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(54) Title: PACKAGE WITH CLOSURE, APERTURE, AND INSERT

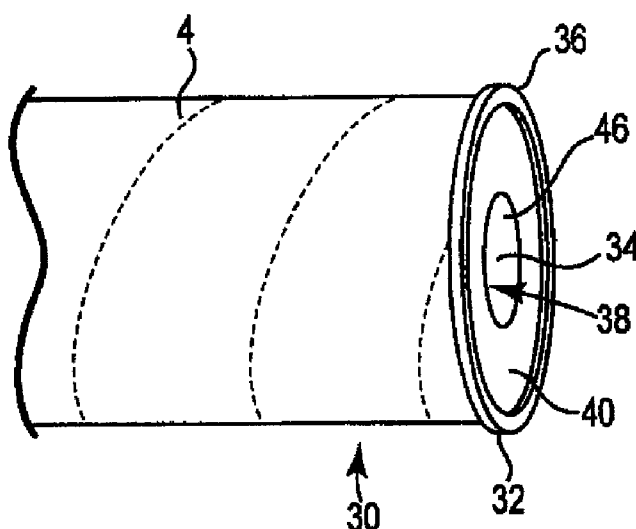


Fig. 4A

(57) Abstract: Described are packages useful for food and non-food items, wherein the packages include a closure, an aperture located on the closure, and an insert that covers the aperture; the package can optionally be pressurized and certain embodiments can be designed to contain a dough product for refrigerated storage.





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PACKAGE WITH CLOSURE, APERTURE, AND INSERT

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Field of the Invention

The invention relates to packages and packaged products wherein a package includes a closure, an aperture located on the closure, and an insert the covers the aperture; the package can be pressurized and certain embodiments can be designed to contain a dough product for refrigerated storage.

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Background

Packages for commercial and consumer items come in countless varieties. Basic package functions can be to contain a product for sale, storage, or transport, and sometimes to describe or display the product and contents. Some package designs can also be useful beyond these basic functions. Some types of consumer packages are designed to preserve freshness of a product (a food or a non-food product) for an extended period of weeks or months, to allow for easy access to the product (easy opening), and may allow viewing of a product within the package. Some products undergo manufacturing or processing steps within the package, such as dough that can expand or “proof” within a package. In these and other ways, a product package can go well beyond merely containing a product for sale.

Products contained by commercial and consumer packages include food and non-food products. Food products include dough products, sometimes packaged in a manner to allow storage stability and convenience to a purchaser, e.g., ease of use of the product. A wide variety of packaged dough products allow a user to “home bake” a dough to produce a desirable hot, fresh-baked item. Many such items are proofed prior to baking, and for consumer convenience may be partially or fully proofed prior to purchase and prior to use by the consumer. Such products, sold after proofing or partial proofing, are examples of products referred to as “pre-proofed.” Examples of pre-proofed or partially proofed dough products include breads and bread-like products that generally contain a leavening ingredient and include but are not limited to loaves of bread such as French bread, white or whole wheat bread, bread sticks, biscuits, rolls, pizza dough, and the like.

Such products include dough formulations that can be, but are not necessarily, chemically-leavenable.

Various commercial dough products, including pre-proofed or partially proofed dough products, are sold in pressurized containers, which have a positive internal pressure, i.e., an internal pressure that is greater than atmospheric. One technique for preparing a pre-proofed dough product in a pressurized package is by placing an unproofed dough in a package having a fixed volume and allowing the dough to proof and expand within the package. Such packages are sometimes referred to as self-sealing packages, and include an interior space that is vented to the outside of the package to allow gas to be removed from the interior space by expansion of dough in the interior space, followed by the vent being sealed from the interior side of the package by the expanded dough. More specifically, after being placed in the package, the dough composition produces carbon dioxide and expands inside of the package. The expanding dough will replace gas from the space inside of the package; the gas expels through a vent and the expanded dough seals the vent from the inside of the package. The dough can continue to produce carbon dioxide and produce an internal pressure inside the package.

Self-sealing packages sometimes used to contain raw dough can be in the form of a canister formed of composite paperboard spirally wound into a cylinder. The initial volume of dough packed into the canister is usually less than the canister volume and as the dough expands by proofing within the canister, the dough volume increases to force the dough to expel gas from the canister, eventually causing the dough to contact interior surfaces of the canister as well as channels, passages, or other openings (e.g., valves, near ends of the container); the dough contacts the channels, passages, or openings, to seal the canister from the interior side.

There is continuing need for new types of packaged pre-proofed dough products that may be refrigerator stable. Similarly, there is continuing need for new methods of packaging and preparing such packaged dough products.

Summary

The described packages can be used to contain any product or material desired, including food and non-food items. This description relates in large part to applications for food, in particular dough products, but other food and non-food items may also be contained and stored in the described packages. Other non-limiting examples of types of food items may include nuts (e.g., peanuts), baby food, snack foods, coffee, milk powders and mixes, sugar, sugar substitutes, or other foods typically sold in small packages and optionally under pressure.

Examples of packages as described include those having a container that defines an interior space, wherein the container includes an opening, and the package includes a closure that covers the opening. The closure includes an aperture, and an insert covers that aperture. Optionally the insert can be transparent to allow viewing of the contents of the package. Also optionally, a package can include a pressurized interior, meaning that the pressure at the interior is greater than ambient pressure. The insert can be made of a metal or a non-metal material, preferably a non-metal material such as plastic, paper, cardboard etc. A two-piece closure that includes a metal piece with an aperture, and a non-metal insert to cover the aperture, can advantageously result in reduced cost relative to an all-metal closure, because the non-metal insert can be less expensive compared to amount of metal that the non-metal insert displaces. Packages according to the invention can optionally and preferably be vented to allow gas contained in an interior space of a package to be expelled from the interior of the package to the exterior, such as upon expansion of a dough composition within the package. With the expansion of a dough composition within the package, the size (volume) of the dough can increase to fill the internal package volume, displacing gas at the interior of the unfilled package. The dough, once expanded, can then contact a vent from the interior side of the package, causing the dough to cover, close, or otherwise seal the vent from inside of the package and prevent further passage of gas through the vent in either direction. Any further proofing and expansion of the dough (such as due to production of carbon dioxide within the dough by yeast or chemical leavening agents) will cause the dough to further pressurize the interior of the package. A vent can be any form of vent (including a valve) at any location. Embodiments of vents include those in the form of a passage (e.g., channel, opening, aperture, etc.) located between a cover (e.g., closure) and a sidewall of a package, or located between a closure and an insert.

In other embodiments, the invention also relates to methods of preparing a package, a packaged food or non-food item, or a packaged dough product. Methods include preparing a package structure as described, including a closure and an insert, placing a food (e.g., dough) or non-food item into the package and closing the package.

- 5 If the item is dough, the dough can be allowed to expand within the package. The package with the contained item can be stored at any desired condition, such as at refrigerated storage conditions.

- Examples of packages can include components of previous and conventional packages, such as conventional pressurized wound cardboard-type cans used to contain
10 dough products, plastic packages that may be wound or extruded, metal packages that may be wound or extruded, etc. An example of a package that includes features of such a conventional package may include a wound cardboard hollow container, metal endcaps (closures), with the endcaps including an aperture and an insert as described herein; the package may be vented at a joint between the endcap and the sidewall, at a location (area
15 of contact) between the closure (near the closure aperture) and the insert, or elsewhere.

- In alternate embodiments, particularly embodiments that place a vent at a location between the closure aperture and the insert, a container may include a hollow container that is not of wound cardboard. Sidewalls may be made, for example, of plastic or metal that may be formed by any method, such as by extrusion methods.
20 According to certain such embodiments, a package interior can be maintained at a relatively low pressure (e.g., below 5, 10, or 15 psig), allowing the sidewalls to be of a relatively reduced thickness compared to similar containers having greater pressures.

- The invention furthermore relates to methods of preparing a package from materials that include a closure material. Certain methods involve steps of making
25 multiple closures from a single piece of closure material by making a first closure that contains an aperture, wherein the first closure is prepared by removing a portion of the closure material to form a aperture. The removed portion of closure material can then be used to make a second closure of a dimension smaller than the dimension of the first closure. Optionally, a portion of closure material from the second closure can be
30 removed to form a closure aperture in the second closure. That portion of closure material, in turn, can be used to prepare another (third) closure of a dimension smaller than the second closure, optionally having still another aperture. Generally, according to this method, a portion of closure material removed to produce a closure aperture can be

used to make another closure having a dimension smaller than the original closure and not larger than the aperture of the original closure.

5 In one aspect, the invention relates to a package capable of being pressurized internally to above atmospheric pressure. The package includes: an interior space defined by a hollow container having sidewalls and an opening at an end of the sidewalls; and a closure at the opening. The closure includes a perimeter that engages the end of the sidewalls, a surface extending between locations of the perimeter, an aperture in the surface, and an insert that covers the aperture.

10 In another aspect, the invention relates to a method of preparing a pressurized packaged dough product. The method includes: providing a package according to the description, placing dough in the interior space, placing the closure at an end opening, and allowing the dough to expand within the interior space such that gas vents from the interior space and expanded dough seals the container.

15 In another aspect the invention relates to a packaged dough product that includes dough in a self-sealed, pressurized dough package. The dough product includes: a package having an interior space defined by a hollow container having sidewalls, an opening at an end of the sidewalls, and a vent; a dough product within the interior space; and a closure at the opening, the closure comprising an aperture that allows viewing of the dough product in the interior space. The package is pressurized and the vent is sealed
20 by expanded dough in the interior space.

In another aspect the invention relates to a method of preparing a pressurized packaged dough product. The method includes: providing a hollow container comprising an interior space, the container having sidewalls and an opening at the end of the sidewalls; placing dough in the interior space; placing a closure at an opening, the
25 closure comprising a perimeter that engages the end of the sidewalls, an aperture at a location inside of the perimeter, and an insert that covers the aperture; and allowing the dough to expand within the interior space such that gas vents from the container and expanded dough seals the container.

