

CONTAINER AND CLOSURE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application No. 61/483,948, filed May 9, 2011, the disclosure of which is hereby incorporated by reference in its entirety.

FIELD OF THE DISCLOSURE

[0002] The present disclosure relates generally to closures for containers, such as plastic disposable containers and the like. More particularly, the present disclosure relates generally to closures for containers adapted to be press-fit to a container and configured to be subsequently threadably removed therefrom.

BACKGROUND OF THE DISCLOSURE

[0003] Infant nutritionals, adult and medical nutritionals, sport nutritionals, energy drinks, soft drinks, and the like often times are provided in plastic bottles or other disposable containers. The bottles are typically sealed after being filled with a product to prevent product degradation and/or contamination of the product. Foil seals may be particularly desirable for products that are aseptically processed.

[0004] Sealing film, such as foil or plastic film, commonly referred to as "seals," is generally considered the most robust form of a sealing closure for plastic bottles. Some consumers, however, prefer direct seal screw caps over seals because the seals typically require multiple steps to open (i.e., removal of the plastic cap, removal of the seal and disposal of the seal). Additional steps may be required if the seal tears in an unexpected manner during removal. Such unexpected and undesired tearing of the seal can lead to frustration by the user, spilling of the contents of the bottle or foil scrap entering the bottle and contaminating the contents.

[0005] Screw caps are also used for sealing containers. However, screw caps are difficult to install onto containers during the manufacturing process, as compared to foil seals. Further, removal of a screw cap may entail application of removal torque sufficient to break a tamper evident seal, overcome the frictional forces of the threads,

and also the force required to break the seal of the container. As such, screw caps may be difficult for elderly or arthritic individuals due to requiring a high removal torque, such as more than 15 in*lbs, with many containers requiring 20 in*lbs of removal torque to open. Other screw caps may also include a shrink band that covers the cap for tamper evidence. However, such tamper evident shrink bands may also be difficult for individuals to remove, and require the additional step of removing and discarding the shrink band before unscrewing the cap.

[0006] Accordingly, there is an unmet need for a convenient closure that remedies existing issues with sealed bottles.

SUMMARY OF THE DISCLOSURE

[0007] The present disclosure is directed to closures for various types of containers, including plastic, metal, composite and glass containers. The closures described herein are capable of being snap-fit (also interchangeably referred to herein as "press-fit") to a container using a downward force, yet removed by unscrewing the cap from the container. In some embodiments, the closures described herein provide a hermetic seal for an aseptically filled container. In some embodiments, the described closures are two piece closures including a sealing member that is snap-fit to the container independently of the cap member, such that the cap member is capable of rotating independently of the sealing member.

[0008] In one aspect, a closure for a container is described. The container has an opening through which contents of the container are dispensed and a holding member for cooperating with the closure to retain the closure on the container. A sealing member is configured to sealingly close the container opening. The sealing member includes a retention member engageable with the holding member of the container to retain the sealing member in sealing engagement with the container. A cap member has a top rim and a sidewall depending from the top rim. The sidewall includes an attachment member for attachment to the container and an engagement member that operatively couples the sealing member to the cap member upon placement of the cap member on the container. The cap member is rotatable relative to the container and relative to the sealing member.

[0009] In another aspect, a method of applying a closure to a container is described. The container includes at least one opening through which contents of the container are dispensed. The method includes press-fitting a sealing member onto the container over the container opening such that a retention member of the sealing member engages a holding member of the container. An axial force resulting from said press-fitting retains the sealing member in sealing engagement with the container to sealingly close the container opening. The method includes applying a cap member to the container at the sealed container opening. The cap member includes a top rim and a sidewall depending therefrom. The sidewall includes an attachment member for engagement with the container and an engagement member coupling the sealing member to the cap member upon application of the cap member to the container. The cap member being rotatable relative to both the container and the sealing member.

[0010] In yet another aspect, a container includes a container body having a neck and a holding member disposed on an outer periphery of the neck. The neck has a rim defining an opening to the container for dispensing contents of the container. A sealing member is configured to seal the opening of the container. The sealing member includes a retention member configured to engage the holding member of the container. The retention member is configured to hold the sealing member in sealing engagement with the container by an axial force resulting from the press-fitting. A cap member includes a top rim and a sidewall that extends downward from the top rim. The sidewall includes an attachment member for engagement with the neck of the container and an engagement member that operatively couples the sealing member to the cap member upon placement of the cap member on the container. The cap member is rotatable relative to the container and relative to the sealing member.

