INGREDIENT DISPENSING CAP FOR BEVERAGE CONTAINER

A beverage ingredient dispenser can include a seal assembly configured to form spillproof seals with the inner surface (I.D.) of a beverage container opening. Additionally, a beverage ingredient dispenser can include a beverage ingredient reservoir containing a beverage ingredient to be mixed with another ingredient for creating a mixed beverage. For example, the beverage ingredient dispenser can include a dried powdered, tablet, or liquid ingredient to be mixed with water contained in a water bottle. The dispenser can also include a sealing mechanism configured to generate spill-proof seals with a plurality of different sizes of beverage containers. The dispenser can also include an anchoring mechanism configured to enhance an anchoring of the dispenser to a beverage container.
FIG. 38
INGREDIENT DISPENSING CAP FOR BEVERAGE CONTAINER

BACKGROUND OF THE INVENTIONS

Field of the Inventions

[0001] The inventions disclosed herein relate to ingredient dispensing devices, for example, devices that can be connected to an opening of a beverage container for facilitating release of beverage ingredients stored therein into the beverage container for later consumption.

Description of the Related Art

[0002] Presently, there are thousands of beverage products widely available to the consuming public. The vast majority, if not all, of these beverages are made by mixing dry or concentrated ingredients with water. Alongside these beverages, various brands of bottled water in variety of differently sized bottles are also widely marketed.

[0003] Many retailers normally cannot sell all of the different beverages and waters currently offered by beverage manufacturers. The practical reality of the large amount of shelf space required for selling beverages effectively limits the number of different beverages many retailers can offer for sale at any one time. Thus, most retailers must choose a limited number of beverages of the many available, they wish to sell through their establishment.

[0004] Recently, beverage ingredient dispensing devices have become available. Such dispensing devices include a reservoir containing dried, compressed and liquid beverage ingredients and a threaded water bottle engagement collar. The threaded collar can be screwed to the top a water bottle with the same thread configuration. The reservoir can then be pierced so as to allow the ingredient to be discharged from the reservoir and mixed with the water in the water bottle. Some versions of this type of cap include drink-through spouts which allow a user to drink the mixed beverage through the dispensing device itself.

SUMMARY OF THE INVENTIONS

[0005] An aspect of at least one of the inventions disclosed herein includes the realization that some beverage ingredient dispensing caps, such as those described above, suffer from several drawbacks. For example, one aspect of at least one of the inventions disclosed herein includes the realization that some known beverage ingredient dispensing caps, which rely on a threaded engagement with the opening of a water bottle, can only be used on one size water bottle. However, there are a range of different sizes of water bottles with differently sized openings presently on the market, many of which have different threads, including different thread sizes, and different thread pitches. Thus, a dispensing cap provided with a threaded collar designed for engagement with one water bottle will not work on most other water bottles. Such beverage ingredient dispensing caps can leave a user without the ability to connect the cap to the bottles that may be available at a given time.

[0006] Thus, in accordance with some embodiments, a beverage ingredient dispenser can include a seal assembly configured to seal against inner surfaces of the openings. As such, the beverage ingredient dispenser can avoid the need for threaded engagement surfaces, such as those used on the prior art devices described above, thereby avoiding unnecessary costs. For example, threaded engagement surfaces such as those provided on the caps of water bottles add a significant amount of cost to the manufacturing of such caps from plastic. Such caps are typically manufactured with a molding process and after an initial stiffening of the material molded with internal threads, the molded part must be unscrewed from the mold itself. Thus the timing and procedures necessary for successfully molding such a part presents significant cost to the manufacturing of such a component. Thus, a beverage ingredient dispenser that includes a seal assembly configured to seal against the inner surfaces of the openings of a beverage container can avoid the cost associated with the formation of internal threads for engaging the external threads typically found on many beverage containers.

[0007] Further, in some embodiments, a beverage ingredient dispenser can include a seal assembly configured to seal against the inner surfaces of a range of sizes of beverage container openings. For example, in some embodiments, the seal assembly is configured to seal with a range of sizes of inner diameters of beverage container necks over a range of at least about ¾ of one inch. This can be particularly convenient for users because a significant number of different water bottles have inner diameters within a range of about ¾ of an inch, for example, about 0.80 inches to about 1¼ inches. Further, in some embodiments, the seal assembly can be configured to seal with a range of sizes of inner diameters of beverage container necks over a range of at least about ¾th of one inch, for example, about 0.63 inches. This can also be convenient for users because a significant number of different water bottles have inner diameters within a range of about 0.63 inches, for example, from about 1.14 inches to about 1.77 inches, a range of sizes larger than those noted above, which can include some bottles commonly used as infant feeding bottles or “baby bottles”. Some of the beverage containers commonly available include inner diameters of about 1.3 inches and 1.61 inches, which also fall within this range.

[0008] Further embodiments can provide further advantages by including seal assemblies that can seal with a range of sizes of inner diameters of ¾ of one inch to about 1 and ¾ of one inch, for example, from 0.8 inches to about 1.77 inches. Thus, such beverage ingredient dispensers can be used with a wide variety of different, widely available water bottles.

[0009] Another aspect of at least one of the inventions disclosed herein includes the realization that some known beverage ingredient dispensers, whether they include powdered, liquid or tablet ingredients, can require an unnecessarily complicated installation procedure. For example, some known beverage ingredient dispensers, such as those described above which include a threaded collar for threaded engagement with a water bottle, require a user to first rotate the dispenser so as to threadedly engage the dispenser with a water bottle. Then after the dispenser has been threadedly engaged, the user must press an actuator to dispense the beverage ingredient into the liquid in the water bottle.

[0010] An aspect of at least one of the inventions disclosed herein includes the realization that beverage ingredient dispensers can be configured with a sealing and dispensing mechanism that provides the dual functions of sealing to an opening of a primary beverage container, and also dispensing a stored ingredient into the liquid, using a single motion. For example, a beverage ingredient dispenser can include a
reservoir, a sealing mechanism, and an actuator. The actuator can be connected to both the dispenser and the sealing mechanism so as to cause the sealing mechanism to enhance a seal between the dispenser and the primary beverage container, as well as actuating the dispenser so as to dispense the beverage ingredient into the liquid in the primary container. For example, in some embodiments, the actuator can be configured for a single actuating movement such that a user can simply place the dispenser onto the opening of a water bottle, then press straight down, thereby actuating the sealing mechanism and dispenser with movement in a single direction. Alternatively, in some embodiments, a beverage ingredient dispenser can include a rotating actuator also connected to both the sealing mechanism and a dispenser so as to actuate the sealing mechanism and the dispenser with a single rotational movement.

[0011] Another aspect of at least one of the inventions disclosed herein includes the realization that some known beverage ingredient dispensers include dispensing actuators that result in interference with the discharge of beverage ingredient into the primary container, the mixing of the liquid in the primary container, as well as the discharge of the mixed beverage through the dispenser, for example, in the context of drink-through dispensers. More specifically, some known beverage ingredient dispensers include a frangible wall, such as a layer of foil. The dispensing mechanism on this type of device includes a rod with a piercing end, such as a sharpened point, configured to pierce the foil when the user pushes the rod downwardly. However, an aspect of at least one of the inventions disclosed herein includes the realization that merely piercing the foil often leaves pieces of the foil in a position interfering with the movement of the beverage ingredient out of the reservoir as well as movement of liquid into the reservoir for mixing purposes. For example, even though a piercing rod may initially cut and push pieces of the foil outwardly away from the reservoir, the foil remains free to bend back and forth and thus can interfere with the movement of the beverage ingredient out of the reservoir as well as liquid from the primary container into the reservoir.

[0012] Thus, in accordance with some embodiments, a beverage ingredient dispenser includes a piercing member and a frangible wall deflecting member. Thus, for example, a piercing member of the beverage ingredient dispenser can be actuated so as to pierce a frangible wall, such as a layer of foil, and then further deflect the foil away from a center of the bottom wall of the dispenser. As such, the frangible wall, such as the layer of foil, can be pushed farther out of the way of the beverage ingredient and thus interfere less with movement of the beverage ingredient out of the reservoir and liquid into the reservoir. In some embodiments, the deflection member includes a ring or collar disposed adjacent to an inside wall of the reservoir and positioned so as to fold a frangible wall toward a perpendicular orientation relative to the orientation of the frangible wall before piercing. Other configurations can also be used.

[0013] Another aspect of at least one of the inventions disclosed herein includes the realization that some beverage ingredient dispensers, such as those described above, can fail to discharge the desired amount of beverage ingredients from the associated reservoir because the piercing rod is smooth-sided. For example, in such known beverage ingredient dispensing devices, dried beverage ingredients can become more viscous (more resistant to movement) over time, for example, by caking. Thus, when the piercing rod is moved downwardly through the beverage ingredient so as to pierce the foil, some of the beverage ingredient can remain lodged in the reservoir.

[0014] Thus, in accordance with some embodiments, a beverage ingredient dispenser can include a dispensing element configured for axial movement relative to the ingredient reservoir. Additionally, the dispensing element can include at least one laterally extending surface extending into the ingredient reservoir. Thus, when the dispenser is actuated, for example, moved axially relative to the ingredient chamber, the laterally extending surface can assist movement of the beverage ingredient axially through the reservoir and thereby better overcome the potential effects of caking of a dry beverage ingredient. Additionally, the laterally extending surface can also, by way of moving a greater amount of ingredient out of the reservoir upon actuation, help push open a frangible wall through the interaction of the ingredient with the opened wall.

[0015] Another aspect of at least one of the inventions disclosed herein includes the realization that certain known beverage ingredient dispensers suffer from breakage and leaks due to the structural configuration of a bellows. More specifically, some known beverage ingredient dispensers include bellows attached to an actuator, for example, those designs described, with reference to FIG. 14 therein, in U.S. Pat. No. 8,701,906 Apr. 22, 2014 titled Ingredient Dispensing Cap For Mixing Beverages with Push-Pull Drinking Spout. The bellows in these devices are flat sided, such as hexagonal or octagonal. An aspect of at least one of the inventions disclosed herein includes the realization that failures of this flat-sided bellows configuration can be solved by using circular bellows, which avoids stress concentrations caused at the corners of the flat-sided bellows.

[0016] Thus, in accordance with some embodiments, a beverage ingredient dispenser includes an actuator connected to a beverage ingredient reservoir with a circular bellows member.

[0017] Another aspect of at least one of the inventions disclosed herein includes the realization that a sealing mechanism can achieve enhanced performance with regard to the ability to seal to a variety of different sizes of inner diameters of beverage container openings by including moveable members configured to increase the size of the contact patch between a resilient sealing member and the inner diameter of the beverage container opening. For example, in some embodiments, a beverage dispenser can include a ratcheting mechanism configured to modulate movement of sealing mechanism components during insertion of the dispenser into the opening of a beverage container opening, so as to press against the seal member and thereby increase a contact patch between the seal member and the inner surface. Ratcheting mechanisms can be configured to engage through axial movement or radial movement. Further, in some examples, ratcheting mechanisms can be used in conjunction with cooperating wedge shaped members.

[0018] Another aspect of at least one of the inventions disclosed herein includes the realization that a beverage ingredient dispenser can include retention members configured to extend into a primary beverage container for engagement with a portion of a neck of a beverage container to resist inadvertent withdrawal of the dispenser from the container. For example, a beverage ingredient dispenser can include extendable arms configured to extend into a bever-
age container, and radially outwardly into a space within the beverage container beneath the neck of the beverage container. As such, a beverage ingredient container can better retain a desired engaged position with the opening of the beverage container, and thereby resist unintended removal of the beverage dispenser.

[0019] Another aspect of at least one of the inventions disclosed herein includes the realization that some forms of beverage ingredients are sold in containers which can be inconvenient or difficult to open and dispense into a beverage container, such as a bottle of water. For example, some beverage ingredients can come in the form of a “blister pack”. Such blister packs typically contain a frame portion, a frangible portion, and a compressible portion. A beverage ingredient can be stored between the compressible portion and the frangible portion such that the beverage ingredient can be discharged by a user by pressing on the compressible portion such that a beverage ingredient is pushed through the frangible portion, causing the frangible portion to break and release the ingredients therethrough.

[0020] When using such a blister pack for discharging ingredients into a beverage container, such as a bottle of water, users can find and encounter difficulty in releasing the full contents of the blister pack into the beverage container. For example, wind can interfere with the process of discharging the ingredient into a beverage container, for example, by blowing some of the ingredients away from the opening of the container at the moment the frangible portion is broken. As such, a user may fail to mix all of the ingredient with the beverage in the container. This problem can be more undesirable in the context of unintended discharge of strong coloring agents (typical in high antioxidant nutrients) or volatile bubbling additives. Additionally, a user may find it awkward to hold beverage container and at the same time rupture the frangible portion of the blister pack while holding the beverage container securely, thereby accidently spilling some of the beverage and/or ingredient out of the bottle. Further, some of the ingredient may stick or adhere to the inside of the compressible portion or frangible portion of the blister pack found thereby preventing all of the ingredient from reaching the beverage in the beverage container.

[0021] An aspect of at least one of the inventions disclosed herein includes the realization that a beverage ingredient dispenser can include blister pack alignment and sealing features and functionality for connection to a beverage container so as to facilitate a more accurate and complete discharge of the beverage ingredient from a blister pack into a beverage container. For example, in some embodiments, beverage ingredient dispenser can include a seal assembly configured to seal to an opening of a beverage container, a blister pack receiver portion ends an aperture aligned with the opening of the beverage container. As such, a user can attach the dispenser to a beverage container with the aperture aligned with the opening of the container. Additionally, user can insert a blister pack into the blister pack receiving portion such that the frangible portion of the blister pack is aligned with the aperture. As such, a user can compress the compressible portion of the blister pack so as to compress the ingredient against the frangible wall, thereby breaking the frangible wall and allowing the ingredient to flow into the opening of the beverage container.