In yet another aspect the invention relates to a method of preparing a pressurized
30 packaged dough product. The method includes: providing a hollow container comprising an interior space, the container having sidewalls and an opening at an end of the sidewalls; placing dough in the interior space; providing a first closure having a perimeter that engages the end of the sidewalls and a surface extending between

locations of the perimeter; removing a second closure from the surface of the first closure to form an aperture at the surface; providing an insert; placing dough in the interior space; placing the first closure at the end opening; placing the insert to cover the aperture; and allowing the dough to expand in the interior space such that gas is vented
5 from the container and expanded dough seals a vent.

Brief Description of the Drawings

Figures 1A and 1B illustrate embodiments of containers useful in exemplary
embodiments of described packages.

10 Figures 2A, 2B, 2C, and 2D illustrate embodiments of closures useful in
exemplary embodiments of described packages.

Figures 3A and 3B illustrate embodiments of closures useful in exemplary
embodiments of described packages.

Figures 4A and 4B illustrate embodiments of described packages.

15 Figure 5 is a cross-sectional illustration of an embodiment of a package having an
anaconda fold.

Figure 6 is a cross-sectional illustration of an embodiment of a package excluding
an anaconda fold.

Detailed Description

20 The invention involves packages that are capable of containing a non-food item
or a food item (e.g., a dough), optionally under pressure. The package includes an
interior space within a hollow container defined at least in part by a sidewall, and
containing an opening, e.g., at an end of the sidewall. A closure covers the opening. The
25 closure includes a closure aperture (or simply "aperture") that is in turn covered by an
insert. The "insert" may be placed on either side of the closure to cover the aperture, i.e.,
either on an exterior side (away from the interior space) or on the interior side (the same
side as the interior space), or may be otherwise placed or incorporated into the closure.
Optionally and preferably a package can be vented. According to particular
30 embodiments of packages for containing a dough product, an optional vent can allow a
dough composition to expand within the interior space, causing gas to be expelled
through the vent, and allowing the expanding dough to seal the package from the interior
of the package by covering and closing the vent.

The hollow container can be any hollow container that defines a suitable interior space, e.g., suitable for a refrigerated dough product. A hollow container may be of any useful material, including a flexible, rigid, or semi-rigid material, e.g., capable of containing a pressurized dough product. Various packaging materials useful for a hollow container are known in the food and dough packaging arts, and include metals (e.g., aluminum, steel, tin), cardboard (e.g., wound cardboard), paper, polymeric or plastic materials (e.g., films, which may be wound, extruded as a sheet or tubular or cylindrical container, or otherwise formed into a hollow container), etc.

Hollow wound paperboard (cardboard, paper, optionally including a barrier material or metalized layer, etc.) containers are well known and are described, for example, in the following United States Patent documents, each of which is incorporated herein by reference: 5,084,284; 6,190,485 (see, e.g., Figure 5 and related text of the 6,190,485 patent); 6,234,386; 6,378,763; 6,510,674;

Described in these listed patents, and well known in the art of food and paperboard packaging, is an optional feature of a wound package seal known as an “anaconda fold.” An anaconda fold is a fold at an edge of an inner layer of a package material that has been wound into a wound canister. The fold of the inner layer is at one edge of the inner layer, at which a short (e.g., 0.2 to 1.0 centimeter, such as from 0.3 to 0.7 centimeter) piece of the inner layer is folded back to meet an underside surface of the inner layer. The folded portion is then used to form a seal with an adjacent edge of the paperboard upon winding. The folded edge is spirally wound against an unfolded edge, with the folded edge overlapping a surface of the adjacent unwound edge.

A feature of an anaconda fold can be an ability of the fold to function as a channel that can facilitate venting of a package having this type of fold. It is believed that the structure of the fold, winding along the inner surface of the package and terminating at the two opposed end openings of the tubular canister, creates a space or “channel” extending helically along the inner surface. During expansion of a dough product within the package, the dough can increase in volume to fill the interior space and match the volume of the interior. When this happens the dough contacts and places internal pressure upon the inner surface of the container, which inhibit continued passage of gaseous fluid from locations at the interior of the package, to ends of the package where the gaseous fluid can be vented. An anaconda fold at the inner surface of the

package can function as a channel that leads from the interior of the package to the ends, to allow venting.

As described in the Background section of U.S. patent 6,190,485, an example of an anaconda fold structure can be prepared from a wound multi-layer (e.g., laminated) package material that includes a body ply layer and a liner layer (an inner layer). The material is wound in a fashion by which the inner liner ply is sealed to itself along a helical seam, which is typically slightly offset from the helical seam of the body ply. The liner ply seam is formed with an “anaconda” fold, wherein the overlying edge of the liner ply is folded back on itself and adhered to the underlying (unfolded) edge.

According to embodiments of packages as described, a wound package may include an anaconda fold. Alternately, according to other embodiments, a wound or otherwise-formed package may avoid the need for an anaconda fold, and the package may exclude an anaconda fold. For example, a wound paperboard (e.g., multi-layer laminated fibrous package material) package can be wound and sealed without the presence of an anaconda fold; an inner liner may be sealed to itself without a folded edge. Alternately, a wound package may be made of wound plastic or other material that includes a helical seal that excludes an anaconda fold structure.

Figure 5 shows an example of a helically-wound package as described herein, including an anaconda fold. Package 100 includes multi-layer package material 102, which includes paperboard layer 104 and inner (e.g., liner) layer 106. A helical seal includes un-folded edges of paperboard 104 abutted at seam 110. Inner layer 106 is folded at seam 108 to include an anaconda fold 112, whereby the edge of inner layer 106 is folded to place edge 114 beneath a surface of the edge of inner layer 106; fold 112 is then wound against the opposing edge 116 of inner layer 106, with fold 112 overlapping a surface of edge 116.

Figure 6 shows an example of a helically-wound package as described herein, which includes a multi-layer package material 102, without an anaconda fold. Package 100 includes multi-layer package material 102, which includes paperboard layer 104 and inner (e.g., liner) layer 106. A helical seal includes un-folded edges of paperboard 104 abutted at seam 110. Edge 114 of inner layer 106 abuts edge 116 of inner layer 106, without either edge being folded. Edges 114 and 116 do not include any overlapping surfaces, but one surface could optionally overlap the other, without either surface being

folded. Additional layers may also be included, such as an outer printed layer, but are not shown at figure 5.

Exemplary hollow containers for dough compositions such as sweet rolls, breads, rolls, buns, biscuits, and others, may have exemplary dimensions that include an interior space volume in the range from 50 to 800 cubic centimeters, e.g., from 200 to 500 cubic centimeters. Stated differently, a hollow container may be sized and shaped to contain a desired volume (e.g., based on number or portions) of dough product, for example, for some retail-sale products, to contain from 1 to 10 chemically leavened biscuits dough pucks; volumes outside of this range may also be useful for biscuit or other dough products.

A hollow container may be of any three-dimensional shape, defined by sidewalls and at least one opening, such as a cylinder (e.g., tube), a cube with one or more open end, a rectangular container with one or more open end, or any other three-dimensional shape or form having sidewalls and an opening. For a cylinder, tube, can, or canister, or similar cylinder-like shape (e.g., with a non-circular cross section), such as for a retail-type product, an exemplary length-wise dimension may be in the range of from 2 to 10 inches (from 5 to 25 centimeters), e.g., from 4 to 8 inches (from 10 to about 20 centimeters), and a diameter (for a round cross section), width (for non-round cross section), or other cross-sectional dimension, also optionally the dimension of an opening of the hollow container, may be in the range from about 1 to about 5 inches (from about 2.5 to about 12.5 centimeters), e.g., from about 2 to about 4 inches (from 5 to about 10 centimeters).

One typical style of package for pressurized dough products includes a hollow container in the form of a can or canister having rigid or semi-rigid materials that define a sidewall, such as paper, cardboard (e.g., wound cardboard), or a polymeric material (e.g. wound, extruded, etc.). A material considered to be “rigid” can be a material that is self-supporting and potentially flexible, but not necessarily able to be substantially stretched (i.e., is inelastic); examples include cardboard, wound cardboard, similarly-stiff plastics, and the like. A material considered to be “flexible” can be a material that is able to bend and change shape without stretching, such as paper, thin inelastic polymeric films, cardboard, wound cardboard, similarly-stiff plastics, and the like.

Certain specific examples of sidewall materials include cardboard and paperboard including 25# ream, 25# bleached kraft, and papers and cardboards of similar strength

and thickness, as well as various polymers including polyolefins such as polyethylene, high density polyethylene, low density polyethylene, and polypropylene; nylon; and the like. A sidewall material may be formed of a single material or layer or multiple materials or layers. A paper or polymeric base layer may be treated with a coating or film such as a metal foil layer, a plastic barrier or sealer layer added to a paper or cardboard (e.g., nylon, ethylene vinyl alcohol, polyethylene, polyvinyl chloride, polyvinylidene chloride, polypropylene, etc.), an adhesive or adhesive layer (e.g., thermoplastic polyolefin), a liner ply, tie-layer, or other functional layers or features. In certain preferred embodiments a sidewall material may be recyclable. As used herein, a recyclable material may be a recyclable metal, plastic, or a recyclable paper. A recyclable paper may be a paper or cardboard material that having a non-paper content that does not exceed 5 percent by weight.