[0011] In yet another aspect, a press-on, twist-off closure for a container includes a top wall and a substantially cylindrical sidewall that extends from an outer circumference of the top wall. The sidewall includes threads configured for rotational engagement with a threaded neck of the container. An annular lip extends from a lower surface of the top wall and is substantially parallel to the sidewall and spaced apart from the sidewall such that a rim of the container is sealable at the space between the annular lip and the sidewall. The sidewall is configured to flex radially outwardly upon

application of an axial force to the top wall such that the closure is capable of being pressed onto the rim of the container. The threads are configured to hold the space between the annular lip and the sidewall in sealing engagement with the rim of the container.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The objects, features and advantages of the present disclosure will become more apparent from a reading of the following description in connection with the accompanying drawings.

[0013] Fig. 1 is a perspective view of an embodiment of a container and closure assembly.

[0014] Fig. 2 is a partial section of the closure shown in Fig. 1 taken in the plane of the line 2-2 of Fig. 1.

[0015] Fig. 3 is a partial section of another embodiment of the closure shown in Fig. 1 taken in the plane of line 2-2 of Fig. 1. Fig. 3A is a magnified detail view of portion A of Fig. 3.

[0016] Fig. 4 is a partial section of an embodiment of a two piece closure. Fig. 4A is a magnified detail view of portion A of Fig. 4.

[0017] Fig. 5 is a partial section of another embodiment of a two piece closure. Fig. 5A is a magnified detail view of portion A of Fig. 5.

[0018] Fig. 6 is a partial section of an embodiment of a sealing member.

[0019] Fig. 7 is a partial section of another embodiment of a sealing member.

[0020] Fig. 8 is a partial section of another embodiment of a sealing member.

[0021] Fig. 9 is a partial section of another embodiment of a sealing member.

[0022] Fig. 10 is a partial section of another embodiment of a sealing member.

[0023] Fig. 11 is a partial section of another embodiment of a sealing member.

[0024] Fig. 12 is a partial section of another embodiment of a sealing member.

[0025] Fig. 13 is a partial section of another embodiment of a sealing member.

[0026] Fig. 14 is a partial section of another embodiment of a sealing member.

[0027] Fig. 15 is a partial section of another embodiment of a sealing member.

[0028] Fig. 16 is a partial section of another embodiment of a sealing member.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0029] The present disclosure provides closures for various types of bottles and containers. The closures described herein substantially provide a hermetic seal for aseptically filled containers by using a press-on sealing member and twist-off cap. The present disclosure provides a solution to the longstanding problem of removing a cap and seal of a container in a single step without a high removal torque. The closures described herein accomplish this by, for example, a pressed on sealing member that hermetically seals the container, and a cap member that is twisted on/off and which removes the sealing member when twisted off.

[0030] For the purposes of promoting an understanding of the principles of the present disclosure, reference will now be made to embodiments and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the claims is thereby intended, such alteration and further modifications of the readings of the disclosure as illustrated herein, being contemplated as would normally occur to one skilled in the art to which the disclosure relates.

[0031] Articles “a” and “an” are used herein to refer to one or to more than one (i.e. at least one) of the grammatical object of the article. By way of example, “an element” means at least one element and can include more than one element.

[0032] Unless otherwise defined, all technical terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure belongs.

[0033] The present disclosure describes closures for containers that may provide functionality to hermetically seal a container using a sealing membrane and provide removal of the closure using a low torque twist-off cap. The containers may be generally any suitable packaging for containing substances including, without limitation, glass, metal or plastic bottles, plastic containers, bags or pouches constructed of films or other plastics, and other suitable packaging.

[0034] The containers disclosed herein may be suitable for use with nutritional substances. As used herein the term "substance" may refer to a liquid product, a semi-liquid product, or powder product. The term "liquid product" means a product that is a flowable non-solid product including, for example but not limited to, aqueous solutions, solutions having a determinable viscosity, emulsions, colloids, pastes, gels, dispersions and other flowable non-solid products so as to exclude solid products such as bars and particulate products, such as powders.

[0035] Unless otherwise identified, like numerals in the Figures indicate like parts.

[0036] Figs. 1-3 show a container and closure assembly 100 according to a first embodiment. Closure 105 is adapted to close container 110. Container 110 comprises a body 120 and a neck 130. In one embodiment, neck 130 is generally cylindrical in shape, and container 110 is symmetric about longitudinal axis C. In other embodiments, container 110 may be non-symmetric, or symmetric about one or more axis. Container 110 may be any shape that allows the closures to function as described herein. Neck 130 includes a set of threads 135 on an outer surface 140 thereof. As used herein, the terms "inner" and "outer" may refer generally a radial direction of container 100 and/or closure 105. Set of threads 135 may include one or more threads that helically wrap at least partially around outer surface 140. Neck 130 includes an inner surface 145 that connects to outer surface 140 at a rim 150, which defines container opening 155. Container 110 may contain a substance, such as a liquid substance.