[0022] In some embodiments, the blister pack receiving portion can be configured to form a leak reducing seal with a portion of the bottom surface of the blister pack surrounding the frangible portion. For example, the blister pack receiving portion can include a surface complimentary to the bottom surface of a blister pack and with a conforming material such that when a user presses the blister pack against the blister pack receiving portion, a spill proof seal can be formed against the blister pack receiving portion and the bottom surface of the blister pack. With such a sealing feature, a user can hold the water bottle while pressing down on the blister pack and shake the water bottle, thereby more thoroughly mix the ingredient within the blister pack with the beverage contained in the beverage container.

[0023] Another aspect of at least one of the inventions disclosed herein includes the realization that beverage ingredient dispensers with blister pack related features and functionality can include blister pack receiving portions configured to simplify the process of insertion of the blister pack into the receiving portion, for example, so as to more easily align the blister pack in the blister pack receiving portion. In some embodiments, blister pack portions can be provided with a circular shape around at least a portion of the outer periphery of the blister pack. As such, the blister pack receiving portion can include a complimentary, partly circular shape. Thus, a blister pack can be inserted with the partly circular periphery pressed against the partly circularly shaped portion of the blister pack receiving portion and thus be more easily alignable with the blister pack receiving portion.

[0024] Thus, in some embodiments, a blister pack assembly can include a plurality of individual blister packs connected together, for example, with frangible portions. Each of the blister pack members can include an outer periphery, at least having a circular shape around at least approximately 180 degrees around the periphery thereof. Further, in some embodiments, the blister pack members can be circular around substantially the entire parameter thereof. Further, in some embodiments, the blister pack members include frangible portions at four locations spaced around the circular periphery, at which the blister pack can be connected to four other blister pack members, forming a blister pack assembly. The frangible portions can present minor discontinuities and/or imperfections along the outer circular periphery of the blister pack members.

[0025] In other embodiments, the outer periphery of blister pack members can include other shapes, for example, but without limitation, other nonrectangular shapes including semi hexagonal, hexagonal, semi octagonal, octagonal, oval, semi oval, or other curved and/or faceted shapes or combinations thereof.

[0026] Another aspect of at least one of the inventions disclosed herein includes the realization that some designs for ingredient dispensers can be improved by including a drink through valve mounted to an ingredient reservoir which can be mounted for piercing movement relative to a piercing element. In such configurations, the piercing element can be coupled to a beverage container opening. In some embodiments, the piercing element can be connected to a sealing assembly configured to seal to a range of sized of openings of beverage containers, including ranges of different sizes of threaded openings typically provided on water bottles.

[0027] This summary is provided to introduce a selection of concepts in a simplified form that are further described below in the detailed description. This summary is not
intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0028] FIG. 1 is a schematic perspective view of two known water bottles of different sizes that are presently commercially available.

[0029] FIG. 2 is a schematic diagram of an embodiment of a beverage ingredient dispenser.

[0030] FIG. 3 is a schematic diagram of a variation of the dispenser of FIG. 2.

[0031] FIG. 4 is a schematic diagram of the dispenser of FIG. 3 indicating an expansion direction of a seal member.

[0032] FIG. 5 is a schematic exploded diagram of a variation of the dispenser of FIG. 2, in a position spaced above the opening of a beverage container.

[0033] FIG. 6 is a schematic diagram of the dispenser of FIG. 5 moved into contact with the opening of the bottle and showing initial deformation of a seal assembly.

[0034] FIG. 7 is a schematic diagram of the dispenser of FIG. 6 moved further into the opening of the bottle and the seal assembly conforming to the bottle.

[0035] FIG. 8 is a schematic diagram of a further embodiment of a beverage ingredient dispenser, which can be used in conjunction with the embodiment of FIG. 2 and its variations, and further including a dispensing member with an optional laterally-projecting surfaces and an optional deflection device.

[0036] FIG. 9 is a variation of the dispenser of FIG. 8 including an actuator optionally connected to both the dispensing member and the seal assembly.

[0037] FIG. 10 is a schematic diagram of the dispenser of FIG. 9 illustrating movement of the dispensing member and deflecting device extending through a lower frangible wall of the dispenser, as well as movement of the laterally projecting surfaces.

[0038] FIG. 11 is a side elevational view of an embodiment of the dispenser member of FIG. 8.

[0039] FIG. 12 is perspective view of the dispenser member of FIG. 11.

[0040] FIG. 13 is an enlarged side elevational view of the piercing end of the dispenser member of FIG. 11.

[0041] FIG. 14 is perspective view of the enlarged view of FIG. 13.

[0042] FIG. 15 is a perspective view of the piercing tip of FIG. 13 piercing a frangible wall of a reservoir.

[0043] FIG. 16 is further perspective view of the piercing member of FIG. 12, illustrating further cutting of the frangible wall.

[0044] FIG. 17 is a further perspective view of the piercing member of FIG. 15, illustrating a deflection of cut pieces of the frangible wall by the deflecting member.

[0045] FIG. 18A is a perspective view of a variation of the dispenser of FIG. 2, including a multi-layered seal assembly.

[0046] FIG. 18B is another perspective view of the dispenser of FIG. 18A.

[0047] FIG. 18C is a side elevational and sectional view of the dispenser of FIG. 18A.

[0048] FIG. 18D is a sectional and partial perspective view of the dispenser of FIG. 18A.

[0049] FIG. 18E is a side elevational and sectional view of the dispenser of FIG. 18F, illustrating a state in which the actuator has been actuated.

[0050] FIG. 18F is a perspective and exploded view of a further embodiment of a seal assembly and two different sizes of bottles to which the seal assembly can seal.

[0051] FIG. 18G is a perspective view of the seal assembly of FIG. 18F with a dispenser assembly assembled thereto, and attached to three sizes of beverage container openings.

[0052] FIG. 18H is a sectional view of the assembly of FIG. 18G.

[0053] FIG. 18I is a top plan view of a blister pack assembly formed of square or rectangular blister pack members attached to each other with frangible portions, and with one blister pack member missing.

[0054] FIG. 18J is a perspective view of a beverage ingredient dispenser showing the insertion movement of a blister pack member.

[0055] FIG. 18K is an exploded perspective view of the embodiment of the beverage ingredient dispenser of FIG. 18J.

[0056] FIG. 18L is a side elevational view of an ingredient receiver portion of the beverage ingredient dispenser of FIG. 18J.

[0057] FIG. 18M is a perspective and partial sectional view of the beverage ingredient receiver portion of FIG. 18L, taken along section line 18M-18M.

[0058] FIG. 18N is a sectional view of the beverage ingredient dispenser with a blister pack member received therein in the position of FIG. 18J.

[0059] FIG. 18O is a top plan view of a blister pack assembly including a plurality of hexagonal blister pack members attached to one another with frangible portions.

[0060] FIG. 18P is a perspective and partial sectional view of a modification of the beverage ingredient receiver portion of FIG. 18M, having a partially hexagonal receiver portion.

[0061] FIG. 18Q is a perspective view of a modification of the beverage ingredient dispenser of FIG. 18J including a partially hexagonal receiver portion illustrated in FIG. 18P.

[0062] FIG. 18R is a top plan view of a blister pack assembly including a plurality of circular blister pack members attached to one another with frangible portions.

[0063] FIG. 18S is a modification of the beverage ingredient receiver portion of FIG. 18P having a partially circular receiver portion.

[0064] FIG. 18T is a perspective view of yet another modification of the beverage ingredient dispenser of FIG. 18J, and including the ingredient receiver portion of embodiment of FIG. 18S.

[0065] FIG. 18U is a side elevational view of a modification of the reservoir of FIG. 18C.

[0066] FIG. 18V is a front elevational view of the embodiment of the reservoir of FIG. 18U.

[0067] FIG. 18W is a top plan view of the reservoir of FIG. 18U.

[0068] FIG. 18X is a perspective and exploded view of the reservoir of FIG. 18U with a discap.

[0069] FIG. 19 is a side elevational view of a modification of the dispenser of FIG. 5 and which can incorporate the dispenser member of FIG. 11 and its variations or other dispensing members.

[0070] FIG. 20 is a perspective and sectional view of the dispenser of FIG. 19.

[0071] FIG. 21 is a side elevational, sectional view of the dispenser of FIG. 19.
FIG. 22 is a side elevational, sectional view of the dispenser of FIG. 21, illustrating conforming deflection of the seal assembly during insertion of the dispenser into the opening of a bottle.

FIG. 23 is a perspective view of yet another variation of the embodiment of FIG. 2 and FIGS. 3-4 having a seal assembly thereof positioned within the opening of a beverage bottle.

FIG. 24 is a perspective and partial sectional view of the dispenser of FIG. 23.

FIG. 25 is a side elevational, sectional view of the dispenser of FIG. 23.

FIG. 26 is a side elevational, sectional view of the dispenser of FIG. 23 illustrating a change in state of the dispenser relative to the state illustrated in FIG. 25.

FIG. 27 is a perspective view of another variation of the embodiment of FIGS. 2-4.

FIG. 28 is a sectional and partial perspective view of the dispenser of FIG. 27.

FIG. 29 is a side elevational, sectional view of the dispenser of FIG. 27.

FIG. 30 is a side elevational, sectional view of the dispenser of FIG. 27 illustrating a change in state from the state illustrated in FIG. 29.

FIG. 31 is a perspective view of yet another variation of the embodiment of FIGS. 2-4.

FIG. 32 is a sectional and partial perspective view of the dispenser of FIG. 31.

FIG. 33 is a side elevational, sectional view of the dispenser of FIG. 31.

FIG. 34 is a side elevational, sectional view of the dispenser of FIG. 31 illustrating a change in state relative to the state illustrated in FIG. 33.

FIG. 35 is a schematic perspective view of a further variation of the embodiment of FIGS. 2 and 5-7 illustrating two positions of the embodiment being placed inside the bottle neck.

FIG. 36 is a perspective and partially translucent view of the dispenser in FIG. 35.

FIG. 37 is a perspective and partial sectional view of the dispenser in FIG. 35, illustrating a spring assist option to maintain force/pressure against inside wall of bottle neck.

FIG. 38 is a perspective view of the dispenser of FIG. 35, removed from a beverage bottle.

FIG. 39 is perspective view of a spring mechanism that can be incorporated into the dispenser of FIGS. 35-38.

FIG. 40 is a perspective and partial sectional view of a modification of the dispenser of FIG. 35, including a radial leaf spring assembly.

FIG. 41 is a schematic perspective view of the dispenser of FIG. 40, illustrating a conforming movement of the seal assembly and radial leaf spring.

FIG. 42 is a perspective view of yet another modification of the embodiment of FIGS. 2 and 5-10.

FIG. 43 is a sectional and partial perspective view of the dispenser of FIG. 42.

FIG. 44 is sectional view of the dispenser of FIG. 42.

FIGS. 45A and 45B are sectional views of the dispenser of FIG. 42 illustrating a change in state relative to the state illustrated in FIG. 44.

FIG. 46 is a side elevational view of another modification of the embodiment of FIGS. 2 and 5-10.

FIG. 47 is perspective view of the dispenser of FIG. 46.

FIG. 48 is a sectional view of the dispenser of FIG. 46.

FIG. 49 is a sectional view of the dispenser of FIG. 46 illustrating a change in state relative to the state illustrated in FIG. 49.

FIG. 50 is an enlarged sectional view of the dispenser of FIG. 46 illustrating a drink through valve in a closed state.

FIG. 51 is an exploded view of the dispenser of FIG. 46.

FIG. 52 is a perspective view of yet another modification of the embodiments of FIGS. 2 and 5-10.

FIG. 53 is a sectional and partial perspective view of the dispenser of FIG. 52.

FIG. 54 is a side elevational, sectional view of the dispenser of FIG. 52.

FIG. 55 is a sectional view of the dispenser of FIG. 52 illustrating a change in state relative to the state illustrated in FIG. 54.

FIG. 56 is a sectional and partial perspective view of yet another modification of the embodiments of FIGS. 2 and 5-10.

FIG. 57 is side elevational, sectional view of the dispenser of FIG. 56.

FIG. 58 is an enlarged isolated view of a bottle locking mechanism included in the dispenser of FIG. 56.

FIG. 59 is an enlarged isolated view of the bottle locking mechanism in FIG. 58 illustrating a change in state relative to the state illustrated in FIG. 58.

FIG. 60 is a perspective view of a modification of the embodiment of FIGS. 2-4 and 8-10.

FIG. 61 is a side elevational, sectional view of the dispenser of FIG. 59.

FIG. 62 is a perspective view of a shell of a closure according to another embodiment.

FIG. 63 is a side elevation view of the shell of FIG. 62.

FIG. 64 is a front elevation view of the shell of FIG. 62.

FIG. 65 is a top plan view of the shell of FIG. 62.

FIG. 66 is a bottom plan view of the shell of FIG. 62.

FIG. 67 is a front section view of the shell of FIG. 1 taken along section line A-A in FIG. 65.

FIG. 68 is a side section view of the shell of FIG. 62 taken along section line B-B of FIG. 64.

FIG. 69 is a side elevation view of a cap of a closure according to another embodiment.

FIG. 70 is a top plan view of the cap of FIG. 69.

FIG. 71 is a section of the cap of FIG. 69 taken along section line A-A of FIG. 70.

FIG. 72 is a side elevation view of a dust cover a closure according to another embodiment.

FIG. 73 is a top plan view of the cover of FIG. 72.

FIG. 74 is a bottom plan view of the cover of FIG. 72.

FIG. 75 is a section of the cover of FIG. 72 taken along section line A-A of FIG. 74.

