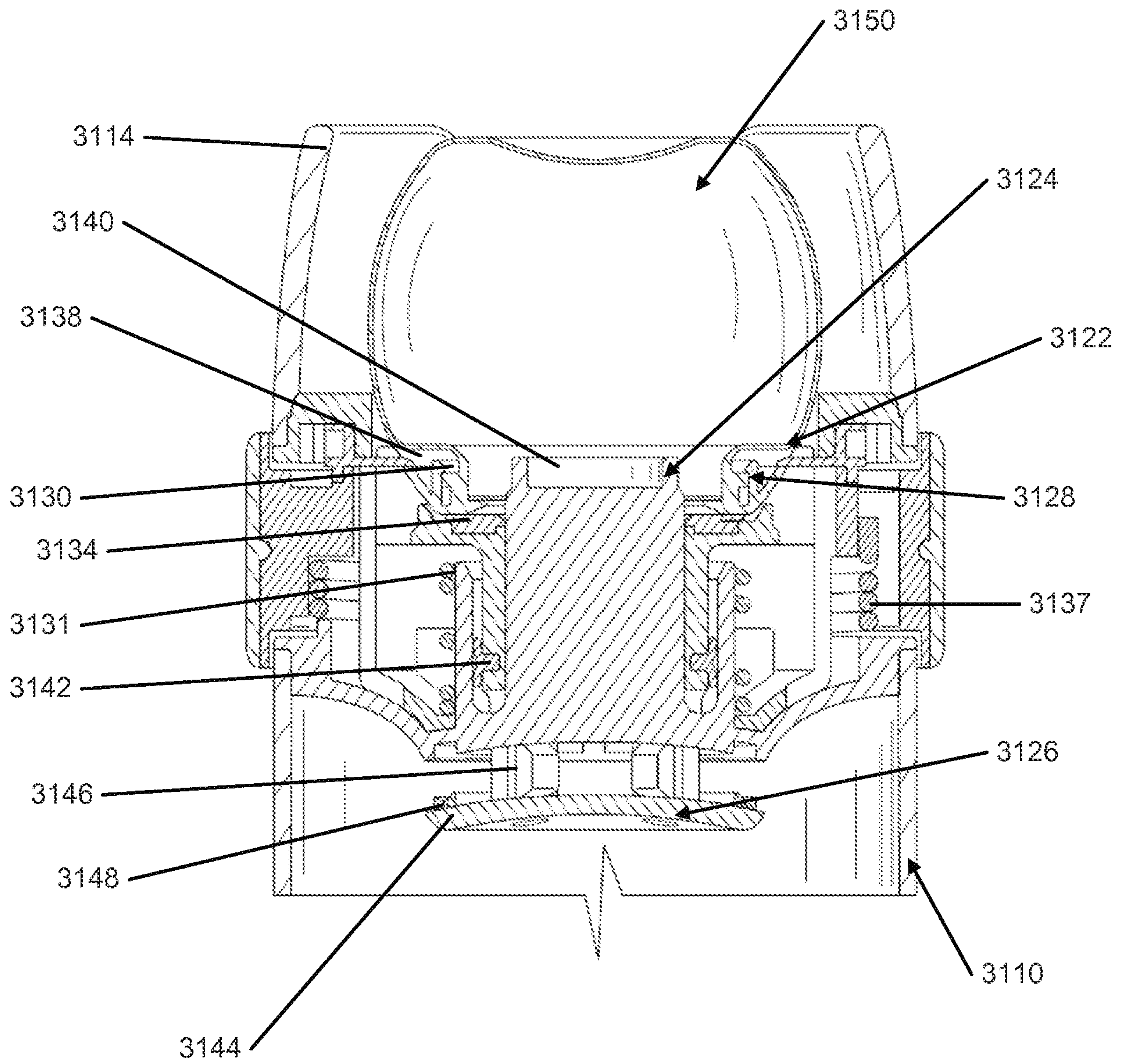
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**FIG. 31**