[0037] In the embodiment shown in Fig. 2, closure 105 is a single piece closure fitted to neck 130 of container 110 (Fig. 1). In the exemplary embodiment, closure 105 includes threads 160 that couple closure 105 to container 110 by threaded

engagement with threads 135. In one embodiment, to provide anti-backoff or tamper evidence for container 110, a tamper band 170 is connected to closure 105 by one or more frangible bridges 175. Tamper band 170 includes one or more ramps 180 that engage one or more locking projections 185 which are disposed on neck outer surface 140. In this embodiment, ramps 180 are engaged with locking protrusion 185 to prevent unintentional opening rotation of closure 105. Locking protrusion 185 may be rectangular, square, ramp shaped or the like for uni-directional engagement with ramps 180.

[0038] As used herein, the terms "closing rotation" and "opening rotation" refer to clockwise or counterclockwise rotation of one element with respect to another element. In one non-limiting example, for right-handed threads, closing rotation refers to clockwise rotation and opening rotation refers to counterclockwise rotation. In another non-limiting example, for left-handed threads, closing rotation refers to counterclockwise rotation and opening rotation refers to clockwise rotation. As one of skill in the art will appreciate, the orientations of the threads in the embodiments discussed herein can be switched if desired so long as the relationships described herein are preserved, thus allowing the closures to function as described herein.

[0039] In the embodiment of Fig. 2, closure 105 includes a top 190 and a substantially cylindrical sidewall 195. In one embodiment, an annular lip 200 is provided on a lower surface of top 190. In order to seal opening 155 of container 110, closure 105 is first placed over opening 155 such that a center of closure 105 is substantially aligned with central axis C. Closure 105 is then press-fit onto neck 130 by applying a force to closure 105 in the longitudinal (i.e., axial) direction of container 110 (Fig. 1) (e.g., the downward direction when the container and closure are in the upright position). As the closure 105 is pressed onto neck 130, sidewall 195 is configured to flex radially outward such that ramps 180 pass over threads 135 and locking projection 185. Sidewall 195 also flexes to allow threads 160 to pass over threads 135. The closure is pressed onto container 110 until a lower surface of top 190 contacts rim 150. At this point, closure 105 is considered to be "snap-fit" onto container 110. The snap-fit may make a "snapping" noise or other audible indication as one or more elements of closure 105 pass over and engage with elements of container 110. However, even if no audible indication

occurs, closure 105 is still considered to be snap-fit to container 110 when pressed thereon and sealed thereto. The closure is sized and configured such that top 190 is in sealing engagement with rim 150 when fully pressed on, for example, as shown in Fig. 2. In one suitable embodiment, closure 105 may be determined to be snap-fit to container 110 by sensing a force applied to closure 105 or the displacement of closure 105. For example, a sensor may measure and compare the applied force to closure 105 to a predetermined force, and when the applied force is within a certain range of the predetermined force, the closure is determined to be snap-fit. In another example, closure 105 may be determined to be snap-fit to container 110 after the closure has moved longitudinally a predetermined distance along neck 130. The distance closure 105 moves along neck 130 is measured and compared to a predetermined distance, and if the measured distance is within a range of the predetermined distance, the closure 105 is determined to be snap-fit to container 110.

[0040] In order to remove closure 105 from neck 130 of container 110 (Fig. 1), a user applies a torque in an opening rotation direction to closure 105. The torque in the opening direction causes closure 105 to threadably move in the longitudinal direction away from container 110, which breaks the sealing engagement of top 190 with rim 150. In embodiments wherein closure 105 is fitted with tamper band 170, the applied torque in the opening rotation direction causes frangible bridges 175 to break, indicating that the closure has been opened. In one embodiment, closure 105 is fabricated from plastic and may include a barrier layer 205 disposed on one or more of an outer surface or inner surface of top 190. In another embodiment, barrier layer 205 may be fabricated as a layer within closure 105. Barrier layer 205 may be an oxygen barrier or the like. In another embodiment, barrier layer 205 may include a design or decorative label.

[0041] In one embodiment, closure 105 includes gasket material 210 disposed on a lower or inner surface of top 190. Gasket material 210 is disposed annularly around a perimeter of top 190 such that it contacts rim 150. Gasket material 210 may be fabricated from a single or multi-layer film, plastisol, rubber, thermoplastic elastomer, foil, paper, plastic, laminate, other suitable sealing material or combinations thereof that is used to seal a substance within a container. In some embodiments, the gasket material 210 may be used to hermetically or aseptically seal container 110. In yet other

embodiments, gasket material 210 is an adhesive or sealing compound, which may be activated/cured by one or more of temperature, light or the like.

[0042] The closure 105 may also include a hole 215, for example as illustrated in Fig. 2. In other embodiments, closure 105 does not include a hole 215. Hole 215 may be used for cleaning, rinsing, drying or inspection of threads 135 and 160 after filling of container 110 (Fig. 1) and hermetic sealing has been created with closure 105, so as to help ensure threads 135 and 160 are clean when the container is later opened and consumed by the end user.