Sidewalls can be designed to have strength (based, e.g., on thickness) that is sufficient to accommodate a desired pressure. According to certain embodiments of packages used for relatively low interior pressure (e.g., below 5, 10, or 15 psig), sidewalls can be selected to have a relatively reduced thickness compared to sidewalls designed for packages required to maintain a relatively higher pressure (e.g., 20, 25, or 30 psig. Non-limiting examples of polymeric materials that can be used for packages designed for relatively low interior pressure reduced (e.g., below 5, 10, or 15 psig) include polymeric materials that include the following polymers and optionally additives or copolymers: polyethylene terephthalate (PET) having a wall thickness of from 10-13 mil, high density polyethylene (HDPE) from 25-35 mil, and polypropylene (PP) from 20-25 mil. Examples of non-polymeric materials that can be used for packages designed for relatively low interior pressure (e.g., below 5, 10, or 15 psig) include paper or cardboard materials alone or in multi-layer sidewall materials.

Exemplary hollow containers that can be useful according to the present description, forming a can or canister (sometimes referred to collectively herein as “can”) can have a fixed interior space volume, can be in the form of a tube or cylindrical, and can be vented to allow a contained dough composition to expand within the package to expel gas, to seal the package from within, and to optionally build a desired interior pressure. A “can” can define sidewalls and two opposing ends, the ends being closed with a cap or other closure (see below) secured to the cylinder (e.g., at sidewalls) by any useful technique such as heat sealing, adhesive, a mechanical engagement (e.g.,

crimping), or the like. With expansion of a dough composition inside of the hollow container (can), after a closure is placed over an opening, the dough volume can increase to fill the entire volume of the interior space, and upon any further proofing the pressure inside the container can increase and, (according to certain embodiments of packages)

5 the expanded dough can seal vents from the inside of the package.

A canister can be formed from any of a selection of useful materials such as paper, cardboard, plastic, and multilayer composites that include one or more of these materials optionally additionally including additional layers such as a metal layer or other barrier layer. A canister may be formed as desired. For example, a plastic canister
10 may be formed by molding, e.g., blow molding, injection molding, winding, etc. A canister may be spirally wound into a cylinder, from plastic, paper, cardboard, etc., or from another type of rigid, semi-rigid, or flexible material capable of being so formed and then sealed to contain a dough composition. This “can” embodiment is discussed in terms of a cylindrical package, but other shapes can also be useful and are contemplated
15 according to the present description, such shapes including “tube”-type hollow containers having non-circular cross section, such as an elongate container having sidewalls of square, hexagonal, oval, octagonal, rhombus, rectangle, or other shape cross section. The can may be rigid or semi-rigid in an elongate direction and sealed at one or more ends with one or more closure as described.

20 As described, the package can optionally be vented. A useful vent can be any type of vent that allows gas to be expelled from the interior, optionally also being capable of being closed or covered from the interior, such as by a food (e.g., dough) product expanding within the interior space. Examples of vents that can be incorporated into a package of the present description include those described in Assignee’s
25 copending Patent Application Publication No. 2008/0286420, the entirety of which is incorporated herein by reference. A vent can be located at any desired location, including at a perimeter of a closure, at a perimeter of an insert, or elsewhere. A vent can be of any size or design, including microvents (see, e.g., Patent Application Publication No. 2010/0021591, the entirety of which is incorporated herein by
30 reference).

Figures 1A and 1B illustrate examples of hollow container structures. Referring to figure 1A, hollow container 2 includes sidewalls 4, sidewall ends 6, and openings 8 at opposing ends of sidewalls 4; these collectively define internal space 10. Hollow

container 2 is in the form of a hollow cylinder, or “tube,” having dimensions to contain a dough product. Sidewalls 4 can be made of any suitable material, such as paper, wound cardboard, plastic film, another type of extruded or wound plastic material, or other plastic, polymeric, or non-polymeric materials. Sidewalls 4 can be made of a single layer (e.g., of plastic, paper, or cardboard) or can be of a multi-layer material that may include combinations of materials such as paper or cardboard optionally coated with or laminated to one or more additional layer of paper, metal, plastic or metal foil, thermoplastic, cardboard, or polymer. Figure 1B shows a similar hollow container with having a rectangular or square cross section.

A package as described herein includes a closure to cover an opening of the hollow container, e.g., by engaging sidewalls of the hollow container. The closure can be any structure that can engage the hollow container, e.g. at ends of a sidewall structure, to close an opening of the hollow container by covering the opening (optionally allowing for venting). A closure can be of any desired material such as metal, plastic, cardboard, or another polymeric or non-polymeric material capable of combining with a hollow container as described to contain a pressurized dough product. The size and shape of the closure can correspond to a size and shape of an opening of a hollow container, such as an end of a hollow structure defined by ends of a sidewall structure. The closure can be flat (e.g., planar, two-dimensional) or curved, and can be of a shape that corresponds to a shape of an opening of the hollow container, e.g., a cross section of a hollow container.

Certain exemplary closures for use with a cylindrical or tube-like hollow container can have features of relatively flat (planar), rigid, metal or polymeric discs in the form of “caps” or “end-caps” sometimes used to seal ends of pressurized (wound cardboard, polymeric, etc.) packages used to contain dough products. These closures, e.g. at a perimeter of the closure, can engage ends of sidewalls of the hollow container, with optional venting, by being crimped or otherwise mechanically secured to ends of the sidewalls. Other types of closures can be plastic and can engage sidewalls by alternate engagements such as adhesive or other mechanical engagements.

A closure can be formed from any of a selection of useful materials such as metal, paper, cardboard (e.g., wound, flat, convolute, etc.), plastic, and multilayer composites that include one or more of these materials optionally additionally including additional layers such as a metal layer or other barrier layer. Examples of materials include metal, plastic such as polyethylene terephthalate, polyethylene naphthalate,

polyolefin such as polypropylene and polyethylene, and the like. A closure can be a recyclable metal, plastic, or paper. A closure can include a perimeter designed to engage an opening of a hollow container, e.g., at a sidewall, and the closure can be of any useful form such as mechanical (e.g., vented) or adhesive.

5 According to the invention, a closure includes an aperture, and the aperture is in turn covered by an insert in a manner that can result in a closed or sealed package. The aperture can be any size or shape, and preferably is sufficiently large to allow for visual access to the interior space (and contents) of the package, having a dimension (e.g., diameter) that is at least about 1 centimeter.

10 An aperture can preferably be contained within (i.e., bounded by) a surface of the closure, defined by aperture boundaries that do not extend to edges at the outer perimeter of the closure; the aperture can be defined by a surface or edge of the closure internal to the outer edge or perimeter of the closure so that an inner edge or border of the closure fully defines a perimeter or outer edge or border of the aperture.

15 Dimensions of an aperture of a closure of any particular package can be based on factors such as the size of the package, and particularly the size of the closure (which in turn can relate to the size of the package) and a desired dimension for a closure surface. For certain closure designs, a minimum size of a closure surface may correspond to a distance between a closure aperture and a closure perimeter of at least $\frac{1}{4}$ or $\frac{1}{8}$ of an inch
20 (from 0.6 to about 0.3 centimeters). A dimension of a closure aperture is smaller than a dimension (e.g., diameter) of the closure measured at a closure perimeter. An area of a closure surface (calculated as the area of the closure within a perimeter, excluding the size (area) of the closure aperture) can vary depending on the size of the closure perimeter and the closure aperture. Examples of useful areas of a closure surface may be
25 up to 85 or 90 percent of a total area within a perimeter of the closure, e.g., up to 65 percent of the area within a perimeter of the closure, or up to 50 percent of the area within a perimeter of the closure. For a substantially circular and planar closure, a diameter of a closure aperture may be less than 75 percent of the diameter of the closure perimeter, e.g., less than 65 percent of the diameter of the closure aperture, or less than
30 50 percent of the diameter of the closure perimeter.

 In terms of specific dimensions, for a round (e.g., circular) closure, an outer diameter of a closure perimeter can be a size to engage and close an opening on the hollow container, with examples of useful diameters being the same as diameters of a

tubular container, e.g., in the range from 1 to 5 inches (from 2.5 to 12.5 centimeters), e.g., from 2 to 4 inches (from 5 to about 10 centimeters). For a non-round closure, such as one that covers a non-round opening of a hollow container that has a round or non-round form, these dimensions can relate to a diameter or other dimension of such an opening. A size (e.g., diameter) of an aperture of a closure of a size in this range can be as indicated, with specific examples as follows: for a round or non-round closure having a diameter or dimension of about 3 inches (about 7.5 centimeters), a diameter or dimension of an aperture can be from about 0.3 to about 2.75 inches (from 0.75 to 6.9 centimeters); for a round or non-round closure having a diameter or dimension of about 2.25 inches (about 5.7 centimeters), a diameter or dimension of an aperture can be from about 0.3 to about 2 inches (from about 0.75 to about 5 centimeters); for a round or non-round closure having a diameter or dimension of about 1.75 inches (about 4.4 centimeters), a diameter or dimension of an aperture can be from about 0.3 to about 1.5 inches (from about 0.75 to about 3.8 centimeters).

Figures 2A, 2B, 2C, and 2D illustrate examples of closures that include apertures. (Figures 2A and 2C are side-perspective views, and figures 2B and 2D are top views.) Referring to figure 2A, closure 12 includes aperture 14, outer edge or perimeter 16, inner edge 18 (which is also the outer edge of perimeter 16), and surface 20. Closure 12 is in the form of a planar (substantially two dimensional) round disc having round aperture 14. Aperture 14 is the open space or area removed or absent from the round disc forming closure 12. The size (area and diameter) of aperture 14 is smaller than closure 12 (i.e., is smaller than perimeter 16), and the outer boundary of aperture 14, which consists of a continuous perimeter, is co-extensive with the inner boundary of surface 20. As illustrated, aperture 14 and perimeter 16 are concentric circles; alternately, aperture 14 may be of a different shape than perimeter 16, may have a different center (or central location), or both.