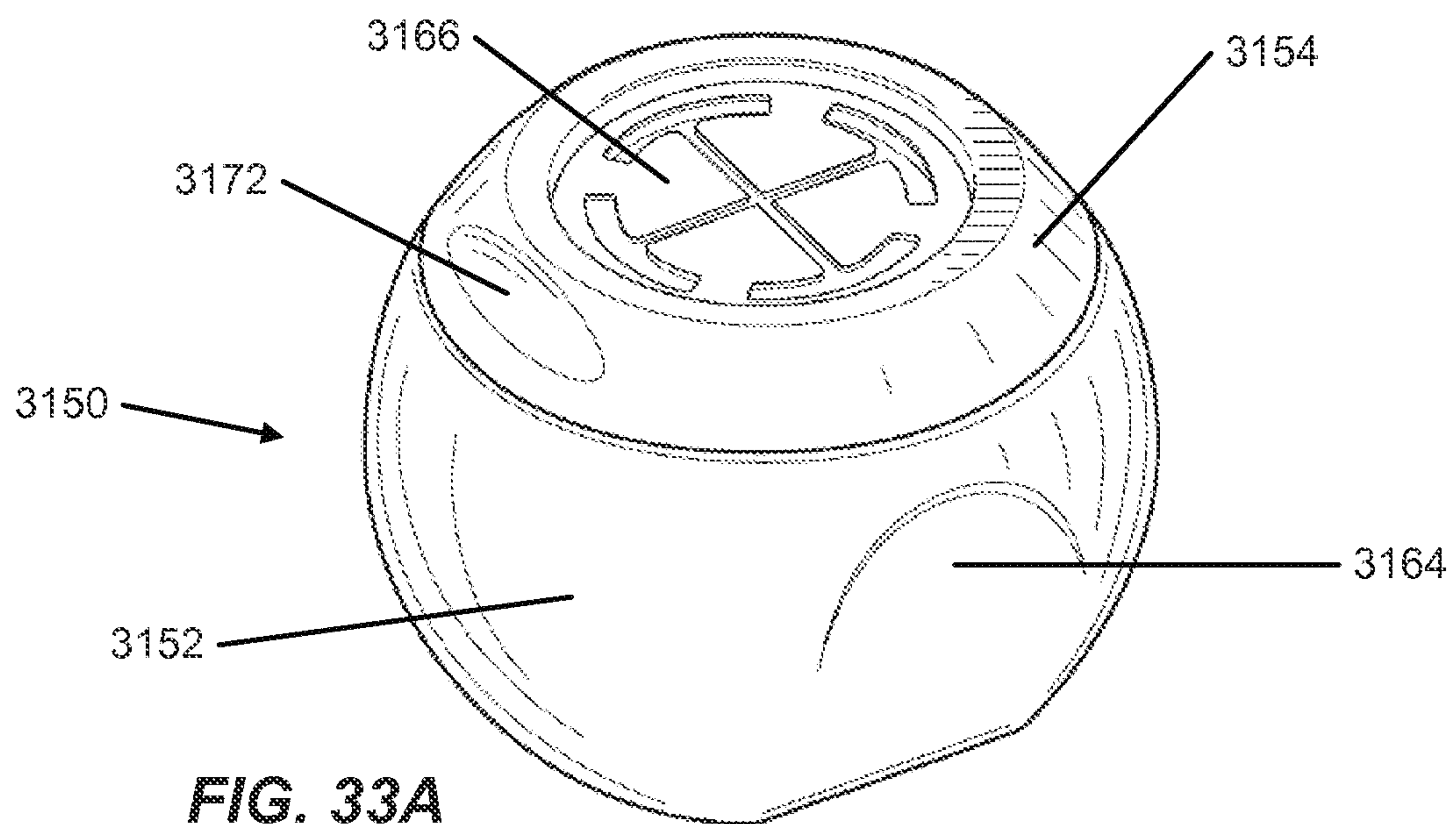
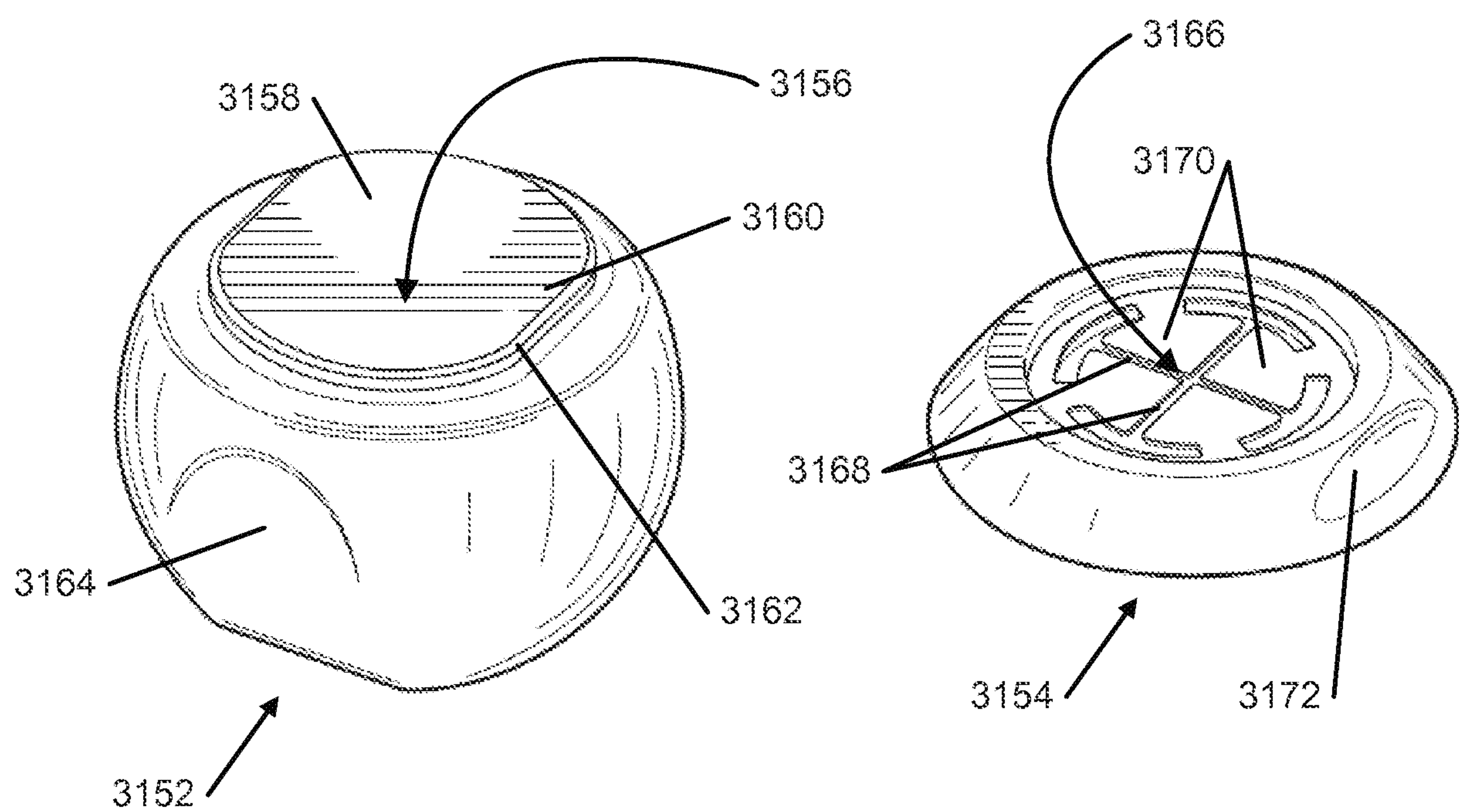