FIG. 76 is an enlarged view of the section view of FIG. 75.
FIG. 77 is a sectional of the closure according to another embodiment, with a cap thereof in a closed sealed position; FIG. 78 is a sectional of the closure of FIG. 77 with the cap thereof in the open, dispensing position; FIG. 79 is a schematic, perspective and partial exploded view of another embodiment of an ingredient reservoir including a drink through valve; FIG. 80 is a schematic, perspective, and sectional view of the embodiment of FIG. 79 with the drink through valve in a closed position; FIG. 81 is a sectional view of the embodiment of FIG. 79, with the drink through valve in an open position; FIG. 82 is a schematic sectional view of yet another embodiment of the dispenser device including the ingredient reservoir of FIGS. 79-81, in a closed and sealed position; FIG. 83 is another sectional view of the embodiment of FIG. 82 in a pierced condition with the drink your valve in a closed position; FIG. 84 is a sectional view of the embodiment of FIG. 82 with the drink through valve in an open position and with the reservoir in a pierced condition.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The inventions disclosed herein are described in the context of beverage ingredient dispensers that can be attached to beverage containers because they have utility in this context. However, the inventions disclosed herein can be used in other contexts as well, including but without limitation, dispensers for other types of ingredients, attachments to other types of devices, other food and beverage related contexts, pharmaceutical and Nutraceutical mixing and/or delivery devices, as well as other industrial and commercial non-food contexts, such as chemical organic/inorganic additives, plasticizers, coloring agents, etc.

FIGS. 2-10 illustrate embodiments and variations of a beverage ingredient dispenser 100. FIGS. 11-82 illustrate variations and further embodiments of the dispenser 100. The embodiments of FIGS. 18-82 are identified generally by the reference numbers 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 3000, 3200. Various parts, components, and features of the embodiments and FIGS. 2-82 are identified using reference numerals with the same 1s and 10s digits used to identify the same or similar parts, components, and features of the other embodiments, but with a 100s digit (100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 3000 or 3200) corresponding to the subject embodiment. Thus, for brevity, descriptions of the same or similar components amongst the various embodiments are not repeated for each of those embodiments. Thus, the below descriptions of any components, features, or parts regarding one embodiment applies to the commonly numbered components, features, or parts of other embodiments where such a description is omitted.

Optionally, at least some of the embodiments disclosed herein can be configured to be used with a primary container, such as a beverage container. In some environments of use, such a primary container can be a beverage or water bottle that is commercially available. It has been determined that a substantial portion of the commercially available beverage bottles, and in particular water bottles, have openings that fall within a well-defined range of sizes.

For example, with reference to FIG. 1, two water bottles 10, 12 are schematically illustrated therein. The water bottle 10 corresponds to beverage containers with a smaller opening at the lower end of a range. The water bottle 12 corresponds to beverage containers with larger openings, at the upper end of the range.

The illustrated beverage containers 10, 12 have similar shapes. For example, the water bottle 10 includes an opening 20 having an inner surface 22 which is generally cylindrical in shape. The inner surface 22 thus can define an inner diameter. The opening 20 includes a shaft length 24 that extends from the upper end 26 of the opening 22 to a lower end 28. At the lower end 28, the water bottle 10 tapers outwardly along a tapering wall 30 out to the maximum diameter portion 32 which forms the bulk of the volumetric capacity of the bottle 10. At the transition between the lower end 28 and the tapering wall 30, the water bottle 10 includes a shoulder 34.

Similarly, the water bottle 12 includes an opening 40 having an upper end 42 and an inner surface 44. The opening 40 has a lower end 46 transitioning to a tapering wall 48 at a shoulder 50. The tapering wall 48 connects to the main portion 52 of the bottle 12.

The water bottle 10 illustrated FIG. 1 includes an inner diameter of 0.85 inches at its inner surface 22. The bottle 12 has an inner diameter of 1.25 inches at its inner surface 44. It has been determined that a substantial portion of the presently commercially available water bottles have openings with inner diameters falling within the range of 0.85 inches to 1.25 inches. Thus the range of inner diameter sizes defined by the bottles 10, 12 extends over approximately 0.4 inches. FIG. 18F, described in greater detail below, illustrates bottles 12a, 12b having other inner diameter sizes.

Additionally, the shaft length 24 of the bottle 10 has a length of 0.38 inches and the shaft length of the bottle 12 is approximately 0.775 inches. It has been determined that a significant portion of the presently commercially available water bottles have shaft lengths within the range of approximately 0.38 inches to 0.775 inches, for example, approximately 0.4 inches to approximately 0.8 inches. Thus, the range of shaft lengths in a portion of the presently commercially available water bottles is 0.395 inches or approximately 0.4 inches.

Typically, the water bottles 10, 12, and other water bottles falling within the range of sizes of the water bottles 10, 12 described above, include threads on the outer surfaces of the openings 20, 40, for threaded engagement with caps. In order to ensure properly oriented positive engagement with such threads, a device to be connected to such threads would need to have threads of a corresponding size and pitch. Thus, it is difficult to design one attachment device which can positively engage in a spill proof manner, water bottles having different thread sizes or pitches.

With reference to FIG. 2, the beverage ingredient dispenser 100 can include a reservoir 110 for containing a beverage ingredient. For example, the reservoir 110 can be used to contain a beverage ingredient to be mixed with water or other liquids which may be contained in a primary container such as one of the water bottles 10, 12. In the embodiment of FIG. 2, the beverage ingredient dispenser 100 is configured for achieving a spill proof seal with a plurality of different water bottles having different sizes, such as the water bottles 10, 12.
In some embodiments, the beverage ingredient dispenser 100 includes a seal assembly 120 that is configured to generate at least spillproof seals with both water bottle 10 and water bottle 12, as well as one or more additional sizes of water bottles having intermediate sizes between the size of water bottle 10 and water bottle 12. For example, another water bottle (not shown) can have an opening with an inner diameter between 0.85 inches and 1.25 inches. Additionally, the seal assembly 120 can be configured to generate at least spillproof seals with different ranges of bottle sizes, optionally, inclusive of and/or greater than inner diameters of 1.25 inches such as 38 mm or about 1.5 inches or inclusive of and/or less than 0.85 inches, or other diameters.

In some embodiments, the seal assembly 120 can be configured to form spillproof seals with the inner surfaces of beverage containers, such as the inner surfaces 22, 44 of the water bottles 10, 12. As such, the seal assembly 120 is more likely to generate spillproof seals with different water bottles having different thread patterns on the outer diameter.

For example, seal assembly 120 can be configured to form a spill proof seal with the inner diameter of primary containers having any inner diameter, but with different thread patterns because such different thread patterns would not interfere with forming seals with the inner surfaces of the openings of such bottles. Additionally, such inner surfaces of beverage containers, which can be inwardly facing, can cooperate with attached devices to provide an anchoring function, for anchoring the attached device to the beverage container. Thus, in some embodiments, the seal assembly 120 can be configured to form a spill proof seal and to achieve an anchoring engagement with the inner surface with sufficient anchoring to prevent the dispenser 100 from being unintentionally removed from the beverage container, for example, when the dispenser is subjected to small axial forces in a direction away from the beverage container.

For example, the seal assembly 120 can be configured to form a spill proof seal and to achieve an anchoring engagement with the inner surface with sufficient anchoring to prevent the dispenser 100 from being removed from the associated bottle when a user pulls axially on a drink-through valve (described below). In some embodiments, the seal assembly 120 can be configured to generate an anchoring engagement with the inner surface of the beverage container that is sufficiently strong to support the entire weight of the beverage container to which it is attached, and optionally, a beverage contained therein, if the dispenser 100 is grasped by a user and lifted off of a table. For example, in some embodiments where the beverage container contains approximately 1 L of a beverage having about the same density of water, the anchoring engagement between the seal assembly 120 and the inner surface of the beverage container can be sufficiently strong to resist a kilogram-force of about 1 kilogram generated by the weight of the beverage container and the 1 L of the beverage contained therein.

Additionally, the dispenser 100 can include an additional anchoring device configured to engage a portion of the beverage container 10, 12 not in contact with the seal assembly 120, with additional anchoring to further resist the dispenser 100 from being unintentionally removed from the beverage container 10, 12, for example, when the dispenser 100 is subjected to small axial forces in a direction away from the beverage container 10, 12. In some embodiments, the combination of the anchoring engagement generated by the seal assembly 120 and such an additional anchoring device can generate an engagement with additional strength for resisting inadvertent removal of the dispenser 100 from the associated bottle, as described above. Optionally, in some embodiments, the additional anchoring device can generate further anchoring engagement sufficient to resist forces greater than the total weight of the beverage container and a beverage contained therein.

The seal assembly 120 can have various different configurations. For example, the seal mechanism 120 can comprise an assembly including multiple sealing surfaces at least one configured to be sealable against the inner surface of the opening of bottle 10 and at least one other configured to be sealable against the inner surface of bottle 12.

Optionally, the beverage ingredient dispenser 100 can include a dispensing mechanism 160 configured to cause the discharge of the beverage ingredient contained in the reservoir 110 and into a liquid contained within a water bottle 10, 12 to which the beverage ingredient dispenser 100 is attached. For example, the dispenser 100 can include a frangible lower wall 111 on the reservoir 110 and the dispensing mechanism can be in the form of a moveable piercing member disposed within the reservoir 110. Alternatively, the dispensing mechanism 160 can be mounted in a fixed position relative to the seal assembly 120 and the reservoir 110 can be mounted to be moveable relative to the seal assembly 120. In such configurations, the movement of the reservoir 110 can cause the frangible lower wall to be pressed against the piercing member, thereby opening the reservoir 160 for discharge of an ingredient container therein.

Optionally, the beverage ingredient dispenser 100 can include an actuator 190 configured to trigger operation of the dispenser mechanism 160. In some embodiments, the actuator 190 can also be integrated with a drink-through mechanism configured to allow a user to discharge liquid from the associated beverage container 10, 12, through the beverage ingredient dispenser 100, and outwardly, for example, for consumption.

FIGS. 3-7 illustrate a variation of the dispenser 100, identified with the reference numeral 100A having seal mechanisms 120A, 120B3 which operate under various principles of operation. FIGS. 8-10 illustrate variations 100C, 100D of the dispenser 100, including variations of the discharge mechanism 160C, 160D, respectively, as well as a variation of the actuator identified with the reference numeral 190D.

With reference to FIGS. 3 and 4, the beverage ingredient dispensers 100A can include a seal assembly 120A that is configured to move between contracted and expanded states. For example, FIG. 3 illustrates the seal assembly 120A in a first contracted state 121A. In some embodiments, the dimension 121A can define an outer diameter of the seal assembly 120A. Additionally, in some embodiments, the outer dimension 121A can be smaller than both the inner surfaces 22, 44 of bottles 10, 12.

