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(54) **Title:** MULTI-USE, REUSABLE, SPILL PROOF PACKAGE FOR FLUIDS WITHOUT A REMOVABLE OR SEPARABLE CLOSURE

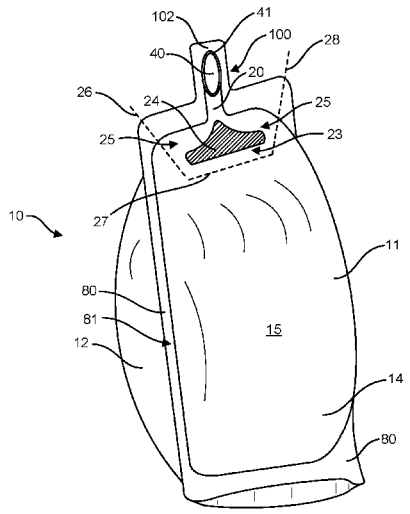

FIG. 1

(57) **Abstract:** A one-piece package or container is disclosed that includes an opening device in conjunction with a self-closing valve for facilitating opening of the package and for dispensing fluids in a controlled manner. In one embodiment, the opening device can include at least one breachable bubble. The at least one breachable bubble can be formed by a seal along a perimeter and/or fluid channel of the package. The package includes a fluid channel with a self-closing valve that can be opened by breaching the breachable bubble. After the package is opened, the self-closing valve prevents fluid from flowing through the fluid channel until pressure is applied to the package, such as pressure through squeezing. Thus, when a user applies pressure to the package, the contents of the package can be dispensed through the fluid channel in a controlled manner.

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MULTI-USE, REUSABLE, SPILL PROOF PACKAGE FOR FLUIDS WITHOUT A REMOVABLE OR SEPARABLE CLOSURE

BACKGROUND

[0001] In the year 2017, global production of plastics reached 348 million metric tons. Roughly half of annual plastic production is destined for a single-use product, including plastic drinking bottles. Humans buy about 1,000,000 plastic bottles per minute, resulting in sales of more than 480 billion plastic drinking bottles worldwide in 2016. Along with plastic drinking bottles, over half a million disposable plastic straws are used by Americans every day. Moreover, 91% of all plastic is discarded and not recycled.

[0002] The discarded single-use plastics, including plastic drinking bottles, caps, fitments, tear strips and labels are harmful to the environment. Not only do discarded single-use plastics fill up landfills, but they also are frequently left to flow into lakes and streams, ending up in rivers and ultimately oceans around the world. Instead of evenly dispersing in the oceans, plastic waste tends to concentrate in the northern and southern gyres, or systems of circular currents, in the oceans, such as what has become known as the “Great Pacific Garbage Patch” in the northern Pacific gyre. The region is currently estimated to have a size of at least 700,000 square kilometers (270,000 square miles – about the size of the state of Texas, or the size of France and Switzerland combined). It has been estimated that over 18,000 pieces of plastic exist within each square kilometer of the patch. Samples from the Great Pacific Garbage Patch reveal that the mass of plastic waste exceeded that of zooplankton, which is the dominant animal life in the area, and it is further estimated that by the year 2050, there will be more plastic than fish in the oceans.

[0003] Plastic waste, particularly in water streams and oceans such as in the Great Pacific Garbage Patch, is subject to plastic photodegradation which causes plastic to degrade into small toxic plastic polymers. Over time, the plastic polymers disintegrate into smaller and smaller pieces, transforming into “microplastics,” or until the molecular level is reached. However, the majority of these polymers are not bio-based or compostable, and typically do not decompose without harming the environment. These small toxic plastic polymers

(microplastics) contaminate the air, water, and soil, and are ultimately ingested by aquatic organisms including fish, thus resulting in plastic waste entering the food chain for animal and human consumption.

[0004] To address the problem of plastic waste, recycling has been introduced into the plastic consumption cycle. However, only a limited portion of plastic waste is sent to recycling facilities. For example, globally over 91% of plastic is not recycled, and only 23% of plastic bottles are recycled in the United States. Moreover, existing plastic bottles and fluid containers utilize multiple types of plastics for their different parts, such as polyethylene terephthalate (PET) for the bottle and polypropylene (PP) for the more rigid bottlecap or closure. Plastic bottles additionally often utilize different plastic or film materials wrapped around the bottle to include label information and chemical adhesives. Because each plastic material used, such as PET and PP, has distinct melting points that are significantly different from the respective other plastic materials, all of the materials must be separated from one another before being melted down for reuse. Thus, the recycling of existing plastic bottles can be economically ineffective because it entails various processes, including collecting, cleaning, and sorting the plastic waste and separately processing of each of the waste materials into materials that can be used in new products. As such, due to the time, money, and infrastructure cost of the collecting and processing, recycling is not widely available, and if available, recycling is often not mandatory. Thus, many people do not have a convenient venue for recycling or may merely choose not to recycle, or lack awareness of recycling as a waste management method.

[0005] Despite the many problems caused by plastic waste around the world, it is estimated that replacing plastics in packaging and consumer products with alternative materials could raise environmental costs multi-fold. Thus, rather than finding or developing materials to replace plastics, there is a critical need for innovation for the design and development of new forms of packaging and materials that use less material are more easily recyclable as compared to existing single-use plastic packaging, as well as improving, collecting and sorting and the infrastructure for increasing the recycling of growing volumes of plastic waste.

[0006] One solution to the above problems of plastic waste with existing plastic bottles and containers has been to package liquid products in flexible

containers made from one or more layers of polymer film. In addition to reducing the amount of plastic material per container compared to existing plastic bottles, packages made from polymer films can offer additional advantages. For instance, the polymer films can be wrapped tightly around the products for eliminating void space and minimizing packaging materials required. The resulting packages are not very bulky, are easy to handle and have a lighter weight. The polymer films can sometimes be translucent or transparent, allowing a purchaser to view the contents prior to making the purchase. In addition, the polymer films can be printed with decorative graphics to make the product more attractive.

[0007] Although packages made from polymer films can provide various advantages, opening such packages can be quite difficult. For example, the polymer films must have sufficient seal strength to prevent against accidental rupture. Increasing the strength of the film or the seals that surround the content of the package, however, often increases the difficulty in opening the package. For example, many such packages that contain liquid or flowable substances, do not include an easy opening feature. Thus, brute force, scissors, a knife, biting with one's teeth, or another suitable instrument need to be used in order to open the package.

[0008] Another disadvantage to containers made from one or more layers of polymer films is that the films are not always compatible with each other and various layers may not be easily recycled. Consequently, multilayer films can restrict easy recyclability and create solid waste generation.

[0009] Further, a greater need exists for packages that are not only sustainable, but also can be made, shipped and delivered with stringent hygiene requirements due to the global COVID-19 pandemic. The ability to make a package from a single material that is easy to open, and without product spillage, would greatly enhance the sustainability of the package balanced with better hygiene characteristics.

[0010] In view of the above, those skilled in the art have attempted to improve the manner in which packages and containers are constructed and opened. For instance, PopPack LLC has made many significant and meritorious advances in the design and construction of packages and particularly in the design of techniques and methods for opening packages and containers. Examples of

opening devices for packages are disclosed in, for example, U.S. Pat. No. 6,726,364 to Perell et al., U.S. Pat. No. 6,938,394 to Perell, U.S. Pat. No. 7,306,371 to Perell, U.S. Pat. No. 7,644,821 to Perell, U.S. Pat. No. RE 41,273 to Perell, U.S. Patent Appl. Pub. No. 20080212904 to Perell, U.S. Patent Appl. Pub. No. 20070295766 to Perell, U.S. Patent Appl. Pub. No. 20070286535 to Perell, U.S. Patent Appl. Pub. No. 20070284375 to Perell, U.S. Patent Appl. Pub. No. 20070241024 to Perell, U.S. Patent Appl. Pub. No. 20070237431 to Perell, U.S. Patent Appl. Pub. No. 20070235369 to Perell, U.S. Patent Appl. Pub. No. 20070235357 to Perell, U.S. Patent Appl. Pub. No. 20060126970 to Perell, U.S. Patent Appl. Pub. No. 20040231292 to Perell, and U.S. Patent Appl. Pub. No. 20040057638 to Perell et al. The subject matter of each of the above-referenced issued patents and published applications is fully incorporated herein by reference.

[0011] Another problem with such previously made polymer film containers is that it is typically difficult to dispense the fluid in a controlled manner. These containers, for instance, are opened by tearing the top off the container, tearing a corner, cutting with scissors or knives, or inserting a straw into the container. Since the packages are flexible, the containers are prone to spill their contents, especially when any type of pressure is applied to the container. Once open, and in the absence of a separate rigid pouring valve welded or glued to the container or otherwise affixed, these receptacles cannot be re-closed easily, and tend to allow the liquid to escape, and expose the liquid to air and possibly to other contaminants. The user is therefore obliged to hold the receptacle once it has been opened, since it cannot be placed on a table or other surface before it has been completely emptied, in order to avoid accidental leaks and contamination and cannot be reclosed.

[0012] In view of the above, the present disclosure is generally directed to an improved polymer film container that utilizes less material, less energy and less water in cleaning and more efficient production lines than a plastic bottle, e.g., a single material film formed from a single polymer, is relatively easy to open and has a built-in self-closing pour channel for dispensing fluids from the container in a controlled manner without being prone to accidental spillage.

SUMMARY

[0013] In general, the present disclosure is directed to a multi-use, reusable, spill proof package for fluids without a removable or separable closure. In one embodiment, the package includes a flexible container having an interior volume for receiving a flowable substance. The flexible container of the package defines a sealed periphery. The package further includes a breachable point located along the sealed periphery of the flexible container. The breachable point has a weaker seal than the remainder of the sealed periphery. The package further includes a fluid channel including a fluid outlet and at least one valve-like passageway. The fluid outlet is located adjacent to the breachable point, and the at least one valve-like passageway is in fluid communication with the interior volume of the flexible container. The package further includes a self-closing valve including a barrier member positioned between the fluid outlet and the interior volume of the flexible container. The at least one valve-like passageway is formed between the barrier member and the sealed periphery. Pressure applied to the flexible container causes the breachable point to breach for dispensing controlled amounts of the flowable substance from the interior volume of the container. When pressure is no longer applied, the self-closing valve inhibits further flow of the flowable substance through the fluid outlet.

[0014] The package of the present disclosure may hold and dispense compositions, such as fluids. A fluid can be a liquid, flowable substance or a gas. The liquid, for instance, can be free flowing and can be lightly to highly viscous. The package, for instance, can hold fluids, such as beverages, edible oils, condiments, personal care products, industrial products, automotive lubricants, health care products, liquid soaps and detergents, hair care products, sunscreen compositions, cleaning products, and the like.

[0015] In one embodiment, the package includes a flexible container defining an interior volume for receiving a fluid. The flexible container may be comprised of a flexible polymer film. The package further includes a fluid channel having a first end connecting the fluid outlet to the ambient and an opposite second end connecting to the interior fluid volume. The fluid channel is in communication with a fluid outlet at the first end and is connected to the interior

volume of the flexible container at the second end. The flexible container additionally contains a self-closing valve of various forms and shapes. Pressure applied to the flexible pouch (such as a user-applied squeeze) opens at least one passageway between the interior volume and the fluid channel. The package also contains at least one breachable point or bubble located along or in close proximity to the outside perimeter of the flexible container. Breaching the bubble or breachable point results in fluid communication between the fluid outlet and the ambient. The breachable bubble after bursting by external pressure opens the seal. The breachable bubble and self-closing valve additionally prevents flow through the fluid outlet to the ambient.

[0016] The breachable bubble seal may contain a weakened portion in order to influence the breachable point or portion of the seal to the perimeter of the sealing portion.

[0017] In one embodiment, the self-closing valve is formed by placing a barrier member attached to the flexible container walls. The barrier member can simply be a seal of opposing layers in a specified location. The barrier member can be located adjacent to the second end of the fluid channel so that at least one valve-like passageway is formed between the second end of the fluid channel and the interior volume of the container. When the package is filled, the shape of the barrier member causes folds or pressure or distortion in the container that prevent fluid flow to the outlet or ambient through the valve-like passageway, absent external user-applied squeezing pressure. In another embodiment, the package includes two or more barrier members. In one aspect, a valve-like passageway is positioned between two barrier members that connects the fluid channel to the interior volume of the container.

[0018] As described above, in one embodiment, the package made in accordance with the present disclosure may include a breachable point positioned on the periphery that can be user breached for dispensing flowable substances from the package. The package can include a flexible container having an interior volume for receiving a flowable substance. The flexible container additionally defines a sealed periphery**.** A breachable point is located along the sealed periphery of the flexible container. The breachable point of the flexible container includes a weaker seal than the remainder of the sealed periphery.

[0019] The package further contains a fluid channel, which includes a fluid outlet and at least one valve-like passageway. The fluid outlet is located adjacent to or part of the breachable point, and the at least one valve-like passageway is in fluid communication with the interior volume of the flexible container. The package additionally includes a self-closing valve, which contains a barrier member positioned between the fluid outlet and the interior volume of the flexible container. The at least one valve-like passageway of the flexible container is formed between the barrier member and the sealed periphery. In this embodiment, intentional pressure such as a user-applied squeeze applied to the flexible container causes the breachable point to breach and dispense controlled amounts of the flowable substance from the interior volume of the flexible container. When pressure is no longer applied to the flexible container, the self-closing valve inhibits further flow of the flowable substance through the fluid outlet. This further flow is inhibited when the flexible container is spilled over on its side, dropped to the ground, or otherwise impacted after the breachable point to the ambient has been breached.

[0020] For example, the fluid channel may contain trapped air. The fluid channel can be initially free of the flowable substance and be “plump” with air or may contain residual amounts of air. In one aspect, the package is filled with the flowable substance from the bottom in order to trap air or other fluid in the fluid channel. The self-closing valve assists in keeping the fluid channel initially free of the flowable substance. A user can then breach the breachable point and dispense the substance through the fluid outlet by applying pressure to the package. For instance, the user can open the package, creating a fluid outlet, by pinching the package with a thumb and finger.

[0021] Also disclosed is a method for opening a package as defined by the present disclosure. The method includes applying pressure to the interior volume of the flexible package, causing the breachable point of the package to breach and thereby placing the fluid outlet in communication with the outside environment or ambient; and applying further pressure to the flexible container, causing the flowable substance contained within the interior volume to exit the flexible container through the self-closing valve, fluid channel and the fluid outlet.

[0022] In another embodiment, the perimeter of the flexible container can include a folded portion. The folded portion lies against an exterior surface of the

flexible container and intersects with the fluid channel to block fluid flow through the channel. In one embodiment, the folded portion of the flexible container includes a folded corner of the flexible container and the folded corner forms an obtuse angle with the top edge of the flexible container. In the same embodiment, a breachable bubble is located on the folded portion extending in a direction opposite the exterior surface of the flexible container.

[0023] In one embodiment, unfolding the folded portion after the bubble is breached allows fluid to be dispensed from the interior volume through the self-closing valve and fluid channel when pressure is applied (such as squeezing by the user) to the flexible container. In one embodiment, the breachable bubble may have a recloseable attachment, fold, adhesive, static cling, or other means in order to close the bubble or the container after the bubble is breached.

[0024] In one embodiment, the flexible container includes a breachable bubble that is formed in the valve-like passageways of the fluid channel when the interior volume is filled with a fluid product.

[0025] In particular, the package of the present invention eliminates bottle caps, straws, nozzles, spray mechanisms, spouts and fitments typical of conventional liquid packaging, and instead enables one-handed opening and no-spill dispensing of fluid materials using one flexible monomer material. Thus, empty, used packages remain intact, without any loose or uncollected parts. The package of the present invention is suitable for on-the-go lifestyles with its easy to open, no-spill features while being accessible for those with disabilities such as vision impairment, impaired or limited hand strength, or arthritis, thus having improved convenience as compared to conventional liquid packaging, e.g., PET water bottles. In addition, unlike conventional water bottles, the package of the present invention may use less material, thus is lighter weight, and additionally does not require applied labels on the package.

[0026] In addition, the package of the present invention may utilize recyclable films, post-consumer recyclable films and specialty films, including bio-based, compostable polymers, enhancing both the flexibility and the sustainability of the package. The sealed polymer film package may incorporate new technologies to eliminate pathogens for each package, thereby potentially extending product shelf life of the packaged contents. The package and/or

breachable bubble can further include one or more sensors, tags, electronic chips, readable codes, spectrally detectable images, scanning strips or watermarking to create “smart” packaging, thus enabling the trackability and traceability of each unique package throughout its supply chain. Thus, the package of the present invention can ensure accurate product components, ingredients, shelf life data and provide knowledge and data of the sustainability footprint of the product and package. The package material and bubble can aid in the efficiency and accuracy of package recycling, with the use of spectral and optical sorting and processing. Packages may provide sourcing data, integrated data, interoperable and aggregated data within such supply chains, including interactive consumer uses, marketing, promotions and modes, and post-consumer sorting, collection, processing and material re-uses. The breach of the bubble can enable GPS location data, time stamp, interactive data exchanges via connection to the internet of things, mobile devices, smart appliances and equipments. Such data can enable information for marketing, consumer use and/or product information or deploy or activate other proximate devices or functions. Sensors may be placed inside the bubble, embedded into the polymer film structure. Data may become dynamic when activated by sound of the “popping” of the breachable bubble or by rapid air flow, or other means.

[0027] Moreover, the package of the present invention provides the additional benefit of tamper evidence. The tamper evidence of the package can ensure that beverages and products are safe to consume by indicating if the package is sealed or if the package or has been opened prior. This can also prevent used, empty bottles and containers from being refilled with contaminated substances, thus assuring product authenticity. The package of the present invention also allows for a “self-closing” valve and flow channel within the package. This feature greatly minimizes pathogens and contaminants after opening and facilitates multi-use and re-use functionality.

[0028] Further aspects and features of the present disclosure are discussed in greater detail below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] A full and enabling disclosure of the present invention, including the best mode thereof to one skilled in the art, is set forth more particularly in the remainder of the specification, including reference to the accompanying figures, in which:

FIG. 1 shows a perspective view of one embodiment of the package with a sealed periphery including a breachable bubble;

FIG. 2 shows a perspective view of the package of FIG. 1 when the breachable bubble has been burst;

FIG. 3 shows a front view of the package of FIG. 1;

FIG. 4 shows a front view of yet another embodiment of the package of FIG. 1 having a generally rectangular-shaped barrier member;

FIG. 5 shows a front view of another embodiment of the package of FIG. 4 having two barrier members;

FIG. 6 shows a front view of a package according to another embodiment of the present invention having a breachable bubble separate from the fluid channel;

FIG. 7 shows a front view of a package according to FIG. 6 having a generally triangular-shaped barrier member;

FIG. 8A shows a front view of yet another embodiment of a package of the present invention having a sealing portion in a corner of the package;

FIG. 8B shows a plan view of the sealing portion of the package of FIG. 8A;

FIG. 9A shows a front view of a package according to another embodiment of the present invention having a sealing portion including two breachable bubbles;

FIG. 9B shows a partial front view of a package according to another embodiment of the present invention having a sealing portion in a corner of the package and having two breachable bubbles;

FIGS. 9C-9E show a cross-sectional view of a method of breaching the breachable bubbles in the package of FIG. 9A;

FIG. 10A shows a front view of the package of FIG. 1 placed on a flat surface;

FIG. 10B shows a side view of the package of FIG. 1 placed on a flat surface;

FIGS. 38 and 39 show another embodiment of a package made in accordance with the present disclosure;

FIG. 11 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 12 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 13 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 14 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 15 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 16 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 17 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 18 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 19 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 20 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 21 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 22 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 23 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 24 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 25 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 26 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 27 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 28 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 29 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 30 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 31 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 32 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 33 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 34 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 35 shows another embodiment of a package made in accordance with the present disclosure;

FIG. 36 shows another embodiment of a package made in accordance with the present disclosure; and

FIG. 37 shows another embodiment of a package made in accordance with the present disclosure.

[0030] Repeat use of reference characters in the present specification and drawings is intended to represent the same or analogous features or elements of the present invention.

DETAILED DESCRIPTION

[0031] Reference now will be made in detail to embodiments of the invention, one or more examples of which are illustrated in the drawings. Each

example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment can be used with another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as come within the scope of the appended claims and their equivalents.

[0032] In general, the present disclosure is directed a multi-use, reusable, spill proof package for fluids without a removable or separable closure. In accordance with the present disclosure, the package includes a breachable point located along the sealed periphery of the flexible container and a self-closing valve. A method for opening a package according to the present disclosure is also disclosed. Because of the specific arrangement of the spill proof package, the present inventor has found that the spill proof package of the present invention substantially improves upon existing fluid bottle packaging because the package can be opened easily, without removing a cap or any material and without a separate cap ring, while the self-closing valve prevents the flowable substance within the package from spilling.

[0033] The package, in one embodiment, can be made from one or more layers of a polymer film. The walls of the package can be flexible, and the package can be integrally formed into one-piece. In the past, such packages have been relatively difficult to open. In this regard, the present disclosure is directed to a package that is not only easy to open but that can also dispense fluids in a precise and controlled manner that prevents accidental spills. In accordance with the present disclosure, the package is a one-piece, one film-type (monomaterial) package. The package has a bubble at the top of the package that can be popped to separate the layers of film and open the package. No cap, lid, or any other material needs to be removed to open the package. The bubble may provide an audible “pop” sound once the film layers are separated due to pressure on the bubble.

[0034] The package also contains a self-closing valve near the fluid channel of the container. The self-closing valve prevents fluid from spilling or leaking out of

the container after the container has been opened. If no pressure is provided on the container by a user, then the self-closing valve prevents the contents of the package from escaping. When the user applies pressure to the container, such as squeezing the container, a passageway of the self-closing valve is opened and liquid can be poured from the fluid outlet of the package into the user's mouth or into a container or control-dispensed. As such, the package provides an easy to open package which can be made simply and inexpensively, which prevents unwanted spilling of its contents. The package may be used and reused multiple times after it has been opened, transforming a single use container to a multi-use container. The package also reduces product waste and loss.

[0035] In another embodiment, the breachable bubble can be located on a folded portion of the package, such as a folded corner of the package. When the folded portion is in a folded position, the bubble is sealed from the interior volume of the package. However, after breaching the bubble, unfolding the folded portion, and applying pressure to the container, liquid in the interior volume of the package may flow through the fluid channel and the fluid outlet. In one more embodiment, the package can include two breachable bubbles with a fold between them.

[0036] In another embodiment, the flexible container of includes a breachable bubble that is formed in the valve-like passageways of the fluid channel when the interior volume is filled with a fluid product.

[0037] In one aspect, the entire package is made from a single material or polymer. By being made from a single material or polymer, the package may be formed that is completely recyclable. In addition, the package can be recycled quickly, easily and economically without having to sort materials.

[0038] Referring to **FIG. 1**, reference numeral **10** generally indicates a package in accordance with one embodiment of the present invention. The package **10** may include a first film **11** and a second film **12**. The first film **11** and second film **12** may, in general, be flexible polymer films. In one embodiment of the present invention, the first film **11** and the second film **12** may be portions of a singular sheet of flexible polymer film. In another embodiment, the first film **11** and the second film **12** may be separate sheets of flexible polymer film. It should be understood that the package **10** can have any suitable shape depending upon

various factors including the type of product contained in or to be received in the package.