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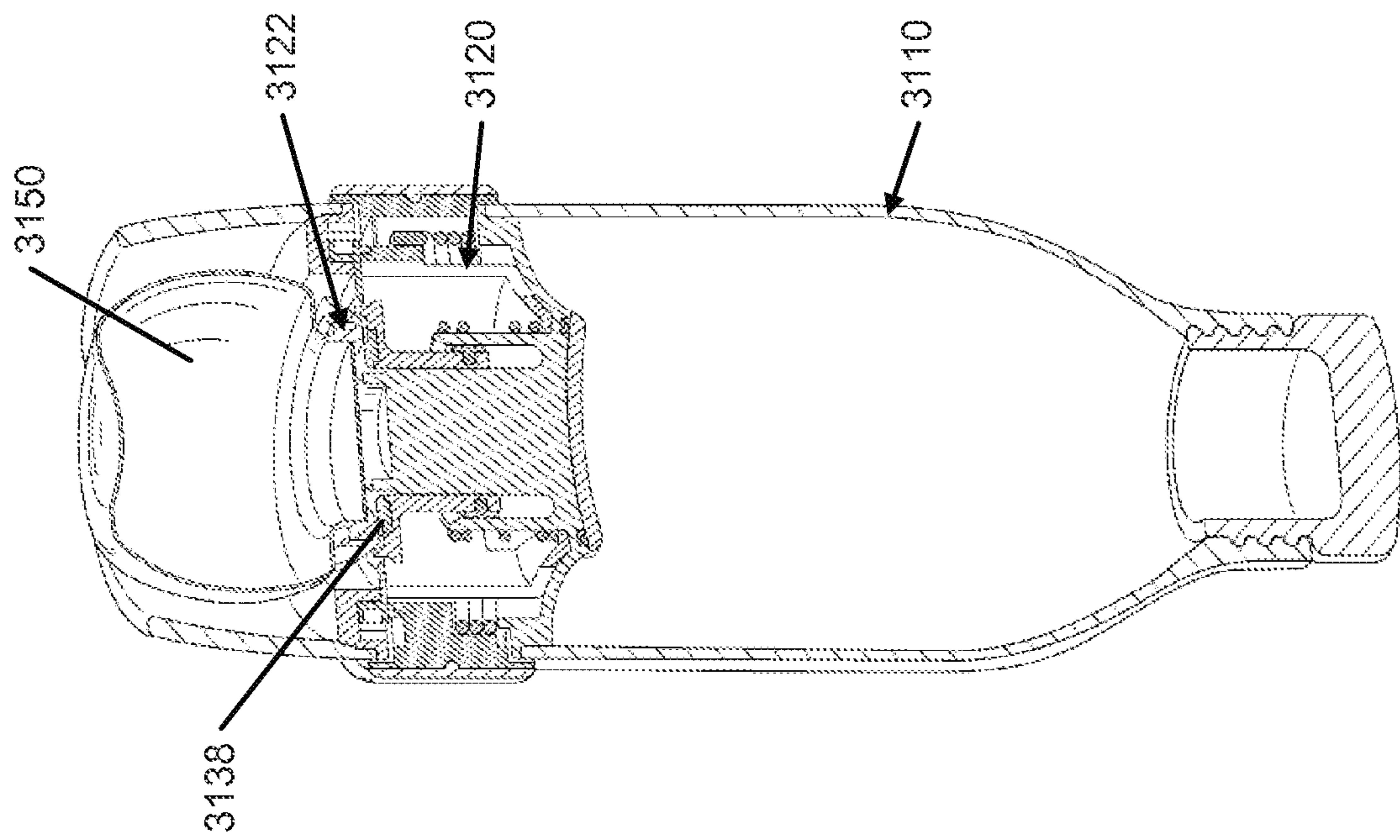
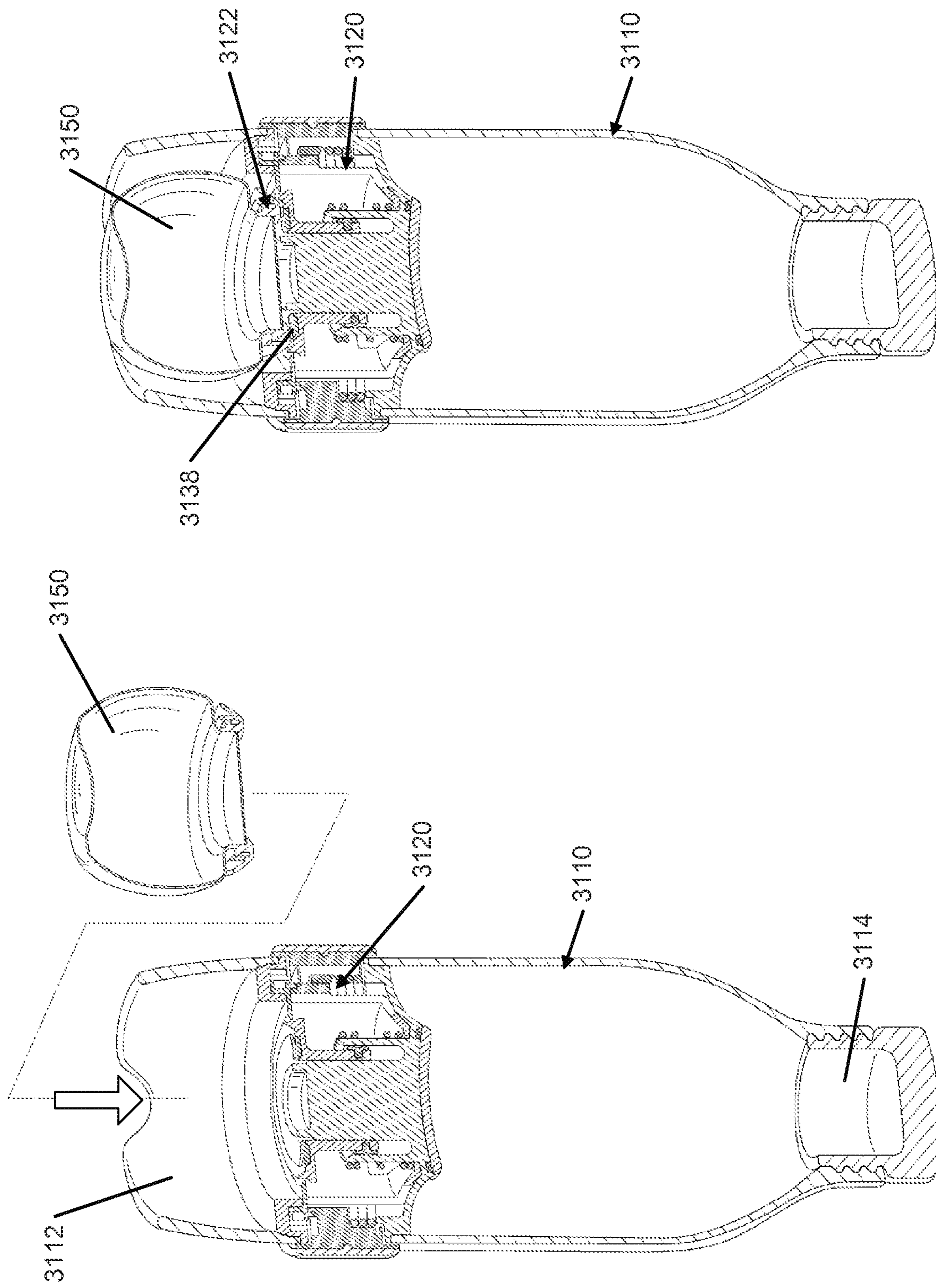