According to the invention, the package includes an insert that covers the aperture of the closure. The insert can be any size and shape that will allow the insert to cover an aperture in a closure, and may be rigid or flexible, can be flat (planar) or optionally curved in three dimensions, and can have a shape that corresponds to a closure, an aperture, or both. Exemplary inserts can have a shape that corresponds to an aperture (e.g., a circular insert to work with a circular aperture) and can have a diameter (or other dimension) that is slightly greater than a diameter (or other dimension) of the

aperture, to optionally allow coverage of the aperture, as well as contact between a peripheral surface of the insert and a surface of the closure adjacent to the aperture. For example, a diameter (or other dimension) of an insert may be greater than a diameter (or other dimension) of a cover aperture by at least 0.25 inch (allowing 0.125 inch of overlap
5 between surfaces of the insert and the closure, on opposite sides of the insert), such as at least 0.5 inch (allowing 0.25 inch of overlap on opposite sides of the insert), or at least 0.8 inch (allowing 0.4 inch of overlap on opposite sides of the insert).

The insert can be of any material, such as any of those mentioned above for other components of the package, including any types of metal, polymer, plastic, paper,
10 cardboard, etc. An insert can be relatively rigid (self-supporting and optionally inelastic) such as in the form of a rigid metal or plastic, or may be more flexible (self-supporting but bendable and optionally inelastic) such as in the form of a bendable paper, cardboard, or polymer, or flaccid (limp and optionally inelastic) such as in the form of a thin paper, foil, or polymer film. An insert can be of sufficient strength and inelasticity to maintain
15 an internal pressure in a package, when the insert covers an aperture, but rigidity is not necessarily required so an insert may be of an inelastic and flaccid material having a relatively low thickness, such as paper, foil, or a thin polymeric film. Certain specific examples of materials useful for an insert include metal, plastic such as polyethylene terephthalate (e.g., 25 mil thick, transparent), polyethylene naphthalate, polyolefin such
20 as polypropylene and polyethylene, and the like. An insert can include a surface designed to engage a surface of the closure to produce a seal or a vent. An insert can be plain, colored, transparent or translucent, and may optionally be decorated and may contain printing. An insert can be shaped to match a shape of a closure aperture or a cross-section of a sidewall, or can have a shape that is different from a closure aperture
25 or a cross-section of a sidewall of a package that includes the insert.

Optionally an insert can be transparent to allow viewing of contents contained in the package through the insert and aperture. As desired, the insert can be located on an interior or exterior side of the closure. Optionally, an adhesive or other securing
30 mechanism can be used to maintain the position of the insert to cover the aperture. Also optionally, the placement of the insert at a surface of the closure can create or maintain a vent (e.g., space, channel, slot, opening, etc.) between the closure and the insert; preferably a vent can be closed or sealed from the interior side of the package by the

expansion of dough contained in the interior space, the expanded dough covering the vent to prevent subsequent passage of gas through the vent.

In particular embodiments an adhesive can be placed adjacent to a vent, e.g., between a surface of the insert and a surface of the closure, such as a pressure-activated adhesive coating. A pressure-activated adhesive coating can be useful to maintain a position of an insert relative to a closure. As used herein, a pressure-activated adhesive coating is a coating that contains an adhesive (e.g., a pressure sensitive adhesive), where the coating as a practical matter does not exhibit properties of a pressure sensitive adhesive (e.g., tack, adhesion (shear or peel)) but that can be caused to exhibit adhesive properties by application of a pressure, such as a minimum amount of pressure referred to as a "threshold pressure." A threshold pressure can be an amount of pressure that causes a pressure-activated adhesive coating to display properties of a pressure-sensitive adhesive, such as tack, shear adhesion, peel adhesion, etc., and may be an amount of pressure that disrupts, fractures, or breaks a feature or structure of the coating that then releases or exposes pressure-sensitive adhesive. Such feature or structure may be, e.g., a polymeric sphere (e.g., "microsphere"), a polymeric coating, a glass sphere (e.g., "glass bead"), non-spherical matrix, etc.

Prior to being exposed to a threshold pressure to activate the adhesive, a pressure-activated adhesive coating does not function as a pressure-sensitive adhesive; subsequent to being exposed to a threshold pressure, the pressure-activated adhesive coating behaves as a pressure-sensitive adhesive. The activation by exposure of the adhesive coating to pressure may be accomplished by known methods, such as by use of coatings that contain polymeric beads or microspheres, glass beads, or other matrixes, wherein the beads or matrixes may contain adhesive or components of adhesive (e.g., different components of a reactive adhesive such as an epoxy). Upon exposure of the beads, spheres, coating, microspheres, or matrix to pressure (e.g., a threshold pressure), the beads, spheres, coating, microspheres, or matrix become disrupted and release or expose the adhesive.

A pressure-activated adhesive coating can be any useful pressure-activated adhesive coating, and for use in a package for containing food can preferably be "generally recognized as safe" (GRAS). In an "unactivated" condition, prior to a threshold pressure being applied to a pressure-activated adhesive coating, one or more properties of tack, peel adhesion, and shear adhesion can be below values for a pressure-

sensitive adhesive, e.g.: for example, an unactivated pressure-activated adhesive coating can exhibit substantially no adhesive property measured as tack (measured by ASTM-D3121-06); peel adhesion (measured by ASTM-D1876-08); or shear adhesion (measured by ASTM-D3654 or Adhesion D-3330). Upon activation by application of a threshold
5 pressure, the pressure-activated adhesive coating can exhibit one or more property of a pressure-sensitive adhesive, such as a useful level of tack (measured by ASTM-D3121-06); a property of peel adhesion (measured by ASTM-D1876-08) of at least 80 gm/in; or a property of shear adhesion (measured by ASTM-D-3330) of at least 2.0 N/10 mm.

An adhesive contained in a pressure-activated adhesive coating can be any
10 adhesive or adhesive component, such as any adhesive known within adhesive arts as “pressure-sensitive adhesives” or “PSA.” Pressure-sensitive adhesives are known compositions that exhibit one or more adhesive properties of tack, peel adhesion, shear adhesion, etc., that can adhere to an adherend surface based on contact and without the requirement of solvent, water, or heat to activate the adhesive. Examples include
15 polyolefins (e.g., poly-alpha olefins), polyacrylates, polystyrene and polystyrene block copolymers, vinyl ethers, ethylene-vinyl acetate, butyl rubber, nitriles, natural rubber, and the like.

A pressure-activated adhesive coating may be applied to a substrate by known methods, such as coating from solvent (e.g., organic or aqueous), hot-melt coating, etc.,
20 as desired. The amount can be an amount to provide desired adhesive properties before and after application of a threshold pressure.

Examples of inserts useful to cover an aperture of a closure are illustrated at figures 3A and 3B. Referring to figure 3A, an end of a package 30 includes closure 32 and insert 34. Closure 32 includes outer perimeter 36, aperture 38, surface 40, and inner
25 edge 42 adjacent to surface 40. Inner edge 42 also defines the outer boundary of aperture 38. Closure 32 may be made out of any material, such as a metal (e.g., steel, tin, polymer (e.g., polyolefin, PET, polyamide)). Insert 34 includes outer diameter 44 (dashed lines) and surface 46, which as illustrated is an exterior surface facing away from an interior space of package 30. Insert 34 can be made of any single or composite
30 material the can be formed to the illustrated shape and capable of covering aperture 38 to close aperture 38 and retain a dough composition under pressure within package 30 (e.g., transparent PET). Distance D_0 represents the difference between the relatively larger diameter 44 of insert 34 and the relatively smaller diameter of aperture 38 as defined by

inner edge 42. The area between outer diameter 44 of insert 43, and inner edge 42 of closure 32, is an area of contact between an “outer” or “exterior” (facing away from an interior space of a package) surface of insert 34 and an “inner” or “interior” (facing toward an interior space of a package) surface of closure 32. As illustrated at figure 3A, this area of contact may be sufficiently tight to produce a fluid-tight (e.g., air-tight) seal that will not allow passage of gas or other fluid from a location within an interior space of package 30, to an exterior location, by the gas or other fluid passing between closure 32 and insert 34. In other embodiments of packages described herein, an engagement between an outer surface of an insert and an inner surface of a closure may include a vent that allows fluid (e.g., gas) to pass from the interior space to an exterior of a package. See, e.g., figure 4B and related text.

Figure 3B shows an alternate end of package 30, which is similar to the end of package 30 at figure 3A, but that has different dimensions, and that also shows adhesive patches 50 at peripheral locations of insert 34, at locations to contact an outer surface of insert 34 and also an inner surface of closure 32, to maintain contact between insert 34 and closure 32. The adhesive may be any useful adhesive such as a thermoplastic material, a pressure-sensitive adhesive, a pressure-activated adhesive (as described herein), or any other food-grade adhesive. In this illustrated embodiment of package 30, the engagement between the outer surface of insert 34 and the inner surface of closure 32 includes a vent that allows fluid (e.g., gas) to pass from the interior space, to an exterior of a package. The vent can be formed by the placement of adhesive patches 50 between closure 32 and insert 34, e.g., a space is created adjacent to each adhesive patch due to the thickness dimension of the adhesive patch. In preferred embodiments of packages described herein the vent can be closed by expansion of dough inside of the package, upon the expanded dough contacting the vent and covering the vent on the interior of the package. As illustrated, the pressure-sensitive adhesive is provided in patches 50 at a circular location; in alternate embodiments the adhesive may be a continuous circular (or other shape) line of adhesive, without gaps between multiple patches.