[0039] The first film **11** and the second film **12** can be made from any suitable polymer. Polymers that may be used to form the package include, for instance, polyolefins such as polyethylene and polypropylene, polyesters, polyamides, polyvinyl chloride, polylactic acid, polyhydroxyalkanoate, bio poly butylene succinate, polycaprolactone, polycarbonates, triglycerides, cellulose polymers, mixtures thereof, copolymers thereof, terpolymers thereof, and the like. In addition, the package can also be made from any suitable elastomeric polymer. It should be understood, however, that the first film **11** and the second film **12** are not limited to flexible polymer films but may be any suitable films. For example, the first film **11** and second film **12** may be formed from a metallized film, laminated paper, cellulose, plant-based or bio-based, biodegradable, bio compostable film or the like.

[0040] The first film **11** and the second film **12** can each comprise a single layer of material or can include multiple layers and can include coatings or additives. For instance, the first film **11** and the second film **12** can each include a core layer of polymeric material coated on one or both sides with other functional polymeric layers. The other functional polymeric layers may include, for instance, an oxygen barrier member layer, an ultraviolet filter layer, an anti-blocking layer, a printed layer, and the like.

[0041] The first film **11** and the second film **12** can each be translucent or transparent. If translucent or transparent, for instance, the contents of the package **10** can be viewed from the outside. In another embodiment, however, the first film **11** and the second film **12** can each be opaque. For instance, in one embodiment, the package **10** can display various graphics that identify, for instance, the brand and the description of the product inside, or that display coupons or incorporate sensors, tags or various other indicia. In other embodiments, the first film **11** can be translucent or transparent while the second film **12** is opaque, and the first film **11** can be opaque while the second film **12** is translucent or transparent.

[0042] In accordance with the present disclosure, the first film **11** and the second film **12** may be sealed together to form a flexible container **14**. The first film **11** and the second film **12** may be sealed or welded together using any suitable

sealing technique, such as an adhesive or polymer or nanomolecular bonding process.

[0043] The flexible container **14** may define an interior volume **15**, shown in **FIG. 2**, configured to receive a fluid product, e.g. a liquid. The portion of the first film **11** and the second film **12** which lies outside the perimeter of the sealed interior volume **15** may define a package periphery **80** defined by a seal **81**. In one embodiment, a product may be situated in the interior volume **15**. The product may, in some embodiments, be a beverage, such as water. In one embodiment, for example, the fluid product may include a beverage, a gel, a cream, a paste, a syrup, a honey, an oil, a sauce, a lubricant, or a grease. In some embodiments, the product may include an emulsion, such as a mayonnaise. In some embodiments, the product may include any other liquid or flowable substance.

[0044] As best shown in **FIGS. 1-5**, the package contains a fluid channel **20**. The fluid channel **20** is connected to a fluid outlet **21** at a first end and to the interior volume **15** of the flexible container **14** at a second end **22**. A self-closing valve **23** is positioned at the second end **22** of the fluid channel **20** to prevent undesired spillage of the product **16**.

[0045] In one embodiment, the self-closing valve **23** includes a barrier member **24**, as shown in **FIGS. 1-5**. The barrier member may be formed by welding or gluing the first flexible film **11** and the second flexible film **12** together at a location near the second end **22** of the fluid channel **20**. The barrier member **24** may be elongated in shape and is transverse to the second end **22** of the fluid channel **20**. In one embodiment, as best seen in **FIGS. 3-5**, the barrier member **24** has a length greater than the width of the fluid channel **20**. Preferably the length of the barrier member **24** is only slightly longer than the width of the fluid channel **20**, such as from about 1 mm to about 10 mm longer. This creates at least one valve-like passageway **25** between the barrier member **24** and an edge of the fluid channel **20**. The barrier member **24** may allow a valve-like passageway **25** on each side of the fluid channel **20** as shown in **FIGS. 1-5**. Alternatively, the barrier member **24** may extend all the way to the package periphery **80** on one side, only allowing a single valve-like passageway **25** between the interior volume **15** and the fluid channel **20**. The at least one valve-like passageway **25** has a curved shape determined by the shape of the space between the barrier member **24** and the seal

80 of the container **14**. The curved shape of the passageway **25** is configured to prevent the flow of fluid through the passageway **25** unless the container **14** is squeezed to cause fluid pressure. Preferably, the barrier member **24** extends approximately perpendicular to the general direction of the fluid channel **20**. The barrier member **24** may be shaped in a way such that the sealing portion **100** of the container arches upward, as shown in **FIGS. 10A-10B**, in order to provide a better seal.

[0046] The self-closing valve **23** of package **10** of **FIGS. 1-2** includes one barrier member **24**. However, in at least one other embodiment such as the package **10** as illustrated in **FIG. 5**, a package **10** according to the present disclosure may include two or more barrier members.

[0047] The fluid channel **20** may have a width of, for example, between 5 mm and 20 mm or any range or value therebetween, preferably between 10 mm and 15 mm, such as about 12 mm. However, the fluid channel **20** may have any desirable width, depending on the application of the container **14**.

[0048] As illustrated in **FIGS. 1-2**, when the interior volume **15** of the flexible container **14** is filled with product, the first flexible film **11** and the second flexible film **12** are spaced apart from each other within the flexible container **14**. The separation of the first flexible film **11** and the second flexible film **12** may create folds across the at least one valve-like passageway **25**. As shown in **FIGS. 1-5**, fold lines **26**, **27** and **28** are present across from the valve-like passageways on each side of the barrier member **24**. The folds extend along the axes marked by dashed lines **26**, **27** and **28**. It should be understood, however, that the fold lines **26**, **27**, and **28** are representative of the approximate axes of the actual folds in the self-closing valve **23**, but they may not be clearly visible from the surface of the package **10**.

[0049] The folds **26**, **27**, and **28**, as well as the barrier member **24** extending across the fluid channel **20** opening cause a portion of the periphery of the package **80** including the sealing portion **100** to curve inward (arch). The arching of the zone between the folds, that includes the fluid channel **20**, has the effect of pressing the two flexible films **11** and **12** in this zone against each other, thus forming a self-closing valve **23** that blocks the flow of the liquid through the valve-like passages **25** and through the fluid channel **20**.

[0050] As illustrated in **FIGS. 10A-10B**, when the package is placed on a flat surface and a vertical force is applied approximately on the large central portion of the flexible container **14** in the center of the front and back package walls, then the folds **26**, **27**, and **28** and the arching effect of the zone between the folds that includes the fluid passage **20**, tends to become more pronounced, thus increasing the effectiveness of the self-closing valve **23**.

[0051] Such accentuation of the folds close to the valve-like passages **25** as well as the increase in the arching of the zone between the folds with the application of a force essentially perpendicular to the plane of the flexible walls of the package **10**, effectively prevents liquid leakages when the flexible package **10** is placed in its natural position on an essentially flat surface. Even when another object is placed on the top of the flexible package **10** or moderate pressure is applied to the center of the package **10** by a user, increasing the pressure in the interior volume **15**, the self-closing valve **23** maintains its integrity. Such a mechanism is extremely helpful in preventing accidental spillage.

[0052] In order to allow the flow of liquid through the valve-like passages **25** and through the fluid channel **20** and outlet **21**, it is sufficient that a user applies a certain pressure to the flexible container **14**, in particular by squeezing it, at least in part, in a direction essentially perpendicular to the plane of the barrier member **24**, thus partially opening the lips which close off the valve-like passages **25**. The release of this squeezing action re-closes the shrunken passages **25** and re-closes the container **14**. Essentially, in order to eject the liquid product from the interior volume **15**, the user needs to squeeze the container from the sides, and when the user removes pressure from the sides, the container **14** re-closes.

[0053] The squeezing of the container **14** from the sides, essentially perpendicular to the plane of the barrier member, has the effect of reducing the arching and the folds, while at the same time increasing the pressure of the liquid in the container **14**, which then causes the lips of the flexible sheets at the entrance of the valve-like passages **25** to partially open, allowing the liquid to flow out. The fluid channel in the outlet can be designed so that a liquid can flow out of the container **14** in different ways. For example, in one embodiment, the fluid can flow in a single channel and form a single stream. Alternatively, the package can

be designed so that the fluid exits the container **14** in a spray pattern. For example, in one embodiment, the outlet may include a plurality of channels.

[0054] The advantages to the described and depicted self-closing valve **23** are that it is extremely simple to form and the operation of the valve **23** is less dependent on the properties of the fluid and the elasticity of the material constituting the container **14** than in other types of flexible containers.

[0055] In some embodiments, for example as shown in **FIGS. 1-3**, the barrier member **24** is located opposite the second end **22** of the fluid channel **20** and has a generally triangular shape. In this embodiment, a side of the generally triangular shaped barrier member **24** that is distal to the fluid channel **20** can have a length wider than a width of the fluid channel **20** and can extend approximately perpendicular to a general direction of the fluid channel **20**. The valve-like passages **25** can extend between the package periphery **80** and two respective sides of the generally triangular barrier member **24** positioned nearest to the second end **22** of the fluid channel **20**. The two respective sides of the generally triangular barrier member **24** that form the valve-like passages **25** can include a concave curvature, as shown in **FIG. 3**, resulting in curved passageways **25**, or can extend in a straight line. The point of the generally triangular shaped barrier member **24** that is nearest to the second end **22** of the fluid channel **20** can extend into the fluid channel **20**, as shown in **FIG. 3**.

[0056] Alternatively, as shown in **FIG. 4**, a barrier member **24A** can be located opposite the second end **22** of the fluid channel **20** and have a generally rectangular shape. In this embodiment, a side of the generally rectangular shaped barrier member **24** that is distal to the fluid channel **20** can have a length wider than a width of the fluid channel **20** and can extend approximately perpendicular to a general direction of the fluid channel **20**. The valve-like passages **25A** can extend between the package periphery **80** and two respective sides of the generally rectangular barrier member **24A** positioned nearest to the second end **22** of the fluid channel **20**.

[0057] In another embodiment, shown in **FIG. 5**, the barrier member is located opposite the second end **22** of the fluid channel **20** as in **FIGS. 3-4**, except that the barrier member includes two barrier members, shown as **24B** and **24C**, and has with a central passage **29**. In this embodiment, the central passage **29**

created between the two barrier members **24B** and **24C** allows the flow of the liquid in the fluid channel **20** to be increased when the user applies pressure to the container **14** in a direction essentially perpendicular to the plane of the barrier member **24**, as previously described.

[0058] In another alternative embodiment, as shown in **FIGS. 8A-8B**, the sealing portion **100** is positioned at a corner of the container **14** and contains a folded portion **30**. In one embodiment, the corner **31** of the container **14** contained by the folded corner **30** forms an acute angle. For example, the corner **31** of the container may form an angle between about 60° and about 88°. The angle of corner **31** is defined as the angle between the top edge **51** of the package and the portion of side edge **52** of the container **14**, shown in **FIGS. 8A-8B**, which lies on folded portion **30**. Such an angled corner allows for the optimum direction of the forces pertaining to the folding and unfolding of the folds **26**, **27**, and **28** and the arching of the zone between folds leading to a higher integrity seal when lying flat in its natural position, and better flow when squeezed from the sides.

[0059] As shown in **FIGS. 1-5**, the external sealing portion **100** may include a breachable bubble **40**. The breachable bubble **40** is surrounded by and defined by a bubble seal **41** that is at least partially breachable. For example, the bubble seal **41** can include at least one breachable point **42**. The breachable point **42** represents a portion of the bubble seal **41** that more easily separates than the remainder of the seal, for example, a weak spot or a soft seal. In one embodiment, the breachable point **42** is positioned at a position on the bubble seal **41** that is distant from the self-closing valve **23**, such as the furthest point on the bubble seal **41** from the self-closing valve **23**.

[0060] In another embodiment, the breachable bubble **40** can have two breachable points **42**, one that is distant from the self-closing valve **23** and one that is adjacent to the self-closing valve **23**, as shown in **FIG. 3**. One breachable point **42** may be breached by bursting the bubble **40**, e.g., by squeezing the bubble **40**. After one breachable point **42** has been breached, the second breachable point **42** may be breached, e.g., by squeezing the container **14** from the sides until the fluid product in the interior volume **15** passes through the channels **25** and generates sufficient pressure against the second breachable point **42** to breach the second breachable point **42**.

[0061] A breachable point **42** can coincide with the boundary **110** of the external sealing portion **100**. Furthermore, the breachable point **42** may be designed to provide the user an access or passageway upon the breach or bursting of the bubble **40**. The access or passageway may be exposed when the gas trapped within the bubble escapes as the breachable bubble **42** is breached. When the bubble **40** includes only one breachable point **42**, the access or passageway may assist the user to grip the front sealing surface **102** and back sealing surface **104** when unfolding the external sealing portion **100**. As shown in **FIG. 2**, the access or passageway provided by the breachable point **42** may be embodied by a portion of the front sealing surface **102** designated as a pull tab **81**.

[0062] In one embodiment, the external sealing portion **100** may be positioned such that the fluid channel **20** lies between the front sealing surface **102** and the rear sealing surface **104**. The front sealing surface **102** of the first flexible film **11** attaches to the rear sealing surface **104** of the second flexible film **12**. The front sealing surface **102** and the rear sealing surface **104** can be attached by way of a resealable or permanent attachment method, such as sealing or welding the surfaces together using any suitable sealing technique, for example an adhesive. A breachable bubble **40** is located within the front sealing surface **102**. The bubble seal **41** coincides with the boundary **110** at a breachable point or weak spot **42**.

[0063] In one embodiment, the external sealing portion **100** may be unfolded or peeled open as shown in **FIG. 2**. The front and rear sealing surfaces **102** and **104** can be peeled apart to separate a lower edge of the bubble seal **41** to permit access to the fluid outlet **21**. The front and rear sealing surfaces **102** and **104** may remain connected to each other at sides or may be fully separated.

[0064] In an alternative embodiment, the breachable bubble **40** of the external sealing portion **100** can be breached at a breachable point **42** within the boundary **110**, and the breachable bubble **40** can have an additional breachable point **42** adjacent to the fluid channel **20**. In this embodiment, when the bubble **40** is breached, an access or passageway is opened at the breachable point **42** within the boundary **110**. Then, the breachable point **42** near the fluid channel **20** is opened by squeezing the container **14** until the fluid pressure of the liquid **16** within the container **14** bursts the second breachable point **42**, thus forming a spout for the fluid outlet **21**.

[0065] In another embodiment, as shown in **FIGS. 6A and 7**, the container **14** generally contains a breachable bubble **40** having a bubble seal **41** in communication with the barrier member **24**. In this embodiment, the fluid channel **20** surrounds the breachable bubble **40** but the breachable bubble **40** is not in fluid communication with the fluid channel **20**. The breachable bubble **40** can include a breachable point **42** in the form of a weak spot or soft seal integrated with the boundary **110** of the external sealing portion **100** such that, when the breachable bubble **40** bursts, the soft seal **42** is breached toward the boundary **110** and provides an access or passageway to the front sealing surface **102** and the rear sealing surface **104**. Then, the front sealing surface **102** and the rear sealing surface **104** may be peeled away from each other to reveal the fluid opening **21**, allowing for unimpeded flow of liquid **15** from the fluid channel **20** to the ambient.

[0066] In addition, the container **14** shown in **FIG. 6A** has a rounded periphery **80** formed by an inverted seal **81**. Stated another way, in contrast to the edge seal **81** shown in **FIGS. 1-5**, the container **14** shown in **FIG. 6A-B** has a seal **81** disposed in the interior **15** of the container **14** such that the periphery **80** is rounded and has no linear or sharp edges of film material. The container **14** of **FIG. 6A** can be formed by bonding the first film **11** and second film **12** together along the seam **81** and inverting the first film **11** and second film **12** inside-out to form the container **14** having a rounded periphery **80** as shown in **FIG. 6B**.

[0067] In a preferred embodiment, the container **14** only contains a single breachable bubble **40**. Additionally, it is preferable that the breachable bubble **40** only protrudes or projects from one side of the package **14**. In some embodiments, such as the embodiment shown in **FIGS. 8A-8B**, this preference minimizes interference with the adherence of the folded portion **30** to the exterior of the flexible container **14**. As such, the bubble **40** preferably only projects from the front sealing surface **102** of the sealing portion **100** opposite the rear sealing surface **104** of the flexible container **14**.

[0068] Alternatively, as shown in **FIGS. 9A-9E**, the sealing portion **100** of the container **14** can include two breachable bubbles **40a** and **40b**. The two breachable bubbles **40a** and **40b** can optionally be formed by folding a single breachable bubble **40** into two halves, as shown in **FIGS. 9C-9D**. As best illustrated in **FIGS. 9A-9B**, the sealing portion **100** can include folding barrier

members **46** to assist with folding the breachable bubble **40** into two bubbles **40a** and **40b**. The breachable bubble **40a** can have a bubble seal **41a** within the boundary **110** of the external sealing portion **100**, and the breachable bubble **40b** can have a bubble seal **41b** adjacent to the fluid channel **20** of the container **14**. As best shown in **FIG. 9B**, both bubble seals **41a** and **41b** can include a breachable point **42a** and **42b**, respectively. Thus, as shown in **FIG. 9D**, the breachable point **42a** can burst the bubble **40a** to open toward the exterior of the package **10** to form an opening **43a**, and breachable point **42b** can be breached to open toward the interior volume **15** of the package **10** to form an opening **43b**. As shown in **FIG. 9E**, when the sealing portion **100** is unfolded, the sealing portion **100** becomes part of the fluid channel **20** such that the opening **43a** forms the fluid outlet **21**.

[0069] Optionally, the breachable bubbles **40a** and **40b** can have a passage **44** between them. The passage **44** can advantageously control the flow of the product through the breachable bubbles **40a** and **40b** when they have been breached. For example, as shown in **FIGS. 9C-D**, when the sealing portion **100** is folded at the passage **44**, no product can flow from bubble **40b** into bubble **40a** and to the fluid outlet **21**. For example, in various embodiments as shown in **FIGS. 9A-9E**, the passage **44** may be a substantially straight passage between the first breachable bubble **40a** and the second breachable bubble **40b**. The width of the passage **44** may vary depending on the desired flow characteristics of the fluid. Alternatively, the passage **44** may be a circuitous or serpentine passage between first breachable bubble **40a** and the second breachable bubble **40b**. Both the width of the passage **44** and the circuitous or serpentine path of the passage **44** may vary depending on the desired flow characteristics of the fluid. In other alternative embodiments, the passage **44** may be a tapered passage.

[0070] The bubble seal **41** can be made using various techniques and methods. For instance, the bubble seal **41** can be made using thermal bonding, ultrasonic bonding, or an adhesive. For instance, in one particular embodiment, the bubble seal **41** can be made by placing a heated sealing bar against the outer periphery of the bubble and exerting heat and pressure so as to form the breachable bubble **40**. In this embodiment, for instance, the breachable bubble **40** can be made from polymer films.

[0071] The breachable point **42** of the bubble seal **41** can also be made using different techniques and methods. When using a sealing bar to form the bubble seal **41**, for instance, the breachable point **42** can be constructed by varying the pressure, varying the temperature, or varying the time in which the sealing bar is contacted with the materials along the portion of the bubble seal **41** where the breachable point **42** is to exist.

[0072] In an alternative embodiment, the bubble seal **41** can include a heat sealed portion. The breachable point **42**, on the other hand, may include a "peel seal" portion. In this embodiment, for instance, when the breachable bubble **40** is breached along the breachable point **42**, a small opening may be formed along the bubble seal **41**. The breached portion of the bubble seal **41** can form at least one, *e.g.* two, tabs **102** and **104** that can be grasped by a user for further breaching the breachable bubble **40**. In this manner, the opening of the bubble can be increased in size to a user's preference. An example of tabs formed by the breaching of the breachable bubble **40** is shown in **FIG. 2**.

[0073] Various different methods and techniques are used to form peel seal portions. For example, in one embodiment, the breachable point **42** of the bubble seal **41** may include a first portion that is adhesively secured to a second portion along the seal **41**. The first portion of the breachable point **42** may be coated with a pressure sensitive adhesive. The adhesive may include, for instance, any suitable adhesive, such as an acrylate. The second and opposing portion of the peel seal, on the other hand, may include a film coated or laminated to a release layer. The release layer may include, for instance, a silicone.

[0074] In an alternative embodiment, each opposing portion of the breachable point **42** of the bubble seal **41** may include a multi-layered film. The major layers of the film may include a supporting layer, a pressure sensitive adhesive component, and a thin contact layer. In this embodiment, the two portions of the breachable point **42** can be brought together and attached. For instance, the thin contact layer of one portion can be attached to the thin contact layer of the opposing portion using heat and/or pressure. When the breachable bubble **40** is breached, and the breachable point **42** of the bubble seal **41** is peeled apart, a part of the sealed area of one of the contact layers tears away from its pressure sensitive adhesive component and remains adhered to the opposing

contact layer. Thereafter, resealing can be affected by re-engaging this torn away contact portion with the pressure sensitive adhesive from which it was separated when the layers were peeled apart.

[0075] In this embodiment, the contact layer can include a film having a relatively low tensile strength and having a relatively low elongation at break. Examples of such materials include polyolefins such as polyethylenes, copolymers of ethylene and ethylenically unsaturated comonomers, copolymers of an olefin and an ethylenically unsaturated monocarboxylic acid, and the like. The pressure sensitive adhesive contained within the layers, on the other hand, may be of the hot-melt variety or otherwise responsive to heat and/or pressure.

[0076] In still another embodiment, the breachable point **42** of the bubble seal **41** can include a combination of heat sealing and adhesive sealing. For instance, in one embodiment, the breachable point **42** may include a first portion that is heat sealed to a second portion. Along the breachable point **42**, however, may also exist a peel seal composition that may, in one embodiment, interfere with the heat sealing process of the bubble seal **41** to produce a breachable portion **42**. The peel seal composition, for instance, may include a lacquer that forms a weak portion along the bubble seal **41**.

[0077] In an alternative embodiment, an adhesive may be spot coated over the length of the breachable point **42**. Once the breachable point **42** is breached, the adhesive can then be used to reseal the two portions together after use.

[0078] In embodiments where the breachable bubble **40** and sealing portion **100** are re-sealable, the container **14** may be re-closed to provide a more robust seal than by relying on the self-closing valve **23** alone.

[0079] The breachable bubble **40** can be filled with a gas, such as air. The breachable bubble may also be filled with any other fluid, such as a liquid, in addition to air or gas. In some embodiments, as shown in **FIGS. 1-5**, the interior volume of the breachable bubble **40** can be generally in fluid communication with the fluid channel **20**. The gas pressure within the bubble can be sufficient so as to prevent the contents of the container from exiting through the fluid channel **20** until the breachable bubble **40** is breached. As such, prior to breaching of the breachable bubble **40**, the fluid within the interior volume of the container **14** is prevented from escaping into the breachable bubble **40** by both the self-closing

valve **23** and the gas pressure within the bubble **40**. It is additionally prevented from escaping into the ambient by the bubble seal **42**.

