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SYSTEMS AND TECHNIQUES FOR ENHANCING PACKAGED BEVERAGES

Abstract

Systems and methods for releasing one or more non-gaseous remediating components into a packaged beverage upon opening of the packaged beverage are provided herein. For example, a cartridge includes a cap that is releasably secured to a top end of a cylindrical body. The cylindrical body may include an inner chamber and an outer chamber. The outer chamber may fill with dissolved gas when the outer chamber reaches a pressure equilibrium with the packaged beverage. The cap may include a pinhole orifice configured to restrict fluid flow between the outer chamber and an environment external to the cartridge such that when the packaged beverage is opened, the pinhole orifice restricts the gas within the outer chamber from flowing to the external environment, thereby causing the cap to decouple from the top end of the cylindrical body and release the remediating components housed in the inner chamber into the packaged beverage.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATION(S) [0001] This application claims the benefit of priority of U.S. Provisional Patent Application Ser. No. 63/552,003, filed on Feb. 9, 2024, and the benefit of priority of U.S. Provisional Patent Application Ser. No. 63/650,716, filed on May 22, 2024, both of which are hereby incorporated by reference as if fully set forth herein.

TECHNICAL FIELD
[0002] Various embodiments of the present technology generally relate to improvements to packaged beverages. More specifically, embodiments of the present technology relate to systems and techniques for providing cartridges configured to release one or more remediating components into the beverage upon consumption.
BACKGROUND
[0003] Packaged beverages, such as bottled or canned carbonated drinks, are enjoyed by millions worldwide for their convenience and refreshing taste. However, despite their popularity, these beverages often degrade over time, leading to a decline in flavor quality and, consequently, negatively impacting the user's experience. One of the primary factors contributing to flavor degradation is the presence of oxygen within the beverage, which can be due to the permeability of the packaging material, which allows oxygen to slowly infiltrate the container. Oxygen exposure triggers oxidative reactions within the beverage, causing changes in flavor compounds and the breakdown of delicate aromatic molecules. Additionally, fluctuations in temperature during storage can accelerate these chemical reactions, further compromising the beverage's flavor profile. Over time, the once crisp and vibrant taste may become flat, stale, or develop off-flavors, leaving consumers disappointed with their drinking experience.
[0004] The degradation of flavor in packaged beverages, such as beer, directly impacts their shelf life, imposing constraints on how long they can maintain their desired taste and quality. Beer, for instance, is particularly sensitive to oxygen exposure and temperature fluctuations, which can rapidly alter its flavor profile. While modern packaging techniques and advancements have extended the shelf life of beers, there is still a finite window within which the beverage retains its intended characteristics. Beyond this period, the flavor degradation becomes more pronounced, leading to a noticeable decline in taste and aroma. Consequently, breweries, like other packaged beverage producers, often provide recommended consumption timelines to ensure consumers enjoy their products at their best. These timelines are often only 6-12 months to ensure optimal consumer experiences.
[0005] Accordingly, there is a need for improved systems and techniques for enhancing packaged beverages, such as by remediating flavor degradation and extending the shelf life of these products. In particular, there is a need for a cartridge that in-situ releases flavor-enhancing components into packaged beverages upon opening. As will be described in detail below, the remediating components, such as a hop additive, may be released into a packaged beverage when a consumer opens the beverage. The remediating components not only revitalize the flavor profile of the beverage, remediating any flavor degradation that may have occurred since producing and

packaging of the beverage, but may also extend the shelf life of the packaged beverage.
[0006] The information provided in this section is presented as background information and serves only to assist in any understanding of the present disclosure. No determination has been made and no assertion is made as to whether any of the above might be applicable as prior art with regard to the present disclosure.
Overview
[0007] Technology is disclosed herein for systems and techniques for providing a cartridge containing remediating components to be released into a packaged beverage upon consumption. As such, the cartridge may be configured to be inserted into a packaged beverage, in some embodiments, during packaging or production of the beverage. As will be described in greater detail below, the cartridge may include a cap and a body. The body may include an inner chamber and an outer chamber formed in an annulus space between the inner chamber and an outer wall. The inner chamber may house a volume of remediating components that are released when the cartridge is activated.
[0008] The cap may include one or more pinhole orifices that allow for dissolved gas from the packaged beverage to ingress into the outer chamber. As the dissolved gas ingresses into the outer chamber, the outer chamber may equilibrate with the pressure of the packaged beverage. A seal formed between the cap and a top end of the inner chamber may prevent the dissolved gas in the outer chamber from entering the inner chamber. The cap may include various features, such as a domed structure, that causes the cartridge to orient the cap towards a bottom surface of the packaged beverage when introduced. In some embodiments, the cap may include features, such as stiffeners, that cause the cartridge to orient the pinhole orifice towards the bottom surface of the packaged beverage.
[0009] When the packaged beverage is opened, the pinhole orifice may restrict fluid flow between the outer chamber and an environment external to cartridge. In particular, the pinhole orifice may restrict the flow of the ingressed gas out of the outer chamber, thereby causing rapid volumetric expansion of the gas within the outer chamber. The volumetric expansion of the gas within the outer chamber may cause the cap of the cartridge to decouple from the body. When the cap decouples from the body, the remediating components housed within the inner chamber may release into the packaged beverage.
[0010] This Overview is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. It may be understood that this Overview is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0011] The accompanying drawings, which are incorporated into and constitute a part of this specification, illustrate one or more certain aspects and, together with the description of the example, serve to explain the principles and implementations of the certain examples.
[0012] FIG. **1** illustrates an example cartridge, according to an embodiment herein;
[0013] FIG. **2** illustrates a perspective of the cartridge from FIG. **1** having a hinge, according to an embodiment herein;
[0014] FIGS. **3**-**5** illustrate various perspectives of the body of the cartridge from FIG. **1**, according to an embodiment herein;
[0015] FIG. **6** illustrates a cross-sectional perspective of the cartridge from FIG. **1**, according to an embodiment herein;
[0016] FIG. **7** illustrates a close-up cross-sectional perspective of seals formed between the cap and

body in the cartridge from FIGS. **1**, according to an embodiment herein;
[0017] FIG. **8** illustrates the pinhole orifice having a conical shaped channel, according to an embodiment herein;
[0018] FIGS. **9-12**B illustrate various perspectives of the cap of the cartridge from FIG. **1**, according to an embodiment herein;
[0019] FIG. **13** illustrates a perspective of the cartridge of FIG. **1** including a stillwand, according to an embodiment herein;
[0020] FIG. **14** illustrates another example cartridge, according to an embodiment herein;
[0021] FIG. **15** illustrates a cross-sectional perspective of the cartridge from FIG. **14** in an open position, according to an embodiment herein;
[0022] FIG. **16** illustrates a cross-sectional perspective of the cartridge from FIG. **14** in a closed position, according to an embodiment herein;
[0023] FIG. **17** illustrates an isometric perspective of the cartridge from FIG. **14**, according to an embodiment herein;
[0024] FIG. **18** illustrates a side-view perspective of the cartridge from FIG. **14**, according to an embodiment herein;
[0025] FIG. **19** illustrates a cross-sectional perspective of the cartridge from FIG. **14** having an inclined inner wall, according to an embodiment herein;
[0026] FIG. **20** illustrates a perspective of the cartridge from FIG. **19** having the inclined inner wall in a near-closed position, according to an embodiment herein;
[0027] FIG. **21** illustrates an example cartridge having wing tabs, according to an embodiment herein;
[0028] FIGS. **22**A and **22**B illustrate example perspectives of a cartridge prior to and during activation within a packaged beverage, according to an embodiment herein; and
[0029] FIGS. **23**A-C provides a table illustrating pressures of various packaged beverages over a range of temperatures, according to an embodiment herein.
[0030] Some components or operations may be separated into different blocks or combined into a single block for the purposes of discussion of some of the embodiments of the present technology. Moreover, while the technology is amenable to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and are described in detail below. The intention, however, is not to limit the technology to the particular embodiments described. On the contrary, the technology is intended to cover all modifications, equivalents, and alternatives falling within the scope of the technology as defined by the appended claims.

DETAILED DESCRIPTION

[0031] Packaged beverages, particularly carbonated drinks, have become ubiquitous in modern society, readily available in countless markets, convenience stores, vending machines, and households worldwide. These beverages, ranging from colas to beer, offer consumers a convenient and refreshing option for quenching thirst or indulging in a flavorful treat. Their popularity stems from a combination of factors, including their portability, long shelf life, and diverse flavor options, catering to a wide range of tastes and preferences. Whether enjoyed on their own or paired with meals, packaged carbonated beverages have become ingrained in daily life, serving as go-to options for hydration, relaxation, or social gatherings. Their widespread availability and enduring appeal highlight their status as staples of modern beverage consumption.
[0032] One significant drawback of packaged beverages, including carbonated drinks, is the inevitable flavor degradation that occurs over time, influenced by various factors including oxygen exposure and temperature fluctuations. Despite meticulous efforts to maintain freshness, these beverages can undergo undesirable changes in taste and quality due to their susceptibility to external elements. Oxygen infiltration, for instance, poses a significant challenge, permeating packaging through various channels. In bottled beverages, imperfect seals between the cap and bottle can allow oxygen to slowly seep in, while canned drinks may experience ingress through

micro-defects in the can's seal or minute pinholes in the aluminum. Furthermore, exposure to oxygen during the manufacturing process may initiate flavor deterioration from the start.

[0033] Additionally, temperature fluctuations during storage play a crucial role in accelerating flavor degradation. Fluctuations in temperature can cause expansion and contraction of the packaging material, leading to the ingress of external air and subsequent oxidation of the beverage. These variations can occur during transportation, storage, or even in-store display, exacerbating the degradation process. Combined with oxygen exposure, temperature fluctuations contribute to oxidative reactions within the beverage, resulting in changes such as a loss of freshness, development of off-flavors, or a decline in overall palatability over time.

[0034] The negative effects of flavor degradation extend beyond mere changes in taste, impacting both consumers and producers alike. One significant consequence is the limited shelf life of packaged beverages, which directly affects their marketability and profitability. As the flavor deteriorates, the beverage becomes less appealing to consumers, leading to decreased sales and potential waste if unsold inventory reaches its expiration date. This not only results in financial losses for producers but also contributes to environmental concerns due to increased packaging waste. Moreover, flavor degradation can tarnish a brand's reputation, eroding consumer trust and loyalty over time. Additionally, in industries like the craft beer market, where flavor nuances and freshness are highly valued, significant flavor degradation can undermine the integrity of the product and damage the reputation of the brewery. Overall, the negative effects of flavor degradation extend beyond the sensory experience, impacting the economic viability, environmental sustainability, and brand image of packaged beverage producers.

[0035] To address flavor degradation, and its negative consequences, for packaged beverages, example systems and techniques are provided herein. In particular, an example cartridge is provided herein which is configured to release one or more remediating components into a packaged beverage upon opening of the beverage by a consumer. Specifically, the cartridges provided herein include an inner chamber configured to contain one or more remediating components and an outer chamber formed in an annulus space between the inner chamber and an outer wall. The cartridge includes one or more pinhole orifices through which dissolved gases present in the packaged beverage can ingress into the outer chamber. As dissolved gases ingress into the outer chamber via the pinhole orifice(s), the outer chamber equalizes with the pressure of the packaged beverage. When the packaged beverage is opened, the ingressed gas in the outer chamber may be restricted by the pinhole orifice and undergo rapid volumetric expansion due to the pressure change. As will be described in greater detail below, the volumetric expansion of the ingressed gas may result in a cap of the cartridge decoupling from a body, thereby releasing the remediating components into the packaged beverage.

[0036] As noted, the cartridge may include one or more remediating components that are designed or selected to remediate the flavor degradation of the respective beverage. For example, if the packaged beverage is an India Pale Ale (IPA), a beer known for its hoppy profile, a cartridge may include a hop additive that, upon its release, enhances the flavor profile of the IPA. In some cases, the remediating component may return the packaged beverage to or near its original flavor profile. Following the above IPA example, the hop additive may add a fresh dose of hops to the IPA such that any degradation to the hop flavor (due to temperature fluctuation or oxygen exposure) is remediated and the IPA at the time of consumption returns to a flavor profile similar to a freshly poured draft of the IPA. Additionally, by housing the remediating components, the cartridge can prevent degradation of the remediating components by providing ultraviolet (UV) and/or light protection to the remediating components.