Figure 4A shows a side perspective view of an embodiment of a package as described. Referring to figure 4A, package 30 includes a hollow container having sidewalls 4 (shown as wound cardboard, but optionally any other material such as wound or extruded plastic or other polymeric material). Closure 32 covers an opening of the hollow container by an engagement (e.g., a mechanical or adhesive engagement)

between perimeter 36 of closure 32 and ends of sidewalls 4. The engagement may be a mechanical engagement (such as a crimped edge of closure 32, optionally including a vent), an adhesive engagement, or any other engagement sufficient to allow package 30 to contain a dough product under pressure. The engagement may also optionally include
5 a vent (e.g., a passage or channel) that allows fluid to escape from an interior space of package 30, to an exterior, passing between an end of sidewall 4 and closure 32 upon expansion of a dough within the interior space (see, e.g., figure 4B). A vent can preferably be of a type that can become sealed from within the interior space upon contact of the expanded dough composition against the vent from the interior side of
10 package 30. A vent could also be located at any other location of the package.

Referring to figure 4B, this shows a side cross-sectional view of package 30, this view illustrating dough and two possible venting options, either of which may be part of a package according to the present description. In use, a package according to the description such as package 30 can be prepared by placing dough 52 in interior space 54
15 of hollow container 56, defined in part by sidewalls 4. When placed into interior space 54, dough 52 has a volume that is less than the volume of interior space 54. Closure 32 and insert 34 can be placed at ends 58 of sidewalls 4. As illustrated, perimeter 36 of closure 32 (e.g., of a metal or plastic) is crimped around ends 58 to secure closure 32 at ends of sidewalls 4. Dough 52 expands in size due to leavening or partial leavening, to
20 fill interior space 54.

Optionally, and as illustrated at figure 4A, a package as described can include a vent to allow gas to escape from interior space 54 as dough 52 expands within the package after a closure has been placed to cover an opening. A vent can be any type of vent now known or developed in the future and can be located at any location on the
25 package such as at a sidewall; at an engagement between a closure and an end of a sidewall, such as at a crimp; at an area of contact between a closure and an insert; or at any other useful location. Figure 4B shows two different vent embodiments, either or both of which may be used separately or together in a package as described herein. One vent embodiment is indicated by arrows 60, indicating gas being expelled from interior
30 space 54, through a passage between closure 32 and sidewall end 58. A second vent embodiment is indicated by arrows 62, indicating gas being expelled from interior space 54, through a passage between an interior surface of closure 32 and an exterior surface of insert 34, traversing a space or distance of overlap (e.g., area of contact) between these

surfaces, designated D_O. Certain specific examples of packages can include a vent indicated by arrows 62 that includes a passage between an interior surface of closure 32 and an exterior surface of insert 34, and can exclude any other vent, particularly not requiring a vent as indicated by arrow 60 that includes a passage between closure 52 and
5 sidewall end 58; these specific examples of packages can include any type of sidewall, such as a polymeric (e.g., extruded plastic) sidewall.

A package according to this description can be prepared from components as described, including a hollow container having an opening (e.g., an opening at one or two opposing ends of sidewalls), a closure (having an aperture), and an insert. In
10 preparation of a packaged dough product, a hollow container can be prepared from a material as described, and wound (e.g., from a plastic, paper, or cardboard material) or extruded (e.g., from a plastic material). A dough composition can be placed at an interior space, and the opening can be closed by placing the closure at the opening, to close the opening, and by placing the insert to cover the aperture in the closure; the insert
15 may be placed on an interior or an exterior side of the closure.

One or more closures can be prepared from any material, such as by being punched or otherwise formed from a sheet or a blank of a piece of metal or other desired closure material. According to particular methods, a first hollow container can be provided, having an interior space. Dough can be provided in the interior space. A first closure
20 can be provided from a blank metal disc or a sheet of metal, cardboard, plastic, or other suitable closure material, by forming a perimeter to be fitted onto the opening of the first hollow container. A first closure aperture can be formed in the first closure, such as by punching, cutting, molding, or otherwise forming a closure with an opening in the middle. Optionally, forming the aperture can be by punching an opening in the closure,
25 whereby a second disc of a smaller (second) perimeter is formed from the material used to produce the opening. The first closure, with an insert, can be used to close an opening of the first hollow container.

The second disc of a smaller (second) perimeter can be used for any purpose, such as in producing a separated package, or may be recycled. As an example, the
30 second disc can have a perimeter that can be fitted onto an opening of a second hollow container having an opening sized to be smaller than the opening of the first hollow container. A third disc can be formed (e.g., punched or cut) from a surface of the second disc, the third disc having a perimeter that can be fitted onto a third hollow container

having an opening sized to be smaller than the opening of the second hollow container. By this method, each aperture formed in one closure, for a particularly-sized opening of a hollow container, can be used to form a closure sized for a smaller opening of a smaller hollow container.

5 A package as described can be used to contain any type of food or non-food product, e.g., under pressure (at an interior pressure that is above atmospheric pressure). Particular embodiments of packages can be used to contain raw dough. A dough contained by a package as described may be of any formulation, with preferred doughs being capable of expanding within the package to contact a vent to seal the package from
10 within. The dough generally will have a rheology, formulation (e.g., water content), and texture to allow expansion of the dough inside the package, against the package interior, optionally and preferably to contact and close a vent from the package interior. The dough may be yeast or chemically leavened, and for use according to the invention may desirably include a leavening system that provides predictable leavening and expansion
15 after packaging and during refrigerated storage.

 Examples of useful dough types include developed and non-developed chemically leavened doughs such as bread doughs, pizza doughs, sweet rolls, rolls, etc. Specific formulations of dough compositions that may be useful as doughs within the present description, include chemically leavenable dough formulations, yeast-leavened
20 dough formulations, combinations of yeast and chemically leavened dough formulations. The dough may be a developed dough formulation or a non-developed dough, such as one of those described in any of the following patent applications: U.S. Serial No. 09/945,204, filed August 31, 2001, titled "CHEMICAL LEAVENED DOUGHS AND RELATED METHODS," (now U.S. Patent Publication No. 2003/0049358); U.S. Serial
25 No. 10/446,481, filed May 28, 2003, titled "PACKAGED DOUGH PRODUCT IN FLEXIBLE PACKAGE, AND RELATED METHODS," (now U.S. Patent Publication No. 2004/0241292); U.S. Serial No. 10/273,668, filed October 16, 2002, titled "DOUGH COMPOSITION PACKAGED IN FLEXIBLE PACKAGING WITH CARBON DIOXIDE SCAVENGER," (now U.S. Patent No. 7,235,274); U.S. Serial No.
30 11/132,831, filed May 19, 2005, titled "PACKAGED, NON-DEVELOPED DOUGH PRODUCT IN LOW PRESSURE PACKAGE, AND RELATED COMPOSITIONS AND METHODS," (now U.S. Patent Publication No. 2005/0271773); U.S. Serial No. 11/132,826, filed May 19, 2005, titled "PACKAGED, DEVELOPED DOUGH

PRODUCTION IN LOW PRESSURE PACKAGE, AND RELATED METHODS,”
(now U.S. Patent Publication No. 2005/0281922); U.S. Serial No. 12/306,745, filed July
11, 2007, titled “DOUGH PRODUCT AND VENTED PACKAGE,” (now U.S. Patent
Publication No. 2010/0021591); and U.S. Serial No. 11/334,301, filed January 18, 2006,
5 titled “REFRIGERATED DOUGH AND PRODUCT IN LOW PRESSURE
CONTAINER,” (now U.S. Patent Publication No. 2006/0177558); the entireties of each
of these being incorporated herein by reference.

As stated, the packaged dough product can include any type or formulation of
yeast or chemically-leavenable dough composition that expands, such as by production
10 of carbon dioxide, after packaging and optionally during refrigerated storage. Many if
not all formulations of (pre-proofed or unproofed) yeast and chemically-leavenable
dough compositions evolve an amount of carbon dioxide prior to or during refrigerated
storage, causing expansion of the dough as presented in this description, within a
package having vents.

15 Preferred dough compositions can be formulated, in combination with selection
of a size of an internal volume of a package and an amount (e.g., volume) of dough to be
contained within the package, such that upon expansion of the dough within the package
a desired internal pressure is achieved. An exemplary pressure can be a positive pressure
(gauge) such as greater than one atmosphere (0 psig), such as a pressure in the range
20 from 1 to 30 pounds per square inch, gauge (psig), such as within the range from 5 to 25
psig. The dough can be placed in the package at a specific volume that is below the
specific volume to which the dough will expand in the package, e.g., a specific volume
of less than 2.0 cubic centimeters per gram (cc/g), such as below 1.5 cc/g, or a specific
volume in the range from 0.9 to 1.1 or 1.2 cc/g. After being placed in the package, and
25 after the package is closed (e.g., a closure is placed on an opening) the dough can expand
to partially proof or proof within the package to a desired raw specific volume. An
example of a partially-proofed or pre-proofed dough may be a dough having an
expanded raw specific volume in the range from 1.5 to 2.0 cubic centimeters per gram
(as measured after removal from the package).

30 Yeast and chemically-leavened dough compositions can be prepared from
ingredients generally known in the dough and bread-making arts, typically including
flour, a liquid component such as oil or water, a leavening agent such as yeast or
chemical leavening agents, and optionally additional ingredients such as shortening, salt,

sweeteners, dairy products, egg products, processing aids, emulsifiers, particulates, dough conditioners, yeast as a flavorant, flavorings, and the like.

As an example, unproofed doughs generally have a raw specific volume within the approximate range of 0.9 to 1.1 cubic centimeters per gram (cc/g). An amount of dough having predictable refrigerated leavening properties can be expected to expand to a desired raw specific volume during refrigerated storage, when allowed to expand within a fixed-volume container. A relevant parameter is the amount of unleavened raw dough volume compared to internal package volume (meaning a fixed or a maximum or “expanded” package volume). According to embodiments of the invention, a volume of unproofed dough per package volume (e.g., having a raw specific volume in the range from 0.9 to 1.1) can be about 50 to 90 percent dough volume per package volume, such as from 80 to 85 percent dough volume to package volume. With certain doughs of the invention, having predictable refrigerated leavening properties, this ratio of non-expanded dough to maximum package volume has been identified as useful to produce a packaged dough product having an internal pressure of 1 to 30 psig, e.g., 5 to 25 psig, or 8 to 15 psig, after allowing the dough to expand inside of the package to a raw specific volume in the range from 1.5 to 2.0 cc/g, e.g., 1.6 to 1.9 cc/g (measured after removal from the package).

