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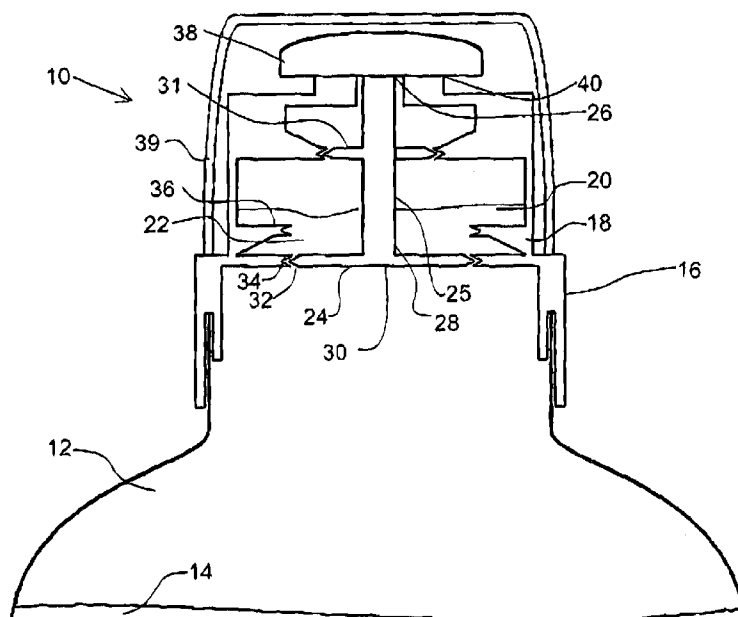


FIG. 1

(57) Abstract: A beverage container has a first compartment containing a fluid, and an airtight second compartment containing tea polyphenols in a substantially oxygen free environment. A movable barrier separates the first compartment from the second compartment. At least one of the first compartment and the second compartment forming a mixing chamber for the tea polyphenols and the fluid upon the barrier being moved.

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TITLE

[0001] Tea Beverage and Container

FIELD

[0002] Tea beverages and containers for separately storing components of the tea beverage.

BACKGROUND

[0003] Soft drink beverages are widely consumed by a large number of people. However, the most popular drinks contain large amount of sugar and are partially responsible for the prevalence of obesity in the world. It has been well established that obesity can cause serious health problems, including diabetes, cancers, and atherosclerosis, etc. Therefore, some of the sugar-containing drinks have been banned from entering some schools in North America. This action is a signal calling for new and healthier beverage soft drinks.

[0004] Tea, prepared from the leaves of a small plant *Camellia sinensis*, has been consumed in China and India as a health drink for preventing and treating many illnesses for 5 thousand years. Tea can be divided into three categories according to their processing procedure: green tea is prepared by directly drying from tea leaves, black tea is prepared after a complete fermentation, and oolong tea is the representative product of semi-fermented tea. Pu-erh tea is prepared via a special procedure and belongs to black tea.

SUMMARY

[0005] According to an aspect, there is provided a beverage container comprising a first compartment containing a fluid and a sealed second compartment containing tea polyphenols. A movable barrier separates the first compartment from the second compartment. At least one of the first compartment and the second compartment forms a mixing chamber for the tea polyphenols and the fluid upon the barrier being moved.

[0006] According to an aspect, there is provided a method of preparing a tea drink, comprising: providing a beverage container as described above; moving the movable barrier; and mixing the tea polyphenols and the fluid.

[0007] According to an aspect, there is provided a beverage container comprising a liquid retaining cavity containing a liquid and a closure cap detachably secured to the cavity. The closure cap has a body that defines an interior compartment containing a flavored substrate. The compartment is closed by a closure barrier. A movable member is provided that has a first end that is accessible from the exterior of the closure cap and a second end that engages the closure barrier. A force exerted upon the first end results in movement of the movable member to move the closure barrier to permit the flavored substrate to mix with the liquid.

[0008] According to an aspect, there is provided a method of preparing a beverage, comprising the steps of: providing a beverage container as described above; placing a liquid in the liquid retaining cavity; placing a flavored substrate in the interior compartment of the closure cap; moving the movable member by exerting a force upon the first end of the movable member such that the closure barrier moves to permit the flavored substrate to mix with the liquid; and mixing the flavored substrate and the liquid.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] These and other features will become more apparent from the following description in which reference is made to the appended drawings, the drawings are for the purpose of illustration only and are not intended to be in any way limiting, wherein:

FIG. 1 is a side elevation view in section of a beverage container.