[0037] In other cases, the remediating component may add additional flavors to the packaged beverage, such to enhance the original flavor profile. For example, the remediating component may be a citrus concentrate (e.g., lime or orange) that may be added to the beverage to provide a twist on the original flavor profile. In still another example, the remediating component may be a solid,

such as baking soda, that upon its release into the packaged beverage generates an experiential effect, such as fizzing or color changes to the beverage.
[0038] In some embodiments, in addition to remediating or enhancing the flavor profile of the packaged beverage, the remediating component may also reduce an amount of ingredients required for producing the beverage. Again, following the IPA example, by introducing the hop additive into the IPA upon opening of the can or bottle, a lower amount of hops may be required during brewing the IPA to achieve the same flavor profile upon consumption. In other words, a cartridge containing hop additive may reduce the hops required to brew the IPA by 5%, 10%, or even 15%, while maintaining the same desired flavor profile. As can be appreciated, this reduction in ingredient amounts may be the same or similar for other beverages, such as a sparkling water or seltzer in which an amount of flavoring is reduced during production but added as a remediating component via the cartridge during consumption. Not only does this reduce the cost associated with manufacturing the packaged beverages, but the cartridge may also reduce the complexity of the manufacturing process by allowing ingredients to be added at the point of consumption.
[0039] As will be described in greater detail below, the cartridge provides numerous benefits to both beverage producers and consumers. By addressing flavor deterioration, the cartridge and related techniques described below can extend the shelf life of packaged beverages, ensuring that consumers enjoy beverages at their peak freshness for longer periods. This not only enhances consumer satisfaction but also reduces product waste and associated costs, leading to improved economic sustainability. That is, the cartridges may allow producers to utilize more efficient operations and potentially lower production costs by reducing ingredient amounts and simplifying manufacturing processes. Moreover, the cartridges provided herein can also enhance product consistency and quality control, reducing the likelihood of flavor variations and ensuring a more reliable consumer experience. Overall, the cartridges and remediating components therein not only benefit producers by enhancing product quality and efficiency but also contribute to a more satisfying and sustainable consumer experience.
[0040] Turning now to the Figures, FIGS. **1-13** illustrate various views and components of an example cartridge **101**, according to various embodiments herein. As shown by FIG. **1**, the cartridge **101** includes a body **102** and a cap **104** and may be configured to be inserted into a packaged beverage. Packaged beverages, as used herein, are meant to encompass any beverage that is packaged in a container for convenient transportation and consumption. The containers of packaged beverages may be made from a variety of materials, including aluminum, glass, plastic, and cartons. The packaged beverages themselves may be a wide range of drinks, from water, juice, and milk to teas, coffees, and alcoholic beverages such as beer or ready-to-drink (RTD) cocktails. While the following discussion focuses on carbonated beverages, such as beer and sparkling water, it should be appreciated that the discussion is equally applicable to other types of beverages.
[0041] The cartridge **101** may have an approximately cylindrical shape defined about a central axis **110** extending along a y-axis between a first end **106** to a second end **108** of the cartridge **101**. As shown, the cartridge **101** may be approximately symmetrical about the central axis **110**. The cartridge **101** may have a cartridge height, H.sub.C, and a cartridge diameter, D.sub.C. The cartridge height, H.sub.C, of the cartridge **101** may be defined parallel to the central axis **110** and the cartridge diameter, D.sub.C, of the cartridge **101** may be defined orthogonal to the central axis **110**. In an embodiment, the cartridge height, H.sub.C, may be defined along the y-axis and the cartridge diameter, D.sub.C, may be defined along the x-axis, as shown.
[0042] As can be appreciated, the size and shape of the cartridge **101** may vary depending on application, such as the packaged beverage into which the cartridge **101** is inserted into. For example, if the cartridge **101** is configured to be inserted via a mouthpiece of a bottle, such as a beer bottle, then the cartridge **101** may have larger cartridge height, H.sub.C, and a smaller cartridge diameter, D.sub.C, to fit through the slender mouthpiece of the bottle. In contrast, if the cartridge **101** is configured to be inserted into a can during a canning process (e.g., prior to the lid

of the can being affixed), then the cartridge **101** may have a lower cartridge height, H.sub.C, and a greater cartridge diameter, D.sub.C. Moreover, the size and shape of the cartridge **101** may depend on an amount of remediating component being released into the packaged beverage, as will be described in greater detail below.

[0043] It should also be appreciated that while the following discussion focuses on the cartridge **101** as configured to be inserted into a personal-use sized packaged beverage (e.g., single 12-20 ounce can or bottle), the cartridge **101** may be configured for insertion into larger packaged beverages, such as a keg-style containers or larger carbonated storage containers. In such cases, while the cartridge **101** may be larger, however, the function and below description of the cartridge **101** may be equally applicable. Additionally, the dimensions of the cartridge **101** may vary depending on the application (e.g., insertion into a can vs. a glass bottle), even within personal-use sized packaged beverages.

[0044] In example embodiments, the cartridge height, H.sub.C, may be in a range from 10 to 80 millimeters (mm), from 20 to 70 mm, from 30 to 60 mm, from 30 to 50 mm, and from 30 to 40 mm. Similarly, in example embodiments, the cartridge diameter, D.sub.C, may be in a range from 10 to 60 mm, from 20 to 50 mm, from 20 to 40 mm, and from 20 to 30 mm. In an illustrative embodiment, the cartridge height, H.sub.C, may be 29 mm while the cartridge diameter, D.sub.C, may be 27 mm. In another illustrative example, such as the example cartridge **1401** described below with respect to FIGS. **14-20**, the cartridge height, H.sub.C, may be approximately 32 mm while the cartridge diameter, D.sub.C, may be approximately 26 mm.

[0045] As shown, the body **102** may include a top end **112** and a bottom end **114**. The body **102** may be cylindrical in shape having a body height, H.sub.B, and a body diameter, DB. The body height, H.sub.B, may be defined parallel to the central axis **110** and the body diameter, DB, may be defined orthogonal to the central axis **110**. In some embodiments, the body diameter, DB, and the cartridge diameter, D.sub.C, may be the same. As noted above, depending on the configuration and application of the cartridge **101**, the body diameter, DB may range from 10 to 60 millimeters (mm), while the body height, H.sub.B, may range from 10 to 70 mm, from 20 to 60 mm, from 20 to 50 mm, from 20 to 40 mm, and from 20 to 30 mm.

[0046] The cap **104** and the body **102** of the cartridge **101** may be monoformed, meaning they are created as a single integrated piece (e.g., unibody), typically through a molding or manufacturing process. As those skilled in the art readily appreciate, in a monoforming process, molten material is injected or molded into a single cavity mold, shaping all components simultaneously (e.g., the cap **104** and the body **102**). The monoforming process ensures precise alignment and fit between the cap **104** and the body **102**, resulting in a seamless and robust cartridge structure. By forming the cap **104** and the body **102** together, potential issues such as misalignment, leakage, or weak joints, often encountered in multi-piece assemblies, are minimized or eliminated. Additionally, monoforming streamlines production processes, reduces assembly time and costs, and enhances the overall reliability and performance of the cartridge **101**. In some embodiments, the components of the cartridge **101** discussed below may also be formed as part of the monoforming process, meaning that the cartridge **101** is a single integrated piece. As can be appreciated, breakage concerns are significantly reduced with a single-piece construction, mitigating the risk of any detached components being inadvertently ingested by the consumer.

[0047] The cartridge **101** may be formed out of or include one or more food-grade materials, such as food-grade polymers, elastomers, aluminum, and the like. Examples of food-grade polymers may include high-density polyethlene (HDPE), low-density polyethylene (LDPE plastic), polyethylene terephthalate (PET/PETE), polypropylene (PP), polycarbonate (PC), acrylic (PMMA), polyetheretherketone (PEEL), acrylonitrile butadiene styrene (ABS), nylon (PA), and the like. Examples of food-grade elastomers may include neoprene, ethylene propylene diene monomer (EPDM), nitrile, silicon, and the like. In some embodiments, the material used to form the cartridge **101** may be selected based on the remediating component being housed by cartridge **101** to prevent absorption of the remediating component into the material (e.g., oil absorbed into PP). Additionally, manufacturing and assembly considerations may impact selection of the material to form the cartridge **101** or its components. For example, during the assembly process, the cartridge **101** or its interior components (e.g., inner chamber **124**) may be subject to ultraviolet (UV) radiation. As such, a material that is food-grade but also UV stable may be selected to ensure durability and safety.

[0048] The cap **104** may be configured to releasably secure to the top end **112** of the body **102**. As will be described in greater detail below, the cap **104** may be secured to the body **102** to form the cartridge **101** in a manner that allows the cap **104** to release and separate from the body **102** when the packaged beverage is opened. In some embodiments, the cap **104** and the body **102** may be separate components, however, in other embodiments, the cap **104** may be connected to the body **102** such that upon releasing, the cap **104** maintains connection with the body **102**. As can be appreciated, the cap **104** and the body **102** may be securely held together using various types of connectors that ensure structural integrity and functionality. For example, as shown by perspective **200** in FIG. **2**, the cartridge **101** may include a hinge **116**. The hinge **116** may be attached on a first side **118**A to the cap **104** and a second side **118**B to the body **102**. In other embodiments, instead of the hinge **116**, the cartridge **101** may include a leash, such as a plastic leash, wire leash, or string that maintains connection between the cap **104** and the body **102**. Another example embodiment of the hinge **116** is described in greater detail below with respect to FIGS. **14-16**.

[0049] The hinge **116** may have a length, L, extending between the first side **118**A and the second side **118**B. The length, L, may be long enough to allow the cap **104** to release far enough apart from the body **102** as to not impede release of the remediating components housed within the body **102**. In other words, the length, L, of the hinge **116** allows the cap **104** to separate far enough from the body **102** to not obstruct the release of the remediating components.

[0050] As noted above, the hinge **116** may maintain a connection between the cap **104** and the body **102**. By keeping the cap **104** and the body **102** together once the cap **104** releases from the body **102**, the hinge **116** may prevent the cap **104** from obstructing an opening of the packaged beverage or preventing the cap **104** from escaping the packaged beverage. As can be appreciated, the body **102** may be the larger of the two components, and by keeping the cap **104** connected to the body **102**, the hinge **116** may prevent the cap **104** from negatively affecting a consumer's experience (e.g., obstructing flow of the beverage from the packaging or escaping the packaging).

[0051] Referring now to FIGS. **3-5**, perspectives **300**, **400**, and **500** of the body **102**, respectively, are provided, according to various embodiments provided herein. As shown, the body **102** may include an outer wall **120** and an inner wall **122**. The outer wall **120** may extend from the bottom end **114** towards the top end **112** parallel to the central axis **110**. Similarly, the inner wall **122** may extend from the bottom end **114** towards the top end **112** parallel to the central axis **110**. The inner wall **122** may form an inner chamber **124** and the outer wall **120** may form an outer chamber **126** in an annulus space **128** between the inner wall **122** and the outer wall **120**.

[0052] For example, the outer wall **120** and the inner wall **122** may have a thickness equal to or less than 2 mm, equal to or less than 1.5 mm, equal to or less than 1 mm, or equal to or less than 0.5 mm. In an example embodiment, the outer wall **120** and the inner wall **122** may have a nominal thickness of approximately 0.62 mm. In some embodiments, the outer wall **120** and the inner wall **122** may have the same thickness, while in other embodiments the outer wall **120** and the inner wall **122** may have different thicknesses.

[0053] As shown, the inner wall **122** may have a height, H.sub.IW, that is greater than the height, H.sub.OW, of the outer wall **120**. For example, the height, H.sub.IW, of the inner wall **122** may be in a range from 10 mm to 40 mm, from 15 mm to 35 mm, from 20 mm to 30 mm, or 25 mm to 30 mm, while the height, H.sub.OW, of the outer wall **120**, may be in the range from 5 mm to 35 mm, from 10 mm to 30 mm, from 15 mm to 25 mm, or from 18 mm to 22 mm. In some embodiments, the height, H.sub.OW, of the outer wall **120** may be the same or similar to the body height, H.sub.B. In other embodiments the height, H.sub.IW, of the inner wall **122** may be greater than the height, H.sub.OW, of the outer wall **120** to form a seal with an interior surface **172** of the cap **104**, while the outer wall **120** seals with a side wall of the cap **104**. In an example embodiment, the height, H.sub.IW, of the inner wall **122** may be between 2 mm to 3 mm higher than the height, H.sub.OW, of the outer wall **120**. For example, the height, H.sub.OW, of the outer wall **120** may be 24 mm while the height, H.sub.IW, of the inner wall **122** may be 26.6 mm. As will be described in greater detail below with respect to FIGS. **19-20**, in some embodiments, the inner wall **122** may have an inclined height, H.sub.IW, to aid in release of the cap **104**.

[0054] As shown by perspectives **600** and **700** of FIGS. **6-7**, an end **136** of the inner wall **122** positioned towards the top end **112** of the body **102** along the central axis **110** may form a seal with the cap **104**. In particular, the end **136** of the inner wall **122** may form an interference seal with the cap **104**. The fitting of the cap **104** to the body **102**, in particular the seals formed by this fitting are described in greater detail below. It should be appreciated that while the illustrated example depicts the interference seal as a radial seal, in other embodiments the interference seal may be an axial or face seal. In other words, in some embodiments, the cap **104** may form a radial seal or lip seal with the body **102**, while in other embodiments, the cap **104** may form an axial or face seal with the body **102**.