Dough compositions that exhibit predictable refrigerated leavening properties can include various types of dough, including doughs formulated with yeast for leavening, chemical leavening systems, or a combination of yeast and chemical leavening systems used for leavening. Doughs may be developed or non-developed types of doughs and dough products. Yeast-leavened doughs can exhibit predictable refrigerated leavening properties based on selection of a yeast that has predictable behavior such as a substrate-limited yeast (in combination with selected substrates), a cold-temperature sensitive yeast, combinations of these types of yeasts, and combinations of these types of yeasts with other ingredients such as a cold-temperature sensitive yeast used in combination with ethanol. Examples of these types of predictable yeasts are described in US patent Nos. 5,939,109, 5,798,256, 5,759,596, 5,650,183, the entireties of which are incorporated herein by reference.

Other examples dough formulations having predictable refrigerated leavening properties can be certain types of chemical leavened doughs, such as those formulated

with acidic or basic chemical leavening agents that are specifically chosen to produce a desired effect on the timing or amount of leavening during refrigerated storage.

Chemically-leavenable (also referred to as “chemically-leavened”) dough compositions are dough compositions that leaven to a substantial extent by the action of chemical ingredients that react to produce a leavening gas. Typically the ingredients include a basic chemical leavening agent and an acidic chemical leavening agent that react to produce carbon dioxide, which, when retained by the dough matrix, causes the dough to expand.

Acidic chemical leavening agents are generally known in the dough and bread-making arts, with examples including sodium aluminum phosphate (SALP), sodium acid pyrophosphate (SAPP), monosodium phosphate, monocalcium phosphate monohydrate (MCP), anhydrous monocalcium phosphate (AMCP), dicalcium phosphate dihydrate (DCPD), glucono-delta-lactone (GDL), as well as a variety of others. Commercially available acidic chemical leavening agents include those sold under the trade names: Levn-Lite® (SALP), Pan-O-Lite® (SALP+MCP), STABIL-9® (SALP+AMCP), PY-RAN® (AMCP), and HT® MCP (MCP). Optionally, an acidic chemical leavening agent can be encapsulated. Optionally, a combination of acidic agents can be useful to produce desired leavening properties; e.g., a dough formulation may include a soluble acidic agent to produce a desired (predictable) amount of leavening and expansion of a dough during refrigerated storage, and an amount of low solubility acidic agent can be included to produce additional expansion during baking.

Soluble acidic chemical leavening agent is considered to be soluble in a liquid (e.g., aqueous) component of the dough composition, at a temperature used during processing (e.g., from 40 to about 72 degrees Fahrenheit) or refrigerated storage (e.g., from about 32 to about 55 degrees Fahrenheit). A soluble acidic chemical leavening agent is an acidic agent that is sufficiently soluble to dissolve in a dough composition at a temperature within processing and refrigerated storage ranges to react with a basic chemical agent if available, e.g., is freely soluble or will substantially entirely dissolve. Particularly useful soluble acidic chemical leavening agents include glucono-delta-lactone and sodium acid pyrophosphate (SAPP) of a moderate to high solubility e.g., SAPP 60, SAPP 80, as well as other acidic chemical leavening agents that exhibit similar solubility behavior.

Soluble acidic chemical leavening agent can be present in an amount that provides refrigerated stability, desired refrigerated raw specific volume, and desired baked leavening properties following refrigerated storage. Exemplary amounts of soluble acidic agent can be included to provide a raw specific volume in the range from 1.5 to 2.0 grams per cubic centimeter upon expansion during refrigerated storage, as well as a desired baked specific volume upon baking, such as a baked specific volume in the range from 3.0 to 4.5.

Insoluble acidic chemical leavening agent refers to acidic chemical leavening agents that are not substantially soluble at a processing or refrigeration temperature, but are insoluble or only slightly soluble at processing and refrigerated storage temperatures, and that are substantially soluble at temperatures that a dough reaches during baking (e.g., early baking). Insoluble acidic chemical leavening agents include sodium aluminum phosphate (SALP) and other acidic chemical leavening agents that have solubility properties that are similar to SALP.

A combination of soluble and insoluble acidic agents may be useful to produce a combination of desired raw and baked specific volumes. A desired raw specific volume can result from the soluble acidic agent reacting to produce a desired amount of leavening gas during processing or refrigerated storage. A desired baked specific volume can result from the insoluble acidic agent reacting to produce an amount of leavening gas during baking.

The total amount of acidic chemical leavening agent included in a dough composition can be an amount that is useful to prepare a dough composition having desired raw and baked specific volumes, and desirable expansion properties for use within a package of this description. An amount of acidic agent that is stoichiometric to the amount of basic agent can be useful, as well as amounts that are above and below a stoichiometric amount. Amounts of acid or base leavening agents are sometimes used in amounts based on neutralization value, which is the amount of base (by weight) neutralized by 100 parts by weight leavening acid. Amounts of soluble and insoluble acidic agents can be in the range from 40:60 to 60:40, based on neutralization values. Specific exemplary ranges of useful amounts of total acidic chemical leavening agent (e.g., soluble acidic agent, insoluble acidic agent, or a combination of these), can be in the range from about 0.5 to about 2.75 weight percent based on the total weight of a

dough composition, including the range from about 0.75 to about 2.25 weight percent, based on total weight of a dough composition.

The dough composition also includes basic chemical leavening agent, such as an encapsulated basic chemical leavening agent. Useful basic chemical leavening agents are generally known in the dough and baking arts, and include soda, i.e., sodium bicarbonate (NaHCO_3), potassium bicarbonate (KHCO_3), ammonium bicarbonate (NH_4HCO_3), etc. These and similar types of basic chemical leavening agents are generally freely soluble in an aqueous component of a dough composition at processing and refrigerated storage temperatures.

The amount of basic chemical leavening agent used in a dough composition may be sufficient to react with the included acidic chemical leavening agent to release a desired amount of gas for leavening, thereby causing a desired degree of expansion of the dough product. Exemplary amounts of basic chemical leavening agent such as sodium bicarbonate may be in the range from about 0.2 or 0.25 to about 1.5 weight percent based on the total weight of a dough composition, including the range from about 0.75 to about 1.25 weight percent based on total weight of a dough composition. (As used throughout this description and claims, unless otherwise noted, amounts of basic chemical leavening agents and encapsulated basic chemical leavening agents are given in terms of the amount of active basic agent, not including the weight of any encapsulant or barrier material.)

Encapsulated basic chemical leavening agents are generally known, and can be prepared by methods known in the baking and encapsulation arts. An example of a method for producing enrobed particles is the use of a fluidized bed.

A dough for use according to this description, whether chemically or yeast-leavened, developed, or non-developed, can contain other ingredients generally known in the dough and bread-making arts, typically including flour, a liquid component such as oil or water, sugar (e.g., glucose), chemical leavening agents as described, and optionally additional ingredients such as shortening, salt, dairy products, egg products, processing aids, emulsifiers, particulates, dough conditioners, yeast as a flavorant, other flavorings, etc. Many dough formulations are known to those skilled in the dough and baking arts and are readily available to the public in commercial cookbooks.

A flour component can be any suitable flour or combination of flours, including glutenous and nonglutenous flours, and combinations thereof. The flour or flours can be

whole grain flour, flour with the bran and/or germ removed, or combinations thereof. Typically, a dough composition can include between about 30 and about 50 weight percent flour, e.g., from about 35 to about 45 weight percent flour, based on the total weight of a dough composition.

5 Examples of liquid components include water, milk, eggs, and oil, or any combination of these, as will be understood to be useful in chemically-leavened, non-developed dough compositions. Water from these components and similar ingredients is available to hydrate flour or protein, and is understood to be "available water." For example, liquid components may provide available water (added as an ingredient and as
10 part of other ingredients), e.g., in an amount in the range from about 15 to 40 weight percent, e.g., from 25 to 35 weight percent, although amounts outside of this range may also be useful. Water may be added during processing in the form of ice, to control the dough temperature in-process; the amount of any such water used is included in the amount of liquid components. The amount of liquid components included in any
15 particular dough composition can depend on a variety of factors including the desired moisture content of the dough composition.

 A dough composition can optionally include fat ingredients such as oils and shortenings. Examples of suitable oils include soybean oil, corn oil, canola oil, sunflower oil, and other vegetable oils. Examples of suitable shortenings include animal
20 fats and hydrogenated vegetable oils. Fat may be used in an amount less than about 20 percent by weight, often in a range from 5 or 10 weight percent to 20 weight percent fat, based on total weight of a dough composition.

 Dough compositions described herein can be prepared according to methods and steps that are known in the dough and dough product arts. These can include steps of
25 mixing or blending ingredients, folding, lapping with and without fat or oil, forming, shaping, cutting, rolling, filling, etc., which are steps well known in the dough and baking arts.

Example of canned dough formula and packaging configuration.

30 Refrigerated biscuit dough was mixed, sheeted and formed using the following formula. The batch sizes were 22.5 kg.

Dough Ingredients	Percent
FLOUR, HARD WINTER	48
WATER, FOOD CONTACT	28
SHORTENING FLAKES	14
GRANULATED SUGAR	4
BUTTERMILK SOLIDS EXTRA GRADE	3
SALT	1
SODIUM ACID PYROPHOSPHATE (SAPP)	1
SODIUM BICARBONATE	1
SODIUM ALUMINUM PHOSPHATE (SALP)	0.2

Biscuits were placed into standard refrigerated dough cans with a diameter of 2.875 inches. Inserts were placed on top of the dough, and the can was sealed with lids

5 (closures) with holes (apertures) of 2.0 and 2.5 inches in diameter.