FIG. 4 illustrates the seal assembly 120A in an expanded state in which the seal assembly 120A is expanded to an outer dimension 122A that is larger than the dimension 121A. For example, in some embodiments, the outer dimension 122A can define an outer diameter of the seal assembly 120A. Additionally, in some embodiments, the outer dimension 122A can be the same as the inner diameter of the
bottles 10 or 12. For example, in some embodiments, the seal assembly 120A can be configured to expand from the outer diameter 121A, which can be the same or less than the inner diameter of the bottle 10 (e.g., 0.85 inches) up to dimension 122A that can be the same or greater than the inner diameter of the inner surfaces 22, 44 and exert sufficient pressure to achieve a spillproof seal with both inner surfaces 22, 44. Additionally, optionally, the seal assembly 120A can be configured to expand the seal assembly 120A to both of the inner diameters of the inner surfaces 22, 44 and exert sufficient pressure to achieve anchoring of the dispenser 100A to both of the bottles 10, 12. [0157] For example, in some embodiments, the seal assembly 120A can include a seal member 124A and an expansion device 125A. As such, the expansion mechanism 125A can expand the seal member 124A in the direction of arrow E. The expansion mechanism 125A can be any type of expansion mechanism, manually or passively activated, electric, pneumatic, hydraulic, mechanical or other types of expansion mechanisms. The expansion mechanism can be configured to generate the desired forces. [0158] With reference to FIGS. 5-7, the beverage ingredient dispenser 1003 includes an outer dimension that is larger than the inner surfaces of both bottles 10, 12, to which the dispenser 1003 can be attached. Further, the seal assembly 1203 is configured to have a dimension of its outer surface reduced as it is moved into contact with the opening of a bottle 10, 12. For example, a seal assembly 1203 can be configured to be constricted so as to enhance a seal formed with a desired bottle 10, 12. [0159] For example, the seal assembly 1203 can include a seal member 1243. The seal member 1243 can include upper end having an outer dimension 1263 and a lower end having an outer dimension of 1273. In some embodiments, the outer dimension 1263 is larger than the largest bottle to which the dispenser 1003 is designed to be attached. For example, in some embodiments, the outer dimension 1263 can be greater than 1.25 inches. [0160] On the other hand, the outer dimension 1273 can be smaller than the smallest size bottle 10 to which the dispenser 1003 is designed to be attached. For example, the outer dimension 1273 can be less than about 0.85 inches. [0161] In some embodiments, the seal member 1243 can be conical in shape. However, other configurations can also be used. [0162] With reference to FIG. 6, the dispenser 1003 is illustrated as having been moved downwardly into the opening of a bottle 10, 12. As shown in FIG. 6, at the locations of initial contact 1283 of the seal number 1243 with the upper end of the openings of the bottles 10, 12, the seal number 1243 distorts forming an initial contact patch 1293. [0163] With reference to FIG. 7, upon further displacement of the dispenser 1003 into the bottles 10, 12, the seal assembly 1263 allows for further deformation of the seal member 1243, so as to better conform to the inner surface of the bottle 10, 12 and thereby increase the size of the contact patch to a larger contact patch 1303. Thus, the seal assembly 1203 can include a relief mechanism 1313 configured to allow contraction of a portion of the seal number 1243, for example, in the direction of arrow C in FIG. 7. [0164] In some embodiments, the relief mechanism 1313 can be configured to bias the seal member 1243 into an expanded state, for example, illustrated in FIG. 5 and to allow gross deformation of the seal member 1243, so as to allow a portion of the seal number 1243 to lie more parallel to an inner surface of a bottle 10, 12, and thus increase the size of a contact patch between the seal number 1243 and the inner surface of a bottle 10, 12 from a smaller contact patch 1283 to a larger contact patch 1303. [0165] In some embodiments, the seal assembly 1203 can be configured to form a contact patch having a height 1323, axially along the opening of the associated bottle 10, 12, of at least one-tenth of an inch and up to about 1/4 inches. Other heights can also be used. For example, in some embodiments, the seal assembly 1203 can be configured to generate the contact patch 1323 of at least one-tenth of one inch when the dispenser 1003 is attached, in the manner illustrated in FIG. 7, to a bottle 10 having an inner diameter of 0.85 inches and when attached to a bottle 12 having an inner diameter of 1.25 inches, and optionally, bottles having other inner diameters between 0.85 inches and 1.25 inches, as well as a range of 0.4" of bottles sizes of different diameters. Optionally, the seal assembly can be configured to form larger contact patches, such as at least 0.5" or 0.75" over such ranges of sizes of inner diameters. [0166] After insertion as illustrated in FIG. 7, a lower portion of the seal member 1243 can have a conical shape, and the upper portion in contact with the inner surface (22 or 44) can have a more cylindrical shape. [0167] With reference to FIG. 8, the beverage ingredient dispenser 100C can include a dispensing mechanism 160C having a piercing member 161C configured to pierce a frangible bottom wall 111C disposed at a lower end of the reservoir 110C. For example, the lower wall 111C can be formed of frangible material such as a foil, other materials commonly used in the food and beverage and/or pharmaceutical industries, or other materials. The frangible wall 111C can be configured to retain a beverage ingredient within the reservoir 110C. [0168] The piercing member 161C can include a lower end 162C configured to pierce the frangible wall 111C when the piercing end 162C is pressed against the frangible wall 111C. [0169] Optionally, the dispensing mechanism 160C can include at least one laterally extending surface 170C extending laterally from piercing member 161C. For example, the lateral surface 170C can be configured to assist in discharging a beverage ingredient from the reservoir 110C when the piercing member 161C is moved downwardly (as viewed in FIG. 8) (further described with reference to lateral surface 170D of FIG. 10). [0170] Additionally, the dispensing mechanism 160C can include a frangible wall deflecting assembly 180C. For example, the frangible wall deflecting assembly 180C can be configured to deflect separated pieces of the frangible wall 111C away from a center axis of the reservoir 110C. Such deflection, for example, can assist in preventing pieces of the broken frangible wall 111C from interfering with the flow of beverage ingredient out of the reservoir 110C or liquid from the attached container flowing into the reservoir 110C. [0171] Optionally, the frangible wall deflecting assembly 180C can be connected to the piercing member 161C with a connection assembly 181C. For example, a connecting assembly 181C can connect the piercing member 161C with
the deflecting assembly 180C such that the deflecting assembly 180C moves with the piercing member 161C. Optionally, the actuator 190D can be also connected to the piercing member 161C. Thus, for example, the actuator 190D can be configured to allow a user to press on an upper surface of the actuator 190D to thereby move the piercing member 161C in a downward direction, as viewed in FIG. 8.

[0172] With reference to FIGS. 9 and 10, the actuator 190D of the beverage ingredient dispenser 100D can be connected to both the dispensing mechanism 160D and the seal assembly 120D by a single movement of the actuator 190D in a single direction. For example, the actuator 190D can be configured to be pressed downwardly (as viewed in FIG. 9) by a user for example, and such a displacement of the actuator 190D causes both movement sufficient to achieve a desired spill-proof seal between the seal assembly 120D and the associated bottle 10, 12, as well as movement of the piercing member 161C into contact with the frangible wall 111D so as to open the frangible wall 111D and thus allow discharge of a beverage ingredient from the reservoir 110D.

[0173] For example, firstly with reference to FIG. 9, a user can press downwardly on the actuator 190D so that the seal assembly 120D deforms, expands, or contracts into a spill-proof sealing engagement with the associated bottle 10, 12, as illustrated in FIG. 10. Additionally, with movement of the actuator 190D, the piercing member 161D can be pressed downwardly, such that the piercing and 162D pierces the frangible wall 111D, thereby opening the frangible wall 110D and allowing a beverage ingredient to be released from reservoir 110D. Such downward movement can also cause downward movement of the lateral extending surface 170D. Oriented as such, the laterally extending surface 170D is oriented perpendicular, skewed, or oblique relative to the movement of the piercing member 161D, and can further cause discharge of ingredient from the reservoir 110D downwardly through the opening in the frangible wall 110D.

[0174] Additionally, the downward movement of the piercing member 161D, can also cause downward movement of a frangible wall deflection assembly 180D. For example, as illustrated in FIG. 10, the deflection assembly 180D is spaced juxtaposed to an inside wall of the reservoir 110D. Thus, as the piercing member 161D and deflection assembly 180D is moved downwardly, the deflection assembly 180D further pushes a broken portion of the frangible wall 110D downwardly and away from the center of the reservoir 110D. As such, the deflection assembly 180D can further enhance discharge of ingredient from the reservoir 110D and prevent the broken piece of frangible wall 110D from moving back into a position interfering with the flow of material in and out of the reservoir 110D.

[0175] Optionally, the actuator 190D can also include a drink through valve, described in greater detail below with reference to the embodiments of FIGS. 42-60.

[0176] FIGS. 11-17 illustrate a variation of the dispenser mechanism 160D, identified generally with the reference number 160E. Although FIGS. 11-17 illustrate the dispensing mechanism 160E in detail as being separated from nearly all other components of a beverage ingredient dispenser, however, the dispensing mechanism 160E can be used with any of the beverage ingredient dispensers described above with reference to FIGS. 2-10 as well as any of the beverage ingredient dispensers disclose below with regard to FIGS. 18-62.

[0177] With reference to FIGS. 11 and 12, the dispensing mechanism 160E includes a piercing member body 161E having the lower piercing tip 162C and an upper end 163C. The upper end 163C can form an actuator 190 (not shown in FIG. 11), can be configured for connection to an actuator 190, and/or connection to a drink through valve which can be optionally incorporated into an actuator 190.

[0178] In the illustrated embodiment, the piercing member body 161E includes a central shaft member 164E. The central shaft member 164E can extend between the upper end 163C and the piercing tip 162C. Additionally, the central shaft member 164E can be provided with sufficient strength to withstand a compression force required for example, the piercing of the frangible wall 111C.

[0179] Optionally, the dispensing mechanism 160E can include at least one laterally extending surface 170E. In the illustrated embodiment, the at least one laterally extending surface 170E includes at least a first laterally extending member 171E extending laterally away from an outer surface of the frangible wall 164E. The laterally extending member 171E includes at least one surface 172E oriented transverse, oblique and/or skewed relative to the direction of movement of the central shaft member 164E. For reference, the arrow D of FIG. 11 represents the direction of movement of the central shaft member 164E when used in conjunction with a beverage ingredient dispenser.

[0180] Optionally, as illustrated in FIG. 11, the surface 172E is disposed between the upper end 163C and the lower end 162C along the portion of the central shaft number 164E that is disposed within a reservoir 110 of an associated beverage ingredient dispenser. As such, when the piercing member 161E is moved in the direction of arrow D, the surface 172E would also move beverage ingredient disposed below the surface 172E and urge it in the direction of arrow D.

[0181] In the illustrated embodiment, the at least one laterally extending surface 170E includes a plurality of laterally extending members 171E disposed around the circumference of the central shaft 164E. In the illustrated embodiment, the laterally extending members 171E are spaced apart from each other in a clover-leaf-like pattern. Other patterns and shapes can also be used.

[0182] With reference to FIGS. 13 and 14, the dispensing mechanism 160E can also include a frangible wall deflection assembly 180E. In the illustrated embodiment, the deflection assembly 180E comprises a ring member 181E having an outer surface 182E juxtaposed and closely spaced to an inner wall 112E of an associated reservoir 110E. With the member 181E positioned as such, as the member 181E is moved downwardly past the lower end of the reservoir 110E, the member 181E can deflect portions of a frangible wall 111E away from the center of the reservoir 110E.

[0183] Optionally, the deflection assembly 180E can include radially oriented cutting blades 183E. In the illustrated embodiment, the deflection assembly 180E includes five blades 183E. However, other numbers of blades and configurations can also be used.

[0184] As shown in FIGS. 13 and 14, the blades 183E extend from the central shaft member 164E, at a position above the piercing tip 162E and laterally outwardly to a position laterally beyond the outer surface 182E and into
close spacing or in contact with the inner surface 112E. Optionally, the blades 183E can be fixed to the ring member 181E so as to directly connect the ring member 181E to the central shaft member 164E. Optionally, a lower edge 184E of the ring member 181E can be rounded or sharpened.

[0185] With reference to FIG. 13, the blades 183E extend beyond the outer surface the ring member 182E by a distance of 185E. This distance 185E can be chosen so as to achieve the desired deflection of an associated frangible wall and allow sufficient space for the ring member 181E to pass by a folded frangible wall portion. In some embodiments, this spacing 185E is at least two or three times the thickness of the associated frangible wall. Other spacings can also be used.

[0186] FIGS. 15-17 schematically illustrate the process of the piercing tip and deflection assembly 180E piercing and deflecting a frangible wall 111E. More specifically, as shown in FIG. 15, a lower end of a reservoir 110E is illustrated in perspective view, and includes a lower frangible wall 111E. In the position illustrated in FIG. 15, the dispensing mechanism 160E (illustrated largely in phantom line) has been displaced downwardly along the direction of arrow D until the piercing tip 162E has pierced a central area of the frangible wall 111E.

[0187] With reference to FIG. 16, with further movement of the discharge mechanism 160E along the direction of arrow D, the cutting blades 183E cut and/or cause further cleavage of the frangible wall 111E. The configuration of the assembly 180E causes the frangible wall 111E to tear into wedges circumferentially arranged around a center of the frangible wall 111E.

[0188] As shown in FIG. 17, as the displacement assembly 180E is moved beyond the lower end of the reservoir 110E, the ring member 181E folds the remaining wedge shaped pieces of the frangible wall 111E downwardly. The spacing 185E described above with reference to FIG. 13, can provide the additional advantage of providing space for the frangible wall portions to fold along the outer circular edge of the lower end of the reservoir 110E. Such a folding movement is not a natural movement for the material, and can cause wrinkles or gathers 186E. Additionally, the spacing 185E reduces the likelihood that the frangible wall 111E would be pulled off from the lower end of the reservoir 110E. Optiona. lly, the spacing 185E is sized such that the frangible wall 111E is not pulled off from the lower end of the reservoir 110E. The magnitude of the spacing 185E sufficient to prevent the frangible wall 111E from being pulled off from the lower end of the reservoir 110E can be effected by the material used for and the thickness of the frangible wall 111E, as well as the manner of attachment of the frangible wall 111E. Thus, the minimum magnitude of the spacing 185E can be determined by experimentation. In some embodiments disclosed here, the spacing 185E can be at least \( \frac{1}{2} \alpha \) further. In some embodiments, the spacing 185E can be between \( \frac{1}{2} \alpha \) and \( \frac{1}{3} \alpha \).

[0189] During use with an associated beverage ingredient dispenser, the dispensing mechanism 160E, optionally, can remain in the position illustrated in FIG. 17, allowing discharge of ingredient from the reservoir 110E and allowing liquid from the associated bottle to flow into the reservoir 110E. Additionally, the ring member 181E prevents the remaining portions of the frangible wall 111E from folding toward the center of the reservoir 110E and potentially interfering with the flow of ingredients and/or liquids in and out of the reservoir 110E. Additionally, the folding deformation of the portions of the frangible wall 111E, which can cause wrinkles or folds 186E noted above, can create a plastic deformation in some materials, such as foil, thereby also generating some resistance against movement of the pieces of the frangible wall 111E toward the center of the reservoir 110E.

[0190] FIGS. 18A-18E illustrate a modification of beverage ingredient dispenser 100, identified generally by the reference numeral 200. Parts, components, and feature of the dispenser 200 that are the same or similar to corresponding parts, feature, or components of the embodiments described above are identified with the same reference numeral, except that 100 has been added to the value of the numeral. The same convention of numeral identification applies to the embodiments of FIGS. 19-62, described below.

[0191] With continued reference to FIGS. 18A-18D, the seal assembly 220 can be configured to form spilloof seals for the plurality of different bottle sizes having openings with different inner diameters. For example, optionally, the seal assembly 220 can be configured to form seals with the inner surfaces of a range of sizes of bottles having diameters that differ over a range of approximately 0.4 inches. In the embodiment of FIG. 18, a seal assembly 220 includes a seal member assembly 224 which includes a plurality of concentric layers 228, 229. The concentric layers 228, 229 can be separate concentric rings or can be formed within a single, monolithic piece of resilient material. Such materials can include any of the following silicone, urethane, various rubber, elastomers, soft plastics, and other materials can also be used. Optionally, the materials used for the layers 228, 229 can have a hardness of 30-90 Shore A scale. Other materials with other hardnesses can also be used.

[0192] The layers 228 can have outer surfaces shaped to fit within the openings, and seal therewith, of bottles of different sizes. For example, the layer 228 can include a lower end 227A defining an outer diameter that is less than 0.85 inches. Additionally, the inner layer 228 can define an outer diameter 226A that is larger than 0.85 inches. Similarly, the outer layer 229 can include a lower end 227B defining a diameter that is less than 1.25 inches but greater than 0.85 inches. Further, the outer layer 229 can include an upper end defining an outer diameter 226B that is greater than 1.25 inches.