[0055] The inner chamber **124** of the body **102** may be configured to be filled with one or more remediating components. In particular, the inner chamber **124** may include an opening **125** at a top end **112** into which the remediating components may be introduced into the inner chamber **124**. As such, the inner chamber **124** may have a volume based on an amount of remediating components to be released into the packaged beverage. In other words, the inner chamber **124** may have a volume based on a volume of remediating components desired to be released into the packaged beverage. In various embodiments, the volume of the inner chamber **124** may be in a range from 1 milliliters (mL) to 10 mL, from 1 mL to 8 mL, from 1.5 mL to 6 mL, from 2 mL to 5 mL, from 2.5 mL to 4.5 mL, or from 3 mL to 4 mL, depending on the remediating component and desired amount of remediating component being released into the packaged beverage. As will be described in greater detail below, it may be desirable that the remediating component completely fill or close to completely fill the inner chamber **124** as to avoid any gaseous components in the inner chamber **124**. To achieve this, the remediating component may be diluted to fill the volume of the inner chamber **124** or the volume of the inner chamber **124** may be modified based on the amount of remediating component, such as illustrated in FIG. **13**.

[0056] The remediating components provided herein may be non-gaseous components that are released by the cartridge **101** upon opening of the packaged beverage. The type of remediating component may vary depending on the packaged beverage (e.g., sparkling water vs. beer) and an intended result of the remediating component (e.g., enhancing a flavor profile vs. enhancing user experience). Remediating components, as provided herein, may be any non-gaseous component that may be added to a beverage to enhance the consumer experience, shelf life of the packaged beverage, or reduce manufacturing costs of the beverage. Following the above IPA example, the remediating component may be a hop additive (e.g., hop flavoring additive), hop concentrate or a hop oil that is added to the IPA upon consumption to return the IPA close to an original, as-brewed flavor profile. The hop additive may also allow for the IPA to be brewed with less hops, thereby reducing the overall manufacturing costs of the IPA. Additionally, since the hop additive returns the IPA to an original flavor profile, introduction of the hop additive at consumption of the IPA may extend the shelf life of the IPA.

[0057] In some embodiments, the remediating component may be a flavor concentrate or flavor oil, such as lime concentrate, mint oil, or mango juice that is released into a packaged beverage. For example, if the packaged beverage is a mint tea or a RTD mojito, the remediating component may be a mint oil or concentrate. Since the flavor of herbs, such as mint, may degrade over time, releasing and mixing the mint oil/concentrate into the beverage at time of consumption, which is assumed to be at or close to opening of the packaged beverage, the flavor profile of the beverage is enhanced, the shelf life of the beverage extended, and in some cases, the manufacturing costs reduced as less mint may be required during production to achieve the same flavor profile at consumption.

[0058] In some cases, instead of a liquid, such as an oil or concentrate, the remediating component may be a solid. For example, the remediating component may be baking soda that upon release into the beverage at consumption causes fizzing in the beverage, thereby enhancing the consumer experience. In another example, a solid-phase remediating component may be salt or another type of spice that is added upon conception to enhance the consumer experience and enhance the flavor profile of the beverage. In some embodiments, more than one remediating component may be added, such as a lime concentrate and mint oil into a RTD mojito.

[0059] Depending on the type and quantity of remediating components being introduced, the volume and configuration of the inner chamber **124** may be modified. As described above, depending on the volume or amount of remediating component to be released, the volume of the inner chamber **124** may be modified to reduce headspace. In other embodiments, there may be more than one inner chamber **124**. For example, if two or more remediating components are to be released, and it is desirable to not pre-mix the remediating components prior to release, the inner chamber **124** may be modified to include two or more chambers to keep the remediating components separate. Following the above RTD mojito example where the remediating components include lime concentrate and mint oil, it may be desirable to keep the lime concentrate and mint oil separate until release. As such, the cartridge **101** may include two inner chambers **124**: one for the mint oil and one for the lime concentrate. It should be appreciated that there may be any number of inner chambers **124**, depending on the quantity of remediating component types being released. For example, there may be two inner chambers **124**, three inner chambers **124**, four inner chambers **124**, or five inner chambers **124**.

[0060] In some embodiments, the inner wall **122** of the inner chamber **124** may be coated or lined with a food-grade material to facilitate the release of the remediating component. Certain remediating components, such as mint oil or hop oil, have high viscosity, which can cause them to adhere to the inner wall **122** after the cap **104** is released. This adherence reduces the amount of remediating component that enters the packaged beverage, potentially diminishing its effectiveness. To compensate, additional remediating component could be added to the inner chamber **124**, but this increases production costs and may require a larger cartridge **101**. A larger cartridge could, in turn, reduce the total beverage volume within the packaging, potentially affecting regulatory compliance. To mitigate these issues, the inner wall **122** may be coated with a food-grade, nonstick material such as polytetrafluoroethylene (PTFE), silicone-based coatings, or food-safe lacquer. These coatings help ensure that the remediating component fully disperses into the beverage, improving efficacy without the need for increased volume or cost.

[0061] Additionally, the shape of the inner chamber **124** may be modified to aid in filling the cartridge **101**. As described in greater detail below with respect to FIGS. **15** and **19-20**, The bottom wall **130** of the inner chamber **124** may be curved or rounded to minimize splash back of the remediating component during filling and/or to facilitate its release. For example, eliminating corners or 90-degree angles by rounding the bottom wall **130** can prevent surface tension from forming between the inner wall **122** and the bottom wall **130**, which might otherwise hinder the release of the remediating component trapped in these areas. Additionally, if the remediating component has low viscosity, a rounded bottom wall **130** can help reduce splash back that would typically occur with a flat-bottomed design.

[0062] Although the remaining discussion focuses on hop additive as the remediating component, it should be appreciated that the discussion is equally applicable to any other remediating component. For example, the remediating components as provided herein may include one or more of a hop additive, herb concentrate, additive, or oil (e.g., mint, basil, rosemary, lavender, lemongrass), citrus concentrate, additive, or oil (e.g., lemon, lime, orange, grapefruit), salt, baking soda, rock candy (e.g., Pop-Rocks™), and the like.

[0063] The outer chamber **126** may be configured to fill with dissolved gas from the packaged beverage such to reach an equilibrium with the packaged beverage. As shown by FIGS. **3-5**, the outer chamber **126** may include an annulus opening **127** extending about the inner wall **122**. When the cap **104** is fitted to the body **102**, the annulus opening **127** may be sealed from the external environment by the cap **104**. As such, as shown by perspective **600** in FIG. **6**, the cap **104** may include a pinhole orifice **134** through which dissolved gas from the packaged beverage ingresses into the outer chamber **126** to equalize the outer chamber **126** with the pressure of the packaged beverage. As is appreciated, packaged beverages, such as canned beer or sparkling water, commonly contain dissolved gases, such as carbon dioxide. During the packaging process, the beverage is sealed into the container under pressure, allowing gasses to dissolve into the liquid. This process alters the pressure of the gases within the packaged beverage. When the cartridge **101** is inserted into the packaged beverage, the cartridge **101** is at atmospheric pressure and as such, the dissolved gas within the beverage may ingress into the outer chamber **126**. As the dissolved gas from the beverage ingresses into the outer chamber **126** from the beverage, the outer chamber **126** may equilibrize with the pressure of the packaged beverage. In other words, once the dissolved gas ingresses into the outer chamber **126**, the outer chamber **126** may have a pressure that is approximately equal to the pressure of the packaged beverage.

[0064] The volume of the outer chamber **126** may depend, in part, on the pressure of the packaged beverage. For example, the volume of the outer chamber **126** may be proportional to an amount of energy required to release the cap **104** from the cylindrical body **102**. As will be described in greater detail below, to release the cap **104** from the body **102**, the dissolved gas within the outer chamber **126** may undergo rapid volumetric expansion when the packaged beverage is opened. Because the dissolved gas in the outer chamber **126** is at equilibrium with the packaged beverage before opening, the dissolved gas in the outer chamber **126** may be at the same pressure as the packaged beverage before opening. When the packaged beverage is opened, the pressure of the packaged beverage adjusts to atmospheric pressure. Since the dissolved gas in the outer chamber **126** is restricted by the pinhole orifice **134**, it is unable to adjust to atmospheric pressure and as such undergoes rapid volumetric expansion in the outer chamber **126**. The greater the pressure difference between the dissolved gas trapped in the outer chamber **126** and atmospheric pressure, the greater the volumetric expansion of the trapped gas. As such, when the pressure of the packaged beverage is higher, the volume of the outer chamber **126** may be less than when the pressure of the packaged beverage is lower. Because a lower pressure results in a lower pressure differential between the trapped gas in the outer chamber **126** and atmospheric pressure, a larger volume of trapped gas may be required to release the cap **104** from the body **102**.

[0065] As is illustrated by Table **2300** in FIGS. **23**A-C, the pressure of the packaged beverage may depend on the type of beverage and the temperature. As such, the volume of the outer chamber **126** may vary depending on the type of beverage and temperature. In various embodiments, the volume of the outer chamber **126** may be in a range from 2 mL to 10 mL, from 3 mL to 9 mL, from 4 mL to 8 mL, from 4 mL to 7 mL, or from 5 mL to 6 mL. In an example embodiment, the volume of the outer chamber **126** may be approximately 7.1 mL.

[0066] Returning now to FIG. **6**, the bottom end **114** of the body **102** may include a bottom wall **130**. In some embodiments, the bottom wall **130** may form the bottom surface of both the inner chamber **124** and the outer chamber **126**. As shown, the bottom wall **130** of the body **102** may include one or more bottom stiffeners **132**. The bottom stiffeners **132** may extend along the central axis **110** towards the top end **112** of the body **102**. The bottom stiffeners **132** may provide structural rigidity to the body **102**. As noted above, the outer chamber **126** may equalize with the pressure of the packaged beverage as the dissolved gas ingresses into the outer chamber **126**. The remediating components within the inner chamber **124**, however, may not equalize to the pressure of the packaged beverage. That is, not only are the remediating components in a different phase state (e.g., liquid or solid) than the ingressed gas in the outer chamber **126**, but the inner chamber **124** is sealed off from the outer chamber **126**, meaning that the inner chamber **124** maintains the pressure at which it was filled and/or sealed (e.g., atmospheric pressure). As such, the inner chamber **124** and the outer chamber **126** may be at different pressures. As those skilled in the art readily appreciate, this may result in various forces being exerted on the inner wall **122**. As such, the bottom stiffeners **132** may provide structural support to the inner wall **122**, thereby mitigating the effects of the unequal pressures between the two chambers.

[0067] In an embodiment, the bottom stiffeners **132** may extend from the outer wall **120**, through the inner wall **122**, and into the inner chamber **124**. In some embodiments, the bottom stiffeners **132** may converge at a central point within the inner chamber **124**, while in other embodiments, such as the illustrated embodiment, the bottom stiffeners **132** may not converge and instead remain distinct from one another. In some embodiments, the bottom stiffeners **132** may be equally spaced in a circumferential manner about the bottom wall **130**.

[0068] The cap **104** may also include a variety of stiffeners or supporting elements to provide rigidity to the cartridge **101**. With reference to FIGS. **9-12**B, various perspectives **900** to **1200**B, respectively, of the cap **104** are provided, according to various embodiments provided herein. As shown, the cap **104** may include a first side **138** and a second side **140**. The first side **138** may be facing or directed towards the first end **106** of the cartridge **101**, while the second side **140** may be approximately orthogonal to the first side **138**. In some embodiments, the second side **140** may be perpendicular to the first side **138** such that the second side **140** is approximately parallel to the central axis **110** of the cartridge **101**. As can be appreciated, the orientation of the first side **138** and the second side **140** to each other may vary depending on the overall configuration of the cartridge **101**.

[0069] As noted above, the cap **104** may include one or more structures or components that provide support and rigidity to the cap **104** and/or the cartridge **101**. For example, the cap **104** may include one or more stiffeners, ribs, braces, girders, plates, and the like. It should be appreciated that while the following discussion is with respect to stiffeners, other supporting components may be used. This is equally applicable with respect to the body **102** and the body stiffeners **132** described above.

[0070] As shown, the first side **138** of the cap **104** may include top stiffeners **142**. The top stiffeners **142** may extend away from an exterior surface **144** of the cap **104** parallel to the central axis **110**. As illustrated, the top stiffeners **142** may be positioned circumferentially about the exterior surface **144** to provide uniform support about the exterior surface **144** of the cap **104**. In some embodiments, the top stiffeners **142** may form a domed structure **146**. The domed structure **146** incorporated into the cap **104** may provide both support and rigidity by distributing applied forces evenly across the exterior surface **144** of the cap **104**, thereby minimizing stress concentrations. As such, the domed structure **146** enhances the cap's **104** ability to withstand external loads and impacts, ensuring structural integrity and longevity of the cartridge **101**.