FIG. 2 is a detailed side elevation view of an engagement lip holding the cap of **FIG. 1**.

FIG. 3 is a detailed side elevation view of the barrier being held in a retaining lip of **FIG. 1**.

FIG. 4 is a detailed top plan view of a baffle within the beverage container of **FIG. 1**.

FIG. 5 is a side elevation view in section of an alternate beverage container with a frangible pocket.

FIG. 6 is a side elevation view in section of the alternate beverage container of **FIG. 5** is the frangible pocket opened.

FIG. 7 is a side elevation view in section of a further alternative beverage container.

FIG. 8 is a top plan view of a movable baffle within the beverage container of **FIG. 7**.

FIG. 9 is a detailed side elevation view of engagement lips within the beverage container of **FIG. 7**.

FIG. 10 is a side elevation view of an alternate release mechanism.

DESCRIPTION

[0010] Recent evidences from laboratory and preclinical studies demonstrated that tea or its constituents tea polyphenols can have broad beneficial effects on health, including inhibiting cancers induced by a wide spectrum of chemical carcinogens in rodents and other animals (Chen ZY et al., *Zhonghua Zhong Liu Zha Zhi* 9:109, 1987 Chinese; Stoner D et al., *J Cell Biochem Suppl.* 22:169, 1995; Yang CS et al., *Annu Rev Pharmacol Toxicol.* 42:25, 2002; Cooper R et al., *J Altern Compl Med.* 11:639, 2005), killing cultured cancer cells of almost all cell types (Nassani I et al., *Biochem Biophys Res Commun.* 249:391, 1998; Mittal A et al., *Int J Oncol.* 24:703, 2004; L'Allemain G., *Bull Cancer* 86:721, 1999; Adhami VW., *J Nutr.* 133:2417S, 2003), preventing atherosclerosis (Kuo KL *J Agri Food Chem* 53:480, 2005; Abe I et al., *J Nat Prod.* 64:1010, 2001; Abe I et al., *Biochem Biophys Res Comm* 268:767, 2000) and neuron-degenerating diseases such as Alzheimer and Parkinson (Rezai-Zadeh K et al., *J Neuroscience* 25:8807, 2005; Mandel S et al., *Mol Nutr Food Res* 50:229, 2006) and anti-diabetes and -obesity in animal models. Almost all evidences point to tea polyphenols (also known as tea catechins), such as (-)-epigallocatechin 3-gallate (EGCG), (-)-epigallocatechin (EGC), (-)-epicatechin (EC), and (-)-epicatechin-3-gallate (ECG), theaflavin, thearubigins, and theaflavin3,3'-digallate as its effective constituents, although caffeine has certain beneficial effects as well. More recently, clinical trials have

demonstrated that green tea or tea polyphenols (catechins) are effective in preventing and treating liver cancer (Zhang ZQ et al., *Guangxi Prevention Medicine* 1:1, 1995), prostate cancer (Bettuzzi et al., *Cancer Res.*, 66:1234, 2006), leukemia (Shanafelt TD., *Leukemia Res.*, 30:707, 2006), and papilloma-infected cervical lesions (Ahn WS et al., *Euro J Cancer Prev.*, 12:383, 2003) in human subjects.

[0011] The tea polyphenol monomers, such as EGCG and EGC and EC and ECG, are the most effective molecule forms. However, when exposed to oxygen, especially in water solution, they undergo oxidization and polymerization to become dimmers or polymers or other oxidative products, such as theaflavin, thearubigins, and theaflavin-3,3'-digallate (Roginsky V et al, *J Agric Food Chem* 53:4529, 2005; Tanaka T et al., *J Agric Food Chem* 49:5785, 2001). With an increase in size, they become more difficult to be absorbed in intestine and less effective in health protection. Fortunately, these deterioration reactions can be prevented or slowed by isolating the tea polyphenols from oxygen and water by keeping them in sealed and vacuumed conditions.

[0012] Although tea drinks have been consumed by many people in many areas of the world, their taste, especially green tea's taste, is not appreciated by many. In preliminary experiments, it has been found that appropriate percent of an oligosaccharide, such as VitaSugar (TM) IMO, the trade-name of the isomalto-oligosaccharide produced by BioNeutra Inc. (Edmonton, Canada), can significantly improve the taste of the tea drinks prepared from tea leaves or from tea polyphenols, which are commercially available. It has been found that the taste of tea drinks starts to improve even when the content of VitaSugar (TM) IMO is only 0.5%. The taste improves VitaSugar (TM) IMO concentration is gradually increased to 5%, 10%, and up to 50% or higher. Other popular elements from natural or artificial sources, such as fruits and flavors, may also be added to change or improve the taste. In some embodiments, the ratio of tea polyphenol to sugar may be between 1:10 and 1:10⁷ by weight.