[0193] Thus, for example, the opening of the bottle 10 can be inserted around the lower end 227 of the layer 228 and moved into a spilloof sealing engagement with the layer 228.

[0194] Similarly, as shown in FIG. 18E, the bottle 12 can be moved over the outer layer 229 and into a sealing engagement with the outer surface of layer 229 so as to form a spilloof seal. Bottles of other sizes can also achieve spilloof seals with either the layer 228 or 229.

[0195] Optionally, a user can actuate the actuator 290 to actuate the dispensing mechanism 260. For example, a user can push downwardly on the actuator 290, which is connected to the dispensing mechanism. Upon downward movement, the dispensing mechanism opens the lower wall 211 of the reservoir 210, thereby allowing beverage ingredient to be released from the reservoir 210. Additionally, a user can apply the downward force to the actuator 290 to cause the movement required to seal the seal assembly 220 with the inner surface of the bottle 12. Thus, the dispenser 200 can be installed and sealed to either of the bottles 10, 12 with a single direction of movement.
FIGS. 18F-18H illustrate another modification of the beverage ingredient dispenser 200, identified generally by the reference number 200a. Parts, components, and features of the dispenser 200a that are the same or similar to corresponding parts, features, or components of the dispenser 200 described above are identified with the same reference number, except that the letter “a” has been added thereto.

With continued reference to FIGS. 18F-18H, the dispenser 200a is configured to form spillproof seals with a plurality of different bottle sizes having openings with different diameters, over a larger range of different sizes than those described above with reference to dispenser 200. For example, with reference to FIG. 18E, the seal assembly 220a is illustrated juxtaposed two different bottles, the first bottle 12a having an inner diameter of approximately 1/4 inches, for example, 1.14 inches or 29 millimeters and second larger beverage container 12b which has an inner diameter of approximately 1/4 inches, for example, 1.77 inches or 45 millimeters.

In some embodiments, the seal assembly 220a includes at least two annular sealing members configured to provide a seal that can seal with a range of beverage container sizes having inner diameters that vary over a range of approximately 1/4ths of an inch, for example, 0.63 inches. Thus, in some embodiments, the seal assembly 200a can include a first seal layer 228a and a second seal layer 228b, arranged concentrically relative to one another. As such, similarly to the embodiments of FIGS. 18A-18E, the seal assembly 220a can generate substantially spillproof seals with a range of sizes of beverage containers.

In some embodiments, the seal assembly 200a can have a third layer 228a1. The layer 228a1 can be configured to generate spillproof seals with smaller beverage containers, for example, the beverage container 10 illustrated in FIGS. 18G and H.

Similarly to the dispenser 200, the dispenser 200a can include a reservoir 210a and an actuator 290a connected to a dispenser mechanism (not shown) for discharging a beverage ingredient from the reservoir 210a.

FIGS. 18I-18N illustrate another modification of the beverage ingredient dispenser 200, identified generally by the reference number 200b. Parts, components, and features of the dispenser 200b that are the same or similar to the corresponding parts, features, or components of the embodiments described above are identified with the same reference number, except that a letter “b” has been added thereto.

With reference to FIGS. 18I and 18J, the dispenser 200b can be configured to receive blister pack members and provide for convenient alignment of the frangible part of the blister pack member for discharging a beverage ingredient into a beverage container. For example, as an example of type of blister pack that can be used with the dispenser 200b, FIG. 18I illustrates a blister pack assembly 2300 which includes a plurality of blister pack members 2302.

As is typical in the construction of blister pack members, each blister pack member has a stiffer frame portion 2304 extending around the periphery of a compressible portion 2306 and a frangible portion 2308. In this context, a beverage ingredient 2310 is disposed between the compressible and frangible portions 2306, 2308. Thus, a user can compress the compressible portion 2306 so as to press the beverage ingredient 2310 against the frangible portion 2308 to thereby break the frangible portion 2308 and thereby discharge the beverage ingredient 2310 from the blister pack assembly 2302.

With reference to FIG. 18K, the beverage ingredient dispenser 200b can include a seal assembly 220b and a blister pack receiver portion 210b. The seal assembly 220b can be configured to generate a spillproof seal against an inner surface of the opening of a beverage container. For example, the seal assembly 220b can include one or more layers 228b, 229b, configured to form spillproof seals the inner surfaces of a plurality of different sizes of beverage containers. In some embodiments, although not illustrated, the seal assembly 220b can include a third layer, such as layer 228a1 of the embodiment of FIG. 18H. More layers can also be used.

The blister pack receiver 210b can include a central portion 2310 and an optional sealing arrangement 2312 configured to seal against an inner surface 2314 of the seal assembly 220b.

The blister pack receiver 210b can also include a blister pack receiving portion 2316 configured to receive a blister pack member 2302. Additionally, the blister pack receiver 210b can include a central aperture 2320 aligned with the central portion of the blister pack receiver portion 2316.

With reference to FIG. 18M, the blister pack receiving portion 2316 can include a slot 2322 having a shape and size sufficient to receive the blister pack member 2302 and to register a position of the blister pack member 2302 in which the frangible portion 2308 is aligned with the aperture 2320. For example, the slot 2322 can include first and second side walls 2324 and 2326 that match a shape of lateral side edges of the blister pack member 2302. Additionally, the slot 2322 can include a back wall 2328 also shaped complimentary to a side edge of the blister pack member 2302. The spacing of the walls 2322, 2326, 2328 can be configured, shaped and positioned such that the frangible portion 2308 of the blister pack member 2302 is aligned with the aperture 2320 when the side walls of the blister pack member 2302 are pressed against the walls 2324, 2326, 2328. As such, when the blister pack member 2302 is pushed into the slot 2322, a user can push down on the compressible portion 2306 to thereby press the beverage ingredient 2310 against the frangible portion 2308 and thereby break the frangible portion 2308 and discharge the beverage ingredient 2310 through the frangible portion 2308, through the aperture 2320, and into the beverage container.

In some embodiments, the slot 3322 can include a bottom surface 2330 configured to improve a seal between a lower surface of the blister pack member 2302 and the receiver 210b. For example, the bottom wall of the 2330 of the slot 2322 can be made from a silicone material or another conforming. Optionally, the entire receiver 210b can be made from the same material. In some embodiments, annullar portion 2332 encircling the aperture 2320 can be made from a different material configured to improve a seal between the lower surface of the blister pack member 2302 and the bottom wall of the slot 2322. In some embodiments, the surface 2332 is configured to extend around and/or across a portion of the frangible portion 2308 of the blister pack member 2302.

As such, when a user presses down on the compressible portion 2306 and discharges the ingredient 2310
into the beverage container, a user can maintain pressure on the compressible portion 2306 and simultaneously shake the beverage container 10, 12a, 12b so as to enhance mixing of the beverage ingredient 2310 with the liquid in the beverage container 10, 12, 12a, 12b.

[0210] FIGS. 18O-18Q illustrate a modification of the dispenser 200c, identified generally by the reference number 200c. Parts, components, and features of the dispenser 200c that are the same or similar to corresponding parts, features, or components of the embodiments described above are identified with the same reference numbers, except that a letter “c” has been added thereto.

[0211] With reference to FIG. 18O, the dispenser 200c can be configured to receive non-square blister pack members 2302c, which can come in the form of a blister pack assembly 2300. In the embodiment of FIG. 18O, the blister pack assembly 2300 includes blister pack members 2302c which include a frame portion that is hexagonal, and surrounding the compressible portion 2306c and the frangible portions 2308c. In some embodiments, the blister pack member 2302c can be partially hexagonal, for example, having a part rectangular frame portion and a part of a hexagonal frame portion, as illustrated in the lower portion of the lower right hand portion of the assembly 2300c illustrated in FIG. 18O. The blister pack members 2302c can be connected to one another at the periphery of the frame portions with frangible portions, for example, at the points at which the blister pack members 2302c contact each other. When broken, the frangible portions can present imperfections along the peripheral edges of the thereby separated blister pack members 2302c.

[0212] With reference to FIG. 18P, the blister pack receiver 210c can include a slot 2322c configured to receive hexagonal or partly hexagonal blister pack members 2302c and register alignment of the frangible portion 2308c of the blister pack member 2302c with the aperture 2320c. For example, sidewalls 2324c, 2326c and 2328c can be configured, sized, and shaped to be complimentary to hexagonal sidewalls of the blister pack member 2302c and align the blister pack member 2302c with the frangible portion 2308c thereof aligned with the aperture 2320 when the hexagonal sidewalls are pressed against the sidewalls 2324c, 2326c, 2328c of the slot 2322c. The configuration, size, and shape of the sidewalls 2324c, 2326c and 2328c can accommodate imperfections that may remain from the frangible portions that may have been broken to separate the blister pack member 2302c from the blister pack assembly 2300c.

[0213] FIGS. 18R-18T illustrate yet another modification of the beverage dispenser 200, identified generally by the reference number 200d. Parts, components, and features of the dispenser 200d that are the same or similar to corresponding parts, features, or components of the embodiments described are identified with the same reference number except that a letter “d” has been added thereto.

[0214] With reference to FIG. 18R, the blister pack receiver 210d can be configured to receive semicircular or circular blister pack members 2302d. As shown in FIG. 18R, the blister pack member 2302d can be attached to one another at frangible portions forming a blister pack assembly 2300d. The blister pack members 2302d can include a generally circular frame member portion surrounding the compressible portions 2306d and frangible portions 2308d. When broken, the frangible portions can present imperfections along the peripheral edges of the thereby separated blister pack members 2302d.

[0215] As shown in the lower right hand portion of FIG. 18R, and phantom line, blister pack member 2302d can be entirely or semicircular, for example, having a partly flat or rectangular outer periphery and a partly circular or semicircular portion. In some embodiments, the non-rectangular portion or the partly circular or semicircular portion of the blister pack member 2302d can extend around about halfway around the periphery, for example, in some embodiments, about 180 degrees around the periphery of the blister pack member 2302d.

[0216] With reference to FIG. 18S, the blister pack receiver 210d can include a partly circular 2322d slot. For example, the back wall 2328d can be circular or semicircular and configured to be complimentary to an outer shape of the blister pack members 2302d. The walls of the slot 2322d including the back wall 2328d can be configured, sized, and positioned so as to hold the blister pack member 2302d in a position with the frangible portion 2308d aligned with the aperture 2320d when the blister pack member 2302d is pressed against the back wall 2328d. The configuration, size, and shape of the sidewalls 2324d, 2326d and 2328d can accommodate imperfections that may remain from the frangible portions that may have been broken to separate the blister pack member 2302d from the blister pack assembly 2300d. The circular or semicircular shape of the blister pack member 2302d can provide a further advantage in simplifying the insertion process of the blister pack member 2302d into the slot 2322d.

[0217] FIGS. 18U-18X illustrate a modification of the chamber 210 of the dispenser 200 illustrated in FIGS. 18A-18E, identified generally by the reference numeral 210c, including a dustcap. Parts, components, and features of the reservoir 210c that are similar or the same as the reservoir 210 are identified with the same reference numerals except that a letter “c” has been added thereto.

[0218] With reference to FIGS. 18U-18W, the reservoir 210c can be configured to engage with a dustcap 291, or other structures that can extend over the actuator 290c. For example, in some embodiments, the reservoir 210c can include arcuate recesses 292 disposed on opposite edges of a peripheral flange 293 thereof. The arcuate recesses 292 can have a uniform depth 294 along the arc lengths of the recesses 292.

[0219] With reference to FIG. 18X, the dustcap 291 can be configured to extend over the actuator 290c and engage the peripheral flange 293. A lower end 295 of the dust 291 can include an inner peripheral edge 296 extending around in inner side of the periphery of the lower end 295. In some embodiments, the dustcap 291 includes one or more anchoring projections 297. The one or more anchoring projections 297 can extend inwardly from the inner peripheral edge 296 and have a shaped complimentary to the arcuate recesses 292 on the reservoir 210c. For example, the anchoring projections 297 can have a uniform depth 298 is approximately the same as or slightly less than the depth 294 of the recesses 292. Additionally, the anchoring projections 297 can be disposed on opposite sides of the dustcap 291 in positions corresponding to the recesses 292 on the chamber 210c. As such, the dustcap 291 can be securely anchored to the chamber 210c in such a position so as to protect the actuator 290c from inadvertent actuation. Additionally, the
arcuate recesses 292 and anchoring projections 297 can be chamfered or otherwise configured to allow a user to remove the dust 291 from the chamber 210e by manual manipulation.

[0220] FIGS. 19-20 illustrate a variation of the beverage ingredient dispensers of FIGS. 2 and 5-10 and is identified generally by the reference numeral 300.

[0221] As illustrated in FIGS. 19-22, the seal assembly 320 includes a conically shaped seal member 324 extending around the reservoir 310. A lower end 327 of the seal body 324 can be attached to the reservoir 310. In the illustrated embodiment, the reservoir 310 includes an outwardly projecting ridge 315 that extends continuously or discontinuously around an outer surface of the reservoir 310. The lower end 327 of the seal number 324 includes a recess shaped complimentary to the ridge 315 for attachment thereto. Optionally, the seal member can be permanently affixed to the ridge with an adhesive or other attachment techniques. Optionally, the connection between the ridge 315 of the reservoir 310 and the seal body 324 can be spill proof and/or water tight.

[0222] Optionally, the seal member 324 can be made from a tubular piece of resilient material. For example, the resilient material forming the seal member 324 can have a straight cylindrical shape at rest. Further, the seal body 324 can be joined with the dispenser 300 such that the upper end 326 of the seal member 324 is elastically deformed in a radially outward direction, for example, in the conically-shaped state illustrated in FIG. 19. This can provide the added advantage that when the seal body 324 is constricted, for example, in a radially inward direction, the seal body 324 would be relaxed, thereby absorbing the inward constriction without forming folds.