[0043] Figs. 3 and 3A illustrate another embodiment of a suitable single piece closure 105 similar to the closure 105 of Fig. 2. In this embodiment, the closure 105 includes gasket material 210 disposed on a lower surface of the top 190 of closure 105. Gasket material 210 is disposed annularly around a perimeter of the top 190 such that the gasket material 210 contacts the rim 150 when closure 105 is sealed on neck 103 of container 110 (Fig. 1). In one embodiment, gasket material 210 is also provided on annular projection 200 to improve the seal of container 110. In one particularly suitable embodiment, the annular projection 200 assists in alignment of the closure 105 on container 110 by guiding the rim 150 between the space between the sidewall 235 and the annular lip 200.

[0044] Figs. 4 and 4A illustrate another embodiment of a closure 105, which is a two piece closure. In this embodiment, closure 105 is a two piece closure, including a sealing member 220 and a cap member 225 that is separate from the sealing member 220. The sealing member 220 is configured to be press-fit onto rim 150 to seal opening 155. Sealing member 220 may be fabricated from metal, plastic, composites or combinations thereof. The sealing member 220 includes gasket material 210 disposed annularly around a perimeter of a first surface (i.e., a lower or inner surface) of sealing member 220 such that it contacts rim 150 when press-fit onto neck 130 of container 110 (Fig. 1).

[0045] In this embodiment, in order to seal container 110, sealing member 220 is first placed over opening 155 such that the center of sealing member 220 substantially aligns with the center of opening 155. Sealing member 220 is then press-fit down onto

neck 130 by applying a force to sealing member 220 in the longitudinal (i.e., axial) direction of container 110. As sealing member 220 is pressed onto neck 130, outer wall 227 of sealing member 220 presses tightly (e.g., snap-fit) against outer rim edge 230 to hold sealing member 220 in sealing engagement with rim 150. In one embodiment, sealing member 220 is press-fit onto container 110 in a sterile zone of a capping operation after container 110 has been aseptically filled with a substance. Subsequent to sealing member 220 being press-fit onto container 110, cap member 225 is fit over sealing member 220 and threadably coupled to container 110, either inside or outside of the sterile zone. In the exemplary embodiment, cap member 225 is substantially cylindrical and includes an upper ledge 230 and a sidewall 235 extending downward from ledge 210. Sidewall 235 includes threads 160 disposed on an inner surface thereof for threadable engagement with threads 135 of container 110.

[0046] In one suitable embodiment, cap member 225 is coupled to container 110 (Fig. 1) by applying a torque to cap member 225 causing a closing rotation of cap member 225 with respect to container 110. As such, cap member 225 is capable of rotating independently of sealing member 220. As used herein, independent rotation refers to the sealing member and the cap member being configured such that the cap member may rotate, at least for a partial turn, without causing rotation of the sealing member. Cap member 225 is rotated in the closing direction until ledge 230 is firmly pressed against upper edge 240 of sealing member 220. An engagement member 245 passes over upper edge 240 of sealing member 220, and is positioned below and apart from sealing member 220 when cap member 220 is fully seated (i.e., press-fit) on container 110. In one embodiment, cap member 225 includes a tamper band 170. Cap member 225 thus substantially ensures that sealing member 220 remains sealed on container 110 until desired opening of the container.

[0047] In order to remove closure 105 from container 110, a user applies a torque in an opening rotation direction to cap member 225. The torque in the opening rotation direction causes closure cap member 225 to rotate in the opening rotation direction independently of sealing member 220 and threadably move in the longitudinal direction away from container 110. As cap member 225 continues to move in the longitudinal direction, an engagement member 245 presses against lower part 250 of

outer wall 227 (i.e., in a longitudinal direction away from the center of container 110) which breaks the sealing engagement of sealing member 220 with rim 150. The engagement member 245 also functions to couple sealing member 220 to cap member 225 so that cap member 225 and sealing member 220 may be removed conjointly in a single operation. In embodiments wherein cap member 225 is fitted with tamper band 170, the applied torque in the opening rotation direction causes frangible bridges 175 to break, indicating that the closure has been opened.

[0048] The removal torque necessary to remove closure 105 may be reduced as compared to conventional closures. For example, upon initiating removal of closure 105, a user need only impart a torque necessary to overcome the frictional forces of threads 160 sliding against threads 135, which in one embodiment may be approximately 5 in·lbs. In embodiments wherein cap member 225 includes tamper band 170, a user must also initially impart enough torque to break frangible bridges 175, which may be an additional approximately 5 in·lbs. Thus, for example, if tamper band 170 is included, a user would need to only impart approximately 10 in·lbs of torque to cap member 225 in the opening rotation direction to initiate removal of closure 105. After the frangible bridges have broken the user no longer is required to impart the torque necessary to break bridges 175, thus reducing the torque back down to approximately 5 in·lbs. As a user continues to rotate the cap member 225 in the opening rotation direction, a user may encounter a slight increase in torque needed to unseat sealing member 220 from rim 150. Due to the helical shape of the threads 160 and 135, the sealing member 220 is unseated in a helical manner (rather than all at once), which reduces the torque necessary to unseat sealing member 220 from rim 150. Thus, in one embodiment, the torque necessary to unseat sealing member 220 from rim 150 is approximately 5 in·lbs. As such, in some embodiments, a user may not be required to impart more than approximately 10 in·lbs for closure removal.