[0013] Isomalto-oligosaccharide and fructo-oligosaccharide are two oligosaccharides derived from starch composed of 4- to 7- glucose or fructose with enzyme-mediated

altered chemical linkage between the monomer. They cannot be absorbed by human digestion system, which lack the enzymes to break the altered linkage. However, they are sweet in taste so that can serve as health sweeteners in place of regular high calorie sugars. In addition to serving as sweeteners, these oligosaccharides have multiple health benefits themselves, including promoting the growth of the favorable bacteria in human colon, preventing colon cancer, dental cavity, constipation and diarrhea, etc.

[0014] Tea elements, such as polyphenols, have broad health benefits, including anti-cancer, -atherosclerosis, -obesity, and -diabetes, and neuron-protection effects, etc., and that isomalto-oligosaccharide and fructo-oligosaccharide, two low calorie sweeteners, have a series of additional health benefits, e.g., prevention of colon cancer and constipation and dental cavity, and promotion of favorable bacterial flora in human colon. Thus, beverages that comprise these elements will provide consumers a class of tasteful drinks with superior health benefits.

[0015] Unfortunately, tea polyphenols will become ineffective through oxidization or polymerization shortly after exposure to oxygen or water in regular drink; consumers will enjoy their health benefits only when these deterioration reactions are effectively prevented; to do this, vacuum and waterproof devices are provided to maintain the integrity of the fragile ingredients in the drink, allowing them to mix with the liquid portion of the drink only immediately before consumed.

[0016] A preferred embodiment of beverages includes green tea and the oligosaccharides, which benefit because of their good taste and their excellent health beneficial effects.

[0017] The vacuum and waterproof devices described herein are designed to store tea polyphenols and other oxygen- and water-sensitive ingredients for an individual drink, allowing them to be mixed with the liquid portion of the drink only immediately before being drunk. Consequently, the consumers can obtain the intact ingredients and expected health benefits of the products. While the beverage containers were initially developed

with tea beverages in mind, it will be understood that they may be used for other beverages formed from other flavored substrates aside from tea.

[0018] The devices can be made up of glass, plastics, metals, membrane, or other safe and nontoxic and FDA approval materials. The solid ingredients, such as tea polyphenols and vitamin C, of each bottle of drink are packed in the vacuum and waterproof container and protected against exposure to air and the fluid, or liquid part of the drink. A mechanism is built into the device, allowing the solid ingredients to mix with the liquid part of the drink by simply rotating or shaking.

[0019] In a preferred embodiment, referring to **FIG. 1**, a beverage container 10 that is used to prepare the tea beverage at the time of consumption is provided with a first compartment 12, or liquid retaining cavity, containing a fluid 14, such as water. An airtight second compartment 20 is also provided containing tea polyphenols 22 in a substantially oxygen free environment. The oxygen free environment helps slow the breakdown of the desirable chemicals. Tea polyphenols 22 are preferably in solid form, such as in a powder, but may be in other states, such as a liquid state, if the solvent used will dissolve the tea polyphenols without causing them to break down. The oxygen free environment is preferably provided done by placing tea polyphenols under vacuum such that the pressure is less than atmospheric pressure, and sufficiently reduced to minimize the amount of oxygen to acceptable levels, which will depend on the intended storage time before use. If a longer storage time is intended, more oxygen must be removed. The oxygen free environment may also be provided by replacing any oxygen with an inert gas, such as nitrogen or argon. A movable barrier 24 separates first compartment 12 from second compartment 20. As depicted, first compartment 12 forms a mixing chamber for tea polyphenols 22 and fluid 14. It will be understood that either or both compartments may be used as the mixing chamber, depending on the relative sizes of the chambers, the type of barrier that is used, and what type of compartment is formed when the barrier is moved.