[0223] With reference to FIGS. 20 and 21, the relief mechanism 331 includes at least one member configured to press outwardly against an inner surface of the seal member 324 so as to support the seal body 324 in the shape illustrated in FIG. 19.

[0224] In some embodiments, the at least one member 324 can be in the form of a leaf spring or cantilevered member attached to the reservoir 310 and at a lower end thereof. The member can be shaped to extend upwardly and radially outwardly from the lower end, relative to the reservoir 310.

[0225] For example, the at least one member 331 can include a lower end 332 attached to an outer wall of the reservoir 310. Optionally, the lower end 332 can be attached to the ridge 315. The member 331 can be mounted in an orientation and made from a material so as to maintain the position illustrated in FIGS. 19-21 when at rest and to contract inwardly when moved against an inner surface of the sealed body 324. When a radially inward force is applied to the outer surface of the seal member 324, the at least one member 331 can deflect inwardly, deforming in accordance with the principle of operation of a cantilever spring or a leaf spring.

[0226] Optionally, the relief mechanism 331 can include a support member 335 configured to maintain a desired arrangement and orientation of the upper end of the member 332 for example, prior to connection with a beverage container. For example, the support member 335 can be formed of a ring of relatively rigid material and be engaged with the upper end 336 of the member 332. For example, in some embodiments, the upper end 336 can be engaged to the support member 335 with a frangible connection, such as a thin or weakened plastic section. The frangible connection between the upper end 336 and the support member 335 can be formed to have sufficiently low strength such that the frangible connection is broken with the dispenser 300 is used in the manner illustrated in FIG. 22 (described below).

[0227] Optionally, the relief mechanism 331 can include a plurality of members 332 arranged concentrically around an outer wall of the reservoir 310. As such, the members 332 can provide a more balanced support for the seal member 324. In some embodiments, the dispenser or the relief mechanism 331 includes 14 members 332 spaced apart from each other. For example, in some embodiments, the members 332 can be spaced apart by approximately 0.1 to 0.3 inches. However, other configurations can also be used.

[0228] With reference to FIG. 22, when a user pushes the dispenser 300 downwardly into a bottle, such as the bottle 10 illustrated in FIG. 22, the seal member 324 is deformed inwardly as it is pressed against the inner surface 22 of the bottle 10. With continued movement into the bottle 10, the seal member 324 presses against the members 332 with sufficient force to break that frangible connection between the upper end 336 and the support member 335. Constructed as a cantilever or leaf spring, the members 332 bend into a curved shape, allowing an upper portion, for example, in the vicinity of the upper end 326 of the seal body 324, to deflect inwardly and achieve an enlarged contact patch between the outer surface of the seal member 324 and the inner surface 22 of the bottle 10. Optionally, after the frangible connections between the upper ends 336 and the support member 335 are broken, a user can discard the support member 335.

[0229] In the illustrated embodiment of the dispenser 300, the actuator 390 includes a cap member 390 having an upper surface 391 and a lower surface engaged with an upper end 363 of the piercing member 361. Additionally, the actuator 390 is engaged with an upper wall 315 of the reservoir 310.

[0230] Optionally, as illustrated in FIG. 21, the upper wall 315 of the reservoir 310 can be configured to be deflectable along the direction of arrow D. In the illustrated embodiment, the upper wall 315 includes corrugations forming bellows 316. As such, the actuator 390 can be moved relative to the lower portion of the reservoir 310, the deformation of the bellows 316, for example, in response to the application of force downwardly onto the actuator 390, by a user.

[0231] The downwardly directed force imparted to the actuator 390 can provide both movement of the piercing member 361 downwardly through the reservoir 310 as to pierce the frangible wall 311, as well as providing a force for the deformation of the seal number 324 as it is pressed against the inner surface of the bottle 10. For example, as shown in FIG. 22, the application of a force F onto the actuator 390 causes all three of the downward movement of the dispenser 300 into the bottle 10, the deformation of the seal member 324, and the downward movement of the piercing member 361. As such, the installation of the dispenser 300 onto a water bottle 300 can be performed by the application of a force in a single direction causing movement along a single direction relative to the bottle 10, thereby simplifying the procedure for mounting the dispenser 300 to a bottle.

[0232] FIGS. 23-26 illustrate a modification of the embodiments of FIGS. 2-4 and 8-10, and is identified generally by the reference numeral 400.

[0233] With reference to FIG. 23, the dispenser 400 includes an actuator 490 with an upper actuation surface 491
and a lower end 492 configured to interact with the expansion mechanism 425 of the seal assembly 420. In the illustrated embodiment, the actuation surface 491 is disposed atop of a plurality of bellows 493 formed in the upper wall of the actuator 490.

[0234] An outer wall 494 extends outwardly from the bellows 493, and downwardly to the lower wall 492. The lower wall 492 tapers inwardly, along a conical shape to the lower end 495 of the actuator 490.

[0235] The seal assembly 420, in the illustrated embodiment, optionally includes two seal members 424A, 424B. Additionally, the seal assembly 420 includes an inner bushing member 428 disposed within the seal members 424A, 424B and attached to inner surfaces of the seal members 424A, 424B. The bushing member 428 includes an inner surface 429 that has a ramped or conical shape. Optionally, the shape of the inner surface 492 can be complimentary to the shape of the lower wall 492 of the actuator 490. Additionally, the bushing member 428 can be resilient and expandable.

[0236] With reference to FIGS. 25 and 26, downward movement of the actuator 490 along the direction of arrow D brings the outer surface 495 into contact with the inner surface 429. Then, further movement of the actuator 490 along the direction of arrow D, causes the bushing 428 to be expanded radially outwardly due to interaction with the ramped or conical surface of the lower end 492. Lower surface 492 and the inner surface 429 are shaped and configured to cause, when moved into a concentric mating orientation with each other, the radial expansion of the seal members 424A, 424B through a range of diameters, as described above. Additionally, a force F applied to the upper surface 491 of the actuator 490 causes deformation of the upper wall, for example the bellows 493, thereby displacing the piercing member 461 downwardly through the frangible wall 411 of the reservoir 410.

[0237] FIGS. 27-30 illustrate another variation of the embodiments of FIGS. 2-4 and 8-10, identified generally by the reference numeral 500. With reference to FIGS. 27 and 28, the dispenser 700 includes an actuation surface 591 that is generally dome-shaped. In the illustrated embodiment, the actuator 590 is made from upper and lower pieces 597, 598 attached together at a joint 599. The upper portion 597 can be made from a flexible or resilient material. The lower portion 598 can be made from a harder material.

[0238] With reference to FIGS. 27 and 28, the outer surface 592 of the actuator 590 can include surface features 592A which can form part of a ratcheting mechanism. For example, the bushing member 528 can include cooperating surface features 529A which can form second part of the ratcheting mechanism.

[0239] For example, with reference to FIGS. 29 and 30, downward movement of the actuator 590, along the direction of arrow D causes the expansion of the seal member 524 through the interaction of the outer surface 595 and inner surface 529. Additionally, the surface features 592A and 529A can be configured to engage in an interference or ratcheting manner, so as to resist movement of the actuator 590 away from the seal assembly 520. For example, the surface features 592A can include upwardly slanted ridges and the surface features 529A can include recessed channels. Sliding movement between the outer surface 595 along inner surface 529 would generate less resistance to movement downwardly in the direction of arrow D due to the upward slanted shape of the surface features 592A but would resist upward relative movement to a greater degree due to the upwardly ramped shape of the surface features 592A. Other configurations can also be used.

[0240] As a result, when the actuator 590 is in the position in the state of illustrated in FIG. 30, the surface features 529A, 592A would resist movements of the actuator 590 upwardly in the opposite direction of arrow D. Additionally, the upper portion 597 can be deformed, for example, by application of a force F by a user thereby causing downward movement of a piercing member 516.

[0241] FIGS. 31-34 illustrate yet another variation of the embodiments of FIGS. 2-4 and 8-10, identified generally by the reference numeral 600. With reference to FIGS. 32-34, the seal assembly 620 includes a bushing 628 having a generally cylindrical shape and a ramp or conically-shaped inner surface 629. Optionally, the bushing 628 can include a plurality of internal passages 628A to provide the grommet 628 with increased flexibility. The internal passages 628A can be in the form of continuous circular hollow passages or discontinuous voids. Other configurations can also be used.

[0242] FIGS. 35-39 illustrate another variation of the embodiments of FIGS. 2 and 5-10 and is identified generally by the reference numeral 700. FIG. 35 illustrates the dispenser 700 engaged with the bottles 10, 12, to illustrate the adaptability of the dispenser 702 engage with the range of sizes of bottles represented by the bottles 10, 12.

[0243] With reference to FIGS. 35-38, the dispenser 700 can include a seal assembly 720 with an inwardly delatable seal member 724. The seal member 724 can be in the shape of a conical seal member. The dispenser 700 can including a bushing 728 disposed within the seal member 724. The bushing 728 can be in the configuration of an expandable split ring. Additionally, the dispenser 700 can include a ratcheting ring 729, disposed within the bushing member 728. Further, the dispenser 700 can include a spring 731 disposed within the ratcheting ring 729. The spring 731 includes an outer end 736 with an engaging feature 740 configured to engage with the ratcheting ring 729 in a ratcheting manner. For example, the ratcheting ring 729 can include surface features 729A in the form of slots, for example. The engaging feature 740 on the spring 731 can be in the form of a ramped tooth, configured to slide over the slots in one direction, for example, a radially inward compression direction of the spring 731, but resist a movement in the opposite direction. As such, portions of the seal member 724 can deflect inwardly, against the outward bias of the spring 731 during insertion of the dispenser 700 onto a bottle. Additionally, the spring 731 can compress in a ratcheting manner, to allow the compression of the seal member 724 to better conform to the shape of the bottle opening and to achieve a spill proof seal.

[0244] FIGS. 40 and 41 illustrate a modification of the spring 731 of the dispenser 700, identified generally by the reference numeral 731A. In this modification, the spring includes an inner, circumferential base member 731A1 and a plurality of flexible, arcuate arms 731A2. The arms 731A2 can be configured to be deflectable between a relaxed state (FIG. 40) and a compressed state (FIG. 41) in which the arms 731A2 are elastically deflected inwardly and pressing outwardly against the inner surface of the bushing 728A.

[0245] FIGS. 42-45 illustrate another modification of the embodiments of FIGS. 2 and 5-10, identified generally by the reference numeral 800.
The dispenser 800 can include a seal assembly 824 that is similar to or the same as the seal assembly 320 described above with reference to FIGS. 19-22.

With reference to FIGS. 43 and 44, the dispenser 800 can include an integrated drink through device 870. The drink through device 870 defines at least a portion of a fluidic passage extending from the interior of the reservoir 810, through an upper wall of the reservoir 810, and to an exterior of the dispenser 800. The drink through mechanism 870 can include a valve 871 including a valve seat and a valve body 873 moveable relative to the valve seat 872. In the embodiment illustrated in FIGS. 43, 44, and 45A, valve 871 is in a closed position. Additionally, the valve seat 872 can be integrated with the dispensing mechanism 860.

In the illustrated embodiment, the piercing member 861 includes an upper laterally extending flange 887 attached to the upper end 863 of the central member 864. In this configuration, the flange 887 defines an upper wall of the reservoir 810. Additionally, the flange member 887 can include one or more fluid passages 887A connecting the interior of the reservoir 810 with the chamber 888A. The piercing member 861 further defines an intermediate chamber 888 disposed between the flange 887 and the valve 871. The piercing member 861 can further include a second flange 889 disposed above the chamber 888 and defining an upper wall of chamber 888. Optionally, the flange 889 can also include the valve seat 872.

The piercing member 861 can also include walls defining a second chamber 888B disposed above the chamber 888A. The flange 889 can define a lower wall of the chamber 888B.

The drink through mechanism 870 can include an external flange member 872 and a fluid aperture 874 defining an opening to the exterior of the dispenser 800. The drink through mechanism 870 can also include an axial fluid passage 875 terminating at the valve member 873. Further, the mechanism 870 can include lateral fluid passages 876 connecting the axial fluid passage 875 with passages within the piercing member 861.

With reference to FIGS. 45A and 45B, at least a portion of the drink through mechanism 870 can be mounted so as to be axially moveable relative to the piercing member 861. For example, the mechanism 870 can be mounted to be moveable between opened (FIG. 45B) and closed (FIG. 45A) positions. The position illustrated in FIGS. 43, 44, and 45A is the closed position, in which the valve member 873 is received in the valve seat 872, thereby blocking a fluidic passage between the reservoir 810 and the aperture 874.

When the mechanism 870 is moved upwardly in the direction of arrow 0, as illustrated in FIG. 45B, the valve member 873 is moved away from the valve seat 872. Thus, a fluidic passage is opened between the reservoir 810 to the aperture 874.

For example, when the mechanism 870 is positioned in the upward, open position (FIG. 45B), a continuous fluidic passage is opened, allowing fluids to pass from the reservoir 810, upwards through the aperture 887A, into the chamber 888A, through the valve seat 872, into the passages 876, upwards through the axial passage 875, and out of the aperture 874, to the exterior of the dispenser 800. In this configuration, the mechanism 870 can also serve as the actuator 890. As such, the drink through mechanism 870 can be considered as being integrated with the actuator 890.

Thus, after a user attaches the dispenser 800 to a container such as a water bottle and presses the upper member 872 downwardly (FIG. 45A), thereby driving the piercing member 861 through the lower frangible wall 811, ingredients can flow out of the reservoir 810 and mix with liquid in the container, creating a mixed beverage. Then a user can pull on the upper member 872 (FIG. 45B), thereby opening the drink through mechanism 870, and drink the mixed beverage within the bottle, wherein the beverage passes through the broken frangible wall 811 up to the reservoir 810, through the chambers 888A and 888B, into the central passage 875 and out through the orifice 874.