**FIG. 32A**

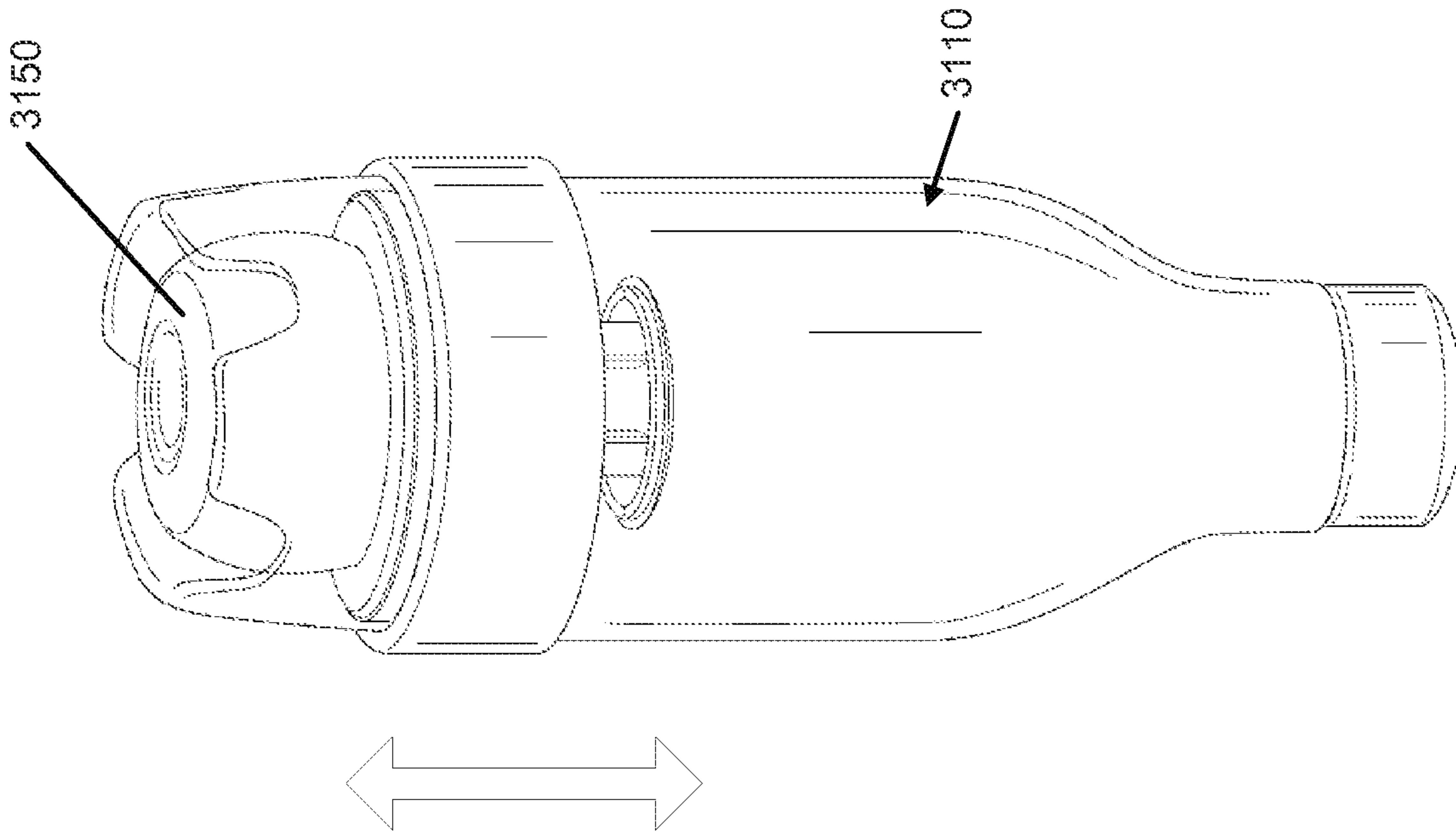
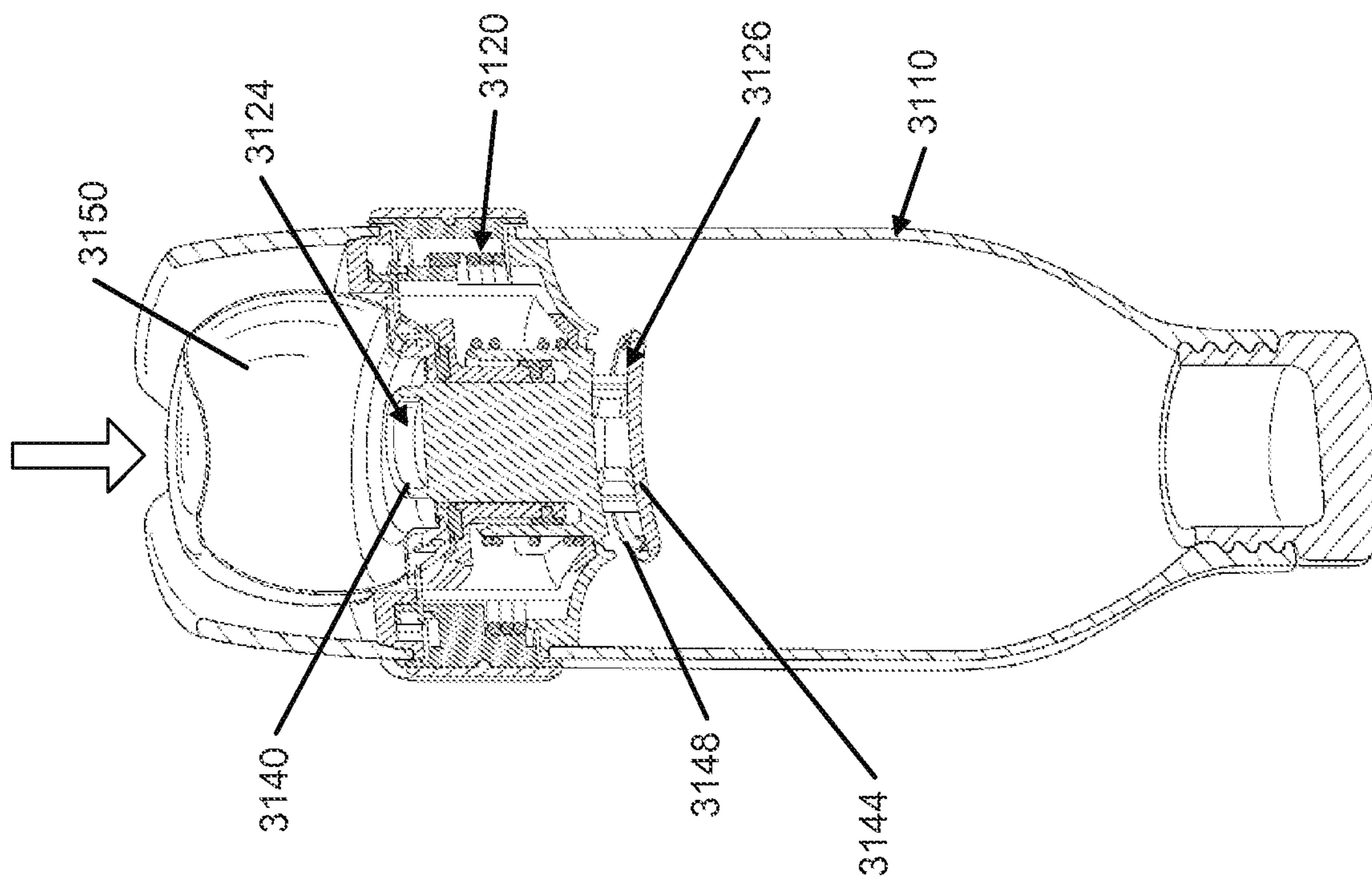