[0080] The breachable bubble **40**, as described above, is expandable to open the container **14** by external pressure applied by a consumer. For small bubbles, the consumer may simply pinch a bubble or bubbles between his thumb and forefinger. Slightly larger bubbles may require thumb-to-thumb pressure. Pressure can also be applied to the bubble by placing the bubble against a flat surface and applying pressure with one's fingers or palm.

[0081] When pressure is applied to the breachable bubble **40**, the atmosphere within the bubble applies pressure to the bubble seal **41** which causes the bubble **40** to breach at the weakest portion. For instance, in embodiments that include a breachable point **42**, separation of the bubble **40** occurs along the breachable point **42** creating an edge breach. In some embodiments, the edge breach may be sufficient to allow access to the fluid channel **20** for dispensing the contents of the container. Alternatively, the edge breach may form flaps **81** and **82** that can be easily peeled apart for better exposing the fluid channel **20**. **FIG. 2** shows the breachable bubble **40** after it has been breached.

[0082] The breachable bubble **40** may provide a distinct breaching sound when the bubble **40** is breached. The breaching sound may be caused by the trapped fluid escaping from the front and rear sealing surfaces **102** and **104** when the breachable bubble **40** is breached. For example, in one embodiment, the breachable bubble **40** may provide a popping sound, similar to a small balloon popping, when the breachable bubble **40** is breached. In other embodiments, the breachable bubble **40** may provide, for example, a peeping sound, a snapping sound, or a whistling sound.

[0083] In the embodiments illustrated, the breachable bubble **40** has a circular shape. It should be understood, however, that the breachable bubble **40** can have any suitable shape. For example, in other embodiments, the breachable bubble **40** may have an oval shape, may be triangular, may have a heart-like shape, may have a rectangular-like shape, or may have a more complex configuration. It should be understood that containers made according to the present disclosure can have any suitable shape and configuration.

[0084] A method for opening the package is also disclosed. A user may open a package as shown in **FIG. 1** with the external sealing portion **100** according to the following method. First, the user bursts the breachable bubble **40**, preferably by breaching the breachable point **42**. Second, the breaching of the breachable point **42** allows the user to access the pull tabs **81** and **82**. Third, by use of the pull tab, the user peels the front sealing surface **102** of the first flexible film **11** apart from the rear sealing surface **104** of the second flexible film **12**. Fourth, the user continues to peel the sealing surfaces **102** and **104** apart until the entire bubble seal **41** is breached. When the bubble seal **41** is breached to a sufficient extent to expose the fluid outlet **21**, the fluid outlet **21** is granted fluid communication with the ambient atmosphere, allowing the user to access the contents within the interior volume **15** by way of the fluid channel **20** and the self-closing valve **23**. Optionally, the user may fold back the first sealing surface **102** for more convenient access to the fluid outlet **21**.

[0085] Alternatively, when the sealing portion **100** includes a single breachable bubble **40** having two breachable points **42** as shown in, e.g., **FIG. 3**, the user bursts the breachable bubble **40** by breaching the breachable point **42** within the boundary **110** of the sealing portion **100** and furthest from the self-closing valve **23**. After the first breachable point **42** has been breached, the user can squeeze the package **10** to increase the pressure of the liquid contents against the second breachable point **42** near to the self-closing valve **23** until the second breachable point **42** is breached by the liquid. Thus, when both breachable points **42** have been breached, a fluid outlet **21** is formed, granting fluid communication with the ambient atmosphere, allowing the user to access the contents within the interior volume **15** by way of the fluid channel **20** and the self-closing valve **23**.

[0086] In another embodiment, when the sealing portion **100** includes a folded portion on a corner of the container **14**, the method may be carried out as follows. First, the package **10** is configured so that the folded portion **30** is in the folded position, cutting off fluid flow between the breachable bubble **40** and the interior volume **15** of the package. This is shown in **FIG. 8A**. Next, a user applies sufficient pressure to the breachable bubble **40** in order to breach the bubble seal

42 and separate first flexible film **11** from second flexible film **12**. Preferably, the user applies pressure on the section of the bubble **40** closest to the fold line **50**.

[0087] After the bubble is breached, the user unfolds the folded portion **30** from the folded position to the unfolded position, as shown in **FIG. 8B**. This allows fluid communication between the ambient and the self-closing valve **23**. The user may have to further separate the two tabs **81** and **82** formed by the breaching of the bubble in order to expose the fluid outlet **21**.

[0088] In yet another embodiment, when the sealing portion **100** includes two breachable bubbles **40a** and **40b** folded over each other, as shown in **FIG. 9C**, the method may be carried out as follows and as illustrated in **FIGS. 9D-9E**. First, the package **10** is configured so that the bubble **40a** is folded over the bubble **40b**, cutting off any fluid flow between the bubbles **40a** and **40b**, as shown in **FIG. 9C**. Next, a user applies sufficient pressure to the breachable bubbles **40a** and **40b** in order to breach the breachable points **42a** and **42b** to form openings **43a** and **43b**, as shown in **FIG. 9D**. After the bubbles **42a** and **42b** are breached, the user unfolds the sealing portion **100** to the unfolded position shown in **FIG. 9E**. This allows fluid communication between the ambient and the self-closing valve **23**. Then, fluid may exit through the fluid outlet **21** of the package **10**.

[0089] In any embodiment, the self-closing valve **23** prevents unwanted fluid flow. For example, as the package **10** is opened and the sealing portion **100** is unfolded or peeled open, the self-closing valve **23** prevents the contents of the interior volume **15** to escape. Further, even if the fluid channel **20** is pointed downward toward the ground, the contents of the package **10** are still unable to escape even if the user supplies a moderate amount of pressure to the center of the front **11** and back **12** walls of the package **10**. This is due to the barrier member **24** and the folds **26**, **27**, and **28** created by the self-closing valve **23** and pressure, as described above.

[0090] When desired, in order to allow the liquid contained in the container **14** to pour out through the fluid channel **20** and fluid outlet **21**, pressure is applied to the sides of the package **10** perpendicular to the plane of the barrier member **24**. The shape of the fluid channel **20** and fluid outlet **21** may be shaped in any manner in order to influence the flow properties as the fluid is poured out of the

package. As such, the package allows for a precise, controlled flow, unlike many similar flexible liquid packages or pouches.

[0091] When the user wants to stop the flow of the liquid, they may simply stop applying pressure to the sides of the container **14** and the self-closing valve **23** will close back up, preventing further flow. In this manner, the user does not need to reposition the container **14** in an upright position in order to stop flow.

[0092] Referring to **FIGS. 11-39**, various other embodiments of packages made in accordance with the present disclosure are shown. In each of these embodiments, the breachable bubble can be integrated into the self-closing valve design. The bubble can be breached for forming a passageway between the interior volume and the outside environment (i.e. outside the package). Breaching the bubble also activates the self-closing valve for a controlled dispensing of a product contained within the package.

[0093] Referring to **FIGS. 38 and 39**, a further embodiment of a package **10** made in accordance with the present disclosure is shown. **FIG. 38** shows the flexible container **14** when the interior volume **15** does not contain a flowable substance, while **FIG. 39** shows the flexible container **14** when the interior volume **15** contains a flowable substance. The package **10** of **FIGS. 38 and 39** includes a flexible container **14** having an interior volume **15** for receiving a flowable substance and defines a sealed periphery **80.** A breachable point **42** is located along the sealed periphery **80** of the flexible container **14**. The breachable point **42** of the flexible container **14** includes a weaker seal than the remainder of the sealed periphery **80**. The breachable point **42** is designed to breach when pressure is applied to the package without other breaches forming along the periphery.

[0094] The package **10** of **FIGS. 38 and 39** further contains a fluid channel **20**, which includes a fluid outlet and at least one valve-like passageway **25**. For example, in **FIGS. 38 and 39**, the fluid channel **20** includes two valve-like passageways **25.** The fluid outlet is located adjacent to the breachable point **42**, and the two valve-like passageways **25** are in fluid communication with the interior volume **15** of the flexible container **14**.

[0095] Referring still to **FIGS. 38 and 39**, the package **10** additionally includes a self-closing valve **23**, which contains a barrier member **24** positioned

between the fluid outlet and the interior volume **15** of the flexible container **14.** The two valve-like passageways **25** of the flexible container **14** are formed on opposite sides of the barrier member **24** between the barrier member **24** and the sealed periphery **80**.

[0096] For the package **14** as shown in **FIGS. 38 and 39,** pressure applied to the flexible container **14** causes the breachable point **42** to breach to dispense controlled amounts of the flowable substance from the interior volume **15** of the flexible container **14**. Of advantage, the package can be easily opened using one hand without having to tear away a top strip of the package and without having to use a cutting tool, such as scissors. Further, when pressure is no longer applied to the flexible container **14**, the self-closing valve **23** inhibits further flow of the flowable substance through the fluid outlet.

[0097] In one embodiment, the fluid channel **20** may contain trapped air, which will then function as a breachable bubble. For example, the fluid channel **20** can be initially free of the flowable substance and be “plump” with air or may contain residual amounts of air. In one aspect, the package **10** is filled with the flowable substance from the bottom in order to trap air in the fluid channel **20**. The self-closing valve **23** assists in keeping the fluid channel **20** initially free of the flowable substance. A user can then breach the breachable point **42** and dispense the substance by applying pressure to the package **10**. For instance, the user can open the package by pinching the package **10** with a thumb and finger. Once breached, the trapped air is released followed by the flowable substance.

[0098] In the embodiment illustrated in **FIGS. 38 and 39**, the flowable substance exhibits a static pressure and is in direct fluid communication with trapped air contained in the fluid channel **20**. **I**n order to prevent the trapped fluid or trapped air in the fluid channel **20** from traveling into the interior volume **15** of the flexible container **14**, the flowable substance in the interior volume **15** can have a sufficient static pressure. Specifically, the flowable substance can have a sufficient static pressure such that applying a pressure to the flexible container **14** causes the trapped air contained in the fluid channel **20** to breach through the breachable point **42** of the boundary **110**, thereby enabling fluid communication between the fluid channel **20** and the ambient. In other words, when a user applies pressure to the flexible container **14**, the fluid product has a sufficient static

pressure that the self-closing valve **23**, the two valve-like passageways **25**, and the fold lines prevent the trapped air in the fluid channel **20** from traveling into the interior volume **15** of the flexible container **14** and instead cause the package to breach.

[0099] The self-closing valve of the present disclosure may take a variety of shapes or forms. In one aspect, the self-closing valve **23** may have a triangular shape. However, the self-closing valve **23** can have a variety of other shapes or forms, such as a rectangular shape, a horizontal oval shape, or a heart shape. In one embodiment, the barrier member can be filled with a gas, such as air.

[0100] In one aspect, the flexible container **14** of the present disclosure may include a top and a bottom, where the fluid outlet and breachable point **42** are located in a middle of the top, as shown in **FIGS. 38 and 39**. The fluid outlet and breachable point, however, can be located at a number of locations around the package **10**. For example, in one aspect, the fluid outlet and the breachable point **42** may be located at a top corner of the flexible container **14**, as shown, for example at least in **FIG. 12**.

[0101] The package **10** of the present disclosure includes a flexible container **14** and an interior volume **15,** both of which may have a variety of spatial volumes. For example, in one aspect, the interior volume **15** of the flexible container **14** may have a volume of from about 0.5 ounces to about 5 ounces. Additionally, in another aspect, the flexible container **14** itself may have a volume of from about 5 ounces to about 64 ounces. However, a flexible container **14** or an interior volume **15** may each be employed having different volumes in other packages made in accordance with the present disclosure. The volume or width of the self-closing valve passageways **25** can by altered and adjusted based on the viscosity of the flowable substance and/or the desired flow rate.

[0102] In one aspect, the present disclosure may include a strip containing a plurality of packages described in accordance with the present disclosure that are connected together in a sequential manner. For instance, the flexible packages may include a top and a bottom, and the top of a flexible package **14** may be connected to the bottom of an adjacent flexible package **14**. In an even further aspect, the packages may be separated by lines of perforations.

[0103] In one embodiment, a method for opening a package **10** as defined by the present disclosure is provided. Referring to **FIG. 39**, for example, the method includes applying pressure to the interior volume **15** of the flexible container **14**, causing the breachable point **42** of the package **10** to breach and thereby placing the fluid outlet in communication with the outside environment; and applying further pressure to the flexible container **14**, causing the flowable substance contained within the interior volume **15** to exit the flexible container through the self-closing valve **23** and the fluid outlet.

[0104] Referring now to **FIG. 11**, a package **10** is shown that includes a flexible container **14** defining an interior volume **15**. In accordance with the present disclosure, the flexible container **14** includes a self-closing valve **23** that is integral with a breachable bubble **40**. The self-closing valve **23**, for instance, can include a barrier member **24** attached to a breachable bubble **40**. The breachable bubble **40** can include a breachable point **42** that faces a boundary **110** of the flexible container **14**. During use, a user can burst the breachable bubble **40** along the breaching point **42**. Breaching the bubble **40** can, in one embodiment, create pull tabs. A user can use the pull tabs to peel a first flexible film apart from a second flexible film. During the peeling process, a fluid outlet forms that is in fluid communication with the interior volume **15** via valve-like passageways **25**.

[0105] Alternatively, breaching the bubble **40** can, in one embodiment, cause a fluid outlet to form that is automatically in communication with the valve-like passageways **25** without having to peel apart any pull tabs that are formed during the breaching process.

[0106] In one embodiment, the breachable bubble **40** can be used to form a fluid outlet for the flexible container **14** when the bubble is breached. After the bubble **40** is breached, breachable points may still remain within each of the valve-like passageways **25**. These breachable points can be breached by applying pressure to the interior volume **15** of the flexible package **14**. In this manner, the bubble **40** is used to form a fluid outlet in a first step and in a second step pressure is placed on the flexible container **14** for breaching further points or seals within the container that, once breached, provide fluid communication between the fluid outlet and the valve-like passageways **25**.

[0107] As shown in **FIG. 11**, the breachable bubble **40** is generally in the shape of a triangle that forms an extended point that forms the breachable point **42**. In **FIG. 11**, the boundary **110** of the flexible container **14** includes a sharp corner where the breachable bubble **40** and self-closing valve **23** are positioned. Alternatively, however, the flexible container **14** can include a rounded corner.

[0108] Referring to **FIG. 12**, another embodiment of a flexible container **14** made in accordance with the present disclosure is shown. The embodiment of **FIG. 12** is very similar to the embodiment illustrated in **FIG. 11**. The flexible container **14** includes a self-closing valve **23** in combination with a breachable bubble **40**. The self-closing valve **23** includes a barrier member **24** that attaches both sides or walls of the flexible container together. The breachable bubble **40** has a triangular shape with a breachable point **42**. Applying pressure to the breachable bubble **40** causes the breachable point **42** to breach and break through a sealed portion **120** of the flexible container **14**. Once the sealed portion **120** is separated, a fluid outlet is formed that is in fluid communication with the valve-like passageways **25** and the interior volume **15** of the flexible container **14**. In the embodiment illustrated in **FIG. 12**, the boundary **110** of the flexible container **14** includes a rounded corner. In addition, the barrier member **24** in **FIG. 12** has a smaller width than the barrier member **24** illustrated in **FIG. 11**.

[0109] Referring now to **FIGS. 13 and 14**, two other embodiments of flexible containers **14** made in accordance with the present disclosure are shown. Referring to **FIG. 13**, the flexible container **14** defines an interior volume **15**. Attached between two opposing film layers is an integrated self-closing valve **23** and breachable bubble **40**. The self-closing valve **23** is defined by a barrier member **24** which also includes a bubble seal for the breachable bubble **40**. The breachable bubble **40** includes a breachable point **42** that is directed towards a fluid outlet defined by a boundary **110** of the flexible container **14**.

[0110] During use, a user can breach the bubble **40** at the breachable point **42** forming a fluid outlet. When the bubble is breached, a pair of opposing pull tabs can be formed for further opening the container so as to form fluid communication between valve-like passageways **25** and the interior volume **15**. Alternatively, or in addition, the flexible container **14** may include breachable seals located along the valve-like passageways **25** which can be breached by applying pressure to the

interior volume **15** of the flexible container **14** after the breachable bubble **40** has been breached.

[0111] The flexible container **14** as shown in **FIG. 14** generally includes the same elements and can operate in substantially the same way. In **FIGS. 13 and 14**, the breachable bubble **40** and the self-closing valve **23** (which are integrated together) have an arc-like shape. More particularly, the self-closing valves **23** and the breachable bubbles **40** have a curved shape such that the concave portion of the curve faces towards the interior volume **15** of the flexible container **14**. In **FIG. 13**, the breachable bubble **40** has a uniform curved shape. In the embodiment illustrated in **FIG. 13**, however, the breachable bubble **40** has more of an arrow-like shape defining an apex wherein the breachable point **42** is located.

[0112] Referring to **FIGS. 15 and 16**, further embodiments of flexible containers **14** made in accordance with the present disclosure are shown. As illustrated in **FIG. 15**, the flexible container **14** includes an interior volume **15** in fluid communication with valve-like passageways **25**. The flexible container **14** further includes an integrated self-closing valve **23** and breachable bubble **40**. The breachable bubble **40** includes a breachable point **42** that faces towards a corner of the package to form a fluid outlet at the boundary **110**. Similar to the embodiments illustrated in **FIGS. 13 and 14**, the bubble seal **41** of the breachable bubble **40** also forms a barrier member for the self-closing valve **23**. The breachable bubble **40**, when breached, forms a fluid outlet and, as described above, the package can be manipulated so that the fluid outlet formed by the breachable bubble is placed in fluid communication with the valve-like passageways **25**.

[0113] In the embodiment illustrated in **FIG. 15**, the self-closing valve **23** and the breachable bubble **40** have a heart-like shape in which the point or apex of the heart faces the boundary **110** of the flexible package **14**. The heart-like shape of the breachable bubble **40** may create additional fold lines in the package and can provide greater strength to the package and/or provide better control over the flow properties of the package when a product, such as a fluid, is dispensed from the interior volume **15**.

[0114] The flexible container **14** as shown in **FIG. 16** is substantially similar to the package illustrated in **FIG. 15**. In **FIG. 16**, however, the boundary **110** of the

flexible container **14** has rounded corners. In addition to having a self-closing valve **23** and a breachable bubble **40** in the shape of a heart, the flexible container **14** as shown in **FIG. 16** further includes an additional barrier member **130** spaced from the breachable bubble **40**. The barrier member **130** and the breachable bubble **40** form the self-closing valve **23**. In the embodiment illustrated in **FIG. 16**, the barrier member **130** has a round or circular shape that connects the opposing walls of the package together. The barrier member **130** is spaced from the breachable bubble **40** a sufficient distance in order to provide further strength and integrity to the self-closing valve **23** without creating adverse fluid flow characteristics within the flexible container **14**. In one embodiment, the barrier member **130** can be a point bond that connects the opposing walls of the flexible container **14**.

[0115] Referring to **FIGS. 17, 18 and 19**, further embodiments of packages made in accordance with the present disclosure are shown. In the embodiments illustrated in **FIGS. 17-19**, the flexible container **14** also includes an integrated self-closing valve **23** and breachable bubble **40**. The bubble seal **41** of the breachable bubble **40**, for instance, forms the self-closing valve **23**. The bubble seal **41** of the breachable bubble **40** also forms valve-like passageways **25** that are in fluid communication with an interior volume **15** for controllably dispensing product from the flexible container **14** to the outside environment through the boundary **110**.

[0116] In the embodiments illustrated in **FIGS. 17-19**, the self-closing valve **23** and the breachable bubble **40** have a flute-like shape or a flask-like shape. As shown in **FIG. 17**, for instance, the breachable bubble **40** includes a conical body **132** in fluid communication with a spout **134**. A breachable point **42** is positioned at the end of the spout **134** in the direction of the boundary **110**. The breachable bubble **40**, when breached, forms a fluid outlet through the boundary **110**. In addition, breaching the bubble **40** also provides a means for providing fluid communication between the valve-like passageways **25** and the fluid outlet that is formed.

[0117] The flexible container **14** as shown in **FIG. 18** is similar in construction to the flexible container **14** shown in **FIG. 17**. In the embodiment illustrated in **FIG. 18**, the conical-shaped body **132** of the breachable bubble **40** has a greater width for forming valve-like passageways **25** with a different configuration. As shown in **FIGS. 17 and 18**, the corner of the flexible container **14**

can have a planar region opposite the breachable point **42** for facilitating the formation of a fluid opening when the bubble **40** is breached.

[0118] Referring to **FIG. 19**, a self-closing valve **23** and breachable bubble **40** are illustrated similar to the shapes illustrated in **FIGS. 17 and 18**. In **FIG. 19**, however, the conical body **132** has a more rounded shape. In addition, the spout **134** is wider in relation to the conical body **132**. In addition, in the embodiment illustrated in **FIG. 19**, the flexible container **14** includes a neck portion **136** that has a shape that conforms to the shape of the spout **134** of the breachable bubble **40**. The neck portion **136** can further define the shape of the valve-like passageways **25** for providing better control over fluid flow. In addition, the neck portion **136** can facilitate formation of a fluid opening once the bubble **40** is breached.

[0119] Referring to **FIGS. 20 and 21**, still further embodiments of flexible containers **14** made in accordance with the present disclosure are illustrated. The flexible containers **14** shown in **FIGS. 20 and 21** are similar to the embodiment shown in **FIG. 19**. For example, as shown in **FIG. 20**, the flexible container **14** includes an integrated self-closing valve **23** and breachable bubble **40**. The breachable bubble **40** includes a bubble seal **41** that forms the barrier member of the self-closing valve. The bubble seal connects between the two outer walls or surfaces of the flexible container **14** and forms valve-like passageways **25**. The flexible container **14** includes a sealed end along the boundary **110**. The breachable bubble **40** includes a breachable point **42**. When pressure is applied to the bubble **40**, the bubble forms a fluid outlet through the boundary **110** of the flexible container **14**. In addition, the fluid outlet can be placed in fluid communication with the valve-like passageways **25** for controllably dispensing product from the interior volume **15** of the flexible container **14**.

[0120] In the embodiment illustrated in **FIG. 20**, the breachable bubble **40** has a bell-like shape that includes a conical-shaped portion **132** and a spout portion **134**. The spout portion **134** generally follows the contours of a neck portion **136** of the flexible container **14**.

[0121] In the embodiment illustrated in **FIG. 21**, the breachable bubble **40** also includes a body portion **132** and a spout portion **134**. The breachable bubble **40** generally includes three triangular lobes to form a flute-like shape as shown in **FIGS. 17, 18 and 19**. In addition, the self-closing valve **23** further includes a barrier

member **130** similar to the barrier member **130** shown in **FIG. 16**. The barrier member **130** can have a circular shape and can connect the two opposing surfaces of the flexible container **14** for providing further strength to the self-closing valve **23**.

[0122] Referring now to the flexible containers **14** illustrated in **FIGS. 22 and 23**, further embodiments of packages made in accordance with the present disclosure are shown in which a self-closing valve **23** is integral with a breachable bubble **40**. The self-closing valve **23** and the breachable bubble **40** can be used to open the package similar to any of the embodiments illustrated in **FIGS. 11-21**. In **FIG. 22**, the breachable bubble **40** is in the shape of an oval. The oval has an elongated shape defining a breachable point **42**. As shown, the elongated body of the bubble **40** faces and corresponds with the neck portion **136** of the flexible container **14** having a boundary **110**. A bubble seal **41** serves as a barrier member for the self-closing valve **23** and defines the valve-like passageways **25**.