FIGS. 46-50 illustrate another modification of the embodiments of FIGS. 2 and 5-10, identified generally by the reference numeral 900.

The dispenser 900 can include a seal assembly 920 that is similar or the same as the seal assembly 320 of the embodiment of FIGS. 19-22, and thus the description of this seal assembly 920 is not repeated with reference to FIGS. 46-51.

With reference to FIG. 49, the relief mechanism 931 includes a plurality of members 932 with lowers end connected to an outer surface of the reservoir 910. The upper ends 936 engage with the upper support member 935 at a plurality of different positions which can be arranged radially.

For example, with reference to FIG. 47, the support member 935 includes a lower surface 937 with a plurality of surface features 938. In the illustrated embodiment, the surface features 938 comprise through holes that pass from the lower surface 937 through the top of the support member 935. However, other configurations can also be used, for example, where the surface features 938 do not extend to the top surface of the support member 935 and for example, are in the form of recesses on the lower surface 937.

With reference to FIG. 47, the surface features 938 are arranged in a plurality of a radially extending groups 939. Each of the groups 939 is aligned with the upper end 936 of one of the members 932.

In the illustrated embodiment, the upper ends 936 of the members 932 include a surface feature 940 which is configured to interact with the surface features 938. For example, the surface feature 940 can be in the form of a tooth optionally with a ramped face. As such, the surface features 940, 938 can interact in accordance with the ratcheting principle of operation. For example, during insertion of the dispenser 900 into a container, the members 932 can be deflected radially inwardly, as described above with reference to FIGS. 19-22. As the upper ends 936 of the members 932 move radially inwardly, the tooth 940 of each moving member 932 can slip from radially outward features 938 in a particular grouping, to a surface feature 938 closer to the axial center of the support member 935. Optionally, the ramped surface of the surface feature 940 can be slanted away from the axial center of the dispenser 900 thereby providing lowered resistance to radially inward movement. Optionally, the tooth forming the surface feature 940 can include a non-ramped surface on a radially outward side thereof so as to provide greater resistance against radially outward movement.

With such a configuration, the radially inward movement of the upper ends 936 of the members 932 can be guided in a more control manner. Additionally, locking the upper ends 936 of the members 932 at a particular radial
position can affect the curvature or bending deformation of the member 932, and can further enlarge a contact patch between the seal member 924 and the inner surface of an opening of a beverage container.

[0262] FIGS. 51-55 illustrate yet another variation of the embodiment of FIGS. 2-10, identified generally by the reference numeral 1000.

[0263] The dispenser 1000 can include a seal assembly 1020 that can have the same or similar construction to the seal assembly 920, and thus the description is not repeated with reference to FIGS. 51-55.

[0264] The dispenser 1000 can be considered as including both expansion mechanism 1025 and a relief mechanism 1031.

[0265] The relief mechanism 1031 has the same structure and performs in accordance with the description of the relief mechanism 331 described above with reference to FIGS. 19-22. Thus, upon insertion of the dispenser 1000 into the opening of a bottle, members 1032 are deflected radially inwardly so as to conform to an inner surface of the opening of a beverage container.

[0266] Additionally, the expansion mechanism 1025 can further enhance the seal achieved between the seal member 1024 and the inner surface of the bottle. For example, the expansion mechanism 1025 can include a catch plate 1050 disposed between the inner surface of the members 1032 and an outer surface of the reservoir 1010. The members 1032 can include surface features 1051 on radially inwardly facing surfaces thereof. For example, the surface features 1051 can be in the form of ramped teeth or grooves, for example, slanted downwardly. The catch plate 1050 can be configured to move axially along with surface features 1051. Additionally, the catch plate 1050 can include an engaging surface 1052 configured to interact with the surface features 1051. The surface features 1051 and 1052 can be configured to provide less resistance to movement in the direction of arrow D and more resistance against movement of the member 1050 in the opposite direction of arrow D.

[0267] With reference to FIG. 55, after initial insertion of the dispenser 1000 into the opening of a bottle, the actuator 1090 can be subjected to a force F thereby driving the catch plate 1050 downwardly into the space between the inner surfaces of the members 1032 and the outer surface of the reservoir 1010. As such, the member 1050 will move sequentially to lower positions, snapping into and out of engagement with the surface features 1051 under the ratcheting principle of operation. As the member 1050 reaches lower positions along the members 1032, it can help further to form the seal member 1024 to increase a contact patch between the seal member 1024 and the inner surface of the average container.

[0268] FIGS. 56-59 illustrate another modification of the embodiments of FIGS. 2 and 5-10, identified generally by the reference numeral 1100. With reference to FIGS. 56 and 57, the dispenser 1100 can include a seal assembly 1120 and drink-through mechanism 1170, and dispensing mechanism 1160, such as those described above with regard to the previously described embodiments.

[0269] Optionally, the dispenser 1100 can also include a bottle anchoring mechanism 2000. For example, the bottle anchoring mechanism 2000 can include a mechanism configured to engage surfaces within a container which are oriented obliquely relative to the inner cylindrical surfaces of the opening of such a container. For example, as described above with reference to FIG. 1, many typical beverage containers include a cylindrical inner surface 22, 44, formed along an opening neck. Inwardly from the opening, many beverage containers include a shoulder transitioning to a tapering wall. In some embodiments, the container anchoring mechanism 2000 can include at least one member moveably mounted to the dispenser 1100 between retracted and expanded states. In the retracted state, the at least one member can be positioned such that the dispenser 1100 and the member can fit within an opening of a beverage container. In the extended position, the at least one member can move to a position into contact or into an interfering fit with at least one wall within the container disclosed or oriented at an oblique angle relative to the cylindrical inner surface of the opening. For example, such a surface can be a surface at the shoulder or tapered wall of a beverage container.

[0270] With reference to FIGS. 58 and 59, the anchoring mechanism 2000 includes a plurality of anchoring members 2002. Each of the anchoring members 2002 includes an upper end 2004 and a lower end 2006. In the illustrated embodiment, the dispenser 1100 includes 14 anchoring members 2002 evenly spaced around the outer periphery of the reservoir 1110. However, other numbers of anchoring members 2002 and configurations can also be used.

[0271] Optionally, the anchoring members 2002 can be pivotally mounted relative to the reservoir 1110. For example, with continued reference to FIGS. 58 and 59, the anchoring members 2002 are pivotally mounted along a pivot mount 2010 which extend circumferentially around the reservoir 1110. The pivot mount pivotally attaches the anchoring members 2002 to the reservoir 1110. As such, the anchoring members 2002 can pivot between a state in which the lower ends 2006 are in a contracted orientation, as illustrated in FIG. 58 to an expanded state, as illustrated in FIG. 59, in which the lower ends 2006 are pivoted away from the reservoir 1110.

[0272] Optionally, the anchor members 2002 can be sized and configured such that in the retracted state illustrated in FIG. 58, the lower ends 2006 are arranged in a configuration in which they can pass through an opening of a beverage container 10, for example. Then, with reference to FIG. 59, as the dispenser 1100 is pushed downwardly into the bottle 10, the seal member 1124 and resilient members 1132 are pressed inwardly (radially inwardly toward the central axis of the dispenser 1100). This radially inward movement of the seal member 1124 and/or the resilient members 1132 can also act on the upper ends 2004 of the anchor members 2002, thereby pivoting the anchor members 2002 from the retracted position illustrated in FIG. 58 to the extended position illustrated in FIG. 59.

[0273] As shown in FIG. 59, the lower ends 2006, when the anchor members 2002 are in the extended position, extend radially outwardly, beyond the inner surface of the opening of the bottle 10, in a location below a shoulder 34 of the container 10. As such, the anchoring mechanism 2000 can enhance an anchoring of the dispenser 1100 to an associated container.

[0274] FIGS. 60 and 61 illustrate yet another variation of the embodiments of FIGS. 2 through 4 and 8 through 10, identified generally by the reference numeral 1200.

[0275] With reference to FIGS. 60 and 61, the dispenser 1200 can include an expansion device 1225 configured to operate under a pneumatic principle of operation. For example, the dispenser 1200 can include an expandable air
bladder 2200 disposed circumferentially around the reservoir 2200. The expansion mechanism 2025 can be configured to inflate the bladder 2200 with any type of pneumatic mechanism. For example, the expansion mechanism 1225 can include an air pump mechanism 2210 configured to the actuator 1290. Embodiments, the pneumatic pump 2210 can include a compressible chamber and one or more check valves 2212 connecting an interior of the pump chamber 2210 with an exterior of the bladder 2200. Thus, when a user applies an actuation force in the direction of arrow F to the actuator 1290, the pump chamber 2210 can be deformed so as to reduce its interior volume, thereby urging a gas disposed therein, such as air, into the inflatable bladder 2200. Inflatable bladder 2200 is thereby inflated, causing a radially outward expansion. In some embodiments, the dispenser 1200 includes a seal member 1224 disposed around the exterior surface of the inflatable bladder 2200. Thus, upon inflation of the bladder 2200, the seal member 1224 is deformed and/or moved radially outwardly, into contact with an interior surface of an associated container 10.

In some embodiments, the valves 2212 can be one-way check valves. Additionally, in some embodiments, the pump chamber 2210 can include additional passages opening to the atmosphere, so as to allow refilling of the pump chamber 2210 upon the expansion of the pump chambers 2210.

In some embodiments, the pump chamber 2210 can be sized such that a single downward movement of the actuator 1290 causes a sufficient deformation of the pump chamber 2210 to inflate the bladder 2200 sufficiently to generate seals with a range of different sizes of containers 10, such as the interior surfaces of the containers 10, 12 described above, or other ranges of sizes.

In some embodiments, the expansion mechanism 1225 can include one or more ratchet members 2214. For example, the ratchet members 2214 can connect upper ends 2216 fixed to the actuator 1290. Additionally, the ratchet members 2214 can include lower ends 2218 configured for a ratcheting engagement with the seal member 1224. For example, the ratcheting members 2214 can be configured for one-way movement relative to the seal member 1224 such that a single downward movement of the actuator 1290 will lock the actuator 1290 into an orientation in which the pump chamber 2210 is compressed. In some embodiments, using the ratchet members 2214 can avoid the need for other check valves, such as the check valves 2212. In such an embodiment, the check valves 2212 can be replaced with open passages, the ratcheting members 2214 venting air from the bladder 2200 from reentering the pump chamber 2210. Other configurations can also be used.

FIGS. 62-78 illustrate yet another embodiment of a dispenser, identified generally by the reference numeral 3000. The dispenser 3000 can be in the form of a single use unit dosage dispenser 3000. The dispenser 3000 is adapted to be attached to a container, such as a range of sizes of bottles, 10, 12, described above. For example, the dispenser can include a seal assembly 3020 configured to form seals with a range of sizes of bottles, such as bottles 10, 12, described above.

The dispenser 3000 includes a shell 3012, shown alone in FIGS. 62-68, which is adapted to be attached to the container by way of the seal assembly 3020. However, the dispenser 3000 can incorporate any of the other seal assemblies disclosed above in FIGS. 2-61.

The shell 3012 can include a tubular inner guide 3022 with an open lower end in communication with the interior of the container 10, 12, to which it can be attached by way of the seal assembly 3020. The inner guide 3022 includes one or more sealing rings(s) 3024, a lower stop 3026 at a lower end thereof and an upper stop 3028 at an upper end thereof. The stops 3026, 3028 can be configured to form interference fits, bump fits, snap fits, one-way latches, or other types of engagements. The sealing ring 3024 can be configured to form a sliding seal with an outer surface of an ingredient chamber 3040, described in greater detail below. The inner guide 3022 can also include a finger access 3030 adjacent an upper end thereof and a second stop 3031 above the seal ring 3024. The shell 3012 may further include an alignment nub on the exterior of the guide 3022 for alignment of the guide during manufacturing.

A piercing element 3032 can be disposed on the inner guide 3022. As such the piercing element can be considered as being fixed relative to the seal assembly 3020. Optionally, the piercing element 3032 can be formed integrally with the inner guide 3022. The piercing element 3032 can be configured to pierce a flexible wall on the ingredient chamber, described in greater detail below. Such a flexible wall can be made from materials such as foils and other materials, as described above with reference to the flexible walls 111. In some embodiments, the piercing element 3032 can include a plurality of radial blades 3034 at a lower end of the inner guide 3022. Optionally, the radial blades 3034 can converge to form a piercing tip extending toward the upper end of the inner guide 3022. Optionally, the piercing tip can form a triangular center piercing tip with a center point for improved piercing of the flexible wall 3050A. Optionally, folding elements 3036 can be disposed adjacent the blades 3034 and can be adapted to engage and fold back a sealing element to facilitate discharge of the unit dosage as will be described. Additionally, the folding elements 3036 can help prevent pieces of the seal from interfering with movement of a mixed beverage from the interior, through the shell 3012, for example, through a drink-through valve described in greater detail below. The piercing element 3032 can also be constructed in accordance with the dispensing mechanism 160c and a flexible wall deflecting assembly 180c described above with reference to FIGS. 11-17.

In some embodiments, the various seals, undercuts and other “jump” features (i.e. elements that effectively deform slightly in the de-molding process) are formed in or integral with the shell 3012. The shell can be made of a polymer that accommodates such features, such as polyolefin or other materials. Some materials that accommodate these jump features do not have significant moisture or gas barrier properties (i.e. high moisture and gas permeability).