The cans were then held at 40F and the package integrity and product evaluated over 12 weeks.

The types of insert material tested were PET (polyester), LDPE (low density polyethylene), HIPS (high impact polystyrene), and can wall material (cardboard). The
10 thickness of the inserts ranged from 10-30 mils. The diameter of the insert was held constant at 2.75 inch.

Insert material	Thicknesses tested (inches)	Can integrity
PET	0.018 inch, 0.030	+++ ,+++
HDPE	0.018, 0.025	+++
LDPE	0.020	+++
HIPS	0.030	-
Can Wall material (composite)		+

Satisfactory can integrity was achieved with all the insert materials except HIPS, which
15 cracked upon pressurizing. Thinner materials deflected more than thicker materials. Can wall material held pressure, but developed a large bend or fold.

Product performance was typical, i.e. no changes in baked specific volume, color or texture were evident when compared to product packaged with control can ends.

Attorney Docket No.: 7415WO01

Claims:

1. A package capable of being pressurized internally to above atmospheric pressure, the package comprising
 - an interior space defined by a hollow container having sidewalls and an opening at an end of the sidewalls, and
 - a closure at the opening, the closure comprising
 - a perimeter that engages the end of the sidewalls,
 - a surface extending between locations of the perimeter,
 - an aperture in the surface, and
 - an insert that covers the aperture.
2. A package according to claim 1 wherein the package is a vented package capable of being sealed by expansion of dough within the interior space.
3. A package according to example claim 1 or 2 wherein the surface contains no more than one aperture.
4. A package according to any of claims 1 through 3 wherein the insert comprises plastic.
5. A package according to any of claims 1 through 4 wherein the insert is at least partially transparent and the insert allows viewing of the interior space.
6. A package according to any of claims 1 through 5 wherein the hollow container comprises an elongate cylinder having sidewalls extending between two openings at opposing ends of the sidewalls, and a closure at each opening, each closure comprising
 - a perimeter that engages an end of the sidewalls,
 - a surface extending between locations of the perimeter,
 - aperture in the surface, and
 - an insert in the interior side of the surface, covering the aperture.

7. A package according to claim 6 wherein the hollow container comprises an elongate cylinder comprising material selected from: a wound cardboard cylinder, a non-wound cardboard cylinder, and a plastic cylinder.
8. A package according to any of claims 1 through 7 comprising a vent between the perimeter and the end of the sidewalls.
9. A package according to any of claims 1 through 7 comprising a vent between the closure aperture and the insert.
10. A packaged dough composition comprising a package according to any of claims 1 through 9 containing a dough and having an internal pressure in the range from greater than 0 to 30 pounds per square inch (gauge).
11. A package according to any of claims 1 through 9 wherein the perimeter is circular and has diameter in a range from 3 to 12 centimeters, and the aperture is circular and has a dimension in the range from 0.3 to 11 centimeters.
12. A method of preparing a pressurized packaged dough product, the method comprising
 - providing a package according to any of claims 1 through 9 and 11,
 - placing dough in the interior space,
 - placing the closure at an end opening, and
 - allowing the dough to expand within the interior space such that gas vents from the interior space and expanded dough seals the container.
13. A method according to claim 12 wherein the dough expands to produce a pressurized interior.
14. A packaged dough product comprising dough in a self-sealed, pressurized dough package, the product comprising
 - a package comprising
 - an interior space defined by a hollow container having sidewalls,

an opening at an end of the sidewalls, and
a vent,
a dough product within the interior space,
a closure at the opening, the closure comprising an aperture that allows
viewing of the dough product in the interior space,
wherein the package is pressurized and the vent is sealed by expanded dough in the
interior space.

15. A method of preparing a pressurized packaged dough product, the method
comprising

providing a hollow container comprising an interior space, the container
having sidewalls and an opening at the end of the sidewalls,
placing dough in the interior space,
placing a closure at an opening, the closure comprising
a perimeter that engages the end of the sidewalls,
an aperture at a location inside of the perimeter, and
an insert that covers the aperture,
allowing the dough to expand within the interior space, such that gas
vents from the container and expanded dough seals the container.

16. A method of preparing a pressurized packaged dough product, the method
comprising

providing a hollow container comprising an interior space, the container
having sidewalls and an opening at an end of the sidewalls,
placing dough in the interior space,
providing a first closure comprising a perimeter that engages the end of
the sidewalls and a surface extending between locations of the perimeter,
removing a second closure from the surface of the first closure to form an
aperture at the surface,
providing an insert,
placing dough in the interior space,
placing the first closure at the end opening,
placing the insert to cover the aperture, and

allowing the dough to expand in the interior space such that gas is vented from the container and expanded dough seals a vent.

17. A method according to claim 16 comprising

providing a second hollow container comprising a second interior space, the second hollow container having second sidewalls and a second opening at an end of the second sidewalls,

placing dough in the second interior space,

providing the second closure, wherein the second closure comprises a second closure perimeter that engages the end of the second sidewalls, and a second closure surface extending between locations of the second perimeter,

forming an aperture at the second closure surface,

providing a second insert,

placing dough in the second interior space,

placing the second closure at the second end opening,

placing the second insert to cover the aperture at the second surface,

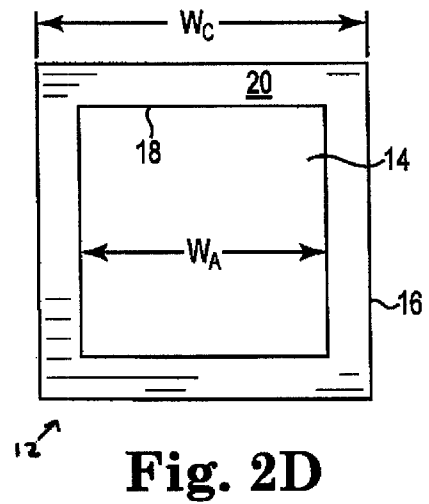
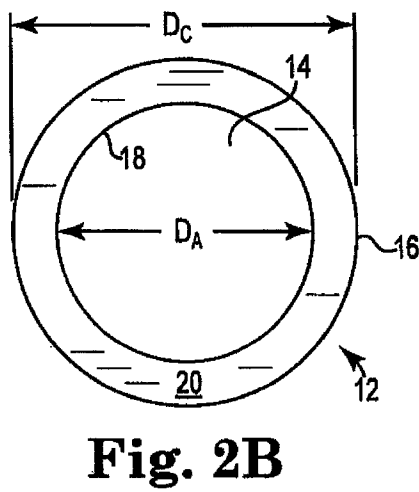
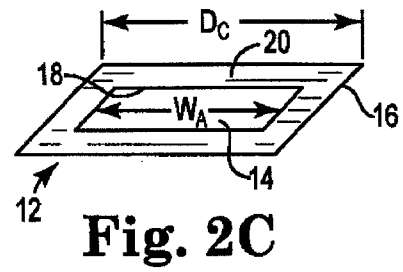
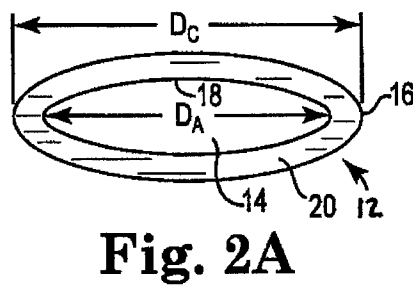
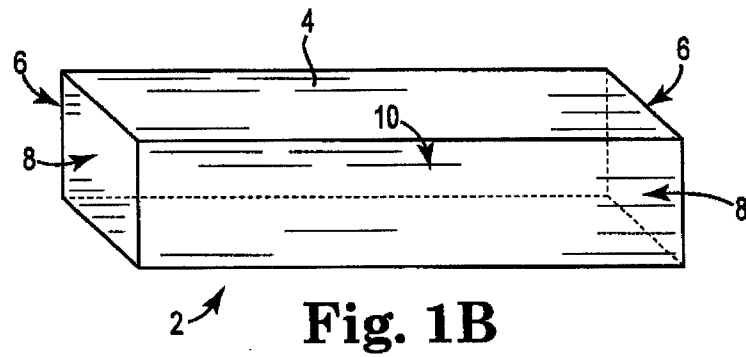
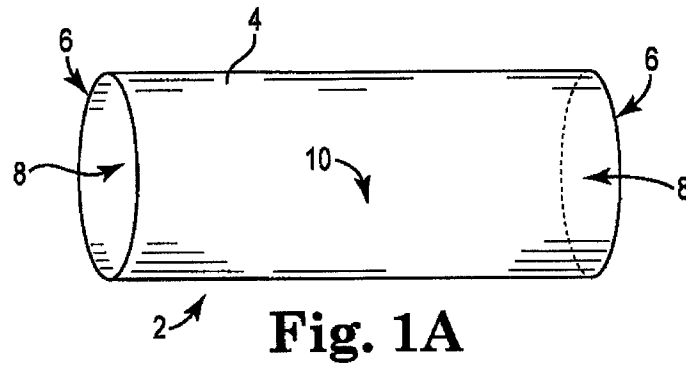
allowing the dough to expand in the second interior space such that gas is vented from the second container and expanded dough seals a vent.

18. A method according to claim 16 or 17 wherein the perimeter of the first closure is circular and has diameter in a range from 4 to 5 inches, and the aperture of the first closure is circular and has a dimension in the range from 1 to 4 inches.

19. A method according to claim 17 or 18 wherein the perimeter of the second closure is circular and has diameter in a range from 2 to 4 inches, and the aperture of the second closure is circular and has a dimension in the range from 0.3 to 2 inches.

20. A packaged dough composition according any of claims 10, 11, and 14, wherein the dough comprises from 30 to 50 weight percent flour, from 15 to 40 weight percent water, and less than 20 weight percent fat, based on the total weight of dough composition.