[0123] In **FIG. 23**, the breachable bubble **40** is in the shape of a circle and operates similar to the embodiment illustrated in **FIG. 22**.

[0124] Referring now to **FIG. 24**, another embodiment of a flexible container **14** is illustrated including a breachable bubble **40** that is integrated with a self-closing valve **23**. The embodiment illustrated in **FIG. 24** is similar to the embodiment illustrated in **FIG. 21**. In **FIG. 24**, however, the self-closing valve **23** is defined exclusively by the bubble seal **41** and does not include a separate barrier member positioned below the breachable bubble **40**.

[0125] Referring now to **FIGS. 25-27**, further embodiments of flexible containers **14** made in accordance with the present disclosure are shown. In the embodiments illustrated in **FIGS. 25-27**, the flexible container **14** includes a breachable bubble **40** having a disc-like shape. The breachable bubble **40** is at least partially integral with a self-closing valve **23**. The self-closing valve **23** and the breachable bubble **40** form valve-like passageways **25** that extend into a neck portion **136** of the flexible container **14**. The valve-like passageways **25** are in fluid communication with an interior volume **15** of the flexible container **14**.

[0126] As shown in **FIG. 25**, the breachable bubble **40** includes a bubble seal **41** and a breachable point **42**. The flexible container **14** further includes a barrier member **24**. In this embodiment, the self-closing valve **23** is formed by the

barrier member **24** in conjunction with the bubble seal **41**. The breachable bubble **40** is configured to breach in the direction of the neck portion **136** through the breachable point **42** for forming a fluid opening through the boundary **110**. By peeling back pull tabs once the bubble **40** is breached or by adding further pressure to the interior volume **15** of the flexible container **14**, the fluid outlet formed by the breachable bubble **40** can be placed in fluid communication with the valve-like passageways **25**.

[0127] In **FIG. 26**, the breachable bubble **40** has a similar shape to the embodiment illustrated in **FIG. 25** except the breachable bubble **40** includes a hump portion positioned opposite the breachable point **42** and the neck portion **136**. Further, the bubble seal **41**, in this embodiment, forms the entire self-closing valve **23**. As shown in **FIGS. 25 and 26**, the breachable bubble **40** includes a concave-shaped surface that faces the neck portion **136**.

[0128] Referring now to the flexible container **14** shown in **FIG. 27**, the breachable bubble **40** and the self-closing valve **23** have a shape similar to the breachable bubble **40** illustrated in **FIG. 26**. In the embodiment illustrated in **FIG. 27**, however, a hump portion **140** is separated by a further barrier member and thus is not part of the breachable bubble **40**. Instead, the flexible container **14** includes a separate barrier member **24** that extends from the breachable bubble **40** for forming the self-closing valve **23**.

[0129] Referring to **FIGS. 28 and 29**, further embodiments of flexible containers **14** made in accordance with the present disclosure are shown. The flexible containers **14** as shown in **FIGS. 28 and 29** are very similar to the flexible container **14** illustrated in **FIG. 14**. More particularly, the breachable bubble in the embodiments illustrated in **FIGS. 28 and 29** are in the shape of an arrow having an apex where the breachable point **42** is located. The apex of each breachable bubble **40** faces a neck portion **136** of the flexible container **14**. The breachable bubble **40** forms valve-like passageways **25** for forming a self-closing valve **23**. In the embodiments illustrated in **FIGS. 28 and 29**, the self-closing valve **23** further includes a barrier member **130** that connects one side of the package with an opposite side of the package for providing strength and integrity. As shown in **FIGS. 28 and 29**, the barrier member **130** can be in the shape of a circle. In other

embodiments, however, the barrier member **130** can have any suitable shape, such as rectangular, square, or a complex shape.

[0130] Referring to **FIG. 31**, a further embodiment of a breachable bubble **40** illustrated in an arrow-like shape is shown. The embodiment illustrated in **FIG. 31** is similar in construction and function to the embodiment illustrated in **FIG. 14**. The breachable bubble **40**, for instance, includes a bubble seal **41** that also serves as forming a self-closing valve **23** and the formation of valve-like passageways **25**.

[0131] Referring to **FIG. 30**, still another embodiment of a flexible container **14** made in accordance with the present disclosure is shown. The flexible container **14** includes a breachable bubble **40** having a breach point **42** and being formed by a bubble seal **41**. The bubble seal **41** also forms a self-closing valve **23** defining valve-like passageways **25**. The breachable bubble **40** is similar in configuration to the embodiment illustrated in **FIG. 13**. In the embodiment illustrated in **FIG. 30**, however, the bubble **40** includes not only a body portion **132** but also a spout portion **134** that extends into the neck portion **136** of the flexible container **14**. The spout portion **134** can facilitate formation of a fluid opening when the bubble is breached and can better define the fluid passageways **25**.

[0132] Referring to **FIGS. 32 and 33**, further embodiments of flexible containers **14** made in accordance with the present disclosure are shown. In **FIGS. 32** and **33**, a breachable bubble **40** defined by a bubble seal **41** and a breachable point **42** forms part of a self-closing valve **23**. The self-closing valve **23**, however, further includes a barrier member **130** which, in the embodiments illustrated, is in the shape of a horizontal rod-like member. The embodiment of **FIG. 32** is very similar in design and function to the embodiment illustrated in **FIG. 23**. The embodiment illustrated in **FIG. 33** is very similar in design and function to the embodiment illustrated in **FIG. 22**. The embodiments illustrated in **FIGS. 32 and 33**, however, include the additional barrier member **130** that connects the opposing walls of the package together and can have various different functions and uses. For instance, the barrier member **130** can better define the valve-like passageways **25** and can provide further structure and integrity to the package. In addition, the barrier members **130** can change the position of the fold lines of the packages after the bubbles **40** have been breached and during dispensing of products from the flexible containers **14** by applying pressure to the interior volume **15**.

[0133] Referring to **FIG. 34**, a flexible container **14** made in accordance with the present disclosure is shown containing an integrated breachable bubble **40** and self-closing valve **23**. More particularly, the breachable bubble **40** includes a bubble seal **41** that defines the self-closing valve **23** and forms the valve-like passageways **25**. The breachable bubble **40** includes a breachable point **42** facing the boundary **110** of the flexible container **14** and within a neck portion **136**. The embodiment illustrated in **FIG. 34** is very similar in shape and function as to the flexible container **14** shown in **FIG. 17**. In **FIG. 34**, however, the body portion **132** of the flexible bubble gradually extends into the spout portion **134** of the breachable bubble **40**.

[0134] Referring to **FIG. 35**, still another embodiment of a flexible container made in accordance with the present disclosure is shown. In **FIG. 35**, the self-closing valve **23** and the breachable bubble **40** are very similar in design and function as to the embodiment illustrated in **FIG. 31**. As shown, the breachable bubble **40** has an arrow-like shape and may be described as having the shape of a "fish tail".

[0135] In the embodiments illustrated in **FIGS. 11-35** and **FIGS. 38 and 39**, each of the flexible containers includes a single breachable bubble. Referring to **FIGS. 36 and 37**, further embodiments of flexible containers **14** made in accordance with the present disclosure are shown. In **FIGS. 36 and 37**, each flexible container **14** contains two different breachable bubbles that cooperate together to form valve-like passageways **25** and a self-closing valve **23**.

[0136] Referring to **FIG. 36**, for instance, the flexible container **14** includes a first breachable bubble **40A** spaced from a second breachable bubble **40B**. The breachable bubbles **40A** and **40B** have a curved or "boomerang" shape. Each breachable bubble **40A** and **40B** includes a bubble seal **41A** and **41B** and a breachable point **42A** and **42B** that faces a boundary **110**. In the embodiment illustrated, the breachable bubbles **40A** and **40B** are located primarily in the neck portion **136** of the flexible container **14**.

[0137] The two cooperating breachable bubbles **40A** and **40B** also form a self-closing valve **23** defining a valve-like passageway **25**. When a user desires to open the package and dispense the contents, a user applies pressure to the breachable bubbles **40A** and **40B** for causing a breach through the boundary **110**.

A user can then peel opposing sides or walls of the container for producing a pour spout that is in fluid communication with the valve-like passageway **25**. Applying pressure to the interior volume **15** allows for controlled flow of product through the fluid outlet.

[0138] Referring to **FIG. 37**, the flexible container **14** is very similar in shape and function to the embodiment illustrated in **FIG. 36**. In **FIG. 37**, however, the opposing breachable bubbles **40A** and **40B** have a "crescent moon-like shape".

[0139] In the embodiment illustrated in **FIG. 37**, the flexible container **14** further includes a barrier member **130** that attaches the opposing walls of the container together. The barrier member **130** can have any suitable shape. In the embodiment illustrated, the barrier member **130** has a circular shape and is spaced from the breachable bubbles **40A** and **40B** for forming valve-like passageways **25**. The barrier member **130** can provide greater strength and integrity to the package and can provide for better control over fluid flow through a fluid outlet formed by the breachable bubbles **40A** and **40B**.

[0140] This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they include structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims.

What Is Claimed:

1. A package comprising:

a flexible container having an interior volume for receiving a flowable substance, the flexible container defining a sealed periphery;

a breachable point located along the sealed periphery of the flexible container, the breachable point having a weaker seal than the remainder of the sealed periphery;

a fluid channel comprising a fluid outlet and at least one valve-like passageway, the fluid outlet being located adjacent to the breachable point, the at least one valve-like passageway being in fluid communication with the interior volume of the flexible container;

a self-closing valve comprising a barrier member positioned between the fluid outlet and the interior volume of the flexible container, the at least one valve-like passageway being formed between the barrier member and the sealed periphery, and wherein pressure applied to the flexible container causes the breachable point to breach for dispensing controlled amounts of the flowable substance from the interior volume of the container and wherein, when pressure is no longer applied, the self-closing valve inhibits further flow of the flowable substance through the fluid outlet.

2. A package as defined in claim 1, wherein the fluid channel initially contains trapped air that causes the breachable point to breach when pressure is applied to the flexible container, the trapped air being released through the fluid outlet before the flowable substance is dispensed.

3. A package as defined in claim 1 or 2, wherein the fluid channel includes a first valve-like passageway located on one side of the barrier member and a second valve-like passageway located on an opposite side of the barrier member.

4. A package as defined in any of the preceding claims, wherein the self-closing valve has a triangular shape.

5. A package as defined in any of the preceding claims, wherein the barrier member comprises a bubble filled with a gas.

6. A package as defined in any of the preceding claims, wherein the barrier member has a shape that forms folds in the flexible container that cause the

flexible container walls to prevent liquid flow through the valve-like passageway absent external pressure.

7. A package as defined in any of the preceding claims, wherein the flexible container includes a top and a bottom, the fluid outlet and breachable point being located in a middle of the top.

8. A package as defined in any of claims 1 through 6, wherein the flexible container includes a top and a bottom, the fluid outlet and breachable point being located at a top corner of the flexible container.

9. A package as defined in any of the preceding claims, wherein the interior volume of the flexible container has a volume of from about 0.5 ounces to about 5 ounces.

10. A package as defined in any of claims 1 through 8, wherein the interior volume of the flexible container has a volume of from about 5 ounces to about 64 ounces.

11. A package as defined in any of the preceding claims, wherein the barrier member is transverse to an end of the fluid channel.

12. A package as defined in claim 1, wherein the barrier member has a generally rectangular or horizontal oval shape.

13. A package as defined in claim 1, wherein the barrier member is formed by attaching together opposing container walls.

14. A package as defined in any of the preceding claims, wherein the flexible container is comprised of a flexible polymer film.

15. A package as defined in any of the preceding claims, wherein the flexible container is comprised of a flexible metallized film.

16. A strip containing a plurality of packages as defined in any of the preceding claims.

17. A strip as defined in claim 16, wherein the flexible packages include a top and a bottom and wherein the top of a flexible package is connected to the bottom of an adjacent flexible package.

18. A strip as defined in claim 16 or 17, wherein the packages are separated by lines of perforations.

19. A method for opening the package as defined in any of the preceding claims comprising:

applying pressure to the interior volume of the flexible package causing the breachable point to breach and thereby placing the fluid outlet in communication with the outside environment; and

applying further pressure to the flexible container to cause the flowable substance contained within the interior volume to exit the flexible container through the self-closing valve and the fluid outlet.