An axially movable reservoir member 3040, shown separately in FIGS. 69-71, can be attached to the shell 3012 so as to be moveable along the inner guide 3022. The reservoir member 3040 defines an inner chamber 3042 therein adapted to hold a unit dosage of material to be dispensed into the container. The reservoir member 3040 can include a top 3044 and a cylindrical side 3046 forming the chamber 3042. In some embodiments, in which the reservoir member 3040 has a simple construction (no jump features), the reservoir member 3040 can be formed from a relatively rigid material, and wherein the cap 3040 and the
shell 3012 are made from different polymer materials. In other words, the axial movable reservoir member 3040 can be formed from a material with a higher oxygen and water barrier property than the material forming the shell 3012. The reservoir member 3040 can be formed a rigid material such as polyethylene terephthalate (PET), nylon, polypropylene (PP) with low shrink filler, and polyethylene (PE) with low shrink filler. Low shrink fillers include talc and mica. Other materials can also be used.

[0285] A frangible wall 3050 can be coupled to the reservoir member 3040 for containing an ingredient within the chamber 3042. The frangible wall 3050 can be in the form of any of the frangible walls 111 described above. The chamber 3042 is sealed with the frangible wall 3050 extending across a lower open end of the reservoir member 3040 at the open end of the cylindrical side member 3046.

[0286] With continued reference to FIGS. 68, 69, 77, and 78, the inner guide 3022, reservoir member 3040 and the piercing element 3032 can be configured such that axial movement of the reservoir member 3040 along the inner guide 3022, toward the piercing member 3032 will cause the piercing element formed by blades 3034 to pierce the frangible wall 3050 and dispense the contents of the chamber 3042 into the container 10, 12 to which the dispenser 3000 is attached. This movement is illustrated by FIG. 77 in which the reservoir 3040 is not yet actuated and FIG. 78 in which the reservoir member 3040 has been moved axially until the piercing member 3032 has pierced the frangible wall 3050. Following the piercing of the frangible wall 3050, the folding elements 3036 can engage the distinct pieces of the frangible wall 3050 and move them out of the way to further assist in the dispensing. As disclosed above, frangible wall 3050 can be in the form of metallic foil, a plastic film, or other materials.

[0287] With the reservoir 3040 in the dispensing position (FIG. 78), the sealing ring 3024 of the guide 3022 engages and seals against the outer surface of the cylindrical side member 3046. The upper stop 3028 and the second stop 3031 can engage against an outward projection of the top 3044 to limit the respective axial motion of the reservoir member 3040. The lower stop 3026 engages against the lower end of the cylindrical side member 3046.

[0288] The dispenser 3000 can additionally include a dust cover 3060 shown in FIGS. 72-75. The dust cover has a top 3062 with an extending cylindrical skirt 3064. A coupling bead 3066 will engage the shell 3020. The cover 3060 is removed prior to actuation of the dispenser 3000 and can further include tamper evident band for security. The shell 3012 would include associated engaging beads for such tamper evident bands, as generally known in the art. The addition of the dust cover 3060 may further assist in the stacking of vertical containers. Further, the dust cover 3060 prevents premature actuation of the reservoir member 3040, since the reservoir member 3040 cannot be pressed downward until the cover 3060 is removed.

[0289] There are numerous variations of the concepts that can be included in the dispenser 3000. For example, FIGS. 79-81 illustrate a modification of the dispenser 3000 and reservoir member 3040, identified generally by the reference numerals 3000A and 3040A, respectively. Parts, components, and features of the dispenser 3000A and reservoir member 3040A that are the same or similar to the corresponding parts, components, and features of the dispenser 3000 and reservoir member 3040, respectively, are identified with the same reference numerals except that a letter "A" has been added thereto.

[0290] With continued reference to FIGS. 79-81, the reservoir member 3040A can include a drink through valve assembly 3100. The drink through valve assembly 3100 can include a stem portion 3102 and a valve member 3104. The configuration of the stem portion 3102 and the valve member 3104 can be in accordance with known designs for drink through valves. For example, the stem portion 3102 can include a central passage 3106 having a lower end 3108 open to the interior of the chamber 3042A. The stem portion 3106 can include an upper end 3110 having at least one opening 3112 and a stopper plug 3114. The stem portion 3102 can include a lower ridge 3120 and an upper ridge 3122, projecting from an outer surface of the stem portion 3102.

[0291] The valve member 3104 can include a lower skirt portion 3130 and an upper mouthpiece 3132. The upper mouthpiece 3132 can protect radially outwardly relative to the an outer surface of the lower skirt portion 3130. This outward projection can provide a grasping ridge for users to pull upwardly on the valve member 3104 to move the valve member 3104 between closed and open positions.

[0292] The upper mouthpiece 3132 can include a through hole 3134. The through hole 3134 can be aligned with the plug 3114 so as to form a seal when the valve 3100 is in the closed position (FIG. 80). In this position, the through hole 3134 is sufficiently sealed such that a user could shake a bottle 10, 12 to which the chamber member 3040A may be attached, without a liquid in the bottle 10, 12 leaking out through the dispenser 3000A. In an open position (FIG. 81), the through hole 3134 can be spaced from the plug 3114.

[0293] The lower skirt portion 3130 can include a radially inward projection 3140. As illustrated in FIGS. 80-81, the inward projection 3140 can be captured between the lower and upper projections 3120, 3022 and configured to limit movement of the valve member 3104 between the closed (FIG. 80) and opened (FIG. 81) positions. Optionally, the stem portion 3102 can also include a further projection 3123 configured to form an interference fit between the stem portion 3102 and the valve member 3104 configured to retain the valve member 3104 in the closed position (FIGS. 80 and 83). For example, the projection 3123 can be in a configuration with a bead-shaped cross section and interact with the inward projection 3140 so as to form a snap fit, retaining the valve member 3104 in the closed position and withstand an kilogram-force of about 1 kilogram, and up to an upper limit, for example, but without limitation, 1.8 kilograms. Other configurations and structures for form interference fits, snap fits, or other types of fittings.

[0294] In the closed position illustrated in FIG. 80, the aperture 3134 is closed by the plug 3114. In this position, the through holes 3112 are closed by inner surfaces of the valve member 3104. On the other hand, as illustrated in FIG. 81, when in the open position, the valve member 3104 is positioned such that the through hole 3134 is spaced from the plug 3114, thereby allowing material, including fluids, to flow from the chamber 3042A to flow upwardly, through the through holes 3112, and through the through hole 3134, thereby defining a drink-through fluidic passage 3150.

[0295] With continued reference to FIGS. 79-80, the cylindrical outer wall 3046A can include one or more projections for limiting movement of the chamber member
3040A during use. For example, the outer cylindrical wall 3046A can include at least a first closed position projection 3160 defining a closed position and at least a first dispensing position projection 3170 defining a dispensing position.

[0296] The first closed position projection 3160 can extend radially outwardly from the surrounding outer surface of the cylindrical wall 3046A and can have, for example, a bead-type cross-sectional shape. The first closed position projection 3160 can be configured to maintain or limit the movement of the chamber member 3040A in a closed position in which the frangible wall 3050A is not pressed against the piercing member 3032A (FIG. 82). For example, with reference to FIG. 68, the shell 3012 can include an alignment projection 3180 positioned and sized to cooperate with the first closed position projection 3160, when the reservoir member 3040A is disposed within the shell 3012 (FIG. 82). In this position, the first closed position projection 3160 is disposed above the projection 3180, thereby resisting downward movement of the chamber member 3048 towards a dispensing position. In some embodiments, the cylindrical wall 3046 can include a second closed position projection 3162 disposed below the first closed position projection 3160 (FIG. 79). Together, the first and second closed position projections 3160, 3162 can positively define a closed position of the dispenser 3040A, resisting both upward and downward movement of the reservoir member 3040A (as viewed in FIG. 82).

[0297] The first closed position projection 3160 and projection 3180 can be configured to allow downward movement of the chamber member 3040A relative to the shell 3012 under an actuation force applied by a user, for example, with a user’s hand or finger. The materials used for forming the cylindrical wall 3046A, the size and shape of the first closed position projection 3160 and the alignment projection 3180 can be chosen to provide the desired resistance to movement.

[0298] With continued reference to FIGS. 79-81, the first dispensing position projection 3170 can be configured and positioned so as to pass over and be disposed below the alignment projection 3180, when the chamber member 3040A is pressed downwardly to the dispensing position (FIG. 83) with sufficient force. As such, the interaction of the dispensing position projection 3170 and the alignment projection 3180 can maintain the chamber member 3040A in the dispensing position, illustrated in FIG. 83. Additionally, the dispensing position projection 3170 and the alignment projection 3180 can cooperate to resist upward movement of the chamber member 3040A after the chamber 3040A has been moved to the dispensing position (FIG. 83). In some embodiments, the cooperation of the dispensing position projection 3170 and the alignment projection 3180 can resist forces greater than approximately 3-4 pounds of force, which is approximately the force required to open a typical drink-through valve. Thus, when the chamber member 3040A is in the dispensing position (FIG. 83), a user can pull upwardly on the valve member 3104 so as to move the valve member 3104 to the open position (FIGS. 81 and 84). In some embodiments, the valve member 3104 and stem 3102 can include snap fits so as to resist movement from the closed position to the open position. In some typical, known valves, a force of approximately 3.7 to 4 pounds is required to move the valve member to the from the closed to the open position. Thus, by configuring the dispensing position projection 3170 and the alignment projection 3180 to resist forces greater than approximately 3.7 to 4 pounds, the projections 3170, 3180 can maintain the chamber member 3040A in the dispensing position during movement of the valve member 3104 from the closed to the open position. In some embodiments, the seal assembly 3020 can be configured to resist upward movements of the seal assembly 3020 off of the opening of the bottle 10, 20. For example, the seal assembly 3020 can be configured to generate sufficient friction with the openings of a range of sizes of bottles 10, 12, to resist axial loads greater than about 3.7 pounds. Thus, both the seal assembly 3020 and the chamber member 3040A can be held in place in the position illustrated in FIG. 83, for example, while the valve member 3104 is moved from the closed to open positions.

[0299] Although specific embodiments have been described above, these embodiments are not intended to limit the scope of the present disclosure, even where only a single embodiment is described with respect to a particular feature. Examples of features provided in the disclosure are intended to be illustrative rather than restrictive unless stated otherwise. The above description is intended to cover such alternatives, modifications, and equivalents as would be apparent to a person skilled in the art having the benefit of this disclosure.

[0300] The scope of the present disclosure includes any feature or combination of features disclosed herein (either explicitly or implicitly), or any generalization thereof, whether or not it mitigates any or all of the problems addressed herein. Accordingly, new claims may be formulated during prosecution of this application (or an application claiming priority thereto) to any such combination of features. In particular, with reference to the appended claims, features from dependent claims can be combined with those of the independent claims and features from respective independent claims can be combined in any appropriate manner and not merely in the specific combinations enumerated in the appended claims.

1-87. (canceled)

88. A beverage ingredient dispenser comprising: a seal assembly comprising at least one resilient seal configured to seal against an inner cylindrical surface of a plurality of different sizes of beverage container openings including a first size and a second size that is larger than the first size by at least about three-eighths of one inch, the seal assembly comprising a piercing member fixed relative to the first resilient seal and at least a first and second projections; and a beverage ingredient reservoir comprising a beverage ingredient contained therein, a lower frangible wall, and at least third and fourth projections, the beverage ingredient reservoir being movably mounted to the seal assembly between closed and dispensing positions and positioned to be aligned with the opening of a beverage container when the seal assembly is sealed to the inner cylindrical surface of a beverage container, wherein in the dispensing position, the frangible wall is broken by the piercing member such that the beverage ingredient flows out of the beverage ingredient reservoir and into a beverage container to which the seal assembly is sealed; wherein the first and third projections define a first snap fit configured to maintain the beverage ingredient reservoir in the closed position and the second and fourth
projections define a second snap fit configured to maintain the beverage reservoir in the dispensing position;

wherein the second snap fit is configured to resist a movement of the beverage reservoir from the dispensing position toward the closed position against a kilogram-force of at least 1.8 kilograms.

98. The dispenser according to claim 94, wherein the seal assembly comprises a piercing member fixed relative to the first resilient seal.

99. The dispenser according to claim 98 additionally comprising a reservoir containing a beverage ingredient, the reservoir being moveable mounted to the seal assembly to be moveable between closed and dispensing positions.

100. The dispenser according to claim 99 additionally comprising a first plurality of projections configured to define snap fits for maintaining the reservoir in the closed and dispensing positions.

101. The dispenser according to claim 99 additionally comprising a plurality of projections configured to form an interference fit maintaining the reservoir in the dispensing position and withstand a kilogram force of at least about one kilogram.

102. The dispenser according to claim 101 wherein the first plurality of projections are configured to form an interference fit maintaining the reservoir in the dispensing position and withstand a kilogram force of at least about 1.8 kilograms.

103. The dispenser according to claim 102, additionally comprising a drink-through valve disposed on the reservoir, the drink-through valve comprising a valve member moveably mounted to a first end of the reservoir and configured to move between open and closed positions.

104. The dispenser according to claim 103 defining a second plurality of projections configured to define a second interference fit between valve member body and the reservoir maintaining the valve member body in the closed position and withstand a kilogram force of less than 1.8 kilograms.

105. A beverage ingredient dispenser comprising: a beverage ingredient reservoir comprising a beverage ingredient contained in therein, a lower frangible wall, the beverage ingredient reservoir being configured for moveable mounting to a seal assembly between closed and dispensing positions and positioned to be aligned with the opening of a beverage container when the seal assembly is sealed to the inner cylindrical surface of a beverage container, wherein in the dispensing position, the frangible wall is broken by the piercing member such that the beverage ingredient flows out of the beverage ingredient reservoir and into a beverage container to which the seal assembly is sealed; and a drink-through valve disposed on the reservoir, the drink-through valve comprising a valve member moveably mounted to a first end of the reservoir and configured to move between open and closed positions.

106. The dispenser according to claim 105 additionally comprising a plurality of projections configured to define an interference fit between valve member body and the reservoir maintaining the valve member body in the closed position and withstand a kilogram force of less than 1.8 kilograms.

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