[0071] In addition to providing support and rigidity to the cap **104**, the domed structure **146** may have a mass such that when the cartridge **101** is introduced into the packaged beverage, the domed structure **146** causes the cartridge **101** to orient downwards towards a bottom of the packaged beverage. That is, the domed structure **146** adds weight to the first end **106** of the cartridge **101** such to cause the cartridge **101** to orient the first end **106** towards the bottom of the packaged beverage when the cartridge **101** is introduced into the packaged beverage. This is described in greater detail with respect to FIGS. **22**A and **22**B.

[0072] The domed structure **146** may include a domed surface **148**. As shown, the domed surface **148** slopes away from the exterior surface **144** of the first side **138** along the central axis **110** and converges at an apex **150** of the domed structure **146**. The apex **150** may be the point at which the cartridge height, H.sub.C, is at a maximum.

[0073] In addition to providing additional mass to the first end **106** of the cartridge **101**, the domed structure **146** may also aid in achieving equilibrium of the cartridge **101** with the packaged beverage. As shown, the cap **104** includes the pinhole orifice **134**. The pinhole orifice **134** may form a channel between an environment external to the cartridge **101** and the outer chamber **126**. As noted above, to achieve equilibrium between the outer chamber **126** and the pressure of the packaged beverage, dissolved gas may ingress into the cartridge **101**, in particular into the outer chamber **126**, via the pinhole orifice **134**. The domed surface **148** may prevent the pinhole orifice **134** from being obstructed by a surface of the packaged beverage. Obstruction of the pinhole orifice **134** may prevent the cartridge **101** from reaching equilibrium with the packaged beverage, thereby resulting in the cap **104** being unable to detach from the body **102** and release the remediating components housed therein.

[0074] As shown the pinhole orifice **134** may be positioned between two of the top stiffeners **142** of the domed structure **146**. As noted above, when the cartridge **101** is introduced into the packaged beverage, the weight or mass of the domed structure **146** may cause the cartridge **101** to orient the cap **104** towards the bottom of the packaged beverage. As such, portions of the cap **104** may contact the bottom surface of the packaged beverage. By positioning the pinhole orifice **134** between the two top stiffeners **142**, the domed surface **148** prevents the pinhole orifice **134** from being obstructed by the surface of the packaged beverage. The domed surface **148** may contact the surface of the packaged beverage instead and allow dissolved gas to freely ingress into the outer chamber **126** via the pinhole orifice **134**.

[0075] In some embodiments, the cap **104** may have more than one pinhole orifice **134**. For example, the cap **104** may have two or more, three or more, or four or more pinhole orifices **134**. In some embodiments, as the number of pinhole orifices **134** increases, the smaller the diameter of the pinhole orifices **134** may be. In other words, the pinhole orifice(s) **134** may have a total orifice surface area through which dissolved gas can ingress into the outer chamber **126**. As such, if there is a single pinhole orifice **134**, then the single pinhole orifice **134** may have a larger orifice surface area. In contrast, if there are two pinhole orifices **134**, then the orifice surface area of the two pinhole orifices **134** may half that of a single pinhole orifice **134** as to achieve the same orifice surface area. As can be appreciated, by maintaining an orifice surface area regardless of the number of pinhole orifices **134**, an amount of backpressure generated in the outer chamber **126** upon consumption of the beverage can be maintained. In example embodiments, the orifice surface area may be in a range from 0.1 to 0.5 mm, from 0.2 to 0.4 mm, or from 0.3 to 0.4 mm. In some embodiments, the pinhole orifice **134** may include a gas permeable membrane such as a PTFE membrane.

[0076] In some embodiments, the outer chamber **126** may be configured to house the remediating components and the inner chamber **124** may be configured to house ingressed gas. In such cases, the pinhole orifice **134** may provide the channel **152** between the inner chamber **124** and the external environment. In other words, in some embodiments, cartridge **101** may be configured such that dissolved gas from the packaged beverage ingresses into the inner chamber **124** while the outer chamber **126** houses the remediating components.

[0077] As can be appreciated, the more pinhole orifices **134** present in the cap **104**, the faster the cartridge **101** may equalize with the pressure of the packaged beverage. In some embodiments, the cartridge **101** may equalize with the pressure of the packaged beverage within 30 seconds, within 20 seconds, within 10 seconds, or within 5 seconds or less. Once the cartridge **101** is equalized with the pressure of the packaged beverage, the cartridge **101** may be primed for activation and release of the remediating components into the beverage, which may occur when the packaged beverage is opened.

[0078] As noted above, the cartridge **101** may be configured to release the remediating components that are housed in the inner chamber **124** upon opening of the packaged beverage. When the packaged beverage is opened, the pressure of the packaged beverage may undergo rapid decompression. That is, opening the packaged beverage may change (e.g., reduce) the pressure of the packaged beverage to pressure of the external environment, most likely atmospheric pressure. This change in pressure may cause the ingressed gas in the outer chamber **126** to undergo rapid volumetric expansion. The pinhole orifice **134**, however, may restrict the flow of the ingressed gas out of the outer chamber **126**. As such, the volumetric expansion of the ingressed gas may cause the cap **104** to decouple from the top end **112** of the body **102**. The decoupling of the cap **104** from the body **102** is discussed in greater detail below.

[0079] As shown by FIG. **7**, the pinhole orifice **134** may include a channel **152** between the outer chamber **126** and an environment external to the cartridge **101**. That is, the channel **152** may be formed through the cap **104**. In the illustrated example, the channel **152** of the pinhole orifice **134** is formed through the first side **138** of the cap **104**, however, it should be appreciated that in some embodiments the pinhole orifice **134** may be formed in the second side **140** of the cartridge **101**. In some embodiments, the channel **152** may be cylindrical in shape, thereby having a consistent diameter through its length. A consistent diameter throughout the length of the channel **152** may allow for simple manufacturing or construction of the pinhole orifice **134**.

[0080] As shown in FIG. **8**, in other embodiments, the channel **152** may have a conical shape such that one side of the channel **152** has a first diameter, d.sub.1, while the second side of the channel **152** has a second diameter, d.sub.2. For example, the first diameter, d.sub.1, may be oriented towards the external environment while the second diameter, d.sub.2, is oriented towards the outer chamber **126**. The first diameter, d.sub.1, may be smaller than the second diameter, d.sub.2, with the channel **152** tapering between the second diameter, d.sub.2, and the first diameter, d.sub.1. By tapering from a larger second diameter, d.sub.2, exposed to the outer chamber **126** to the smaller first diameter, d.sub.1, exposed to the external environment, the channel **152** may support backpressure buildup in the outer chamber **126**, thereby aiding in release of the cap **104** upon opening of the packaged beverage.

[0081] In contrast, in some embodiments, instead of the first diameter, d.sub.1, being smaller than the second diameter, d.sub.2, the first diameter, d.sub.1, may be larger than the second diameter, d.sub.2. As such, the channel **152** may taper from the external environment to the outer chamber **126**. Tapering the channel **152** in this manner may enable ingress of the dissolved gas from the packaged beverage into the outer chamber **126** while restricting or throttling flow of the ingressed gas out of the outer chamber **126**. The orientation of the tapering of the channel **152**, and the dimensions of the first diameter, d.sub.1, and the second diameter, d.sub.2, may vary depending on the application, such as the type and amount of remediating component being released or the type of beverage into which the cartridge **101** is inserted. Additional considerations that may impact the orientation of the tapering of the channel **152** and the dimensions of the first diameter, d.sub.1, and the second diameter, d.sub.2, include manufacturing considerations. For example, it may be advantageous for the channel **152** to be tapered as illustrated in FIG. **8** for ease of production and tooling longevity.

[0082] The diameter of the pinhole orifice **134**, in particular the channel **152** of the pinhole orifice **134**, may be such to adequately restrict the flow of the ingressed gas out of the outer chamber **126** and cause the volumetric expansion of the ingressed gas at a force large enough to decouple the cap **104** from the body **102**. If the pinhole orifice **134** has a diameter that is too large, when packaged beverage is opened the ingressed gas may simply flow out of the pinhole orifice **134** from the outer chamber **126**. If the ingressed gas can freely flow out of the pinhole orifice **134**, then there may not be enough backpressure retained by the outer chamber **126** to cause the cap **104** to decouple from the body **102**. In contrast, if the pinhole orifice **134** has a diameter that is too small, then the cartridge **101** may not equalize with the packaged beverage fast enough to be activated in time for a consumer to open the packaged beverage or at all.

[0083] As such, the diameter or inner diameter of the pinhole orifice **134** (e.g., the channel **152**), may be selected such to allow for ingress of dissolved gas at a rate that activates the cartridge **101** within a minute or less while restricting the outflow of the ingressed gas from the outer chamber **126** enough to maintain the pressure inside of the outer chamber **126**. In some embodiments, the diameter of the pinhole orifice **134** may be in a range from 0.1 mm to 1.5 mm, from 0.2 mm to 1 mm, from 0.3 to 0.9 mm, from 0.4 mm to 0.8 mm, or 0.5 to 0.7 mm. In an example embodiment, the diameter of the pinhole orifice **134** may be 0.3 mm. In some embodiments, the diameter of the pinhole orifice **134** may correspond, in part, to the pressure of the packaged beverage. If the packaged beverage is at a higher pressure, then there will be a larger pressure differential when the beverage is opened. As such, the pinhole orifice **134** may be larger because there may be a larger volumetric expansion with the larger pressure differential. However, if the pressure differential is smaller (e.g., the packaged beverage has a lower pressure), then a smaller diameter pinhole orifice **134** may be required to maintain the higher pressure in the outer chamber **126**, thereby ensuring enough backpressure in the outer chamber **126** when the ingressed gas undergoes volumetric expansion.

[0084] The diameter of the pinhole orifice **134** may be determined, at least in part, by the volume of the outer chamber **126** within the cartridge **101**. As can be appreciated, there may be a direct correlation between the volume of the outer chamber **126** and the extent of volumetric expansion experienced by the ingressed gas upon activation of the cartridge **101**. Specifically, the diameter of the pinhole orifice **134** influences the backpressure maintained within the outer chamber **126** during activation. Since the pressure within the outer chamber **126** is directly proportional to the volumetric expansion of the ingressed gas, the diameter of the pinhole orifice **134** may be linked to the volume of the outer chamber **126**. For example, if the volume of the outer chamber **126** is 7000 mm.sup.3 (7 milliliters (ml)), then the diameter or orifice surface area of the pinhole orifice **134** may be 0.3 mm.

[0085] As shown by FIGS. **6-7**, the cap **104** may contact an interior surface **154** of the outer wall **120** of the body **102**. In particular, an attachment surface **156** of the cap **104** may contact the interior surface **154** of the outer wall **120**. The attachment surface **156** may releasably secure the cap **104** to the body **102**. To secure the cap **104** to the body **102**, the attachment surface **156** may forme on the exterior surface **144** of the second side **140** such to insert into the outer chamber **126** when the cap **104** is positioned atop the body **102**. When the cap **104** is positioned on the body **102**, as illustrated, the attachment 01surface **156** may contact the interior surface **154** of the outer wall **120** and form a seal therebetween. Specifically, the attachment surface **156** may form a compression seal between the cap **104** and the body **102**.

[0086] In some embodiments, such as illustrated by a perspective **1000** in FIG. **10**, the attachment surface **156** may include a profile **158**. The profile **158** may be a convex portion of the attachment surface **156** which extends along the x-axis away from the central axis **110** of the cap **104**. The profile **158** may contact and press against the interior surface **154** of the outer wall **120** when the cap **104** is fitted to the body **102**. In some embodiments, the compression seal may be formed between the profile **158** and the interior surface **154** of the outer wall **120**. Although the profile **158** is shown as extending circumferentially about the exterior surface **144** of the second side **140** in a continuous manner that is orthogonal (e.g., perpendicular) to the central axis **110**, in some embodiments the profile **158** may be formed as discrete segments. That is, instead of continuously extending circumferentially along the attachment surface **156**, the profile **158** may include segments that have breaks therebetween. In other words, the profile **158** may be formed as nubs or bumps that are positioned circumferentially along the attachment surface **156**.

[0087] In some embodiments, the cap **104** may include a lip **160**. The lip **160** may be positioned on the second side of the cap **104** to seat on an end **162** of the outer wall **120**. That is, when the cap **104** is fitted to the body **102** (e.g., positioned on the body **102** to form the cartridge **101**), the lip **160** may contact the end **162** of the outer wall **120** to prevent the cap **104** from moving further along the central axis **110** towards the bottom end **114**. If the embodiment of the cap **104** includes the lip **160**, then the attachment surface **156** may be positioned lower on the central axis **110** than the lip **160** such that the attachment surface **156** is inserted into the body **102** when the lip **160** contacts the end **162** of the outer wall **120**. As noted above, it should be appreciated that while the illustrated embodiments depict a radial seal formed between the cap **104** and the body **102**, in other embodiments an axial or face seal may be formed between the cap **104** and the body **102**.