[0020] If other ingredients are desired, they may either be previously dissolved in the fluid 14 in first compartment 12 or included with tea polyphenols in second compartment 20. For example, a sweetener, such as VitaSugar (TM) may be dissolved in the water in first compartment 12, or it may be in powder form with tea polyphenols 22, such that it is also dissolved and mixed when barrier 24 is moved. Other ingredients may include natural or artificial flavors. The tea polyphenols 22 may be powdered tea leaves, or may be derived from green tea, black tea, oolong tea, and pu-erh tea, or combinations thereof. In addition, as will be described below, beverage container 10 may be used for other multi-component beverages when it is desirable to allow the user to mix the components of the beverage at a preferred time, such as immediately before to consuming.

[0021] Referring now to **FIG. 1**, a preferred embodiment of a beverage container 10 is shown. Beverage container 10 has a liquid retaining cavity 12 containing a liquid 14 and a closure cap 16 detachably secured to cavity 12. Closure cap 16 has a body 18 that defines an interior compartment 20 containing a flavored substrate 22. Compartment 20 is being closed by a closure barrier 24. A movable member 25 that has a first end 26 that is accessible from the exterior of closure cap 16 and a second end 28 that engages closure barrier 24 is provided. A force exerted upon first end 26 results in movement of movable member 25 to move closure barrier 24 to permit flavored substrate 22 to mix with liquid 14. Different types of movable members 25 and forces may be applied.

[0022] Referring to **FIG. 1**, barrier 24 is a plate 30 separating interior compartment 20 of closure cap 16 from second compartment. There may also be a secondary plate 31. An outer edge 32 of plate 30 is engaged by a contoured lip 34, as shown in **FIG. 3**. Plate 30 is moved to by applying a lifting force to plate 30 via a handle 38 attached to movable member 25. As depicted, plate 30 may then be engaged by a secondary contoured lip 36 which, referring to **FIG. 4**, may have a series of holes 37 to allow mixing to occur. Referring to **FIG. 2**, handle 38 may be secured by a male to female lip engagement 40 to closure cap 16 to prevent accidental opening. Referring to **FIG. 1**, a cover 39 may also be provided to keep the top of closure cap 16 clean during transport and handling.

[0023] Referring to **FIG. 5**, movable member 25 may be a lever 41 that is depressed, and barrier 24 may be a rupturable membrane 42. When it is desired to release tea polyphenols 22, a force is applied to lever 41 to rupture membrane 42, as shown in **FIG. 6**. Referring to **FIG. 5**, a peel away cover 44 or other covering may be included to protect rupturable membrane 42.

[0024] Referring to **FIG. 7**, barrier 24 may also be a liner 46 that is peeled away by applying an upward force on handle 38 and movable member 25. Referring to **FIG. 8**, movable member 25 may then be supported by a secondary lip 36, or by a series of supporting protrusions 46. Protrusions 46 are preferably spaced about the perimeter to allow fluid flow, and would not form a continuous body. Referring to **FIG. 9**, upper plate 31 may have holes 37 to allow mixing.

[0025] Referring to **FIG. 10**, instead of an upward force, threads 48 may be provided such that barrier 24 is moved as movable member 25 is rotated.

[0026] It will be apparent that other designs for allowing the contents of two compartments to mix are possible. Some examples, not shown, are described below. A chamber holding the flavored substrate may be provided that is opened as it is rotated about either a horizontal or vertical axis. In another example, the flavored substrate may be provided under vacuum in a rupturable membrane adjacent to the liquid retaining cavity, which is also under vacuum. The rupturable membrane would rupture when the vacuum is released, and deposit the contents into the liquid in the cavity. Another option is to have a movable member that is pushed down instead of raised to release the flavored substrate. In another example, the cap may be similar to spouts commonly found on sports drink bottles. When the drinking spout is opened by lifting upward, this would also raise the barrier and allow mixing to occur.

Example 1

[0027] A liquid tea drink is prepared by mixing 500 millimeters of tea liquid with 5 to 150 grams of VitaSugar (TM) IMO powder or syrup. The tea liquid is prepared by

pouring 500 milliliters of boiling water into 1 to 100 grams or more of tea leaves, either green tea, black tea, oolong tea, or Pu-erh tea, followed by mixing for 30 minutes or longer and filtering. The tea drink is filtered for sterilization before divided into 50- to 500-milliliter aliquots. The ratio between the tea leaves, VitaSugar (TM) and water can be variable. The production can be scaled up to industrial volume.