[0049] Figs. 5 and 5A illustrate another embodiment of a closure 105, which is a two piece closure including a sealing member 220 and a cap member 225 that is separate from the sealing member 220. Sealing member 220 is configured to be press-fit onto rim 150 to seal opening 155. Sealing member 220 may be fabricated from metal, plastic, composites or combinations thereof. In one embodiment, sealing member 220

includes gasket material 210 disposed annularly around a perimeter of a first surface (i.e., a lower or inner surface) of sealing member 220 such that it contacts rim 150 when press-fit onto container 110 (Fig. 1). In this embodiment, rim 150 includes an annular bead portion 255 that projects radially inward from an inner surface of rim 150.

[0050] In the exemplary embodiment, gasket material 210 includes an annular groove 260 that corresponds to annular bead portion 255. In this embodiment, in order to seal container 110, sealing member 220 is first placed over opening 155 such that a center of sealing member 220 substantially aligns with a center of opening 155. Sealing member 220 is then press-fit onto neck 130 by applying a force to sealing member 220 in the longitudinal direction of container 110. As sealing member 220 is pressed onto neck 130, groove 260 of gasket material 210 engages with annular bead portion 255 to hold sealing member 220 in sealing engagement with rim 150. Sealing member 220 is press-fit onto container 110 in a sterile zone of a capping operation after container 110 has been aseptically filled with a substance. In one embodiment, sealing member 220 is sterilized in an aseptic area of a filling machine. The sealing member 220 may be sterilized using one or more of liquid hydrogen peroxide, vapor hydrogen peroxide, peracetic acid, electron beam radiation or other direct or indirect radiation or the like. Subsequent to sealing member 220 being press-fit onto container 110, cap member 225 is fit over sealing member 220.

[0051] In the exemplary embodiment, cap member 225 is substantially cylindrical and includes an upper ledge 230 and a sidewall 235 extending downward from ledge 230. Sidewall 235 includes threads 160 disposed on an inner surface thereof for threadable engagement with threads 135 of container 110. Cap member 225 is coupled to container 110 by applying a torque to cap member 225 causing a closing rotation of cap member 225 with respect to container 110. As such, cap member 225 is capable of rotating independently of sealing member 220. Cap member 225 is rotated in the closing rotation direction until ledge 230 is firmly pressed against upper edge 240 of sealing member 220. An engagement member 245 passes over upper edge 240 of sealing member 220, and is positioned below and apart from sealing member 220 when cap member 220 is fully seated on container 110. In one embodiment, cap member 225

includes a tamper band 170. In yet another embodiment, cap member 105 includes knurling 265 (shown also in Fig. 1).

[0052] In order to remove closure 105 from container 110, a user applies a torque in an opening rotation direction to cap member 225. The torque in the opening rotation direction causes cap member 225 to rotate in the opening rotation direction independently of sealing member 220 and threadably move in the longitudinal direction away from container 110. As cap member 225 continues to move in the longitudinal direction, engagement member 245 presses against lower part 270 of sealing member 220 which breaks the sealing engagement of sealing member 220 with rim 150. The engagement member 245 also functions to couple sealing member 220 to cap member 225 so that cap member 225 and sealing member 220 may be removed conjointly in a single operation. In embodiments wherein cap member 225 is fitted with tamper band 170, the applied torque in the opening direction causes frangible bridges 175 to break, indicating that the closure has been opened.

[0053] Although Figs. 4 and 5 illustrate cap member 225 including sidewall threads as the attachment member for engagement with the container 110 (Fig. 1), any suitable attachment member may be used for engagement with the container, such that the container and closure assembly functions as described herein. For example, the cap member 225 may be engaged with the container by way of a bayonet assembly, clip, pin, hook or other suitable attachment means.

[0054] Figs. 6-16 illustrate alternative embodiments of sealing member 220. For ease of understanding, Figs. 6-16 omit the cap member 225. However, each of the closure embodiments Figs. 6-16 may include a cap member 225 as described above, and illustrated for example in Figs. 4 and 5.