[0088] As illustrated in FIG. **7**, in some embodiments, the end **162** of the outer wall **120** may include a ramp **164**. In particular, the ramp **164** may be formed between an exterior surface **166** and the interior surface **154** of the outer wall **120**. The ramp **164** may aid in decoupling the cap **104** from the body **102** during activation of the cartridge **101** (e.g., when the packaged beverage is opened). For example, as the ingressed gas in the outer chamber **126** exerts a force on the cap **104**, pushing the cap **104** away from the body **102** along the central axis **110**, the profile **158** may slide along the ramp **164** to decouple the cap **104** from the body **102**. The sloped surface of the ramp **164** from the interior surface **154** to the exterior surface **166** may facilitate the slide of the profile **158** along the outer wall **120** and aid the attachment surface **156** from releasing the seal formed with the interior surface **154** of the outer wall **120**.

[0089] As illustrated in FIGS. **8** and **9**, the cap **104** may include one or more ribs **168** positioned circumferentially about the second side **140**. The ribs **168** may provide structural rigidity to the cap **104** along the second side **140**. In particular, the ribs **168** may function to combat the forces exerted by the ingressed gas in the outer chamber **126** during activation (e.g., during volumetric expansion of the ingressed gas). As shown in the illustrated embodiment, the ribs **168** may be in contact with the lip **160** or as an integrated part with the lip **160**. The ribs **168** may be uniformly spaced circumferentially about the exterior surface **144** of the second side **140**.

[0090] The cap **104** may include one or more inner stiffeners **170**. As exemplified by perspective **1100** of FIG. **11**, the inner stiffeners **170** may be positioned about an interior surface **172** of the cap **104**. In particular, the inner stiffeners **170** may be positioned at a spacing distance, d.sub.S, circumferentially about the interior surface **172**. The inner stiffeners **170** may extend along the interior surface **172** to a third side **176** of the cap **104**. In some embodiments, the third side **176** of the cap may be parallel to the first side **138** and/or orthogonal (e.g., perpendicular) to the second side **140** of the cap. As shown in FIG. **11**, in some embodiments, the inner stiffeners **170** may extend from a reinforcement ring **174**, which is described below, to the third side **176** of the cap **104**. In some embodiments, the inner stiffeners **170** may extend beyond the third side **173**, as illustrated in FIG. **7**.

[0091] As shown in FIG. **11**, the interior surface **172** of the cap **104** may include a reinforcement ring **174**. The reinforcement ring **174** may extend towards the bottom end **114** of the body **102** along the central axis **110**. In other words, the reinforcement ring **174** may extend away from the interior surface **172** of the cap **104** parallel to the central axis **110**. In some embodiments, a portion of the reinforcement ring **174** extends into the outer chamber **126** and contacts the inner wall **122**. As shown in FIG. **7**, the reinforcement ring **174** may be inserted in the outer chamber **126** such to contact an exterior surface **180** of the inner wall **122**. The exterior surface **180** of the inner wall **122** may be the surface of the inner wall **122** that faces the outer chamber **126**.

[0092] The reinforcement ring **174** may include a sealing element **182** that creates an interference seal between the reinforcement ring **174** and the exterior surface **180** of the inner wall **122**. For example, the sealing element **182** may be a slight inflection or slope of the reinforcement ring **174** along the surface that contacts the exterior surface **180** of the inner wall **122**. In some embodiments, the sealing element **182** may include a sealing material, such as a rubber or soft plastic that creates a seal between the inner chamber **124** and the outer chamber **126**. In other embodiments, the sealing element **182** is formed of the same material as the reinforcement ring **174** and/or the rest of the cartridge **101**. It should be appreciated that while the illustrations and related description discusses the interference seal being formed between the exterior surface **180** of the inner wall **122** and the reinforcement ring **174**, it should be appreciated that in some embodiments the interference seal may be formed between an interior surface **184** of the inner wall and the reinforcement ring **174**. In such cases, the reinforcement ring **174** may be inserted, at least partially, into the inner chamber **124** instead of into the outer chamber **126**.

[0093] Because the inner chamber **124** contains, during use of the cartridge **101**, the remediating components, sealing the inner chamber **124** from the outer chamber **126** may be important to prevent leakage between the two chambers. That is, because the inner chamber **124** contains a non-gaseous component while the outer chamber **126** contains a gaseous component during use, preventing leakage between the two chambers may be important. For example, any leakage of the non-gaseous remediating component into the outer chamber **126** may impact the activation of the cartridge **101**, such as obstructing the pinhole orifice **134**. As can be appreciated, if the remediating component is an oil, such as a hop additive, and leaks into the outer chamber **126**, when the cartridge **101** orients towards the bottom of the packaged beverage, the leaked oil may pool near or on the pinhole orifice **134**. If the cartridge **101** has not yet been equalized to the packaged beverage pressure, the leaked oil may prevent the ingress of the dissolved gas.

[0094] Conversely, if the ingressed gas leaks into the inner chamber **124**, then this could cause the cap **104** to decouple from the body **102** preemptively or before the consumer opens the packaged beverage. For example, since non-gaseous components, such as the remediating components have a different compression rate than gas, any slight changes in pressure may cause the leaked gas to expand in the inner chamber **124**, thereby decoupling the cap **104** from the body **102**. Moreover, any gas leaked into the inner chamber **124** may degrade the remediating components. For example, the remediating components, such as hop additive, may degrade in the presence of oxygen or carbon dioxide. As such, a gas that contains oxygen, such as dissolved gas, present in the inner chamber **124** may degrade the remediating components. Additional negative consequences of having gaseous components present in the inner chamber **124** are described in greater detail below.

[0095] In addition to preventing leakage between the inner chamber **124** and the outer chamber **126**, the interference seal may have an interference fit that does not prevent decoupling of the cap **104** from the body **102**. For example, if the interference seal has an interference fit that is too tight, then the cap **104** may not decouple from the body **102** during activation of the cartridge **101**. As such, the interference seal formed between the reinforcement ring **174** and the inner wall **122** may have an interference fit of equal to or less than 0.1 micrometers (μm), equal to or less than 0.075 μm, equal to or less than 0.05 μm, or equal to or less than 0.025 μm.

[0096] As noted above, the cap **104** may include the inner stiffeners **170**. The inner stiffeners **170** may provide structural support to the outer chamber **126** and may aid in the assembly process of the cartridge **101**. As can be appreciated, the outer wall **120** and the inner wall **122** may be formed from thin material that may deform or flex during assembly. As such, fitting the cap **104** to the body **102**, in particular inserting the attachment surface **156** and the reinforcement ring **174** into the outer chamber **126**, may be difficult due to the flexing of the outer wall **120** and/or the inner wall **122**. To provide rigidity and prevent the outer wall **120** and/or the inner wall **122** from flexing during the assembly process, the cap may include the inner stiffeners **170**. In some embodiments, the inner stiffeners **170** may include a ramped edge **178**. The ramped edge **178** may aid insertion of the inner stiffeners **170** into the outer chamber **126**. For example, if the inner wall **122** is slightly flexed outwards during assembly, the ramped edge **178** of the inner stiffener **170** may catch the inner wall **122** and redirect the inner wall **12** into position.

[0097] In addition to providing structural rigidity to the outer chamber **126** and the cap **104**, the inner stiffeners **170** may also function to prevent the inner wall **122** from flexing inwards into the inner chamber **124** during activation. When the cartridge **101** is activated and the ingressed gas undergoes volumetric expansion, the expanding gas may exert force in all directions, including onto the cap **104**, the outer wall **120**, and the inner wall **122**. This force may cause the inner wall **122** to flex inwards as well as the outer wall **120** outwards (e.g., away from the inner chamber **124**). By including the inner stiffeners **170**, the inner wall **122** may be supported and the force of the expanding gas may be redirected, in part, to the outer wall **120**. Because the outer wall **120** can freely flex outwards, when the cartridge **101** is activated, the expanding gas may flex the outer wall **120** outwards, thereby aiding in the release of the attachment surface **156** from the interior surface **154** of the outer wall **120**. As can be appreciated, flexing the outer wall **120** outwards may release the seal formed at the attachment surface **156**, thereby allowing the cap **104** to decouple at lower pressures than if the seal was maintained.

[0098] Referring now to FIGS. **12**A-B, in some embodiments the inner stiffeners **170** may be positioned about the interior surface **172** such to have a different spacing distance, d.sub.S, around the pinhole orifice **134**. As shown, around the pinhole orifice **134**, the inner stiffeners **170** may be positioned at a first spacing distance, d.sub.S1, while the remaining inner stiffeners **170** that are further from the pinhole orifice **134** may have positioned at a second spacing distance, d.sub.S2. The first spacing distance, d.sub.S1, may be less than the second spacing distance, d.sub.S2, such that there is a greater density of inner stiffeners **170** proximal to the pinhole orifice **134**.

[0099] The first spacing distance, d.sub.S1, may be less than the second spacing distance, d.sub.S2, to position more inner stiffeners **170** proximate to the pinhole orifice **134**. This may cause the cartridge **101** to orient the pinhole orifice **134** towards a bottom of the packaged beverage. Orienting the pinhole orifice **134** towards the bottom of the packaged beverage may serve multiple functions. One function may be orienting the pinhole orifice **134** towards the bottom of the packaged beverage may prevent plugging of the pinhole orifice **134** by particulate or suspended solids that may be present in the beverage (e.g., an unfiltered IPA). When the pinhole orifice **134** is oriented downwards, the domed structure **146** may prevent the pinhole orifice **134** from contacting the bottom of the packaged beverage and prevent larger particles from reaching the pinhole orifice **134**.

[0100] Another function of orienting the pinhole orifice **134** downwards is to aid in the activation of the cartridge **101**. When the dissolved gas ingresses into the outer chamber **126**, components of the beverage may be entrained. As such, there may be a small amount of the beverage that ingresses into the outer chamber **126** along with the ingressed gas. When the cartridge **101** is oriented downwards, the higher density of inner stiffeners **170** proximate to the pinhole orifice **134** may cause the pinhole orifice **134** to be the low point in the outer chamber **126**. As such, the entrained beverage may pool around the pinhole orifice **134**. The first spacing, d.sub.S1, of the inner stiffeners **170** may act to prevent the pooling beverage from dispersing away from the pinhole orifice **134**. By pooling the entrained beverage around and on the pinhole orifice **134**, the volumetric expansion of the ingressed gas may be enhanced. As those skilled in the art readily appreciate, during volumetric expansion, the ingressed gas may try to flow out of the pinhole orifice **134**, however, the pooling beverage, being a liquid, may prevent the outward flow of the ingressed gas. In other words, the entrained beverage may act as a plug when pooled over the pinhole orifice **134**. In some cases, pooling the beverage over the pinhole orifice **134** may double the efficiency of the volumetric expansion or activation of the cartridge **101**.

[0101] Referring now to FIG. **13**, a perspective **1300** of the cartridge **101** including a stillwand **186** is illustrated, according to an embodiment herein. For example, the interior surface **172** may include a stillwand **186** (e.g., stir stick or rod) to aid in dispersing the remediating components out of the inner chamber **124**. The stillwand **186** may be positioned to insert into the inner chamber **124** when the cap **104** is fitted to the body **102**. In particular, the stillwand **186** may be positioned to insert into the remediating components housed within the inner chamber **124**. When the cap **104** decouples from the body **102**, the stillwand **186** may function to suction or pull the remediating components out of the inner chamber **124**. As noted above, the remediating components may be a viscous material, such as an oil, meaning that the remediating components may resist flow. As such, even when the cap **104** decouples from the body **102** and the inner chamber **124** is exposed to the packaged beverage, the remediating components may not freely flow into the packaged beverage. The stillwand **186** may aid in releasing and flowing the remediating components into the packaged beverage upon activation of the cartridge **101**. In some embodiments, there may be more than one stillwand **186**, such as two or more stillwands **186**, three or more stillwands **186**, four or more stillwands **186**, or five or more stillwands **186**.

[0102] The stillwand **186** may have a length, L, that does not impede the decoupling of the cap **104** from the body **102**. For example, if the stillwand **186** has a length, L, that is too great, then the stillwand **186** may catch on the inner wall **122** when the cap **104** is released. In some cases, catching of the stillwand **186** on the inner wall **122** may prevent complete decoupling of the cap **104** from the body **102** and impede release of the remediating components in the packaged beverage. As such, the stillwand **186** may have a length in a range from 2 mm to 20 mm, from 5 mm to 20 mm, from 10 mm to 20 mm, or from 10 mm to 15 mm. In some embodiments, instead of a straight stillwand **186**, as illustrated, the stillwand **186** may have a curvature or spiral, such as having a corkscrew shape. Depending on the viscosity and composition of the remediating component, the stillwand's **186** shape and/or curvature may aid in mixing the remediating components with the packaged beverage upon release.