Example 2

[0028] A liquid tea drink is prepared by mixing 1 to 2,000 milligrams of tea polyphenols (the specifications of which, for example, are tea polyphenols 98%, catechins 80%, and EGCG 55%; but the tea polyphenols purity and each components are variable) with 500 milliliters of water and 5 to 500 grams of VitaSugar (TM) IMO powder or syrup. The tea is filtered for sterilization before divided into 50- to 500-milliliter aliquots. The production can be scaled up to industrial volume.

Example 3

[0029] A liquid tea drink is prepared by mixing 1 to 2,000 milligrams of EGCG with 500 milliliters of water and 5 to 500 grams of VitaSugar (TM) IMO powder or syrup. The tea is filtered for sterilization before divided into 50- to 500-milliliter aliquots. The production can be scaled up to industrial volume.

Example 4

[0030] A powder form of tea drink is prepared by mixing 1 to 2,000 milligrams of tea polyphenols (the specifications of which, for example, are tea polyphenols 98%, catechins 80%, and EGCG 55%; but the tea polyphenols purity and each components are variable) with 5 to 500 grams of VitaSugar (TM) IMO powder. The tea powder is divided into 5- to 500-gram aliquots. The tea drink is prepared by dissolving the powder in appropriate volume of water immediately before being consumed. The production can be scaled up to industrial volume.

Example 5

[0031] A powder form of tea drink is prepared by mixing 1 to 2,000 milligrams of EGCG with 5 to 500 grams of VitaSugar (TM) IMO powder. The tea powder is divided into 5- to 500-grams aliquots. The tea drink is prepared by dissolving the powder in appropriate volume of water immediately before being consumed. The production can be scaled up to industrial volume.

Example 6

[0032] A powder form of tea drink is prepared using the dispenser design as outlined in Figure 1 to 10. One to 2,000 milligrams of EGCG, or a mix of tea polyphenols, is stored in the sealed and vacuumed chamber or a bag, and mixed with the liquid in the container only immediately before being consumed.

[0033] In this patent document, the word "comprising" is used in its non-limiting sense to mean that items following the word are included, but items not specifically mentioned are not excluded. A reference to an element by the indefinite article "a" does not exclude the possibility that more than one of the element is present, unless the context clearly requires that there be one and only one of the elements.

[0034] The following claims are to be understood to include what is specifically illustrated and described above, what is conceptually equivalent, and what can be obviously substituted. Those skilled in the art will appreciate that various adaptations and modifications of the described embodiments can be configured without departing from the scope of the claims. The illustrated embodiments have been set forth only as examples and should not be taken as limiting the invention. It is to be understood that, within the scope of the following claims, the invention may be practiced other than as specifically illustrated and described.

What is claimed is:

1. A beverage container, comprising:
 - a first compartment containing a fluid;
 - a sealed second compartment containing tea polyphenols;
 - a movable barrier separating the first compartment from the second compartment, at least one of the first compartment and the second compartment forming a mixing chamber for the tea polyphenols and the fluid upon the barrier being moved.
2. The beverage container of claim 1, wherein the second compartment is under vacuum such that the pressure is less than atmospheric pressure.
3. The beverage container of claim 1, wherein the second compartment contains tea polyphenols in a substantially oxygen and moisture free environment.
4. The beverage container of claim 1, wherein at least one of the first and second compartments further contains a sweetener.
5. The beverage container of claim 4, wherein the sweetener contains an oligosaccharide.
6. The beverage container of claim 1, wherein the movable barrier is a rupturable bag defining one of the first compartment and the second compartment.
7. The beverage container of claim 1, wherein the movable barrier comprises a plate separating the first compartment from the second compartment.
8. The beverage container of claim 7, wherein an outer edge of the plate is engaged in a contoured lip, the plate being moved by applying a force to the plate.

9. The beverage container of claim 7, wherein the plate is secured in position by threads, the plate being moved by rotating the plate.
10. The beverage container of claim 1, wherein the tea polyphenols are powdered tea leaves, are derived from at least one of green tea, black tea, oolong tea, and pu-erh tea, or are combinations thereof.
11. The beverage container of claim 1, wherein the tea polyphenols are in powder form.
12. The beverage container of claim 1, wherein the fluid is water.
13. The beverage container of claim 5, wherein the ratio of tea polyphenol to sugar is between 1:10 and 1:10000000 by weight.
14. The beverage container of claim 1, wherein the second compartment contains at least one of (-)-epigallocatechin 3-gallate (EGCG), (-)-epigallocatechin (EGC), (-)-epicatechin (EC), and (-)-epicatechin-3-gallate (ECG), theaflavin, thearubigins, and theaflavin 3,3'-digallate, caffeine, or combinations thereof.
15. The beverage container of claim 1, wherein at least one of the first compartment and the second compartment contain one or more natural or artificial flavoring.
16. A method of preparing a tea drink, comprising:
 - providing a beverage container, comprising:
 - a sealed first compartment containing tea polyphenols;
 - a second compartment containing a fluid;
 - a movable barrier separating the first compartment from the second compartment, at least one of the first compartment and the second compartment forming a mixing chamber for the tea polyphenols and the fluid upon the barrier being moved;
 - moving the movable barrier; and

mixing the tea polyphenols and the fluid.