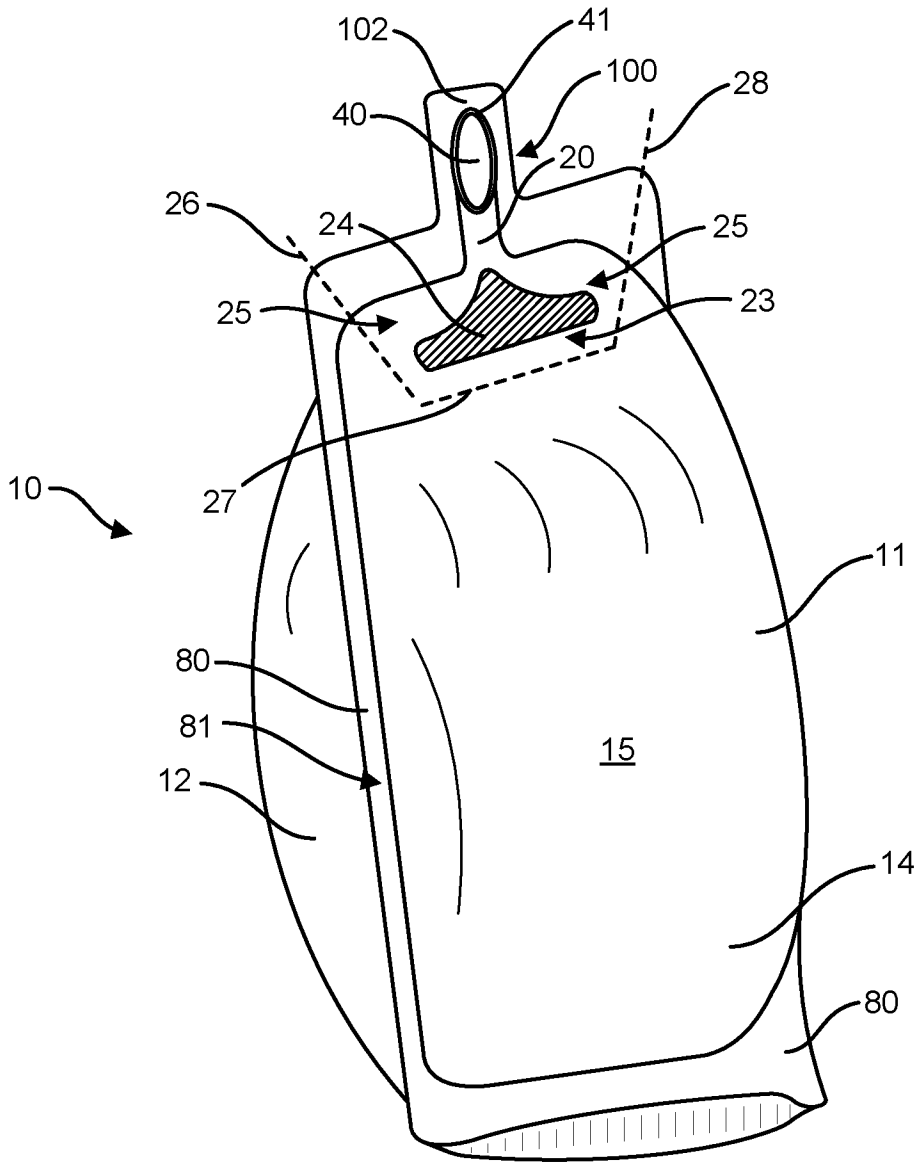


FIG. 1

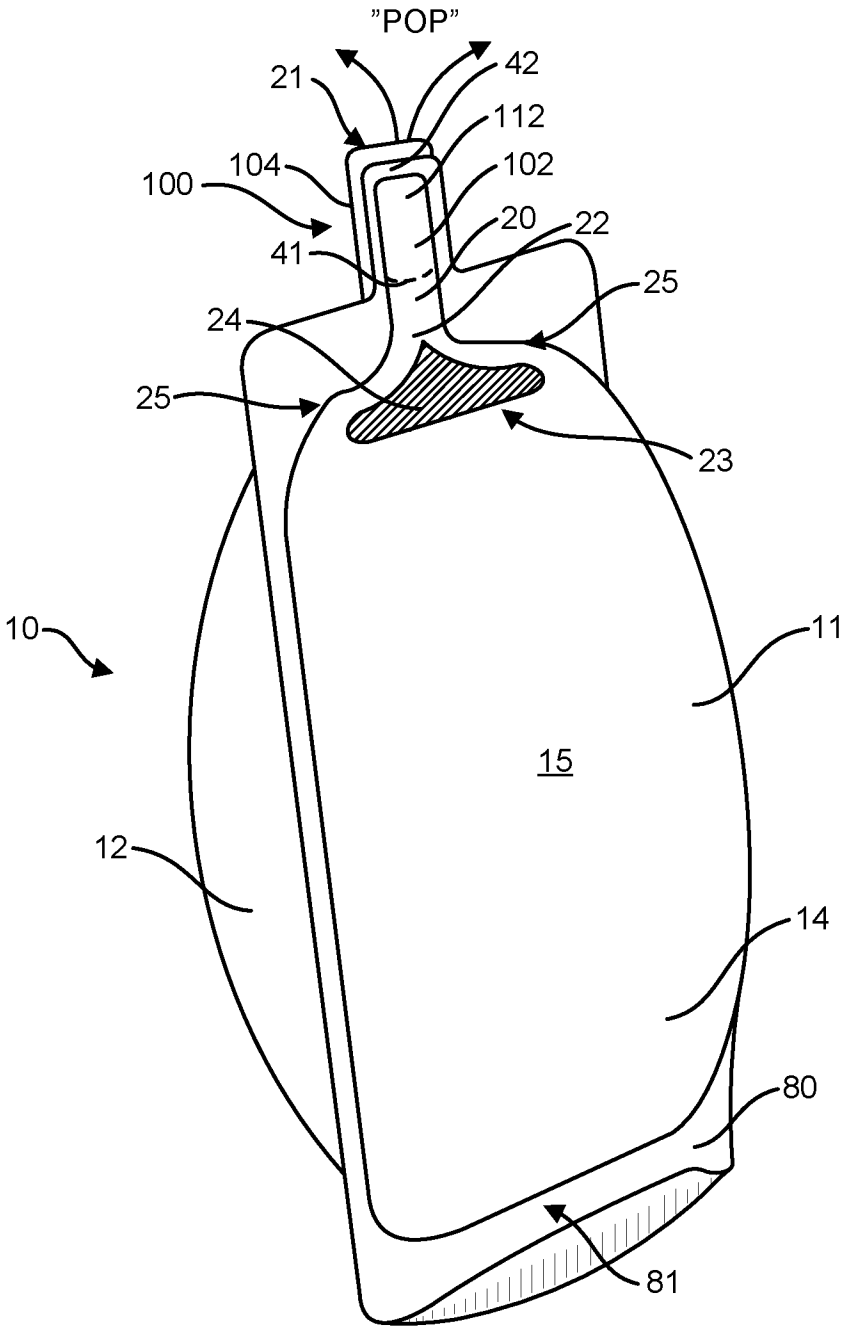


FIG. 2

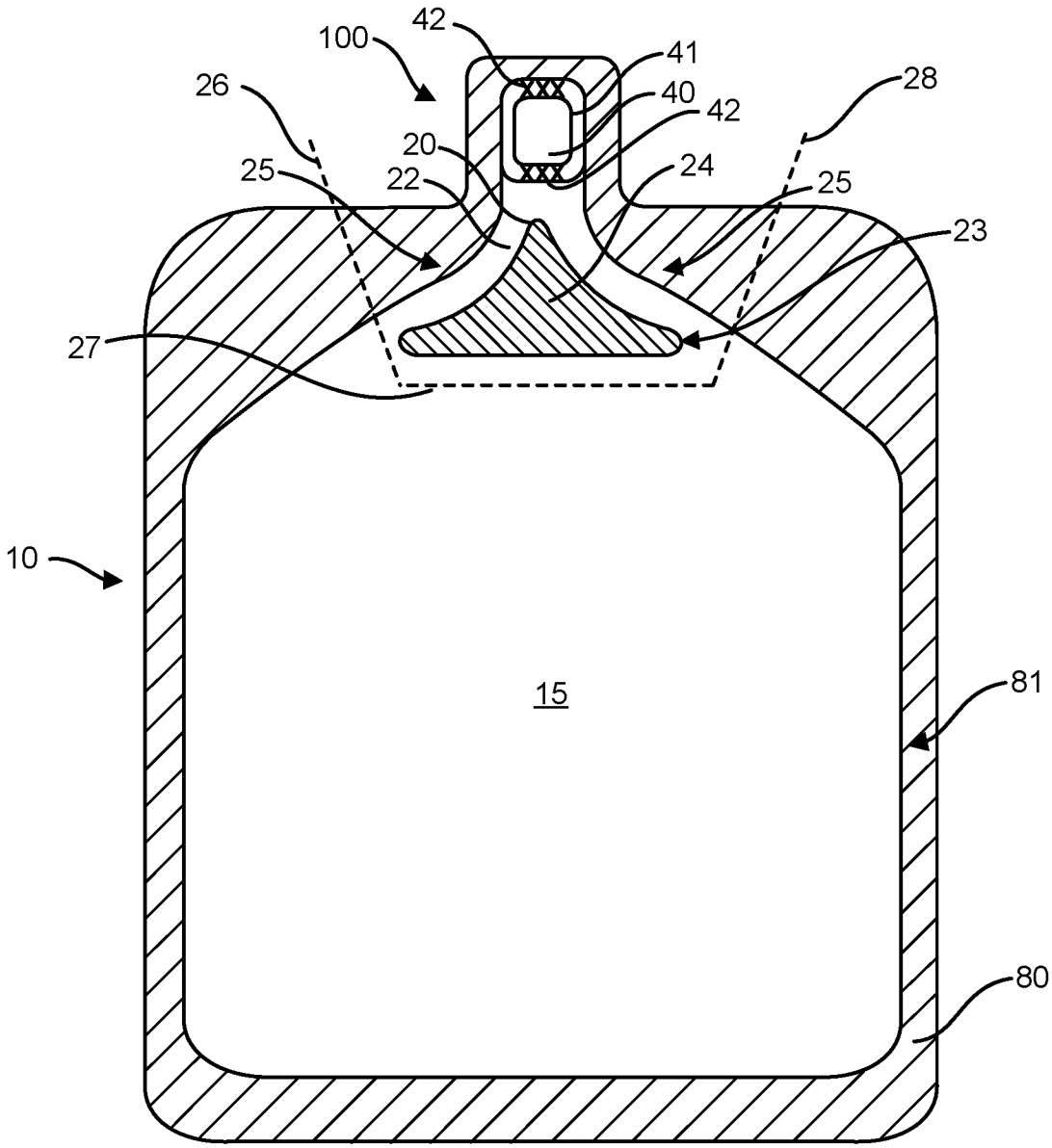


FIG. 3

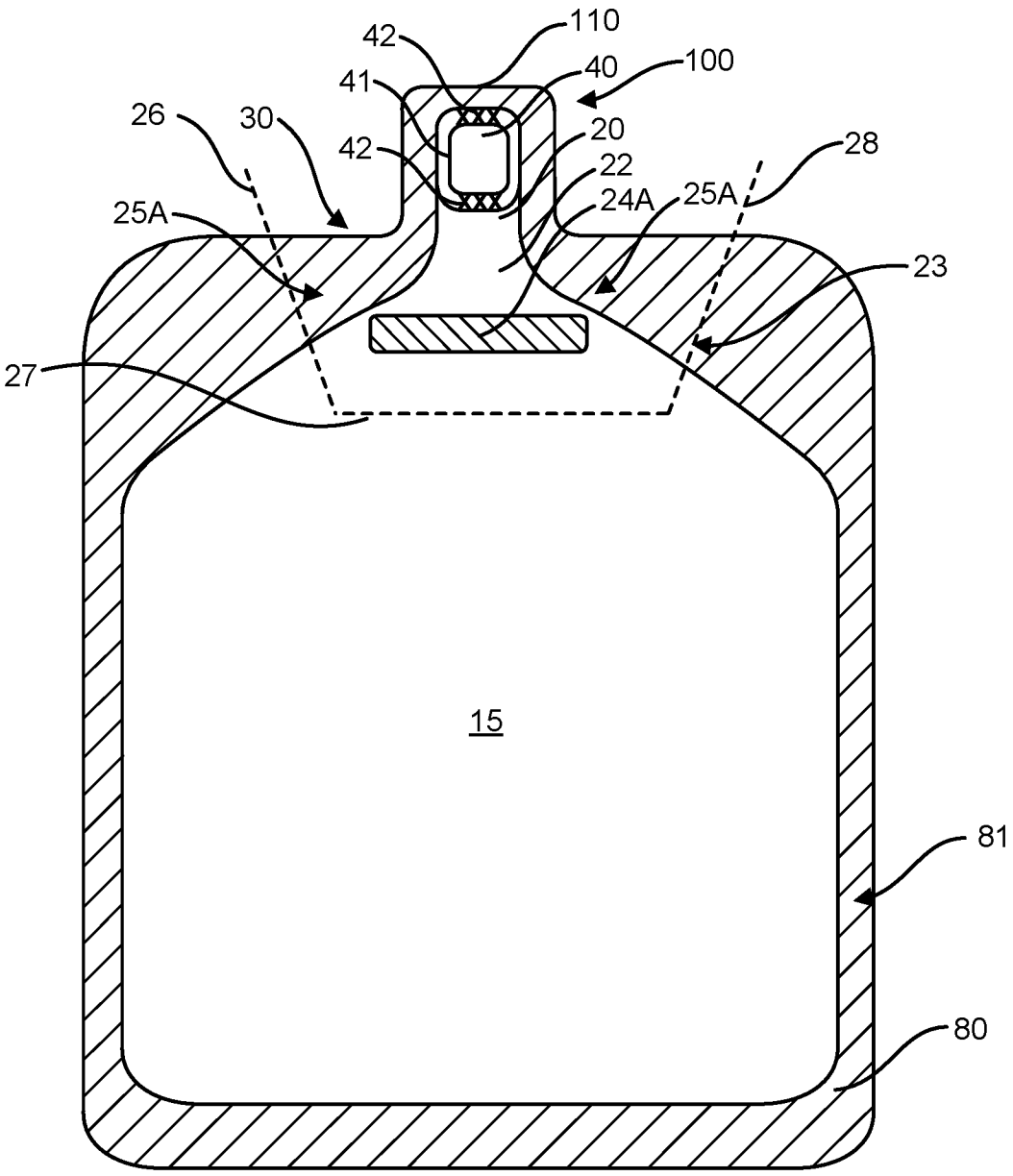


FIG. 4

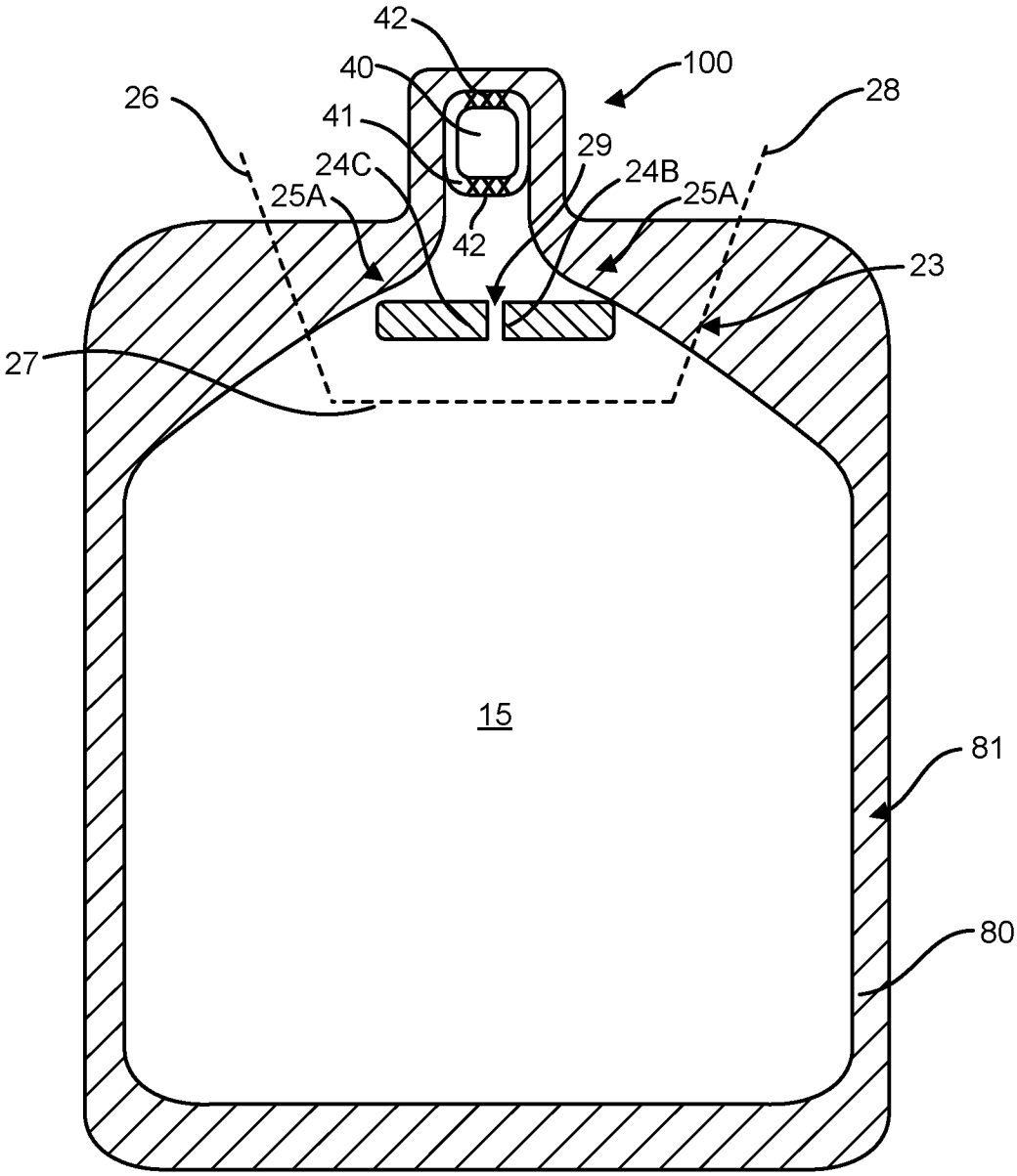


FIG. 5

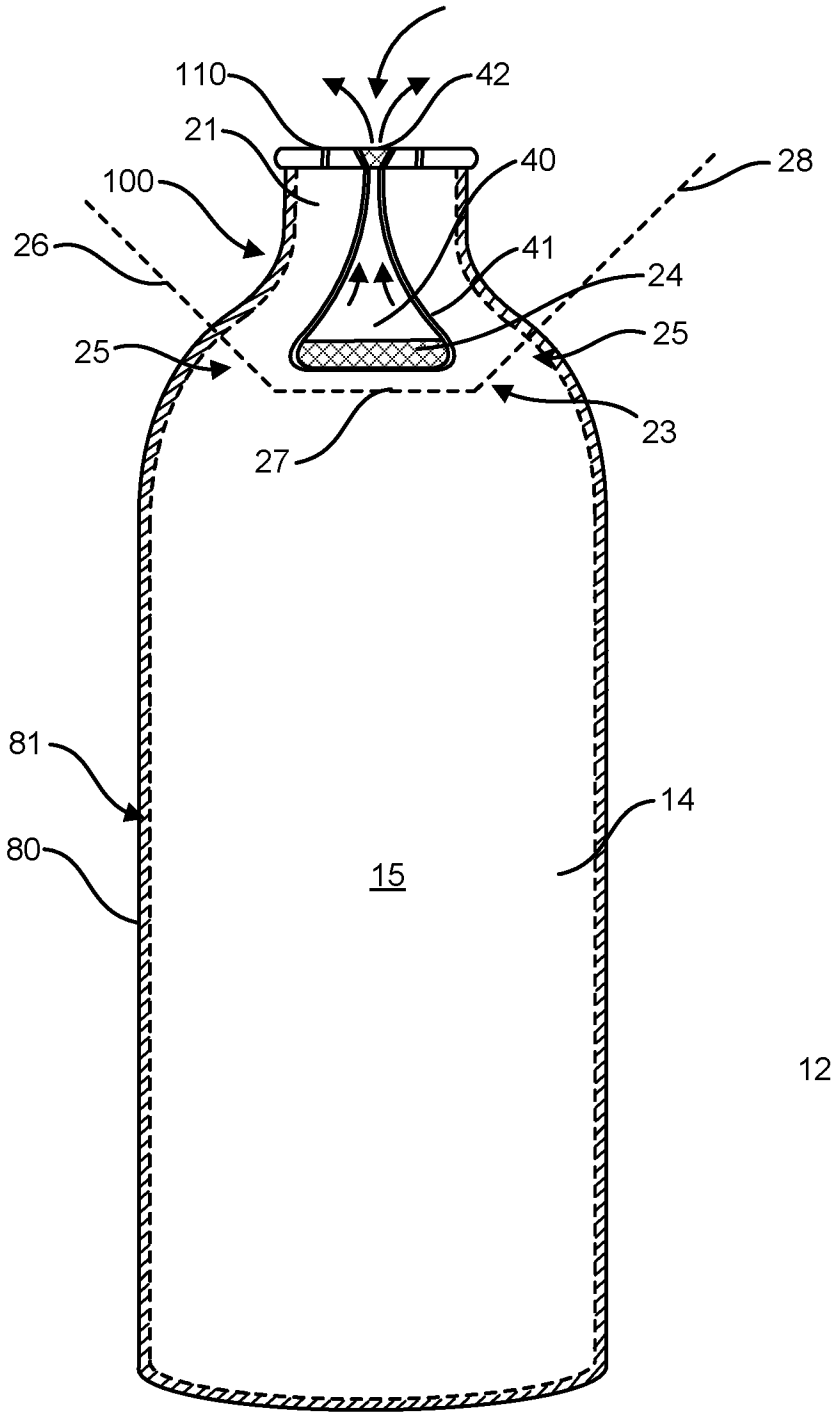


FIG. 6A

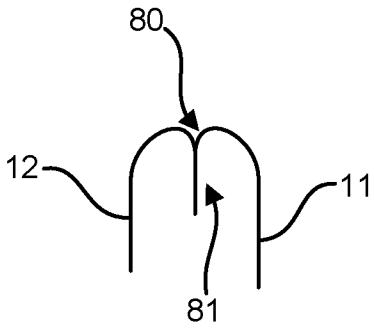


FIG. 6B

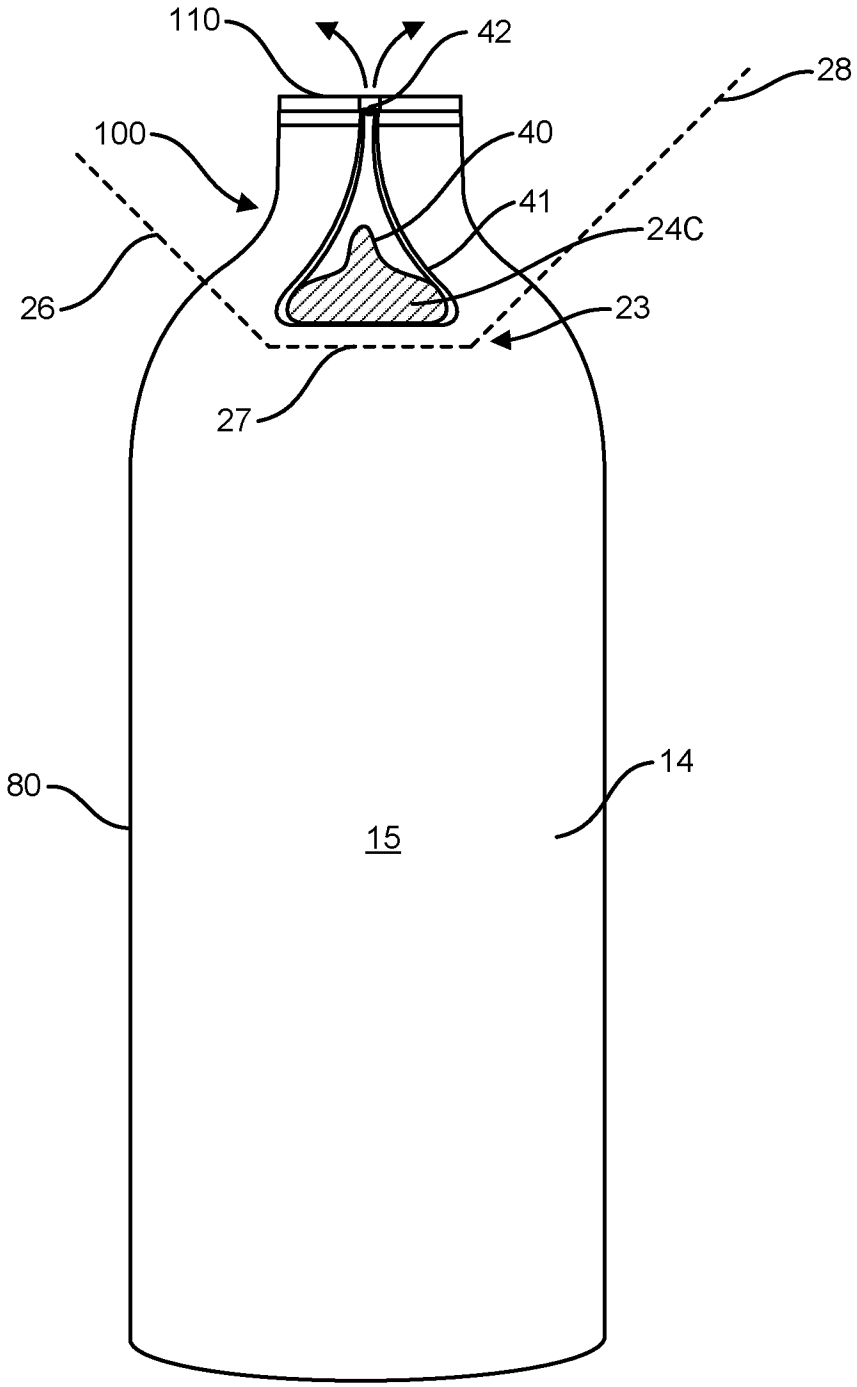


FIG. 7

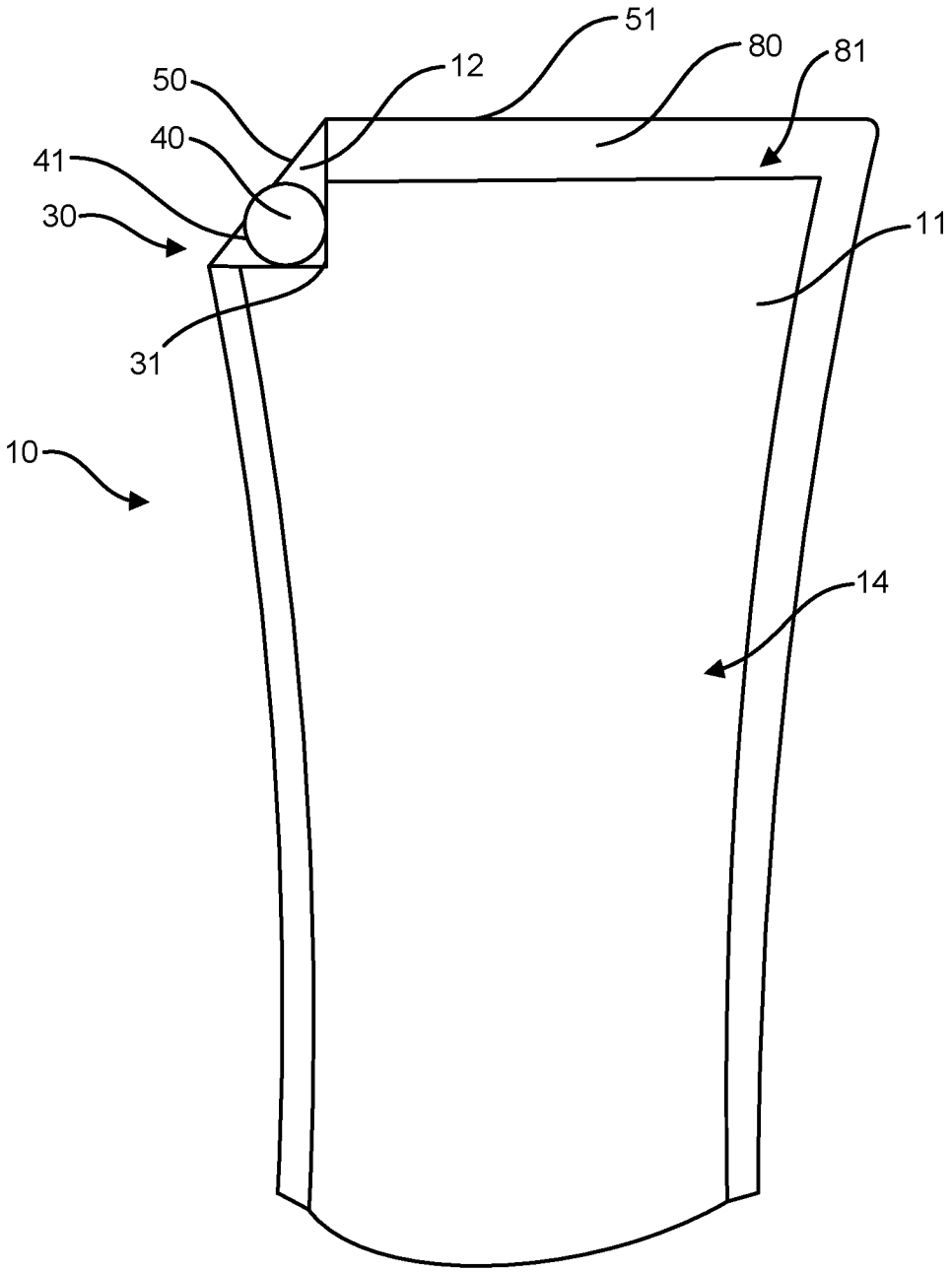


FIG. 8A

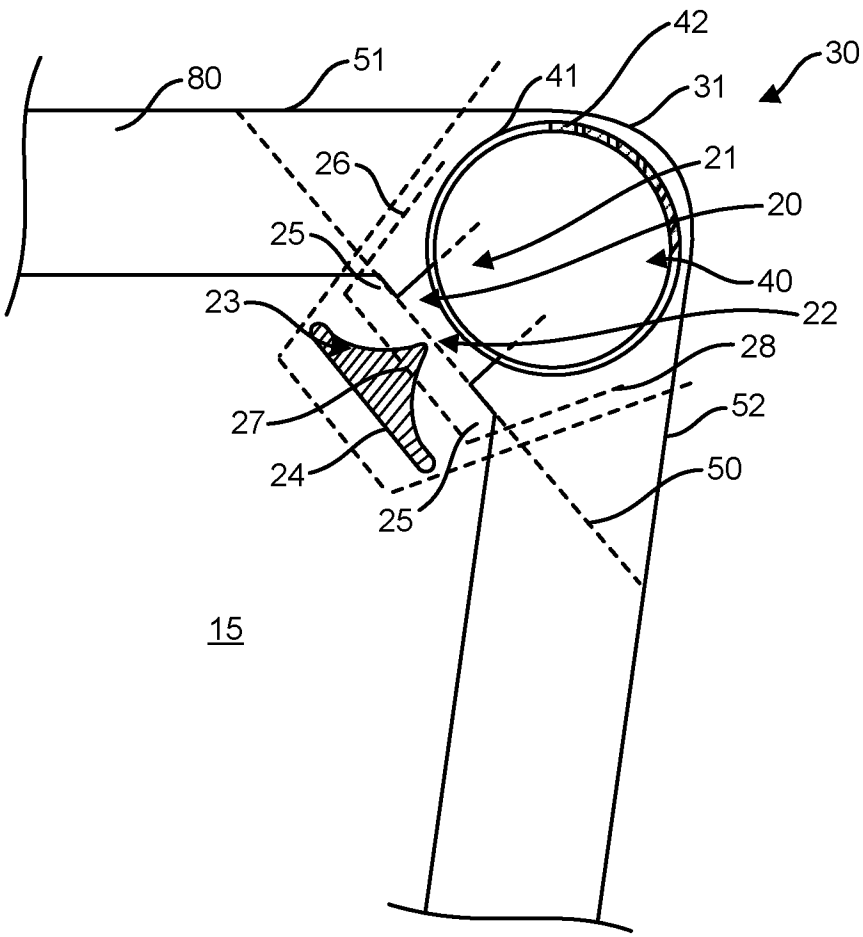


FIG. 8B

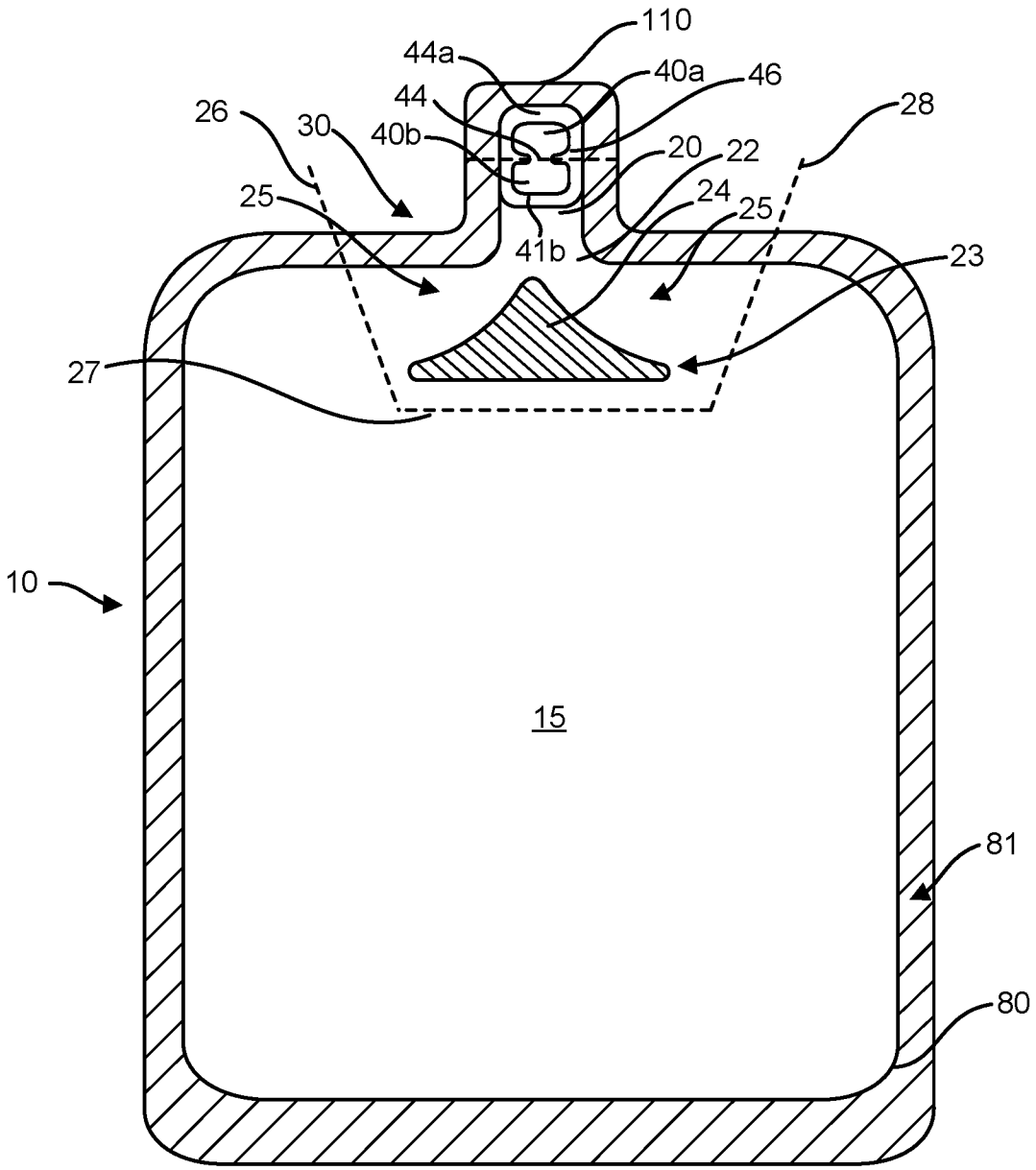


FIG. 9A

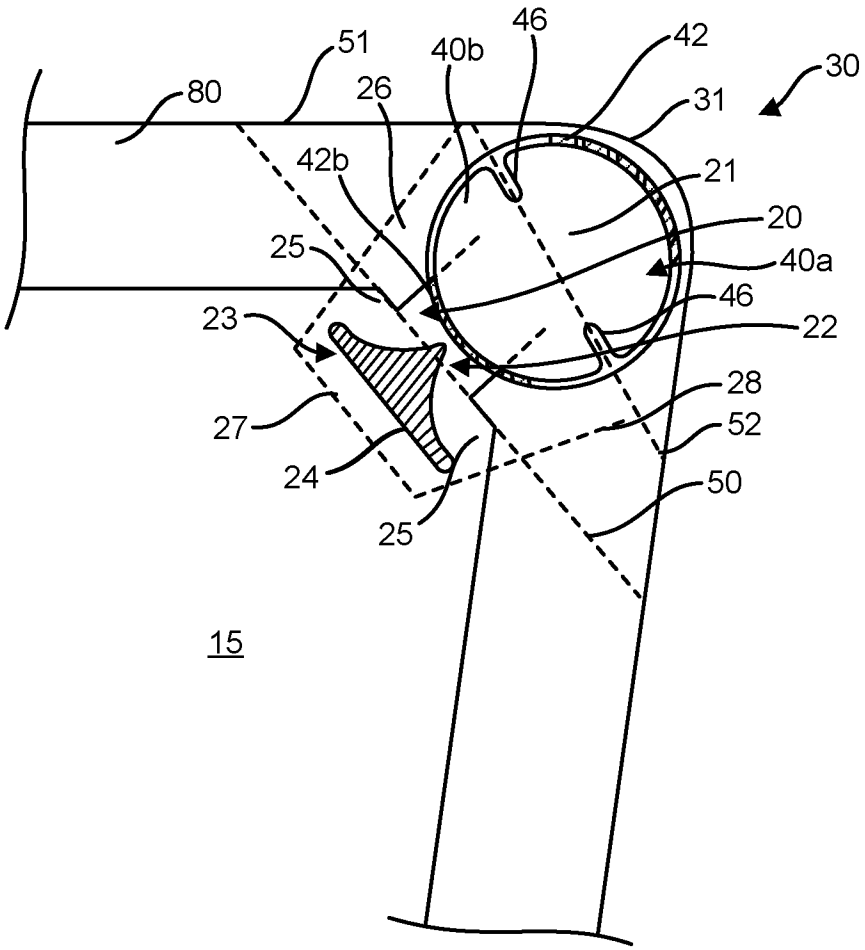


FIG. 9B

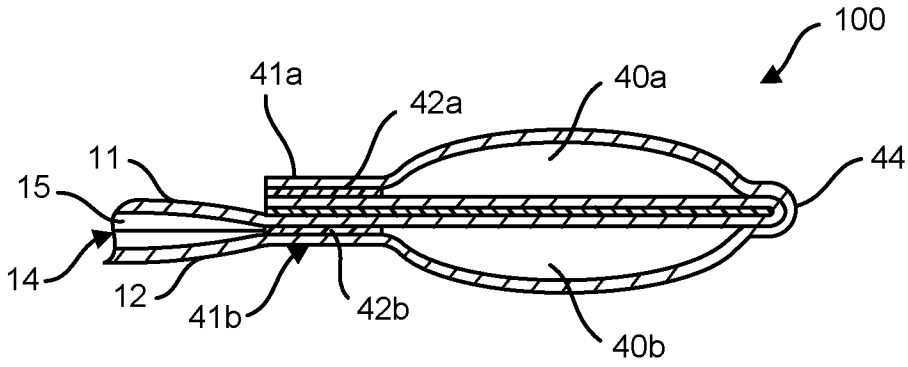