[0103] The perspective **1300** of the cartridge **101** also illustrates that in some embodiments the outer chamber **126** and the inner chamber **124** may have two different bottom walls. As illustrated, the outer chamber **126** may have an outer bottom wall **188** and the inner chamber **124** may have an inner bottom wall **190**, the outer bottom wall **188** at a different height along the central axis **110** than the inner bottom wall **190**. In some embodiments, it may be beneficial to fill the inner chamber **124** with the remediating components as close to full as possible. That is, it may be advantageous to fill the inner chamber **124** only with non-gaseous components (e.g., the remediating components) because any gas in the inner chamber **124** may cause the center of gravity of the cartridge **101** to shift. As described above, when the cartridge **101** is inserted into the packaged beverage, the cartridge **101** may be designed to orient the cap **104** downwards. Orienting the cap **104** downwards or towards the bottom of the packaged beverage may ensure that the pinhole orifice **134** is positioned within the beverage, thereby ensuring that the dissolved gas can ingress into the outer chamber **126** and the cartridge equilibrize to the pressure of the packaged beverage. If there is gas in the inner chamber **124** this may prevent the cartridge **101** from orienting the pinhole orifice **134** downwards, thereby preventing the cartridge **101** from equalizing with the pressure of the packaged beverage.

[0104] Moreover, if there is an airhead in the inner chamber **124** (e.g., gas components in the inner chamber **124** along with the remediating components), this may degrade the remediating components. For example, the remediating components, such as hop additive, may degrade in the presence of oxygen. As such, a gas that contains oxygen, such as air, present in the inner chamber **124** may degrade the remediating components. As will be described in greater detail below with respect to FIGS. **14-15**, if the inner chamber **124** is completely filled with a remediating component, the compressibility of the component may negatively impact the sealing process when closing the cap **104**. As such, in some embodiments, the cap **104** may include an excess gas chamber or pocket.

[0105] Furthermore, the presence of gas in the inner chamber **124** may negatively affect the decoupling of the cap **104** from the body **102**. For example, if the cartridge **101** is prepared/activated at a higher elevation, such as in Denver, Colorado, but the packaged beverage is opened and consumed at sea level, such as in San Diego, California, the pressure differential between gas within the inner chamber **124** and the higher atmospheric pressure may limit the release of the cap **104**. In other words, any gas within the inner chamber **124** when prepared at a higher elevation may maintain the lower pressure (due to the higher elevation) when the cartridge **101** is inserted into the packaged beverage. If the packaged beverage is opened at a lower elevation, thus having a higher atmospheric pressure than the pressure of the gas in the inner chamber **124**, this may cause an additional 1-3 psi of pressure that is required to be overcome for the cap **104** to decouple from the body **102**.

[0106] To ensure that the inner chamber **124** is filled to a desired fill volume (e.g., max fill volume), an amount of remediating components may be added to the inner chamber to reach the desired fill volume. If the amount of remediating component to be released in the packaged beverage is less than the amount needed to reach the desired fill volume, then water or another inert component may be added to the remediating components to achieve the desired fill volume of the inner chamber **124**. In other cases, instead of diluting the remediating components, the inner bottom wall **190** of the inner chamber **124** may be raised to reduce the volume of the inner chamber **124** to the desired volume of remediating components, such as is illustrated in FIG. **13**.

[0107] Referring now to FIGS. **14-20**, another example cartridge **1401** is illustrated, according to various embodiments herein. The example cartridge **1401** may be the same or substantially similar to the cartridge **101**. As such, the cartridge **1401** includes the body **102** and the cap **104**, as well as various other components, such as the inner chamber **124** and the outer chamber **126**. The cartridge **1401** may illustrate additional components, such as an excess gas chamber **1475**, in the cap **104**, a hinge **1416**, one or more cutouts **1477**, and a rounded bottom **1531**, each of which is described in turn below.

[0108] As described above, it may be desirable to completely fill the inner chamber **124** with remediating component. In such cases, however, the compressibility of the remediating component may negatively impact the sealing process when closing the cap **104**. This may occur because compressible materials can create resistance or backpressure, making it difficult to achieve a secure closure and potentially leading to leaks or improper sealing. To address this issue, in some embodiments, the cap **104** may include the excess gas chamber **1475**. The excess gas chamber **1475** allows the inner chamber **124** to be fully filled while still accommodating any expansion or compression of the remediating component during the closure process, ensuring a secure and effective seal.

[0109] As illustrated, the excess gas chamber **1475** may be formed approximately centered in the cap **104** such to align with the central axis **110** of the cartridge **1401**. To form the excess gas chamber **1475** in the cap **104**, a reinforcement ring **1474**, which may be the same or similar to the reinforcement ring **174**, may extend from the cap **104** towards the inner chamber **124**, when the cartridge **1401** is in a closed position. A surface **1473** may be formed between an opening of the excess gas chamber **1475** and the reinforcement ring **1474**.

[0110] As illustrated in FIG. **16**, which provides a cross-sectional perspective view **1600** of the cartridge **1401** in a closed position, when the cap **104** is secured to the body **102**, the surface **1473** may face or otherwise be directed towards the inner chamber **124**. The presence of the excess gas chamber **1475** within the cap **104** may form an annular space **1471** in the cap **104** as well. As depicted, when the cap **104** is secured to the body **102**, the annular space **1471** aligns with the outer chamber **126**. Additionally, when in the closed position, an interior surface **1472** of the reinforcement ring **1474**, which may be the same or similar to the interior surface **172**, may create a seal with the interior surface **184** of the inner wall **122** of the inner chamber **124**, as described above.

[0111] With reference to FIG. **15**, which provides a cross-sectional perspective **1500** of the cartridge **1401**, the excess gas chamber **1475** may have a slightly conical shape to accommodate or otherwise align with the domed structure **146** of the cap **104**. In such cases, the excess gas chamber **1475** may include a first diameter, d.sub.1, and a second diameter, d.sub.2, as illustrated. The first diameter, d.sub.1, and the second diameter, d.sub.2, along with a depth of the excess gas chamber **1475** may result in an opening angle, a, of the excess gas chamber **1475**. In some embodiments, the opening angle, a, may be 30°, while in other embodiments, the opening angle, a, may be 20°, 25°, 35°, 40°, or 45°. The opening angle, a, facilitates release of the remediating component by, for example, decreasing the amount of “weaving” required for the remediating component to flow from the inner chamber **124** to the external environment, thereby reducing the time it takes for the remediating component to mix into the packaged beverage. It should be appreciated that while the illustrated examples illustrate the excess gas chamber **1475** as conical shaped, in other embodiments, the excess gas chamber **1475** may be cylindrically shaped, domed shaped, or any other shape.

[0112] The cartridge **1401** also includes the hinge **1416**, which may be the same or similar to the hinge **116** in that it provides a mechanism allowing the cap **104** to securably release from the body **102**. With reference to FIG. **15**, the hinge **1416** includes a ridge **1417** that aids in the release of the cap **104** from the body **102**. When the cap **104** is affixed to the body **102** and the inner chamber **124** is filled with remediating components, various physical forces may resist the cap's **102** release. One such force arises from the potential formation of a partial vacuum within the inner chamber **124** due to the settling or compaction of the remediating components, which can create negative pressure against the cap **104**, increasing the force required to disengage it. Additionally, in environments where the cartridge **1401** is inserted into a packaged beverage at low temperatures, thermal contraction of the polymeric material composing the hinge **1416** may occur. This contraction can reduce the hinge's **1416** elasticity and compromise its ability to return to its original open position due to decreased molecular mobility and increased material stiffness at lower temperatures.

[0113] To counteract these physical forces resisting the cap's **102** release, the hinge **1416** includes the ridge **1417**. As illustrated in perspective view **1505**, the hinge assembly **1416** comprises a primary segment **1421**, into which a thinned segment **1419** is integrated. The segment **1421** may structurally correspond to both the first side **118**A and the second side **118**B of the hinge **1416**, providing anchoring points on either end. The thinned segment **1419** functions as the flexible joint that interconnects the first side **118**A and the second side **118**B, facilitating controlled articulation.

[0114] The thinned segment **1419** is specifically engineered to act as the flexural zone of the hinge **1416**, permitting deflection and bending when the cap **104** is engaged with the body **102**. To enhance its flexibility, the thinned segment **1419** has a reduced cross-sectional thickness relative to the adjacent segment **1421**. This localized reduction in material thickness decreases the bending stiffness, thereby allowing the hinge to deform more easily under load while maintaining structural integrity. The material composition of the hinge **1416** may be a polymeric or elastomeric compound, optimized for repeated flexure without significant fatigue failure. Additionally, the transition between the thinned segment **1419** and the segment **1421** may incorporate a gradual taper to distribute stress and minimize localized stress concentrations, which could otherwise lead to premature failure

[0115] The ridge **1417** is strategically positioned on the primary segment **1421**, located either on the first side **118**A or the second side **118**B, depending on the hinge **1416** configuration. As illustrated, the ridge **1417** is placed at a distance, D, along the primary segment **1421**, extending towards the thinned segment **1419**. The placement of the ridge **1417** influences the mechanical response of the hinge **1416** when the cap **104** is secured to or released from the body **102**. Specifically, as the distance, D, increases, the ridge **1417** engages with the hinge **1416** mechanism in a manner that increases the resistance to flexing at the thinned segment **1419**. This results in a higher reactive force opposing deformation when the cap **104** is being opened. The ridge **1417** functions as a mechanical stop or fulcrum, amplifying the force needed to disengage the cap **104** by introducing a localized resistance point along the hinge.

[0116] Additionally, the ridge **1417** may serve to pre-load the hinge **1416** in a partially stressed state when the cap **104** is closed, enhancing the snap-fit retention between the cap **104** and body **102**. The material selection and geometric profile of the ridge **1417** can further refine its influence on the hinge's **1416** mechanical behavior and optimizing durability. In some cases, instead of the illustrated configuration that includes the ridge **1417**, the hinge **1416** may be a butterfly hinge that incorporates a dual-flexure design or an over-center mechanism to generate a restoring force. This design allows the hinge **1416** to store potential energy when the cap **104** is in the closed position and then release it upon actuation, effectively overcoming any counter forces resisting the cap's **104** movement. By doing so, the butterfly hinge facilitates a smoother and more controlled release of the cap **104** from the body **102**, enhancing usability and reducing the effort required for disengagement.

[0117] As described above, the inner chamber **124** is filled with remediating components that rejuvenate a beverage upon decoupling of the cap **104** from the body **102**. As such, the cartridge may undergo a filling process during which one or more remediating components are inserted or otherwise placed into the inner chamber **124**. Depending on the viscosity of the remediating components, splash back may occur, resulting in a portion of the remediating component inadvertently spilling or spraying out of the inner chamber **124**. To prevent splash back, as well as provide aid in release of the remediating component as described above, the inner chamber **124** may include a rounded bottom **1531**, as depicted in FIG. **15**. As shown, the bottom wall **130** of the inner chamber **124** may include a rounded bottom **1531**. The rounded bottom surface **1531** may reduce the amount of splash back during filling of the inner chamber **124** as well as reduce adherence of remediating components to the bottom wall **130**, as described above.

[0118] The rounded bottom **1531** of the bottom wall **130** may create a void **1579**A within the cartridge **1401**, specifically between the outer chamber **126** and the inner chamber **124**. In some cases, rather than leaving this space empty, it may be filled with a material **1579**B. This material **1579**B could serve various purposes, such as providing structural support or enhancing thermal insulation. The choice between maintaining a void **1579**A or incorporating a filler material **1579**B may depend on factors such as the desired performance characteristics, the nature of the remediating component, or manufacturing considerations.

[0119] Referring now to FIG. **17**, an isometric perspective **1700** of the cartridge **1401** is provided, according to an embodiment herein. The perspective **1700** illustrates the bottom end **114** of the body **102**, which features the voids **1579**A formed by the rounded bottom **1531** of the inner chamber **124**. In some embodiments, the bottom end **114** incorporates one or more bottom stiffeners **1732**, which may be the same or similar to the bottom stiffeners **132** discussed above. The bottom stiffeners **1732** provide added structural integrity, helping to resist deformation under pressure or external forces. Additionally, the bottom end **114** includes a gate **1733**, which serves to further reinforce the bottom section of the body **102**. The gate **1733** not only enhances the overall strength and rigidity of the bottom end but also aids in ensuring proper alignment during manufacturing and assembly.