[0055] Fig. 6 shows a partial cross section of an embodiment of sealing member 220 that includes a positive retention bead 275 formed in sidewall 280 of sealing member 220. In this embodiment, container 110 (Fig. 1) includes a negative retention groove 285 that is sized and configured to retain positive retention bead 275 such that sealing member 220 maintains a seal with rim 150. In one embodiment, sealing member 220 includes gasket material 210 disposed annularly about the periphery of a

lower surface of sealing member 220, such that gasket material 220 seals against rim 150 when press-fit to container 110.

[0056] Fig. 7 illustrates a partial cross section of an embodiment of sealing member 220 that includes a positive retention member 290 formed in sidewall 280 of sealing member 220. In this embodiment, container 110 (Fig. 1) includes a negative retention groove 295 that is sized and configured to retain positive retention bead 290 such that sealing member 220 maintains a seal with rim 150. In this embodiment, positive retention bead 290 is fabricated by rolling the lower edge of sidewall 280 such that it forms a positive retention bead 290. Sealing member 220 includes gasket material 210 disposed annularly about the periphery of a lower surface of sealing member 220, such that gasket material 220 seals against rim 150 when press-fit to container 110.

[0057] Fig. 8 illustrates a partial cross section of an embodiment of sealing member 220 that includes a hook retention member 300 fabricated from gasket material 210. In this embodiment, container 110 (Fig. 1) includes an inner lip 305 that is sized and configured to engage hook retention member 300 such that sealing member 220 maintains a seal with rim 150. Sealing member 220 includes additional gasket material 210 disposed annularly about the periphery of a lower surface of sealing member 220, such that gasket material 220 seals against rim 150 when press-fit to container 110.

[0058] Fig. 9 illustrates a partial cross section of an embodiment of sealing member 220 that includes a positive retention member 305 formed by a substantially rectangular rolled edge 310 of sealing member 220. In this embodiment, container 110 (Fig. 1) includes a ramped retention member 315 sized and configured to retain positive retention member 305 such that sealing member 220 maintains a seal with rim 150. Sealing member 220 includes additional gasket material 210 disposed annularly about the periphery of a lower surface of sealing member 220, such that gasket material 220 seals against rim 150 when press-fit to container 110.

[0059] Fig. 10 illustrates a partial cross section of another embodiment of sealing member 220 that includes a positive retention member 320 formed by a bent edge portion 325 of sealing member 220. In this embodiment, container 110 (Fig. 1) includes a ramped retention member 315 sized and configured to retain positive retention

member 320 such that sealing member 220 maintains a seal with rim 150. Sealing member 220 includes additional gasket material 210 disposed annularly about the periphery of a lower surface of sealing member 220, such that gasket material 220 seals against rim 150 when press-fit to container 110.

[0060] Fig. 11 illustrates a partial cross section of an embodiment of sealing member 220 that includes a positive retention bead 330 formed by a rounded curled edge portion 335 of sealing member 220. In this embodiment, container 110 (Fig. 1) includes a negative retention groove 340 that is sized and configured to retain positive retention bead 330 such that sealing member 220 maintains a seal with rim 150. Sealing member 220 includes gasket material 210 disposed annularly about the periphery of a lower surface of sealing member 220, such that gasket material 220 seals against rim 150 when press-fit to container 110.

[0061] Fig. 12 illustrates a partial cross section of an embodiment of sealing member 220 that includes a positive retention bead 345 formed by inwardly protruding bead portion of sealing member 220. In this embodiment, container 110 (Fig. 1) includes a negative retention groove 350 that is sized and configured to retain positive retention bead 345 such that sealing member 220 maintains a seal with rim 150. Sealing member 220 includes gasket material 210 disposed annularly about the periphery of a lower surface of sealing member 220, such that gasket material 210 seals against rim 150 when press-fit to container 110.

[0062] Fig. 13 illustrates a partial cross section of an embodiment of sealing member 220 that includes a positive retention bead 355 formed by a portion of gasket material 210 applied to sealing member 220. In this embodiment, container 110 (Fig. 1) includes a ramped retention member 315 sized and configured to retain positive retention bead 355 such that sealing member 220 maintains a seal with rim 150. Sealing member 220 includes additional gasket material forming hook retention member 300 formed fabricated from gasket material 210. In this embodiment, container 110 includes an inner lip 305 that is sized and configured to engage hook retention member 300 such that sealing member 220 maintains a seal with rim 150. In this embodiment, lower edge 250 is curled radially inwardly and substantially covers positive retention bead 355.

[0063] Fig. 14 illustrates a partial cross section of an embodiment of sealing member 220 that includes a positive retention bead 355 formed by a portion of gasket material applied to sealing member 220. In this embodiment, container 110 (Fig. 1) includes a retention member 316 sized and configured to retain positive retention bead 355 such that sealing member 220 maintains a seal with rim 150. Sealing member 220 includes additional gasket material forming hook retention member 300 fabricated from gasket material 210. In this embodiment, container 110 includes an inner lip 305 that is sized and configured to engage hook retention member 300 such that sealing member 220 maintains a seal with rim 150. In this embodiment, lower edge 250 is curled radially outwardly such that it does not substantially cover positive retention bead 355.