FIG. 9C

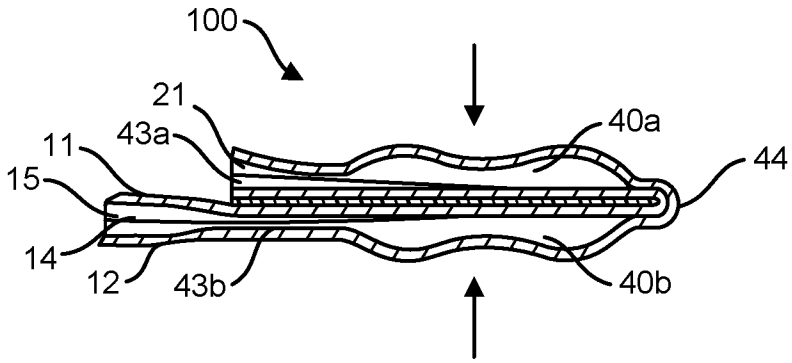


FIG. 9D

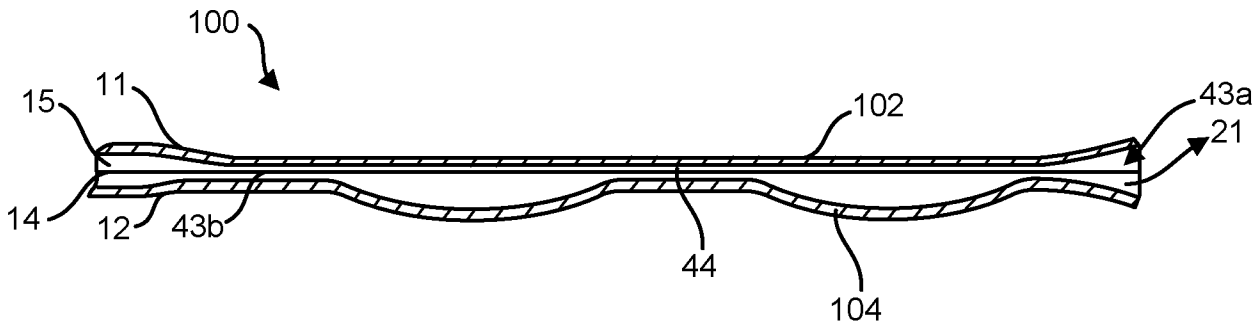


FIG. 9E

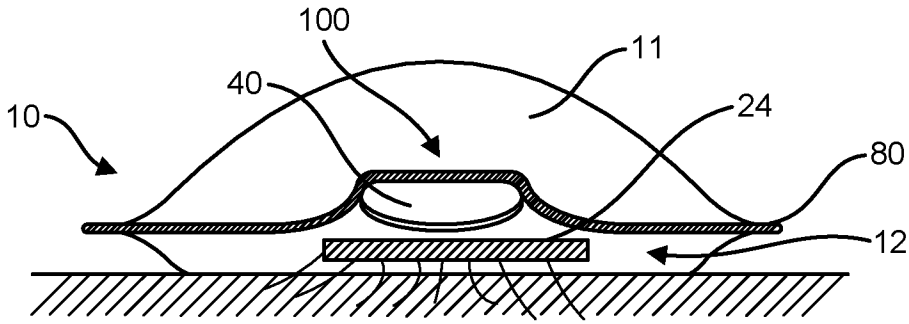


FIG. 10A

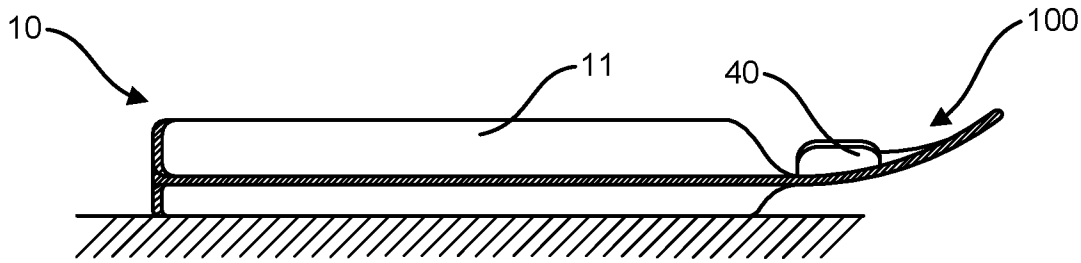


FIG. 10B

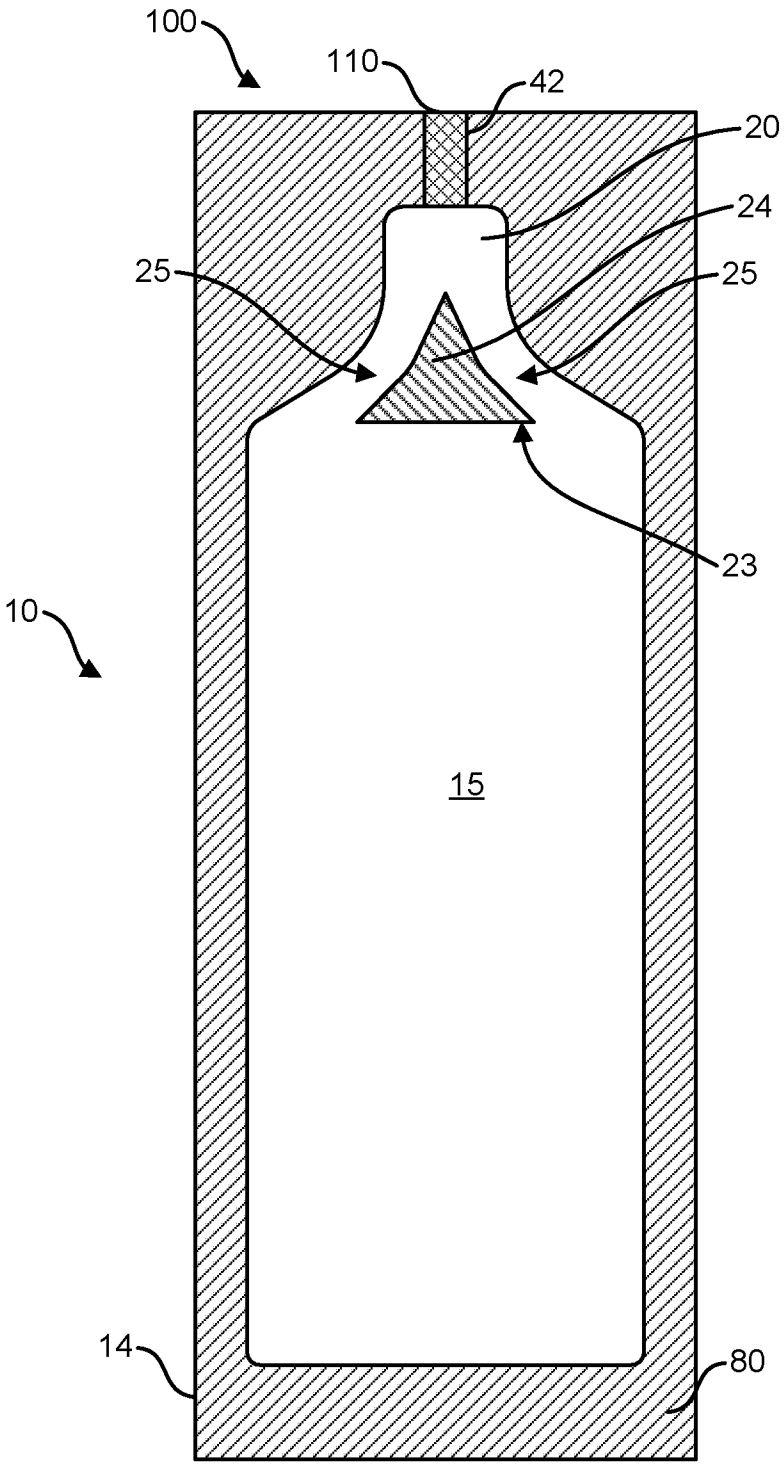


FIG. 38

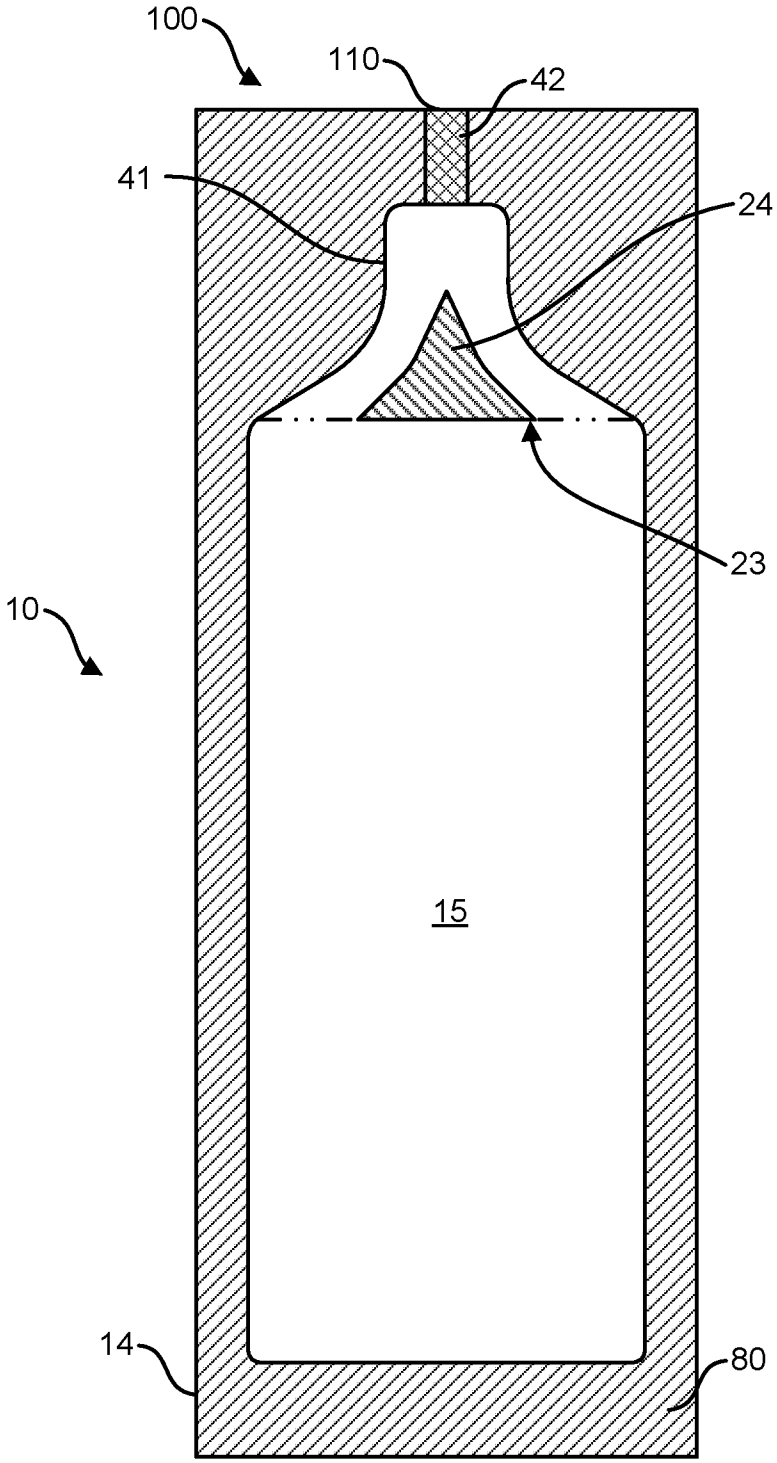


FIG. 39

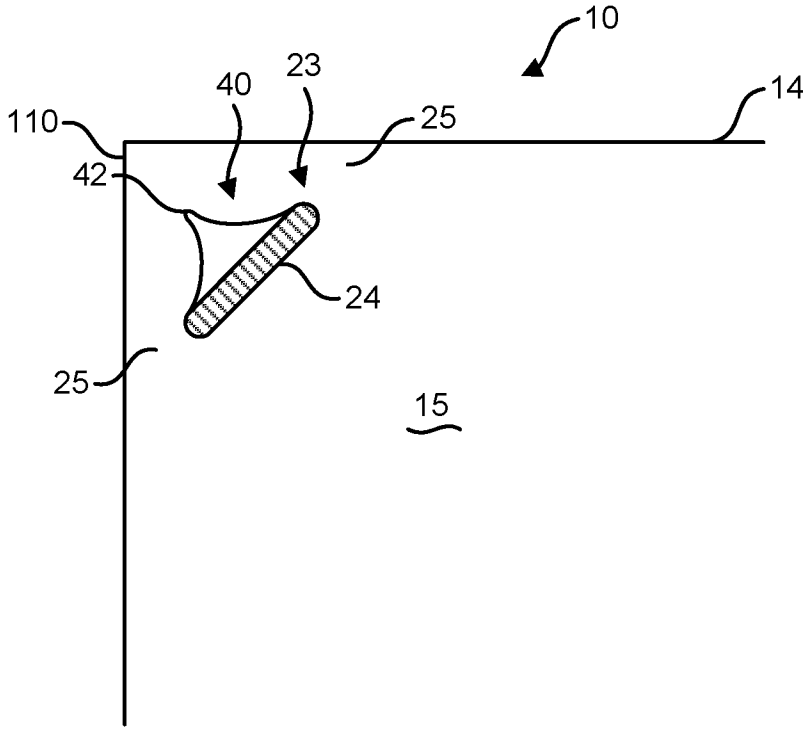


FIG. 11

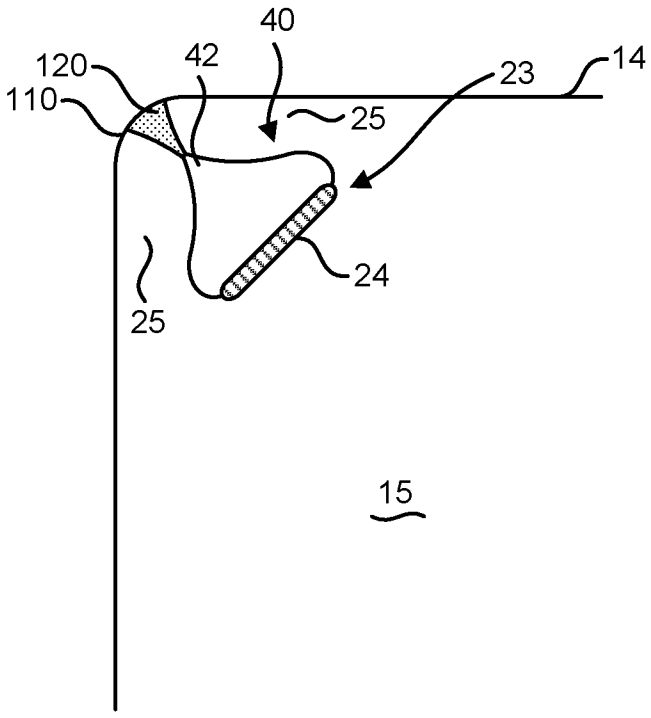


FIG. 12

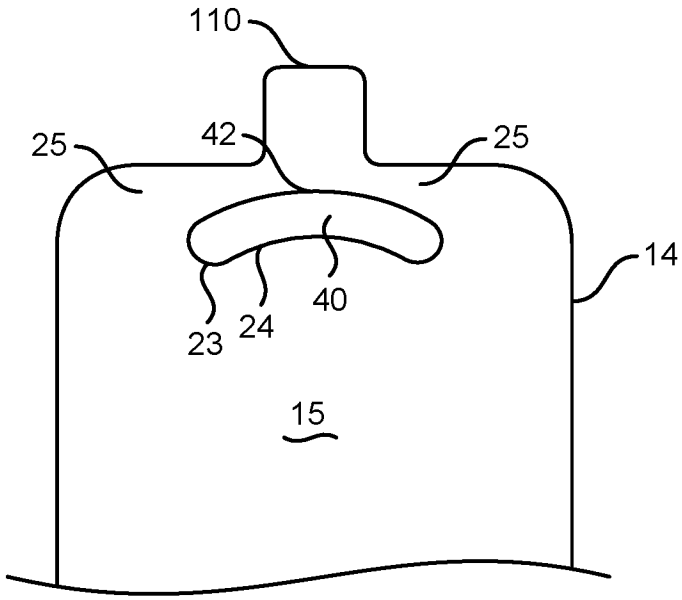


FIG. 13

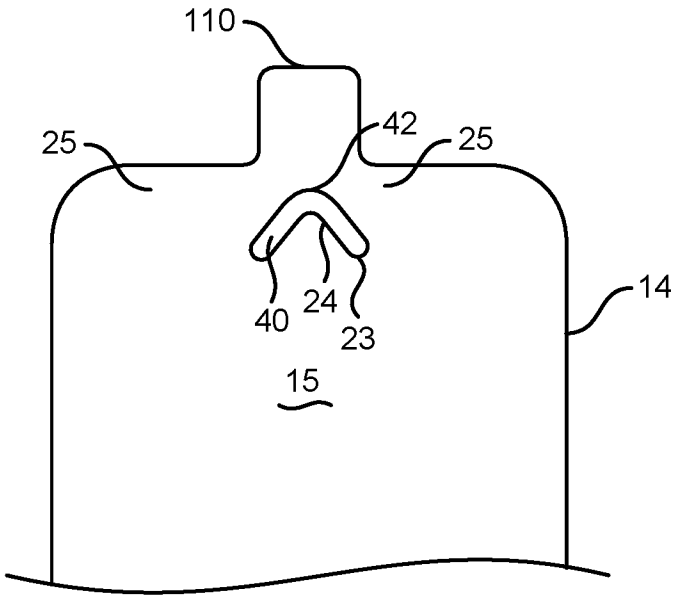


FIG. 14

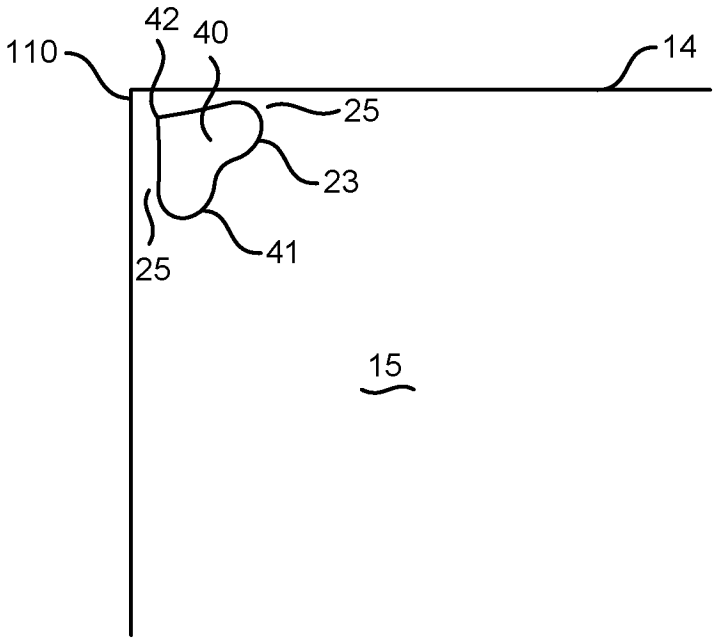


FIG. 15

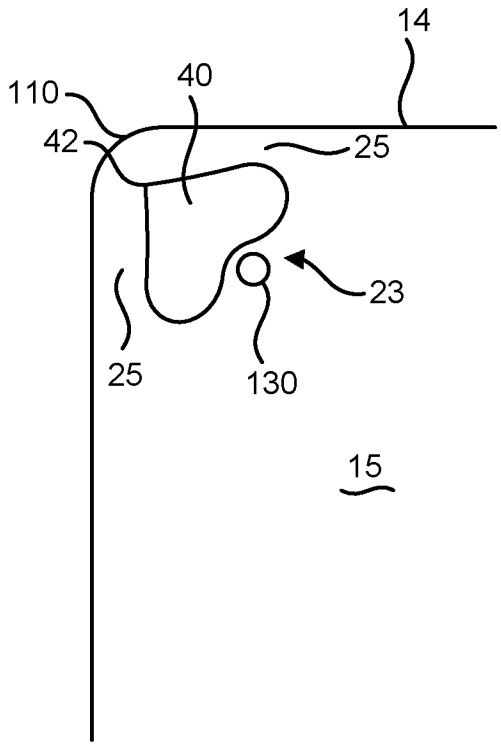


FIG. 16