17. A beverage container, comprising:
 - a liquid retaining cavity containing a liquid;
 - a closure cap detachably secured to the cavity, the closure cap having a body that defines an interior compartment containing a flavored substrate, the compartment being closed by a closure barrier; and
 - a movable member having a first end that is accessible from the exterior of the closure cap and a second end that engages the closure barrier, such that a force exerted upon the first end results in movement of the movable member to move the closure barrier to permit the flavored substrate to mix with the liquid.
18. The beverage container of claim 17, wherein the interior compartment is under vacuum such that the pressure is less than atmospheric pressure.
19. The beverage container of claim 17, wherein at least one of the liquid retaining cavity and the interior compartment further contains a sweetener.
20. The beverage container of claim 19, wherein the sweetener contains an oligosaccharide.
21. The beverage container of claim 17, wherein the closure barrier is a rupturable barrier.
22. The beverage container of claim 17, wherein the closure barrier comprises a plate separating the liquid retaining cavity from the interior compartment.
23. The beverage container of claim 22, wherein an outer edge of the plate is engaged in a contoured lip, the outer edge becoming disengaged by applying a force to the movable member.

24. The beverage container of claim 22, wherein the plate is secured in position by threads, the plate being moved by exerting a rotational force upon the movable member.
25. The beverage container of claim 17, wherein the flavored substrate comprises tea polyphenols.
26. The beverage container of claim 25, wherein the tea polyphenols are powdered tea leaves, are derived from at least one of green tea, black tea, oolong tea, and pu-erh tea, or are combinations thereof.
27. The beverage container of claim 25, wherein the tea polyphenols are in powder form.
28. The beverage container of claim 17, wherein the liquid is water.
29. The beverage container of claim 25, wherein the interior compartment contains at least one of (-)-epigallocatechin 3-gallate (EGCG), (-)-epigallocatechin (EGC), (-)-epicatechin (EC), and (-)-epicatechin-3-gallate (ECG), theaflavin, thearubigins, and theaflavin 3,3'-digallate, caffeine, or combinations thereof.
30. The beverage container of claim 19, wherein at least one of the first compartment and the second compartment contain one or more natural or artificial flavoring.
31. A method of preparing a beverage, comprising:
providing a beverage container comprising:
a liquid retaining cavity;
a closure cap detachably secured to the cavity, the closure cap having a body that defines an interior compartment, the compartment being closed by a closure barrier; and

a movable member having a first end that is accessible from the exterior of the closure cap and a second end that engages the closure barrier;

placing a liquid in the liquid retaining cavity;

placing a flavored substrate in the interior compartment of the closure cap;

moving the movable member by exerting a force upon the first end of the movable member such that the closure barrier moves to permit the flavored substrate to mix with the liquid; and

mixing the flavored substrate and the liquid.