[0120] The perspective **1700** also illustrates the cutout **1477** formed as part of the body **102**. The cartridge **1401** may include one or more cutouts **147** formed as part of the outer wall **120** of the body **102**. The cutouts **1477** may aid in alignment and orientation of the cartridge **1401** during manufacturing and assembly processes, such as ensuring that the cap **104** is in correct alignment for closure. FIG. **18** illustrates a side-view perspective **1800** of the cartridge **1401** including two cutouts **1477**A and the **1477**B. The cutouts **1477**A and **1447**B may be positioned on the body **102** to ensure the cartridge **1401** is aligned properly as needed during manufacturing and assembly. The cutouts **1477** may also reduce the weight of the cartridge **1401** and volume displacement of the cartridge **1401** within the packaged beverage. The size and configuration of the cutouts **1477** may vary depending on the manufacturing process, assembly processes, and/or design of the cartridge **1401**.

[0121] Referring now to FIG. **19**, a cross-sectional perspective **1900** of the cartridge **1401** having an inclined inner wall **122** is illustrated. As shown, the inner wall **122** of the inner chamber **124** may include a first side **1922**A and a second side **1922**B. The second side **1922**B may be oriented closest to the hinge **1416** and the first side **1922**A may be oriented opposite to the second side **1922**B. The first side **1922**A may have a first height that is greater than a second height of the second side **1922**B. The height of the inner wall **122** may slope from the first side **1922**A to the second side **1922**B, thereby forming an inclined inner wall **122**.

[0122] The inclined inner wall **122** may aid in releasing the cap **104** from the body **102**. As described above, when the cartridge **1401** is in the closed position, various forces can impact the release of the cap **104** from the body **102**, one of which is the friction formed between the cap **104** and the body **102**. As shown in FIG. **16**, when in the closed position, the interior surface **184** of the inner wall **122** contacts with the interior surface **1472** of the reinforcement ring **1474**. The height of the inner wall **122**, particularly near the hinge **1416**, plays a significant role in determining the frictional forces involved. The greater the height of the inner wall **122**, the more contact is made between the interior surfaces **184** and **1472**, which increases friction and makes it more difficult to release the cap **104**. By designing the inner wall **122** with a sloped or inclined height—particularly with the second side **1922**B of the inner wall **122** having a reduced height—friction between the inner surfaces is minimized. This inclined shape allows for a smoother transition and easier release of the cap **104**, as it reduces the amount of contact and friction that would otherwise occur at the hinge **1416** region. The inclined inner wall **122** helps to mitigate the resistance and facilitates a more efficient uncoupling of the cap **104** from the body **102**.

[0123] Referring now to FIG. **20**, a perspective **2000** of the cartridge **1401** is illustrated, showing the inclined inner wall **122** in a near-closed position. As depicted, when the cap **104** is being secured to the body **102**, the interior surface **1472**A of the cap **104** contacts the first side **1922**A of the inner wall **122**. This occurs approximately simultaneously with the contact of the interior surface **1472**B of the cap **104** with the second side **1922**B of the inner wall **122**. The key to this timing is the difference in height between the first side **1922**A and the second side **1922**B of the inner wall **122**. If the height of the second side **1922**B were equal to that of the first side **1922**A, the contact sequence would be altered. Specifically, the interior surface **1472**B of the cap **104** would make contact with the interior surface **184** of the second side **1922**B earlier than the interior surface **1472**A would contact the first side **1922**A, as the inner wall **122** would have a more uniform height, creating less of a gradual slope. This earlier contact could introduce uneven pressure distribution, increasing the friction and resistance during the securing process. By incorporating a reduced height in the second side **1922**B, the design allows the two interior surfaces **1472**A and **1472**B to engage with the inner wall **122** in a more balanced and controlled manner, optimizing the sealing process while minimizing friction during the final stages of closure as well as during the release of the cap **104** from the body **102**.

[0124] Referring now to FIG. **21**, an example cartridge **2101** is illustrated, according to an embodiment herein. As shown, the cartridge **2101** includes an elongate body **2102** and a cap **2104**, which may be the same or similar to the body **102** and the cap **104**. The cartridge **2101** is illustrated in an orientation that the cartridge **2101** may achieve when inserted into the packaged beverage. For example, the cap **2104** is illustrated oriented downwards and directed towards a bottom surface **2194** of the packaged beverage. In some embodiments, the cartridge **2101** may be inserted into the packaged beverage in this orientation. For example, if the cartridge **2101** is inserted into a beer bottle or a packaged beverage that does not have a width or configuration that allows the cartridge **2101** to freely move and orient itself downwards, the cartridge **2101** may be inserted into the packaged beverage such to orient the cap **104** towards the bottom surface **2194** of the packaged beverage.

[0125] In some embodiments, the cartridge **2101** may include one or more wing tabs **2192**. The wing tabs **2192** may be configured to collapse or otherwise fold around the cartridge **2101** upon insertion into the packaged beverage and then unfold or expand once inserted. When the wing tabs **2192** expand, the wing tabs **2192** may prevent the cartridge **2101** from moving within the packaged beverage. That is, the wing tabs **2192**, once expanded may secure the cartridge's **2101** position within the packaged beverage. This may ensure that the cartridge **2101** stays in a downward position. The wing tabs **2192** may also prevent the cartridge **2101** from obstructing a mouthpiece of the packaged beverage. For example, if the cartridge **2101** is inserted into a beer bottle, then without the wing tabs **2192**, the cartridge **2101** may flow out of the beer bottle mouthpiece when a consumer drinks the beer. As can be appreciated, this may not only negatively impact the consumer's experience, but it may also be dangerous (e.g., the cartridge **2101** may be a choking hazard). As such, the wing tabs **2192** may prevent the cartridge **2101** from moving when the packaged beverage is tipped up during consumption.

[0126] It should be appreciated that while the wing tabs **2192** are illustrated as solid, in some embodiments, the wing tabs **2192** may be formed as a skeleton structure, such to minimize impact on fluid flow within the packaged beverage during consumption while maintaining the cartridge **2101** in a secure position. In some embodiments, the wing tabs **2192** may be formed from the same material as the cartridge **2101**, while in other embodiments, the wing tabs **2192** may be formed of different material to aid in their expansion or unfurling.

[0127] Referring now to FIGS. **22**A and **22**B, perspectives **2200**A and **2200**B are provided respectively, according to an embodiment herein. In particular, the perspectives **2200**A and **2200**B illustrate a cartridge **2201** prior to and during activation within a packaged beverage **2296**. The cartridge **2201** may be the same or similar to the cartridge **101** or **2101**, such as including a body **2202** and a cap **2204**. As illustrated, when the cartridge **2201** is introduced into the packaged beverage **2296**, the cartridge **2201** may orient towards a bottom surface **2294** of the packaged beverage **2296**. In particular, the cartridge **2201** may orient the cap **2204** towards the bottom surface **2294**. As described above, the orientation of the cartridge **2201** may be due to various features of the cartridge **2201**, such as having a domed structure like the domed structure **146**.

[0128] As illustrated by arrows **2298** in the perspective **2200**A, dissolved gas may flow or ingress into the cartridge **2201** to activate the cartridge **2201**. The arrows **2298** may indicate the flow of dissolved gas from the packaged beverage **2296** into an outer chamber, such as the outer chamber **126**, within the cartridge **2201**. Although not visible, dissolved gases may be flowing through a pinhole orifice present in the cap **2204** and into the cartridge **2201**. As described above, to facilitate activation of the cartridge **2201**, the pinhole orifice may be oriented towards the bottom surface **2294** of the packaged beverage **2296**. As such, the arrows **2298** may indicate the flow of dissolved gas into the pinhole orifice present at the point of the cap **2204** oriented towards the bottom surface **2294**.

[0129] The perspective **2200**B illustrates activation of the cartridge **2201**. In particular, arrows **2299** illustrate the flow of remediating components being released from cartridge **2201**. As described above, an inner chamber (not shown) of the cartridge **2201** may house remediating components and release the components upon opening of the packaged beverage **2296**. The packaged beverage **2296** may be opened in the perspective **2200**B, as indicated by a tab **2297**. As such, when the packaged beverage **2296** is opened, the cartridge **2201** may activate and release the remediating components, as shown by the arrows **2299**.

[0130] As illustrated by the arrows **2299**, orienting the cartridge **2201**, in particular the cap **2204** towards the bottom surface **2294** may aid in releasing the remediating components. For example, because the cartridge **2201** is oriented downwards, when the remediating components are released out of the inner chamber (e.g., the inner chamber **124**), the remediating components may hit the bottom surface **2294** and deflect off, thereby achieving a mixing effect. Moreover, as a consumer drinks the packaged beverage **2296**, the consumer often lifts the bottom of the packaged beverage **2296** upwards, meaning that the releasing remediating components may mix further as the consumer drinks. In part, by releasing the remediating components near the bottom surface **2294**, the remediating components have longer to mix with the packaged beverage **2296** before being consumed. This can prevent a user from ingesting or tasting the remediating components in an unmixed state, which may be an undesirable experience.

[0131] The foregoing examples and descriptions are described herein in the context of systems and methods for providing a cartridge for releasing remediating components into a packaged beverage upon consumption. Those of ordinary skill in the art will realize that these descriptions are illustrative only and are not intended to be in any way limiting. Reference is made in detail to implementations of examples as illustrated in the accompanying drawings. The same reference indicators are used throughout the drawings and the description to refer to the same or like items.

[0132] In the interest of clarity, not all of the routine features of the examples described herein are shown and described. It will, of course, be appreciated that in the development of any such actual implementation, numerous implementation-specific decisions must be made in order to achieve the developer's specific goals, such as compliance with application- and business-related constraints, and that these specific goals will vary from one implementation to another and from one developer to another. That is, the foregoing description of some examples has been presented only for the purpose of illustration and description and is not intended to be exhaustive or to limit the disclosure to the precise forms disclosed. Numerous modifications and adaptations thereof will be apparent to those skilled in the art without departing from the spirit and scope of the disclosure.
[0133] Reference herein to an example or implementation means that a particular feature, structure, operation, or other characteristic described in connection with the example may be included in at least one implementation of the disclosure. The disclosure is not restricted to the particular examples or implementations described as such. The appearance of the phrases "in one example," "in an example," "in an embodiment," or "in an implementation," or variations of the same in various places in the specification does not necessarily refer to the same example or implementation. Any particular feature, structure, operation, or other characteristic described in this specification in relation to one example or implementation may be combined with other features, structures, operations, or other characteristics described in respect of any other example or implementation.
[0134] Use herein of the word "or" is intended to cover inclusive and exclusive OR conditions. In other words, A or B or C includes any or all of the following alternative combinations as appropriate for a particular usage: A alone; B alone; C alone; A and B only; A and C only; B and C only; and A and B and C.
[0135] Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise," "comprising," and the like are to be construed in an inclusive sense, as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to." As used herein, the terms "connected," "coupled," or any variant thereof means any connection or coupling, either direct or indirect, between two or more elements; the coupling or connection between the elements can be physical, logical, or a combination thereof. Additionally, the words "herein," "above," "below," and words of similar import, when used in this application, refer to this application as a whole and not to any particular portions of this application. Where the context permits, words in the above Detailed Description using the singular or plural number may also include the plural or singular number respectively. The word "or," in reference to a list of two or more items, covers all the following interpretations of the word: any of the items in the list, all the items in the list, and any combination of the items in the list.
[0136] The above Detailed Description of examples of the technology is not intended to be exhaustive or to limit the technology to the precise form disclosed above. While specific examples for the technology are described above for illustrative purposes, various equivalent modifications are possible within the scope of the technology, as those skilled in the relevant art will recognize. For example, while processes or blocks are presented in a given order, alternative implementations may perform routines having steps, or employ systems having blocks, in a different order, and some processes or blocks may be deleted, moved, added, subdivided, combined, and/or modified to provide alternative or sub combinations. Each of these processes or blocks may be implemented in a variety of different ways. Also, while processes or blocks are at times shown as being performed in series, these processes or blocks may instead be performed or implemented in parallel, or may be performed at different times. Further any specific numbers noted herein are only examples: alternative implementations may employ differing values or ranges.
[0137] The teachings of the technology provided herein can be applied to other systems, not necessarily the system described above. The elements and acts of the various examples described above can be combined to provide further implementations of the technology. Some alternative

implementations of the technology may include not only additional elements to those implementations noted above, but also may include fewer elements.

[0138] To reduce the number of claims, certain aspects of the technology are presented below in certain claim forms, but the applicant contemplates the various aspects of the technology in any number of claim forms. For example, while only one aspect of the technology is recited as a computer-readable medium claim, other aspects may likewise be embodied as a computer-readable medium claim, or in other forms, such as being embodied in a means-plus-function claim. Any claims intended to be treated under 35 U.S.C. § 112(f) will begin with the words “means for” but use of the term “for” in any other context is not intended to invoke treatment under 35 U.S.C. § 112(f). Accordingly, the applicant reserves the right to pursue additional claims after filing this application to pursue such additional claim forms, in either this application or in a continuing application.

EXAMPLES

[0139] These illustrative examples are mentioned not to limit or define the scope of this disclosure, but rather to provide examples to aid understanding thereof. Illustrative examples are discussed above in the Detailed Description, which provides further description. Advantages offered by various examples may be further understood by examining this specification.