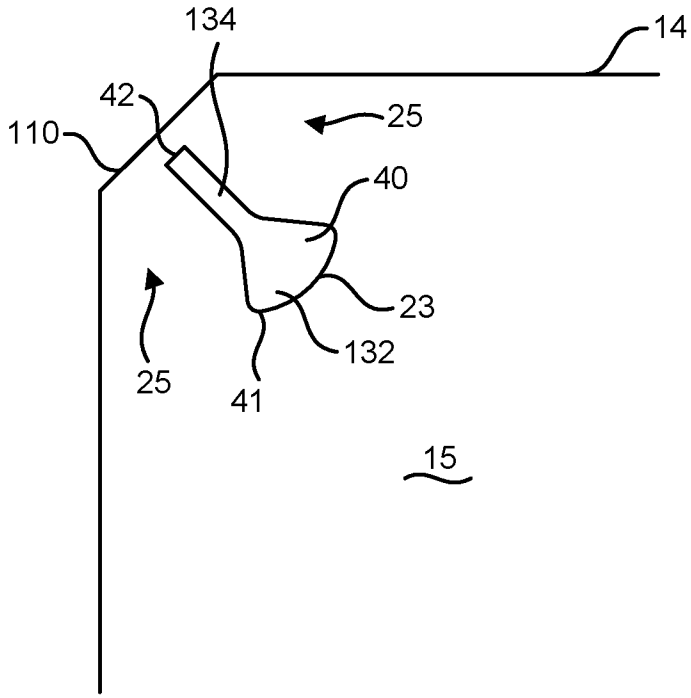


FIG. 17

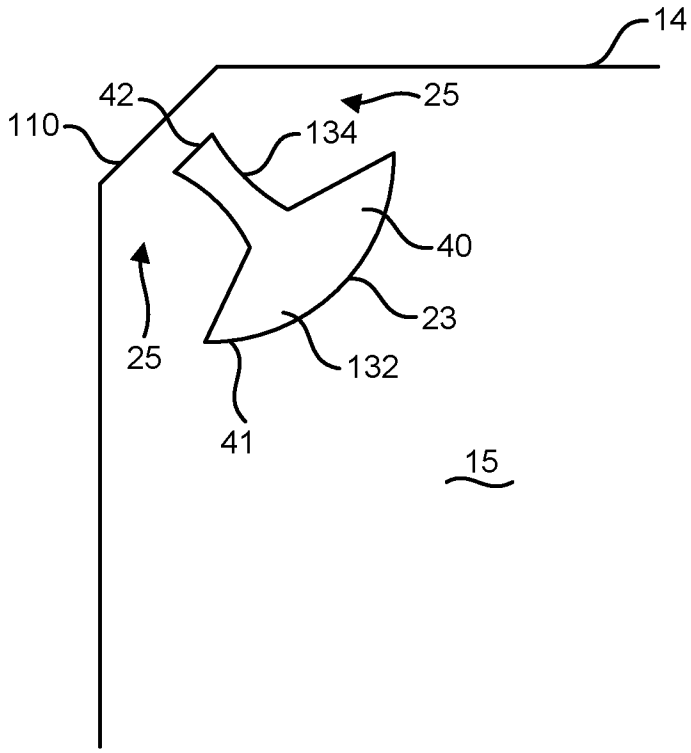


FIG. 18

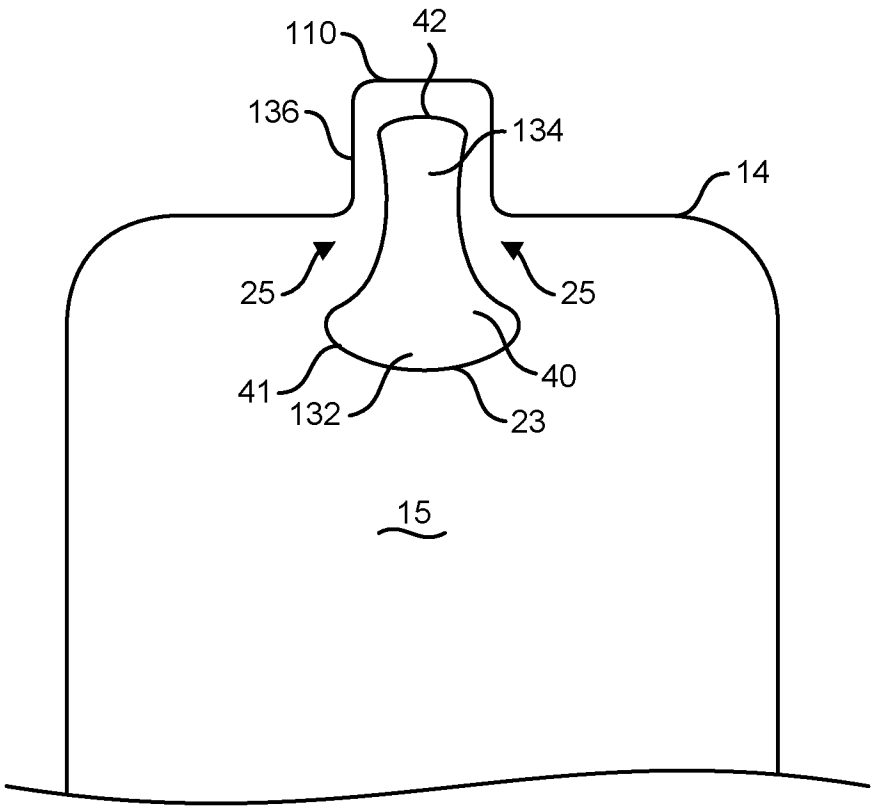


FIG. 19

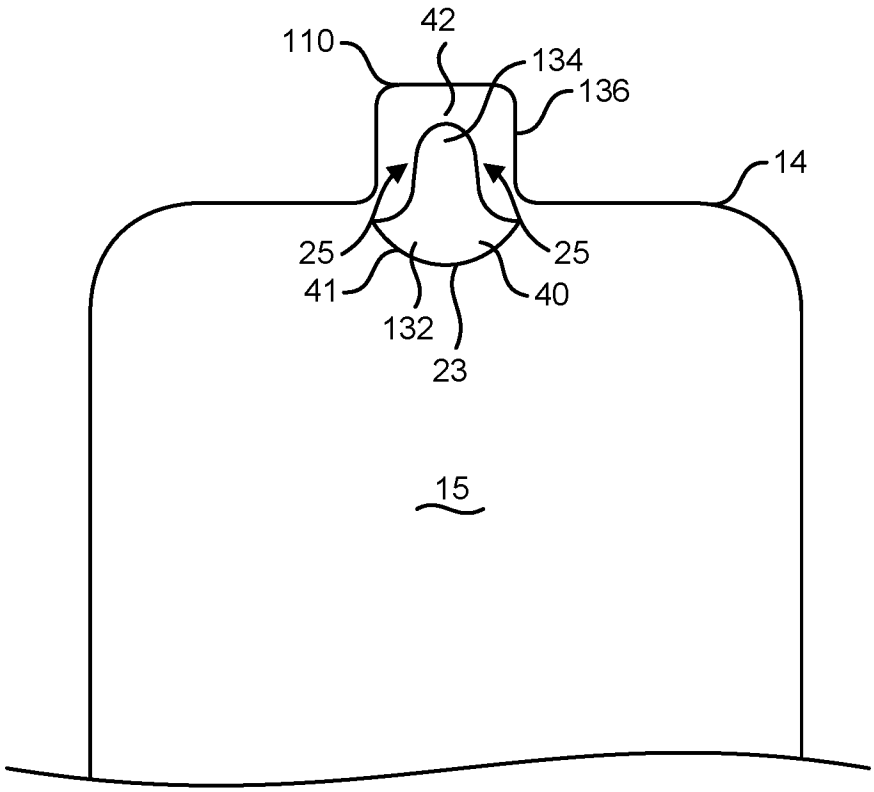


FIG. 20

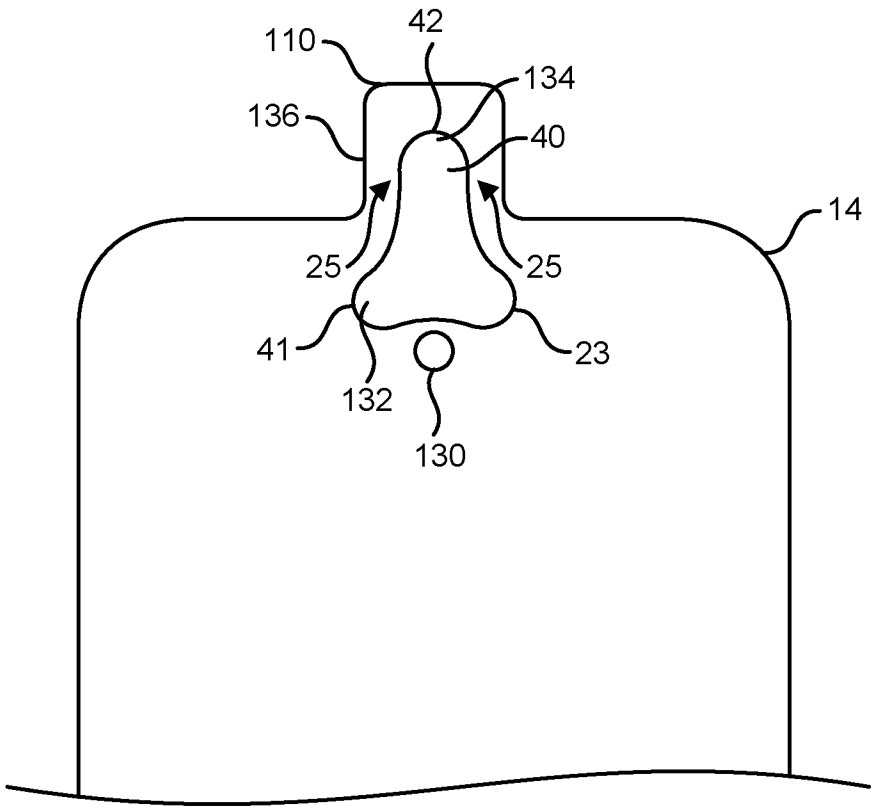


FIG. 21

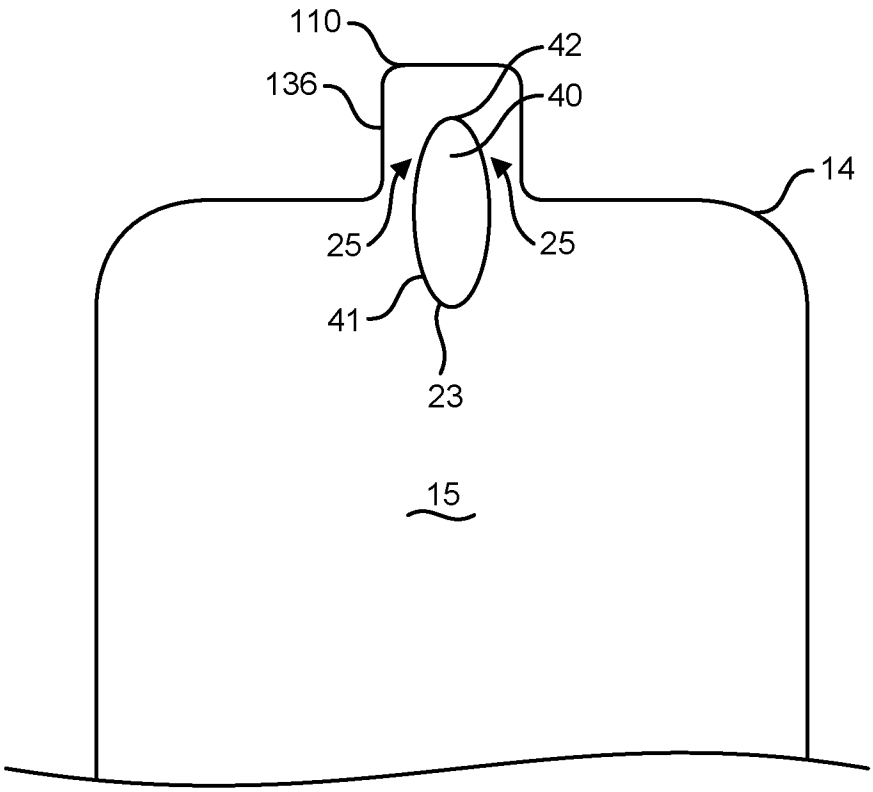


FIG. 22

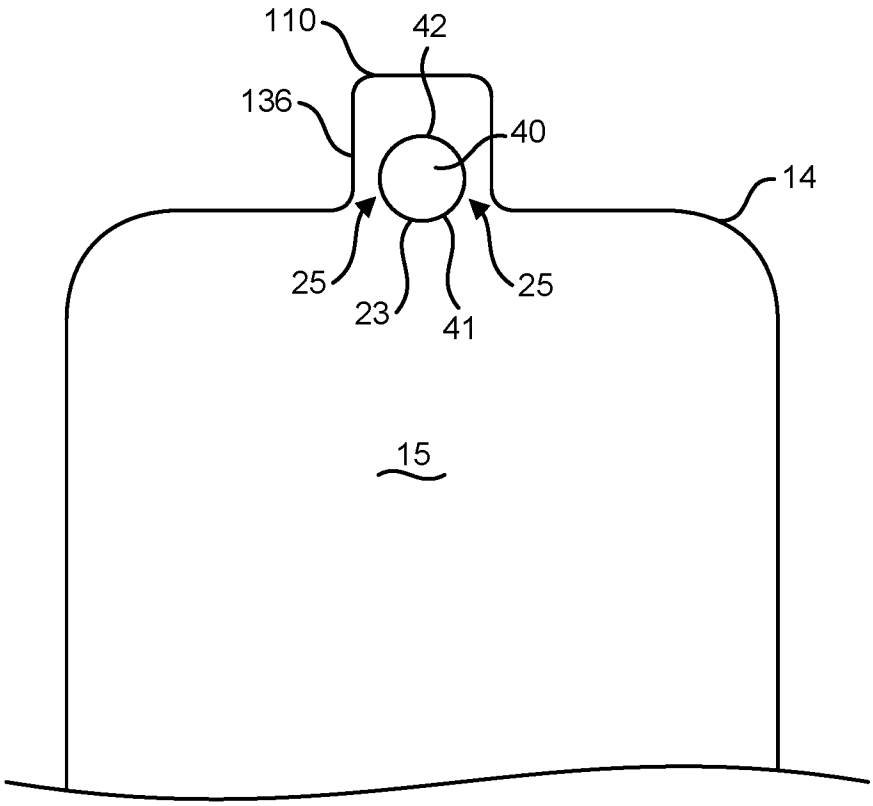


FIG. 23

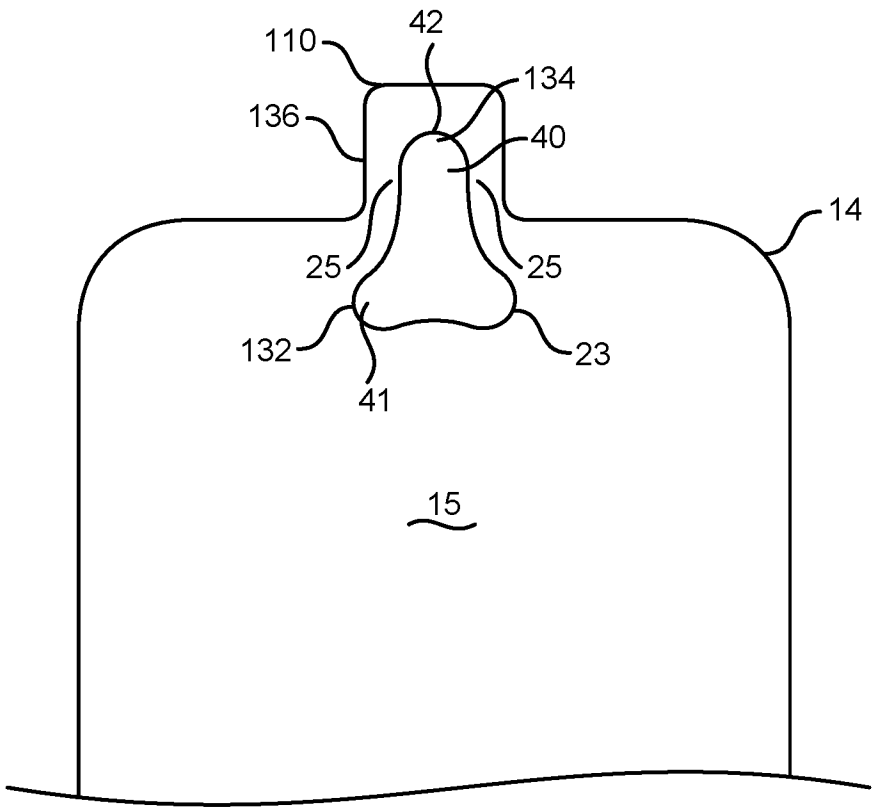


FIG. 24

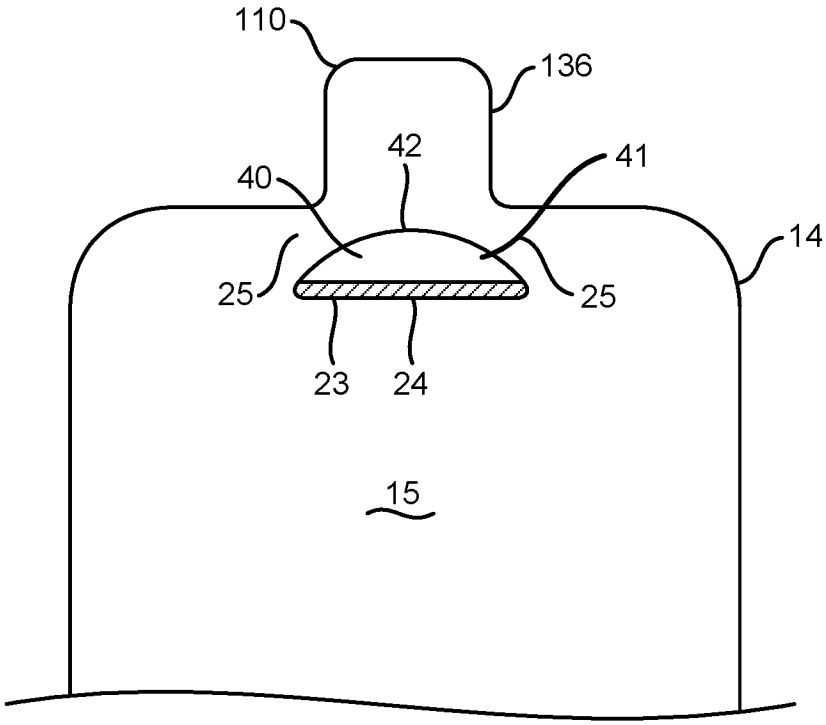


FIG. 25

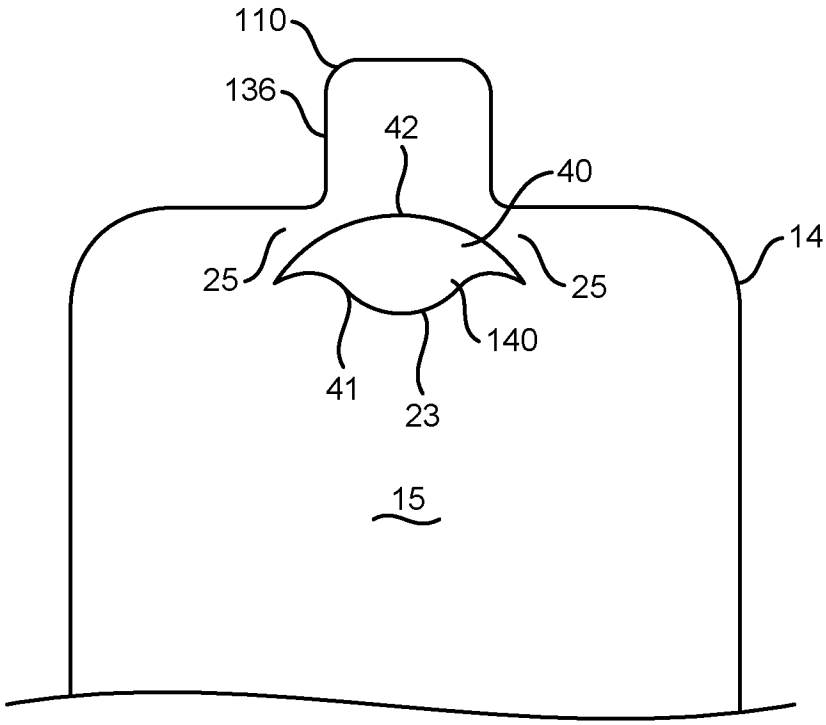


FIG. 26

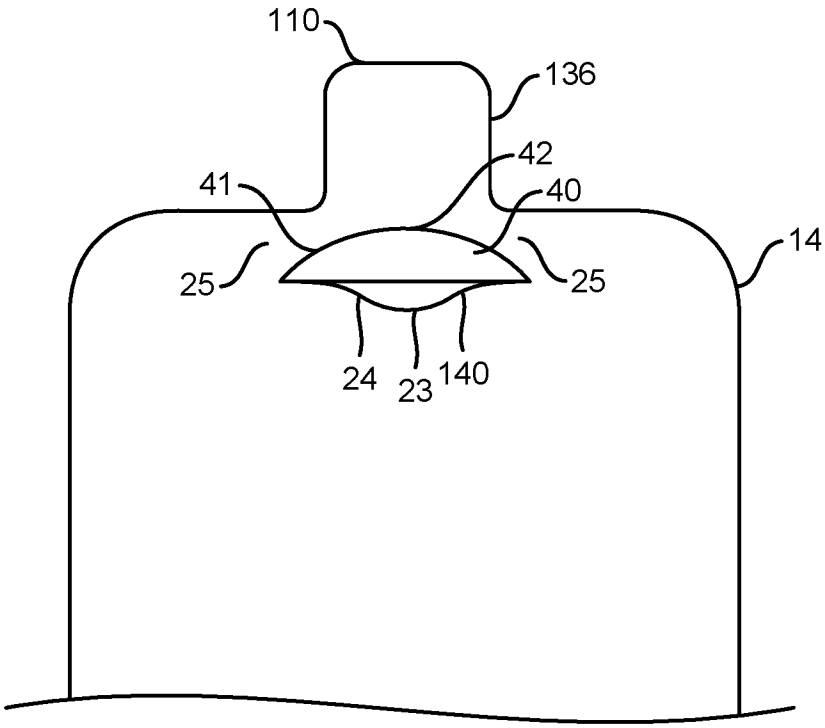


FIG. 27

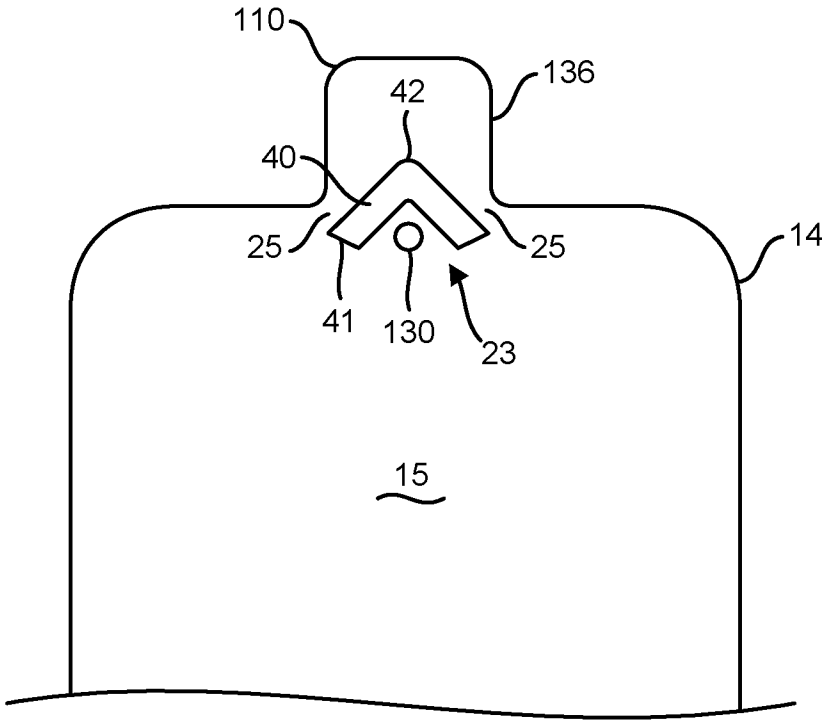


FIG. 28

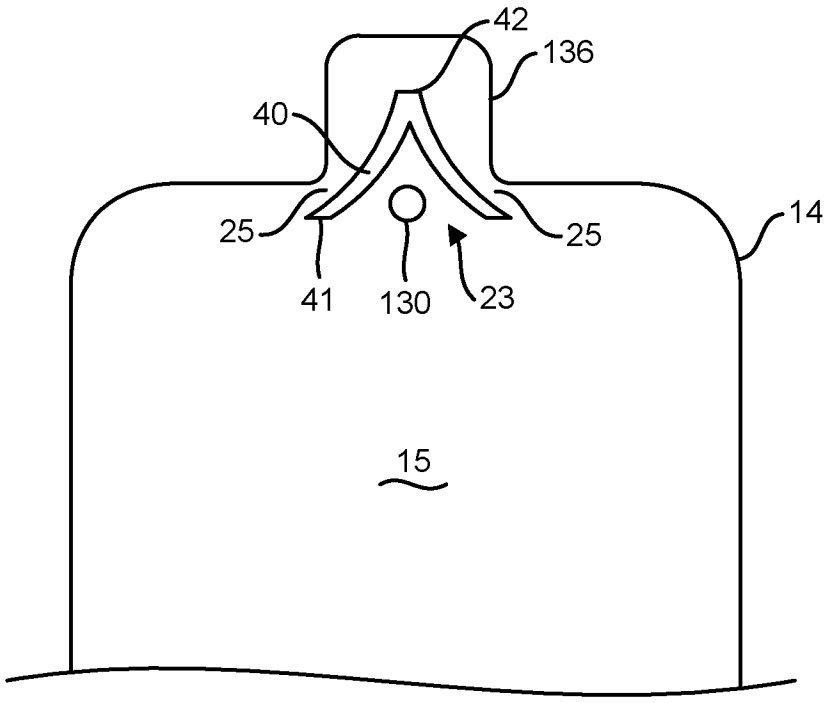


FIG. 29