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**FIG. 32B**

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**FIG. 33A****FIG. 33B**



**FIG. 34D****FIG. 34C**

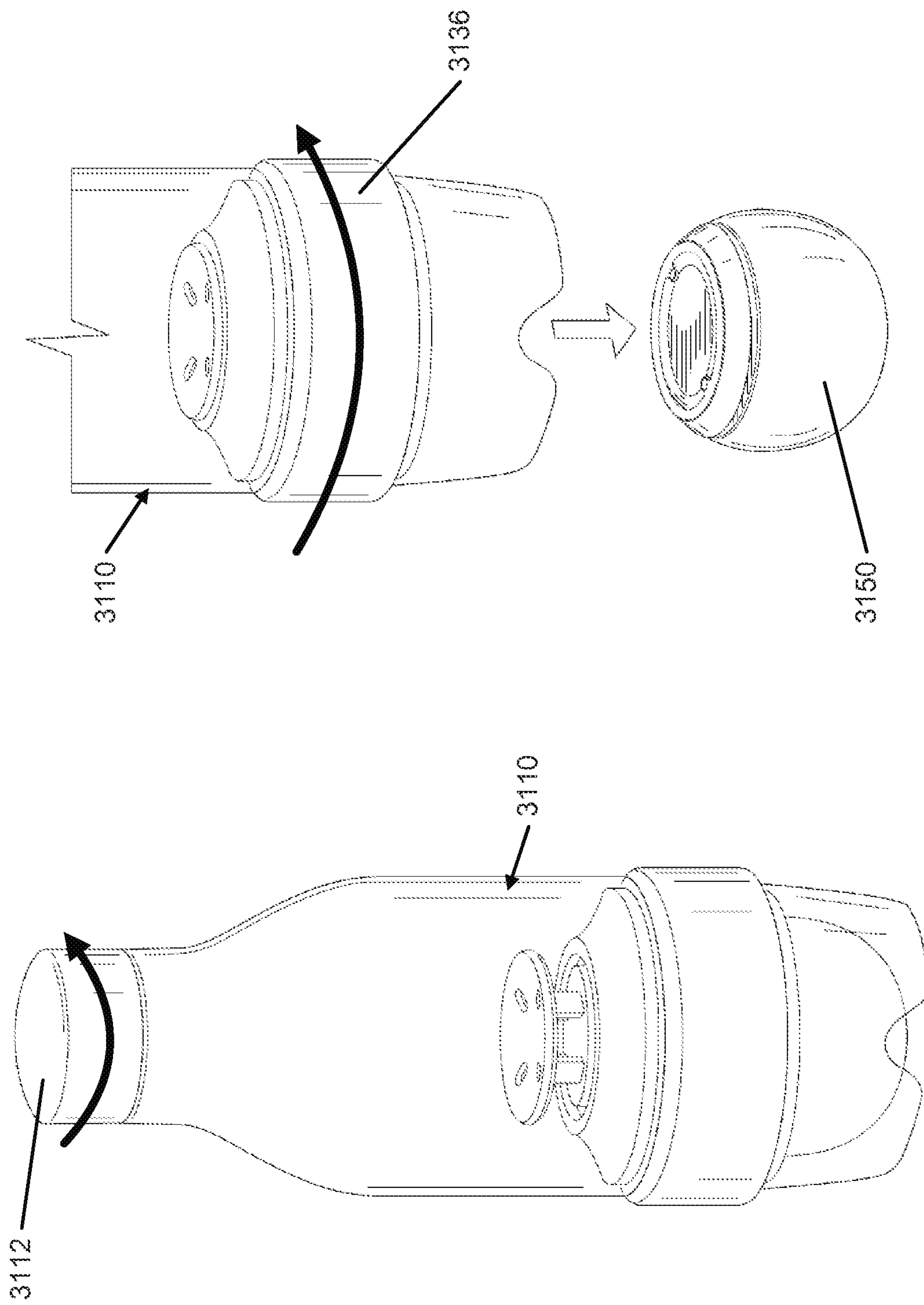