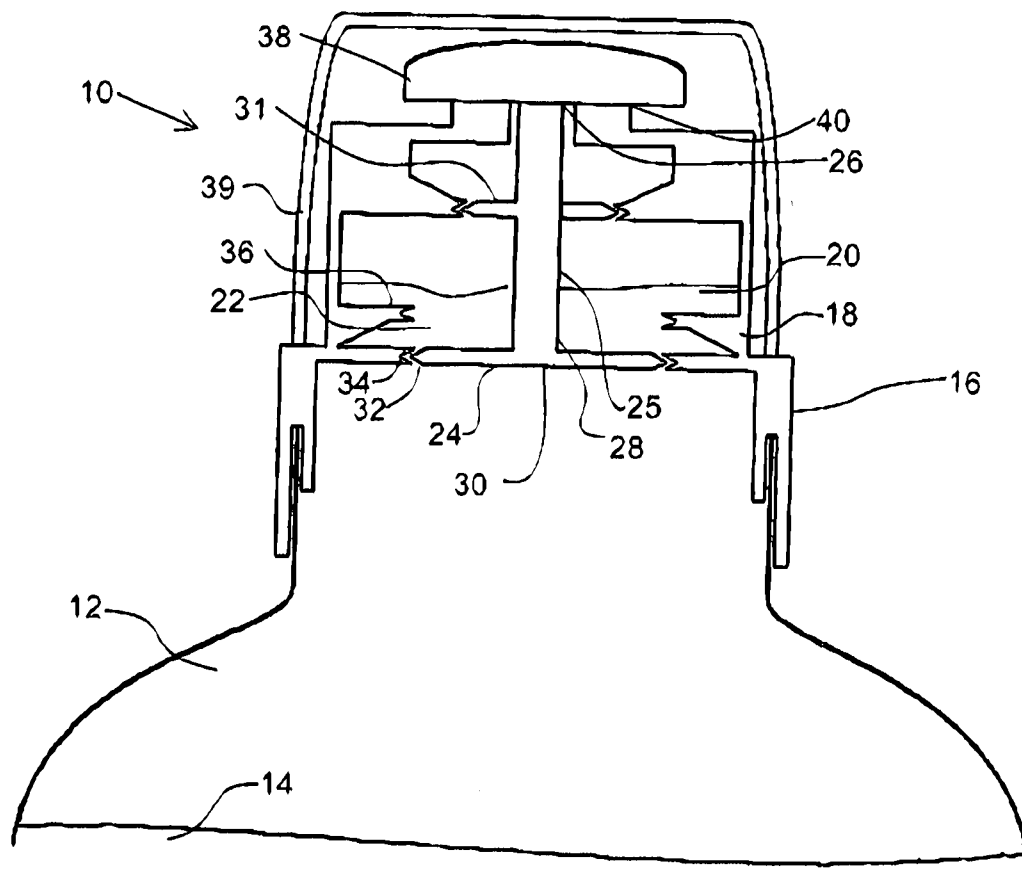


FIG. 1

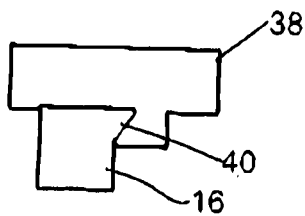


FIG. 2

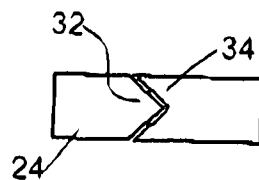


FIG. 3

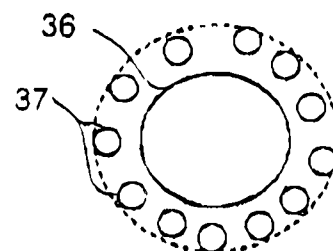


FIG. 4

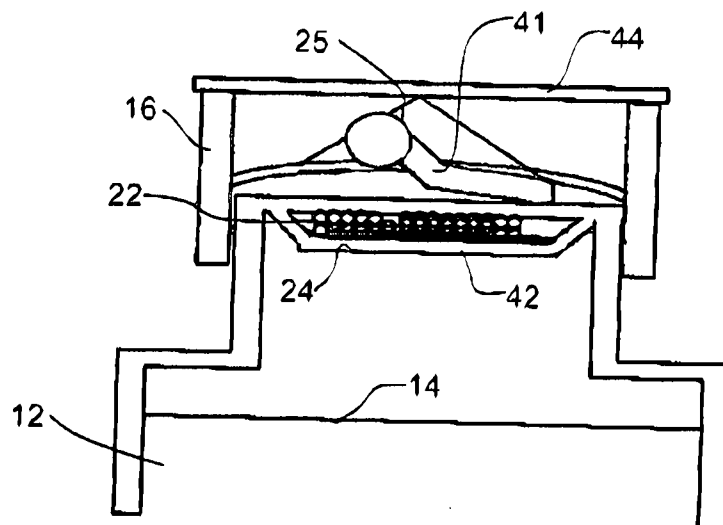