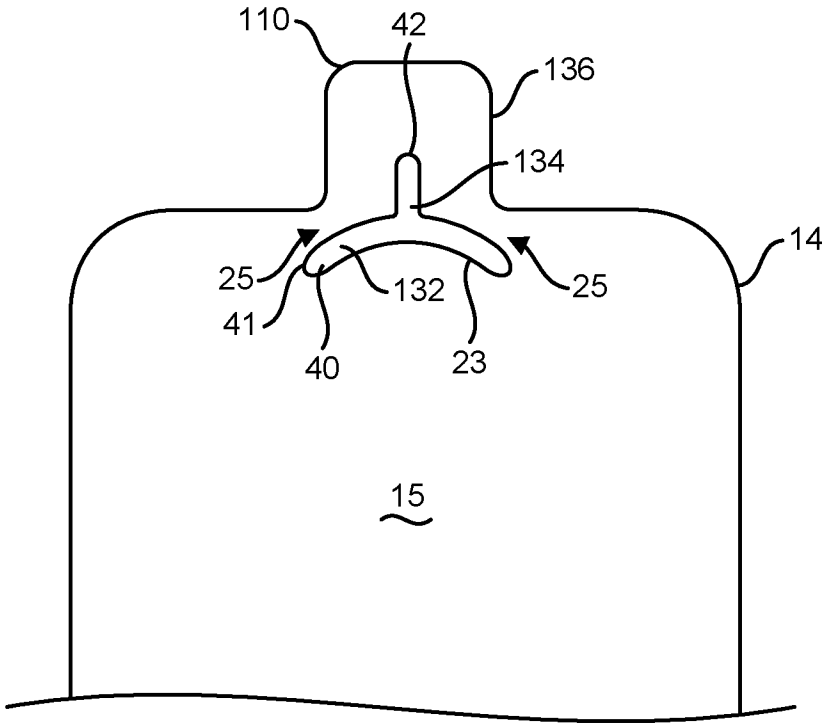
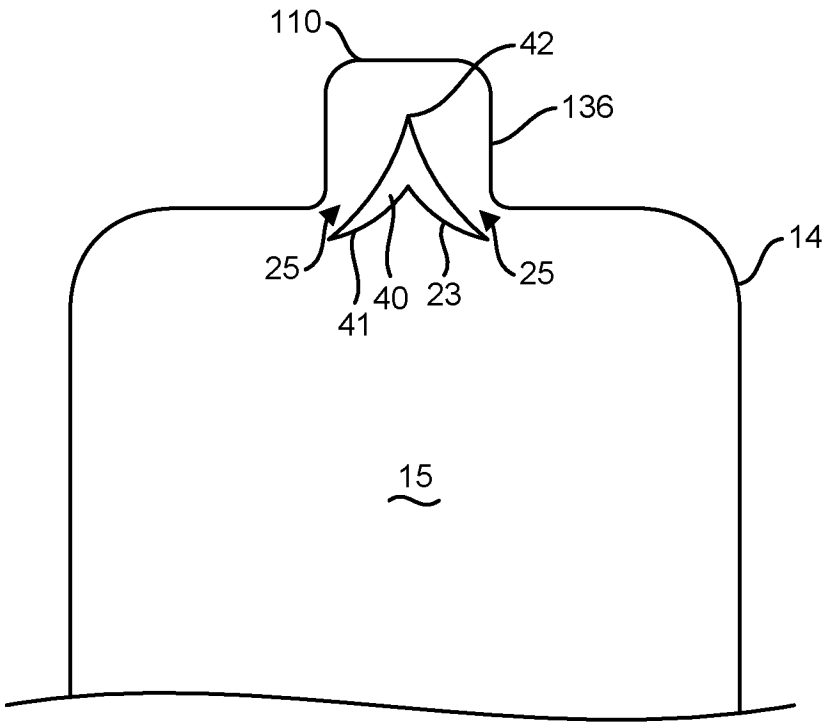

110
42
136
134
14
25
132
25
41
40
23
15

FIG. 30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42
136
14
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23
41
15

FIG. 31

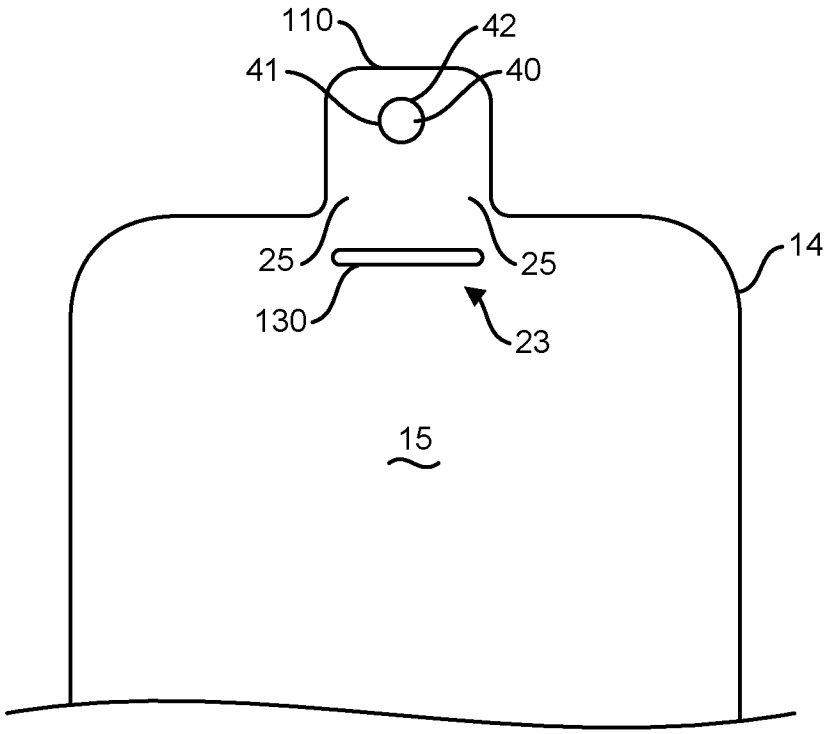

FIG. 32

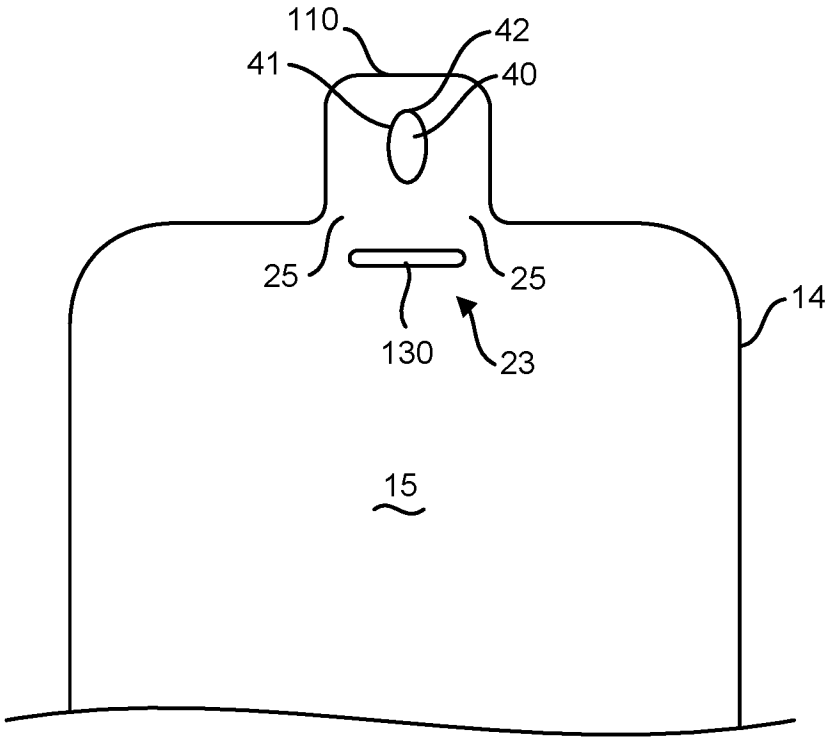

FIG. 33

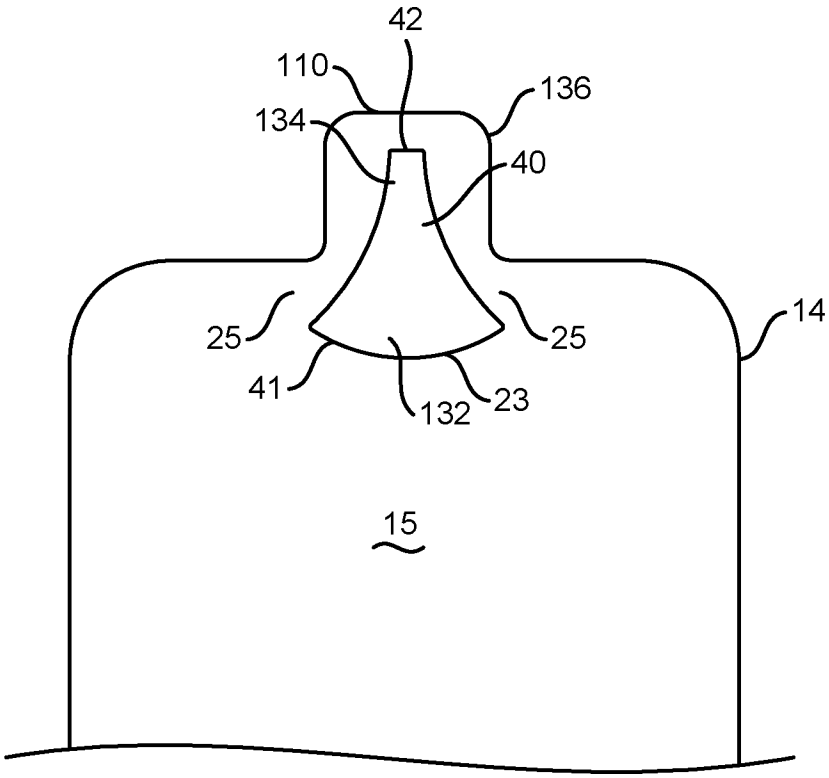

FIG. 34

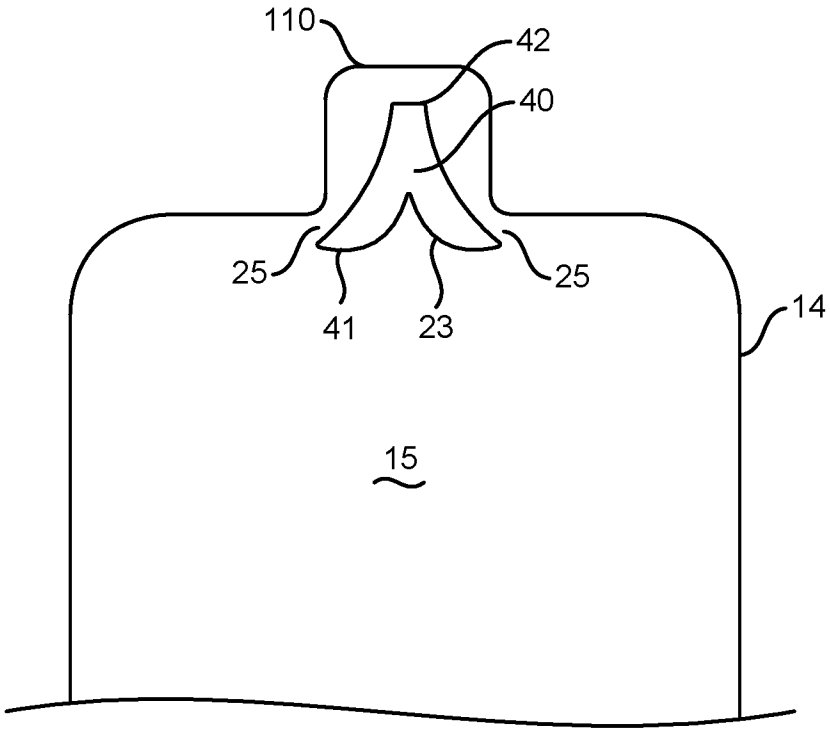

FIG. 35

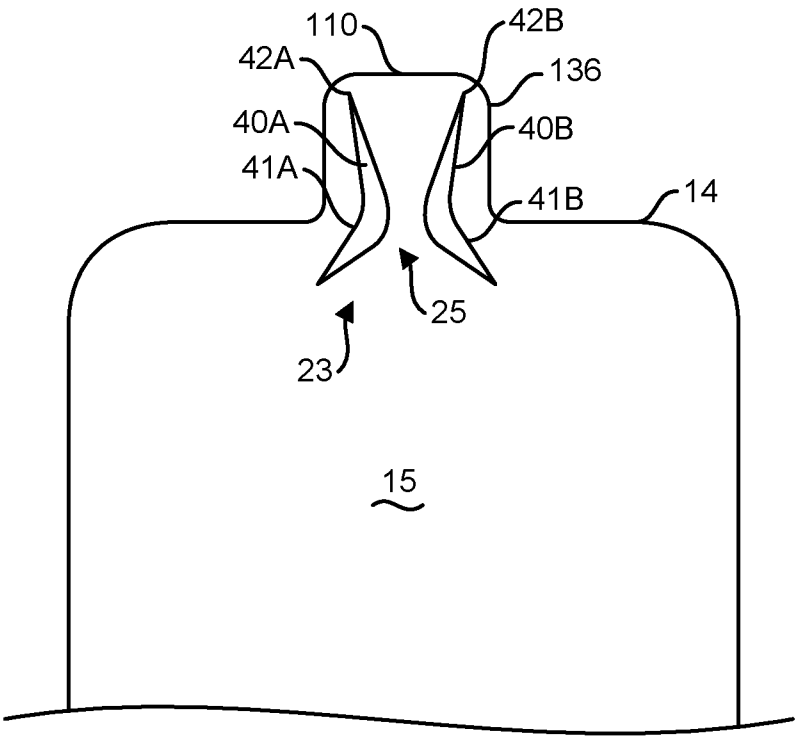
110
42B
42A
136
40A
40B
41A
41B
14
25
23
15

FIG. 36

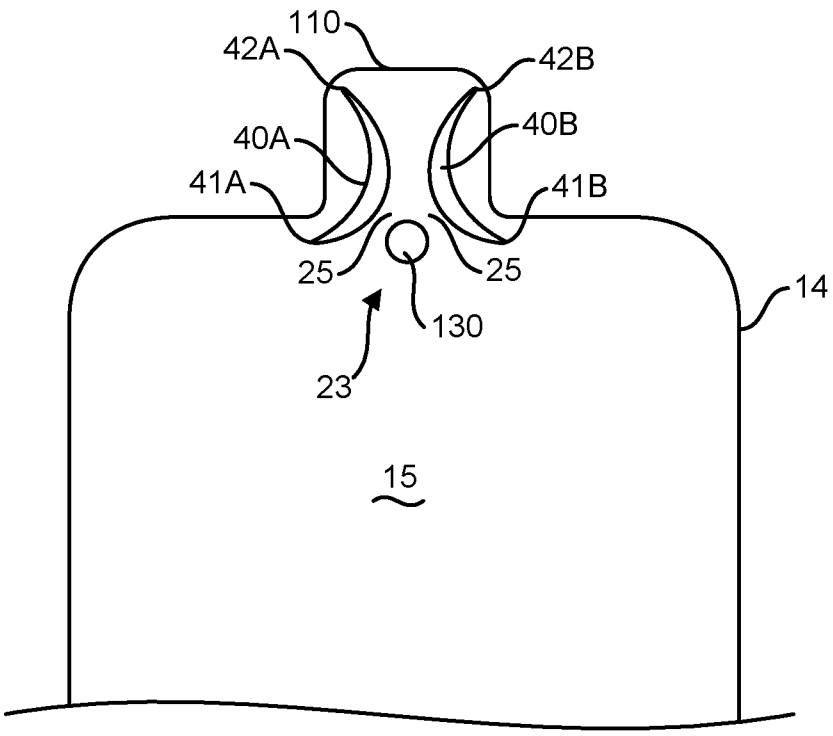
110
42A
42B
40A
40B
41A
41B
25
25
14
130
23
15

FIG. 37