[0140] As used below, any reference to a series of examples is to be understood as a reference to each of those examples disjunctively (e.g., “Examples 1-4” is to be understood as “Examples 1, 2, 3, or 4”).

[0141] Aspect 1 is a cartridge for releasing at least one remediating component into a packaged beverage, the cartridge comprising: a cylindrical body having a top end and a bottom end, the cylindrical body comprising: an outer wall extending from the bottom end towards the top end; an inner wall extending from the bottom end towards the top end, wherein: the inner wall forms an inner chamber and an outer chamber; and the outer chamber comprises an annulus space circumferentially about the inner chamber, a bottom wall forming a bottom surface of the inner chamber and the outer chamber, wherein the bottom end comprises the bottom wall, wherein: the inner chamber comprises an opening at the top end; and the outer chamber comprises an annulus opening at the top end; a cap configured to releasably secure to the top end of the cylindrical body, wherein the cap comprises: a first side and a second side, wherein the second side is approximately orthogonal to the first side, each of the first side and the second side comprising an interior surface opposing an exterior surface, wherein: the second side comprises an attachment surface; and the attachment surface releasably attaches the cap to the outer wall of the cylindrical body; and a pinhole orifice extending between the interior surface and the exterior surface of the first side, wherein the pinhole orifice comprises a channel between the inner chamber and an environment exterior to the cartridge.

[0142] Aspect 2 is the cartridge of any previous or subsequent aspect, wherein the pinhole orifice comprises a diameter of 0.3 millimeters (mm).

[0143] Aspect 3 is the cartridge of any previous or subsequent aspect, wherein the cylindrical body comprises a plurality of stiffeners circumferentially positioned about the bottom wall, wherein the plurality of stiffeners extends along at least of a portion of the bottom surface of the outer chamber and at least a portion of the bottom surface of the interior surface.

[0144] Aspect 4 is the cartridge of any previous or subsequent aspect, wherein the inner wall comprises a first height and the outer wall comprises a second height, wherein the first height is greater than the second height.

[0145] Aspect 5 is the cartridge of any previous or subsequent aspect, wherein the cap comprises a stillwand extending into the inner chamber when the cap is secured to the top end of the cylindrical body.

[0146] Aspect 6 is the cartridge of any previous or subsequent aspect, wherein the attachment surface comprises a profile extending circumferentially about the exterior surface of the second side, wherein the profile contacts an interior surface of the outer wall of the cylindrical body to form a compression seal between the outer wall and the attachment surface.

[0147] Aspect 7 is the cartridge of any previous or subsequent aspect, wherein the interior surface of the first side of the cap comprises a sealing element extending approximately perpendicular to the first side towards the bottom end of the cylindrical body, wherein the sealing element contacts the inner wall of the cylindrical body to form an interference seal between the sealing element and the inner wall to form the inner chamber.

[0148] Aspect 8 is the cartridge of any previous or subsequent aspect, wherein the annulus space of the outer chamber comprises a volume proportional to an amount of energy required to release the cap from the cylindrical body based on a pressure of the packaged beverage into which the cartridge is introduced.

[0149] Aspect 9 is the cartridge of any previous or subsequent aspect, wherein the cap comprises a plurality of inner stiffeners, wherein each of the inner stiffeners extends inwards from the interior surface into the annulus space of the outer chamber, wherein a first subset of the plurality of inner stiffeners is positioned on the interior surface proximate to the pinhole orifice such to weight the cap towards the pinhole orifice.

[0150] Aspect 10 is the cartridge of any previous or subsequent aspect, wherein the cap comprises a domed structure having a plurality of top stiffeners, wherein the plurality of top stiffeners comprises a mass such that when the cartridge is introduced into the packaged beverage the cap orients downwards towards a bottom of the packaged beverage and the bottom end of the cylindrical body orients upwards towards a top of the packaged beverage.

[0151] Aspect 11 is the cartridge of any previous or subsequent aspect, where the cartridge further comprises a hinge attached on a first end to the cap and on a second end to the cylindrical body.

[0152] Aspect 12 is a system for releasing one or more non-gaseous remediating components into a packaged beverage upon opening of the packaged beverage, the system comprising: a cartridge comprising a cap and a cylindrical body, wherein the cap is releasably secured to a top end of the cylindrical body, wherein: the cylindrical body comprises an inner chamber and an outer chamber, both extending from the top end towards a bottom end of the cylindrical body, wherein: the outer chamber forms an annulus space about the inner chamber; the annulus space of the outer chamber fills with gas when the outer chamber reaches a pressure equilibrium with the packaged beverage, the gas being dissolved gas from the packaged beverage; and the inner chamber comprises the one or more non-gaseous remediating components; and the cap comprises a pinhole orifice configured to restrict fluid flow between the outer chamber and an environment external to the cartridge such that when the packaged beverage is opened, the pinhole orifice restricts the gas within the outer chamber from flowing to the environment external, thereby causing rapid volumetric expansion of the gas in the outer chamber, wherein the rapid volumetric expansion of the gas causes the cap to decouple from the top end of the cylindrical body thereby releasing the non-gaseous remediating components into the packaged beverage.

[0153] Aspect 13 is the system of any previous or subsequent aspect, wherein: the outer chamber comprises an outer wall having an interior surface and an exterior surface; and the cap comprises an attachment element, wherein the attachment element forms a compression seal between the cap and the interior surface of the outer wall.

[0154] Aspect 14 is the system of any previous or subsequent aspect, wherein the cartridge comprises a unibody forming the cylindrical body and the cap.

[0155] Aspect 15 is the system of any previous or subsequent aspect, wherein the cap comprises a plurality of stiffeners, wherein the stiffeners are configured to cause pinhole orifice to orient towards a bottom of the packaged beverage.

[0156] Aspect 16 is the system of any previous or subsequent aspect, wherein the cap comprises a plurality of inner stiffeners positioned about an interior surface proximate to the pinhole orifice, wherein the plurality of inner stiffeners is configured to pool entrained beverage around the pinhole

orifice.
[0157] Aspect 17 is the system of any previous or subsequent aspect, wherein the one or more non-gaseous remediating components comprise one or more of: a flavor-enhancing additive; a citrus additive; a hop additive; an herb additive; salt; or baking soda.
[0158] Aspect 18 is the system of any previous or subsequent aspect, wherein an interior surface of the cap comprises a reinforcement ring extending towards the bottom end of the cylindrical body, wherein the reinforcement ring contacts an exterior surface of the inner chamber to form an interference seal between the inner chamber and the outer chamber.
[0159] Aspect 19 is the system of any previous or subsequent aspect, wherein the cap comprises a dome structure and is configured to orient towards a bottom of the packaged beverage such that the dome structure prevents obstruction of the pinhole orifice.
[0160] Aspect 20 is the system of any previous or subsequent aspect, wherein the cartridge comprises a plurality of wing tabs that are configured to contact an interior surface of the packaged beverage and limit movement of the cartridge within the packaged beverage.

Claims

1. A cartridge for releasing at least one remediating component into a packaged beverage, the cartridge comprising: a cylindrical body having a top end and a bottom end, the cylindrical body comprising: an outer wall extending from the bottom end towards the top end; an inner wall extending from the bottom end towards the top end, wherein: the inner wall forms an inner chamber and an outer chamber; and the outer chamber comprises an annulus space circumferentially about the inner chamber, a bottom wall forming a bottom surface of the inner chamber and the outer chamber, wherein the bottom end comprises the bottom wall, wherein: the inner chamber comprises an opening at the top end; and the outer chamber comprises an annulus opening at the top end; a cap configured to releasably secure to the top end of the cylindrical body, wherein the cap comprises: a first side and a second side, wherein the second side is approximately orthogonal to the first side, each of the first side and the second side comprising an interior surface opposing an exterior surface, wherein: the second side comprises an attachment surface; and the attachment surface releasably attaches the cap to the outer wall of the cylindrical body; and a pinhole orifice extending between the interior surface and the exterior surface of the first side, wherein the pinhole orifice comprises a channel between the inner chamber and an environment exterior to the cartridge.
2. The cartridge of claim 1, wherein the pinhole orifice comprises a diameter of 0.3 millimeters (mm).
3. The cartridge of claim 1, wherein the cylindrical body comprises a plurality of stiffeners circumferentially positioned about the bottom wall, wherein the plurality of stiffeners extends along at least of a portion of the bottom surface of the outer chamber and at least a portion of the bottom surface of the interior surface.
4. The cartridge of claim 1, wherein the inner wall comprises a first height and the outer wall comprises a second height, wherein the first height is greater than the second height.
5. The cartridge of claim 1, wherein the cap comprises a stillwand extending into the inner chamber when the cap is secured to the top end of the cylindrical body.
6. The cartridge of claim 1, wherein the attachment surface comprises a profile extending circumferentially about the exterior surface of the second side, wherein the profile contacts an interior surface of the outer wall of the cylindrical body to form a compression seal between the outer wall and the attachment surface.
7. The cartridge of claim 1, wherein the interior surface of the first side of the cap comprises a sealing element extending approximately perpendicular to the first side towards the bottom end of the cylindrical body, wherein the sealing element contacts the inner wall of the cylindrical body to

form an interference seal between the sealing element and the inner wall to form the inner chamber.
8. The cartridge of claim 1, wherein the annulus space of the outer chamber comprises a volume proportional to an amount of energy required to release the cap from the cylindrical body based on a pressure of the packaged beverage into which the cartridge is introduced.
9. The cartridge of claim 1, wherein the cap comprises a plurality of inner stiffeners, wherein each of the inner stiffeners extends inwards from the interior surface into the annulus space of the outer chamber, wherein a first subset of the plurality of inner stiffeners is positioned on the interior surface proximate to the pinhole orifice such to weight the cap towards the pinhole orifice.
10. The cartridge of claim 1, wherein the cap comprises a domed structure having a plurality of top stiffeners, wherein the plurality of top stiffeners comprises a mass such that when the cartridge is introduced into the packaged beverage the cap orients downwards towards a bottom of the packaged beverage and the bottom end of the cylindrical body orients upwards towards a top of the packaged beverage.
11. The cartridge of claim 1, where the cartridge further comprises a hinge attached on a first end to the cap and on a second end to the cylindrical body.
12. A system for releasing one or more non-gaseous remediating components into a packaged beverage upon opening of the packaged beverage, the system comprising: a cartridge comprising a cap and a cylindrical body, wherein the cap is releasably secured to a top end of the cylindrical body, wherein: the cylindrical body comprises an inner chamber and an outer chamber, both extending from the top end towards a bottom end of the cylindrical body, wherein: the outer chamber forms an annulus space about the inner chamber; the annulus space of the outer chamber fills with gas when the outer chamber reaches a pressure equilibrium with the packaged beverage, the gas being dissolved gas from the packaged beverage; and the inner chamber comprises the one or more non-gaseous remediating components; and the cap comprises a pinhole orifice configured to restrict fluid flow between the outer chamber and an environment external to the cartridge such that when the packaged beverage is opened, the pinhole orifice restricts the gas within the outer chamber from flowing to the environment external, thereby causing rapid volumetric expansion of the gas in the outer chamber, wherein the rapid volumetric expansion of the gas causes the cap to decouple from the top end of the cylindrical body thereby releasing the non-gaseous remediating components into the packaged beverage.
13. The system of claim 12, wherein: the outer chamber comprises an outer wall having an interior surface and an exterior surface; and the cap comprises an attachment element, wherein the attachment element forms a compression seal between the cap and the interior surface of the outer wall.
14. The system of claim 12, wherein the cartridge comprises a unibody forming the cylindrical body and the cap.
15. The system of claim 12, wherein the cap comprises a plurality of stiffeners, wherein the stiffeners are configured to cause pinhole orifice to orient towards a bottom of the packaged beverage.
16. The system of claim 12, wherein the cap comprises a plurality of inner stiffeners positioned about an interior surface proximate to the pinhole orifice, wherein the plurality of inner stiffeners is configured to pool entrained beverage around the pinhole orifice.
17. The system of claim 12, wherein the one or more non-gaseous remediating components comprise one or more of: a flavor-enhancing additive; a citrus additive; a hop additive; an herb additive; salt; or baking soda.
18. The system of claim 12, wherein an interior surface of the cap comprises a reinforcement ring extending towards the bottom end of the cylindrical body, wherein the reinforcement ring contacts an exterior surface of the inner chamber to form an interference seal between the inner chamber and the outer chamber.
19. The system of claim 12, wherein the cap comprises a dome structure and is configured to orient

towards a bottom of the packaged beverage such that the dome structure prevents obstruction of the pinhole orifice.

20. The system of claim 12, wherein the cartridge comprises a plurality of wing tabs that are configured to contact an interior surface of the packaged beverage and limit movement of the cartridge within the packaged beverage.