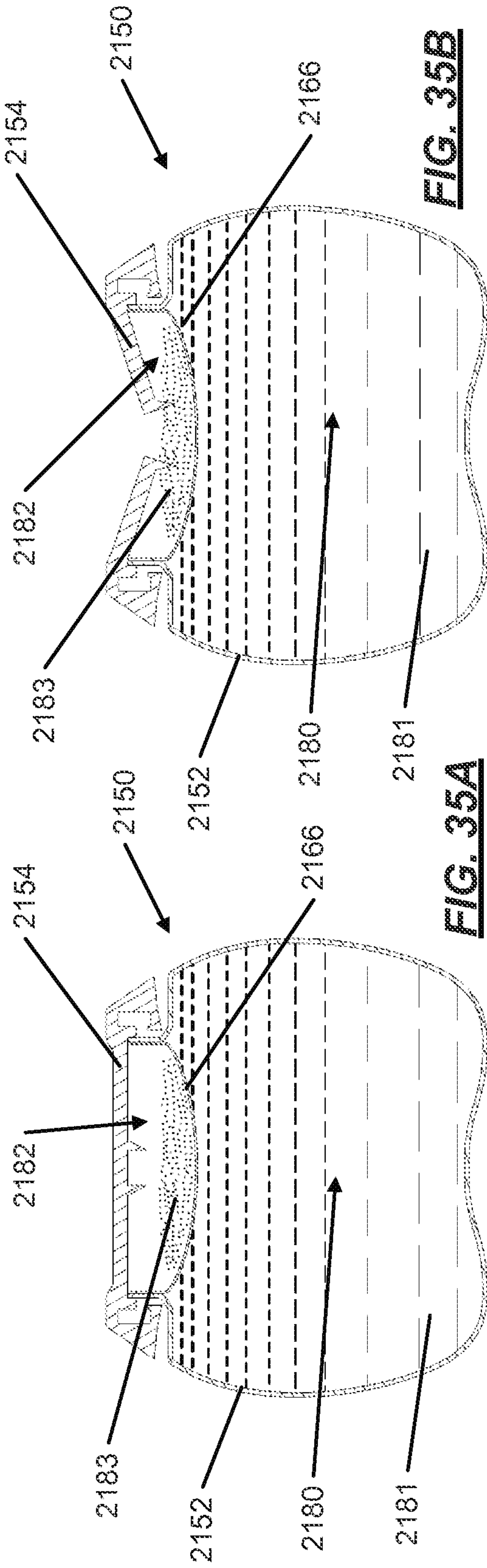
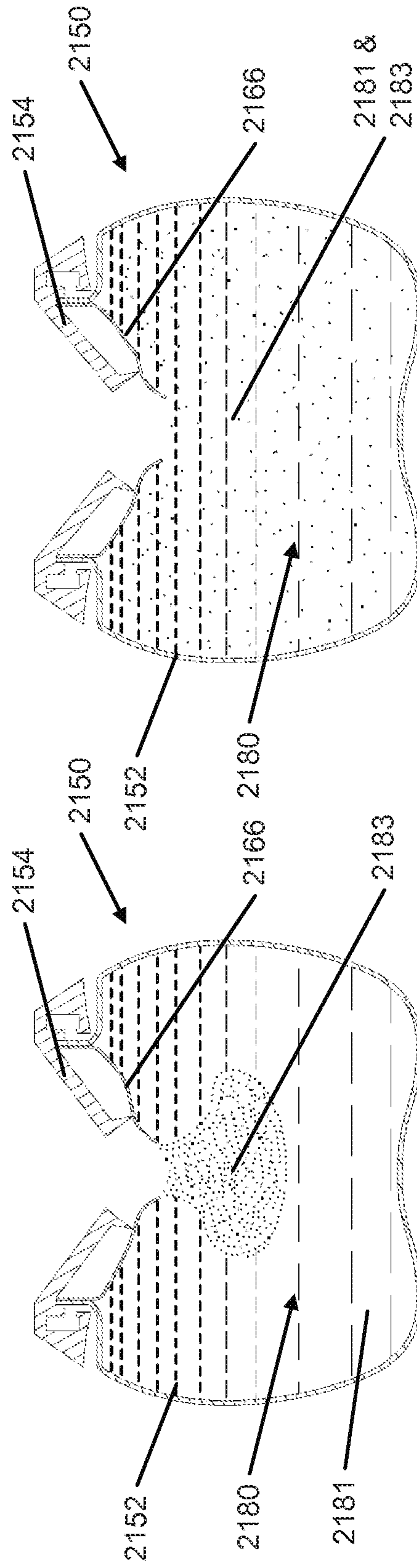


FIG. 34F

FIG. 34E