[0064] Fig. 15 illustrates a partial cross section of an embodiment of sealing member 220 that includes a positive retention bead 355 formed by a portion of gasket material applied to sealing member 220. In this embodiment, container 110 (Fig. 1) includes a ramped retention member 315 sized and configured to retain positive retention bead 355 such that sealing member 220 maintains a seal with rim 150. This embodiment is substantially similar to the embodiment illustrated in Fig. 13, but does not include additional gasket material forming a hook retention member. In this embodiment, lower edge 250 is curled radially inwardly and substantially covers positive retention bead 355.

[0065] Fig. 16 illustrates a partial cross section of an embodiment of sealing member 220 that includes a positive retention bead 355 formed by a portion of gasket material applied to sealing member 220. In this embodiment, container 110 (Fig. 1) includes a retention member 317 sized and configured to retain positive retention bead 355 such that sealing member 220 maintains a seal with rim 150. This embodiment is substantially similar to the embodiment illustrated in Fig. 14, but does not include additional gasket material forming a hook retention member. In this embodiment, lower edge 250 is curled radially outwardly such that it does not substantially cover positive retention bead 355.

[0066] For each of the described embodiments, sealing member 220 may be press-fit onto container 110 and form a hermetic seal with container 110 in a sterile zone of a capping operation, after container 110 has been aseptically filled with a substance.

After sealing member 220 has been press-fit onto container 110, the threads 135 and optionally other portions of container 110 may be cleaned, rinsed and/or dried to ensure the threads 135, and other portions of container 110, are clean before the bottle is opened. Subsequent to sealing member 220 being press-fit onto container 110 and the threads 135 being cleaned, rinsed and dried, cap member 225 is fit over sealing member 220 and threadably coupled to container 110, either inside or outside of the sterile zone. The use of the two piece closures described herein thus may reduce the complexity of the sterile zone of a filling and capping operation because the threaded cap member 225 may be applied outside of the sterile zone, which may improve efficiency, downtime and maintenance, and thereby reduce cost.

[0067] In another embodiment, closure 105 is fitted onto container 110 in a container filling and system utilizing one or more sterilization processes such as, for example, heating, retort processing, hot filling and high acid hot or cold filling of container 110.

[0068] In yet other embodiments, sealing member 220 is press-fit onto container 110 using a typical foil lid sealing system or snap cap sealing system using the compression portion of the sealing system to press-fit the sealing member 220. Such sealing system may press-fit sealing member 220 onto container 110 with or without a partial heat, conduction or induction heating function turned on to allow for softening of gasket material 210 to assist with press-fitting and sealing of sealing member 220 onto container 110. In still other embodiments, sealing member 220 may be adhered to container 110 using a contact adhesive layer or a heat sealable layer in conjunction with, or as an alternative to gasket material 210. As used herein, the term heat sealable layer refers to a material capable of forming a seal with container 110 upon application of sufficient heat. Heat applied to sealing member 220 may soften gasket material 210 such that gasket material 210 and or the adhesive layer at least partially melts to adhere the sealing member 220 to container 110. In one suitable embodiment, the additional adhesive layer is strong enough to adhere sealing member 220 to the container 110, yet does not provide significant additional resistance when a user desires to remove the sealing member 220 by applying a torque in an opening rotation direction to cap member 225.

[0069] In some embodiments, one or more elements of closure 105 and container 110 may be fabricated from plastic, such as a substantially transparent plastic material allowing a user to view the threads before opening to ensure cleanliness. In other embodiments, one or more elements of closure 105 or container 110 are fabricated from substantially opaque materials, thus preventing light from entering container 110, and possibly degrading a substance contained therein. One or more elements of closure 105 and container 110 may be made from a suitable plastic, such as high density polyethylene, polypropylene, polyethylene terephthalate or other suitable plastics, or may be made from other materials such as metal, paper, various resiliently flexible laminates and other suitable resiliently flexible materials without departing from the scope of the present invention. High density polyethylene, for example, can be formed to be suitably resiliently flexible and to allow for generally resilient deformation when a pressure is applied in a longitudinal direction. Container 110 can be molded, such as by blow molding, injection molding or formed in other ways without departing from the scope of the present invention.

[0070] In another embodiment, container 110 may be generally resiliently deformable when a pressure is applied in a radially inward direction (i.e., toward the axis C). By being resiliently deformable, the container 110 resists denting and other physical defects which may occur during shipping and storage. Moreover, a user may more readily “squeeze” the container 110 with his or her hand, causing the container to resiliently deform. In one embodiment, the resiliency of the container facilitates easier removal of the substance contained therein from the container upon squeezing of container 110. Providing such resiliency of the container 110 may also enhance the user’s grip on the container. When the user releases the container 110, the sidewall thereof will substantially rebound to its original shape, without denting, creasing, or other permanent and readily visible deformation.