21. A method according to any of claims 12, 13, 15, 16, 17, 18, and 19, wherein the dough comprises from 30 to 50 weight percent flour, from 15 to 40 weight percent water, and less than 20 weight percent fat, based on the total weight of dough composition.
22. A package according to any of claims 1 through 9 and 11 wherein the sidewalls comprise an inner layer comprising an anaconda fold.
23. A package according to any of claims 1 through 9 and 11 wherein the sidewalls do not include an anaconda fold.
24. A package according to any of claims 1 through 9, 11, 22, and 23, wherein the closure comprises a metal and the insert comprises a non-metal.
25. A package according to claim 24 wherein the non-metal is selected from a polymeric material, cardboard, and paperboard.
24. A package according to any of claims 1 through 9, 11, 22, 23, and 24, comprising adhesive between a surface of the closure and a surface of the insert.



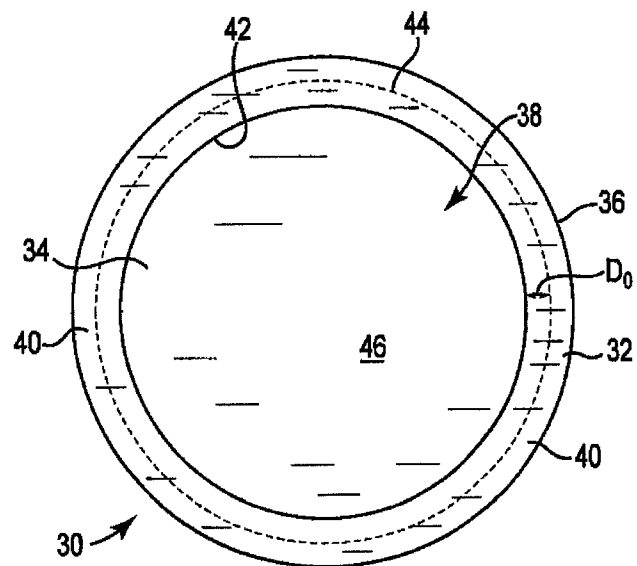


Fig. 3A

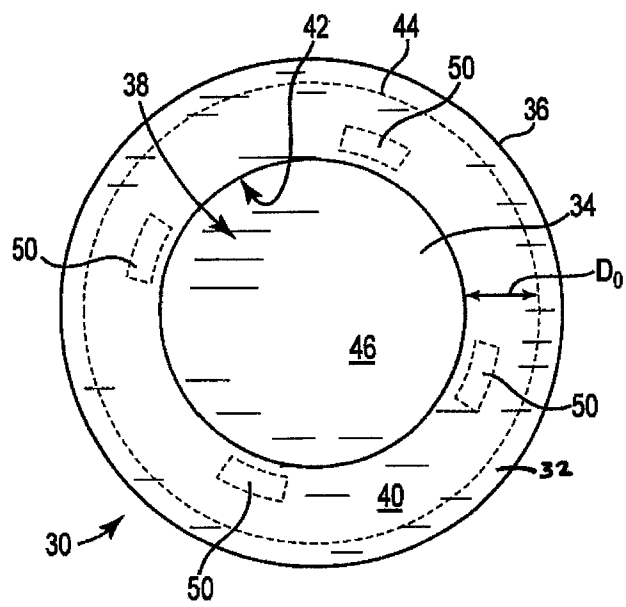


Fig. 3B

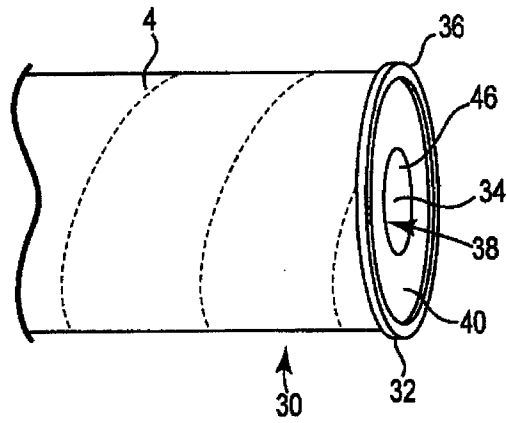


Fig. 4A

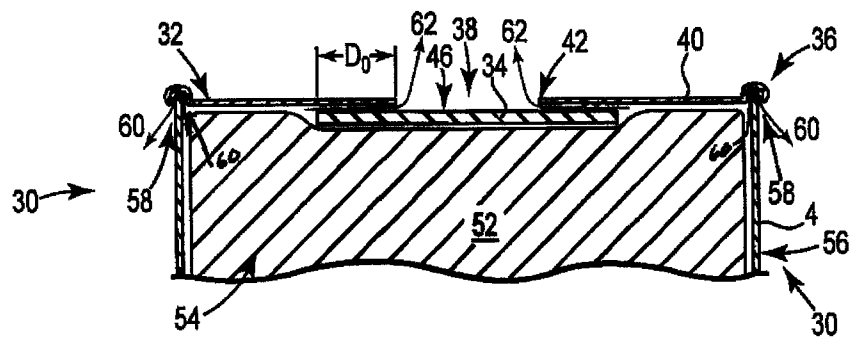


Fig. 4B

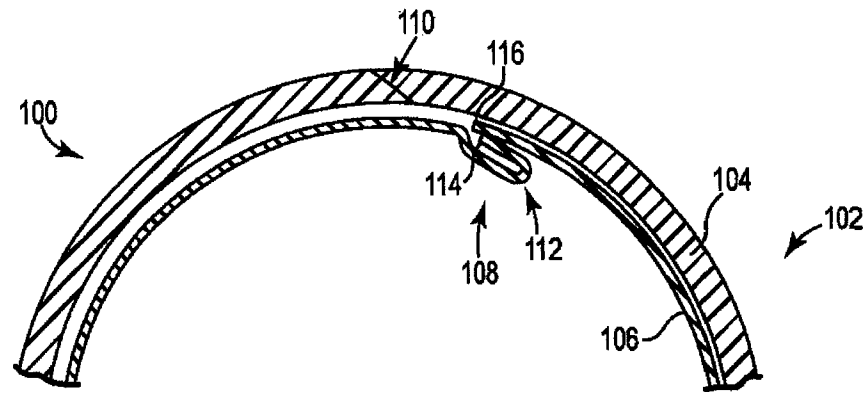


Fig. 5

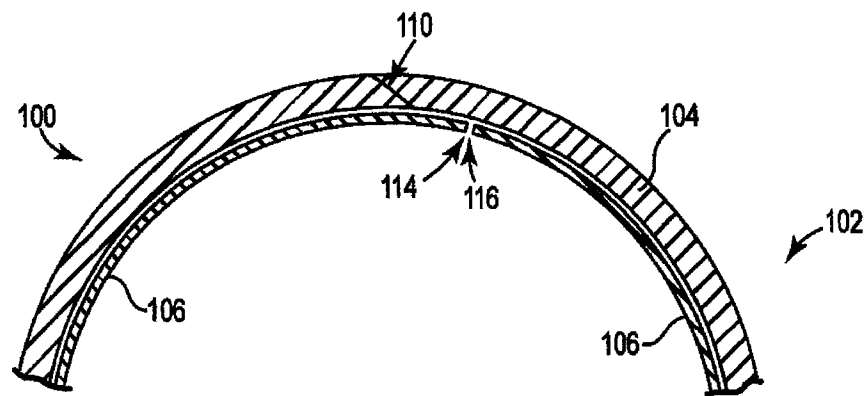


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 11/45695

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B65D 81/20; A21D 10/02; B65D 85/00 (2011.01)

USPC - 426/118; 426/128; 426/395

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - B65D 81/20; A21D 10/02; B65D 85/00 (2011.01)

USPC - 426/118; 426/128; 426/395

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

USPC - 426/118; 426/128; 426/395 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Dialog; Google Scholar; Google Patent; WIPO Patent Search; USPTO

Search Terms used: dough, product, packaging, proof, insert, aperture, closure, vent, pillsbury, transparent, food, diameter, inches, endcap, opening, circular, second closure, first closure, inch, plastic, removing

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2008/008804 A2 (DOMINGUES, et al.) 17 January 2008 (17.01.2008), entire document especially pg 1, ln 30-32; pg 4, ln 17-20; pg 9, ln 19-24; pg 10 ln 13-19; pg 27, claim 11	1-3, 14-17
Y	US 5,547,694 A (PERRY, et al.) 20 August 1996 (20.08.1996), entire document especially col 4, ln 21-33; 35-46; col 2, ln 36-39	1-3, 15-17
Y	US 4,545,509 A (CRIBB, Jr., et al.) 08 October 1995 (09.10.1995), entire document especially fig. 2	16-18
Y	US 5,314,702 A (LEWANDOWSKI, et al.) 24 May 1994 (24.05.1994), entire document especially col 4, ln 23-29; col 7, ln 20-29	14
Y	US 6,378,763 B1 (NELSON, et al.) 20 April 2002 (30.04.2002), entire document especially col 1, ln 24-32	14
Y	US 3,851,757 A (TURPIN) 03 December 1974 (03.12.1974), entire document especially col 2, ln 63-66	17, 18
Y	US 4,919,949 A (MITZ, et al.) 24 April 1990 (24.04.1990), entire document especially col 7, ln 61-64	18
Y	US 5,083,671 A (HAYES) 28 January 1992 (28.01.1992), entire document especially col 2, ln 30-33	18
Y	US 3,312,368 A (REYNOLDS, et al.) 04 April 1967 (04.04.1967) col 4, ln 20-25	14

☐ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search

30 November 2011 (30.11.2011)

Date of mailing of the international search report

19 DEC 2011

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 11/45695

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☒ Claims Nos.: 4-13, 19-23, 24a, 25, 24b
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.