**FIG. 35A****FIG. 35B****FIG. 35C****FIG. 35D**

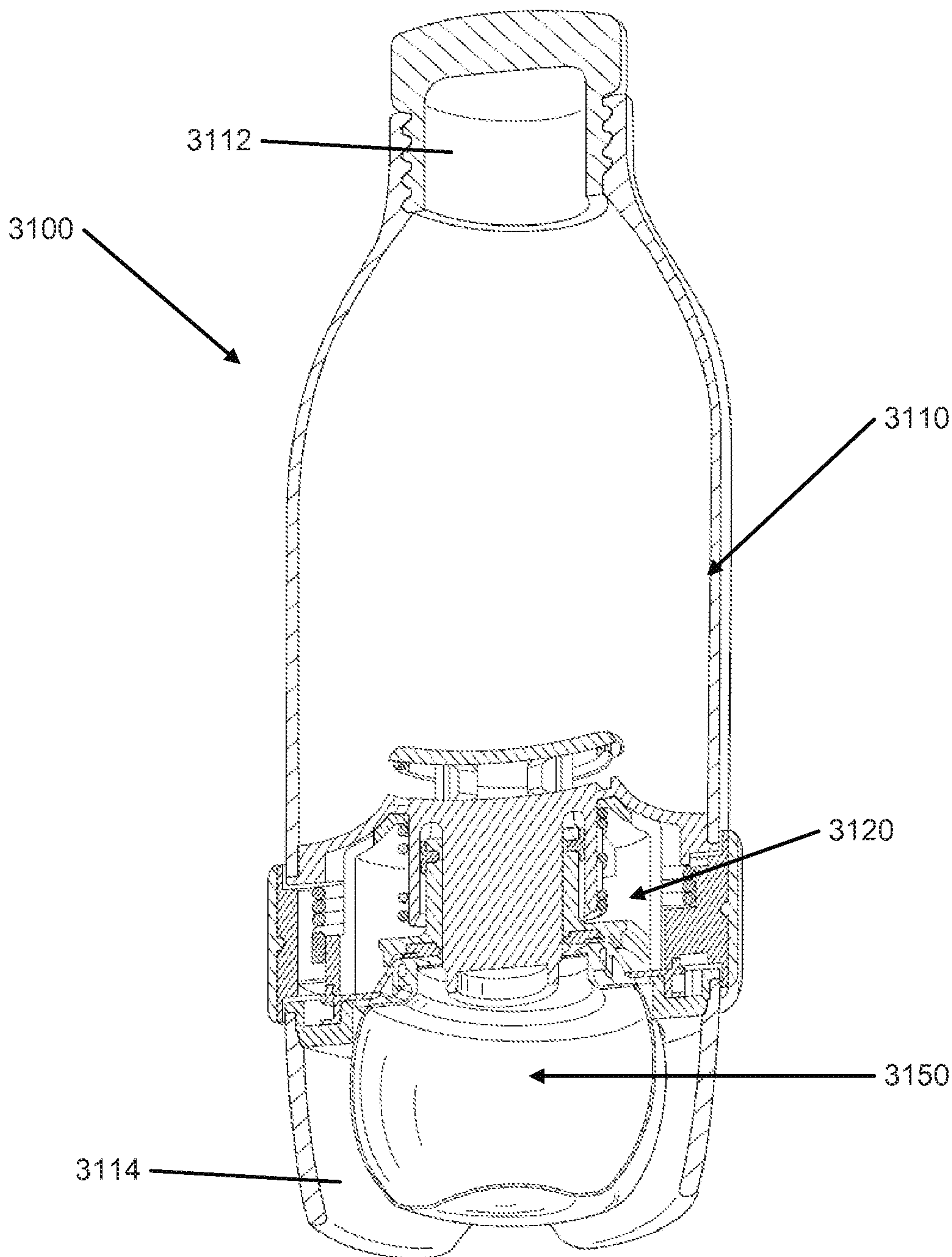


FIG. 32A