[0071] In another suitable embodiment, sealing member 220 is fabricated from metal, which allows for heating of the sealing member 220 for sterilization, which may eliminate the need for secondary sterilants, such as hydrogen peroxide, peracetic acid or electron beam sterilization.

[0072] The above described closure 105 may reduce the amount of a liquid sterilant required to sterilize a container and closure assembly as compared to a traditional screw cap due to a reduced size, surface area and complexity of the closures described herein.

[0073] 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 have 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 IS:

1. A closure for a container, the container having an opening through which contents of the container are dispensed, and a holding member for cooperating with the closure to retain the closure on the container, the closure comprising:

a sealing member configured to sealingly close the container opening, the sealing member including a retention member engageable with the holding member of the container to retain the sealing member in sealing engagement with the container, and

a cap member having a top rim and a sidewall depending from the top rim, the sidewall including an attachment member for attachment to the container, and an engagement member that operatively couples the sealing member to the cap member upon placement of the cap member on the container, the cap member being rotatable relative to the container and relative to the sealing member.

2. The closure according to claim 1, wherein the holding member of the container comprises a groove disposed in the container, the retention member comprising an annular protrusion projecting transversely of the sealing member.

3. The closure according to claim 1, wherein the retention member of the sealing member imparts an axial force to the holding member to hold the sealing member in sealing engagement with the container upon placement of the sealing member on the container.

4. The closure according to claim 1, wherein the sealing member comprises a gasket material disposed along a periphery of a first surface of the sealing member.

5. The closure according to claim 4, wherein the attachment member comprises one or more screw threads for threaded engagement with the container.

6. A method of applying a closure to a container, the container including at least one opening through which contents of the container are dispensed, the method comprising:

press-fitting a sealing member onto the container over the container opening such that a retention member of the sealing member engages a holding member of the container, an axial force resulting from said press-fitting retaining the sealing member in sealing engagement with the container to sealingly close the container opening,

applying a cap member to the container at the sealed container opening, the cap member including a top rim and a sidewall depending therefrom, the sidewall including an attachment member for engagement with the container, and an engagement member coupling the sealing member to the cap member upon application of the cap member to the container, the cap member being rotatable relative to both the container and the sealing member.

7. The method according to claim 6, wherein the press-fitting comprises applying a force to the sealing member parallel to a longitudinal axis of the container until the retention member engages with the holding member.

8. The method according to claim 6, wherein the applying a cap member to the container is performed after the press-fitting.

9. The method according to claim 8, wherein the press-fitting occurs in a sterile area of a capping zone and the screwing a cap member to the container occurs outside of the sterile area.

10. A container, comprising:

a container body including a neck and a holding member disposed on an outer periphery of the neck, the neck having a rim defining an opening to the container,

a sealing member configured to seal the opening of the container, the sealing member including a retention member configured to engage the holding member of the container, the retention member configured to hold the sealing member in sealing engagement with the container by an axial force resulting from said press-fitting, and

a cap member including a top rim and a sidewall that extends downward from the top rim, the sidewall including an attachment member for engagement with the neck of the container, and an engagement member that operatively couples the sealing member to the cap member upon placement of the cap member on the container, the cap member being rotatable relative to the container and relative to the sealing member.

11. The assembly according to claim 10, wherein the cap member further includes a tamper evident band frangibly connected to the cap member, the tamper evident band comprising at least one ramp, and the container further includes at least one locking projection, the tamper evident band configured to be secured to the container via a ratcheting engagement of the at least one ramp with the locking projection of the container.

12. The assembly according to claim 10, wherein the retention member is an annular protrusion projecting radially inwardly and the holding member is a groove.

13. The assembly according to claim 10, wherein the sealing member further includes a gasket material disposed on a first surface of the sealing member, the gasket member configured for hermetic or aseptic sealing of the sealing member to the rim of the container.

14. The assembly according to claim 10, wherein the sealing member comprises at least one of an adhesive layer or a heat sealable material.

15. A press-on, twist-off closure for a container, comprising:

a top wall;

a substantially cylindrical sidewall that extends from an outer circumference of the top wall, the sidewall including threads configured for rotational engagement with a threaded neck of the container,

an annular lip that extends from a lower surface of the top wall and is substantially parallel to the sidewall and spaced apart from the sidewall such that a rim of the container is sealable at the space between the annular lip and the sidewall,

wherein the sidewall is configured to flex radially outwardly upon application of an axial force to the top wall such that the closure is capable of being pressed onto the rim of the container, and wherein the threads are configured to hold the space between the annular lip and the sidewall in sealing engagement with the rim of the container.