FIG. 5

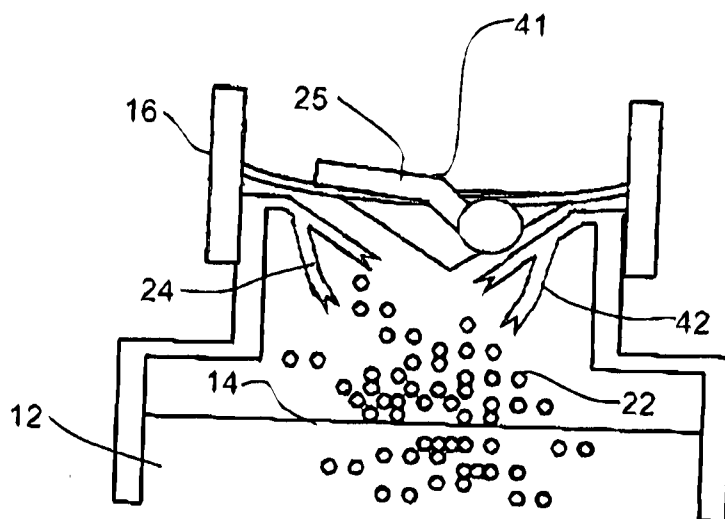


FIG. 6

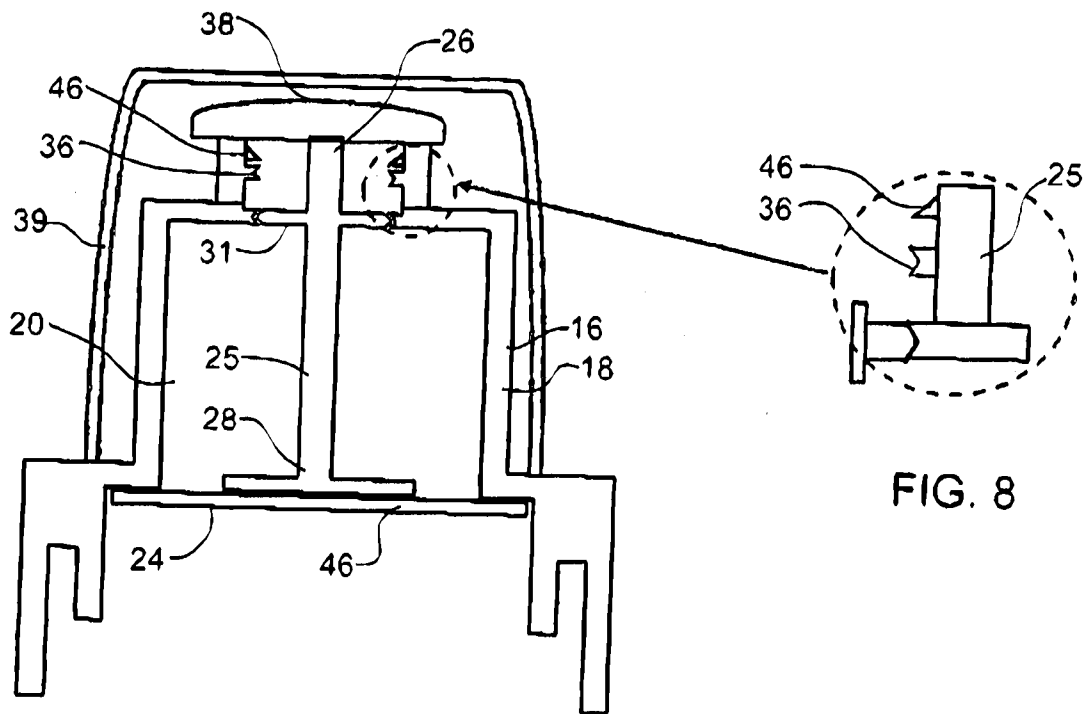


FIG. 7

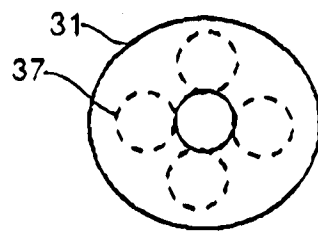


FIG. 9

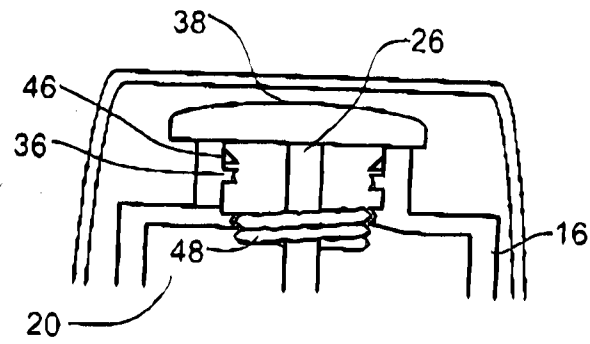


FIG. 10